

V. Data Management (Ambient WQM)

A. Introduction to Data Management

Data management within DEQ's Ambient Water Quality Monitoring Program actually begins with the planning activities for the coming year's monitoring schedule. Historically, DEQ's monitoring year corresponded with the Commonwealth's fiscal year, extending from 1 July of each year to 30 June of the following year (e.g., MY2004 extended from 1 July 2003 – 30 June 2004). In 2006, the monitoring year was redefined to correspond with the 'ecological'/calendar years that dictate the seasonal duration and annual evaluations of numerous monitoring activities. Under the new schedule, monitoring staffs from the DEQ Regional Offices and the Central Offices of Water Quality Standards (WQS) and Water Quality Monitoring and Assessment (WQMA) enter their annual planning summaries into DEQ's CEDS 2000 (Comprehensive Environmental Database System) database by 1 December of each year. The Central Office WQM Coordinators subsequently consolidate the [Annual Monitoring Plan](#) (MonPlan) [III-A-0aa.xls] summaries by querying the appropriate information out of CEDS. These summaries document the specific stations that will be associated with each monitoring activity or program during the following year, the parameter groups that will be analyzed, and their sampling frequencies (which determine the total numbers of samples and analytical costs per year).

These yearly summaries facilitate further planning by the DEQ Central and Regional Offices and by the state, institutional and private laboratories that will receive samples for analysis. Budgetary requirements for the next monitoring year can be calculated on the basis of specific program or activity, specific parameter group, specific Regional Office, or even specific drainage or water body. Parameter groups and sampling frequencies associated with specific monitoring programs can be compared among regions to verify whether statewide standardization requirements are being observed. During the year, monthly schedules are also completed in CEDS before regional office field staffs initiate the monitoring activities for a specific month. The monthly schedules permit additions, deletions and/or other modifications to the yearly schedule, and include the anticipated date that a specific sampling run will be carried out. The information in these monthly schedules is uploaded twice daily into the central database, and is immediately available to participating laboratories in order to prepare for receiving and analyzing samples in an efficient manner. Immediately following a monitoring run, the same monthly summaries serve as a medium for entering field data, such as date, time, and depth of sampling, weather and water conditions, and field measurements of water temperature, dissolved oxygen, pH, etc. into the CEDS database in association with each monitoring site and date. This information is matched and confirmed with the labels on samples that arrive at the laboratory the following morning, and any discrepancies are resolved prior to accepting samples for analysis. The flow through the CEDS 2000 Database of samples, data and the information generated, from field to laboratory to databases, as well as the subsequent assessment and reporting procedures, are summarized schematically in the figure "[Data Collection and Information Flow](#)" [V-2.doc].

B. Ambient Water Quality Monitoring Programs

Prior to beginning a sample run, regional monitoring staffs use the monthly schedule in CEDS to print a field data sheet and container labels for the samples to be collected. The field data sheet lists the stations in the monitoring run in the order in which they will be visited, the samples to be collected at each site, and the required sample preservatives, and provides fields for recording standard field measurements: temperature, dissolved oxygen, pH and specific conductance or salinity, as well as weather and stream level or tidal observations. Sample labels include the station identification, the date, the depth and matrix

sampled, the name of the collector, the container number (unique, sequential list for each site), and the parameter group code to be analyzed. In the field, the collector confirms each label, completes the time of collection, and affixes the label on the appropriate container as each sample is collected.

The “Parameter Group Codes” stored in the CEDS database and associated with each station in the run schedule come directly from the DCLS analytical catalog stored in the database. The DCLS “Lab Catalog Codes” screens for Parameter Group Code “WAT” are illustrated on the following page. All information pertinent to the Parameter Group Code can be found there, including cost, turnaround time, and the matrix to be sampled. In the first catalog screen - “STORET Parameters” - each individual analyte included in the analysis is listed by name, and the associated STORET Code, holding time (hrs), lower detection limit, units of measurement, and analytical method are identified. Double-clicking on the Technical Procedure Id will open an associated “Technical Procedure” screen, which provides additional information about the associated analytical method(s) (see example below). The second catalog screen - “Container” - provides the information that the field technician needs to know for the monthly monitoring run, *i.e.*, the type and number of container(s) needed and the type of preservation that the sample requires.

Prior to leaving for the field, the monitoring technician prints out the “Field Sheet” associated with the monthly run, as well as labels for all the samples to be collected, directly from the CEDS database (see examples below). The heading of the field sheet identifies the name of the monitoring run, the sampling date, and the initials of the collector responsible for the run. The stations to be sampled are listed in the order that they are to be visited, along with a brief description of the site and a list of the Parameter Group Codes to be collected and the associated container numbers. The printed sample labels identify the station, date, and depth where the sample is to be collected, as well as the unit (*e.g.*, Regional Office code) and collector. The parameter group code, container number, sample type description (*e.g.*, Regular, Split – S1 or S2, Field Blank, etc.), container type, and type of preservation required are all preprinted on each label.

Once on site, the field technician notes the time of sampling (Time), observations on the weather (Wx) and water level or tide (Tide) in the appropriate columns of the form, and all field parameter measurements are recorded in their appropriate fields (Temp, pH, DO, Cond., Sal.). The only thing that the field technician is required to complete on the sample labels is the time of sampling, which should be the same on all sample labels and on the field sheet. If there is a specific reason for doing so, the field technician can add an altered priority code to a sample label; normal priority is the default value if the “PRIOR” field is left empty on the sample label.

Upon return to the regional office, all samples are shipped overnight to DCLS or other responsible laboratory and the field technician enters all data related specifically to the sampling event into the “Field Data” screen of the CEDS database (see example below). Information on the run identification, station identification, date, and sample depth are already associated with the run/date combination in the database. The technician needs to enter only the time of sample collection, and the other appropriate observations or measurements recorded on the field data sheet: Wx (weather), Tide, Temp, pH, DO, Specific Conductance / Salinity, etc. A comment field associated with the same sampling event is also available for the notation of any additional observations that the field technician thinks appropriate. The completed information from the run schedule is shipped electronically from CEDS to the DCLS Laboratory Information Management System (LIMS) database twice daily, at 10:35 PM and 9:35 AM, from Monday evening through Friday evening.

When the samples shipped overnight arrive at the laboratory the following morning, laboratory personnel confirm that the information on the sample labels agrees with the information recorded in the LIMS

database. If there are any discrepancies, the responsible person at the laboratory contacts a pre-specified DEQ Central Office representative to resolve the difference. If differences are not satisfactorily resolved, either with the Central Office representative or the Regional Office monitoring staff, the sample is rejected and discarded by the laboratory. Each combination of station identification, date, time, depth and/or matrix, and parameter group code subsequently becomes the unique sample identifier associated with a specific analysis and its resultant parameter values. Additional system-generated, sample-specific codes are assigned by both CEDS and LIMS. The laboratory numbers assigned by LIMS are often used as a reference if questions arise about a specific analytical result.

Following analysis and QA/QC data checks at the laboratory, the responsible analyst enters each result into the LIMS. LIMS performs further checks on the data and the data are peer reviewed before approval for release. The laboratory ships data daily from LIMS to DEQ's FTP site for subsequent upload into CEDS. The analytical results are associated with the field data using the unique sample identifiers described above (site identification, date, time, depth). At that time, pertinent electronic data are also transferred to the EPA Chesapeake Bay Program's centralized database (CIMS) and/or the Virginia Department of Health (VDH). Further QA/QC checks on the field and laboratory results are carried out at DEQ's Central Office prior to releasing the data for upload to the EPA national database. Data held within the CEDS, CIMS, VDH and EPA databases are immediately available to the public. DEQ subsequently utilizes the data in its CEDS database to initiate water quality assessment. Additional data and/or assessments are provided by regional DEQ biologists, the Coordinator of the Fish Tissue and Sediment Program, by the Virginia Department of Conservation and Recreation (DCR – Non-Point Source assessments), by the VDH (fish consumption advisories, health advisories, beach closings, etc.), as well as by various federal agencies and by volunteer monitoring groups who's data have passed the agency's QA/QC screening.

For further information relative to DEQ's management of ambient water quality data and the agency's Comprehensive Environmental Data System (CEDS) database contact:

Roger E. Stewart II
629 East Main Street
Richmond, Virginia 23219
(804) 698-4449
Roger.Stewart@deq.virginia.gov

or Donald H. Smith
629 East Main Street
Richmond, Virginia 23219
(804) 698-4429
Donald.Smith@deq.virginia.gov

Figure III-B-1. - Partial Monthly Run Schedule for the Piedmont Regional Office Run PAPP06”

Run ID	Station ID	Sta	Survey	Depth	% Depth FRB	Blank / Dup	Lab ID	Cont Proc	Special	Parameter Group Cd	Sample Collect Date
PAPP06	2-DCR003.00	1	AW	S	.3	50 R	1	000002	EC 4		11/20/2006
PAPP06	2-DCR003.00	1	AW	S	.3	50 R	2	000002	TPLL		11/20/2006
PAPP06	2-DCR003.00	1	AW	S	.3	50 R	3	000002	WAT		11/20/2006
PAPP06	2-DCR003.00	1	AW	S	.3	50 R	4	000002	HTIT		11/20/2006
PAPP06	2-SLE002.65	2	AW	S	.3	50 R	1	000002	EC 4		11/20/2006
PAPP06	2-SLE002.65	2	AW	S	.3	50 R	2	000002	TPLL		11/20/2006
PAPP06	2-SLE002.65	2	AW	S	.3	50 R	3	000002	WAT		11/20/2006
PAPP06	2-SLE002.65	2	AW	S	.3	50 R	4	000002	HTIT		11/20/2006
PAPP06	2-APP081.04	3	AW	S	.3	50 R	1	000002	EC 4		11/20/2006
PAPP06	2-APP081.04	3	AW	S	.3	50 R	2	000002	TPLL		11/20/2006
PAPP06	2-APP081.04	3	AW	S	.3	50 R	3	000002	WAT		11/20/2006
PAPP06	2-APP081.04	3	AW	S	.3	50 R	4	000002	HTIT		11/20/2006
PAPP06	2-FLA018.71	4	AW	S	.3	50 R	1	000002	EC 4		11/20/2006
PAPP06	2-FLA018.71	4	AW	S	.3	50 R	2	000002	TPLL		11/20/2006
PAPP06	2-FLA018.71	4	AW	S	.3	50 R	3	000002	WAT		11/20/2006

Figure III-B-2. - Printed Field Sheet from CEDS Database – Piedmont Office Run “PAPP06”

Run ID: PAPP06	Sample Date: 11/20/2006	Collector: DHS									
Station	Description	Time	Nx	Tide	Temp	Ph	Do	Cond	Sal	Epb	Group
2-DCR003.00	RT. 684 BRIDGE									.3	1 EC 4 4 HTIT 2 TPLL 3 WAT
2-SLE002.65	SALLEE CREEK, RT. 60 BRIDGE									.3	1 EC 4 4 HTIT 2 TPLL 3 WAT
2-APP081.04	RT. 681 CEMENTOWN MILLS (AMELIA/DONHATAN)									.3	1 EC 4 4 HTIT 2 TPLL 3 WAT
2-FLA018.71	Flat Creek at Rt. 642									.3	1 EC 4 4 HTIT 2 TPLL 3 WAT
2-APP050.23	RT. 360 GOODES BRIDGE									.3	1 PCMFBC4 4 HTIT 2 TPLL 3 T2
2-GOC001.19	Goodes Creek off Rt. 360 or Pear Orchard									.3	1 EC 4 4 HTIT 2 TPLL 3 WAT
2-SQT001.54	SKINQUARTER CREEK, RT. 603 BRIDGE									.3	1 EC 4 4 HTIT 2 TPLL 3 WAT
2-RFD002.58	ROCKY FORD CREEK, TR. 603 BRIDGE									.3	1 EC 4 4 HTIT 2 TPLL 3 WAT

Figure III-B-3. - Example Sample Label for Parameter Group Code “WAT” (container number 3) at the first station on the run schedule above, printed from the CEDS Database

STATION ID	DATE COLLECTED	PRIOR
2-DCR003.00	11/20/2006	
TIME COLLECTED	DEPTH	UNIT CODE
	.3	607
LAB PROC	GROUP CODE	CONTAINER#
	WAT	3
	BLANKS/DUPS	
	R	
PRESERVATIVES		
1 half-gal Cubitainer; 4 C		

Figure III-B-4. - Field Data Screen from the CEDS Database

Virginia Department of Environmental Quality - Current Screen : Field Data, Database: CEDSPROD Release:10.06.34 Date:12/06/2006 11:53

Action Edit Query Block Record Field Help Window **i-CEDS**

Field Data/Samples **Get Monthly Run Data**

Run ID: PAPP06 Collector ID: GWN Collecting Agency: DEQ Survey Program: AW Field Data Special Study #: 000002 Shipping Seal No.: Chain of Custody Shipped Date: **Print Form**

Station ID	Date Time	Depth Desc	Depth	% FRB	Wx	Tide	Temp C	pH	DO	Specific Conduct	Salinity	Secchi Depth
2-DCR003.00	11/20/2006 1000	S	.3	50	3		7.7	6.9	8.5	60		0

Samples

Parameter Group Code	Blanks / Dups	Cont ID	Lab Name	Lab Num	Lab Status	Ana Recv Code	Priority	Lab Received Date	Lab Code	Volume Filtered	Comp. Hours	Aliqt. Num
EC 4	R	1	DCLS	1435616	ON	V	7	11/21/2006				
TPLL	R	2	DCLS	1435617	ON		7	11/21/2006				
WAT	R	3	DCLS	1435618	ON		7	11/21/2006				
HTIT	R	4	DCLS	1435619	ON		7	11/21/2006				

RUN ID (CRUISE) SAMPLING - DEQ ACTIVITY
Record: 1/1 <OSC>

Figure III-B-5. - DCLS “Lab Catalog Codes” Screens for Parameter Group Code “WAT” - from CEDS Database

Virginia Department of Environmental Quality - Current Screen : Lab Catalog Codes, Database: CEDSPROD Release:10.06.34 Date:12/06/2006 0...

Action Edit Query Block Record Field Help Window

Lab Catalog Codes

Parm Group Code: **WAT** Watershed Waters' Parameters

Status: **ACTIVE** Cost: **40.73** Turn Around Days: **21** Matrix: **83** surface water

STORET Parameters **Container**

STORET Parameters

STORET Code	DCLS Parameter Name	Holding Hours	Lower Detection Limit	Measure Unit	Technical Procedure ID
02079	TURBIDITY,LAB NEPHELOMETRIC TURBIDITY UNITS, NTU	48	.1	NTU	604
00530	RESIDUE, TOTAL NONFILTRABLE (MG/L)	168	3	mg/l	593
00600	NITROGEN, TOTAL (MG/L AS N)	672	.1	mg/l as N	781
00610	NITROGEN, AMMONIA, TOTAL (MG/L AS N)	48	.04	mg/l as N	158
00630	NITRITE PLUS NITRATE, TOTAL 1 DET. (MG/L AS N)	48	.04	mg/l as N	581

SPECIFIC ANALYSIS BY LABORATORY

Record: 1/1 <OSC>

Virginia Department of Environmental Quality - Current Screen : Lab Catalog Codes, Database: CEDSPROD Release:10.06.34 Date:12/06/2006 0...

Action Edit Query Block Record Field Help Window

Lab Catalog Codes

Parm Group Code: **WAT** Watershed Waters' Parameters

Status: **ACTIVE** Cost: **40.73** Turn Around Days: **21** Matrix: **83** surface water

STORET Parameters **Container**

Containers

Number Of Containers	Size	Units	Type
1	1	half-gal	CUBITAINER

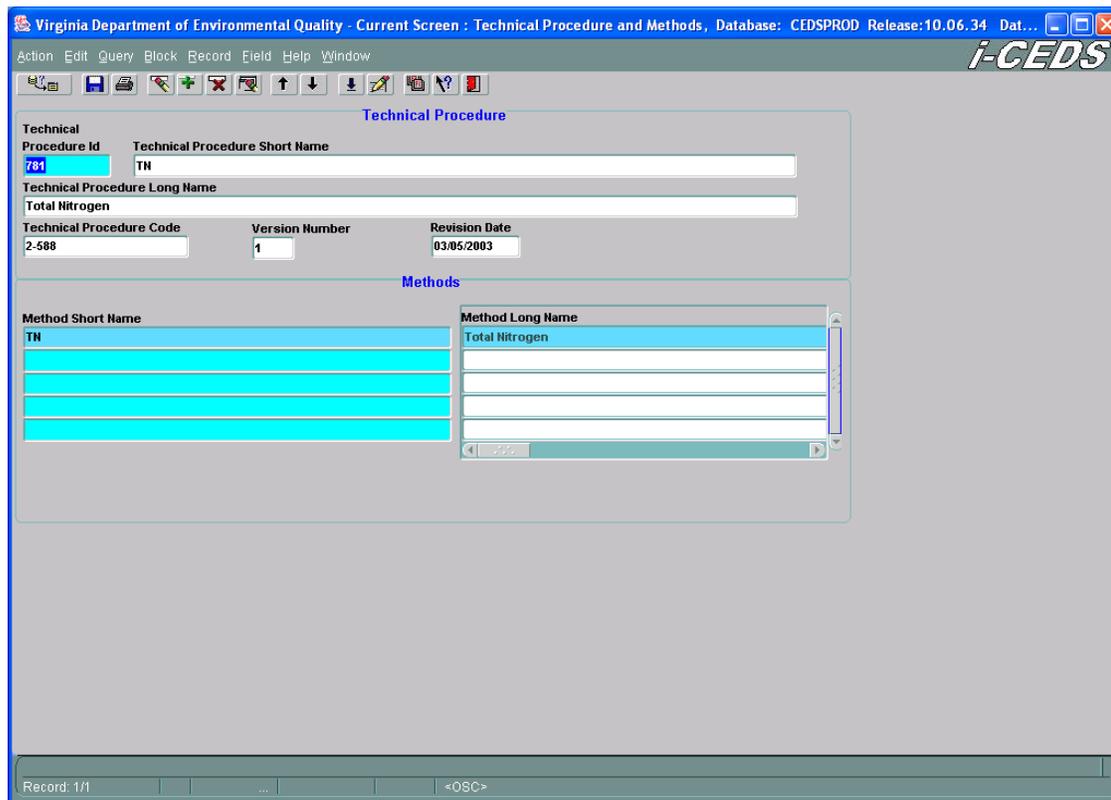
Preservatives

Quantity	Units	Type
		4 C

SPECIFIC ANALYSIS BY LABORATORY

Record: 1/1 <OSC>

Figure III-B-6. - Technical Procedure Screen from CEDS, describing analytical procedure associated with “Total Nitrogen” in the Parameter Group Code “WAT”.



C. Fish Tissue and Sediment Monitoring

Fish tissue and sediment samples collected by the Fish Tissue and Sediment Contaminants Monitoring Program (FT) unit of the Water Quality Monitoring Programs (WQM) are frozen and periodically shipped to laboratories at the Virginia Institute of Marine Science (VIMS), where they may be analyzed immediately or held for simultaneous batch analyses during the winter. When analyses are complete, VIMS returns the individual analytical results to FT on laboratory data sheets. FT subsequently consolidates the results on electronic spreadsheets for comparison with published Effects-Range (ER-L and ER-M) screening values of possible or probable effects (PECs) for sediment, or fish tissue Screening Values (TVs and TSVs) for evaluation of possible human health effects from fish consumption.

The summarized results for fish tissue are then submitted directly to the Virginia Department of Health (VDH) for evaluation relative to issuing [Fish Consumption ‘Advisories’ or ‘Restrictions’](http://www.vdh.state.va.us/epidemiology/DEE/publichealthtoxicology/Advisories/index.htm).

The results of FT’s sediment and fish tissue assessments are subsequently posted on the [DEQ WebPages](http://www.deq.virginia.gov/Programs/Water/WaterQualityInformationTMDLs/WaterQualityMonitoring/FishTissueMonitoring.aspx) [http://www.deq.virginia.gov/Programs/Water/WaterQualityInformationTMDLs/WaterQualityMonitoring/FishTissueMonitoring.aspx] and are communicated to those within the Office of Water Quality Monitoring and Assessment for inclusion in descriptive summaries and reports (e.g., Biennial Integrated 305(b)/303(d) Reports).

For further information on data management within the Targeted Fish Tissue and Sediment Monitoring Program contact:

Gabriel A. Darkwah
Virginia Department of Environmental Quality
629 East Main Street
P.O. Box 1105
Richmond, VA 23218
(804) 698-4127
Gabriel.Darkwah@deq.virginia.gov

or

Richard G. Browder
Virginia Department of Environmental Quality
629 East Main Street
P.O. Box 1105
Richmond, VA 23218
(804) 698-4134
Richard.Browder@deq.virginia.gov

D. Biological Monitoring

Regional biologists collect biological monitoring data of benthic macroinvertebrate communities in wadeable streams using EPA Rapid Biological Assessment Protocols. The taxonomic compositions of these samples, along with associated habitat data, are subsequently recorded in a centralized electronic database (Ecological Data Application System - EDAS), currently located at DEQ's West Central Regional Office in Roanoke, for standardized calculations of two multi-metric summary indices ('Virginia Stream Condition Index' – VSCI and 'Coastal Plain Macroinvertebrate Index' – CPMI). These results are then available for regional biologists to perform a subsequent evaluation of the condition of the associated water body segments. The EDAS database was developed in collaboration between DEQ and Tetra Tech, Inc., under an EPA funded agreement, to develop more efficient biological indices for Virginia's various ecoregions

Physical water column and sediment samples collected during biological monitoring are shipped overnight to the state laboratory (DCLS) for analysis. Field-related metadata (location, date, time, depth, etc.) are entered into the CEDS database at the regional office and the end of each field day and are linked to samples in the DCLS LIMS database when they arrive at the laboratory. These metadata and the associated analytical results are subsequently shipped electronically to the CEDS database as soon as laboratory QA procedures have been completed.

For further information on data management within the Biological Monitoring Program, contact:

Richard Browder
Virginia Department of Environmental Quality
629 East Main Street
Richmond, Virginia 23219
(804) 698-4134
Richard.Browder@deq.virginia.gov

E. Citizen's Monitoring and Other Non-Agency Data

Every year, DEQ receives water quality data from various citizens' monitoring groups. This, along with data collected by various other government agencies is submitted to DEQ through the Water Quality Data Liaison (WQDL). All volunteer and non-agency data used in the biennial 305(b)/303(d) Integrated Water Quality Assessment Report undergoes QA/QC screening by DEQ's Quality Assurance Coordinator and the WQDL. QA/QC acceptable data then goes to those responsible for 305(b) assessment or 303(d) listing. In the past, the usual method of submitting data to DEQ involved mail or e-mail. This resulted in a relatively slow review and approval process.

Beginning in late 2006, volunteer and non-agency water quality data have been able to go directly into an online database. This database, similar to a system used by the Pennsylvania Department of Environmental Protection, will help DEQ staff to process the data more efficiently. The database is located at www.deq.virginia.gov/easi/. A link to the database is also available on the [DEQ Citizen Water Quality Monitoring WebPages](#).

[<http://www.deq.state.va.us/Programs/Water/WaterQualityInformationTMDLs/WaterQualityMonitoring/CitizenMonitoring.aspx>]

Users are able to securely log on to the system with a unique username and password. Only the sample team leader and QA officer can upload or edit their organization's data. The website requires users to first establish monitoring stations. The system asks the user to confirm the sample site by looking at a web-based map. After establishing their stations and receiving an approved list or "suite" of monitoring parameters from DEQ, the user can begin to upload data.

Users can upload data using a batch upload feature. The batch upload feature requires the user to format an Excel® compatible spreadsheet to match their monitoring suite. The database then recognizes the data offered by the group and sorts it by site, sample, and parameter. The capabilities of the database will allow users to submit data for many types of physical, chemical, and biological parameters. In addition, the database will allow DEQ to add new parameters as needed.

In either upload method, the database will 'flag' or identify questionable data that falls outside of pre-established parameter limits. The user then has an opportunity to check their results and correct any data entry errors. The data then becomes available on the website and is accessible to the public. The DEQ Quality Assurance Coordinator administers the website and will confirm sample station locations and data. If the QA Coordinator identifies any potentially incorrect records, the respective group will be contacted to confirm the data. The QA Coordinator or the group will then proceed to make any necessary changes. This will allow for faster response by DEQ to identify data entry errors and other QA/QC issues.

In the past, the process of receiving paper or e-mail datasheets made it very difficult to share this data with the public. Now, anyone can view and download data contained in the database. Although the database will allow anyone to download and view data, only registered individuals can upload or edit data on the system. This helps to maintain the integrity of the data while allowing for public access.

To view data, interested data users can go to the website and select the type of data they wish to view. Users will be presented with a menu asking them to refine their search by monitoring group, county, watershed, or other characteristic. Once they select the type of data they wish to view, the database will show a list of monitoring sites. By selecting a site, a user can select data features including a map of the sample location, bar charts of data, and details of a sampling event, or view and download data. To download data, the user must select the period of time they are interested in viewing. The database will then display the data and allow the user to download the information using an Excel® compatible format.

For further information about the management of non-agency water quality monitoring data contact:

James Beckley
Quality Assurance Coordinator
PO Box 1105
Richmond, Virginia 23218
(804) 698-4025
James.Beckley@deq.virginia.gov