PHYSICAL AND CHEMICAL PROPERTIES OF POTOMAC RIVER AND ENVIRONS, AUGUST 1978

U.S. GEOLOGICAL SURVEY
Open-File Report 80—746

Prepared as part of a continuing study of the Potomac River estuary

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Compiled and Edited by RICHARD E. SMITH and RAYNOL E. HERNDON

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UNITED STATES DEPARTMENT OF THE INTERIOR

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PHYSICAL AND CHEMICAL PROPERTIES OF THE POTOMAC RIVER AND ENVIRONS

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and Raynol E. Herndon

ABSTRACT

Basic data on the physical and chemical properties measured over the period 21 August through 31 August 1978 on the tidally influenced Potomac River and estuary are presented herein. Forty-two vertical profiles, and approximately 170 surface observations were made of the distributions of salinity, temperature, light transmission, chlorophyll-a fluorescence, dissolved oxygen, partial pressure of CO2, orthophosphate, nitrate+nitrite, nitrite, ammonia, and silicate. Additional analyses were performed on discrete samples collected for particulate organic carbon, alkalinity, pH, suspended particulate matter, total phosphate, total nitrogen, total dissolved phosphate, and total dissolved nitrogen.

The broad goals of the U. S. Geological Survey's estuarine studies are to understand hydrodynamic, chemical and biological processes by which, and to measure rates at which, water, solutes, particulate matter, and organisms interact in a river-estuarine system, and to develop and verify conceptual and numerical models of these interactions. (See also Conomos et al. 1978).

Field activities in the Potomac River estuary (Fig. 1) were organized to provide a detailed overview as background for a five-year study of the estuary begun by the Geological Survey in 1977 (Bennett 1979). The sampling dates were chosen to examine the three major seasonal extremes:

1. The period of low river discharge and high insolation in late summer, when the maximum effects of nonconservative processes should occur;
2. The period of high river discharge and low insolation in winter, when rates of nonconservative processes are minimal; and
3. The period of moderate river discharge and high insolation in late spring, when maximum rates of biological production begin.

This report is based on observations made during period 1, the summer of 1978. The measurements included here are salinity, temperature, concentration of dissolved oxygen and carbon dioxide, pH of the water, the abundance of plant nutrients, and the abundance, size, and composition (organic and mineral) of suspended and sedimented particulate matter such as chlorophyll a concentrations. Scientific personnel and their primary areas of responsibility are listed in Appendix A.

Sampling System. -Because the study of estuarine-transport processes is extremely complex, a program which can adequately define a system that is influenced by widely varying factors such as basin morphology, river inflow, tidal and density-induced water movements, and short-term biochemical processes is difficult to design. A first step in the design was a comprehensive automated sampling system capable of continuous and rapid analyses. In many of the analyses somewhat less than "state-of-the-art" accuracy was accepted in favor of automation. Salinity, for example, is measured continuously and instantaneously as a function of conductivity, with precision and accuracy better than 0.2 $^{o}/_{oo}$; this method is well suited for estuarine salinity ranges, giving better than 1-percent resolution in the range of values observed (2-25 $^{o}/_{oo}$).

An automated sampling and data-acquisition system developed for work on San Francisco Bay (Schemel and Dedini, 1979a) was installed with modification on the R/V Ridgely Warfield, a 106-foot vessel operated by the Chesapeake Bay Institute. The system has two sampling modes, one for longitudinal or surface profiling and one for vertical profiling. In the surface-profiling mode, water was pumped through a one-inch PVC conduit mounted on the bow of the Warfield at a depth of one meter. Vertical profiles were performed by lowering a submersible pump with attached temperature and depth sensors. The pumped sample was split for the various continuous and discrete analyses (Table 1).

Position.-Station positions (Fig. 1, Table 2, Table 3) were determined using radar and visual sightings of local landmarks. They are reported herein to the nearest 0.1 kilometer, in the Universal Transverse Mercator system (UTM), which allows direct computation of distances (Richardus and Adler, 1972). For convenience of entry and manipulation, only significant digits have been included and the kilometer has been assigned unit position (for example, a UTM position of 4190000 M North would appear as 190.0N). Discrete samples were generally collected within 30 seconds of a station mark. For stations sampled under way while profiling at maximum speed of 28 km/hr (15 knots), this converts to a potential relative error in station position of $\pm$0.2 km. Vertical profiles of water properties were made after anchoring on station if currents or wind were excessive; the pump was then lowered to selected depths (usually 0, 2, 5, 10, 15 and 20 m if water depths permitted) and allowed to equilibrate (usually 3-5 min) before sampling. Readings were recorded and discrete samples collected for subsequent analysis. The procedure was then repeated for additional sampling depths.

Time. -All times are Eastern Daylight Savings Time (local time).

River Mile. -The axial distance, in nautical miles from the line drawn between Smith Point and Point Lookout at the mouth of the Potomac River (National Oceanographic and Atmospheric Administration Chart 12285). The river mile designation for stations not located along the axis were determined by drawing a line normal to the axis through the station.

Temperature. -Measurements were made using linearized thermistors mounted on a submersible pump and in line just after the deck pump, about 3 m from the intake. The temperature circuits were calibrated daily at the

ice point (0^{0}C) and at the anticipated maximum water temperature (20-30°C). Periodic checks with standard laboratory thermometers agreed within ±0.2°C.

Depth. -The pump depth was determined using a pressure transducer having an accuracy of ±1 m. Readings listed as zero meters are actually representative of a pump-intake depth of about 0.2 m. Samples taken via the surface-profiling intake are listed at a depth of 1 m. The actual depth varied at least 50 percent depending on sea state and ship speed.

Salinity. -A flow-through induction salinometer was used and calibrated at roughly 2-°/oo intervals by collecting discrete samples for subsequent analysis using a Beckman RS7-B laboratory salinometer.[1/] Under stable conditions, salinity differences of less than 0.05 °/oo were observed.

Sigma-t. -This oceanographic expression of density is calculated as a function of temperature and salinity according to Knudson's equation (Table 4).

Dissolved Oxygen. -Carpenter's (1965) modification of the Winkler titration was used for determinations of dissolved oxygen. Samples were collected in 125-ml titration flasks, with care taken to minimize atmospheric contamination, then fixed in the basic form and held up to two hours before acidification and titration to a starch end point with 0.2 N thiosulfate. Precision of analysis was ± 4 µg-at/L[2/]. Nitrite is known to interfere with the analysis. In comparisons made with the azide modification of the Winkler method (American Public Health Assoc., 1972), using San Francisco Bay water, the error was found to be

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[1/] The mention of brand names is for identification purposes and does not constitute endorsement by the U. S. Geological Survey.

[2/] Conversion factors for concentration units are listed in Appendix B.

stoichiometric, i.e., 1 μm (NO_2) is equivalent to 1 μg-at (O). Additional errors due to high content of dissolved organic material in the metropolitan Washington, D. C., area were observed. In these areas the titration end points drifted slowly positively as interfering reactions continued to release free iodine. All samples were titrated rapidly, but all samples collected in the vicinity of the Blue Plains outfall (river mile 90 to 95) probably have a positive bias.

AOU. -Apparent oxygen utilization (AOU) is calculated as the difference between the saturation concentration of dissolved oxygen at the sample temperature and salinity and the observed concentration of dissolved oxygen (Table 4). Samples having a concentration greater than the saturation concentration therefore have a negative AOU.

Percent Oxygen Saturation. -Similarly, percent saturation is an expression of the closeness of an observed oxygen concentration to the equilibrium or saturation concentration. Rather than a difference, percent saturation is the ratio of the observed value to the saturation value (Table 4).

Light Transmission. -A modified Hydro Products Model 411 altered for use in a flow-through cell was used to measure water transparency. This instrument has a 10-cm path length and is calibrated daily to read 100 in air. Because of limitation in the optics, readings greater than 100 are often encountered and changes in the light source often result in a sensitivity change. As a result of these errors, precision using a single light source is about 5 percent.

Dissolved Oxygen Probe. -In addition to discrete titration for dissolved oxygen, a polarographic-type oxygen probe was used to determine variations

in oxygen saturation. The probe was on line with other continuous-measurement equipment and was used primarily to obtain instantaneous approximations of oxygen saturation. Each day the instrument output was adjusted to read 100 in air and 0 in a sodium sulfite solution. Correlation with oxygen percent saturation determined by titration agreed within 5 to 10 percent saturation.

Micronutrients. -All micronutrient analyses were performed using a Technicon AutoAnalyzer. The analyses were usually conducted "on line", with a continuous stream of filtered water passed to the AutoAnalyzer sample tubes. Experiments conducted during the spring of 1978 (Harmon and Smith, 1980) indicated that the turbidity error encountered during the January cruise (Smith and Herndon, 1980) could be eliminated if the sample was passed through a 0.4-μ Nucleopore filter. Consequently a 120-mm diameter Nucleopore radial flow cell was used to supply the filtered sample to the AutoAnalyzer. To increase the filtration rate of discrete samples a two-stage filter (through a glass-fiber filter followed by a Nucleopore filter) was used. The sample signal was referenced to single upscale standards and blanks which were analyzed at 2- to 4-hour intervals. The linearity of each of the analyses was confirmed before initial data collection and at times of suspected malfunction. Specific analytical methods are as follows:

Silicate. -The method is an adaptation of Technicon Corporation (1976) method AII 105-71W. The sample tube has been reduced to half the normal delivery rate in order to extend the linear range to 320 μM/L. Absorbance is measured at 660 nm and a 3 percent precision is observed over a 2- to 300-μM/L range in concentration.

Nitrate+nitrite. -The method is Technicon Corporation (1973) method number AII 100-71W with one additional 20-turn coil added for better stability with respect to room temperature. Nitrate is reduced to nitrite

by passing the sample through a cadmium reduction column. Color reagent is then added and the absorbance is read at 540 nm. A precision of 3 percent is observed over a range in concentration of 1 to 80 μM/L.

Nitrite. -The Technicon Corporation (1973) method number AII 100-70W, for nitrate + nitrite, was used with the cadmium column removed. In order to fit all five analyses on a single Technicon proportioning pump, the sample/ammonium chloride mixture was drawn from the debubbler which precedes the cadmium column in the nitrate + nitrite analysis. Absorbance was measured at 540 nm and a precision of 3 percent was observed over the range 1 to 50 μM/L.

Orthophosphate. -The method is a modification of the method of Atlas et al. (1971), using ascorbic acid (70 g/L with 50 mL acetone/L) instead of hydrazine sulfate as a reductant. This change was made to enable analysis of samples predigested with hydrogen peroxide and ultraviolet light. Absorbance is measured at 660 nm and a 3 percent precision is observed over a 2- to 30-μM/L range in concentration.

Ammonia. -The analysis is an automated version of the method of Solorzano (1969), similar to that of Head (1971). The absorbance of the phenolhypochlorite complex is measured at 630 nm and has a precision of 3 percent observed over the range 5 to 100 μM/L.

Total Particulate and Total Dissolved Nutrients. -In order to distinguish between the effects of conservative and nonconservative processes on the distribution of the particulate phase also must be known. Analysis for particulate phosphate, carbon, or nitrogen has traditionally involved high-temperature acid oxidation. Recently ultraviolet light has been used to catalyze the oxidation of dissolved organic matter (Armstrong, Williams

and Strickland, 1966). Even though complete oxidation of particulate matter may not be achieved using ultraviolet radiation, we feel that it does provide an accurate and reproduceable estimate of the labile or rapidly oxidizable fraction available for mineralization and recycling by phytoplankton on a time scale of days to weeks. In addition, sample handling and sources of reagent contamination are reduced using UV digestion.

The system described by Armstrong et al. (1966) was used for irradiation. Two drops of peroxide was added to each of twelve samples placed at an equal distance surrounding a 1200-watt UV mercury-arc tube for a period of four to six hours. Irradiation of duplicate filtered and unfiltered samples was carried out using this apparatus. The irradiation time was determined by splitting a sample into twelve subsamples and analyzing at 30-min intervals for a period of irradiation of 1 to 6 hours. After one hour a stable concentration for phosphate was achieved; oxidation of ammonia to nitrate required three hours. To insure complete oxidation samples were digested for six hours. Standards supplied by the Quality Control Laboratories of the Environmental Protection Agency for organic phosphate and nitrogen were analyzed and better than 90 percent recovery was achieved.

The values given in this report for total particulates, total dissolved nitrogen, and total dissolved phosphate are averages of two digestions each for filtered and unfiltered portions of a sample. The unfiltered samples were digested as described above, filtered to remove refractory material, and then analyzed using the methods for dissolved inorganic materials documented above.

Turbidity. -This determination was made using a Turner Designs nephelometer, a device that measures light scattered at 90° by suspended particulate matter. All values presented here have been converted to a single scale for ease of comparison.

Fluorescence. -In vivo fluorescence was measured using a Turner Designs model 10 fluorometer equipped with a flow-through cell. As with turbidity, all readings have been converted to a single scale. Using discrete chlorophyll measurements on samples collected at nearby stations, fluorescence can be used to estimate chlorophyll a.

pH. -The pH measurements were made on discrete samples or are on-line measurements which have been corrected on the basis of calibration with discrete samples. As with oxygen samples, when pH samples were collected care was taken to eliminate all bubbles and the container was allowed to overflow. The sample was then placed in a constant-temperature bath and brought to within 1°C of the temperature of the buffer solution (usually 20 to 25°C). A combination electrode was used to determine the pH of the stirred sample within one hour of the sample collection. In situ pH is calculated as described in Strickland and Parsons (1972).

Total CO_2. -Water samples for ΣCO_2 analyses were collected in 30-mL amber glass bottles. Bottles were filled from the bottom, preserved with 0.2 mL saturated $HgCl_2$ solution, then refrigerated until analysis. Aliquots (approximately 1 mL) were injected into a gas-stripper cell, containing 0.5 mL of 0.1M H_3PO_4 solution, in which evolved CO_2 is carried in the flow of nitrogen gas to a non-dispersive infrared analyzer and CO_2

peaks are related to standard solutions of Na_2CO_3. Computed areas for replicate injections of samples agreed within ±1 percent. The accuracy of the method is estimated to be ±2 to 3 percent of value.

pCO_2. -The partial pressure of carbon dioxide in the water was estimated by measuring the CO_2 content of air continuously equilibrated with the sample stream. The CO_2 concentration is determined by infrared analysis (Gordon and Park,1972) and expressed as ppt (by volume) in dry air. Data agree with values calculated from discrete pH and alkalinity data within 5 percent.

Alkalinity. -Total alkalinity was determined using the method described by Edmond (1970). A 125-mL sample was titrated in a sealed vessel to the carbonate end point and total alkalinity was calculated from a regression of the Gran function. Precision on replicate analyses was ±.016 meq/L.

Suspended Particulate Matter. -Gross suspended particulate material was estimated gravimetrically by filtering a known volume of water sample through a preweighed 0.45-μ silver filter. After drying in air for 2 to 4 weeks the filters were reweighed and concentrations calculated. The precision is 20 percent and is dependent on the mass of the filter cake.

Particulate Organic Carbon. -A modified Menzel and Vaccaro (1964) method was used to determine particulate organic carbon. Each sample was collected on a glass-fiber filter which has been prepared by being heated to 450°C. The sample was then wet oxidized in a sealed glass ampule using potassium persulfate. The CO_2 content of each ampule was determined using a Beckman model IR 215A infrared analyzer. Standard curves were

prepared using sucrose solutions. The precision of the analysis is about 10 percent over a range of 5 to 800 μM/L (Schemel and Dedini, 1979b).

Chlorophyll a. -Discrete chlorophyll samples were analyzed according to Strickland and Parsons (1972). Calculations were based on the trichromatic equation recommended by SCOR-UNESCO Working Group 17 (1966). Precision of the analyses was ±10 percent, as calculated from replicates.

Extinction Coefficient. -Attenuation of incident radiation was determined while at anchor obtaining vertical profiles of water properties. Photosynthetically active radiation (400-700 nm) was determined using a Li Cor® 1925 quantum sensor. Quanta measurements were recorded at 6-7 depths over the photic zone. The resulting depth profile was fitted to an exponential curve. The exponential derivative of the log of light corresponds to the extinction coefficient of the water column.

DATA

Longitudinal, vertical, and single-station time-sequence data are presented in chronological order. Table 5 can be used as an index to the data.

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Figure 1. Hydrographic Sampling Stations

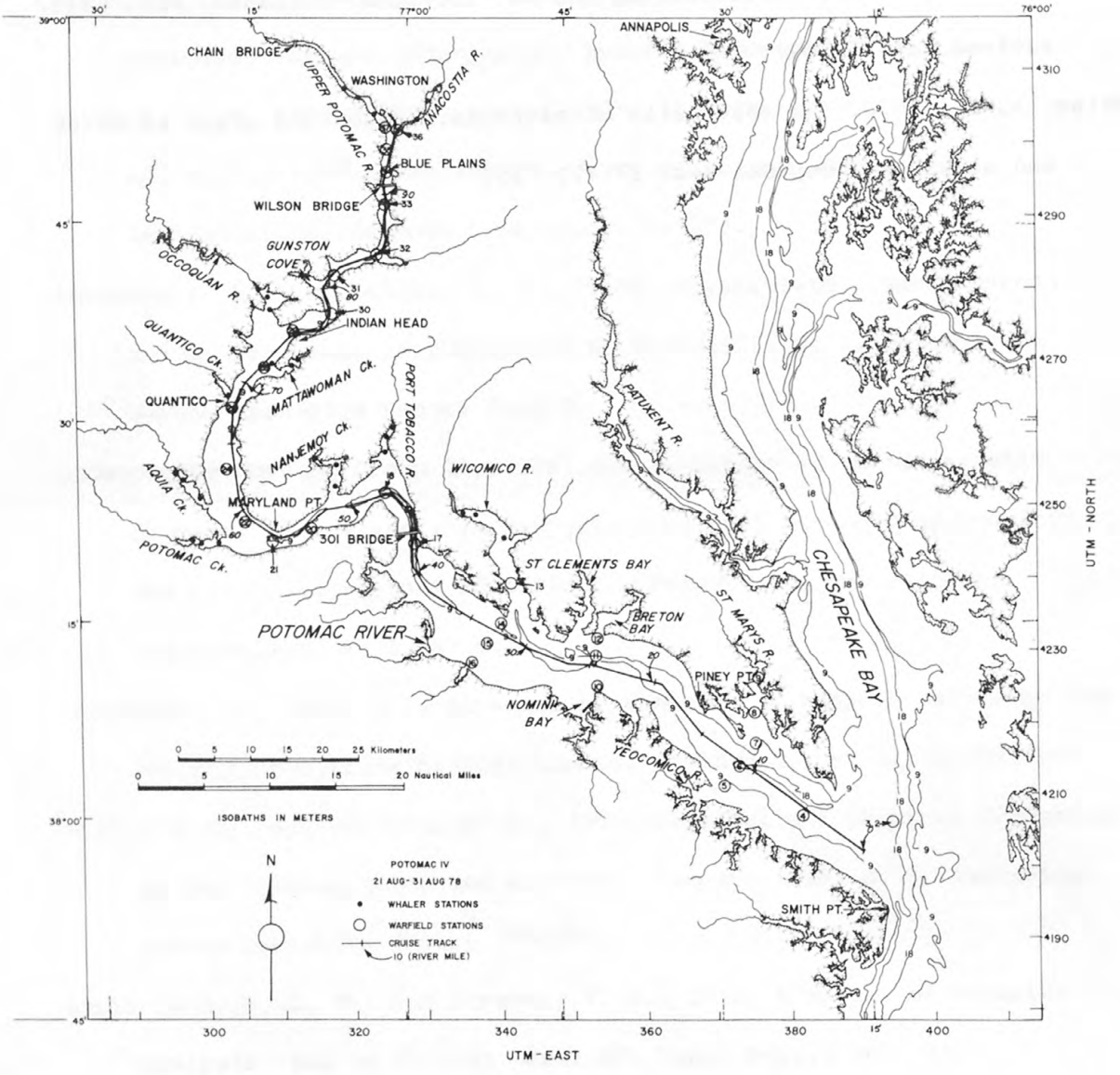

Table 1. Summary of analytical methods

Variable (ABBREVIATION)	Primary Reference or Manufacturer of Instrument	Units	Precision[1/]
Time		local	± min
Station (STA)			
River mile (RIV MI)	NOAA Chart 12285	n mi	±0.01
Position (UTM-N & UTM-E)		UTM	±0.2 km
Depth	Gentran Inc.	meters	±0.2 m
Temperature (TEMP)	Yellow Springs Inst. Co.	deg C	±0.1 deg C
Salinity (SALIN)	W. Peterson (consultant)	ppt	0.05 °/oo
Light transmission (TRANS)	Hydroproducts Corp.		5 units (day to day) 10 units (cruise to cruise)
Dissolved oxygen (DIS OXY)	Carpenter (1965)	µg-at/L	±4
Dissolved oxygen (02 PROB)	Schemel and Dedini, 1979a		±7 percent
Silicate (SiO_2)	Technicon Corporation (1976)	µM/L	3 percent over range 20 to 300
Orthophosphate (PO_4)	Atlas et al. (1971)	µM/L	3 percent over range 2 to 50
Total phosphate (TOTAL PHOSPH)	Armstrong et al. (1966)	µM/L	5 percent over range 2 to 100
Total dissolved phosphate (DISSOL PHOSPH)	Armstrong et al. (1966)	µM/L	5 percent over range 2 to 100
Nitrate+nitrite (NO_3+NO_2)	Technicon Corporation (1973)	µM/L	3 percent over range 1 to 80
Nitrite (NO_2)	Technicon Corporation (1973)	µM/L	3 percent over range 1 to 50
Ammonia (NH_3)	Solorzano (1969)	µM/L	3 percent over range 5 to 100

1/ Where possible estimates of precision are based on splits of discrete samples

Table 1 - Cont'd.

Variable (ABBREVIATION)	Primary Reference or Manufacturer of Instrument	Units	Precision[1/]
Total nitrogen (TOTAL NITROG)	Armstrong et al.(1966)	µM/L	5 percent over range 1 to 200
Total dissolved nitrogen (DISSOL NITROG)	Armstrong et al. (1966)	µM/L	5 percent over range 1 to 200
Turbidity (TURB)	G. K. Turner Associates		5 percent
Chlorophyll-a fluorescence (FLUOR)	G. K. Turner Associates		5 percent
Extinction coefficient (EXT COEFF)	LiCor Corporation		
Particulate organic carbon (POC)	Menzel and Vaccaro (1964)	µM/L	10 percent over range 5 to 250
Discrete chlorophyll (DIS CHL)	Strickland and Parsons (1972)		±10 percent
Alkalinity (ALKALIN)	Edmond (1970)	meq/L	±.016
pH	Strickland and Parsons (1972)		±0.005 units
pCO_2	Gordon and Park (1972)	ppt	5 percent
Total CO2	Schemel (in prep.)		±1 percent
Suspended particulate matter (SPM)		mg/L	20 percent

1/ Where possible estimates of precision are based on splits of discrete samples

Table 2. Locations of Hydrographic Stations

STA. #	RM[a/]	UTM Station N	UTM Station E	Sampling Area	N. Latitude		W. Longitude	
1		314.2	379.4	Chesapeake Bay	38°	58.2'	76°	23.5'
2		241.9	384.5	Chesapeake Bay	38	19.2	76	19.3
3		199.0	400.0	Chesapeake Bay	37	56.1	76	8.3
4	4.4	207.8	382.1	Potomac River	38	0.7	76	20.6
5	12.5	213.2	366.8	Potomac River	38	3.5	76	31.1
6	11.9	215.0	369.7	Potomac River	38	4.5	76	29.1
7	12.0	217.2	371.2	Potomac River	38	5.7	76	28.1
8	11.0	222.3	372.9	St. Marys River	38	8.5	76	27.0
9	11.0	227.3	373.9	St. Marys River	38	11.2	76	26.4
10	24.7	225.3	350.9	Potomac River	38	9.9	76	42.1
11	24.9	228.2	350.5	Potomac River	38	11.5	76	42.4
12	24.8	231.8	351.0	Potomac River	38	13.4	76	42.1
13	30.5	238.6	340.1	Wicomico River	38	17.0	76	49.7
14	32.4	234.6	338.3	Potomac River	38	14.8	76	50.9
15	32.6	232.2	336.3	Potomac River	38	13.5	76	52.2
16	33.3	229.3	333.9	Potomac River	38	11.9	76	53.8
17	43.0	246.7	326.0	Potomac River	38	21.3	76	59.4
18	47.4	253.2	322.2	Potomac River	38	24.7	77	2.2
19	52.5	248.8	313.0	Potomac River	38	22.2	77	8.4
20	52.9	249.6	312.6	Potomac River	38	22.6	77	8.7
21	56.3	246.7	306.7	Potomac River	38	21.0	77	12.6
22	59.6	250.9	302.7	Potomac River	38	23.2	77	15.5
23	59.6	251.0	299.5	Potomac River	38	23.2	77	17.7
24	62.9	256.7	301.9	Potomac River	38	26.7	77	16.4
25	63.8	256.7	386.4	Potomac River	38	27.2	77	18.1
26	67.8	265.7	301.7	Potomac River	38	31.2	77	16.5
28	70.9	270.1	305.2	Potomac River	38	33.6	77	14.1
29	75.4	275.3	311.2	Potomac River	38	36.5	77	10.1
30	78.0	277.8	315.2	Potomac River	38	37.9	77	7.4
31	81.0	283.0	315.0	Potomac River	38	40.7	77	7.6
32	85.1	286.0	321.8	Potomac River	38	42.4	77	2.9
33	89.5	293.4	323.3	Potomac River	38	46.2	77	2.0
34	91.8	297.8	323.3	Potomac River	38	48.8	77	2.1
35	93.9	301.5	324.4	Potomac River	38	50.8	77	1.4
36	95.4	303.5	325.7	Anacostia River	38	51.7	77	0.5
37	95.0	303.2	323.9	Potomac River	38	51.9	77	1.8

[a/] river mile

Table 3. Samples from Tributaries

Station	River Mile	Sampling Area
106	30.5	Wicomico River
107	47.1	Port Tobacco
108	51.0	Nanjemoy Creek
109	58.0	Potomac Creek
110	60.0	Aquia Creek
111	68.0	Quantico Creek
112	71.6	Mattawoman Creek
113	74.1	Indian Head
114	78.1	Occoquan Bay
115	80.2	Gunston Cove
136	96.1	Anacostia River
137	95.9	Upper Potomac

Table 4. Calculations

Sigma-t (Knudson, 1901; modified for salinity rather than chlorinity input)

$$\sigma_T = \Sigma_T + (\sigma_O + 0.1324)\,(1 - A_T + B_T\,[\sigma_O - 0.1324])$$

$$\sigma_O = -0.069 + 0.8141S - 0.0004811S^2 + 0.00000675S^3$$

$$\Sigma_T = \frac{-(T - 3.98)^2(T + 283)}{503.57(T + 67.26)}$$

$$A_T = T(4.7867 - 0.098185T + 0.0010843T^2)10^{-3}$$

$$B_T = T(18.030 - 0.8164T + 0.01667T^2)10^{-6}$$

S = Salinity, $^{o}/oo$

T = Temperature, ^{o}C

Apparent oxygen utilization

$$AOU = O_2' - O_2$$

where oxygen saturation concentration (O_2') is calculated using the equation of Weiss (1970)

$$Ln(O_2') = A_1 + A_2\,(100/T) + A_3 Ln(T/100) + A_4(T/100) + S\,[B_1 + B_2(T/100) + B_3(T/100^2]$$

For O_2' in mL/L

T = absolute temperature

S = salinity

$A_1 = -173.4292$ $\quad B_1 = -0.033096$

$A_2 = 249.6339$ $\quad B_2 = 0.014259$

$A_3 = 143.3483$ $\quad B_3 = -0.0017000$

$A_4 = -21.8492$

O_2' µg-at/L = O_2' mL/L (89.13)

Oxygen percent saturation

$$POS = O_2/O_2' \times 100\%$$

Table 5. Summary of sample collections

Date	Vessel	River Mile	Vertical	Station Range	(Anchor Sta) Name Time Series	Report Page No.
21 August 1978	Warfield	0.0-4.4	Yes	3.2-4.0	-	1
22	Warfield	11.0-30.5	Yes	9.0-13.0	-	4
22	B. Whaler	30.5	Yes	106.4-106.6	-	6
23	Warfield	31.4-77.9	Yes	17.0-30.0	-	9
23	B. Whaler	47.1-74.1	Yes	107.6-113.1	-	13
24	Warfield	77.9-95.4	Yes	30.0-36.0	-	17
25	B. Whaler	101.0-95.4	No	137.6-36.0	-	19
28	Warfield	95.2-43.5	No	-	-	21
30	Warfield	82.2-30.5	No	-	-	23
31	Warfield	31.3-3.0	Yes	-	-	25

APPENDIX A

LIST OF SCIENTIFIC PERSONNEL

	Primary Areas of Responsibility
Andrea E. Alpine	C-14, chlorophyll, light
Brian E. Cole	C-14, chlorophyll, light
T. John Conomos	Chief scientist
Lee A. Dedini	Hydrographic data
Stephen W. Hager	Micronutrients
Dana D. Harmon	Micronutrients
Raynol E. Herndon	Data reduction
Anne Hutchinson	Dissolved oxygen, zooplankton
Frederic H. Nichols	Benthic respiration
David H. Peterson	Chief Scientist
Laurence E. Schemel	Carbon, hydrographic data
Richard E. Smith	Data reduction, suspended particulate matter
Elliott C. Spiker	Carbon isotopes
Sally M. Wienke	Drafting

APPENDIX B

CONVERSION TABLE

	From	To	Factor
Dissolved oxygen	µg-at	mg(O)	0.016
Dissolved oxygen	µg-at	mL(O_2)	0.0112
Nitrate + nitrite	µM/L[1/]	mg/L(N)	0.0140
Nitrite	µM/L	mg/L(N)	0.0140
Ammonia	µM/L	mg/L(N)	0.0140
Phosphate	µM/L	mg/L(P)	0.0310
Silicate	µM/L	mg/L(Si)	0.0281
Carbon	µM/L	mg/L(C)	0.0120

[1/] For any element, 1 gram atom = 1 Mole = 10^6 microgram atoms (µg-at), and for elements which occur in a ratio of one atom per molecule, which is the case for the nutrients listed above, 1 µM = 1 µg-at.

For elements which occur as diatomic species, such as oxygen, 1 µM(O_2) = 2 µg-at(O).

APPENDIX C

DATA TABLES

U.S. GEOLOGICAL SURVEY - WATER RESOURCES DIVISION

ESTUARINE STUDIES GROUP

DATE	JULIAN DATE	CRUISE #	LOCATION	VESSEL
21 AUG 78	78233	4	CHESAPEAKE	WARFIELD

TIME	STA	RIV MI n mi	UTM-N	UTM-E	DEPTH m	TEMP C	SALIN o/oo	SIG-T	DIS OXY ug-at/l	AOU ug-at/l	DIS OXY O2 PROB % SAT		TURBID	TRANS EXT COEF		SPM mg/l
1315	-	-	313.2	380.3	1	27.9	8.5	2.6	-	-	-	56	0.122	111	-	-
1330	-	-	312.7	379.4	1	27.8	8.8	2.9	342	124	73	49	0.114	113	-	3.8
1345	-	-	306.8	378.4	1	27.9	8.7	2.9	438	27	94	70	0.114	106	-	-
1400	-	-	299.9	377.8	1	28.1	8.8	2.9	408	56	88	65	0.117	109	-	-
1415	-	-	302.7	377.2	1	28.2	9.6	3.4	352	109	76	60	0.101	115	-	-
1430	-	-	289.6	374.7	1	28.4	9.1	3.0	465	-5	101	77	0.114	110	-	5.6
1445	-	-	285.2	374.8	1	28.5	9.2	3.0	462	-3	101	80	0.101	116	-	-
1500	-	-	276.9	374.8	1	28.8	9.5	3.2	472	-16	103	79	0.114	110	-	-
1515	-	-	273.7	375.2	1	28.9	9.8	3.3	447	8	98	76	0.098	116	-	-
1530	-	-	267.8	375.4	1	28.8	10.1	3.6	467	-12	103	82	0.095	118	-	3.6
1545	-	-	262.0	377.3	1	28.4	10.7	4.1	482	-26	106	83	0.117	110	-	-
1600	-	-	257.9	379.0	1	28.8	10.5	3.9	481	-27	106	84	0.098	116	-	-
1615	-	-	252.5	380.7	1	28.9	10.6	3.9	487	-34	108	82	0.095	117	-	-
1630	-	-	246.2	383.2	1	28.7	11.1	4.4	438	15	97	73	0.095	120	-	4.8
1645	-	-	241.2	385.0	1	28.4	12.4	5.4	362	90	80	64	0.100	116	-	-
1700	-	-	236.7	387.1	1	28.7	11.3	4.5	425	27	94	73	0.085	120	-	-
1715	-	-	231.5	389.7	1	28.8	11.5	4.7	449	2	100	78	0.095	118	-	-
1730	-	-	226.9	391.4	1	28.9	11.7	4.8	414	36	92	72	0.092	122	-	1.2
1745	-	-	220.0	392.5	1	28.8	12.1	5.1	492	-42	109	88	0.098	120	-	-
1800	-	-	214.1	392.8	1	28.6	12.8	5.6	459	-9	102	82	0.092	119	-	-
1911	3.2	-	207.6	392.7	0	27.6	12.8	6.0	431	26	94	69	0.092	127	-	-
1915	3.2	-	207.6	392.7	2	27.6	12.8	6.0	433	24	95	72	0.082	127	-	3.6
1924	3.2	-	207.6	392.7	5	27.5	12.8	6.0	429	29	94	72	0.076	127	-	-
1930	3.2	-	207.6	392.7	10	27.5	13.4	6.5	374	83	82	59	0.079	120	-	-
1938	3.2	-	207.6	392.7	14	26.4	19.7	11.5	110	339	24	0	0.111	120	-	6.0
2000	-	0.0	207.1	391.1	1	29.0	12.5	5.3	427	20	96	71	0.089	127	-	-
2015	-	2.5	205.5	385.8	1	28.9	12.7	5.5	435	13	97	76	0.089	125	-	-
2038	4.0	4.4	207.4	381.5	0	27.6	10.9	4.6	488	-26	106	88	0.082	125	-	-
2041	4.0	4.4	207.4	381.5	2	27.6	11.0	4.6	493	-31	107	88	0.085	125	-	3.6
2048	4.0	4.4	207.4	381.5	5	27.6	10.9	4.6	487	-25	105	88	0.082	124	-	-
2055	4.0	4.4	207.4	381.5	11	27.4	12.7	5.9	254	205	55	37	0.098	124	-	3.2

- DATA NOT AVAILABLE

DATE	JULIAN DATE	CRUISE #	LOCATION	VESSEL
21 AUG 78	78233	4	CHESAPEAKE	WARFIELD

TIME	SiO2 uM/l	PO4 uM/l	NO3+NO2 uM/l	NO2 uM/l	NH3 uM/l	TOTAL NITROG	DISSOL NITROG	TOTAL PHOSPH	DISSOL PHOSPH	FLUOR	DIS CHL ug/l	ALKALIN meq/l	TOT CO2 mM/l	POC uM/l	pH	pCO2 ppt
1315	-	-	-	-	-	-	-	-	-	0.097	-	-	-	-	7.78	0.881
1330	-	-	-	-	-	-	-	-	-	0.085	-	-	-	111	-	0.954
1345	53	0.19	4.2	0.41	4.55	-	-	-	-	0.221	-	-	-	-	8.03	0.441
1400	54	0.12	4.6	0.42	5.29	-	-	-	-	0.164	-	1.16	-	191	7.95	0.565
1415	56	0.11	1.1	0.25	4.35	-	-	-	-	0.073	9.65	-	-	-	7.91	0.610
1430	55	0.05	0.9	0.27	1.92	-	-	-	-	0.145	-	1.18	-	172	8.10	0.433
1445	55	0.03	0.2	0.14	0.22	-	-	-	-	0.127	-	-	-	-	8.23	0.290
1500	58	0.05	0.2	0.15	0.14	-	-	-	-	0.174	37.50	1.18	-	212	8.16	0.359
1515	54	0.02	0.2	0.15	0.18	-	-	-	-	0.107	-	-	-	-	8.13	0.363
1530	50	0.06	0.3	0.11	0.25	-	-	-	-	0.089	-	1.17	-	110	8.30	0.257
1545	49	0.05	0.3	0.08	0.25	-	-	-	-	0.123	-	-	-	-	8.23	0.254
1600	46	0.03	0.3	0.12	0.26	-	-	-	-	0.097	18.10	1.19	-	-	8.33	0.256
1615	46	0.03	0.3	0.10	0.25	-	-	-	-	0.104	-	-	-	-	8.33	0.248
1630	46	0.08	0.2	0.13	0.39	-	-	-	-	0.082	-	1.24	-	-	8.18	0.322
1645	47	0.17	0.3	0.16	1.34	-	-	-	-	0.097	-	-	-	-	7.96	-
1700	47	0.09	0.3	0.14	0.39	-	-	-	-	0.089	18.10	1.13	-	96	8.16	0.346
1715	46	0.07	0.3	0.17	0.19	-	-	-	-	0.089	-	-	-	-	8.20	0.334
1730	45	0.07	0.3	0.14	0.51	-	-	-	-	0.063	-	1.28	-	111	8.11	0.393
1745	38	0.00	0.2	0.16	0.10	-	-	-	-	0.139	-	-	-	-	8.25	0.281
1800	38	0.03	0.2	0.17	0.09	-	-	-	-	0.123	-	-	-	-	8.13	0.412
1911	41	0.17	0.2	0.11	0.05	-	-	-	-	0.047	-	-	-	-	8.30	0.255
1915	41	0.16	0.1	0.11	0.03	-	-	-	-	0.049	9.74	-	1.17	82	8.31	0.246
1924	41	0.16	0.2	0.13	0.00	-	-	-	-	0.050	-	-	-	-	8.31	0.260
1930	43	0.24	0.2	0.17	0.06	-	-	-	-	0.054	-	-	-	-	8.20	0.334
1938	42	0.33	0.5	0.31	2.79	-	-	-	-	0.060	12.00	1.62	1.51	106	7.72	1.050
2000	42	0.14	0.2	0.16	0.02	-	-	-	-	0.045	-	-	-	-	8.29	0.272
2015	37	0.06	0.2	0.13	0.00	-	-	-	-	0.046	-	-	-	-	8.29	0.264
2038	51	0.34	0.2	0.14	0.11	-	-	-	-	0.075	-	-	-	-	8.41	0.208
2041	51	0.35	0.2	0.14	0.06	28.7	14.2	1.67	0.70	0.077	14.20	1.30	1.15	117	8.41	0.204
2048	51	0.33	0.2	0.13	0.08	-	-	-	-	0.076	-	-	-	-	8.40	0.204
2055	46	0.25	0.3	0.09	1.26	-	-	-	-	0.061	-	1.37	-	143	7.92	0.565

- DATA NOT AVAILABLE

U.S. GEOLOGICAL SURVEY - WATER RESOURCES DIVISION

ESTUARINE STUDIES GROUP

DATE	JULIAN DATE	CRUISE #	LOCATION	VESSEL
22 AUG 78	78234	4	POTOMAC R	WARFIELD

TIME	STA	RIV MI n mi	UTM-N	UTM-E	DEPTH m	TEMP C	SALIN o/oo	SIG-T	DIS OXY ug-at/l	AOU ug-at/l	DIS OXY O2 PROB % SAT	TURBID	TRANS	EXT COEF	SPM mg/l
727	9.0	11.0	226.4	373.6	0	27.0	11.6	5.2	278	187	60	14	0.098	122	-	-
731	9.0	11.0	226.4	373.6	2	27.0	11.6	5.2	269	196	58	12	0.117	122	1.18	10.4
741	9.0	11.0	226.4	373.6	5	26.9	12.8	6.2	7	456	2	0	0.168	113	-	-
800	-	-	223.9	374.9	1	28.4	11.7	4.9	299	155	66	20	0.095	120	-	-
814	8.0	11.0	222.3	372.9	0	27.0	11.7	5.4	-	-	-	28	0.085	124	-	-
818	8.0	11.0	222.3	372.9	2	27.0	11.8	5.4	-	-	-	28	0.085	124	1.13	2.8
827	8.0	11.0	222.3	372.9	5	27.0	12.2	5.7	-	-	-	0	0.123	119	-	-
845	-	-	220.3	373.2	1	28.2	11.9	5.1	351	104	77	24	0.079	126	-	-
900	7.0	10.9	216.2	373.9	0	27.0	11.9	5.5	402	63	87	45	0.073	128	-	-
906	7.0	10.9	216.2	373.9	2	27.0	11.9	5.5	403	61	87	47	0.077	128	1.08	3.6
917	7.0	10.9	216.2	373.9	8	27.2	12.4	5.8	260	202	56	14	0.084	129	-	-
929	-	10.2	214.5	373.2	1	28.4	10.7	4.2	464	-8	102	48	0.095	128	-	-
940	6.0	10.8	214.0	371.5	0	26.7	9.9	4.1	481	-9	102	58	0.073	126	-	-
945	6.0	10.8	214.0	371.5	2	26.8	10.0	4.1	474	-3	101	59	0.075	125	1.02	4.0
1002	6.0	10.8	214.0	371.5	5	27.3	12.0	5.5	413	49	89	44	0.076	128	-	-
1015	6.0	10.8	214.0	371.5	10	27.1	13.2	6.4	80	380	17	0	0.101	124	-	-
1022	6.0	10.8	214.0	371.5	17	25.8	14.1	7.5	0	-	-	0	0.139	110	-	-
1050	5.0	10.7	213.9	368.4	0	27.0	9.6	3.7	519	-48	110	67	0.092	115	-	-
1054	5.0	10.7	213.9	368.4	2	26.9	9.6	3.8	507	-36	108	60	0.091	114	1.27	7.6
1103	5.0	10.7	213.9	368.4	7	27.6	12.3	5.6	260	199	57	9	0.091	126	-	-
1115	-	12.1	214.2	368.7	1	28.5	9.9	3.6	486	-29	106	52	0.098	119	-	-
1130	-	14.3	218.5	366.7	1	28.4	10.3	3.8	497	-40	109	62	0.145	96	-	-
1145	-	17.5	222.3	362.5	1	28.1	9.4	3.3	478	-16	103	51	0.142	97	-	-
1200	-	20.3	225.3	358.5	1	27.9	9.0	3.0	521	-56	112	60	0.130	104	-	-
1215	-	23.3	226.9	353.3	1	28.5	7.7	1.9	556	-93	120	68	0.092	125	-	-
1226	10.0	24.8	225.3	350.9	0	27.7	7.6	2.1	567	-97	121	78	0.073	128	-	-
1233	10.0	24.8	225.3	350.9	2	26.8	7.8	2.5	489	-12	103	62	0.095	120	1.02	4.0
1244	10.0	24.8	225.3	350.9	5	26.6	11.0	4.9	78	392	17	0	0.114	115	-	-
1301	11.0	24.7	228.1	350.8	0	27.6	7.5	2.0	586	-115	124	83	0.082	122	-	-
1306	11.0	24.7	228.1	350.8	2	26.9	8.0	2.6	579	-104	122	78	0.114	104	1.35	9.0
1323	11.0	24.7	228.1	350.8	5	26.3	11.9	5.7	57	413	12	0	0.142	116	-	-
1330	-	24.7	228.4	351.0	1	29.1	7.5	1.6	599	-140	130	83	0.107	118	-	-
1343	12.0	24.8	231.8	351.0	0	27.2	8.8	3.1	536	-65	114	70	0.107	108	-	-
1347	12.0	24.8	231.8	351.0	2	27.0	9.4	3.6	532	-61	113	66	0.107	109	1.34	6.4
1357	12.0	24.8	231.8	351.0	5	26.4	11.7	5.5	64	406	14	0	0.107	118	-	-
1415	-	26.5	228.9	347.5	1	29.1	7.5	1.5	718	-259	156	95	0.127	107	-	-
1430	-	29.0	230.8	343.3	1	29.0	8.2	2.1	617	-159	135	65	0.127	105	-	-
1500	-	31.5	232.2	338.8	1	29.5	6.7	0.2	646	-188	141	87	0.104	114	-	-
1521	16.0	33.3	229.3	333.9	0	29.6	5.9	0.2	758	-294	163	121	0.104	-	-	-
1528	16.0	33.3	229.3	333.9	2	26.9	6.0	1.1	594	-113	123	80	0.149	102	1.82	10.0

- DATA NOT AVAILABLE

DATE	JULIAN DATE	CRUISE #	LOCATION	VESSEL
22 AUG 78	78234	4	POTOMAC R	WARFIELD

TIME	SiO2 uM/l	PO4 uM/l	NO3+NO2 uM/l	NO2 uM/l	NH3 uM/l	TOTAL NITROG	DISSOL NITROG	TOTAL PHOSPH	DISSOL PHOSPH	FLUOR	DIS CHL ug/l	ALKALIN meq/l	TOT CO2 mM/l	POC uM/l	pH	pCO2 ppt
727	59	0.34	0.3	0.07	0.23	-	-	-	-	0.074	-	-	-	-	7.84	0.818
731	59	0.30	0.3	0.08	0.28	-	-	-	-	0.076	13.90	1.36	1.29	125	7.84	0.782
741	57	1.61	0.3	0.07	5.04	-	-	-	-	0.075	-	-	-	-	7.23	-
800	57	0.36	0.4	0.10	0.28	-	-	-	-	0.090	-	-	-	-	7.86	0.723
814	55	0.35	0.4	0.12	0.29	-	-	-	-	0.072	-	-	-	-	7.95	0.594
818	55	0.37	0.5	0.12	0.32	-	-	-	-	0.072	11.50	1.37	1.26	107	7.95	0.613
827	54	0.66	0.5	0.13	0.29	-	-	-	-	0.089	-	-	-	-	7.50	1.843
845	54	0.40	0.3	0.13	0.11	-	-	-	-	0.059	-	-	-	-	-	0.580
900	47	0.48	0.2	0.12	0.06	-	-	-	-	0.073	-	-	-	-	8.13	0.402
906	46	0.52	0.3	0.12	0.11	-	-	-	-	0.074	15.20	1.34	1.20	113	8.14	0.405
917	46	0.48	0.3	0.16	0.42	-	-	-	-	0.044	-	-	-	-	7.80	0.913
929	-	-	-	-	-	-	-	-	-	0.053	-	-	-	-	8.32	0.284
940	60	1.13	0.4	0.17	0.51	-	-	-	-	0.082	-	-	-	-	8.34	0.252
945	61	1.11	0.3	0.14	0.37	-	-	-	-	0.095	23.40	1.40	1.24	134	8.33	0.256
1002	43	0.45	0.3	0.14	0.41	-	-	-	-	0.069	-	-	-	-	8.22	0.319
1015	50	0.64	0.3	0.14	0.37	-	-	-	-	0.094	-	-	-	-	7.38	2.070
1022	-	-	-	0.11	-	-	-	-	-	0.133	-	-	-	-	7.21	3.366
1050	62	1.05	0.1	0.18	0.27	-	-	-	-	0.120	-	-	-	-	8.43	0.254
1054	61	1.10	0.3	0.17	0.20	-	-	-	-	0.256	45.50	1.43	1.24	241	8.41	0.236
1103	54	0.87	0.2	0.10	0.22	-	-	-	-	0.045	-	-	-	-	7.85	0.727
1115	57	0.79	0.2	0.14	0.37	-	-	-	-	0.177	-	-	-	-	8.39	0.240
1130	58	1.03	0.2	0.13	0.24	-	-	-	-	0.660	-	-	-	-	8.44	0.226
1145	63	1.23	0.2	0.00	0.29	-	-	-	-	0.350	-	-	-	-	8.32	0.255
1200	63	1.28	0.2	0.08	0.37	-	-	-	-	0.340	-	-	-	-	8.40	0.243
1215	63	1.77	0.1	0.04	0.40	-	-	-	-	0.053	-	-	-	-	8.52	0.183
1226	63	1.64	0.2	0.06	0.77	-	-	-	-	0.044	-	-	-	-	8.55	0.171
1233	64	1.69	0.1	0.04	0.16	-	-	-	-	0.149	17.50	1.45	-	130	8.38	0.208
1244	65	1.59	0.2	0.06	1.36	-	-	-	-	0.071	-	-	-	-	7.30	2.661
1301	64	1.78	0.1	0.12	0.25	-	-	-	-	0.085	-	-	-	-	8.57	0.188
1306	64	1.72	0.1	0.13	0.28	52.0	18.1	4.66	2.30	0.045	38.40	1.44	1.24	334	8.49	0.197
1323	62	1.63	0.1	0.13	4.66	-	-	-	-	0.056	-	-	-	-	7.28	2.775
1330	64	1.86	0.2	0.16	0.60	-	-	-	-	0.093	-	-	-	-	8.59	0.242
1343	64	1.48	0.2	0.15	0.27	-	-	-	-	0.241	-	-	-	-	8.37	0.241
1347	65	1.31	0.2	0.12	0.28	-	-	-	-	0.270	31.60	1.43	1.26	212	8.34	0.262
1357	63	1.29	0.2	0.15	0.31	-	-	-	-	0.060	-	-	-	-	7.26	2.816
1415	65	1.72	0.2	0.19	0.13	-	-	-	-	0.026	-	-	-	-	8.70	0.134
1430	66	1.96	0.2	0.18	0.23	-	-	-	-	0.475	-	-	-	-	8.54	0.125
1500	62	2.53	0.3	0.19	0.27	-	-	-	-	0.082	-	-	-	-	8.53	0.195
1521	56	2.86	0.2	0.16	0.37	-	-	-	-	0.082	-	-	-	-	8.60	0.162
1528	66	2.93	0.2	0.16	0.35	-	-	-	-	0.195	37.20	1.47	1.30	260	8.29	0.285

- DATA NOT AVAILABLE

U.S. GEOLOGICAL SURVEY - WATER RESOURCES DIVISION

ESTUARINE STUDIES GROUP

DATE	JULIAN DATE	CRUISE #	LOCATION	VESSEL
22 AUG 78	78234	4	POTOMAC R	WARFIELD

TIME	STA	RIV MI n mi	UTM-N	UTM-E	DEPTH m	TEMP C	SALIN o/oo	SIG-T	DIS OXY ug-at/l	AOU ug-at/l	DIS OXY O2 % SAT	PROB	TURBID	TRANS	EXT COEF	SPM mg/l
1534	16.0	33.3	229.3	333.9	4	26.8	6.0	1.1	531	-49	110	67	0.165	100	-	-
1545	-	32.9	230.6	335.1	1	29.6	6.2	0.4	1035	-577	226	190	0.275	100	-	-
1555	15.0	32.7	232.2	336.5	0	28.6	6.3	0.8	685	-219	147	108	0.089	115	-	-
1600	15.0	32.7	232.2	336.5	2	27.0	6.4	1.4	552	-73	115	84	0.098	102	1.05	7.2
1614	15.0	32.7	232.2	336.5	5	27.0	9.1	3.4	224	248	47	7	0.092	112	-	-
1631	14.0	32.5	234.8	338.1	0	28.7	6.8	1.2	650	-186	140	96	0.085	113	-	-
1635	14.0	32.5	234.8	338.1	2	26.9	7.2	2.0	-	-	-	69	0.089	112	1.15	6.0
1643	14.0	32.5	234.8	338.1	5	27.0	9.7	3.8	198	272	42	0	0.092	118	-	-
1700	-	31.0	233.3	340.4	1	28.6	7.2	1.5	576	-112	124	73	0.104	110	-	-
1715	-	32.1	237.7	340.5	1	28.9	8.7	2.5	396	62	87	30	0.127	107	-	-
1734	13.0	30.5	240.3	339.5	0	27.1	8.8	3.2	307	165	65	26	0.180	87	-	-
1740	13.0	30.5	240.3	339.5	2	26.9	9.0	3.3	247	226	52	16	0.190	-	1.96	10.8
1748	13.0	30.5	240.3	339.5	4	26.8	9.3	3.6	141	332	30	0	0.209	-	-	-

- DATA NOT AVAILABLE

U.S. GEOLOGICAL SURVEY - WATER RESOURCES DIVISION

ESTUARINE STUDIES GROUP

DATE	JULIAN DATE	CRUISE #	LOCATION	VESSEL
22 AUG 78	78234	4	POTOMAC R	WARFIELD

TIME	SiO2 uM/l	PO4 uM/l	NO3+NO2 uM/l	NO2 uM/l	NH3 uM/l	TOTAL NITROG	DISSOL NITROG	TOTAL PHOSPH	DISSOL PHOSPH	FLUOR	DIS CHL us/l	ALKALIN meq/l	TOT CO2 mM/l	POC uM/l	pH	pCO2 ppt
1534	67	2.91	0.2	0.14	0.33	-	-	-	-	0.123	-	-	-	-	8.10	0.489
1545	60	2.89	0.2	0.14	0.44	-	-	-	-	0.200	-	-	-	-	9.05	-
1555	60	2.55	0.2	0.11	0.44	-	-	-	-	0.079	-	-	-	-	8.55	0.211
1600	61	2.59	0.2	0.09	0.32	-	-	-	-	0.152	13.40	1.45	1.32	146	8.37	0.286
1614	66	1.80	0.2	0.13	0.27	-	-	-	-	0.098	-	-	-	-	7.57	1.543
1631	61	2.44	0.2	0.16	0.36	-	-	-	-	0.136	-	-	-	-	8.49	0.235
1635	61	2.39	0.2	0.14	0.40	-	-	-	-	0.153	14.80	1.46	1.33	162	8.29	0.283
1643	65	1.58	0.2	0.19	0.58	-	-	-	-	0.082	-	-	-	-	8.49	1.897
1700	62	2.37	0.2	0.25	0.11	-	-	-	-	0.150	-	-	-	-	8.43	-
1715	68	2.06	0.2	0.19	0.08	-	-	-	-	0.136	-	-	-	-	7.93	-
1734	75	2.16	0.2	0.17	0.15	-	-	-	-	0.133	-	-	-	-	7.68	1.201
1740	80	2.24	0.4	0.38	0.48	-	-	-	-	0.092	11.90	1.40	1.40	130	7.54	1.413
1748	79	2.07	0.2	0.14	0.18	-	-	-	-	0.054	-	-	-	-	7.30	2.654

- DATA NOT AVAILABLE

U.S. GEOLOGICAL SURVEY - WATER RESOURCES DIVISION.

ESTUARINE STUDIES GROUP

DATE	JULIAN DATE	CRUISE #	LOCATION	VESSEL
22 AUG 58	78234	4	WICOMICO R	B WHALER

TIME	STA	RIV MI n mi	UTM-N	UTM-E	DEPTH m	TEMP C	SALIN o/oo	SIG-T	DIS OXY ug-at/l	AOU ug-at/l	DIS OXY O2 PROB % SAT	TURBID	TRANS	EXT COEF	SPM mg/l
1535	106.4	30.5	247.2	338.8	0	28.1	6.6	1.2	-	-	-	-	-	-	16.0
1538	106.4	30.5	247.2	338.8	1	26.8	7.5	2.2	-	-	-	-	-	-	-
1541	106.4	30.5	247.2	338.8	2	26.6	7.5	2.3	-	-	-	-	-	-	-
1554	106.5	30.5	249.8	334.3	0	28.8	3.6	-1.2	-	-	-	-	-	-	13.5
1557	106.5	30.5	249.8	334.3	1	27.2	4.8	0.1	-	-	-	-	-	-	-
1616	106.6	30.5	250.3	332.0	0	28.5	2.1	-2.2	-	-	-	-	-	-	18.3
1619	106.6	30.5	250.3	332.0	1	28.2	2.7	-1.7	-	-	-	-	-	-	-
1622	106.6	30.5	250.3	332.0	2	26.7	2.8	-1.2	-	-	-	-	-	-	-

- DATA NOT AVAILABLE

DATE	JULIAN DATE	CRUISE #	LOCATION	VESSEL
22 AUG 58	78234	4	WICOMICO R	B WHALER

TIME	SiO2 uM/l	PO4 uM/l	NO3+NO2 uM/l	NO2 uM/l	NH3 uM/l	TOTAL NITROG	DISSOL NITROG	TOTAL PHOSPH	DISSOL PHOSPH	FLUOR	DIS CHL ug/l	ALKALIN meq/l	TOT CO2 mM/l	POC uM/l	pH	pCO2 ppt
1535	96	1.12	0.9	0.15	0.51	-	-	-	-	-	13.10	1.09	-	-	-	-
1538	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1541	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1554	101	0.33	0.4	0.17	0.30	-	-	-	-	-	10.40	0.79	-	-	-	-
1557	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1616	103	1.04	0.7	0.18	1.06	-	-	-	-	-	9.56	0.65	-	-	-	-
1619	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1622	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

- DATA NOT AVAILABLE

U.S. GEOLOGICAL SURVEY - WATER RESOURCES DIVISION

ESTUARINE STUDIES GROUP

DATE	JULIAN DATE	CRUISE #	LOCATION	VESSEL
23 AUG 78	78235	4	POTOMAC R	WARFIELD

TIME	STA	RIV MI n mi	UTM-N	UTM-E	DEPTH m	TEMP C	SALIN o/oo	SIG-T	DIS OXY ug-at/l	AOU ug-at/l	DIS OXY O2 PROB % SAT		TURBID	TRANS	EXT COEF	SPM mg/l
645	-	31.4	232.7	339.5	1	26.4	6.7	1.8	527	-44	109	50	0.104	123	-	-
700	-	34.4	235.2	334.5	1	26.8	6.1	1.2	596	-114	124	70	0.161	111	-	-
715	-	37.6	237.9	329.1	1	26.8	6.2	1.3	407	74	85	28	0.174	102	-	-
730	-	40.5	242.2	326.2	1	27.6	5.6	0.6	293	183	62	12	0.190	92	-	-
753	17.0	43.0	246.7	326.0	0	27.3	5.5	0.6	333	146	70	30	0.228	88	-	-
800	17.0	43.0	246.7	326.0	2	27.3	6.0	1.0	288	190	60	20	0.215	90	1.99	14.0
813	17.0	43.0	246.7	326.0	5	27.2	6.7	1.5	264	213	55	12	0.215	93	-	-
818	17.0	43.0	246.7	326.0	10	27.1	7.2	2.0	190	286	40	0	0.247	85	-	-
825	17.0	43.0	246.7	326.0	16	27.1	7.4	2.1	145	330	30	0	0.450	51	-	-
845	-	44.9	250.4	325.2	1	27.6	5.3	0.4	300	177	63	23	0.220	88	-	-
900	18.0	47.4	253.1	322.2	0	27.4	4.6	0.0	334	147	70	37	0.250	83	-	-
905	18.0	47.4	253.1	322.2	2	27.4	4.6	0.0	332	148	69	36	0.250	84	1.99	12.8
915	18.0	47.4	253.1	322.2	5	27.3	4.9	0.2	299	181	62	29	0.296	75	-	-
920	18.0	47.4	253.1	322.2	10	27.3	5.1	0.3	291	189	61	27	0.499	43	-	-
930	-	47.9	252.7	321.1	1	27.7	4.6	-0.1	311	167	65	26	0.270	82	-	-
945	-	51.8	251.0	314.3	1	27.7	3.1	-1.2	357	125	74	38	0.310	71	-	-
958	20.0	52.9	249.8	312.5	0	27.8	3.0	-1.3	341	140	71	43	0.420	56	-	-
1002	20.0	52.9	249.8	312.5	2	27.6	3.3	-1.0	304	178	63	32	0.460	50	2.83	27.6
1014	20.0	52.9	249.8	312.5	5	27.6	4.0	-0.5	274	206	57	27	1.076	12	-	-
1030	-	56.0	274.1	307.8	1	27.9	2.1	-2.0	376	107	78	47	0.379	67	-	-
1043	21.0	56.3	246.9	306.7	0	28.1	1.3	-2.6	466	17	96	72	0.310	72	-	-
1049	21.0	56.3	246.9	306.7	2	27.8	1.7	-2.2	361	124	74	50	0.360	64	2.26	19.2
1102	21.0	56.3	246.9	306.7	5	27.8	2.3	-1.8	342	141	71	41	0.457	50	-	-
1115	-	58.4	248.7	303.7	1	28.2	1.2	-2.7	377	106	78	55	0.430	36	-	-
1128	22.0	59.5	250.7	302.6	0	28.2	0.8	-3.1	455	29	94	74	0.282	81	-	-
1134	22.0	59.5	250.7	302.6	2	27.9	0.8	-3.0	419	67	86	64	0.340	68	2.36	18.4
1144	22.0	59.5	250.7	302.6	5	27.8	0.9	-2.8	384	103	79	58	0.900	15	-	-
1230	-	61.1	253.5	301.8	1	28.1	0.3	-3.4	517	-31	106	95	0.370	64	-	-
1248	24.0	62.9	256.7	301.9	0	28.1	0.2	-3.5	678	-192	139	126	0.250	80	-	-
1253	24.0	62.9	256.7	301.9	2	27.7	0.2	-3.4	541	-51	110	99	0.340	68	2.27	14.8
1304	24.0	62.9	256.7	301.9	5	27.7	0.2	-3.4	496	-6	101	91	0.500	48	-	-
1330	-	64.8	260.4	301.4	1	28.0	0.1	-3.5	628	-141	129	112	0.300	75	-	-
1350	26.0	67.8	265.7	301.7	0	29.0	0.1	-3.8	758	-279	158	150	0.250	80	-	-
1356	26.0	67.8	265.7	301.7	2	27.6	0.1	-3.4	543	-52	111	104	0.290	76	2.50	16.0
1406	26.0	67.8	265.7	301.7	5	27.4	0.1	-3.3	500	-7	101	92	0.660	26	-	-
1430	-	70.1	269.0	304.2	1	28.3	0.1	-3.6	790	-305	163	152	0.320	67	-	-
1440	28.0	71.0	270.3	305.3	0	30.4	0.1	-4.2	869	-402	186	178	0.240	80	-	-
1445	28.0	71.0	270.3	305.3	2	27.4	0.1	-3.3	494	-1	100	93	0.370	63	2.69	38.7
1455	28.0	71.0	270.3	305.3	5	27.4	0.1	-3.3	439	54	89	83	0.800	21	-	-
1515	-	72.7	272.7	307.3	1	27.8	0.1	-3.5	404	85	83	78	0.300	75	-	-

DATA NOT AVAILABLE

DATE	JULIAN DATE	CRUISE #	LOCATION	VESSEL
23 AUG 78	78235	4	POTOMAC R	WARFIELD

TIME	SiO2 uM/l	PO4 uM/l	NO3+NO2 uM/l	NO2 uM/l	NH3 uM/l	TOTAL NITROG	DISSOL NITROG	TOTAL PHOSPH	DISSOL PHOSPH	FLUOR	DIS CHL ug/l	ALKALIN meq/l	TOT CO2 mM/l	POC uM/l	pH	pCO2 ppt
645	59	2.30	0.3	0.22	0.34	-	-	-	-	0.076	-	-	-	-	8.33	0.288
700	57	2.63	-	0.26	-	-	-	-	-	0.063	-	-	-	-	8.53	0.182
715	58	2.77	2.8	0.33	0.89	-	-	-	-	0.066	-	-	-	-	7.89	0.879
730	55	2.88	5.1	0.34	0.06	-	-	-	-	0.149	-	-	-	-	7.61	1.395
753	53	2.96	6.8	0.35	0.11	-	-	-	-	0.120	-	-	-	-	7.65	1.526
800	55	2.92	5.4	0.32	0.56	50.0	23.8	5.00	3.57	0.127	31.20	1.45	1.45	156	7.56	1.812
813	59	2.83	2.7	0.27	0.52	-	-	-	-	0.089	-	-	-	-	7.52	2.068
818	64	2.65	0.5	0.21	0.45	-	-	-	-	0.085	-	-	-	-	7.41	2.644
825	65	2.60	0.3	0.21	0.55	-	-	-	-	0.070	-	-	-	-	7.34	3.085
845	52	3.01	7.3	0.36	0.46	-	-	-	-	0.130	-	-	-	-	7.65	1.584
900	45	3.13	14.5	0.37	1.27	-	-	-	-	0.120	-	-	-	-	7.65	1.688
905	47	3.11	13.3	0.36	0.56	-	-	-	-	0.111	17.00	1.48	1.45	149	7.64	1.627
915	47	3.11	12.2	0.38	0.79	-	-	-	-	0.097	-	-	-	-	7.55	1.887
920	50	3.11	11.0	0.41	0.73	-	-	-	-	0.085	-	-	-	-	7.52	2.062
930	47	3.09	12.6	0.39	0.97	-	-	-	-	0.079	-	-	-	-	7.59	1.769
945	43	3.16	15.2	0.46	1.34	-	-	-	-	0.117	-	-	-	-	7.77	2.013
958	36	3.14	20.4	0.46	1.53	-	-	-	-	0.095	-	-	-	-	7.72	1.547
1002	45	3.13	19.9	0.46	1.69	59.8	41.5	4.78	3.72	0.085	14.30	1.47	1.43	148 P	7.63	1.718
1014	38	3.16	18.5	0.39	1.63	-	-	-	-	0.082	-	-	-	-	7.52	2.161
1030	31	3.13	21.7	0.39	0.60	-	-	-	-	0.101	-	-	-	-	7.95	0.959
1043	19	2.97	21.3	0.32	0.55	-	-	-	-	0.139	-	-	-	-	7.50	0.300
1049	20	2.84	22.2	0.34	0.83	-	-	-	-	0.120	19.80	1.47	1.39	164	8.07	0.677
1102	26	2.95	22.8	0.39	1.00	-	-	-	-	0.097	-	-	-	-	7.80	1.186
1115	21	2.95	24.5	0.40	0.98	-	-	-	-	0.123	-	-	-	-	8.21	0.640
1128	10	2.83	27.4	0.33	1.22	-	-	-	-	0.126	-	-	-	-	8.49	0.295
1134	12	2.72	27.0	0.32	1.03	77.6	52.5	4.44	3.27	0.139	39.10	1.44	1.34	187	8.37	0.344
1144	11	2.72	25.7	0.35	0.67	-	-	-	-	0.149	-	-	-	-	8.16	0.482
1230	6	2.46	48.4	0.25	0.27	-	-	-	-	0.203	-	-	-	-	8.62	0.206
1248	3	1.62	50.1	0.32	0.16	-	-	-	-	0.253	-	-	-	-	8.87	0.123
1253	3	1.70	52.5	0.74	0.22	-	-	3.80	2.45	0.215	64.70	1.51	1.39	171	8.55	0.253
1304	3	1.87	52.3	0.72	0.26	-	-	-	-	0.152	-	-	-	-	8.48	0.285
1330	3	1.51	52.0	0.92	0.00	-	-	-	-	0.237	-	-	-	-	8.72	0.194
1350	15	0.83	47.9	2.31	0.00	-	-	-	-	0.253	-	-	-	-	9.01	0.139
1356	17	0.77	46.8	2.72	0.00	93.7	59.0	2.86	1.18	0.240	61.50	1.40	1.33	-	8.46	0.250
1406	13	0.86	51.7	2.05	0.18	-	-	-	-	0.082	-	-	-	-	8.31	0.414
1430	28	0.63	51.0	4.49	0.00	-	-	-	-	0.212	-	-	-	-	9.04	0.142
1440	37	0.94	41.4	6.53	0.00	-	-	-	-	0.253	-	-	-	-	9.16	0.121
1445	37	0.62	42.9	6.59	0.07	107.3	73.1	2.77	1.03	0.199	47.40	1.27	1.24	234	8.15	0.560
1455	41	0.67	48.8	7.19	0.35	-	-	-	-	0.215	-	-	-	-	7.89	0.994
1515	57	0.88	64.3	11.21	2.88	-	-	-	-	0.149	-	-	-	-	7.78	1.471

- DATA NOT AVAILABLE

DATE	JULIAN DATE	CRUISE #	LOCATION	VESSEL
23 AUG 78	78235	4	POTOMAC R	WARFIELD

TIME	STA	RIV MI n mi	UTM-N	UTM-E	DEPTH m	TEMP C	SALIN o/oo	SIG-T	DIS OXY ug-at/l	AOU ug-at/l	DIS OXY O2 % SAT	PROB	TURBID	TRANS	EXT COEF	SPM mg/l
1533	29.0	75.4	275.3	311.3	0	30.0	0.1	-4.1	801	-330	170	168	0.220	85	-	-
1540	29.0	75.4	275.3	311.3	2	28.1	0.1	-3.5	527	-40	108	98	0.260	80	2.89	-
1559	29.0	75.4	275.3	311.3	5	28.2	0.1	-3.6	598	-112	123	116	0.854	22	-	-
1615	-	-	275.7	318.4	1	28.5	0.1	-3.6	562	-79	116	110	0.260	80	-	-
1629	30.0	77.9	277.7	315.0	0	28.1	0.1	-3.5	571	-84	117	110	0.320	74	-	-
1633	30.0	77.9	277.7	315.0	2	28.1	0.1	-3.5	573	-86	118	108	0.310	72	2.56	13.3
1645	30.0	77.9	277.7	315.0	5	27.9	0.1	-3.5	513	-25	105	98	0.340	69	-	-
1652	30.0	77.9	277.7	315.0	12	27.9	0.1	-3.5	471	17	96	92	0.380	60	-	-

- DATA NOT AVAILABLE

DATE	JULIAN DATE	CRUISE #	LOCATION	VESSEL
23 AUG 78	78235	4	POTOMAC R	WARFIELD

TIME	SiO2 uM/l	PO4 uM/l	NO3+NO2 uM/l	NO2 uM/l	NH3 uM/l	TOTAL NITROG	DISSOL NITROG	TOTAL PHOSPH	DISSOL PHOSPH	FLUOR	DIS CHL ug/l	ALKALIN meq/l	TOT CO2 mM/l	POC uM/l	pH	pCO2 ppt
1533	56	0.73	60.0	8.90	0.47	-	-	-	-	0.237	-	-	-	-	9.00	0.113
1540	58	0.74	62.3	9.54	1.94	103.4	80.3	2.52	1.04	0.196	37.10	1.33	1.31	213	8.13	0.677
1559	54	0.80	58.0	8.81	0.55	-	-	-	-	0.234	-	-	-	-	8.46	0.375
1615	56	0.76	59.4	8.74	1.13	-	-	-	-	0.171	-	-	-	-	8.35	0.440
1629	58	0.72	63.4	8.86	1.13	-	-	-	-	0.190	-	-	-	-	8.33	0.418
1633	58	0.71	63.6	8.81	0.85	108.4	85.1	2.59	1.08	0.191	46.90	1.37	1.35	226	8.29	0.408
1645	58	0.60	63.2	8.87	1.62	-	-	-	-	0.190	-	-	-	-	8.12	0.663
1652	60	0.65	64.1	9.17	2.83	-	-	-	-	0.174	-	-	-	-	7.99	0.880

- DATA NOT AVAILABLE

DATE	JULIAN DATE	CRUISE #	LOCATION	VESSEL
23 AUG 58	78235	4	TRIBUTARIES	B WHALER

TIME	STA	RIV MI n mi	UTM-N	UTM-E	DEPTH m	TEMP C	SALIN o/oo	SIG-T	DIS OXY ug-at/l	AOU ug-at/l	DIS OXY O2 % SAT	PROB	TURBID	TRANS	EXT COEF	SPM mg/l
835	107.6	47.1	262.5	323.8	0	23.2	0.7	-1.8	-	-	-	-	-	-	-	21.5
837	107.6	47.1	262.5	323.8	1	24.4	0.9	-2.0	-	-	-	-	-	-	-	-
845	107.4	47.1	261.2	323.2	0	24.4	1.4	-1.6	-	-	-	-	-	-	-	18.5
847	107.4	47.1	261.2	323.2	1	24.9	1.6	-1.6	-	-	-	-	-	-	-	-
849	107.4	47.1	261.2	323.2	2	25.0	1.2	-1.9	-	-	-	-	-	-	-	-
854	107.2	47.1	259.0	322.6	0	24.8	2.3	-1.0	-	-	-	-	-	-	-	10.8
856	107.2	47.1	259.0	322.6	1	25.1	2.4	-1.0	-	-	-	-	-	-	-	-
858	107.2	47.1	259.0	322.6	2	25.1	2.6	-0.9	-	-	-	-	-	-	-	-
932	108.7	51.0	257.9	312.7	0	22.4	1.2	-1.3	-	-	-	-	-	-	-	15.0
934	108.7	51.0	257.9	312.7	1	22.9	1.2	-1.4	-	-	-	-	-	-	-	-
943	108.4	51.0	256.7	315.5	0	24.4	0.2	-2.5	-	-	-	-	-	-	-	17.3
945	108.4	51.0	256.7	315.5	1	24.3	0.7	-2.1	-	-	-	-	-	-	-	-
951	108.2	51.0	254.7	315.4	0	24.9	1.6	-1.6	-	-	-	-	-	-	-	21.2
953	108.2	51.0	254.7	315.4	1	24.8	2.2	-1.1	-	-	-	-	-	-	-	-
1058	109.5	58.0	247.4	296.0	0	24.8	1.4	-1.7	-	-	-	-	-	-	-	24.7
1100	109.5	58.0	247.4	296.0	1	24.7	1.4	-1.7	-	-	-	-	-	-	-	-
1109	109.4	58.0	246.4	296.9	0	25.6	0.7	-2.4	-	-	-	-	-	-	-	-
1111	109.4	58.0	246.4	296.9	1	25.2	0.8	-2.3	-	-	-	-	-	-	-	-
1120	109.2	58.0	246.5	299.3	0	25.9	0.6	-2.6	-	-	-	-	-	-	-	16.7
1122	109.2	58.0	246.5	299.3	1	25.6	0.6	-2.5	-	-	-	-	-	-	-	-
1204	110.4	60.0	256.3	293.9	0	26.3	0.2	-3.0	-	-	-	-	-	-	-	19.3
1206	110.4	60.0	256.3	293.9	1	25.6	0.2	-2.8	-	-	-	-	-	-	-	-
1210	110.3	60.0	255.0	294.4	0	26.7	0.1	-3.2	-	-	-	-	-	-	-	-
1212	110.3	60.0	255.0	294.4	1	26.4	0.1	-3.1	-	-	-	-	-	-	-	-
1222	110.2	60.0	252.6	296.5	0	27.5	0.1	-3.4	-	-	-	-	-	-	-	12.0
1224	110.2	60.0	252.6	296.5	1	26.4	0.1	-3.1	-	-	-	-	-	-	-	-
1348	111.1	68.0	266.9	298.9	0	29.5	-	-	-	-	-	-	-	-	-	21.0
1350	111.1	68.0	266.9	298.9	1	28.7	-	-	-	-	-	-	-	-	-	-
1426	112.2	71.6	273.1	311.0	0	27.3	-	-	-	-	-	-	-	-	-	22.0
1428	112.2	71.6	273.1	311.0	1	27.3	-	-	-	-	-	-	-	-	-	-
1437	112.1	71.6	274.6	309.1	0	28.7	-	-	-	-	-	-	-	-	-	-
1439	112.1	71.6	274.6	309.1	1	27.5	-	-	-	-	-	-	-	-	-	-
1520	114.3	78.1	283.7	303.7	0	27.1	-	-	-	-	-	-	-	-	-	10.5
1522	114.3	78.1	283.7	303.7	1	25.7	-	-	-	-	-	-	-	-	-	-
1524	114.3	78.1	283.7	303.7	2	24.7	-	-	-	-	-	-	-	-	-	-
1550	114.2	78.1	280.7	305.7	0	27.2	-	-	-	-	-	-	-	-	-	-
1552	114.2	78.1	280.7	305.7	1	26.0	-	-	-	-	-	-	-	-	-	-
1554	114.2	78.1	280.7	305.7	2	25.4	-	-	-	-	-	-	-	-	-	-
1558	114.1	78.1	278.9	306.8	0	28.3	-	-	-	-	-	-	-	-	-	12.7
1600	114.1	78.1	278.9	306.8	1	27.3	-	-	-	-	-	-	-	-	-	-

- DATA NOT AVAILABLE

DATE	JULIAN DATE	CRUISE #	LOCATION	VESSEL
23 AUG 58	78235	4	TRIBUTARIES	B WHALER

TIME	SiO2 uM/l	PO4 uM/l	NO3+NO2 uM/l	NO2 uM/l	NH3 uM/l	TOTAL NITROG	DISSOL NITROG	TOTAL PHOSPH	DISSOL PHOSPH	FLUOR	DIS CHL ug/l	ALKALIN meq/l	TOT CO2 mM/l	POC uM/l	pH	pCO2 ppt
835	110	1.49	0.3	0.22	0.30	-	-	-	-	-	26.90	-	-	302	-	-
837	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
845	90	2.78	0.3	0.23	0.30	-	-	-	-	-	23.50	1.27	-	267	-	-
847	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
849	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
854	68	2.63	0.3	0.20	0.34	-	-	-	-	-	27.10	1.38	-	264	-	-
856	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
858	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
932	29	1.64	0.8	0.24	0.45	-	-	-	-	-	35.70	1.20	-	-	-	-
934	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
943	23	2.64	0.5	0.38	0.46	-	-	-	-	-	70.80	1.34	-	-	-	-
945	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
951	27	2.91	8.3	0.40	0.66	-	-	-	-	-	54.30	1.46	-	207	-	-
953	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1058	99	0.40	1.4	0.24	0.35	-	-	-	-	-	129.00	1.02	-	-	-	-
1100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1109	74	0.22	1.9	0.53	0.40	-	-	-	-	-	140.00	0.68	-	-	-	-
1111	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1120	16	0.86	0.5	0.25	0.41	-	-	-	-	-	85.40	1.37	-	579	-	-
1122	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1204	90	0.18	4.5	1.00	0.31	-	-	-	-	-	68.30	0.64	-	655	-	-
1206	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1210	85	0.48	0.9	0.30	0.31	-	-	-	-	-	92.70	0.78	-	880	-	-
1212	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1222	31	0.47	0.4	0.23	0.51	-	-	-	-	-	73.40	1.31	-	655	-	-
1224	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1348	20	0.16	21.4	3.12	0.53	-	-	2.46	0.84	-	92.20	-	-	395	-	-
1350	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1426	14	0.11	0.5	0.22	0.36	77.9	28.1	3.08	0.58	-	65.60	1.01	-	739	-	-
1428	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1437	21	0.48	0.9	0.24	0.45	-	-	-	-	-	84.10	1.16	-	728	-	-
1439	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1520	99	0.11	11.6	1.30	12.29	64.2	46.1	1.02	0.29	-	25.60	0.51	-	209	-	-
1522	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1524	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1550	70	0.31	0.7	0.14	0.48	-	-	-	-	-	29.10	0.62	-	493	-	-
1552	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1554	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1558	60	0.15	0.4	0.19	0.55	-	-	-	-	-	60.60	0.78	-	-	-	-
1600	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

- DATA NOT AVAILABLE

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DATE	JULIAN DATE	CRUISE #	LOCATION	VESSEL
23 AUG 58	78235	4	TRIBUTARIES	B WHALER

TIME	STA	RIV MI n mi	UTM-N	UTM-E	DEPTH m	TEMP C	SALIN o/oo	SIG-T	DIS OXY ug-at/l	AOU ug-at/l	DIS OXY O2 % SAT	PROB	TURBID	TRANS	EXT COEF	SPM mg/l
1602	114.1	78.1	278.9	306.8	2	26.8	-	-	-	-	-	-	-	-	-	-
1641	115.1	80.2	282.9	311.8	0	28.2	-	-	-	-	-	-	-	-	-	28.3
1643	115.1	80.2	282.9	311.8	1	26.9	-	-	-	-	-	-	-	-	-	-
1721	113.1	74.1	274.1	309.4	0	28.2	-	-	-	-	-	-	-	-	-	12.0
1723	113.1	74.1	274.1	309.4	1	27.6	-	-	-	-	-	-	-	-	-	-

- DATA NOT AVAILABLE

DATE	JULIAN DATE	CRUISE #	LOCATION	VESSEL
23 AUG 58	78235	4	TRIBUTARIES	B WHALER

TIME	SiO2 uM/l	PO4 uM/l	NO3+NO2 uM/l	NO2 uM/l	NH3 uM/l	TOTAL NITROG	DISSOL NITROG	TOTAL PHOSPH	DISSOL PHOSPH	FLUOR	DIS CHL ug/l	ALKALIN meq/l	TOT CO2 mM/l	POC uM/l	pH	pCO2 ppt
1602	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1641	142	5.12	0.4	0.22	0.76	113.8	40.5	11.16	7.18	-	82.00	0.83	-	-	-	-
1643	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1721	51	0.84	21.9	9.84	0.44	100.2	77.9	2.40	1.02	-	35.00	1.22	-	313	-	-
1723	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

- DATA NOT AVAILABLE

DATE	JULIAN DATE	CRUISE #	LOCATION	VESSEL
24 AUG 78	78236	4	POTOMAC R	WARFIELD

TIME	STA	RIV MI n mi	UTM-N	UTM-E	DEPTH m	TEMP C	SALIN o/oo	SIG-T	DIS OXY ug-at/l	AOU ug-at/l	DIS OXY O2 % SAT	PROB	TURBID	TRANS	EXT COEF	SPM mg/l
848	30.0	77.9	277.5	315.2	0	27.5	0.1	-3.4	458	34	93	86	0.280	84	-	-
855	30.0	77.9	277.5	315.2	2	27.5	0.1	-3.4	473	19	96	86	0.260	85	2.21	12.7
905	30.0	77.9	277.5	315.2	5	-	0.1	-	464	-	-	84	0.260	86	-	-
911	30.0	77.9	277.5	315.2	13	27.5	0.1	-3.4	473	19	96	84	0.460	56	-	-
930	-	78.6	278.8	314.9	1	27.6	0.1	-3.4	550	-59	112	89	0.350	78	-	-
948	31.0	81.0	283.0	315.0	0	27.5	0.1	-3.4	426	66	87	73	0.260	85	-	-
952	31.0	81.0	283.0	315.0	2	27.5	0.1	-3.4	427	65	87	73	0.260	85	2.08	17.5
1003	31.0	81.0	283.0	315.0	5	27.5	0.1	-3.4	409	83	83	76	0.330	73	-	-
1009	31.0	81.0	283.0	315.0	10	-	0.1	-	412	-	-	76	0.550	45	-	-
1030	-	83.4	285.0	318.8	1	27.8	0.1	-3.4	446	43	91	83	0.300	76	-	-
1048	32.0	85.1	285.8	322.0	0	-	0.1	-	445	-	-	84	0.270	78	-	-
1053	32.0	85.1	285.8	322.0	2	-	0.1	-	416	-	-	77	0.300	74	2.29	18.4
1101	32.0	85.1	285.8	322.0	5	-	0.1	-	412	-	-	77	0.320	74	-	-
1107	32.0	85.1	285.8	322.0	10	27.4	0.1	-3.3	423	70	86	77	0.300	75	-	-
1112	32.0	85.1	285.8	322.0	15	27.5	0.1	-3.4	422	70	86	78	0.490	60	-	-
1145	-	89.1	292.6	323.3	1	27.8	0.1	-3.4	392	97	80	73	0.310	75	-	-
1155	33.0	89.5	293.4	323.3	0	27.6	0.1	-3.4	376	115	77	70	0.280	80	-	-
1159	33.0	89.5	293.4	323.3	2	27.4	0.1	-3.3	358	135	73	67	0.320	71	2.14	21.6
1210	33.0	89.5	293.4	323.3	7	27.4	0.1	-3.3	345	148	70	63	0.500	46	-	-
1230	-	90.4	294.9	323.1	1	28.1	0.1	-3.5	380	107	78	70	0.300	77	-	-
1249	34.0	91.8	297.8	323.5	0	28.0	0.1	-3.5	390	97	80	74	0.280	78	-	-
1252	34.0	91.8	297.8	323.5	2	28.0	0.1	-3.5	398	89	82	75	0.270	81	2.09	13.2
1301	34.0	91.8	297.8	323.5	5	27.7	0.1	-3.4	357	133	73	68	0.410	59	-	-
1336	35.0	93.8	301.3	324.4	0	27.7	0.1	-3.4	435	55	89	83	0.320	75	-	-
1340	35.0	93.8	301.3	324.4	2	27.9	0.1	-3.5	452	36	93	86	0.320	74	2.05	17.7
1352	35.0	93.8	301.3	324.4	8	27.3	0.1	-3.3	356	137	72	66	0.360	67	-	-
1412	37.0	95.0	303.2	323.9	0	27.6	0.1	-3.4	602	-111	123	116	0.300	71	-	-
1418	37.0	95.0	303.2	323.9	2	27.5	0.1	-3.3	532	-40	108	105	0.370	64	2.26	16.0
1426	37.0	95.0	303.2	323.9	4	27.3	0.1	-3.3	534	-41	108	94	0.470	53	-	-
1450	36.0	95.4	303.5	325.7	0	29.7	0.1	-4.0	417	56	88	83	0.400	61	-	-
1455	36.0	95.4	303.5	325.7	2	29.5	0.1	-3.9	400	75	84	78	0.410	60	2.64	21.9
1502	36.0	95.4	303.5	325.7	5	27.4	0.1	-3.3	375	118	76	69	0.450	55	-	-

- DATA NOT AVAILABLE

DATE	JULIAN DATE	CRUISE #	LOCATION	VESSEL
24 AUG 78	78236	4	POTOMAC R	WARFIELD

TIME	SiO2 uM/l	PO4 uM/l	NO3+NO2 uM/l	NO2 uM/l	NH3 uM/l	TOTAL NITROG	DISSOL NITROG	TOTAL PHOSPH	DISSOL PHOSPH	FLUOR	DIS CHL ug/l	ALKALIN meq/l	TOT CO2 mM/l	POC uM/l	pH	pCO2 ppt
848	63	0.91	69.6	9.49	9.38	-	-	-	-	0.152	-	-	-	-	7.85	1.096
855	64	0.89	69.8	9.53	9.34	114.1	94.4	2.54	1.16	0.152	13.80	1.35	-	-	7.86	1.107
905	61	0.83	68.4	9.37	8.62	-	-	-	-	0.152	-	-	-	-	7.87	1.043
911	58	0.79	66.7	9.20	6.35	113.2	87.8	2.84	1.20	0.161	-	-	-	-	7.89	1.000
930	63	0.68	67.0	9.14	3.40	-	-	-	-	0.205	-	-	-	-	8.11	-
948	70	0.77	75.4	10.33	13.23	-	-	-	-	0.133	-	-	-	-	7.69	1.669
952	69	0.78	75.5	10.53	12.03	118.6	100.7	2.50	1.35	0.133	10.50	1.36	1.43	166	7.69	1.739
1003	70	0.79	75.4	10.44	13.90	-	-	-	-	0.133	-	-	-	-	7.66	1.836
1009	72	0.80	75.7	9.93	16.45	-	-	-	-	0.139	-	-	-	-	7.66	1.875
1030	76	0.71	76.1	9.24	21.63	-	-	-	-	0.152	-	-	-	-	7.73	1.600
1048	92	0.88	73.7	6.84	38.98	-	-	-	-	0.158	-	-	-	-	7.66	2.029
1053	92	0.85	73.7	6.84	38.19	140.7	122.9	2.79	1.51	0.152	29.70	1.42	1.55	131	7.64	1.985
1101	91	0.86	74.3	7.12	35.55	-	-	-	-	0.149	-	-	-	-	7.64	2.077
1107	89	0.83	75.2	7.41	33.55	-	-	-	-	0.149	-	-	-	-	7.65	2.009
1112	88	0.82	75.1	7.48	32.14	-	-	-	-	0.155	-	-	-	-	7.66	1.936
1145	95	0.81	72.0	6.10	45.56	-	-	-	-	0.117	-	-	-	-	7.59	-
1155	109	1.24	71.8	4.82	58.48	-	-	-	-	0.104	-	-	-	-	7.55	2.598
1159	109	1.24	71.9	4.87	59.74	157.0	141.7	2.88	1.96	0.107	15.80	1.52	1.63	-	7.52	2.801
1210	109	1.26	71.9	4.94	61.14	-	-	-	-	0.101	-	-	-	-	7.49	3.039
1230	104	1.60	71.8	4.24	60.79	-	-	-	-	0.104	-	-	-	-	7.57	2.399
1249	117	1.75	70.5	3.61	70.63	-	-	-	-	0.101	-	-	-	-	7.57	2.659
1252	117	1.73	70.5	3.53	70.77	165.3	148.0	3.46	2.37	0.104	9.39	1.56	1.65	131	7.45	2.513
1301	117	1.80	70.5	3.58	85.32	-	-	-	-	0.107	-	-	-	-	7.47	3.315
1336	119	1.74	67.9	3.21	53.33	-	-	-	-	0.114	-	-	-	-	7.73	1.643
1340	120	1.65	67.3	2.79	63.80	-	-	-	-	0.127	9.82	1.58	1.62	132	7.71	1.736
1352	122	1.78	65.2	2.63	101.70	-	-	-	-	0.085	-	-	-	-	7.45	3.183
1412	111	1.09	63.6	1.10	0.41	-	-	-	-	0.168	-	-	-	-	7.60	0.288
1418	111	1.01	63.2	1.07	0.21	87.2	75.4	1.94	1.38	0.142	12.30	1.68	1.58	155	7.47	0.380
1426	112	0.94	64.3	1.15	0.29	-	-	-	-	0.107	-	-	-	-	7.33	0.441
1450	100	0.54	65.2	6.29	4.42	-	-	-	-	0.127	-	-	-	-	7.62	2.087
1455	99	0.52	70.6	6.26	4.18	101.1	88.5	1.82	1.08	0.110	34.90	1.35	1.46	-	7.59	2.222
1502	100	0.50	70.7	6.42	4.97	-	-	-	-	0.070	-	-	-	-	7.62	2.363

- DATA NOT AVAILABLE

DATE	JULIAN DATE	CRUISE #	LOCATION	VESSEL
25 AUG 78	78237	4	TRIBUTARIES	B WHALER

TIME	STA	RIV MI n mi	UTM-N	UTM-E	DEPTH m	TEMP C	SALIN o/oo	SIG-T	DIS OXY ug-at/l	AOU ug-at/l	DIS OXY O2 PROB % SAT	TURBID	TRANS	EXT COEF	SPM mg/l
907	137.6	101.0	310.7	316.5	1	-	-	-	-	-	-	-	-	-	17.3
920	137.4	99.3	308.3	318.5	1	-	-	-	-	-	-	-	-	-	10.7
938	137.2	96.9	305.9	321.7	1	-	-	-	-	-	-	-	-	-	10.8
949	37.0	95.0	303.2	323.9	1	-	-	-	-	-	-	-	-	-	24.1
1026	136.4	99.6	307.6	330.5	1	-	-	-	-	-	-	-	-	-	54.8
1038	136.2	97.3	305.1	329.0	1	-	-	-	-	-	-	-	-	-	45.9
1110	36.0	95.4	303.5	325.7	1	-	-	-	-	-	-	-	-	-	21.3

- DATA NOT AVAILABLE

DATE	JULIAN DATE	CRUISE #	LOCATION	VESSEL
25 AUG 78	78237	4	TRIBUTARIES	B WHALER

TIME	SiO2 uM/l	PO4 uM/l	NO3+NO2 uM/l	NO2 uM/l	NH3 uM/l	TOTAL NITROG	DISSOL NITROG	TOTAL PHOSPH	DISSOL PHOSPH	FLUOR	DIS CHL ug/l	ALKALIN meq/l	TOT CO2 mM/l	POC uM/l	pH	pCO2 ppt
907	92	0.41	45.9	0.76	2.91	64.2	47.8	1.20	0.09	-	26.70	1.80	-	-	-	-
920	98	0.65	57.0	0.67	0.87	-	-	-	-	-	21.10	1.78	-	98	-	-
938	95	0.60	53.3	0.59	0.71	-	-	-	-	-	20.70	1.76	-	113	-	-
949	101	0.68	60.3	0.77	1.02	-	-	-	-	-	26.20	1.77	-	-	-	-
1026	96	0.11	34.6	2.74	11.97	86.0	55.9	1.28	0.42	-	39.70	0.88	-	375	-	-
1038	99	0.13	42.7	7.84	25.54	-	-	-	-	-	46.10	0.93	-	-	-	-
1110	104	0.39	72.6	8.64	13.66	-	-	-	-	-	17.90	1.13	-	148	-	-

- DATA NOT AVAILABLE

DATE	JULIAN DATE	CRUISE #	LOCATION	VESSEL
28 AUG 78	78240	4	POTOMAC R	WARFIELD

TIME	STA	RIV MI n mi	UTM-N	UTM-E	DEPTH m	TEMP C	SALIN o/oo	SIG-T	DIS OXY ug-at/l	AOU ug-at/l	DIS OXY O2 PROB % SAT		TURBID	TRANS EXT COEF	SPM mg/l
927	-	95.2	303.5	323.7	1	27.6	0.1	-3.4	472	19	96	91	0.310	78	-	-
931	-	94.3	302.4	324.3	1	27.3	0.1	-3.3	464	30	94	89	0.360	70	-	-
942	-	92.3	298.9	323.6	1	27.2	0.1	-3.3	451	43	91	88	0.340	74	-	-
954	-	90.7	295.6	323.1	1	27.6	0.1	-3.4	324	167	66	62	0.300	84	-	-
1000	-	89.5	293.4	323.3	1	27.7	0.1	-3.4	339	151	69	66	0.330	76	-	-
1008	-	88.0	290.6	323.1	1	27.8	0.1	-3.4	326	163	67	61	0.330	75	-	-
1018	-	85.6	286.5	322.6	1	27.9	0.1	-3.5	376	112	77	72	0.320	80	-	-
1037	-	82.1	284.3	316.5	1	28.1	0.1	-3.5	380	107	78	72	0.280	84	-	-
1046	-	80.0	281.4	314.4	1	28.0	0.1	-3.5	432	55	89	85	0.260	87	-	-
1058	-	77.4	276.9	314.6	1	27.9	0.1	-3.5	466	22	95	90	0.290	82	-	-
1110	-	74.8	275.2	310.0	1	28.1	0.1	-3.5	482	5	99	95	0.320	75	-	-
1124	-	71.7	271.4	306.3	1	27.9	0.1	-3.5	459	29	94	88	0.350	71	-	-
1139	-	68.5	267.0	302.4	1	27.8	0.1	-3.5	482	7	99	92	0.310	74	-	-
1153	-	65.5	261.5	301.3	1	27.8	0.1	-3.4	497	-8	102	94	0.380	71	-	-
1212	-	61.6	254.3	301.8	1	27.8	0.2	-3.4	493	-4	101	96	0.300	80	-	-
1302	-	56.0	247.1	307.6	1	28.3	2.3	-1.9	404	75	84	62	0.250	91	-	-
1323	-	51.4	251.2	315.1	1	28.4	3.5	-1.1	422	53	89	59	0.250	87	-	-
1338	-	47.7	252.7	321.4	1	28.2	4.9	0.0	487	-14	103	80	0.240	91	-	-
1358	-	43.5	247.8	326.1	1	28.6	5.9	0.5	563	-96	121	111	0.260	93	-	-

- DATA NOT AVAILABLE

U.S. GEOLOGICAL SURVEY - WATER RESOURCES DIVISION

ESTUARINE STUDIES GROUP

DATE	JULIAN DATE	CRUISE #	LOCATION	VESSEL
28 AUG 78	78240	4	POTOMAC R	WARFIELD

TIME	SiO2 uM/l	PO4 uM/l	NO3+NO2 uM/l	NO2 uM/l	NH3 uM/l	TOTAL NITROG	DISSOL NITROG	TOTAL PHOSPH	DISSOL PHOSPH	FLUOR	DIS CHL ug/l	ALKALIN meq/l	TOT CO2 mM/l	POC uM/l	pH	pCO2 ppt
927	84	0.23	26.4	0.80	5.01	-	-	-	-	0.206	32.20	1.62	-	-	8.75	0.203
931	84	0.22	26.5	0.85	4.54	-	-	-	-	0.180	-	1.70	-	89	8.70	0.163
942	92	0.45	44.6	2.25	5.24	-	-	-	-	0.133	-	1.71	-	67	8.38	0.364
954	105	2.81	50.7	3.96	112.90	-	-	-	-	0.104	19.20	1.75	1.76	73	7.50	2.235
1000	106	2.30	55.2	4.73	93.00	-	-	-	-	0.092	-	1.68	-	-	7.55	2.433
1008	107	2.33	61.9	4.93	101.40	-	-	-	-	0.101	-	1.70	-	-	7.45	2.751
1018	97	1.03	64.6	6.71	81.90	-	-	-	-	0.120	-	1.58	-	-	7.53	2.495
1037	74	1.05	73.5	10.10	41.60	-	-	-	-	0.142	32.80	1.49	1.54	-	7.53	2.189
1046	54	0.89	74.5	11.85	19.30	-	-	-	-	0.183	-	1.42	-	-	7.74	1.629
1058	43	0.74	67.4	10.20	8.62	-	-	-	-	0.206	-	1.37	1.29	-	7.98	0.870
1110	31	0.65	58.7	7.42	4.26	-	-	-	-	0.215	51.90	1.29	-	-	8.13	0.530
1124	27	0.67	57.7	8.96	3.26	-	-	-	-	0.196	-	1.25	1.19	-	7.90	0.894
1139	23	0.86	46.2	7.29	3.26	-	-	-	-	0.193	60.60	1.21	-	-	8.19	0.553
1153	10	1.07	33.8	3.28	2.84	-	-	-	-	0.215	-	1.29	-	191	8.33	0.346
1212	4	1.70	11.0	1.33	5.80	-	-	-	-	0.171	45.20	1.42	-	-	8.41	0.344
1302	24	2.67	6.2	0.51	3.32	-	-	-	-	0.101	12.60	1.41	1.40	-	8.04	0.554
1323	37	2.69	11.8	0.50	0.82	-	-	-	-	0.136	19.60	1.42	1.41	-	7.87	0.830
1338	48	2.69	3.0	0.38	0.12	-	-	-	-	0.190	-	1.39	-	-	7.97	0.701
1358	55	2.66	2.7	0.29	0.05	-	-	-	-	0.220	-	1.39	1.30	-	8.28	0.238

- DATA NOT AVAILABLE

DATE	JULIAN DATE	CRUISE #	LOCATION	VESSEL
30 AUG 78	78242	4	POTOMAC R	WARFIELD

TIME	STA	RIV MI n mi	UTM-N	UTM-E	DEPTH m	TEMP C	SALIN o/oo	SIG-T	DIS OXY ug-at/l	AOU ug-at/l	DIS OXY O2 PROB % SAT		TURBID	TRANS	EXT COEF	SPM mg/l
1100	-	82.2	284.5	316.8	1	28.6	0.1	-3.7	443	39	92	92	0.270	84	-	-
1115	-	78.9	279.5	314.6	1	28.6	0.1	-3.7	462	20	96	96	0.240	88	-	-
1130	-	75.5	273.5	311.4	1	28.6	0.1	-3.7	543	-61	113	114	0.310	80	-	-
1145	-	71.9	271.7	306.6	1	28.7	0.1	-3.7	501	-20	104	109	0.310	75	-	-
1200	-	68.8	267.4	302.4	1	28.6	0.1	-3.7	633	-151	131	128	0.300	76	-	-
1217	-	68.0	265.6	300.8	1	28.9	0.1	-3.8	559	-79	117	117	0.370	64	-	-
1230	-	65.0	260.6	301.5	1	28.5	0.1	-3.6	523	-40	108	109	0.320	72	-	-
1245	-	61.3	253.9	301.9	1	28.6	0.1	-3.7	526	-44	109	110	0.300	78	-	-
1300	-	58.4	248.7	303.7	1	28.6	0.3	-3.5	-	-	-	102	0.280	81	-	-
1500	-	55.5	247.1	308.5	1	29.3	1.8	-2.6	-	-	-	105	0.270	82	-	-
1515	-	52.1	250.7	313.7	1	28.7	2.8	-1.7	419	55	88	80	0.280	81	-	-
1530	-	49.4	252.0	318.7	1	29.0	4.3	-0.7	441	27	94	81	0.270	80	-	-
1545	-	45.7	251.7	324.6	1	29.1	4.9	-0.3	418	48	90	92	0.220	94	-	-
1600	-	42.9	246.9	326.3	1	29.0	5.9	0.4	473	-9	102	85	0.300	80	-	-
1615	-	39.6	240.6	326.9	1	29.1	5.6	0.2	587	-123	127	115	0.240	93	-	-
1630	-	36.2	236.8	331.3	1	29.8	6.3	0.5	932	-476	204	-	0.310	104	-	-
1645	-	32.5	233.7	337.5	1	28.9	7.1	1.3	683	-221	148	135	0.160	120	-	-
1700	-	31.0	235.3	340.5	1	29.2	7.9	1.8	579	-122	127	115	0.161	107	-	-
1722	13.0	30.5	240.3	339.4	1	29.1	8.0	2.0	434	24	95	74	0.263	80	-	-

- DATA NOT AVAILABLE

U.S. GEOLOGICAL SURVEY - WATER RESOURCES DIVISION

ESTUARINE STUDIES GROUP

DATE	JULIAN DATE	CRUISE #	LOCATION	VESSEL
30 AUG 78	78242	4	POTOMAC R	WARFIELD

TIME	SiO2 uM/l	PO4 uM/l	NO3+NO2 uM/l	NO2 uM/l	NH3 uM/l	TOTAL NITROG	DISSOL NITROG	TOTAL PHOSPH	DISSOL PHOSPH	FLUOR	DIS CHL us/l	ALKALIN meq/l	TOT CO2 mM/l	POC uM/l	pH	pCO2 ppt
1100	72	0.72	65.0	9.93	4.61	-	-	-	-	0.190	53.40	-	-	-	-	1.555
1115	46	0.39	73.3	14.56	13.95	-	-	-	-	0.199	-	-	-	-	-	1.285
1130	26	0.33	57.0	10.32	1.32	-	-	-	-	0.231	76.80	-	-	-	-	0.335
1145	19	0.34	50.8	8.71	0.22	-	-	-	-	0.221	-	-	-	-	-	0.362
1200	13	0.43	42.7	7.28	0.11	-	-	-	-	0.250	81.10	-	-	-	-	0.220
1217	10	0.53	27.4	4.01	0.17	-	-	-	-	0.256	-	-	-	-	-	-
1230	5	0.33	24.2	3.32	0.17	-	-	-	-	0.230	76.80	-	-	-	-	0.193
1245	3	0.85	25.0	1.92	0.19	-	-	-	-	0.180	-	-	-	-	-	0.237
1300	2	1.16	25.4	1.29	0.15	-	-	-	-	0.158	45.60	-	-	-	-	0.295
1500	14	2.32	18.0	0.56	0.99	-	-	-	-	0.149	35.20	-	-	-	-	0.320
1515	29	2.57	14.2	0.58	2.29	-	-	-	-	0.114	-	-	-	-	-	0.710
1530	37	2.56	9.3	0.56	0.98	-	-	-	-	0.127	23.00	-	-	-	-	0.835
1545	45	2.56	4.8	0.52	0.44	-	-	-	-	0.139	-	-	-	-	-	0.934
1600	51	2.63	1.1	0.21	0.25	-	-	-	-	0.158	-	-	-	-	-	0.348
1615	53	2.60	1.1	0.40	0.34	-	-	-	-	0.200	-	-	-	-	-	0.358
1630	59	2.73	0.4	0.33	0.51	-	-	-	-	0.150	42.70	-	-	-	-	0.065
1645	60	2.39	0.3	0.31	0.59	-	-	-	-	0.085	-	-	-	-	-	0.143
1700	67	2.16	0.3	0.34	0.43	-	-	-	-	0.117	22.40	-	-	-	-	0.237
1722	87	2.19	0.4	0.37	0.50	-	-	-	-	0.253	-	-	-	-	-	1.073

- DATA NOT AVAILABLE

DATE	JULIAN DATE	CRUISE #	LOCATION	VESSEL
31 AUG 78	78243	4	POTOMAC R	WARFIELD

TIME	STA	RIV MI n mi	UTM-N	UTM-E	DEPTH m	TEMP C	SALIN o/oo	SIG-T	DIS OXY ug-at/l	AOU ug-at/l	DIS OXY O2 PROB % SAT	TURBID	TRANS	EXT COEF	SPM mg/l
745	-	31.3	239.6	339.7	1	28.2	8.4	2.5	385	79	83	-	0.170	95	-	-
800	-	30.8	235.7	340.6	1	27.8	8.0	2.3	394	74	84	50	0.142	109	-	-
815	-	27.7	229.8	345.5	1	27.9	8.0	2.3	439	28	94	65	0.107	121	-	-
830	-	24.6	227.9	350.8	1	27.7	8.4	2.6	406	62	87	58	0.107	120	-	-
845	-	21.5	226.1	356.5	1	27.7	8.5	2.7	453	15	97	66	0.104	122	-	-
900	-	17.4	221.9	362.7	1	28.1	9.5	3.3	451	11	98	70	0.114	122	-	-
915	-	13.8	217.6	367.1	1	27.8	10.1	3.9	430	33	93	57	0.101	126	-	-
938	6.0	10.8	214.0	371.3	0	27.5	10.7	4.4	392	72	85	56	0.092	121	-	-
941	6.0	10.8	214.0	371.3	2	27.5	10.7	4.4	390	74	84	56	0.092	121	-	-
953	6.0	10.8	214.0	371.3	4	27.0	12.2	5.7	21	443	5	0	0.089	129	-	-
958	6.0	10.8	214.0	371.3	8	26.8	14.1	7.1	10	450	2	0	0.111	128	-	-
1002	6.0	10.8	214.0	371.3	12	26.5	15.6	8.3	0	-	-	0	0.076	137	-	-
1005	6.0	10.8	214.0	371.3	16	26.4	17.8	10.0	0	-	-	0	0.079	139	-	-
1046	5.0	10.9	212.0	369.7	0	27.6	10.7	4.4	393	70	85	54	0.104	119	-	-
1050	5.0	10.9	212.0	369.7	2	27.6	10.6	4.3	415	48	90	58	0.107	118	-	-
1057	5.0	10.9	212.0	369.7	4	26.7	13.3	6.6	0	-	-	0	0.120	132	-	-
1100	5.0	10.9	212.0	369.7	8	26.5	16.4	8.9	0	-	-	0	0.085	139	-	-
1206	-	15.7	220.2	365.1	0	27.8	9.9	3.7	459	4	99	71	0.104	124	-	-
1210	-	15.7	220.2	365.1	2	27.7	9.9	3.7	460	4	99	70	0.104	122	-	-
1215	-	15.7	220.2	365.1	4	27.5	11.7	5.1	252	209	55	26	0.117	124	-	-
1220	-	15.7	220.2	365.1	8	26.6	14.6	7.6	0	-	-	0	0.095	140	-	-
1223	-	15.7	220.2	365.1	12	26.5	16.1	8.7	0	-	-	0	0.092	140	-	-
1227	-	15.7	220.2	365.1	20	26.3	18.0	10.2	0	-	-	0	0.085	141	-	-
1300	-	14.0	217.6	367.0	1	28.2	10.0	3.7	518	-58	113	74	0.114	122	-	-
1315	-	10.1	213.4	372.6	1	28.1	10.6	4.1	487	-28	106	70	0.111	121	-	-
1330	-	6.7	209.9	377.7	1	28.0	11.2	4.6	465	-7	101	66	0.107	124	-	-
1345	-	3.0	205.5	383.2	1	28.0	11.4	4.8	506	-48	111	76	0.101	129	-	-

- DATA NOT AVAILABLE

DATE	JULIAN DATE	CRUISE #	LOCATION	VESSEL
31 AUG 78	78243	4	POTOMAC R	WARFIELD

TIME	SiO2 uM/l	PO4 uM/l	NO3+NO2 uM/l	NO2 uM/l	NH3 uM/l	TOTAL NITROG	DISSOL NITROG	TOTAL PHOSPH	DISSOL PHOSPH	FLUOR	DIS CHL ug/l	ALKALIN meq/l	TOT CO2 mM/l	POC uM/l	pH	pCO2 ppt
745	-	-	-	-	-	-	-	-	-	0.123	-	-	-	-	7.79	-
800	66	1.89	0.2	0.19	0.21	-	-	-	-	0.095	-	-	-	-	8.10	0.410
815	63	1.92	0.2	0.14	0.17	-	-	-	-	0.082	10.80	-	-	-	8.27	0.258
830	63	1.92	0.2	0.15	0.14	-	-	-	-	0.111	-	-	1.30	-	8.20	0.280
845	63	1.94	0.3	0.12	0.20	-	-	-	-	0.082	11.50	-	1.45	-	8.37	0.199
900	61	1.45	0.2	0.09	0.11	-	-	-	-	0.073	-	-	1.27	-	8.44	0.149
915	59	1.19	0.2	0.13	0.04	-	-	-	-	0.056	9.93	-	1.27	-	8.29	0.204
938	57	0.96	0.1	0.07	0.00	-	-	-	-	0.101	-	-	-	-	8.15	0.300
941	57	0.95	0.1	0.07	0.01	-	-	-	-	0.107	16.30	-	1.30	-	8.15	0.298
953	54	0.69	0.2	0.08	0.01	-	-	-	-	0.050	-	-	-	-	8.22	2.973
958	49	0.54	0.1	0.12	0.02	-	-	-	-	0.027	-	-	1.42	-	8.32	2.618
1002	50	0.77	0.2	0.11	3.22	-	-	-	-	0.027	-	-	1.53	-	8.36	2.557
1005	52	1.03	0.2	0.06	7.50	-	-	-	-	0.024	-	-	1.57	-	8.45	2.437
1046	56	1.01	0.3	0.10	0.13	-	-	-	-	0.133	-	-	-	-	8.14	0.343
1050	56	0.95	0.3	0.09	0.13	-	-	-	-	0.161	-	-	1.28	-	8.22	0.310
1057	54	1.15	0.2	0.11	2.16	-	-	-	-	0.040	-	-	-	-	7.11	2.873
1100	53	1.27	0.3	0.03	10.49	-	-	-	-	0.027	-	-	1.58	-	7.22	2.745
1206	59	1.17	0.2	0.08	0.02	-	-	-	-	0.074	-	-	-	-	8.37	0.190
1210	59	1.20	0.2	0.07	0.05	-	-	-	-	0.075	-	-	-	-	8.36	0.190
1215	57	0.96	0.2	0.03	0.03	-	-	-	-	0.045	-	-	-	-	7.79	0.684
1220	54	1.16	0.2	0.09	4.20	-	-	-	-	0.026	-	-	-	-	7.21	2.413
1223	53	1.15	0.2	0.03	6.84	-	-	-	-	0.025	-	-	-	-	7.23	2.506
1227	52	1.18	0.2	0.00	9.27	-	-	-	-	0.026	-	-	-	-	7.30	2.296
1300	-	-	-	-	-	-	-	-	-	0.114	-	-	-	-	8.43	0.237
1315	56	0.95	0.3	0.14	0.15	-	-	-	-	0.114	-	-	-	-	8.36	0.252
1330	55	0.86	0.3	0.17	0.14	-	-	-	-	0.117	-	-	-	-	8.30	0.293
1345	52	0.70	0.2	0.15	0.17	-	-	-	-	0.073	-	-	-	-	8.45	0.220

- DATA NOT AVAILABLE