Groundwater Programs and Activities

Biennial Report to the West Virginia 2004 Legislature

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Editor's Notes

This biennial report was compiled and edited by the Division of Water and Waste Management s' Groundwater Program staff from information submitted by those agencies with ground water regulatory authority. Copies of this report can be obtained on-line at www.wvdep.org or from:

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Rules promulgated by West Virginia State Agencies mentioned in this report can be obtained from:

Secretary of State
Administrative Law Division
Building 1, Capitol Complex
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Copies of documents and educational information mentioned in this report can be obtained from the individual programs with groundwater regulatory responsibilities. For more program activity information, please contact the respective regulatory agency. A list of these agencies is included in Appendix A.

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GROUNDWATER BIENNIAL REPORT TO THE 2004 LEGISLATURE

I. EXECUTIVE SUMMARY

Under the Groundwater Protection Act, West Virginia Code Chapter 22, Article 12, Section 6.a.3, the West Virginia Division of Environmental Protection (WV DEP) is required to provide a biennial report to the Legislature on the status of the state's groundwater and groundwater management program, including detailed reports from each agency that hold groundwater regulatory responsibility. This is the sixth Biennial Report to the Legislature since the passage of the Act in 1991 and covers the period from July 1, 2001 through June 30, 2003. The WV DEP Division of Water and Waste Management (DWWM) Groundwater Program is responsible for compiling and editing information submitted for this report. The WV Department of Environmental Protection (WV DEP), the WV Department of Agriculture (WV DOA), and the WV Department of Health and Human Resources (WV DHHR) all have groundwater regulatory responsibility and have contributed to this report. Additionally, several boards and standing committees which currently share the responsibility of developing and implementing rules, policies, and procedures for the Ground Water Protection Act (1991) are: The Environmental Quality Board, The Groundwater Coordinating Committee, The Ground Water Protection Act Committee, The Groundwater Monitoring Well Drillers Advisory Board, The Well Head Protection Committee, and The Non-Point Source Coordinating Committee.

This report endeavors to provide a concise, yet thorough, overview of those programs that are charged with the responsibility of protecting and insuring the continued viability of groundwater resources in West Virginia. It is also the intent of this report to express the challenges faced and the goals accomplished as we work together to protect and restore West Virginia's water resources.

Many of the programs and offices in the reporting divisions express a need for an accessible central and statewide electronic data system. Currently all groundwater and other data is collected by individual programs and offices. The WV DEP Information Technology Office (ITO) has implemented the Environmental Resource Information System (ERIS) system and is currently working on the implementation of the Environmental Quality Information System (EQuIS).

Another theme expressed is the need for a systematic approach to groundwater complaint investigation that would enhance involvement and coordination between agencies with groundwater protection responsibilities.

Programs and agencies have also identified the need for specific hydrogeologic information on the state's groundwater such as regional and local potentiometric surfaces (water levels), ground water flow studies, and access to statewide dedicated groundwater monitoring data. The installation of a centralized database linked to GIS coverages accessible to the various agencies and the public will go a long way in resolving this problem. Additional themes include greater outreach to the citizens of West Virginia on issues such as nonpoint source pollution, protecting individual ground and drinking water sources, and the installation of toll free help lines to enhance statewide consistency and a unified approach to the implementation of groundwater rules. Much of this need is being addressed by five-year cooperative studies performed jointly between the Division of Water and Waste Management and the United States Geological Survey (USGS). The current Division of Water and Waste Management /USGS study is presented in section C of this report.

The Ambient Groundwater Quality Monitoring Network was established by the DEP-DWWM in cooperation with the USGS in 1992 and is an on going project. The Ambient Groundwater Quality Monitoring Network will provide critical data needed for proper management of West Virginia's groundwater resources. The major objective of this USGS study is to assess the ambient groundwater quality of major systems (geologic units) within the state of West Virginia and to characterize the individual systems. Characterization of the quality of water from the major systems will help to (1) determine which water quality constituents are problems within the state, (2) determine which systems have potential water-quality problems, (3) assess the severity of water quality problems in respective systems, (4) and prioritize these concerns. Only by documenting present ambient groundwater quality of the State's major systems can regulatory agencies assess whether water quality degradation has occurred in certain areas and whether potential degradation is a result of natural processes or those associated with human activity.

Spatial variability in water quality will be determined for specific geologic units based on sampling of approximately 30 wells annually. The sampling will continue over a period of approximately five years and will provide a database of over 175 wells from which comprehensive water samples will be collected. Wells will be selected in specific drainage basins in given years, rotating annually to new basins, thus providing sampling of ground water in all watersheds of the state over the five year period. Then, the cycle of sampling begins again. The watershed samples will correspond with those from which the West Virginia Division of Environmental Protection, Division of Water Division of Water and Waste Management (DEP-DWWM) will be collecting stream water quality samples as part of its watershed initiative and will provide a linked dataset of both groundwater and surface water quality data which can be used to assess water quality conditions throughout the state. Upon completion of the five year sampling effort, certain wells may be resampled if deemed necessary for the watershed program and comprehensive statistical analyses of all groundwater quality data will be conducted. An interpretative report summarizing ambient groundwater quality in West Virginia may be prepared at the end of the five year data collection period, pending funding. An assessment of future data needs will also occur at that

time. All associated groundwater quality data for each well sampled and summaries of groundwater quality for each respective watershed will be published annually in the U.S. Geological Survey (USGS) Water Resources Data for West Virginia annual report. The U.S. Geological Survey will report the results of this study annually to the Division of Water and Waste Management. These results will be incorporated into reports submitted by the Division of Water and Waste Management. The thirty water sampling sites in the watersheds sampled in the ambient groundwater quality study are listed in the data tables in Appendix B. These tables provide a detailed analysis of geochemical field parameters, ionic concentrations, concentrations of metals, radon, nutrients, organic carbon, volatile organic compounds, and pesticides.

While many challenges remain, much has been done to provide protection and continued viability of the groundwater of the state of West Virginia. The Division of Water and Waste Management, WV DOA, and WV DHHR continue to work closely to fulfill the mission of the Department of Environmental Protection, “Promoting a healthy environment”.

II. Groundwater Protection and Watershed Management

Under the guidance of EPA and the signing of the West Virginia Watershed Management Framework Document in 1997, a new approach to management of the state's groundwater has begun. Total watershed management attempts to bring a holistic approach to protecting the waters of the state. The signing of the 1997 document by those agencies that chose to participate as partners, indicates their understanding that by collective agreement and cooperation stakeholders can better achieve the goals of individual water quality programs. The WV DEP has chosen to participate as a partner and stakeholder in watershed management in West Virginia.

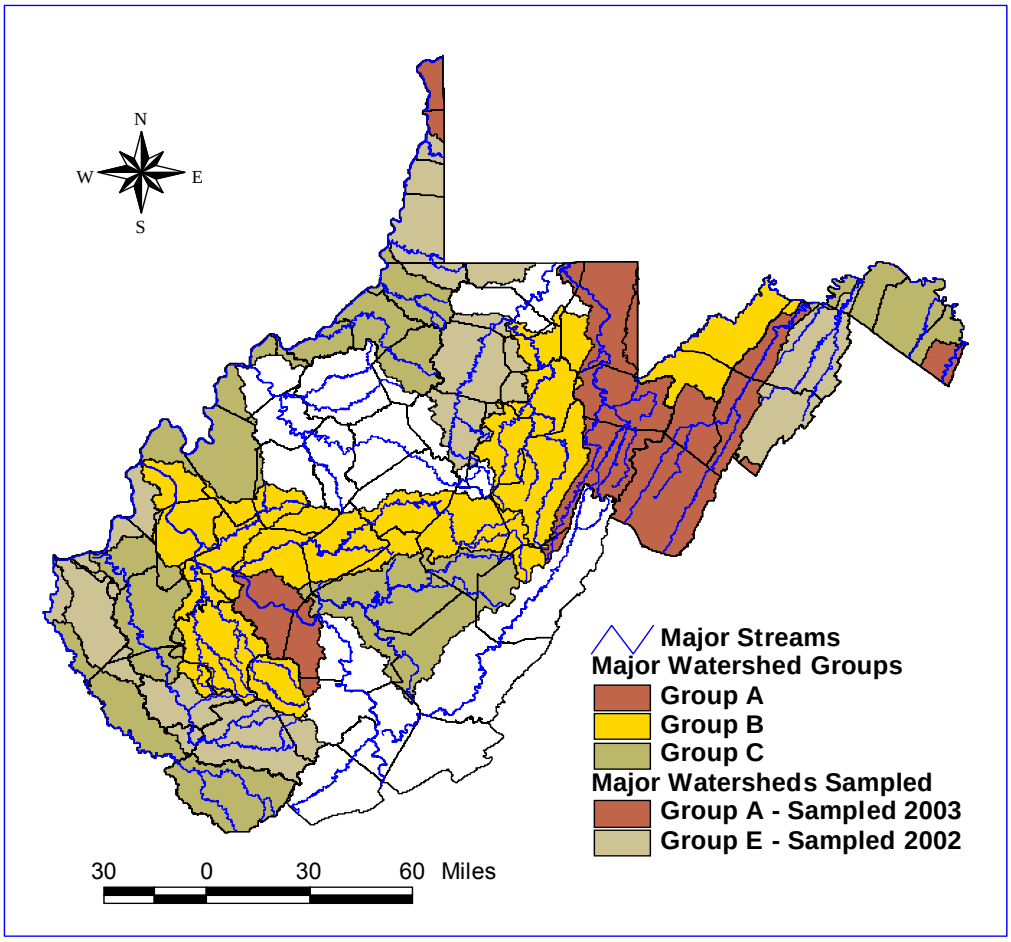
The groundwater program has included in this document maps of the eighteen West Virginia watershed groups for 2001-2003 as well as fifteen maps of the West Virginia watershed groups sampled as part of the Ambient Sampling Program for 2001-2003. The year indicates the time frame in which those watersheds were characterized by the Watershed Branch Assessment Program. However, that program is charged primarily with characterizing the surface waters using predominantly recent water data. The maps of the watersheds are intended to illustrate the activities and facilities found in those watersheds, and to provide a clear picture of the environmental stressors to the ground and surface waters in those watersheds.

All agencies with groundwater regulatory authority and responsibility provide repositories for ground and surface water data collected by those facilities under their authority. As stated in the executive summary, compilation of the available groundwater data into a collective database continues as a work in progress. This report provides the reader with a picture of the state's groundwater protection activities and how those programs that have contributed to this report are contributing to groundwater protection. In time, all groundwater data that is generated by each of these activities and facilities will be housed in a central location and data repository overseen by senior scientists from each agency under the guidance of the Groundwater Coordinating Committee and the Information Technology Office of WV DEP. We anticipate that population of the central database will be implemented using a watershed approach. Each watershed has within it smaller watersheds, called sub-watersheds, which comprise the larger watershed. Data will be gathered from the component sub-watersheds and entered systematically until the larger picture is obtained.

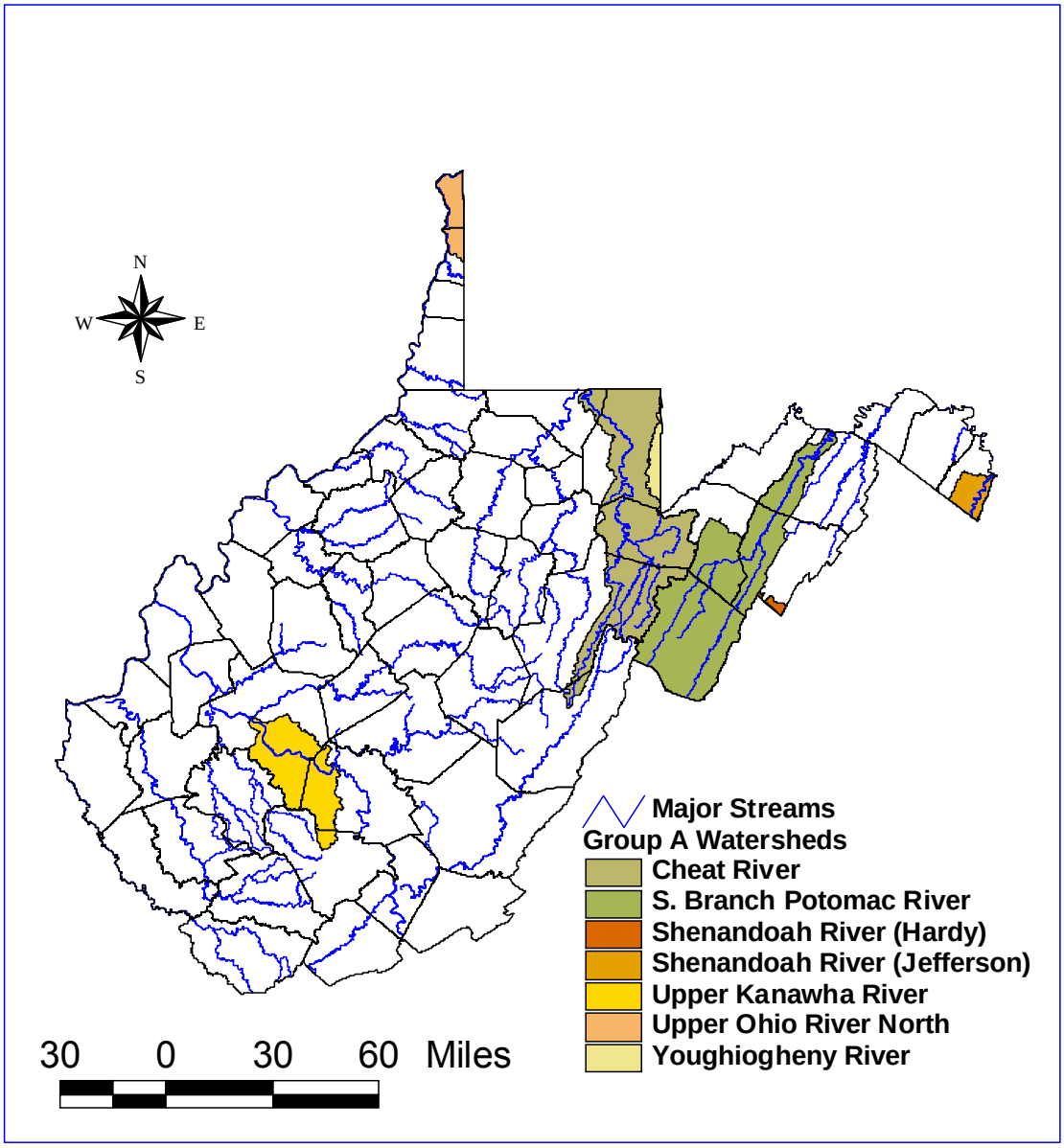
Maps of Watershed Groups for 2001-2003

Watershed Groups A, B, and C from the WV Priority Watersheds list, and individual maps of these watersheds, are shown on the following pages. A list of the major rivers in each watershed group appears in the following table.

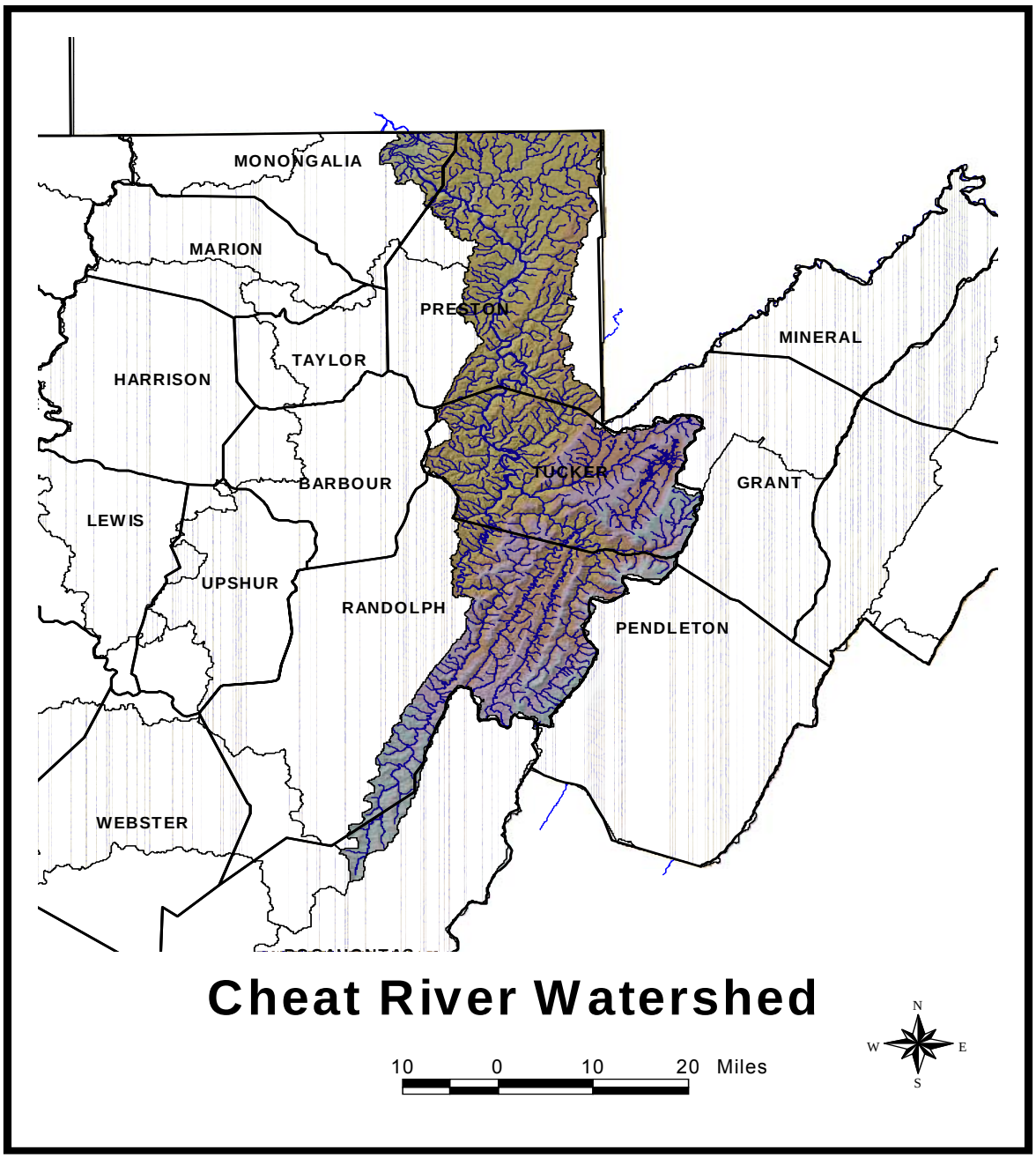
WEST VIRGINIA WATERSHED GROUPS		
Group A - 2001	**Group B - 2002**	**Group C - 2003**
Cheat River	Coal River	Gauley River
Shenandoah River - Jefferson	Elk River	Lower Guyandotte River
Shenandoah River - Hardy	Lower Kanawha River	Middle Ohio River North
South Branch of the Potomac River	North Branch of the Potomac River	Middle Ohio River South
Upper Kanawha River	Tygart Valley River	Potomac River Drains
Upper Ohio River North		Tug Fork River
Youghiogheny River		



Major Watersheds Studied in this Report



Group A Watersheds


MONONGALIA
MARION
PRESTON
MINERAL
TAYLOR
HARRISON
TUCKER
GRANT
BARBOUR
LEWIS
UPSHUR
RANDOLPH
PENDLETON
WEBSTER
Cheat River Watershed
10 0 10 20 Miles
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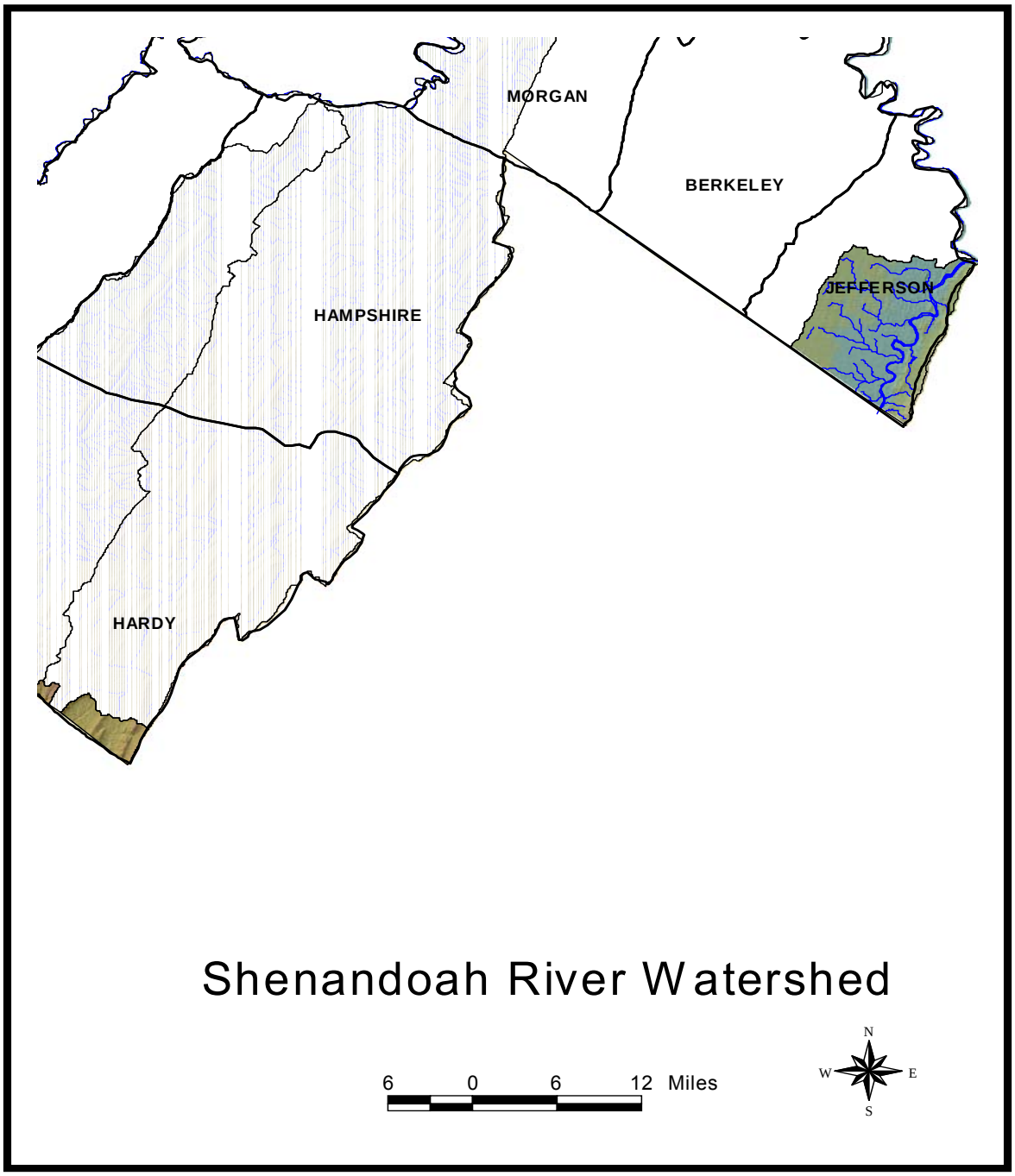
MORGAN
BERKELEY
JEFFERSON
HAMPSHIRE
HARDY
Shenandoah River Watershed
6 0 6 12 Miles
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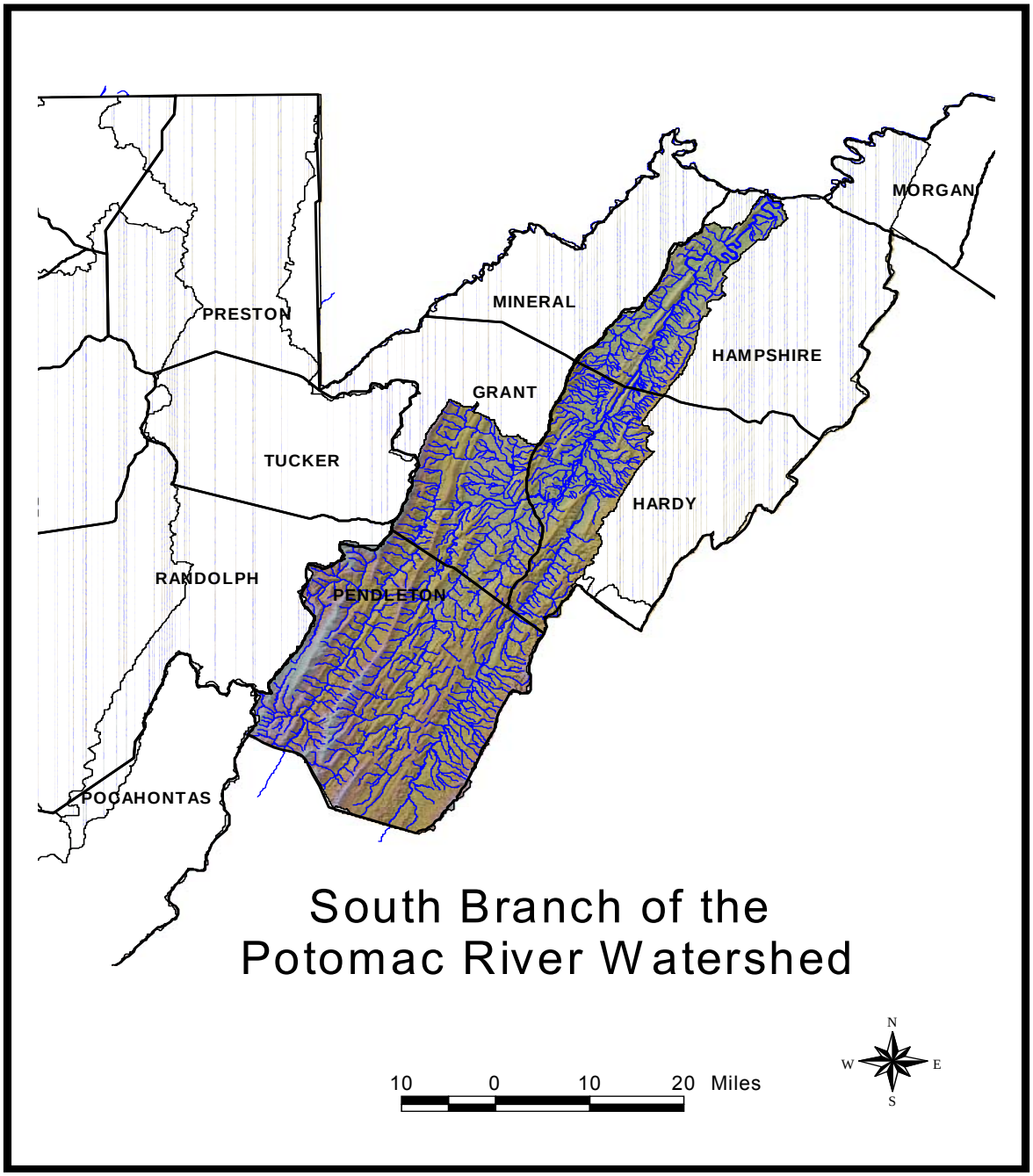
MORGAN
MINERAL
PRESTON
HAMPSHIRE
GRANT
TUCKER
HARDY
RANDOLPH
PENDLETON
POCAHONTAS
South Branch of the
Potomac River Watershed
10 0 10 20 Miles
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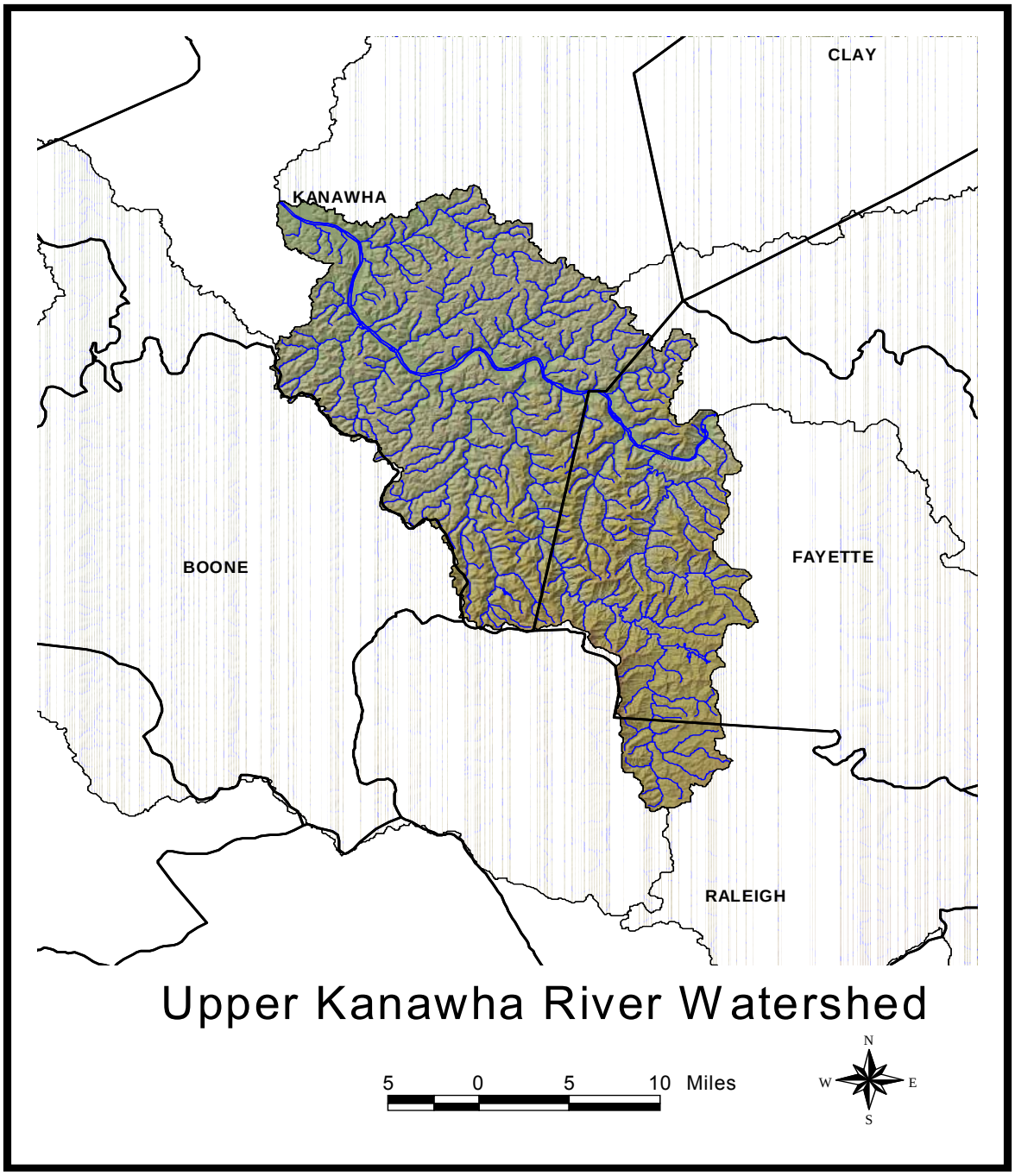
CLAY
KANAWHA
BOONE
FAYETTE
RALEIGH
Upper Kanawha River Watershed
5 0 5 10 Miles
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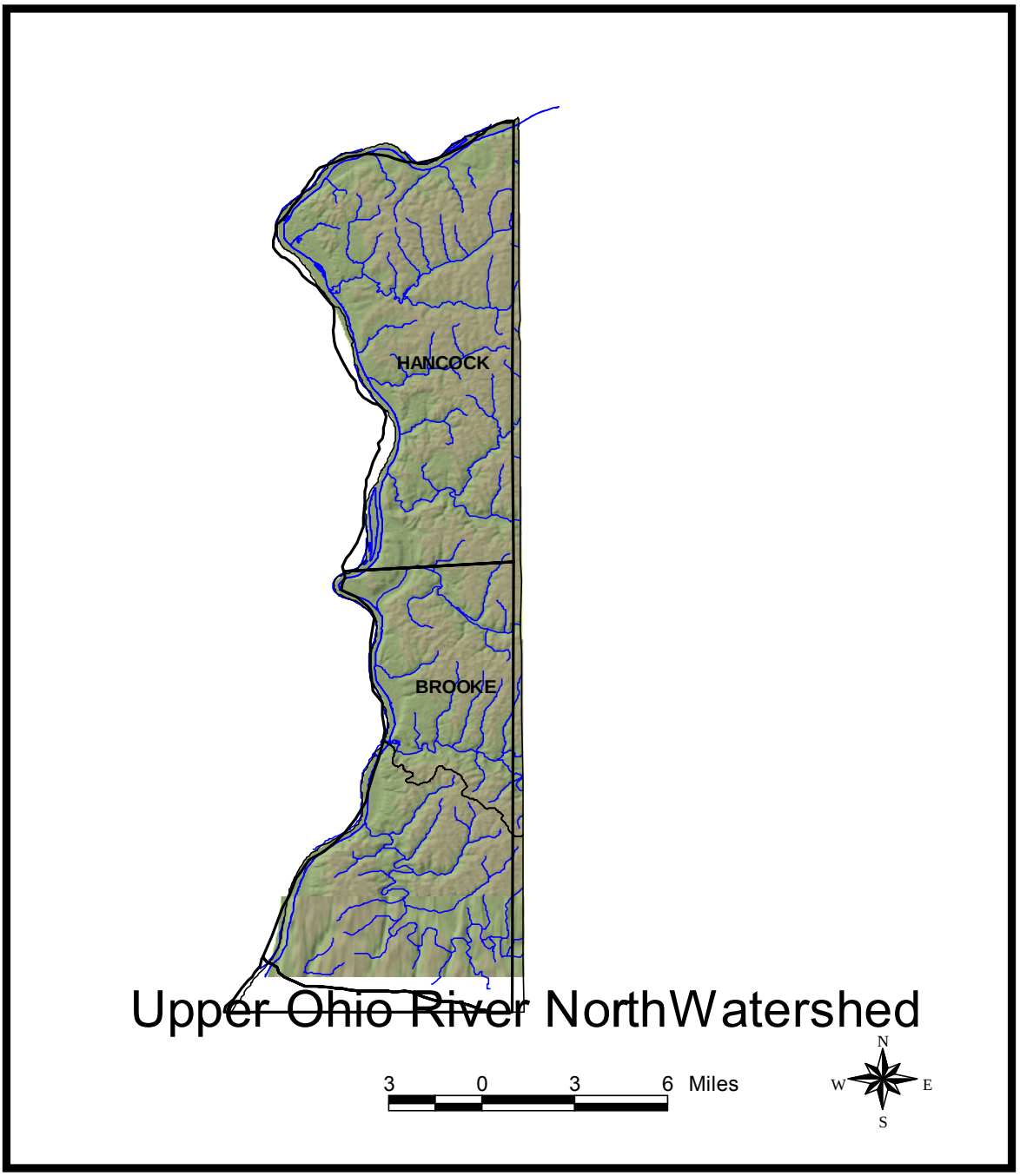
HANCOCK
BROOKE
Upper Ohio River NorthWatershed
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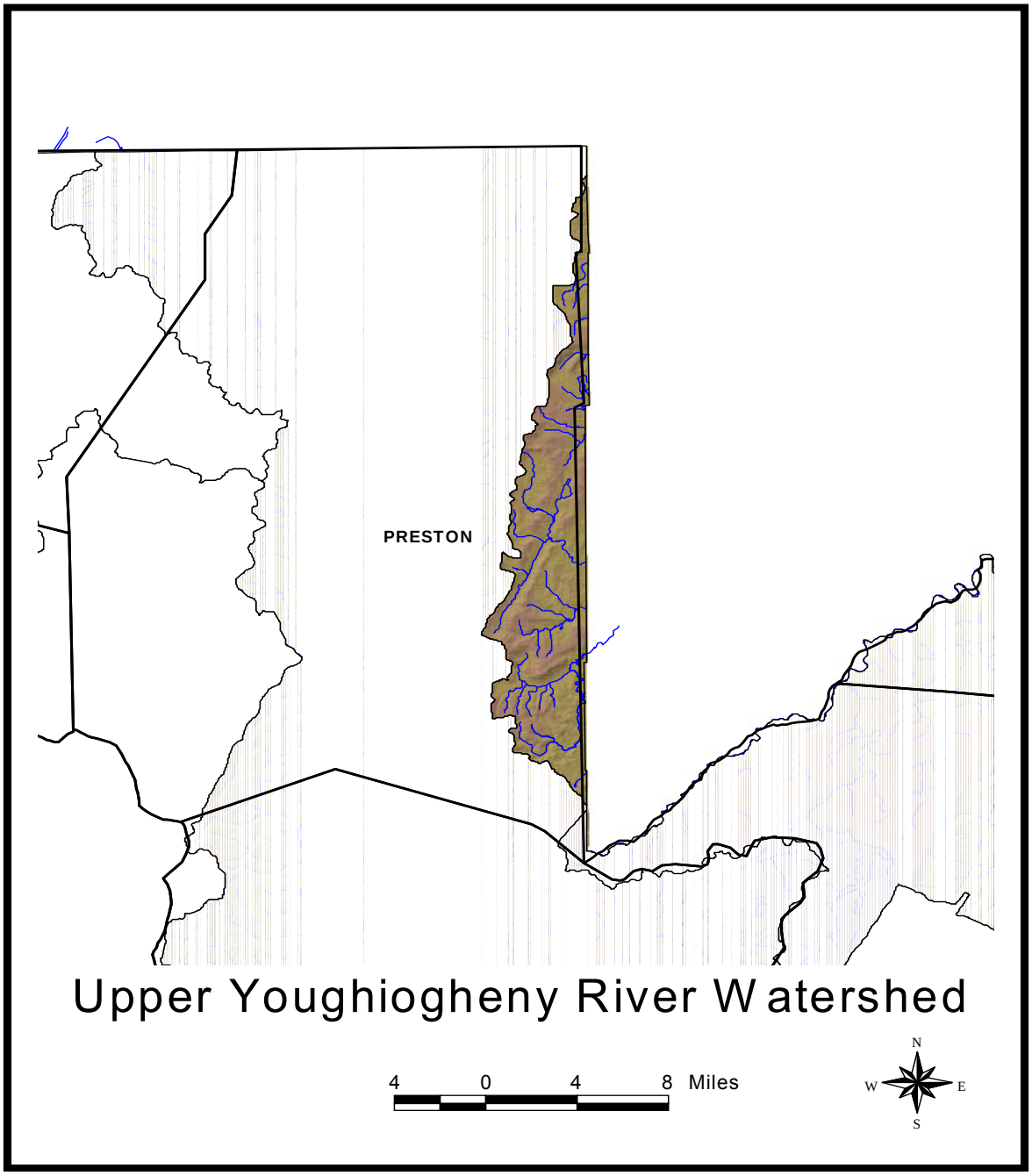
PRESTON
Upper Youghiogheny River Watershed
4 0 4 8 Miles
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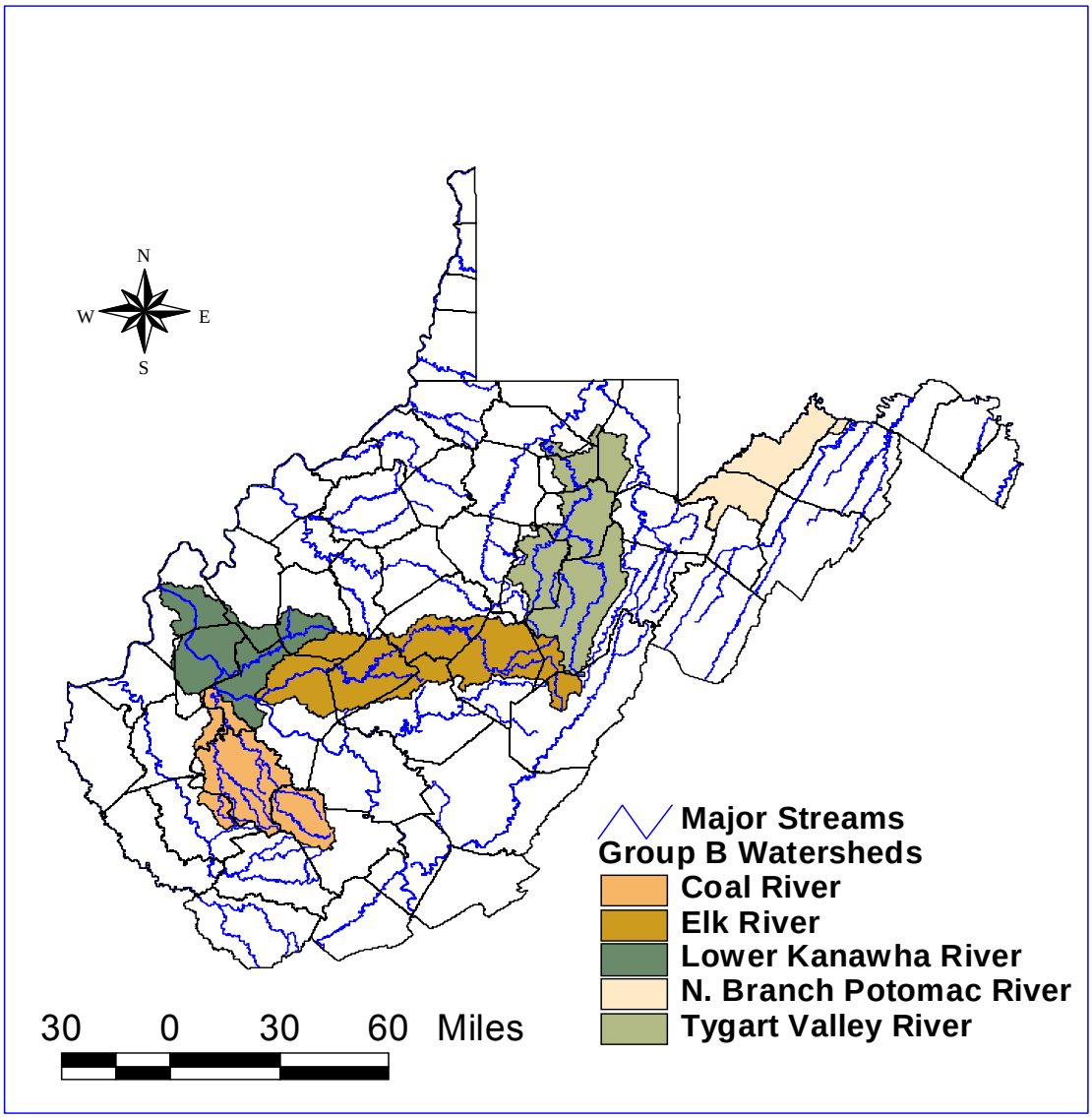
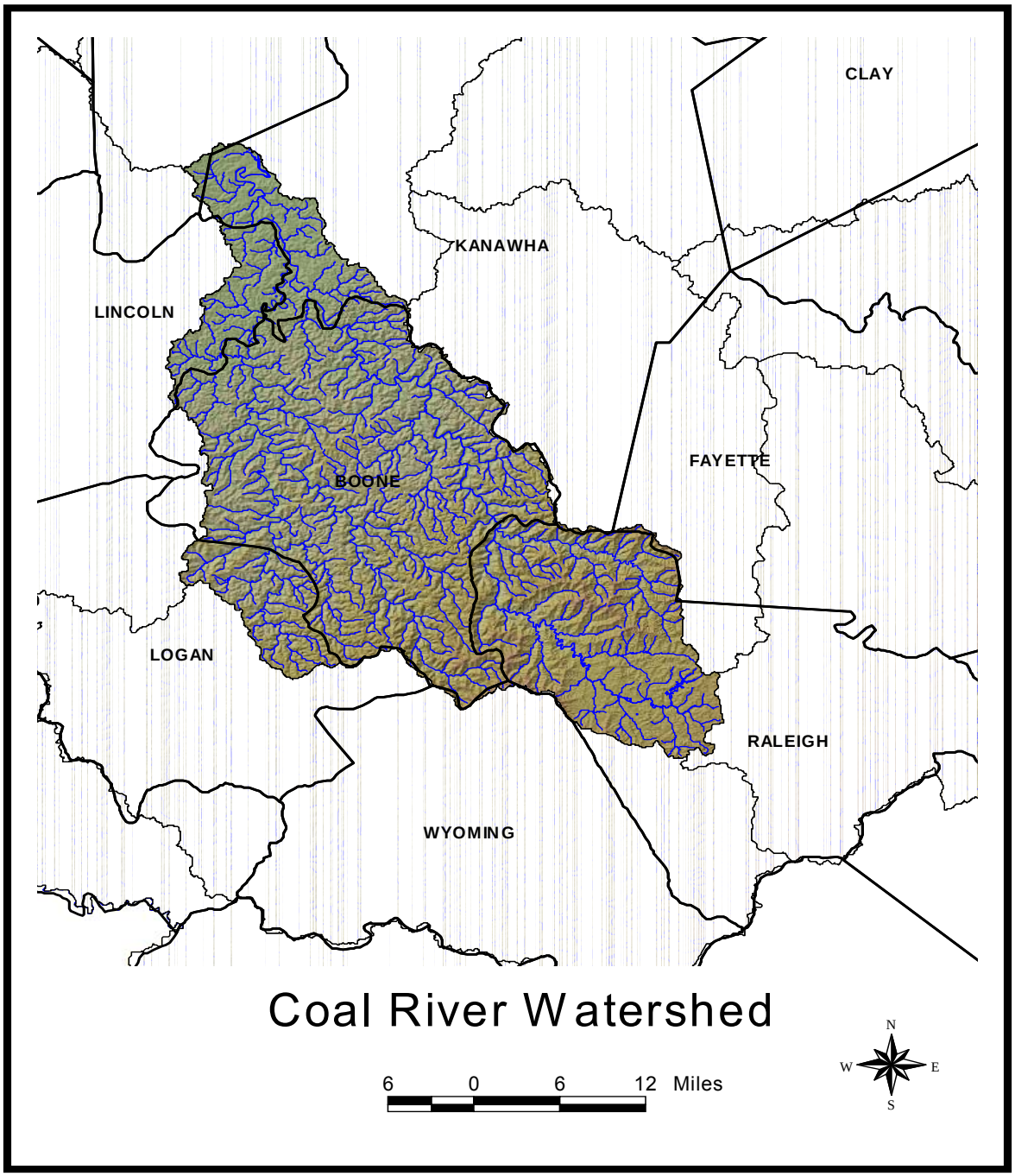


Group B Watersheds


CLAY
KANAWHA
LINCOLN
FAYETTE
BOONE
LOGAN
RALEIGH
WYOMING
Coal River Watershed
6 0 6 12 Miles
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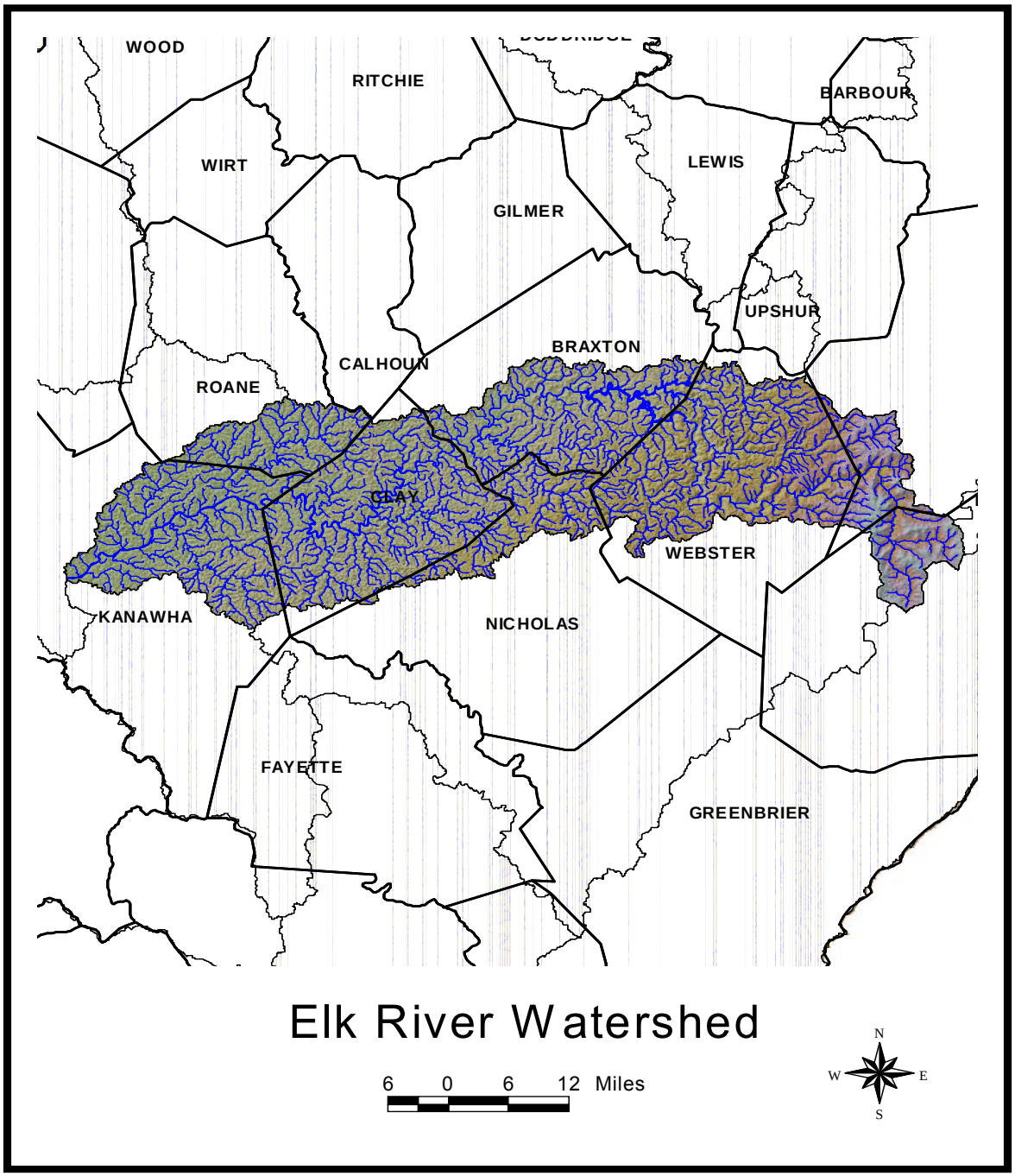
WOOD
RITCHIE
BARBOUR
WIRT
LEWIS
GILMER
UPSHUR
BRAXTON
CALHOUN
ROANE
CLAY
WEBSTER
KANAWHA
NICHOLAS
FAYETTE
GREENBRIER
Elk River Watershed
6 0 6 12 Miles
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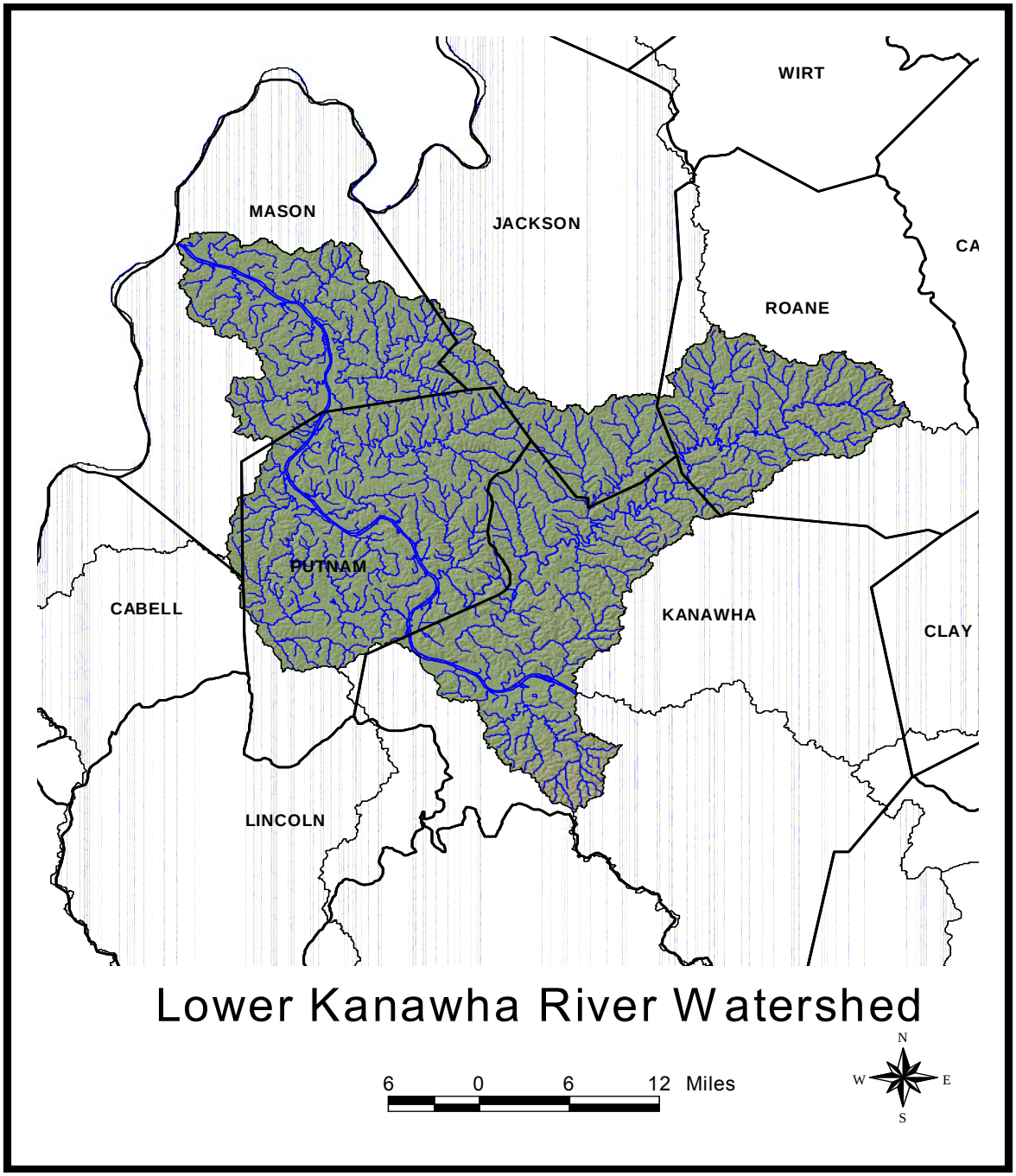
WIRT
MASON
JACKSON
CA
ROANE
PUTNAM
CABELL
KANAWHA
CLAY
LINCOLN
Lower Kanawha River Watershed
6 0 6 12 Miles
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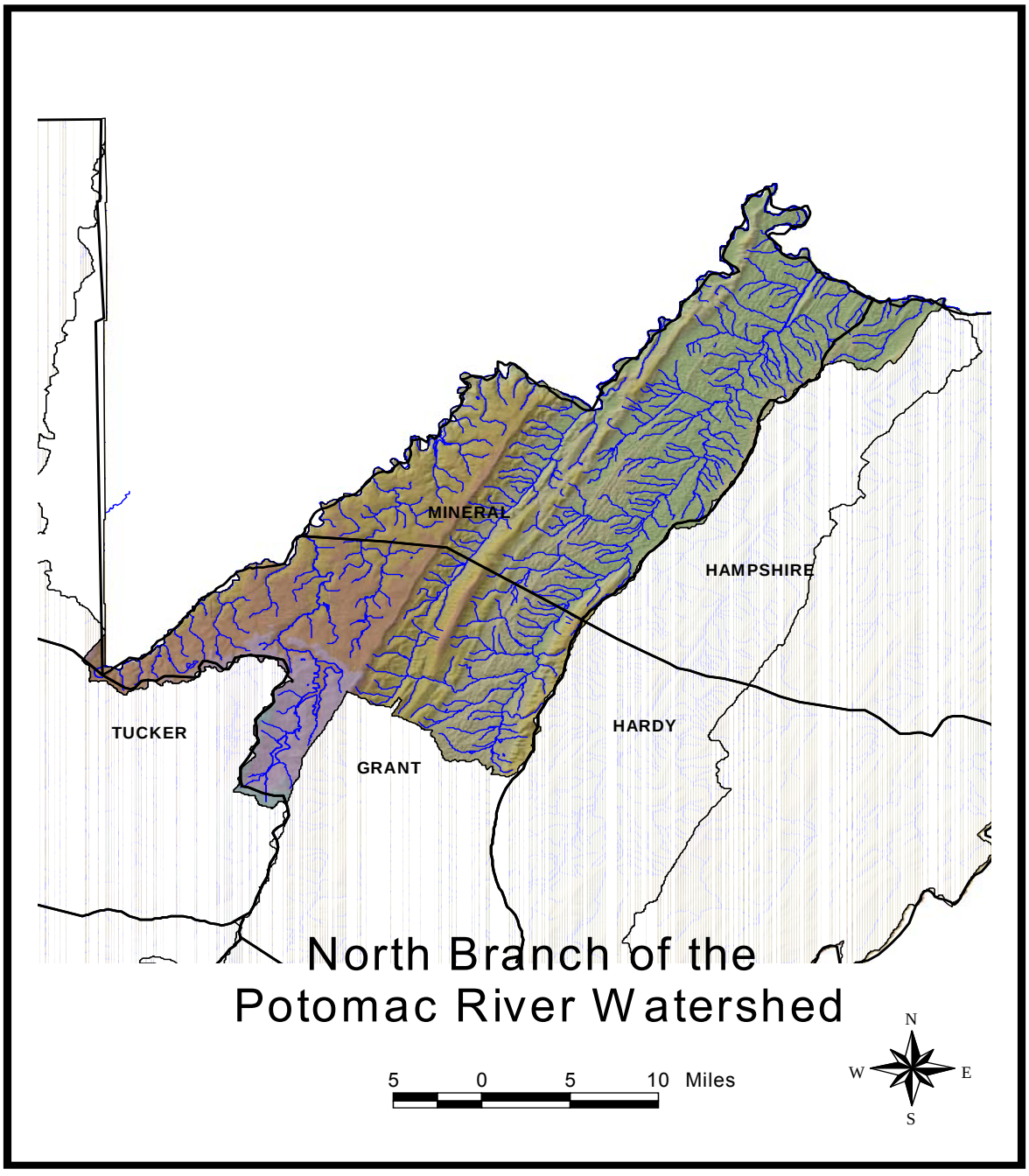
MINERAL
HAMPSHIRE
TUCKER
GRANT
HARDY
North Branch of the
Potomac River Watershed
5 0 5 10 Miles
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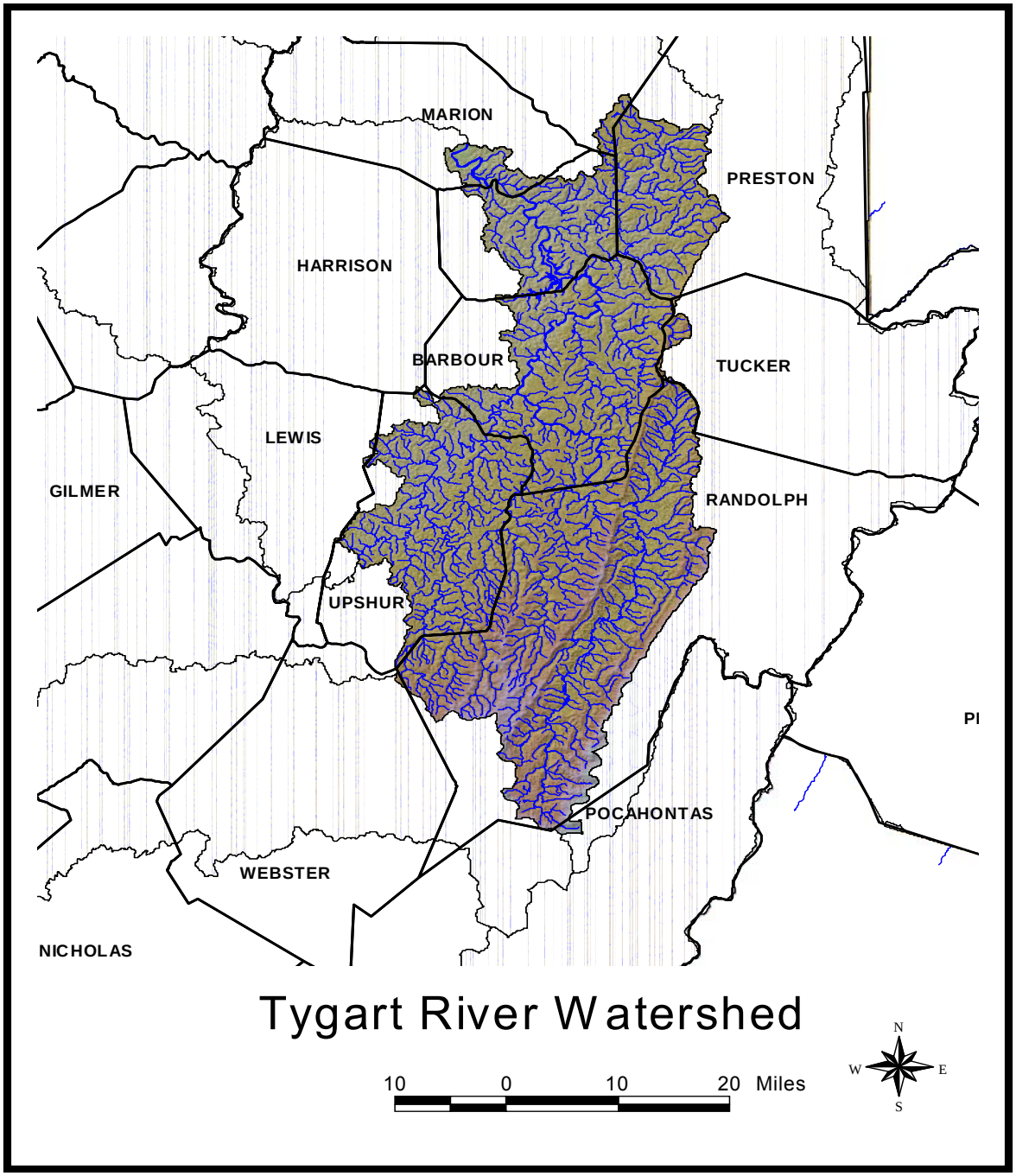
MARION
PRESTON
HARRISON
BARBOUR
TUCKER
LEWIS
GILMER
RANDOLPH
UPSHUR
POCAHONTAS
WEBSTER
NICHOLAS
Tygart River Watershed
10 0 10 20 Miles
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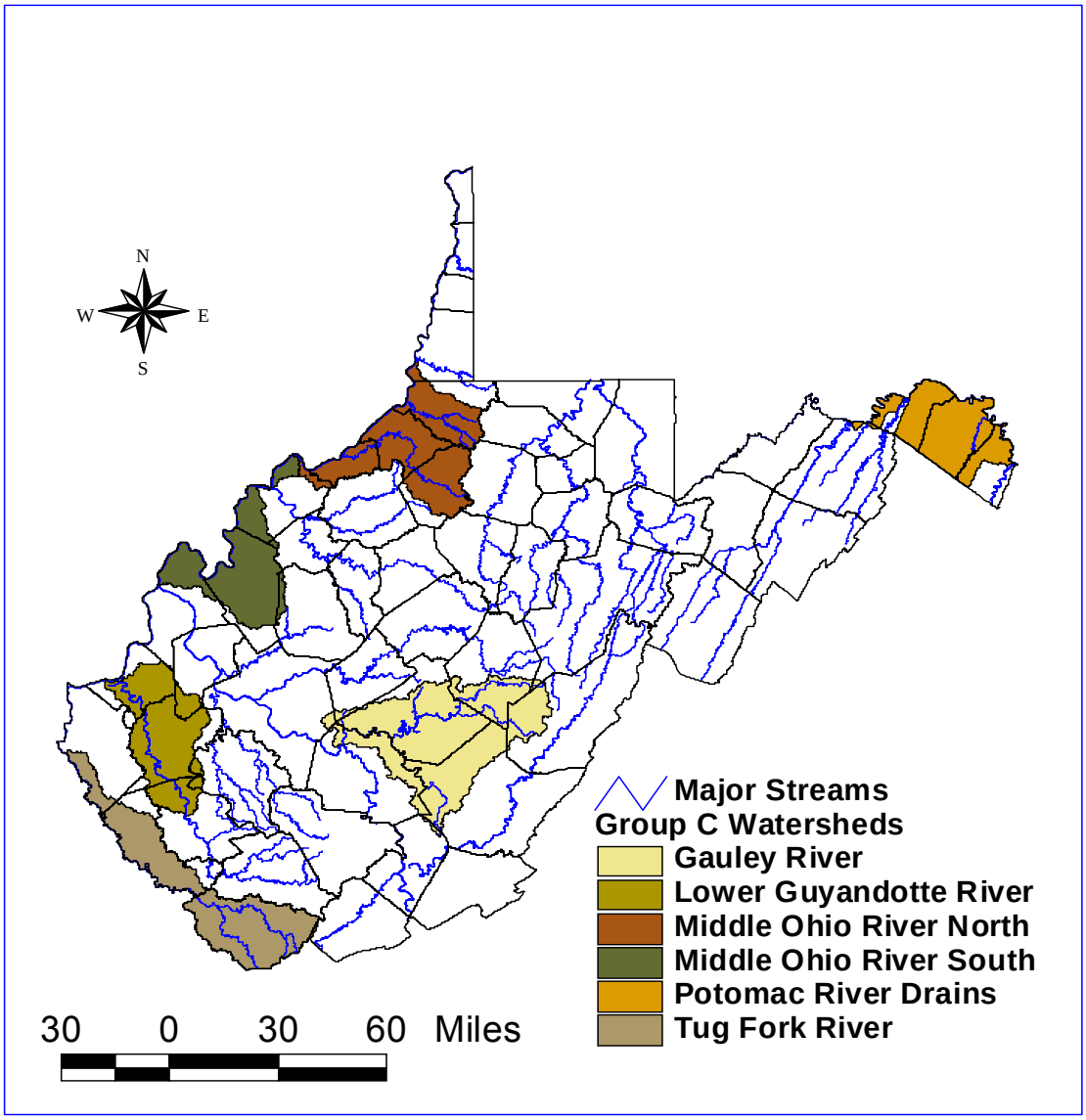
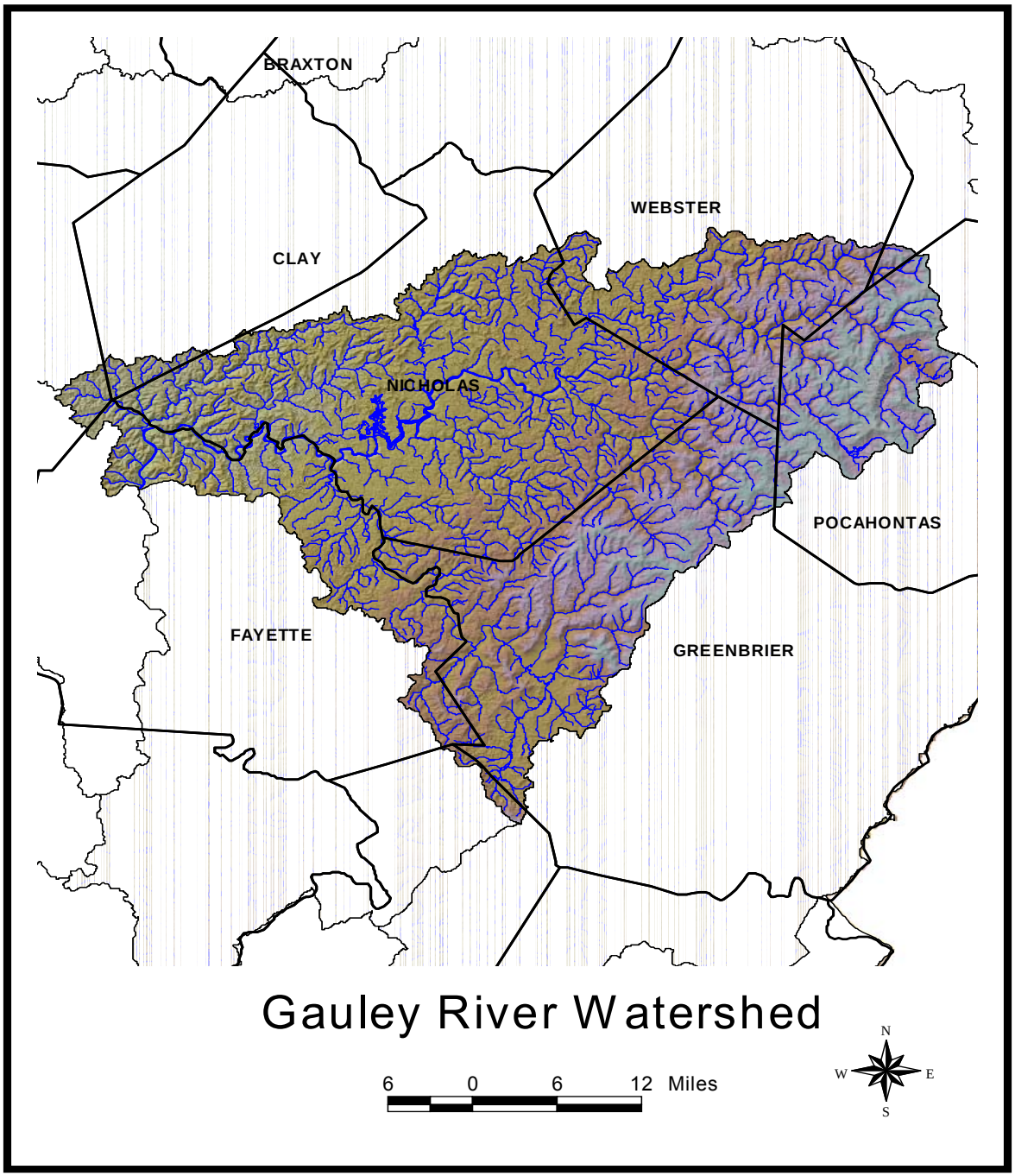


Group C Watersheds


BRAXTON
WEBSTER
CLAY
NICHOLAS
POCAHONTAS
FAYETTE
GREENBRIER
Gauley River Watershed
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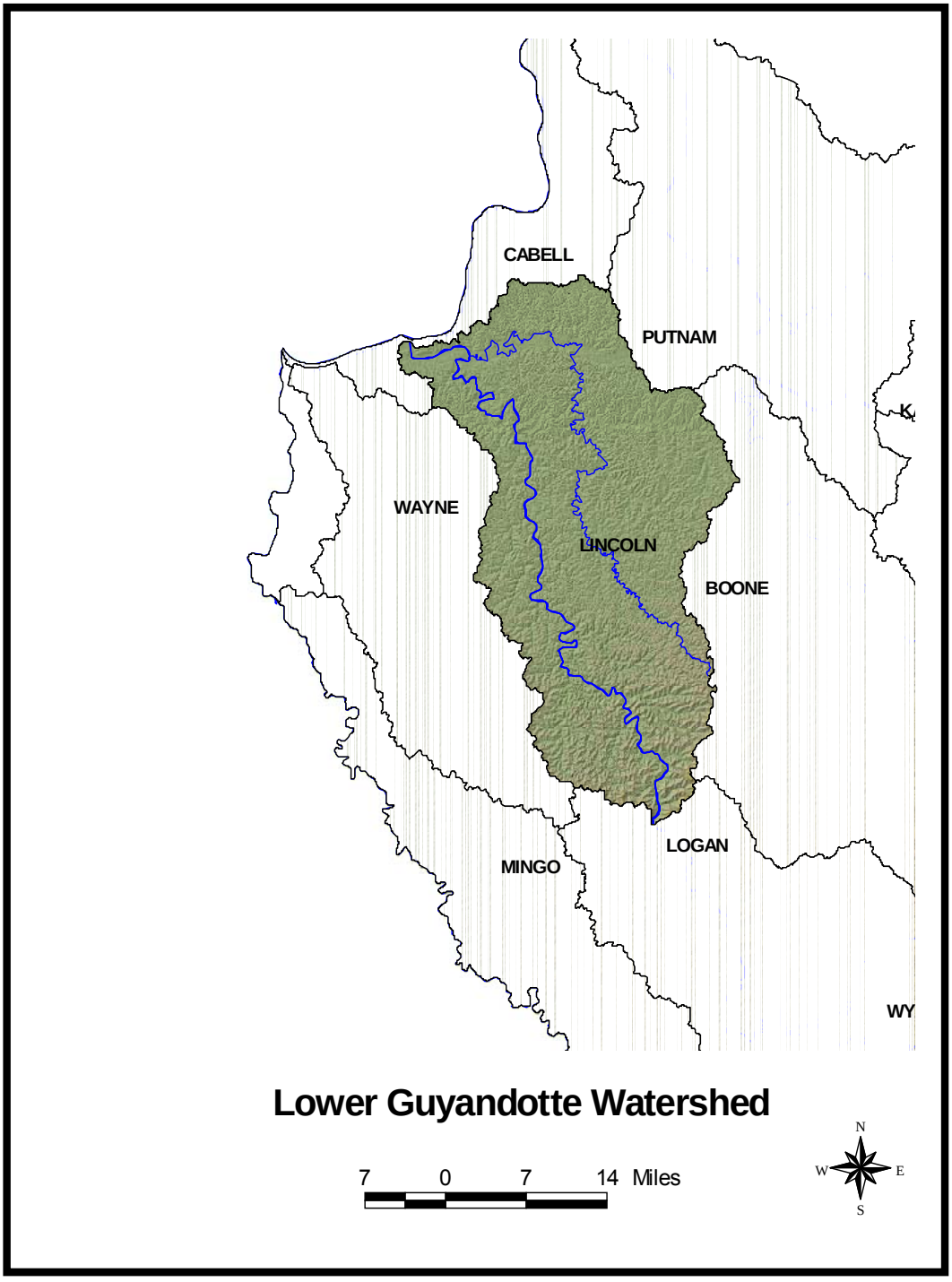
CABELL
PUTNAM
WAYNE
LINCOLN
BOONE
LOGAN
MINGO
Lower Guyandotte Watershed
7 0 7 14 Miles
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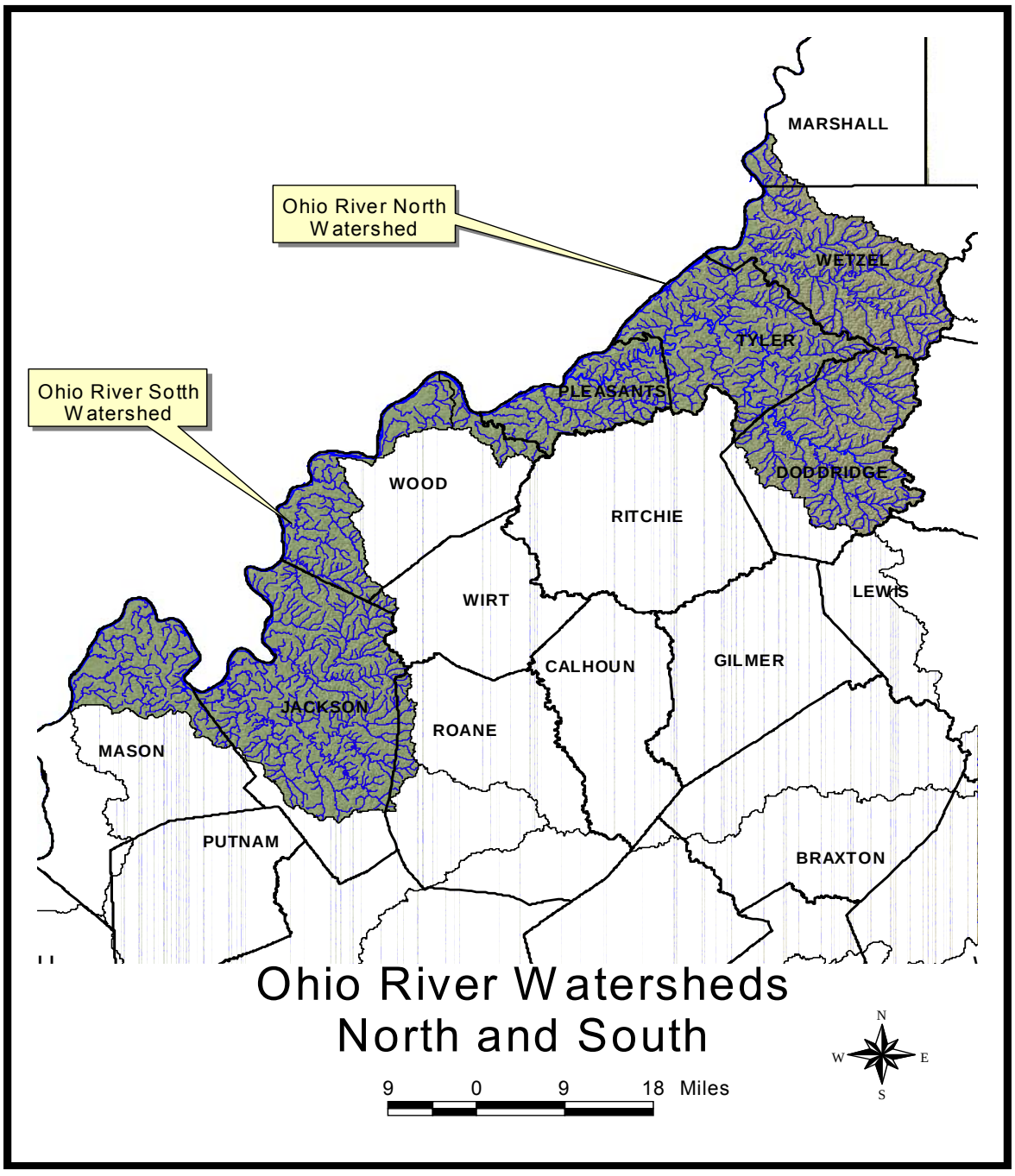
MARSHALL
Ohio River North Watershed
WETZEL
TYLER
Ohio River Sotth Watershed
PLEASANTS
DODDRIDGE
WOOD
RITCHIE
WIRT
LEWIS
CALHOUN
GILMER
JACKSON
ROANE
MASON
PUTNAM
BRAXTON
Ohio River Watersheds
North and South
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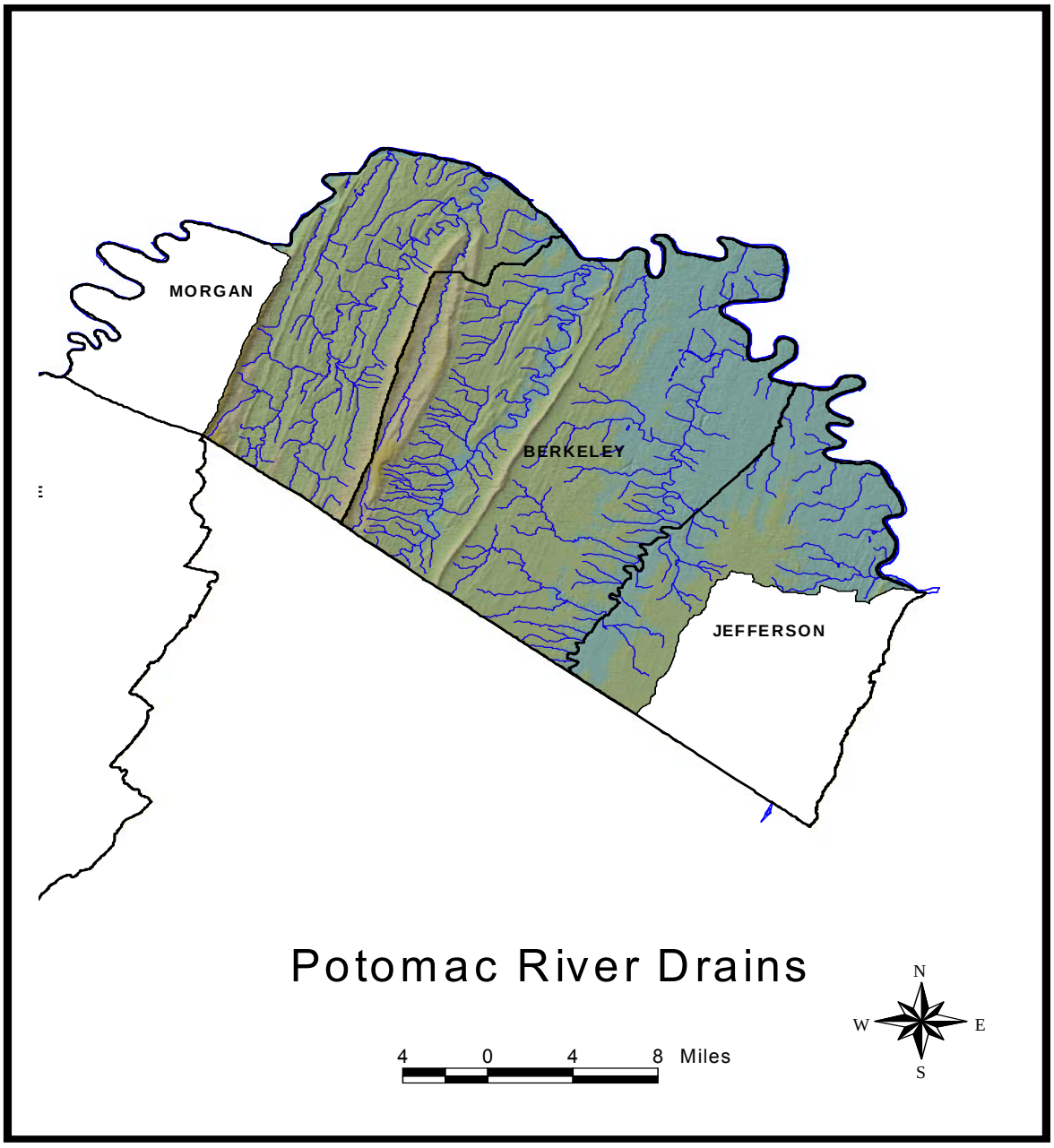
MORGAN
BERKELEY
JEFFERSON
Potomac River Drains
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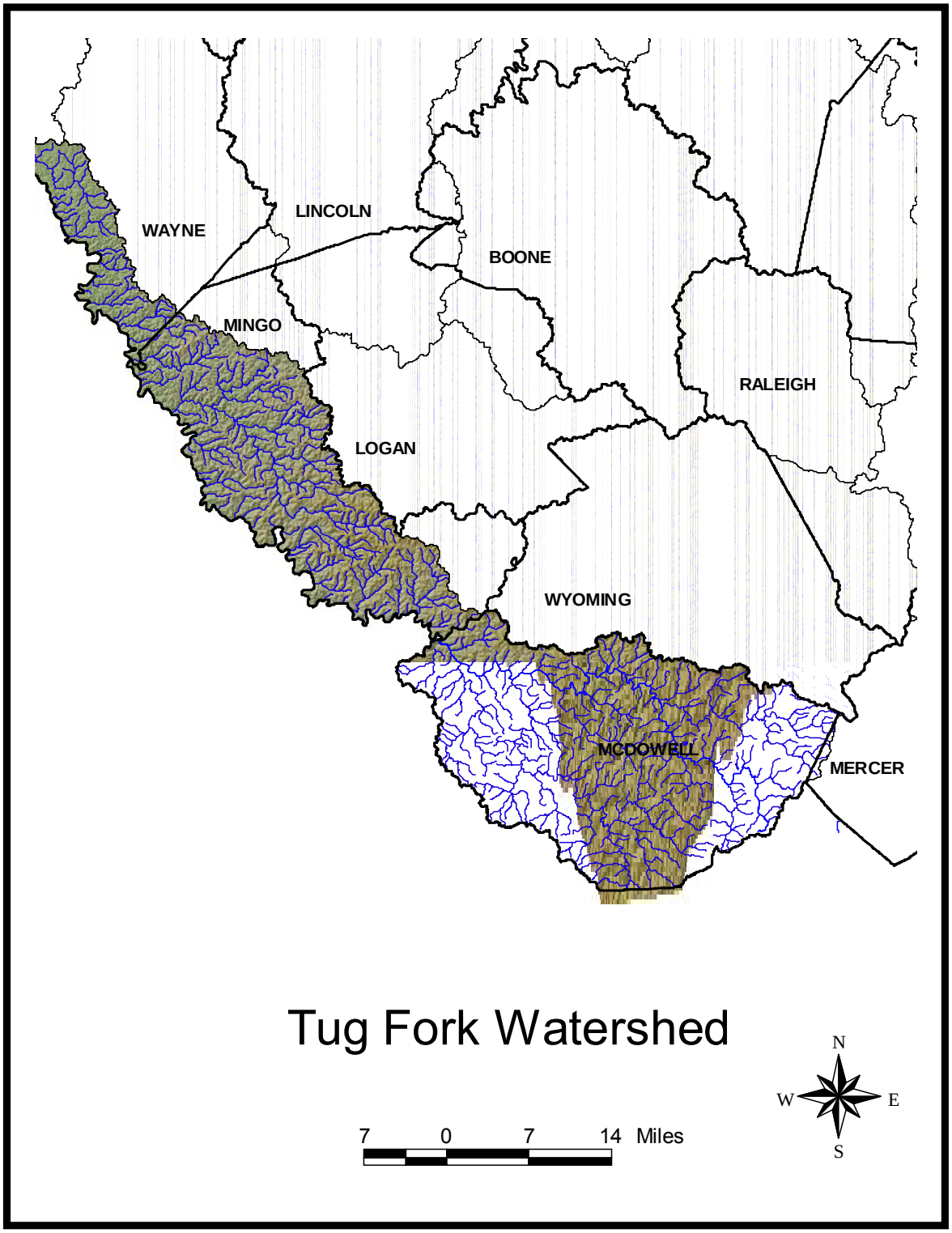
WAYNE
LINCOLN
BOONE
MINGO
RALEIGH
LOGAN
WYOMING
MCDOWELL
MERCER
Tug Fork Watershed
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III. BOARDS AND COMMITTEES

The following boards and committees are responsible for developing and implementing policies, procedures and rules to ensure proper application of the Groundwater Protection Act (GWPA).

1. Environmental Quality Board

Appellate Activities and Permit Appeals

The Board is authorized by WV Code 22-11-21 to hear appeals of agency decisions concerning groundwater protection. The following are administrative appeals which were filed with or addressed by the Board during the last biennial reporting period and include issues arising under provisions of the Groundwater Protection Act:

Universal Wood Products - Appeal 1-13-01
Filed 7-13-01
Resolved 9-27-01 – Agreed Order

PPG - Appeal 01-15-EQB
Filed 8-6-01
Resolved 10-11-01 – Consent Order

Allegheny Energy/ Ft. Martin - Appeal 01-20-EQB
Filed 8-27-01
Resolved 11-19-01

Weirton Steel - Appeal 03-10-EQB
Filed 4-9-03
Pending

Review of Civil Administrative Penalties

WV Code 22-12-10 establishes procedures for review of the assessment of civil administrative penalties. This provision provides for an informal hearing to review the penalty, and gives the Board appellate authority for review of the final decision. The Board has not received any appeals filed pursuant to this provision.

Rulemaking Activities

Requirements Governing Groundwater Standards, 46 CSR 12

The Board is authorized by Section 22 of the Groundwater Protection Act to promulgate standards of purity and quality for groundwater. This has been accomplished by the promulgation of the legislative rule 46 CSR 12 – "Requirements Governing Groundwater Standards". As outlined in the preceding biennial report, the Board proposed a revision to groundwater standards rule (46 CSR 12) and held a public hearing on the proposal in June of 2001. The revision added the parameter arsenic to the standards with a numeric criterion of 50 milligrams per liter (µg/L). This value was the maximum contaminant level (MCL) for arsenic published by the US Environmental Protection Agency pursuant to the federal Safe Drinking Water Act. The proposed rule was submitted to the WV Legislative Rule-Making Review Committee on July 27, 2001.

After the Board filed its proposal, USEPA announced a revision to the arsenic MCL from 50 µg/L to 10 µg/L. Upon learning of the revision, the Board reconsidered the proposed arsenic value. After holding a public hearing on the matter on December 19th 2001, the Board wrote a letter to the Legislative WV Rule-making Review committee requesting that the committee support a revision of the proposed arsenic criterion to reflect the 10 µg/L value proposed by USEPA. The committee agreed to that change and forwarded the rule to the Legislature with the 10 µg/L numeric criterion for arsenic. The Legislature passed the rule as amended. After final promulgation by the Board, the revised rule became effective on July 1, 2002.

Other Authorized Activities

Groundwater Coordinating Committee

Section 22-12-7 provides for the continuation of the groundwater coordinating committee. That section further provides that the chair of the EQB is a member of that committee. The committee is responsible for review and consultation regarding implementation of the programs developed by each of the groundwater regulatory agencies. The Board has received no notices of coordinating committee meetings since 1994.

Groundwater Variance Review

In 1994, the DEP promulgated a rule that was drafted by a subcommittee of the Groundwater Coordinating Committee, which establishes procedures for applicants seeking variances from groundwater standards. The duties established for the Board by that rule are twofold.

First, the rule provides that any person adversely affected by the Director's decision to deny a variance may appeal that decision to the Board within 30 days of the date of publication of a denial decision in the State Register. In addition, section 6.9 of the rule

provides that when a variance is proposed to the legislature, if the terms and conditions of the variance include alternative groundwater standards the Director is required to consult with the Environmental Quality Board in establishing such alternative standards.

No appeals or requests for consultation were received by the Board during this reporting period.

2. Groundwater Coordinating Committee

This committee consults, reviews, and makes recommendations on the implementation of the GWPA by the groundwater regulatory agencies. The committee is authorized and empowered to promulgate legislative rules as may be necessary to implement the GWPA. The committee also reviews programs for compliance and recommends necessary changes.

This committee is comprised of senior managers from the various groundwater regulatory agencies which includes:

Commissioner of the Bureau for Public Health,
Commissioner of the Department of Agriculture,
Director of the Department of Environmental Protection,
Director of the Division of Water and Waste Management, and
Chairman of the Environmental Quality Board.

3. Ground Water Protection Act Committee

This committee deals with the development of groundwater policies, groundwater protection practices, and addresses past, present, or future rule-making issues. This committee consists of program managers from groundwater regulatory agencies.

4. Groundwater Monitoring Well Drillers' Advisory Board

This board was created to advise WV DEP on the certification of monitoring well drillers, and to assist WV DEP in the development of Groundwater Monitoring Well Design Standards. This board consists of representatives from the drilling and coal industries, Division of Water and Waste Management, Division of Oil and Gas, Division of Waste Management's Underground Storage Tank Section, Bureau for Public Health, Department of Highways, and West Virginia Geologic Survey.

The board works closely with WV DEP Division of Water and Waste Management's Groundwater Program Monitoring Well Driller Section in the development of policies relating to monitoring well design standards, documentation, testing, and drilling related issues. During this reporting period, the board has assisted in the Monitoring Well Driller development of the following policies:

1. Driller's whose license has expired for longer than 1 year must retest.

2. Driller may review their written examination at Bureau for Public Health's Office of Environmental Health Services (OEHS) upon written request.

3. Defined recourse procedure to protect a driller from enforcement action when he/she has been denied access to a well that he/she has been working on by the landowner or responsible well party.

4. Defined recourse procedures to protect a driller from enforcement action when he/she has been requested by the landowner or responsible well party to deviate from the minimum well design standards without the approval of a written variance request.

5. All temporary wells must be installed with lockable caps and annular space seals to a minimum of one foot below groundwater level with impervious bentonite or similar impervious material.

6. Procedures for the reporting of multiple boreholes on a contaminated or suspected contaminated site.

7. Any borehole, which could contribute to or cause the alteration of water quality either a private or public drinking water source, must be abandoned in accordance with the monitoring well design standards. This includes those boreholes (*e.g.* high risk) drilled on contaminated or suspected contaminated sites.

8. All wells installed by cone penetration must meet monitoring well design standards and the boreholes created by cone penetration must be abandoned by monitoring well design standards.

9. Horizontal well installers and cone penetration operators are required to be a certified WV monitoring well driller if the borehole and/or well intersects groundwater.

10. Jurisdiction was established by OEHS and DWR on whose responsibility it is on the construction and abandonment of wells. OEHS responsibility is for public water supply wells, exploratory/observation wells used in determination of drinking water and production wells, irrigation wells and those industrial water wells not located on contaminated sites. Local health department's responsibility is for private water supplies; exploratory/well observation wells used in the determination of private wells, heat pump wells and de-watering wells. DEP's responsibility is for all groundwater monitoring wells, driven point wells, recovery wells, piezometers, UIC wells and those industrial wells located on contaminated sites.

The board approved 2 monitoring well designs to be used on abandoned mine sites which eliminated the need to submit a written variance request from the minimum monitoring well design standards.

The board's support has been instrumental in the development of electronic submission of the *Monitoring Well Construction Documentation Form* and the *Abandonment of Monitoring Wells/Boreholes Forms* via the Internet. This service was made available to all monitoring well drillers in January 2002.

5. Well Head/Source Water Protection Committees

These committees deal with groundwater and source water issues in source water protection areas. This committee essentially consists of the same members as the Groundwater Protection Act committee. In addition, representatives from the Public Service Commission, the Rural Water Association, Division of Highways, and the Office of Emergency Services serve on this committee.

6. Nonpoint Source Coordinating Review Board

Due to the number of State agencies involved in coordinating and/or regulating nonpoint sources, the various technical advisory committees must assure that State requirements are understood and met. This is important since funding sources, other than National Clean Water Act, Section 319 funds, are available to support implementation of best management practices (BMP's). To maximize utilization of these funds, requirements of the various agencies that manage the funds must be addressed during the evaluative, priority watershed selection, planning and implementation phases.

This requires an interagency mechanism to allow review of individual agency requirements and to discuss conflicts in objectives for specific types of nonpoint source prevention (NPS). Therefore, an interagency NPS Coordinating Review Board made up of representatives from each of the NPS Technical Advisory Committees has been created to integrate the efforts of all category agencies into a unified NPS watershed management approach. It will be the responsibility of the Coordinating Review Board to guide implementation, identify specific BMP's for multi-category targeted watersheds and resolve conflicts in accordance to meeting Section 319(b)(2)(F) Federal Consistency requirements.

IV. DEPARTMENT OF AGRICULTURE
A. Pesticides Section

The Department has remained active in the promotion and implementation of State and Federal programs for the protection of groundwater resources. Inspections of permanent pesticide operational areas as defined under Title 61.Series 12I; Non-Bulk Pesticide Rules for Permanent Operational Areas have been maintained. Although there were no additional agricultural commercial sites built during this period, inspections and compliance efforts concentrated on golf courses and nursery operations.

The pesticide container and recycling project was continued through this period with approximately 18,000 containers collected over the report period. The slight decrease in containers when compared to the last reporting period is due to an industry shift to returnable containers and non-liquid formulations. The container collection project has proved to be a valuable educational tool.

The Department secured funding for a waste pesticide disposal program. Approximately 10,000 pounds of surplus and waste pesticide have been inventoried for subsequent disposal. Half of this material is located in Jefferson and Berkeley counties. The lack of appropriate and economic disposal options for waste pesticides usually results in illegal disposal by burial onsite. The recognized vulnerability of ground water in these two counties emphasizes the importance of this project. The need for a standing hazardous chemical collection programs at the level of the homeowner are substantiated by routine inquires to the Department. The Department has investigated the establishment of additional programs to address homeowner waste pesticide disposal needs.

As a lead agency in the groundwater protection plan, the Department remained active in the development of the groundwater database and associated interagency water quality programs. Applicator certification and training materials were updated to reflect changes in pesticide use patterns.

Groundwater Staffing and Resource Needs

The Department of Agriculture's Plant Industries Division / Pesticide Regulatory Programs Environmental Program Specialist was transferred to the Regulatory and Environmental Affairs Division. The Department's responsibilities in groundwater protection will not be hampered by this transfer. Several areas have been identified in which additional funding would result in increased protection and quality assessment of the groundwater resource. These areas include:

- Development and implementation of groundwater monitoring projects. A Network of dedicated monitoring wells in vulnerable areas needs to be expanded.

- Waste pesticide collection and disposal programs must be supported by consistent funding. Agricultural chemical collections and home use pesticide collections must be supported annually to reduce hazardous inputs into community landfills.

- Continued funding for the Pesticide container collection and recycling program.

- Funding to support additional staff, for groundwater monitoring and compliance programs and associated cost of training and materials.

- Implementation of the statewide data collection and management requirement of the groundwater protection act.

A disposal site in Berkeley County

IV. DEPARTMENT OF AGRICULTURE
B. Soil Conservation Agency

The vast majority of resource conservation activities performed have an immediate and direct influence on surface water quality but many do have an indirect correlation to ground water quality. In areas of the state where karst geology or certain soil types are present there is a particular concern for nitrate, nitrite, phosphorus and heavy metals leaching which can easily occur degrading subsurface waters. Nutrient management planning, manure storage and animal feeding facilities are important in reducing direct leaching of nutrients in all areas of the state but the areas where karst geology and highly permeable soils are present land use activities have a major influence on ground water.

Source Water Protection (Ground Water and Surface Water)

Working with the WV Department of Health and Human Resources Office of Environmental Health Services an Environmental Management Plan was developed for a dairy operation to protect three source water wells for the Town of Terra Alta located on the dairy farm. The high water tables and stream bed porosity create a high potential for aquifer contamination.

This plan dealt with all factors recognized by WVDHHR's Source Water Protection Program which includes the use, storage and disposal of petroleum products, agricultural chemicals, manure, milk house wastes as well as land management practices on the farm. Nutrient management, animal management and crop production practices were also planned to provide maximum protection of water resources.

Recommendations were also made to the Terra Alta Water Department to further protect water resources from both agricultural and non-agricultural activities. The Town has approximately 400 water customers.

The Conservation Agency is also assisting with developing a source water protection program for all of Preston County and is developing a working relationship with WVDHHR implementing the program in other areas of the state.

West Virginia WaterSafe Agency staff continues to use and promote the WV WaterSafe program where landowners have private water wells. The program provides a checklist of potential groundwater contamination problems and a list of recommendations the homeowner can utilize to protect their wells.

Educational Activities

- Five Best Management Practices workshops for stormwater and erosion control with over 300 attendees

- Three farm producer meetings dealing with nutrient management, pesticide use and land management with 106 attendees

- Contractor's Expo co-presenter Groundwater Protection Forum, with 25 attendees

- Water Quality Workshop with 93 attendees

- Nutrient Management Workshop with 25 attendees

Nutrient management of animal manure, litter and chemical fertilizers

- Nutrient management plans were written for 4328 acres of agricultural land.

- 1176 acres of pasture had management plans developed for them reducing erosion and fertilizer applications rates.

- 6000 tons of litter were moved out of the Potomac Valley through a distribution program overseen by WVCA staff.

- 1450 acres of corn were Nitrogen quick tested to determine exact amounts of nitrogen fertilizer needed to achieve yield goals.

- 30 feeding and manure storage facilities were constructed

- 13410 feet of exclusion fencing were constructed

- Other BMPs installed on farms include animal walkways, watering facilities, stream crossings and critical area stabilization

Note: There are several dozen cooperator contracts in development for nutrient management and facilities construction that will be implemented this coming year.

Biosolids loading rates and land evaluation

Land evaluation for site suitability and the recommendation of loading rates have direct influences on groundwater. Mandatory application setbacks are required regarding wells, springs, sinkholes and limestone outcrops. Land with high water tables or have high rates of permeability (leaching potential) are also unacceptable for receiving applications of biosolids. By managing applications and restricting application areas aquifers and surface waters are protected from nutrients, pathogenic organisms and heavy metals.

From July 1, 2001 until January 2003, when the Soil Conservation Agency ended the affiliation with WVDEP in the biosolids land application program, field staff completed the following activities associated with biosolids:

- 223 farms evaluated
- 622 fields (application sites) evaluated
- 15838 acres evaluated and 7211 approved as acceptable (46% approval rate)
- 636318 pounds of nitrogen managed
- 256735 pounds of phosphorus managed
- 223 nutrient management plans (loading rates) completed

V. WV DEPARTMENT OF ENVIRONMENTAL PROTECTION
A. Office of Oil and Gas

The Office of Oil and Gas (OOG) regulates West Virginia's oil and natural gas industry to protect the environment, including groundwater. This is achieved through the permitting, inspection and enforcement of exploration, production, plugging and injection activities of the industry. Over 44,000 active wells are maintained by the OOG. Regulations aimed at protecting groundwater have been in existence since 1929. Additional regulations have been added in the years to follow to further aid in the protection of groundwater. The OOG believes that groundwater protection is maximized by conforming to these existing regulations and practices. The following is a summary of selected regulatory functions and activities the OOG conducts in protecting groundwater.

Fresh Water Casing and Drilling Practices - 35CSR4-11.3 and 11.7

Fresh water casing must be set, by the operator, at least 30 feet below the deepest fresh water horizon and cement circulated to surface prior to drilling into any oil, gas or salt water bearing strata. The operator shall use practices and procedures necessary to minimize damage or disturbance to strata including groundwater until casing has been set.

Plugging Methodology - 35CSR4-13 and 22-6-24

During plugging and abandonment operations of a well, the operator is required to separate oil, gas and water bearing strata with 100 foot cement plugs to completely seal the hole and prevent communication with other zones including groundwater.

Water Supply Testing - 35CSR4-19

Operators are required to notify landowners within 1000 feet of a proposed well drilling site. At the request of the landowner, the operator shall sample and analyze water from any wells or springs within this 1000 feet. If no requests are made, then the operator shall choose an existing well or spring from within the 1000 feet to sample and analyze. Results are to be submitted to the landowner as well as the OOG. Results are kept on file for groundwater quality purposes should a problem ever arise.

Underground Injection Control Program - 35CSR4-7

The OOG administers the Class II and III injection wells under the Underground Injection Control (UIC) Program. Class II wells include brine disposal and secondary recovery gas and water injection wells. Class III wells include solution mining wells. The inventory consists of 68 brine disposal wells, 550 secondary recovery wells and 35 solution mining wells. Primary focus of this program is the protection of groundwater from injection operations. Operators are required to submit reports monthly of each injection wells daily activity. UIC permits are issued for five-year periods and must be renewed for injection to continue. During permitting, operators

are required to sample and analyze water wells, springs and surface water bodies within a ¼ mile radius of the injection well or facility. Solution mining permits require that groundwater be sampled, analyzed and charted on a quarterly basis. Mechanical Integrity Tests (MITS) are required to be conducted by the operator at least once every five years to ensure that injected fluid is not migrating into any Underground Source of Drinking Water (USDW). The OOG is required to conduct field compliance reviews of all injection wells.

Abandoned Well - 35CSR6

Abandoned wells are the most problematic area relating to groundwater, especially for wells drilled 75 to 100 years ago when technology and concern for groundwater protection were not as advanced as today. These wells, which are throughout the state, now pose potential and actual threats to groundwater quality, as aquifers penetrated by these wells are typically not cased to protect them from contaminants within the borehole of the well. Contaminants that may affect groundwater quality include hydrocarbons, chlorides and metals. The OOG works with both industry and the federal government to locate, prioritize and plug or produce abandoned wells. The OOG has a priority ranking of abandoned wells and those which pose a significant and/or immediate threat to human health or the environment are scheduled for evaluation first.

Annual Inspection - 35CSR4-11.6

Operators are required to visually inspect all their wells which are not plugged and which have been drilled for more than five years. Any significant leakage or well integrity failure is reported to the OOG and measures are taken to remedy the problem. Operators are required to submit certification to the OOG that the inspections have been conducted.

General Water Pollution Control Permit

Operators applying for a permit involving the use of a pit for holding wastes generated during well work must also register this site and indicate the method for treating and disposing of the pit contents. Most pit contents are land applied after proper treatment and aeration. Primary function of this general permit is the prevention of pollution to the waters of the state relating to the handling and disposing of these wastes.

Wellhead Protection Program

The OOG participates in the Wellhead Protection Program by determining if a proposed well drilling site is located within a protected water supply area prior to permit issuance.

Spill Prevention and SPCC Plans - 35CSR1

All operators are to have adequate containment or diversionary structures in place at each well or facility to prevent discharged oil from reaching waters of the state. Operators are also required to have a Spill Prevention Control Countermeasure (SPCC) Plan for these facilities. This requirement was devised as a result of the passage of the Clean Water Act to protect waters of the state from discharged oil.

Well Plugging Certification Program

The OOG is evaluating the need and implementation of this program. This program would provide training and testing of industry personnel. It will provide the OOG with some increased assurance that operators or contractors have personnel that are familiar with requirements and procedures for plugging wells. Once this program is initiated the OOG expects to require, through policy, that at least one operator or contractor representative, certified through the program, be on-site during plugging operations.

Groundwater data is primarily collected from three activities regulated by the OOG. Operators proposing a new drilling location must provide notice to every dwelling within 1000 feet of this location and offer to sample and analyze their well water and/or spring. This data then represents the groundwater quality standard for the area of proposed drilling. Parameters include, but are not limited to, pH, iron, chlorides, total dissolved solids and detergents (MBAS). Results are currently being submitted in paper form and kept on file with its corresponding permit.

Operators applying for an Underground Injection Control (UIC) Permit are required to sample and analyze all water wells, springs and surface water bodies within ¼ mile radius of the proposed facility. Parameters are the same as those mentioned above. Results are submitted in paper form and kept in the corresponding UIC file.

The OOG investigates numerous water well contamination cases yearly. Sampling and analytical work have become routine tasks during such investigations. Parameters vary from case to case, but usually at a minimum, include those which have already been mentioned. Again, the analyses are submitted in paper form and kept in the corresponding investigation file.

The OOG does not currently track via computer any groundwater data submitted although the need for such a system has been realized for several years. The OOG has had a representative on the committee created to address this database issue. Upon implementation

of a system linking all DEP offices, the OOG will actively participate with the hopes that all analytical data will be submitted electronically in the near future.

A computer tracking system has been established for the chloride content of streams receiving discharges of produced water associated with stripper oil wells. National Pollutant Discharge Elimination (NPDES) permits require the chloride content and stream flow be checked and submitted monthly. Under this permit, the operator of these permitted facilities must also sample and analyze the effluent every month for pH, iron, chlorides, total dissolved solids and oil and grease. The monthly analytical data is currently submitted in paper form on a Discharge Monitoring Report. However, electronic filing will be encouraged in the near future. The point at which the effluent enters the stream is going to be identified by GPS for all active facilities.

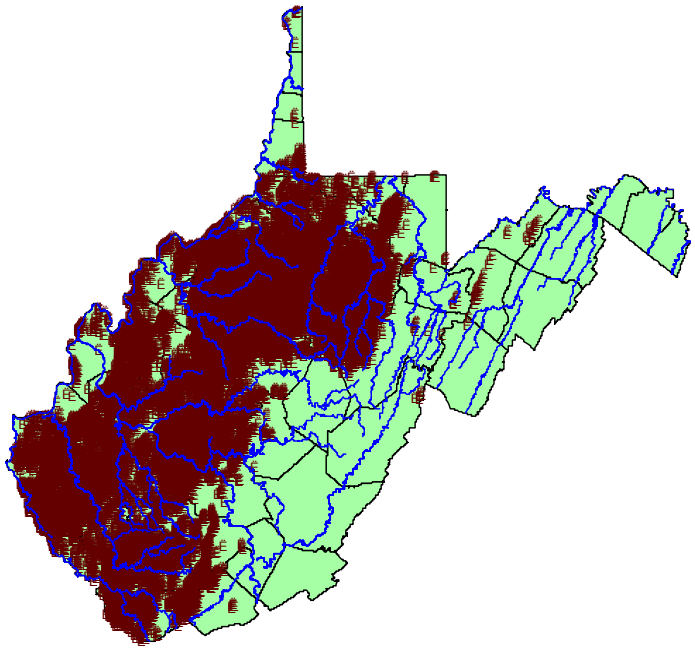
The OOG has made a significant commitment in the GIS/GPS area. Over the past few years, the OOG has invested in the purchase of Trimble hand held GPS units for our entire field staff, along with a UNIX workstation and color laser printer. As a complement to the GPS units, Trimble software has been purchased to provide for differential correction of the collected data.

To date, the OOG has collected GPS data on over 3,000 wells. This data is first corrected for various external degredational effects, the largest of which is intentionally imposed by the U. S. Department of Defense. After correction, this data is placed on the GIS server to allow for incorporation with other GPS data. Over time, we will be able to develop a more complete and accurate (2-5 meters) locational database.

Presently, in our GPS work, we are focusing on the “abandoned” well population, as many of these wells are not mapped and often tend to be sources of groundwater contamination. The GIS provides us the capability of relating our well locational information with such basic coverages as topography, roads and streams. A vast amount of other, more area specific, coverages are also accessible on this system. This data can be pulled together into a map to be used in the field for environmental investigations and presentations.

Often times, the citizens of West Virginia encounter contamination of their water wells, possibly due to oil and gas wells or their operations or other unrelated surface or underground activities. An alliance should be formed between the offices within DEP and other state and county agencies such as Dept. of Health, Public Service Commission and County Public Service Districts to pool talents and resources for providing relief to the families whose drinking water has been adversely affected. While the offices within DEP and outside agencies may not have the funding to provide the total solution to a particular situation, some funding from each as well as a review of possible alternatives may result in helping the family. Currently, there is no such alliance, but the need for one is certainly obvious and the benefits will more effectively help the citizens of West Virginia.

Active Oil & Gas Wells



There are 41,872 active wells plotted on this map.

N

Major Streams
Active Oil & Gas Wells

30 0 30 60 Miles

V. Department of Environmental Protection
B. Division of Water and Waste Management, Office of Waste Management

1. Hazardous Waste Section

The Hazardous Waste Permitting Unit (Permits) was established by Chapter 22, Article 18 of the West Virginia Code and the rules promulgated there under. Legislative Rule, Title 33, Series 20, known as the Hazardous Waste Management Rule (HWMR), are the regulations promulgated to regulate the storage, treatment, and disposal of hazardous wastes generated and managed in West Virginia. The HWMR has incorporated by reference the Code of Federal Regulations (CFR) promulgated under the Resource Conservation and Recovery Act (RCRA) amendments of 1984. All provisions of 40CFR264 Subpart F and 40CFR265 Subpart F, which pertains to groundwater protection and any releases from a Solid Waste Management Unit (SWMU), have been incorporated by reference in their entirety.

Permits and the State of West Virginia coordinate this regulatory effort with the United States Environmental Protection Agency (EPA). In general, the State of West Virginia has authorization to assume the lead role in the groundwater protection and monitoring at the permitted units in West Virginia, while EPA has the lead for implementing corrective action activities.

Groundwater Protection Goal and Priorities

The goal of Permits is to have 75% of all sites with contamination under engineering control and stabilized to prevent additional contamination to groundwater and eliminate further migration of contaminated groundwater by the year 2005.

Permits will pursue this goal by seeking to identify all permitted sites with groundwater contamination or potential for groundwater contamination due to a release, remediate the site, and return the site to its original condition.

The priority objectives are as follows:

- Identify all sites with contaminated groundwater or potential for groundwater contamination.

- Define the contaminants, source, and extent of contamination.

Mechanisms to Regulate and Protect Groundwater at Permitted Units

The groundwater monitoring regulations in Part 264/265, Subpart F, is one part of an overall strategy to reduce the likelihood of environmental contamination resulting from hazardous waste treatment, storage, and disposal. This strategy includes restrictions on disposal of untreated hazardous waste, unit-specific standards for land-based hazardous waste management units,

and monitoring groundwater below these units. The land disposal restrictions program requires the treatment of hazardous wastes before disposal to reduce the mobility or toxicity of hazardous constituents. The unit-specific standards for land-based hazardous waste management units seek to prevent the release of hazardous waste to the environment. Groundwater monitoring is the final link in this strategy to prevent environmental contamination. Owners and operators of all land-based units must institute a groundwater-monitoring program that is able to detect and characterize any releases of hazardous waste or hazardous constituents to the groundwater underlying the facility. Should the other elements of the strategy fail, groundwater monitoring will detect the release so it can be remedied.

The regulations in Subpart F of Part 264/265 are general requirements, establishing performance-based standards that state what a successful groundwater-monitoring program must accomplish; they do not dictate specific technical standards. Each facility's groundwater monitoring program is unique because no two Treatment, Storage, or Disposal Facilities (TSDF) are the same. Individual groundwater monitoring programs are based on site-specific conditions, including the underlying geology and hydrology, as well as the properties of wastes managed on site.

Regulatory authority is available to require the owner and operator of a TSDF to remediate releases of hazardous waste or hazardous constituents to the environment. All permitted facilities must comply with Part 264, Subpart F, for releases from SWMU's. There are three stages to the Part 264, Subpart F, groundwater monitoring and follow-up activities:

- Detection monitoring - to detect if a release has occurred
- Compliance monitoring - to determine if regulatory standards have been exceeded once a release has occurred
- Corrective action - to remediate a release to the groundwater

Section 264.97 sets out the basic requirements that apply to all groundwater monitoring programs under Part 264, Subpart F. The specific requirements that apply to each of the three phases of groundwater monitoring are found in 264.98, 264.99, and 264.100.

The general requirements for groundwater monitoring programs at permitted facilities are found in 264.97. These general requirements apply to all three phases of groundwater monitoring: detection monitoring, compliance monitoring, and corrective action. A groundwater monitoring program established pursuant to Part 264, Subpart F, must have a sufficient number of monitoring wells, installed at appropriate locations and depths, to yield water samples that:

- Represent the background conditions of the site.
- Represent the quality of groundwater passing the point of compliance.
- Detect any contamination of the uppermost aquifer at the point of compliance.

The goal of a detection monitoring program is to detect and characterize any release of hazardous constituents from a regulated unit into the uppermost aquifer. The detection monitoring system must be installed at the point of compliance and adhere to the task requirements applicable to all groundwater monitoring systems. The owner and operator must monitor for certain indicator parameters and any other specific waste constituents or reaction products that would provide a reliable indication of the presence of hazardous constituents in groundwater at the point of compliance.

Once it is established that a release has occurred, the owner and operator must institute a compliance monitoring program. The goal of the compliance monitoring program is to ensure that the amount of hazardous constituents released into the uppermost aquifer does not exceed acceptable levels. Once those levels are exceeded, the owner and operator must initiate corrective action. The compliance monitoring program establishes routine monitoring (at least semiannually).

The goal of the Subpart F corrective action program is to bring regulated units back into compliance with the required standards at the point of compliance. The Subpart F corrective action program seeks to accomplish this goal by requiring that the owner and operator either remove the hazardous constituents or treat them in place. Examples of corrective measures include excavation, stabilization, solidification, and source control. The owner and, operator must also conduct corrective action to remove or treat in place any hazardous constituents that exceed the required standards between the point of compliance and the downgradient property boundary, and beyond the facility boundary where necessary to protect human health and the environment.

Mechanisms for HSWA Corrective Action

The Hazardous and Solid Waste Act of 1984 (HSWA) required corrective action for all releases of hazardous waste or constituents from any SWMU at a facility seeking a permit regardless of when the waste was placed in the unit. A SWMU is any discernible unit at which solid wastes have been placed at any time, irrespective of whether the unit was intended for the management of solid or hazardous waste. This definition includes any area at a facility where solid wastes have been routinely and systematically released. This authority is applied to any facility seeking a permit, including operating permit, post-closure permits, and permits-by-rule after November 8,1984.

Under HSWA, Congress also gave EPA the authority to issue orders requiring cleanups at interim status facilities. Interim status TSDF's that were already in operation when the applicable RCRA standards were established, and that are operating under the standards in 40 CFR Part 265 until they receive a permit Under 3008(h), as added by HSWA, EPA can issue an administrative order or file a civil action whenever it determines on the basis of any information that there is or has been a release of hazardous waste into the environment from an interim status facility. This applies to facilities that are currently operating under interim status, that formerly operated under interim status, or that should have obtained interim status. It also

applies to any release of hazardous waste or constituents from the facility. In addition to requiring cleanup, EPA has the authority under 3008(h) to revoke or suspend interim status. Finally, as with 3004(v), EPA may use 3008(h) to require corrective action beyond the facility boundary and to require proof of financial assurance for cleanup.

One of the keys to understanding the RCRA corrective action program is knowing when a facility becomes subject to the corrective action. A facility can enter the corrective action program in a variety of ways. There are primarily four ways a facility becomes subject to corrective action. Facilities can enter the corrective action program under statutory authorities, by enforcement orders, by volunteering to perform cleanups, or after detecting statistically significant increases of contamination according to the groundwater monitoring requirements in 40CFR264, Subpart F.

In the past, EPA has used the corrective action process to evaluate and document the nature and extent of contamination, identify the physical and geographic characteristics of the facility, and identify, develop, and implement appropriate corrective measures. The conditions at contaminated sites vary significantly, making it difficult to adhere to one rigid process. Consequently, the corrective action process is designed to be flexible.

The original corrective action process of investigation and remedy selection and implementation comprise several activities. These activities are not always undertaken as a linear progression towards final facility cleanup, but can be implemented flexibly to most effectively meet site-specific corrective action needs. These activities are:

- RCRA Facility Assessment (RFA) - identifies potential or actual releases from SWMU's
- Interim/Stabilization Measures - implements measures to achieve high-priority, short-term remediation needs
- RCRA Facility Investigation (RFI) - compiles information to fully characterize the release
- Corrective Measures Study (CMS) - identifies appropriate measures to address the release

Once the implementing agency has selected a remedy, the facility enters the corrective measures implementation (CMI) phase of corrective action. During the CMI, the owner and operator of the facility implement the chosen remedy. This phase includes design, construction, maintenance, and monitoring of the chosen remedy, all of which are performed by the facility owner and operator with Agency oversight a remedy may be implemented through a phased approach. Phases could consist of any logically connected set of actions performed sequentially over time or concurrently at different parts of a site.

Facilities with Permitted Units and Groundwater Status

There are 27 permitted facilities in West Virginia that address groundwater issues at their sites as a part of their permit. Table 1 shows the addresses of these facilities.

Table 1

Facility Name	Address	City	State	Zip
Allegany Ballistics Laboratory	WV Secondary Rte 956	Rocket Center	WV	26753
American Environmental Services	1000 Dupont Rd Bldg 170	Morgantown	WV	26505
Appalachian Timber Service	525 East Stonewall Street	Sutton	WV	26601
Bayer CropScience	Rte 25	Institute	WV	25112
Bayer Polymers	Rte 2	New Martinsville	WV	26155
Chemical Leaman Tank Lines Inc	Rte 25	Institute	WV	25112
Crompton Corporation	Morgantown Industrial Park	Morgantown	WV	26505
Cytec WV	#1 Heilman Ave	Willow Island	WV	26134
Dupont – Belle	901 W Dupont Ave	Belle	WV	25015
Dupont - Washington	Dupont Road	Washington	WV	26102
Dupont – Washington	Dupont Road	Washington	WV	26102
F M C – Nitro	200 Pickens Road	Nitro	WV	25143
General Elec - Washington	State Route 892	Washington	WV	26181
GE Silicones, WV, LLP	3500 South State Route 2	Friendly	WV	26146
Huntington Alloys	3200 Riverside Drive	Huntington	WV	25705
Koppers-Colliers (Beazer)	RD 1 Crosscreek District	Colliers	WV	26035
Koppers-Follansbee (Beazer East)	100 Koppers Road	Follansbee	WV	26037

Table 1				
Facility Name	**Address**	**City**	**State**	**Zip**
Koppers-Green Spring (CSXT)	Railroad Street	Green Spring	WV	26722
P P G Industries	Route 2 North	New Martinsville	WV	26155
Pechiney Rolled Prod LLC	98 Willow Grove Road	Ravenswood	WV	26164
Safety-Kleen Systems Inc	10 Industrial Park Drive	Wheeling	WV	26003
Solutia (Flexsys, Monsanto)	1 Monsanto Road	Nitro	WV	25143
UCC – So. Charleston (Arco)	437 MacCorkle Ave. SW	South Charleston	WV	25303
UCC Tech Center	200 Kanawha Turnpike	South Charleston	WV	25303
Union Carbide - PTO	31350 First Ave South	Nitro	WV	25143
Weirton Steel	State Route 2	Weirton	WV	26062
Wheeling - Pitts Steel	State Route 2	Follansbee	WV	26037

There are 30 sites, either presently under permit for the operation of a Treatment, Storage, or Disposal Facility, for post-closure, or which at one time had a permit or interim status or should have had interim status, that are addressing corrective action issues. These following thirty facilities are under HSWA Corrective Action.

1. AEP
2. Airco
3. Appalachian Timber
4. BASF
5. Bayer CropScience
6. Bayer Polymers
7. Crompton Corporation
8. Cytec
9. DuPont Belle
10. DuPont Martinsburg
11. DuPont Washington
12. FMC South Charleston

13. GE Morgantown (1)
14. GE Morgantown (2)
15. GE Washington
16. GMC Martinsburg
17. Great Lakes
18. Kaiser Aluminum
19. Koppers Follansbee
20. Koppers Colliers
21. Koppers Greensprings
22. OxyChem
23. Pechiney
24. PPG Industries
25. Quaker State
26. SMR Technologies
27. Solutia
28. St. Mary's Refinery
29. UCC S. Charleston
30. UCC Tech Center

V. Department of Environmental Protection
B. Division of Water and Waste Management, Office of Waste Management

2. Underground Storage Tank (UST) Unit

The Underground Storage Tank Unit (UST) of the Division of Water and Waste Management's Office of Waste Management is responsible for the implementation of the provisions of the Underground Storage Tank Act (USTA), Chapter 22 Article 17, of the West Virginia Code.

The UST Unit regulates tanks containing either petroleum products or hazardous substances that are included in the federal UST law. The unit maintains a database with a total of 22,398 registered USTs, 16,556 of which have been permanently closed. The remaining 6,308 are either active or temporarily out of service. The UST Inspectors perform UST installation, closure, and compliance monitoring inspections and respond to and investigate suspected releases.

The UST Unit also administers the UST worker certification program to certify those who install, repair, retrofit, upgrade, tightness test, permanently close UST systems or install, repair, or test UST cathodic protection systems. In addition, the unit oversees the claims processing for the UST Petroleum Insurance Trust Fund.

Goals

The UST Unit's goal is to protect human health and the environment by requiring UST systems to have release detection, corrosion prevention, overfill control, and spill prevention. Double-walled UST systems would be advisable in sensitive groundwater areas such as the Well Head Protection Areas designated by the Department of Health and Human Resources. However, the USTA does not allow state regulations to be more stringent than the federal regulations which do not require double-walled systems.

Staffing

The creation of the Office of Environmental Remediation reduced the inspection force from a high of thirteen inspectors to seven and saw a reduction in office staff from six to two. The UST Unit currently has one vacant office position and one vacant inspector position. The unit's lack of revenue resources does not allow filling these positions. An amendment to the USTA was submitted to the 2003 Legislature that would have allowed an increase in the annual tank registration fees. The amendment did not pass.

Public Outreach

The USTA created a UST Advisory Committee consisting of petroleum industry representatives, the insurance commissioner, the DEP secretary, and a citizen at large. This committee meets monthly to discuss UST related issues.

An *O & M Manual for West Virginia UST Owners and Operators* has been developed and distributed to the regulated community and along with other information is posted on the Office of Waste Management's webpage. The UST Unit has in the past held owner/operator seminars to inform the regulated community of the UST regulations. The unit also has mailed instructional manuals, pamphlets and fliers on UST regulations and the effects that a release can have on the environment and the public. Two videos, "*LUST in A Small Town"* and "*Tank Time",* were mailed to all of the public libraries in West Virginia.

V. Department of Environmental Protection
B. Division of Water and Waste Management, Office of Waste Management

3. Solid Waste Permitting Unit (SWPU)

SWPU activities affecting groundwater include reviewing solid waste facility permit applications, reviewing applications to accept special waste, reviewing applications to alter groundwater monitoring systems, reviewing statistical groundwater monitoring reports, conducting construction quality assurance and quality control inspections, and compliance assistance to waste generators.

The SWPU regulates facilities under the Solid Waste Management Rule, 33 CSR § 1. The number and types of facilities regulated by the SWPU and calendar year 2002 permitting approval activities are:

Class*	Description**	Approved Facilities	Modification and Renewal Applications Reviewed, 2002
A	Commercial solid waste facility, ≥ 10,000 tons per month	8	21
B	Commercial solid waste facility, < 10,000 tons per month and ≥100 tons per day	11	
A-B	Permit modifications to accept special waste	n/a	392
C	Commercial solid waste facility, < 100 tons per day and serves <40,000 people	0	0
D	Construction and demolition waste, noncommercial facility	23	25
D-1	Construction and demolition waste, commercial facility	0	0
E	Recycling	0	0
--	Sewage Sludge Processing Facility	0	0
--	Yard Waste Composting Facility	1	1
--	Mixed Waste Processing Facility	0	0
--	Other	0	0
--	Closed facilities managed by the Landfill Closure Assistance Program	29	0

* Waste facility classes are defined in 33 CSR § 1-2.
** "Approvable facilities" are listed in 33 CSR § 1-3.3.

In addition to the above facilities, the Division of Water and Waste Management regulates Class F Noncommercial Industrial Landfills, and the Hazardous Waste Permitting Unit in the Office of Waste Management regulates noncommercial hazardous waste facilities. There are no commercial hazardous waste disposal facilities in West Virginia. Class F and hazardous waste facilities have design, construction, and groundwater monitoring requirements similar to nonhazardous solid waste facilities. The Office of Environmental Restoration regulates hazardous waste cleanup sites.

The Pollution Prevention and Open Dump Program (PPOD) in the Office of Environmental Restoration identifies and cleans up illegal open dumps. Illegal dumps are expected to have minimal impact on groundwater because they are much smaller than commercial and industrial facilities.

Several years have passed since the SWPU last received a permit application to construct a new facility, and none is anticipated in the foreseeable future. Over the long term, the disposal areas of landfills must expand to accommodate more waste. Expansions are planned in a general way when the facility is initially designed, and when the expansion is necessary, detailed plans are prepared. Most of the work of the SWPU is reviewing detailed plans for expanding the disposal areas of Class A, B, and C facilities. These modifications usually include structures or procedures for stormwater management, leachate management, or groundwater monitoring.

In reviewing the plans and granting permit modifications to allow expansions, the role of the SWPU is to ensure that the facilities are properly designed. During construction of these facilities, the SWPU conducts spot inspections to ensure the facilities are built according to specifications and accepted industry practices. This is construction quality assurance and quality control.

Leachate, the contaminated water coming out of the waste, should be trapped by impermeable liners and piped to wastewater treatment facilities. Improperly designed or constructed facilities, or facilities damaged by poor construction techniques, can result in groundwater being contaminated by leachate. Reviews of permit applications and spot construction checks by the SWPU ensure that leachate handling systems are designed and built to continue to function after they are buried under thousands to millions of tons of waste.

Oil and other chemicals, primarily from vehicles, and leachate can contaminate stormwater flowing from solid waste facilities. Plans for structures and procedures for managing stormwater are a part of the detailed plans reviewed by the SWPU. Proper design, construction, and management prevent contaminated stormwater from infiltrating into the groundwater.

Keeping hazardous waste out of landfills and proper handling of wastes that require special handling reduces the likelihood of groundwater contamination by reducing the amount and controlling the types of contaminates in leachate. In 2002, the SWPU reviewed about 400 special waste disposal requests and rejected about 25%.

The SWPU fields numerous calls from the public. Most callers ask how to dispose of particular wastes generated at their business or home. Directing callers to the proper waste management option protects the groundwater by reducing the likelihood of illegal dumping and surreptitious disposal of hazardous waste in solid waste facilities.

Groundwater monitoring wells must sometimes be replaced because they have caved in, gone dry, or are located where the disposal area is expanding. The SWPU reviews well replacement plans to ensure that the new wells are properly placed to detect potential groundwater contamination as soon as possible.

Twice each year, permitted landfills must sample groundwater monitoring wells and perform statistical tests to determine whether groundwater has been contaminated. The statistical reports are reviewed by the SWPU and the Office of Environmental Enforcement takes any necessary enforcement action.

If contamination has been detected by routine detection monitoring, the landfill must begin much more extensive assessment monitoring. Depending on the results of assessment monitoring, the landfill may be required to begin corrective action to clean up the groundwater. Currently (October 2003) Deitz Hollow Landfill, a closed landfill near Huntington, is the only facility conducting assessment monitoring. A release has been detected at Sycamore Landfill near Hurricane and assessment monitoring is expected to begin there soon. A third landfill is undergoing further study to determine whether ambiguous data is the result of a release.

Although some releases have been detected, the statistical groundwater monitoring program is greatly in need of improvement. A large proportion of the groundwater sampling personnel used by landfills are inadequately trained and supervised. The Division of Water and Waste Management has prepared a guide to groundwater sampling, but no State training or certification of groundwater samplers exists. As improved statistical methods are introduced, as discussed below, contamination caused by poor sampling techniques will become more apparent. Currently, the SWPU does not have sufficient staff or regulatory authority to address the problem of inadequate sampling.

To remedy the problem of improper statistical procedures, the SWPU has proposed modifying 33 CSR § 1 to require adherence to the American Society for Testing Materials (ASTM) Standard D 6312-98, "Standard Guide for Developing Appropriate Statistical Approaches for Ground-Water Detection Monitoring Programs." The proposed modifications will be reviewed by an industry panel and then submitted to the Legislature during the 2005 session. In the meantime, the SWPU will use Standard D 6312-98 as a point of reference for judging the quality of statistical reports, and will encourage landfills to comply with the Standard voluntarily. A list of consultants who have expressed an interest in performing this work has been compiled by the SWPU.

The Landfill Closure Assistance Program (LCAP) manages 29 closed landfills that were constructed before impermeable liners were required. The SWPU has assisted the LCAP program by providing geological advice on program priorities and helping to write proposed contracts. It is planned that in early 2004 a contractor will begin conducting hydrogeological studies of all LCAP landfills, including the testing of nearby drinking water wells. The eventual aim is to implement groundwater monitoring comparable to that conducted at active landfills.

Groundwater monitoring reports are submitted to the SWPU on paper. The Environmental Quality Information System (EQuIS), which is being developed by the DEP, will accept groundwater monitoring data electronically and provide an interface to statistical and mapping software that will allow the SWPU to check statistical calculations.

V. DEPARTMENT OF ENVIRONMENTAL PROTECTION
C. Division of Water and Waste Management
Groundwater Program

SUMMARY OF GROUNDWATER QUALITY IN WEST VIRGINIA

Prepared by the Division of Water and Waste Management, Groundwater Program in conjunction with U.S. Geological Survey

Background

Water quality data from locations in the Group B Watershed was collected during the period 2001-2003 from the ambient groundwater quality network. The report also summarizes groundwater-quality data stored in the USGS National Water Information System (NWIS) water quality database for West Virginia.

Water quality data for the 30 sites in the West Virginia ambient groundwater quality network and for wells in the U.S. Geological Survey National Water Information System (NWIS) database for West Virginia were analyzed statistically to identify any water quality trends and relations and to compare data from the two data sets. Site selection was concentrated in areas of high priority or special interest to the West Virginia Department of Environmental Protection, Division of Water and Waste Management's Groundwater Program.

Parameters

Data for selected properties and constituents were grouped by geologic unit, topographic setting, geologic age, well depth, and season. The constituents include field parameters such as specific conductance, pH, oxidation-reduction potential, and turbidity; dissolved oxygen and other gases; bacterial counts of fecal coliform, total coliform, and E. coli; organic carbon, hardness, and acidity; ionic concentration of calcium, magnesium, sodium, potassium, bicarbonate, alkalinity, chloride, fluoride, bromide, sulfate, and dissolved solids; nutrients such as nitrogen including nitrate plus nitrite, and phosphorus; concentration of metals such as aluminum, antimony, arsenic, barium, beryllium, cadmium, iron, lead, manganese, zinc; radon, and a variety of hydrocarbons, volatile organic compounds, and pesticides.

Data from the ambient network did not show any significant seasonal variations in groundwater quality.

Abundance of Groundwater

Although there seems to be adequate supplies of groundwater for public and private use, industry must usually rely on other sources of water. Groundwater quantity is highly variable throughout the State. Yields range considerably, even from location to location within the same water bearing formation. Water bearing formations in areas of fractured limestone in the

southeastern and eastern part of the State and wells drilled in alluvium along the Ohio River tend to have the greatest yields. Water bearing formations produce from a few gallons per minute (gpm) to more than 2300 gpm in some sand and gravel aquifers along the Ohio River. Average yields throughout the State are around 260 gpm.

The Geochemistry of West Virginia's Water

Groundwater quality is affected by human activities and can be degraded as a result of industrial waste disposal, coal mining, oil and gas drilling, agricultural activities, domestic or municipal waste disposal, transportation, and rural development. Waters sampled at the thirty locations show that background levels of pesticides, hydrocarbons, organic compounds and other chemicals that were tested occur at concentrations far below action levels set by groundwater quality standards, with three exceptions. Traces of two organic compounds, Bromo-di-chloro methane at a concentration of 0.2 µg/L, and Tri-chloro methane at a concentration of 0.8 µg/L, were found in one sampling site in Clay County. Only one hydrocarbon, the gasoline additive MTBE, was found at one sampling site in Lincoln County at a concentration of 3.5 µg/L, well below the WV groundwater action level of 20 µg/L. Detection of these three chemicals are not a cause of concern at this time. However, the metals iron and manganese were found to exceed secondary groundwater standards in twenty-two out of thirty sites sampled.

Concerns

A major concern among environmental professionals worldwide has been the presence of pharmaceuticals and endocrine disrupting chemicals in surface waters and groundwater. Scientists from the WV DEP have been tracking research on this issue and have attended the first two International Conferences on Pharmaceuticals and Endocrine Disrupting Chemicals in Water held over the last two years. With the increasing age of West Virginia's population, and the concomitant increase in medications for blood pressure, heart problems, and a variety of other medications, the presence of pharmaceuticals and endocrine disrupting chemicals in our waters has had a marked effect on aquatic life forms, and bears careful watching.

The discovery of the presence of pharmaceuticals and endocrine disrupting chemicals in groundwater has raised concerns regarding their effects on human health and the continued viability of antibiotic medications. Endocrine disrupting chemicals are found in a wide variety of products from medicines, personal care products, and chemicals used in clothing. Their presence appears to be ubiquitous in the environment. At this time, more study needs to be done in this area to determine the appropriate course of action needed to address this concern.

Another major concern is high concentrations of radon in groundwater. Radon is a naturally occurring element found in many soils and rock types. While no official groundwater quality standard has been finalized for radon, the USEPA has proposed a maximum contaminant level for radon at 300 pCi/L.

Exceedences of the proposed maximum contaminant level for radon at 300 pCi/L were found at nine of the thirty sites sampled. Data collected by the USGS for the Ambient Groundwater Quality study show concentrations of radon as high as 3200 pCi/L at one site. These high concentrations of radon were found in diverse geological settings and well depths.

Although not a threat to public health, high concentrations of iron and manganese may render groundwater unsuitable for domestic use due to aesthetic reasons in some locations. These concentrations of dissolved iron and dissolved manganese are naturally occurring and are found sporadically throughout the State, but are especially prevalent in Pennsylvanian aged sandstones. Concentrations of iron ranged as high as 40,000 µg/l; the secondary groundwater quality standard for iron is 300 µg/L. Concentrations of manganese ranged as high as 1,000 µg/l; the secondary groundwater quality standard for manganese is 50 µg/L.

Bacterial contamination continues to be a concern in many areas, especially in areas where large poultry farms, feedlots, and the practice of maintaining manure ponds may be found. However, the most likely source of bacterial contamination is failing, inadequately sited, or the sheer profusion of septic systems. Some improvement in reducing bacterial contamination has been noted.

The need for managed de-centralized on-site waste water systems has come, and serious consideration should be given by State and local officials, as well as lenders, realtors, and developers in the use of managed de-centralized on-site waste water systems in future planning, especially in areas of sensitive groundwater, the absence of public sewage, and where siting limitations require alternative technologies when conventional systems will not work.

No pesticides were found in ambient groundwater samples of this study above the limit of detection.

V. DEPARTMENT OF ENVIRONMENTAL PROTECTION
C. Division Of Water and Waste Management

1. Groundwater Program

a. Groundwater Quality Standard Variances - Title 47, Series 57

Title 47 Series 57 established procedures for facilities to petition the Secretary for a variance from groundwater protection standards for an individual source or for a class of sources. If the Secretary agrees that a variance is appropriate, the rulemaking procedures will be initiated in accordance with Article 3, Chapter 29 of the W. Va. Code. The Secretary may deny a variance; however, only the legislature may grant a variance.

Variances may be granted by the legislature to allow groundwater quality standards to be exceeded for a single source or class of sources which by their nature cannot be conducted in compliance with the requirements of W. Va. Code 22-12-5. The benefits of granting the variance must outweigh the benefit of complying with existing groundwater quality standards and demonstrate that there is no technologically feasible alternative available. The request must also show that granting the variance is more in the public interest than adherence to existing groundwater quality standards. No requests for variances from groundwater standards were received in this reporting period.

b. Groundwater Protection Regulations - Title 47, Series 58

Groundwater Protection Plans (GPP) for 164 facilities in West Virginia have been received (130 approved) by the Groundwater Program. Memoranda identifying their deficiencies or approving the GPP were prepared and sent to the Permits Section where these deficiencies will be addressed during the permitting process. Facilities that do not have permits were mailed letters identifying the deficiencies in their GPP's, or received letters approving the document. These 164 facilities are listed in the table at the end of this section.

Underground Storage Tank (UST) facilities that distribute only gasoline or diesel fuel are adequately regulated by the Underground Storage Tank Section of the Division of Water and Waste Management. Therefore, some facilities have received a waiver from the requirement to develop and maintain GPP's. In lieu of a site specific GPP, the facility must complete and submit a registration form certifying that they do not have service bays, do not provide mechanical service, do not have above ground storage tanks, and do not have outside bulk storage of materials with the potential to harm groundwater. As of June 30, 1999, 802 underground storage tank facilities have submitted registration forms. Six hundred twenty-one (621) of these facilities qualify for the waiver based on the information submitted. One hundred seventy-five (175) of these facilities do not qualify for the waiver based on the information submitted. The status of six (6) facilities cannot be determined from the information submitted. A database to identify gasoline dealers who have received waivers has been developed. Data entry is currently in progress on this project.

Guidance documents have been developed to aid in the preparation and implementation of Groundwater Protection Plans (GPP). These are the Groundwater Protection Plan Guidance Document and the Groundwater Protection Plan for Small Businesses. Other technical assistance documents are the Salt Storage Guidelines, the Above Ground Storage Tank Guidance, the Site Evaluation for Land Application of Industrial Sludge Guidance Document, and the Groundwater Sampling QA/QC/SOP. Short descriptions of these documents are presented below.

Groundwater Protection Plan Guidance Document

This document summarizes and explains all of the elements required in a GPP for an industrial /commercial facility, or any other facility that the Secretary of DEP reasonably determines may have a potential to impact groundwater.

Groundwater Protection Plan for Small Businesses

This document is a “fill in the blank” style GPP for small businesses which are unfamiliar with environmental regulation. It helps them be in compliance with and understand groundwater protection measures as required by 47CSR58.

Salt Storage Guidelines

This is a guidance document to enable consistency in the environmental regulation of salt storage facilities which includes sections on salt pile configuration, storage pad construction, covering salt during storage periods, runoff handling, best management practices, groundwater monitoring, and permitting.

Above Ground Storage Tank Guidance

This guidance outlines the groundwater protection requirements for Above Ground Storage Tanks (AST’s). It also includes sections on AST construction, operation, safety, closure procedures, and post fuel storage use.

Site Evaluation for Land Application of Industrial Sludge

This is a manual designed to evaluate proposed sites for receiving land applied industrial sludge. Chapters include soil evaluation, geology and hydrogeology, hydrology, climate, vegetation, application method and rate, and land ownership.

Groundwater Sampling QA/QC/SOP

This is a guidance document intended to standardize groundwater sampling practices in West Virginia. It includes chapters on equipment, field data collection, well purging, filtering, preservation, and sampling monitoring and drinking water wells.

Vulnerable Groundwater Use Areas

Currently, areas of the state have been identified as areas which are “areas of karst, wetlands, faults, subsidence, delineated wellhead protection areas or other areas determined by the Secretary to be vulnerable based on geologic or hydrogeologic information,…”. These areas are the Berkeley – Jefferson area in Berkeley and Jefferson counties, and the Deer Creek Valley area around Green Bank and Boyer in Pocahontas County.

The following table summarizes Groundwater Protection Plans reviewed and approved during this reporting period.

Site No.	Site Name, Location	Date reviewed	Comments or approval date
1	Republic Paperboard, Halltown	7/21/99	App.-10/1/01
2	Panda Energy	8/2/01	App.-8/10/01
3	O’Dells Exxon	8/9/01	App.-8/10/01
4	Crystal Car Wash	8/3/01	App.-8/10/01
5	J’s Hillbilly Mart, Red House	9/21/01	App.-9/24/01
6	A.E., Inc., Buckhannon	4/30/02	App.-5/17/02
7	American Fiber Resources, Fairmont	6/1/02	App.-6/18/02
8	Amma DOH HQ, Amma	3/22/02	App.-3/22/02
9	Apex Demolition, Kanawha Co.	3/18/02	App.-3/18/02 App.-6/2/03
10	Aristech Chemical, Neal, Wayne Co.	10/30/01	App.-11/16/01
11	National Guard Shop #6, Pt. Pleasant	1/15/02	App.-1/23/02
12	Ashland Chem., Neal, Wayne Co.	10/29/01	App.-11/15/01
13	Grandview – New River Gorge N.R.	11/30/01	App.-12/5/00
14	Belt Paving, Mineral Co.	1/30/03	App.-2/10/03
15	Bingamon Corp., Monongalia Co.	1/30/03	App.-2/6/02

Site No.	Site Name, Location	Date reviewed	Comments or approval date
16	Boxley Concrete, Summersville	11/7/02	App.-11/7/02
17	Brandywine WTP, Pendleton Co.	10/15/01	App.-10/18/01
18	Briar Patch Development, Harpers Ferry	10/16/02	App.-10/16/02
19	Century Aluminum, Ravenswood	6/12/02	App.-6/12/02
20	City of Beckley, Raleigh Co.	3/8/02 5/8/03	App.-3/8/02 App.-5/8/03
21	City of Bluefield, Mercer Co.	2/6/02 2/25/03	App.-2/6/02 App.-2/25/03
22	City of Clarksburg, Harrison Co.	3/6/02 3/4/03	App.-3/6/02 App.-3/4/03
23	City of St. Albans, Kanawha Co.	2/25/02 2/28/03	App.-2/25/02 App.-2/28/03
24	Clearon Corp., South Charleston	10/30/01	App.-11/6/01
25	Charleston Composting Facility	2/5/02	App.-2/13/02
26	Cossin's Car Wash, Red House	2/28/02	App.-2/28/02
27	Crystal Car Wash, Roderfield	8/10/01	App.-8/10/01
28	Cunningham Exc., Montrose	1/23/02 2/28/03	App.-1/23/02 App.-2/28/03
29	DuPont – Belle Class D, Belle	2/19/02 4/15/03	App.-2/19/02 App.-4/15/03
30	DuPont Blennerhassett Warehouse, Wood Co.	10/18/01	App.-10/18/01
31	Empire Salvage, Mercer Co.	2/25/02 2/26/03	App.-2/25/02 App.-2/26/03
32	Flexsys, Nitro	2/8/02	App.-2/8/02
33	FMC Steam Plant, South Charleston	12/10/98	App.-2/7/02
34	Osage Class D, Monongalia Co.	2/19/02	App.-2/19/02

Site No.	Site Name, Location	Date reviewed	Comments or approval date
35	High Wall Park Class D, Mercer Co.	2/11/02 3/20/03	App.-2/11/02 App.-3/20/03
36	Harper Class D, Beverly	3/14/02	App.-3/14/02
37	J.C. Bosley Const. Class D	1/11/02	App.-1/11/02
38	Joe Blosser Const. Class D, Monongalia Co.	2/21/03	App.-2/21/03
39	R. Loftis Class D, Kanawha Co.	3/11/02 4/15/03	App.-3/11/02 App.-4/15/03
40	Lumberport WTP, Harrison Co.	6/14/02	App.-6/14/02
41	Markle's Inc. Class D, Berkeley Co.	3/18/02	App.-3/18/02
42	Marmet Lock project, Marmet	11/13/02	App.-11/13/02
43	Masteller Coal Class D, Mineral Co.	2/21/03	App.-2/21/03
44	Morgantown Exc.Class D, Monongalia Co.	3/29/02 4/11/03	App.-3/29/02 App.-4/11/03
45	Mountaineer Raceway, Inwood		App.-10/22/01
45	New Martinsville Hydro Plant, NM	2/15/03	App.-2/24/03
47	Noah Perry Class D, Putnam Co.	1/21/03	App.-1/21/03
48	Norfolk Southern, Mullens	8/12/03	App.-8/12/03
49	Orange Const. Class D, Morgantown	4/23/02	App.-4/23/02
50	Peer's Sanitation, Mill Gap Class D	2/7/02	App.-2/7/02
51	Preston Co. PSD #4, Bruceton Mills	4/3/02	App.-4/3/02
52	R&L Carriers, Gallipolis Ferry, Mason Co.	4/25/02	App.-4/25/02

Site No.	Site Name, Location	Date reviewed	Comments or approval date
53	Raze Int. Class D, Triadelphia, Ohio Co.	3/21/02	App.-3/21/02
54	Red Dawson Class D	2/8/02 4/22/03	App.-2/8/02 App.-4/22/03
55	Rolfe's Meats	3/14/03	App.-3/14/03
56	Roseland Guest House & Campground, Proctor	3/21/02	App.-3/21/02
57	Shannon Br. Class D, McDowell Co.	6/12/02 5/29/03	App.-6/12/02 App.-5/29/03
58	Slack's Class D, Kanawha Co.	3/14/02 3/12/03	App.-3/14/02 App.-3/12/03

c. Monitoring Well Driller Certification/Recertification Program

The Monitoring Well Driller Program (MWDP) certifies monitoring well drillers in the design, construction, alteration, and abandonment of monitoring wells and boreholes in accordance with 47CSR60, "Monitoring Well Design Standards". This program, as authorized by 47CSR59 *Monitoring Well Regulations*, was established to ensure industry, well owners, and the regulatory community that all monitoring wells installed or abandoned would meet a minimum set of standards.

Although the Department of Environmental Protection (DEP) is responsible for the certification of monitoring well drillers, the Bureau for Public Health's Office of Environmental Health Services (OEHS) conducts the training and testing for certification of these drillers. OEHS has a long established water well driller certification program and is ideally suited for providing these services to DEP, while eliminating the need for increased staffing.

As of June 30, 2003, the Monitoring Well Driller Program (MWDP) has certified three hundred and fifty-one (351) monitoring well drillers. Thirty-five (35) new drillers were certified during this reporting period.

The monitoring well driller certification information is available on the Internet. The web site address is http://www.wvdhhr.org/bph/monwell/. This site provides information on testing requirements, testing dates, and an application for the testing and training. The recertification of the monitoring well drillers is handled directly by the Monitoring Well Driller Program. Recertification requires a fee and the completion of an address verification form.

During this same reporting period 254 drillers were recertified. This total includes those drillers who recertified in 2001, 2002, and 2003. To track the driller certification and recertification

process the DEP's Information Technology Office developed a monitoring well driller module to the ERIS (Environmental Resource Information System). ERIS is a flexible client/server system of Windows programs that allows DEP offices to track and manage a wide variety of environmental information. At this time the environmental information that can be tracked includes permitting activities, complaints, violations, inspections and the licensing of technical capabilities, (e.g. the monitoring well driller module). The driller database contains a listing of drillers that are currently certified, and those whose certification has expired. As of June 30, 2003 there are 347 active drillers and 93 drillers that have been placed on inactive status. This database is capable of generating invoices for the recertification fees, related certification and recertification correspondences, certification cards, and address verification forms. Reports can be generated from this database containing all drillers' addresses, initial certification date, certification expiration date, driller registration numbers and fee invoicing information.

d. Monitoring Well Installation and Abandonment

Concerns from the drilling industry, the desire to protect well owners, and an overwhelming need by groundwater regulatory agencies for quality control of data from monitoring wells led to the enactment of 47CSR60 *Monitoring Well Design Standards* in May 1996. This rule established the minimum acceptable documentation and standards for the design, installation, construction, and abandonment of monitoring wells; and the abandonment of boreholes. This rule does not eliminate nor supersede the more stringent aspects of well design criteria as established by federal programs such as RCRA or CERCLA; but only stipulates that at a minimum, monitoring wells must be constructed and abandoned in accordance with 47CSR60.

As is the case of any rule there are unforeseen circumstances that require alternatives and exceptions when compliance with the rule is infeasible or unnecessary. The alternative and/or exceptions are handled through written variance requests on an individual basis.

The rule has resulted in the need for electronic files to capture the well installation and abandonment, and high-risk borehole abandonment information. As of June 2002 electronic submission of the *Monitoring Well Construction Documentation Forms* and *Abandonment Documentation for Monitoring Well/Borehole Forms* are available by Internet access at www.wvdep.org. The format for the electronic submission consists of drop down menus for choices of materials and procedures and areas for written comments. The information will also be stored in EQuIS along with water quality and site information.

During this reporting period the following documentation forms were received and reviewed:

Forms Received and Reviewed Between July 1, 2001 and June 30, 2003	**Totals**
Monitoring Well Construction Forms	1334
Monitoring Well Abandonment Forms	663
High Risk Borehole Abandonment Forms	62

These totals include hard copy and electronic submissions of forms. The forms were reviewed for completion and correct information. Major deficiencies noted in the hard copies were incomplete or incorrect latitudes and longitudes, incomplete physical site information, incorrect and missing information regarding installation materials and procedures. The electronic submission of forms have eliminated several of these problem areas.

The following table details the number of wells constructed, abandoned and high-risk boreholes by counties during this reporting period.

Monitoring Well & Borehole Count from July 1, 2001 - June 30, 2003			
Counties	**MW Installed**	**MW Abandoned**	**Boreholes Installed and Abandoned**
Barbour	0	0	0
Berkeley	14	33	0
Boone	1	0	0
Braxton	0	3	0
Brooke	68	0	0
Cabell	63	18	0
Calhoun	0	0	0
Clay	0	0	0
Doddridge	15	0	0
Fayette	27	11	14
Gilmer	0	0	0
Grant	7	1	0
Greenbrier	30	13	10
Hampshire	27	0	0
Hancock	21	10	0
Hardy	0	4	0
Harrison	32	33	0
Jackson	14	1	0
Jefferson	33	3	0
Kanawha	240	110	0
Lewis	3	7	1
Lincoln	7	0	0
Logan	26	9	0
Marion	28	29	0
Marshall	60	51	4
Mason	27	0	1
McDowell	18	16	0
Mercer	33	24	0
Mineral	50	42	0
Mingo	23	13	2
Monongalia	62	35	7

Counties	MW Installed	MW Abandoned	Boreholes Installed and Abandoned
Monroe	0	5	0
Morgan	3	15	0
Nicholas	11	2	0
Ohio	22	18	8
Pendleton	0	0	0
Pleasants	49	7	0
Pocahontas	9	1	0
Preston	13	41	0
Putnam	17	3	11
Raleigh	58	3	0
Randolph	22	7	1
Ritchie	0	0	0
Roane	0	0	0
Summers	6	14	0
Taylor	14	0	0
Tucker	0	0	0
Tyler	12	0	0
Upshur	6	17	0
Wayne	19	17	0
Webster	0	3	0
Wetzel	53	23	2
Wirt	0	0	0
Wood	64	8	1
Wyoming	24	12	0
TOTALS	**1334**	**663**	**62**

e. Complaints and Calls

The Division of Water and Waste Management's Monitoring Well Driller Program responded to approximately eight hundred and twenty calls/requests for information concerning monitoring well drillers certification and recertification, monitoring well design standards, documentation, variances and enforcement. This does not include minor telephone call requests for basic information.

f. Public Outreach:

Personnel from the Groundwater Program have held training sessions for Barbour, Lewis, Upshur, Wetzel, Tyler, Cabell, and Jefferson county health department sanitarians and staff members on the use of their Global Positioning System (GPS) for the location of septic tanks and water well installations. The GPS information, septic tank system permit number, septic

tank seal number, owner's mailing address, and written directions to the site where the well and/or tank is located are then compiled into a database.

County health departments issued a total of nine thousand, two hundred sixty-eight (9268) septic tank permits from July 1, 2001 through June 30, 2003. Although permits were issued, not all septic tanks have been installed. The following table details the number by county that have been issued septic tank registrations.

Septic Tank Registrations from July 1, 2001 - June 30, 2003			
County	**Septic Tanks Registered**	**County**	**Septic Tanks Registered**
Barbour	93	Mineral	115
Berkeley	960	Mingo	3
Boone	54	Monongalia	187
Braxton	129	Monroe	71
Brooke	62	Morgan	415
Cabell	227	Nicholas	294
Calhoun	87	Ohio	1
Clay	48	Pendleton	157
Doddridge	36	Pleasants	68
Fayette	63	Pocahontas	194
Gilmer	23	Preston	397
Grant	140	Putnam	44
Greenbrier	214	Raleigh	495
Hampshire	560	Randolph	203
Hancock	39	Ritchie	121
Hardy	311	Roane	123
Harrison	55	Summers	128
Jackson	219	Taylor	114
Jefferson	641	Tucker	69
Kanawha	127	Tyler	55
Lewis	178	Upshur	132
Lincoln	164	Wayne	53
Logan	103	Webster	91
Marion	156	Wetzel	68
Marshall	141	Wirt	71
Mason	152	Wood	311
McDowell	116	Wyoming	1
Mercer	189		
Total = 9268			

g. Underground Injection Control Program (UIC)

The federal Safe Drinking Water Act of 1974 established the UIC program to ensure that fluids injected underground will not endanger drinking water sources. Applying the UIC regulations (47 CSR 13) promulgated under the authority of Chapter 22, Article 11 of the State Code, the Division of Water and Waste Managements' UIC program mainly regulates the subsurface emplacement of fluids into or above underground sources of drinking water by permitting the siting, construction, operation, and abandonment of Class 5 shallow injection wells.

The Class 5 category includes 32 types of injection wells ranging from high-tech aquifer remediation wells to low-tech septic systems. Two types of Class 5 injection wells have recently been banned by the federal government and subsequently by the state UIC program. New large capacity cesspools (well code 5W10) were prohibited nationwide as of April 2000. Existing large capacity cesspools will be phased out nationwide by April 2005. Motor vehicle waste disposal wells (well code 5X28) have also been banned as of April 2000. When such injection wells (usually a floor drain disposing waste into a subsurface distribution system i.e. septic tank with leach field), are encountered by UIC personnel, the facility owner is instructed to permanently plug and abandon the injection point and devise alternative appropriate disposal methods for such waste. One hundred twenty two floor drains in vehicle service areas were abandoned by plugging with cement during this reporting period.

The Division of Water and Waste Management's UIC program has faced many challenges to the problem of environmentally sound shallow injection well disposal of waste fluids in areas where other wastewater disposal methods are not available. One of the many achievements of the UIC program has been to develop and implement an environmentally sound method of permitting storm water disposal in karst and other environmentally sensitive areas. The UIC program has worked closely with state and local government officials to develop best management practices that keep potential contamination from entering the subsurface distribution systems to the greatest extent possible. This has included the development of an Emergency Response Plan to close off the injection point in case of fuel spills or other accidents. The Emergency Response Plan is integrated with local emergency response personnel. UIC storm water permits insure groundwater protection by requiring adequate monitoring, sampling and the routine cleaning and maintenance of the injection points.

West Virginia's UIC program continues be on the leading edge of developing and implementing environmentally sound methods of shallow injection well disposal of waste fluids. This has been acknowledged in the praise received from the US EPA, who have looked to West Virginia's UIC program as the role model for other UIC programs. Staff from West Virginia's UIC program attended the September 2002 Groundwater Protection Council meeting in San Francisco where West Virginia's UIC program was routinely approached by other UIC programs for guidance and innovative working solutions in areas of program implementation, outreach and enforcement, and scientific and technological expertise.

Inspections

The UIC inspections are conducted at business facilities, residential multiple dwellings (i.e. trailer parks and apartment complexes), schools not serviced by public sewage disposal plants, and campgrounds. Single-family dwellings with no co-mingled waste streams (sanitary waste only) are exempt from UIC regulation. Some inspections are conducted as multimedia inspections with other programs or agencies. Priority is given to inspections conducted in selected watershed areas, which rotate on a 5-year basis.

The regional Environmental Enforcement Inspector and local sanitarians are contacted to gather useful information regarding areas that are not serviced by a public sewage disposal system and may contain facilities that require a UIC permit. The regional Environmental Enforcement Inspector and local sanitarians are given the opportunity to coordinate inspections in the area if they wish to accompany the UIC inspector. Inspections are focused on wellhead and sourcewater protection areas.

In addition to the routine inspection of permitted facilities, facilities that are found to require a UIC permit are inventoried and a determination is made regarding the proper injection well classification. In addition to Class 5 wells discovered during routine inspections, information on suspected injection wells may come from the Class 5 inventory database, complaints, request for permits, and referrals from other agencies. During the inspections, a UIC inspection form is completed on site. The owner/operator is verbally informed of the status of his well and informed of what actions are to be taken to come into compliance with UIC regulations. The UIC program has achieved a greater degree of regulatory compliance with the addition of an enforcement and inspection person. Since this position has been filled, 766 UIC inspections have been performed. This has resulted in finding and correcting potential environmental problems. The UIC Program has conducted 440 UIC inspections during this reporting period.

If the facility has a Class 5 well that is not permitted, the owner/operator is given the option to apply and obtain a UIC permit for the well or submit a plan for the UIC Program's approval to close the well. All injection wells must be properly abandoned according to UIC regulations. If there are other environmental concerns the owner/operator is given the information necessary to come into compliance with DEP regulations. During this reporting period, 154 verbal enforcements were given to owners/operators of facilities. Groundwater Protection Plans (GPP's) and Best Management Practices (BMP'S) are reviewed with the facility owner/operator. Working with facility owners in the implementation of these practices not only helps protect the environment, but also assists the owner/operator of the facility in reducing the amount of waste generated.

Locational data and information regarding underground storage tanks (UST's) and aboveground storage tanks (AST's) is gathered and made available to the Department of Environmental Health, the Division of Waste Management's Underground Storage Section, and other regulatory agencies. Data was collected on 210 UST's and 173 AST's at 121 facilities during this reporting period.

Enforcement

The enforcement of UIC regulations is primarily dependent on UIC staff with some assistance from DEP enforcement personnel. Although the major enforcement steps are outlined in 47 CSR 13, "Underground Injection Control", DWWM will often informally deal with problems on an individual basis to achieve a quick solution based on characteristics unique to the situation with a success rate of nearly 100%. When an informal enforcement has failed or is not likely to succeed, a Notice of Violation or an Administrative Order is issued instructing the violator to take appropriate action within a specified amount of time. If a satisfactory resolution has not been achieved within a reasonable time frame, civil and criminal actions may be filed.

UIC Outreach

The UIC program personnel provide technical assistance to State agencies, business and industrial personnel, and concerned citizens throughout the state. UIC program personnel continue to work with and educate county sanitarians on the types of injection wells that require oversight by the UIC program. An agreement has been reached with local Health Departments to forward any and all potential UIC concerns to the UIC Program. This has enabled the UIC Program to determine if a UIC permit is required at a particular site and will lessen the potential for the dissemination of misinformation to the prospective permittee. This communication between the UIC Program and county sanitarians has greatly benefited the regulatory community and citizens alike.

Permitting

The Underground Injection Control Program takes great pride in pointing to the many improvements made in the last two years. Although the UIC Program operates with minimal staffing, tremendous progress has been made in clearing the backlog of UIC permit applications. Currently, the only bottleneck in the permitting process comes from the occasional lack of information submitted by applicants, resulting in placing the application on hold pending information submittal. Integration of UIC data into the ERIS database has commenced and will enhance the efficiency of the permitting process, fee tracking, and sharing of data with other DEP programs and the public.

The permitting of UIC wells provides for minimum standards and technical requirements for the proper siting, construction, operation, monitoring, and abandonment of injection wells. When UIC permit applications are received and reviewed, they are accepted, accepted with modifications, or denied. Upon acceptance, an individual permit is issued in draft form and placed in public notice for a 30 day comment period. If no significant comments are received, a final permit is issued 30 days after the end of the comment period. Public hearings are held if necessary. Permits for facilities at 130 locations have been issued during this reporting period. Permits for facilities at 8 locations have been closed during this reporting period. Locations of UIC shallow injection wells permitted during this reporting period are shown on page 74.

In addition to the greatly improved flow of the actual permitting process, and perhaps of greater importance, is the refining of the UIC permit itself. UIC industrial permits have been improved to assure a higher level of regulatory compliance in terms of compliance, fee collection, and reporting. UIC industrial permits require that constituents of the waste stream are identified, and each permit stipulates that the appropriate EPA approved testing method is used in the analysis of the injected fluids. Discharge limits are set where applicable to insure that all injected fluids meet WV DEP groundwater quality standards, maximum concentration levels (MCL's) established by the federal Environmental Protection Agency, health advisory limits, or other risk-based limits as appropriate. These refinements in UIC permits insure the greatest degree of protection to human health and the environment. Improvements to the UIC industrial permit also include greater regulatory control over sampling, reporting schedules, construction details regarding the subsurface distribution system, and how the subsurface distribution system is to be properly closed.

In addition to issuing UIC permits, Rule Authorizations for the injection of fluids into the subsurface are granted for situations where coverage under a UIC permit is not needed. Typically, these Rule Authorizations, issued for one year, are issued to permit the injection of subsurface releasing compounds (SRC) used in the bioremediation of contaminated groundwater. The most common application of SRC is in remediation of hydrocarbon contaminated waters, where oxygen releasing compounds, sometimes mixed with a microbial agent, is injected into the shallow subsurface. The addition of oxygen is often necessary to enhance the natural chemical and biological processes that breakdown hydrocarbons and certain other compounds *in situ*. Usually there is no need for the addition of other microbial agents, as the native bacteria in the soil are sufficient for bioremediation purposes as long as there is sufficient oxygen to fuel this process. In addition to remediating some metals and hydrocarbons, other subsurface releasing compounds may be used to remediate chlorinated hydrocarbons, other metals, and chlorinated biphenyls using hydrogen releasing compounds. Rule Authorizations for 21 sites have been granted during this reporting period. The locations of these Rule Authorizations are shown on the map on page 76.

Oxygen releasing compounds are being pumped into several injection points at a facility in Institute in an effort to clean up carbon tetrachloride, chloroform, and fluorocarbons.

Groundwater/UIC Program – Mining and Quarrying

As noted in Chapter 22 Article 12, Groundwater Protection Act, "Over fifty percent of West Virginia's overall population, and over ninety percent of the state's rural population, depend on groundwater for drinking water" [§22 12 2 (a) (2)], and because mineral mining, both coal and non-coal, are ubiquitous in West Virginia, protecting the quality and quantity of the groundwater from adverse impacts due to these activities is imperative to both the environment and human health and safety. These programs' goals are identical and twofold: to ensure the future chemical and biological quality of the groundwater of the state, and to prevent adverse changes in the quantity of the groundwater, *e.g*., the dewatering of existing aquifers or the excessive flooding of underground mine voids.

Groundwater protection at mine sites was begun nearly ten years ago in West Virginia with the passage of Legislative Rule Title 38 CSR 2F, Groundwater Protection Regulations for Coal Mining Operations, and the policies and practices established by WVDEP DWWM and DMR to enforce it. The resulting changes in the handling of surface activities and substances at mine sites have already protected both public and private water sources, present and future, from much damage due to mining, and have greatly diminished the impacts which have occurred despite the changes. An early and thorough policy of providing information for agency personnel, the regulated industries, and the public resulted in a smooth transition and a spirit of cooperation.

Today, the Groundwater Protection Program is an integral part of WVDEP's permitting/inspection/enforcement procedures for mine sites. Groundwater Protection Plans are incorporated in and are essential to mining permits, both SMCRA (Chapter 22 Article 3) and NPDES (Chapter 22 Article 11); further, all such permits contain terms and limits that provide for protection of the subsurface environment. Violations of the groundwater protection conditions of a permit can incur penalties ranging from Administrative to Criminal and can even result in revocation of the permit.

The Underground Injection Control Program, as established under Legislative Rule Title 47 CSR 13, Underground Injection Control, applies to mining in the permitting of Class 5 Type X13 injection wells, typically for the disposal of coal preparation plant slurry or acid mine drainage treatment sludge into abandoned underground mine voids. The UIC 5X13 permitting process is designed to assure that the injectate meets Federal Safe Drinking Water Standards at the point of injection and that the additional volume of fluid will not endanger human safety or the environment.

Mining operations are typically remote, not easily accessible by the public, and usually involve large surface areas. These factors can make monitoring difficult as far as small details are concerned, rendering scrupulous enforcement of Groundwater Protection Act and UIC permit terms to be virtually impossible. The programs must be constantly adjusted, therefore, to provide as much control as possible under the circumstances for assuring compliance on a day-to-day basis.

Because no two mine sites are exactly alike, each UIC permit application must be approached as a unique entity. Development of a general permit for these operations, such as the NPDES general permits for mines and quarries, is probably not a viable option. Furthermore, WVDEP relies on just one employee, the DMR Geologist III for DWWM's Groundwater Protection/UIC Programs, to conduct all activities associated with mining-associated groundwater protection and UIC, from conducting pre-permitting field inspections to program development, permit writing to filing and data entry. As the universe of mine sites that inject underground, or wish to do so, grows, time allotment for the geologist/permit writer becomes more problematic.

Along with other types of environmental permitting, UIC – Mining is anticipating the development of electronic application procedures in the near future, thus streamlining and standardizing the submission of data for review. Additionally, the electronic submittal of Discharge Monitoring Reports from UIC – Mining permits will be instituted as soon as possible, because reviewing and tracking the 17 to 18 parameters plus mine pool level for every injection point for every month is becoming increasingly labor-intensive.

When time constraints allow, after the above electronic programs are fully functional, a UIC – Mining training program for DMR I & E inspectors will help establish protocols for inspecting UIC permitted sites and enforcing the terms and conditions of the permit. At that time, the UIC geologist/permit writer will also begin conducting unannounced inspections of permitted sites to check for compliance.

Because the UIC – Mining Program is relatively new, the need for the reissuance of existing permits will not begin to manifest until June 2004. Prior to that time, a reissuance protocol will be developed allowing for both the redress of problems encountered with the early permits and for the smooth transition into the new terms and conditions.

The practice of injecting mine wastes into abandoned mine voids has been going on for decades. A continuing challenge has been to locate and identify pre-existing injection sites and either bring them into the permitting process or stop the injection activities. Assistance from the WVDEP DMR field office personnel (permit writers, geologists, engineers, and inspectors) has been invaluable in this endeavor. In the five years since UIC – Mining began virtually all such sites in the state have been identified and are now at some stage of the UIC permitting process.

Within the past two years, protocols have been developed for submitting all UIC – Mining draft permits to the West Virginia Geologic and Economic Survey, West Virginia University Hydrology Research Center, and the Federal Mine Safety and Health Administration (MSHA) for review and comments. Additionally, copies of all permits issued prior to beginning these submittals have been sent to the appropriate MSHA office.

As no one but the present permit writer has had an intimate and working knowledge of the program, a process has been created for training backup personnel, should the need arise.

Also, as UIC – Mining permits are transferable, just as SMCRA or NPDES permits, a procedure was developed to achieve a valid transition in accord with the other permits, so as not to interrupt injection activities at the site.

Initial information about an ongoing injection site usually comes from the DMR I & E Inspector assigned to the mine; he or she will require the operator to begin the process of obtaining a UIC permit or cease injection activities at the site. Applicants proposing to inject underground initiate the process by providing basic details about the site prior to receiving an application number and form. All applicants must be compliant with WV BEP Title 96 or the process will not move forward.

Further information about the proposed injection activity comes from the operator or consultant via the ten-page UIC – Mining application form. This required data includes maps, drawings, and laboratory analyses, among other information. A field inspection by the permit writer, along with the DMR I & E inspector and representatives of the applicant adds other vital information.

Finally, input from the public via the 30-day public comment period, from the WVGES, MSHA, or WVU completes the necessary data for issuing the permit. After issuance, continued monitoring is required by the permit, and observations by the DMR I & E Inspector assure a continuous influx of information about the site.

Although the UIC application process requires the submittal of maps, the draft permit will include a map produced via ArcView from the proposed coordinates, confirming the locations of the proposed injection points. Wells already installed, or wells on existing UIC permits can be assessed with a GPS to ascertain the accuracy of siting.

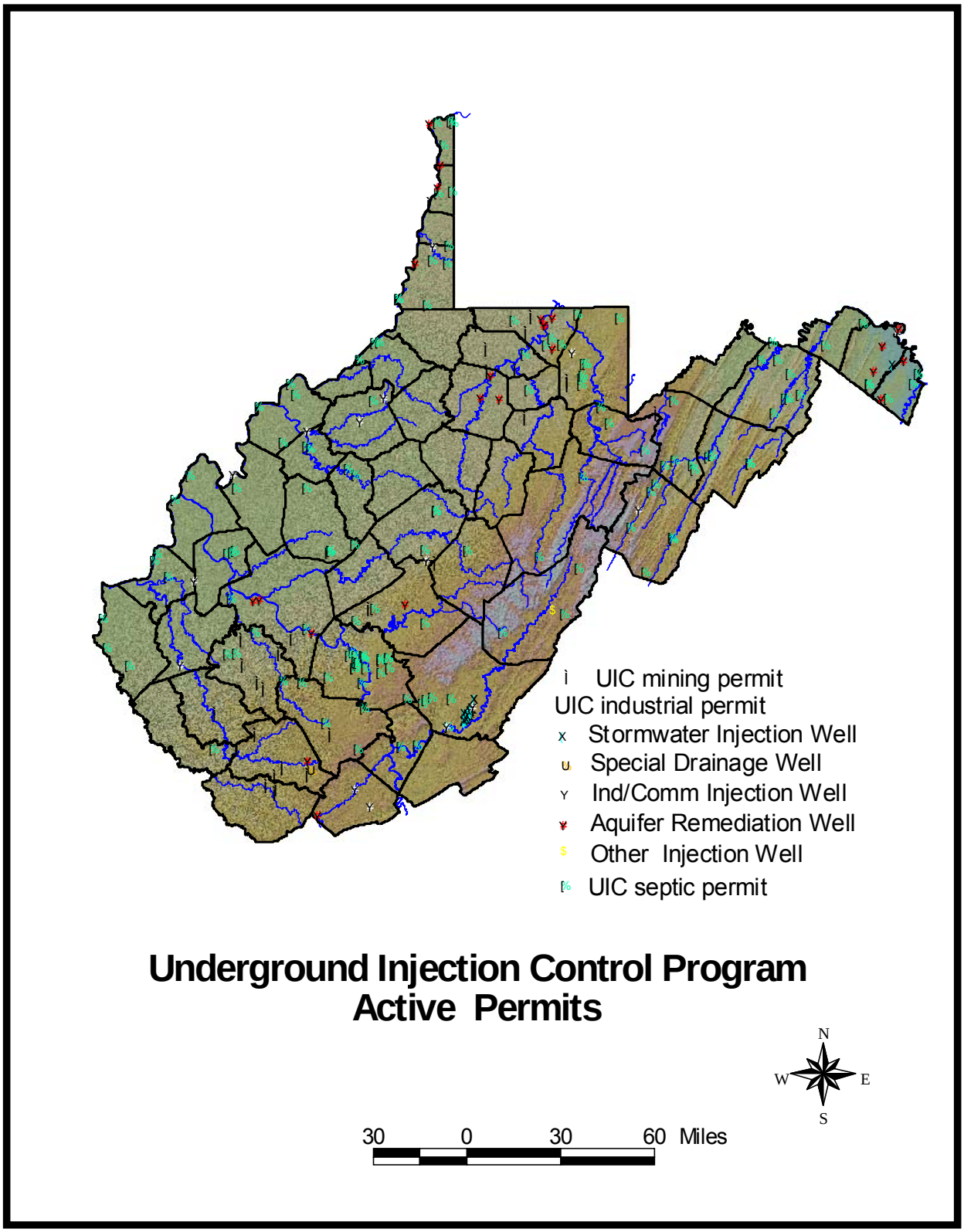
Every UIC – Mining application, once the tracking number has been assigned, is entered into the ERIS Database. As information is received, especially the data in the completed application, it is logged into the database. Activities on the application are thereby available to all WVDEP personnel. Also, information about the mine site and/or applicant is readily accessible by the UIC permit writer from the ERIS entries made by DMR field office and headquarters personnel.

The most critical need, at present, is for materials, assistance, or procedures to alleviate some of the time-consuming logistical or clerical tasks which burden the geologist/permit writer. Electronic UIC permit application and electronic submittal of Discharge Monitoring Reports should go a long way toward freeing up time for more technical activities, such as impromptu field inspections and assessment of trends in permit violations. Increased availability of necessary equipment, including vehicles, would also help the both programs to be more efficient in both permitting and enforcement.

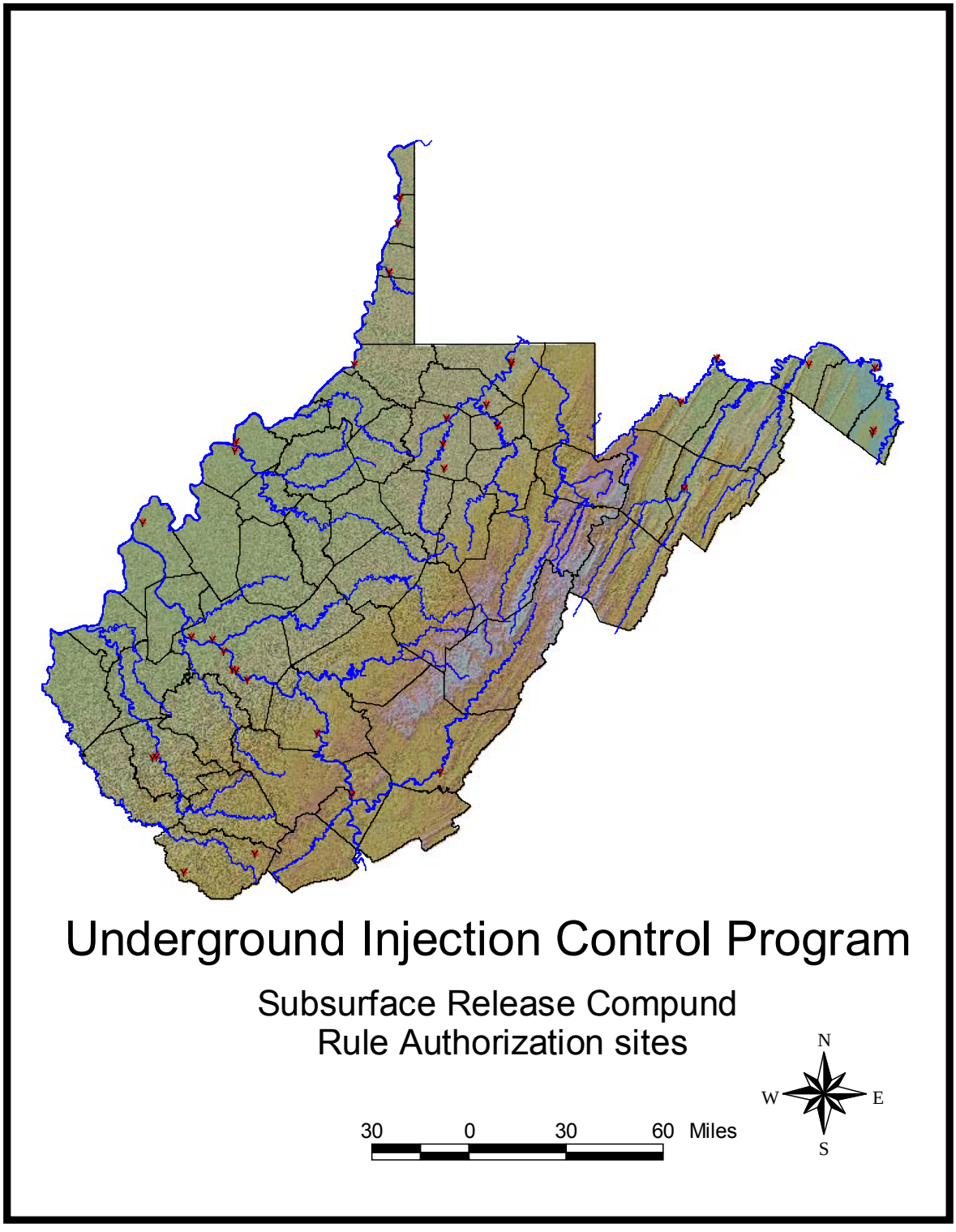
Some UIC Mining Statistics:

Mine Sites Known, Suspected or Proposing to Inject Underground…..…… 64
Injection Points Known, Suspected, or Proposed…….……..…… 430
Sites Presently in the Application/Permitting Process…..…….. 52
Permits Issued/ Injection Points Permitted ……. 35/300
Modifications Issued……..…… 14
Permits Closed/Abandoned……. 2
Permits/Injection Points Denied…….. … 3/13
Permits/Injection Points Invalidated……..…….. 1/20
Applications Voluntarily Withdrawn……..…… 5
Applications/Injection Points presently “On Hold” (Pending Resolution
of Groundwater Problems)……..…….. 2/18

Active UIC permits by Watersheds	UIC Industrial / Commercial permits issued				UIC Mining permits issued	UIC Sewage permits issued
	storm water	aquifer remediation	industrial / commercial	other		
Group A Watersheds						
Upper Ohio River North		2				5
Cheat River						9
Youghiogheny River						
S. Branch Potomac River			1			13
Shenandoah River						2
Upper Kanawha River		1			2	2
Group B Watersheds						
N. Branch Potomac River					1	2
Tygart Valley River					4	4
Lower Kanawha River		2				3
Elk River			1		1	6
Coal River					4	7
Group C Watersheds						
Middle Ohio River North						4
Potomac River Drains	1	5	1			5
Middle Ohio River South			1			4
Lower Guyandotte River			2			1
Gauley River					1	9
Tug Fork River					3	1
Group D Watersheds						
Monongahela River		5	1		3	4
Little Kanawha River			3			9
Greenbrier River	4		2	1		7
James River						
Lower New River					1	18
Upper New River		1	2			
Group E Watersheds						
Upper Ohio River South		2	1		1	5
Dunkard Creek					1	1
Cacapon River						7
West Fork River		3			1	
Lower Ohio River						3
Big Sandy River						1
Twelvepole Creek						1
Upper Guyandotte River		1		1	5	1


UIC mining permit
UIC industrial permit
Stormwater Injection Well
Special Drainage Well
Ind/Comm Injection Well
Aquifer Remediation Well
Other Injection Well
UIC septic permit
Underground Injection Control Program
Active Permits
N
W
E
S
30
0
30
60 Miles

Subsurface Release Compound Rule Authorizations by Watersheds		
Group A Watersheds		
	number of sites	number of injection points
Upper Ohio River North	1	6
Cheat River		
Youghiogheny River		
S. Branch Potomac River	1	6
Shenandoah River	2	58
Upper Kanawha River	4	101
Group B Watersheds		
	number of sites	number of injection points
N. Branch Potomac River	2	7
Tygart Valley River	2	2
Lower Kanawha River	2	14
Elk River		
Coal River		
Group C Watersheds		
	number of sites	number of injection points
Middle Ohio River North	2	41
Potomac River Drains	2	17
Middle Ohio River South	2	9
Lower Guyandotte River		
Gauley River		
Tug Fork River	2	77
Group D Watersheds		
	number of sites	number of injection points
Monongahela River	2	16
Little Kanawha River	1	28
Greenbrier River	1	1
James River		
Lower New River	2	32
Upper New River		
Group E Watersheds		
	number of sites	number of injection points
Upper Ohio River South	2	27
Dunkard Creek		
Cacapon River		
West Fork River	3	26
Lower Ohio River		
Big Sandy River		
Twelvepole Creek	2	
Upper Guyandotte River		48


Underground Injection Control Program
Subsurface Release Compund
Rule Authorization sites
N
W
E
S
30
0
30
60
Miles

h. Groundwater Remediation

The Groundwater Program is responsible for the investigation and remediation of those sites with contaminated groundwater within West Virginia that do not fit under the jurisdiction of other state agency programs, such as RCRA, CERCLA, Leaking Underground Storage Tanks, Mining and Reclamation, Oil and Gas, and Voluntary Remediation.

To date, the remediation section of the Groundwater Program of the Division of Water and Waste Management has worked on 154 sites, 91 of which where active during the July 2001 to June 2003 time frame. This is an addition of 51 sites in the past two years. These sites vary between equipment yards, above-ground tank releases, old petroleum bulk terminals and refineries, both active and abandoned railyards, and various other odds and ends. Most of the contamination is hydrocarbon (usually diesel fuel); however, we also have sites with chlorinated solvent contamination as well as some unique problems involving road salt, propylene glycol, and cow manure. Our office is the lead state agency at many of these sites; although on other occasions we work in cooperation with Environmental Enforcement or provide advice to other DEP offices.

The following table summarizes groundwater remediation activities between July 1, 2001 and June 30, 2003:

Sites that were active	84
Sites that were investigated - no action required	3
Sites with groundwater monitoring	47
Sites with product recovery	9
Sites with soil excavation	15
Sites were technical advice was provided	6
Sites that were provided with a No Further Action letter	21
Sites where a No Further Action letter was denied	2
Sites with bio farming of the soils	3
Sites with pump-and-treat systems of the groundwater	4
Sites that were referred to other DEP programs	7
Sites with *insitu* bio vent systems	3
Sites where high vacuum systems were used	4
Sites with air sparging	2
Sites with natural attenuation	3
Sites where Oxygen Releasing Compounds or other subsurface releasing products were used	4
Sites with phytroremediation	2
Sites where refurbishing of infrastructure was required	2

Locations of the remediation sites are shown on the map on page 91.

Groundwater Program Remediation Sites						
No.	*Site*	*County*	*River Basin*	*Contamination*	*Aquifer Type*	*Groundwater Program Status*
1	Abbott Site Elm Grove	Ohio	Upper Ohio	Benzene	Alluvium	Cabinet Secretary is requiring annual groundwater monitoring by Waste Management
2	AE, Inc. Buckhannon	Upshur	Monongahela	Hydrocarbon	Colluvium	Company is continuing to sample small unnamed tributary of Ratcliff Run
3	AEP Belmont Substation	Pleasants	Middle Ohio	Hydrocarbon	Colluvium	No further action letter was issued on 5 June 2002
4	Alabama Properties (NPS)	Fayette	New	Hydrocarbon	Colluvium	Site is inactive
5	City of Bridgeport	Harrison	Monongahela	Hydraulic Oil	Alluvium	Provided advice; site was ultimately moved to OER
6	ATF Building in Martinsburg	Berkeley	Lower Potomac	Fuel Oil	Colluvium	Site will be issued a no further action letter once the facility has provided us with a GPP
7	Ace Tank (Martin Oil) Buckhannon	Upshur	Monongahela	Hydrocarbon	Alluvium	No further action letter was issued on 9 May 2003
8	Appalachian Oil Purchasers	Harrison	Monongahela	Crude oil	Colluvium	Provided advice to Environment Enforcement
9	Arrow Concrete Scary Creek	Putnam	Lower Kanawha	Benzene	Alluvium	No further action letter was issued on 16 January 2003
10	Ashland Caldwell Bulk Terminal	Greenbrier	Greenbrier	Fuel Oil	Colluvium	No further action letter was issued on 30 October 2002

Groundwater Program Remediation Sites						
11	Big John's Salvage Yard Fairmont	Marion	Monongahela	Solvents	Colluvium	Provided Waste Management with advice
12	Bluewell Church of God	Mercer	Upper New	Hydrocarbon	Alluvium	Provided advice to Environmental Enforcement
13	Chevron Huntington Bulk Terminal	Cabell	Lower Ohio	Hydrocarbon	Alluvium	Site has been referred to the Office of Environmental Remediation
14	Citgo Cabin Creek Bulk Terminal	Kanawha	Upper Kanawha	Hydrocarbon	Alluvium	No further action letter was issued on 22 November 2002
15	Continental Bakery Wheeling	Ohio	Upper Ohio	Hydraulic Oil	Alluvium	No further action letter was issued on 9 September 2002
16	Cowabunga Holsteins Union	Monroe	Upper New	Manure	Karst	Provided advice to Environmental Enforcement
17	CSX Cowen Railyard--Refueling area	Webster	Gauley	Unknown	Alluvium	The company is attempting a second round of bioremedation
18	CSX Fairmont Railyard (TPH)	Marion	Monongahela	Diesel	Alluvium	Groundwater monitoring continuing; second investigation found additional contamination
19	CSX Fairmont Railyard (Solvents)	Marion	Monongahela	Solvents	Alluvium	No further action letter was issued on 17 January 2002
20	CSX Grafton Railyard locomotive shop	Taylor	Tygart Valley	Solvents	Alluvium	Continued groundwater monitoring

Groundwater Program Remediation Sites						
21	CSX Grafton Railyard locomotive shop	Taylor	Tygart Valley	Diesel	Alluvium	Continued groundwater monitoring with bioremediation
22	CSX Grafton Railyard car shop	Taylor	Tygart Valley	Diesel	Alluvium	Continued groundwater monitoring
23	CSX Handley Railyard (TPH-DRO)	Kanawha	Upper Kanawha	Diesel	Alluvium	Fluid recovery and soil vent system on line; continued groundwater monitoring
24	CSX Hinton West Railyard	Summers	Lower New	Diesel	Alluvium	No further action letter was issued on 7 December 2001
25	CSX Huntington Railyard	Cabell	Lower Ohio	Diesel	Alluvium	Natural attenuation with groundwater monitoring
26	CSX Keyser Railyard (solvents)	Mineral	North Branch Potomac	Solvents	Alluvium	Soil removal completed, followed by natural attenuation with groundwater monitoring
27	CSX Maryland Junction Railyard	Mineral	North Branch Potomac	Diesel	Alluvium over karst	Soil removal completed; groundwater monitoring continues with bioremediation
28	CSX Parkersburg Railyard	Wood	Little Kanawha	Diesel	Alluvium	Natural attenuation, and continued free product recovery and groundwater monitoring
29	CSX Peach Creek Railyard	Logan	Guyandotte	Diesel	Alluvium	One well still contains free product; additional work delayed by a lack of groundwater

Groundwater Program Remediation Sites						
30	CSX Rainelle Railyard	Greenbrier	Gauley	Unknown	Alluvium	Continued groundwater monitoring with remediation planned
31	CSX Raleigh Railyard	Raleigh	Lower New	Diesel	Alluvium	No Further Action letter was issued on 3 July 2001
32	CSX Rowlesburg Railyard	Preston	Cheat	Diesel	Alluvium	Some soil removal, active bio-vent system, and continued groundwater monitoring
33	CSX Saint Albans Railyard	Kanawha	Lower Kanawha	Diesel	Alluvium	No Further Action letter was issued on 6 November 2001
34	CSX South Charleston Car Repair Shop	Kanawha	Lower Kanawha	Unknown	Alluvium	Continued groundwater monitoring; recent request for a no further action letter denied
35	CSX Thurmond Railyard	Fayette	Lower New	Diesel	Alluvium	No further action letter was issued on 7 May 2003
36	DOH Buckhannon equipment yard	Upshur	Monongahela	Heavy Oil	Alluvium	No further action letter was issued on 3 July 2002
37	DOH Huntington equipment yard	Mason	Lower Ohio	Hydrocarbon	Alluvium	Site has been referred to the Office of Environmental Remediation
38	DOH Hurricane equipment yard	Putnam	Lower Kanawha	Unknown	Unknown	Have approved the DOH's proposed soil excavation

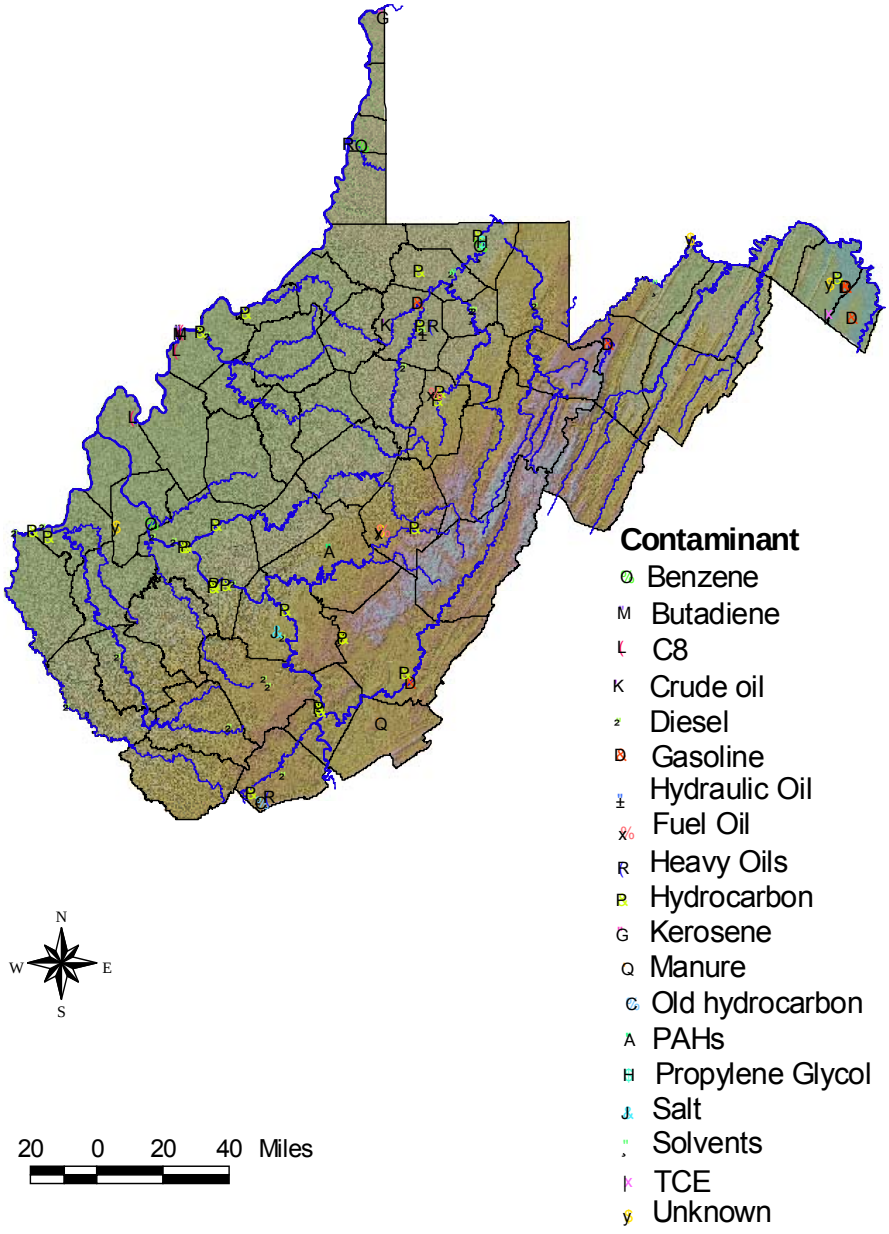
Groundwater Program Remediation Sites						
39	DOH Oak Hill equipment yard	Fayette	Lower New	Hydrocarbon and Chloride	Colluvium	DOH has removed salt and hydrocarbon contaminated soils; more work is required
40	DOH Piedmont equipment yard	Kanawha	Lower Kanawha	Hydrocarbon	Fill	No further action letter was issued on 29 April 2002
41	DuPont Dry Run Landfill	Wood	Lower Ohio	C8	Colluvium	Continued groundwater monitoring
42	DuPont Letart Landfill	Mason	Lower Ohio	C8	Colluvium	Continued groundwater monitoring
43	Dupont Local Landfill	Wood	Lower Ohio	C8	Colluvium	Continued groundwater monitoring
44	Dupont Washington Works Facility	Wood	Lower Ohio	C8	Alluvium	Continued groundwater monitoring
45	Exxon Charleston Bulk Terminal	Kanawha	Upper Kanawha	Hydrocarbon	Alluvium	Intermittent high vacuum extraction with on-site system
46	Fryer Oil Bulk Terminal	Hancock	Upper Ohio	Kerosene	Colluvium	Bank into adjacent pond has slid down; additional remedial work should soon be starting
47	FWA Drilling Blue Creek	Kanawha	Lower Elk	Hydrocarbon	Colluvium	No further action letter was issued on 31 May 2002
48	GE Washington Plant	Wood	Lower Ohio	Butadiene	Alluvium	Air sparging system in operation
49	GSA site Parkersburg	Wood	Little Kanawha	Hydrocarbon	Colluvium	City has decided to work with Voluntary Remediation on this site

Groundwater Program Remediation Sites						
50	Harrison Power Plant	Harrison	Monongahela	Fuel Oil	Fill	The problem has been resolved by the company
51	Harrison Recycling Center	Harrison	Monongahela	Hydrocarbon	Colluvium	Company has moved their car crusher, and will soon begin soil excavation
52	Kable Oil Company	Jefferson	Lower Potomac	Fuel Oil	Karst	Company has removed a great deal of soil, and is now using an oxygen releasing product
53	Little Whitestick Creek	Raleigh	Lower New	Diesel	Aluvium	First sampling of the creek has been completed
54	Logan General Hospital	Logan	Guyandotte	Fuel oil	Colluvium	No further action letter was issued on 14 August 2002
55	Morgantown Ordnance (Olin)	Monongalia	Monongahela	Solvents	Colluvium	Provided advice to Waste Management
56	Murphy (C.G.) Building Rainelle	Greenbrier	Gauley	Hydrocarbon	Basement	No further action letter was issued 30 October 2002
57	NS Bluefield Railyard (fuel transloading)	Mercer	Upper New	Diesel	Alluvium over karst	Soil excavation completed; high vaccum system continues to remove free product
58	NS Bluefield Railyard (locomotive area)	Mercer	Upper New	Old hydrocarbon	Alluvium over karst	Storm water refit completed; groundwater monitoring continues
59	NS Kenova Railyard	Cabell	Lower Ohio	Diesel	Alluvium	The soil excavation is complete; additional remedial work is required

Groundwater Program Remediation Sites						
60	NS Mullens Railyard	Wyoming	Guyandotte	Diesel	Alluvium	Product recovery and UIC systems on line; groundwater monitoring continuing
61	NS Princeton Railyard	Mercer	Upper New	Diesel	Alluvium	Referred to Office of Environmental Remediation
62	NS Williamson Railyard	Mingo	Tug Fork	Diesel	Alluvium	Continued groundwater monitoring and product recovery
63	Pantry Store Anmore (Benzene)	Harrison	Monongahela	Gasoline	Colluvium	Continued groundwater monitoring
64	Pantry Store Anmore (TPH-DRO)	Harrison	Monongahela	Diesel fuel	Colluvium	No futher action letter was issued on 28 September 2001
65	Pennzoil Huntington Bulk Terminal	Cabell	Lower Ohio	Hydrocarbon	Alluvium	Referred to the Office of Environmental Remediation
66	Pennzoil Mannington Compressor	Marion	Monongahela	Hydrocarbon	Soil	No further action letter was issued on 3 July 2002
67	Pennzoil Star City Bulk Terminal	Monongalia	Monongahela	Hydrocarbon	Alluvium	Referred to the Office of Environmental Remediation
68	Reynolds Bulk Terminal Lewisburg	Greenbrier	Greenbrier	Hydrocarbon	Karst	Approved company's soil removal plan; no action as yet from company
69	R. M. Roach Bulk Terminal Martinsburg	Berkeley	Lower Potomac	Hydrocarbon	Alluvium over karst	Soil removal required; no action as yet from company
70	R.T. Rogers Bulk Terminal Hinton	Summers	Lower New	Hydrocarbon	Alluvium	Contaminated soils have been removed; post remedial monitoring in progress
71	Ryder Truck, Parkersburg	Wood	Middle Ohio	Diesel	Colluvium	No further action letter was issued in the Spring of 2003

Groundwater Program Remediation Sites						
73	Sears Auto Mercer County Mall	Mercer	Upper New	Hydraulic oil	Colluvium	No further action letter was issued on 31 January 2003
74	South High Street Service Center	Monongalia	Monongahela	Benzene	Colluvium	No further action letter was issued on 20 December 2002
75	Spectratech (TCE) Middleway	Jefferson	Lower Potomac	TCE	Karst	Pump and treat system on line, and is having an effect on the contamination
76	Unocal Cabin Creek East Refinery	Kanawha	Upper Kanawha	Hydrocarbon	Alluvium	Phytroremediation with continued groundwater monitoring
77	Unocal Cabin Creek Speedway	Kanawha	Upper Kanawha	Hydrocarbon	Alluvium	A third investigation has been approved
78	Unocal Cabin Creek West Refinery	Kanawha	Upper Kanawha	Hydrocarbon	Alluvium	Phytroremediation with continued groundwater monitoring
79	VA Hospital Martinsburg	Berkeley	Lower Potomac	Fuel Oil	Karst	Continued groundwater monitoring
80	VEPCO Mount Storm Power Plant	Grant	North Branch Potomac	Fuel Oil	Colluvium	Groundwater monitoring continues
81	Verizon Summersville	Nicholas	Gauley	PAHs	Alluvium	No further action letter was issued on 14 August 2002
82	World Kitchen Martinsburg	Berkeley	Lower Potomac	Fuel Oil	Karst	Company has requested no further action; DEP asks for additional groundwater monitoring
83	WVU-PRT Beechurst Station	Monongalia	Monongahela	Propylene Glycol	Colluvium	Long-term maintenance and refurbishing of source pipe lines

Division of Water and Waste Management
Groundwater Program Remediation Sites



V. DEPARTMENT OF ENVIRONMENTAL PROTECTION
C. Division of Water and Waste Management

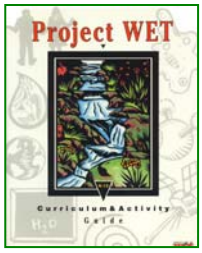
2. Public Information Office

Project WET (Water Education for Teachers)
July 1, 2001 – June 30, 2003

Introduction

Project WET (Water Education for Teachers) is a national water education program that provides formal and non-formal educators with effective K-12 classroom materials through training workshops. The Department of Environmental Protection (DEP) sponsors the program in West Virginia.

How does the Project WET program work?



The *Project WET Curriculum and Activity Guide* is the main publication distributed at free workshops. The *Guide* is a collection of over 90, K-12 activities easily integrated into chemistry, physics, language arts, life science, earth systems, natural resources, history, social studies, fine arts, and culture. Project WET guides students through a process that begins with awareness, moves toward understanding, and instills the skills and motivation to be responsible stewards of water resources.

RESULTS IN BRIEF:

Teacher Training Workshops.
Three hundred ninety four (394) K-12 teachers attended Project WET workshops. At these daylong sessions educators experience the activities of the *Project WET Curriculum and Activity Guide* from a student's perspective. They learn to use a groundwater flow model to teach about groundwater and receive educational materials including a copy of the *Guide*. A breakdown of workshops is provided in Table A.

Outreach Events

Outreach events include presentations at professional conventions as well as sessions with students who participate in annual educational events such as Wetlands Field Day in Wirt County and Science Olympiads in Jefferson County. During the reporting period, more than 950 students and educators received information about groundwater and surface water at 14 statewide events. Table B.

Jefferson County Science Olympiad. Students drill wells in the tray sand and test for acidity in search of a contaminant buried in the sand.

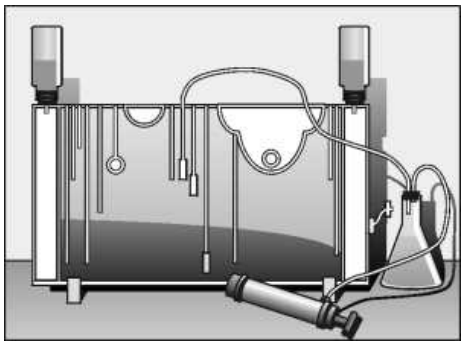
Governor's Environmental Stewardship Awards – Environmental Education

Governor Bob Wise bestowed the 2002 Environmental Stewardship Award for education to Dr. James A. Rye of West Virginia University for his efforts to prepare teachers with environmental topics in K-12 classrooms. National Park Service Ranger and Project WET facilitator, Mark Bollinger, received the 2003 award for his education activities in the New River Gorge National River watershed.

Children's Water Festivals – 2001 & 2002

The second and third annual *Children's Water Festivals – Make a Splash with Project WET* were held on the Marshall University Graduate College Campus in South Charleston on *September 21, 2001 and September 26, 2002*. Approximately 530 Kanawha county students accompanied by teachers and parents enjoyed the various stations that covered a variety of topics including groundwater, water quality, and pollution prevention. Students also had a lot of fun at the art station where they made rainsticks. The festivals relied on the talent and skills of presenters from six state and federal agencies, and the private sector.

Images from the water festivals: Left: A student is handling a bug at the Macroinvertebrates station. Middle: Making "rainsticks" is one of the most popular activities. Right: Geologist Chad Board uses the groundwater flow model for the activity "Get the Groundwater Picture."



Groundwater Flow Model

The model is a teaching tool that is used at outdoor events, conventions, and at Project WET workshops to increase understanding of groundwater. In addition, the model is checked out to schools or individuals. The Randolph County Board of Education used the model for two countywide education events each attended by over 200 students. The James Ramsey School in Jefferson County borrowed the model for use in several classes. Other schools include: West Virginia University's School of Forestry, and Glenville State College.

Special programs: In celebration of the 30th anniversary of the Clean Water Act, Governor Bob Wise issued a proclamation designating 2002 as the Year of Clean Water. In addition, Project WET and WV Save Our Streams (SOS) staff developed a series of events to increase awareness of surface and groundwater resources. The events are posted at http://www.yearofcleanwater.org

The Year Of Clean Water – 2002

Proclamation
by
Governor Bob Wise

Whereas, clean water is a basic and essential need of mankind and a significant issue for the future; and,

Whereas, maintaining and improving water quality is necessary to protect public health, fisheries and wildlife and to ensure abundant opportunities for economic development and public recreation; and,

Whereas, it is the responsibility of both the state and federal governments to provide clean water for future generations; and,

Whereas, clean water results from the dedication of citizens who have made significant contributions in the protection of our water supplies; and,

Whereas, further advancements to increase the importance of citizen stewardship and environmental ethics, especially in our children, are necessary to maintain those achievements and to complete the task already begun; and,

Whereas, October 2002 marks the 30th anniversary of the enactment of the 1972 Federal Water Pollution Control Act or the Clean Water Act;

Now, Therefore, Be it Resolved that I, Bob Wise, Governor of the State of West Virginia, do hereby proclaim *2002* as:

The Year of Clean Water

and *October 2002* as:

Clean Water Month

in the Mountain State and encourage all citizens to protect and preserve West Virginia's water resources.

In Witness Whereof, I have hereunto set my hand and caused the Great Seal of the State of West Virginia to be affixed.

Done at the Capitol, City of Charleston, State of West Virginia, this the Twentieth day of March, in the year of our Lord, Two Thousand Two, and in the One Hundred Thirty-ninth year of the State.

Bob Wise
Governor

By the Governor:

Joe Manchin III
Secretary of State

- **National Youth Water Summit 2002** – Governor Bob Wise nominated five Williamstown High School students and their teacher to the National Youth Watershed Summit in Maryland. The October 6-7 event was hosted by the America's Clean Water Foundation and the Smithsonian Institution to celebrate the 30th anniversary of the Clean Water Act. The Wood County students had distinguished themselves by investigating local wetlands issues with a grant from West Virginia University.

- **The Murky Water Caper – A Play**. Capital High School students led by their drama teacher, Helen Freeman, performed a play about water quality for the 250 students who attended the September 26 Make a Splash with Project WET Children's Water Festival. The performance was repeated for an additional 400 Capital High School students and 200 Elementary students.

- **Friends of the Cheat,** a Preston County watershed association, partnered with Project WET and the Aurora School to develop an education program for 4th, 5th and 6th grade students. The project emphasizes watershed awareness and the impacts of acid mine drainage on Preston County streams. Attached is the schedule of events that includes Project WET activities. The event took place in May 2003.

Aurora Elementary	4th grade	5th grade	6th grade
Day 1 - Program introduction	*H_2 Olympics*	*H_2 Olympics*	*H_2 Olympics*
Day 2 Program introduction	*The Life Box*	*Aqua Bodies*	*A Drop in the Bucket*
Day 3 Water Quality	*Sum of the Parts*	*Macroinvertebrates Mayhem* – Part1	*The Pucker Effect* Part 1
Day 4 Water Quality	*Where are the Frogs*	*Macroinvertebrates Mayhem* – Part 2	*The Pucker Effect* Part 2
Day 5 Groundwater	**Groundwater flow model**	**Groundwater flow model**	**Groundwater flow model**
Day 6 Watershed	**Just Passing Through** Part 1&2	Capture, Store and Release Part 1	**Branching Out** Part 1
Day 7 Watershed	**Just Passing Through** Part 3	Capture, Store and Release Part 2	**Branching Out** Part 2
Day 8 Watershed	Field Trip: Wetland Walk	Field Trip: Wetland Walk	Field Trip: WV SOS
Day 9 Watershed Address	Know Your Watershed Video: *AMD in the Cheat River Basin*	Know Your Watershed Video: *AMD in the Cheat River Basin*	Know Your Watershed Video: *AMD in the Cheat River Basin*
Day 10 Fun, games & learning	Acids and Bases	Tie-dye T shirts	AMD Treatment Model

Day 11 Field Trip	Field Trip to the River of Promise Interpretative Trail and Acid Mine Drainage Treatment Site.

Table A. Project WET Teacher Training Workshops. July 1, 2001 – June 30, 2003

Workshop Location (Community)	Date	No. of Participants	Participant Breakdown
Parkersburg, Board of Education	July 23, 2001	24	Classroom teachers
Charles Town, South Jefferson Elementary WET/Underground	August 7, 2001	30	Classroom teachers
Elkins, Elkins High School WET/Underground	August 212001	12	Classroom teachers
West Virginia University, Morgantown	October 17, 2001	25	Preservice Teachers
West Virginia University, Morgantown	October 18, 2001	25	Preservice Teachers
New Martinsville, PPG Industries WOW! The Wonders of Wetlands	July 23, 2002	33	Classroom teachers
Belle, Riverside High School	August 20, 2002	59	Classroom teachers
Charleston, Capital High School, WSTA academy	September 21, 2002	45	Classroom teachers
West Virginia University, Morgantown	October 22, 2002	20	Preservice Teachers
West Virginia University, Morgantown	October 23, 2002	39	Preservice Teachers
Charleston Edison Science Center	February 12, 2003	25	Classroom Teachers
Sissonville, Sissonville High School	April 8, 2003	22	Classroom Teachers
West Virginia State College, Institute	April 14, 2003	5	Preservice Teachers
New Martinsville - PPG Industries	June 24, 2003	25	Classroom Teachers
Total		394	

Table B. Outreach Events and Student Programs. July 1, 2001 – June 30, 2003

Location	Date	Event	Participants Approximate No.
Elizabeth Wirt County	**May 3, 2002**	**Wetlands Field Day**	**80 students in 6th and 8th grades**
Camp Virgil Tate Kanawha County	**May 15, 2002**	**Youth Camp**	**56 students in 5th and 6th grades**
Shepherdstown, NCTC Jefferson County	**May 21, 2002**	**Science Olympiad**	**40 students in 6th grade**
Camp Virgil Tate Kanawha County	**June 18, 2002**	**Kids Camp**	**50 students in 5th grade**
Charleston Embassy Suites	**October 17-18, 2002**	**Science Teachers Association Convention**	**25 educators**
Martinsburg Holiday Inn	**October, 2002**	**Youth Environmental Conference**	**50 middle/high school students**
Charleston State Capitol	**Feb. 6, 2003**	**DEP Public Outreach Day for the State Legislature**	**100**
Charleston State Capitol	**Feb. 20, 2003**	**Wildlife Diversity Day**	**200 students**
Charleston, Civic Center	**March 3, 2003**	**Kanawha County Science Fair**	**10 students**
Charleston Charleston House	**March 7, 2003**	**WV Council for Social Studies Annual Conference**	**50 educators**
Charleston Embassy Suites	**March 17, 2003**	**Governor's Conference on Education**	**150 general public**
Charleston Civic Center	**March 26, 2003**	**EXPO/ Groundwater Protection Forum**	**25 general public**
Elizabeth, Wirt County	**April 2, 2003**	**Wetlands Field Day**	**80 students**
Shepherdstown, NCTC	**May 20, 2003**	**Jefferson County Science Olympiad**	**40 students**
Total			**956**

Groundwater Program - Public Information Program

Speakers Bureau

The Department of Environmental Protection established its Speakers' Bureau in September 1998 to help educate the public about the importance of protecting and restoring West Virginia's environment. Staff members are available to speak to a variety of audiences about diverse environmental topics.

To book a speaker or to get more information, please contact Anne Howell with the Public Information Office at (304) 558-4253 or e-mail her at ahowell@wvdep.org.

V. DEPARTMENT OF ENVIRONMENTAL PROTECTION
Division of Water & Waste Management

3. Watershed Branch

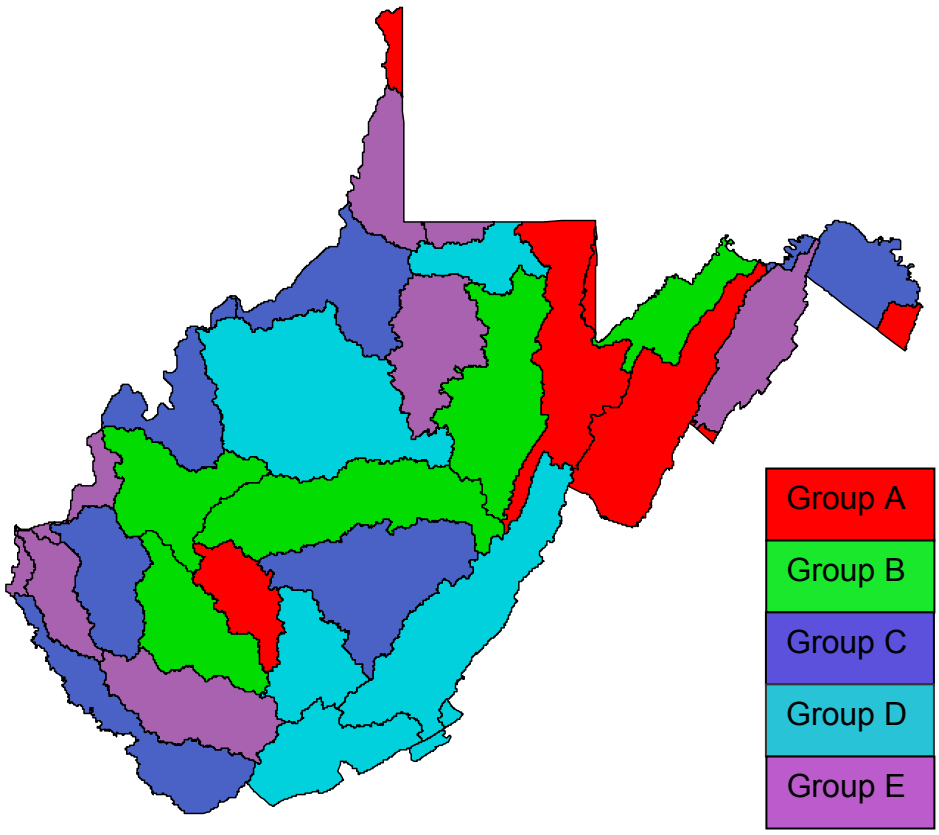
The "Watershed Branch" was created in 2002 and is basically unchanged from the Watershed Assessment and Strategic Planning group that included two major programs, the Watershed Assessment Program (Watershed Branch) and the TMDL Program, now referred to as the Watershed Assessment Section and the TMDL Section. The name change came as a result of a reorganization of Water Resources and the merging with Waste Management.

The Watershed Assessment Section was designed to study tributaries, drainage areas and entire watersheds instead of specific streams or stream segments. The Watershed Assessment Section has chosen a specific combination of physical, chemical and biological variables to help determine the streams' health and what types of stressors may be operating on the benthic (aquatic bottom-dwelling) community. Field personnel collected over 9000 samples from more than 1000 streams in FY 2002 & 2003.

The streamside and instream habitats, and benthic macroinvertebrates (bottom-dwelling animals that do not have backbones), are the center of the ecological assessment. Periphyton (in-stream algae) was recently added to the program's assessment tool kit. Habitat evaluations are important to the assessment because they reflect the physical conditions that support the benthic community. The benthic community is crucial because it reflects environmental conditions over an extended period of time. Periphyton analysis should provide more information about the environment, specifically regarding nutrient enrichment. Other parameters, like dissolved oxygen concentration, are important, but may reflect recent fluctuations in environmental conditions. A contaminant, which flowed through the reach a week ago, for example, would be reflected by the impaired benthos, but probably, would not be revealed in a water sample.

Assessments are performed on a watershed basis. To better manage the state's water resources, West Virginia has been divided into 32 watersheds, or hydrologic regions (Figure 1). Each watershed is assessed every five years, according to the state's watershed management framework.

Each year the Watershed Assessment Section will assess the water quality in approximately one fifth of the watersheds in West Virginia. All thirty-two (32) watersheds will be assessed in a five-year period (see table below). After the initial round of assessments the cycle will begin again. These assessments will be used to develop and modify plans for protecting and enhancing West Virginia's water quality.



West Virginia Watershed Assessment Schedule

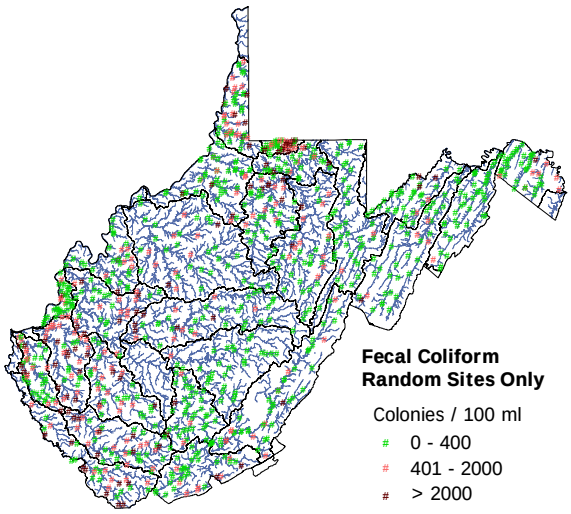
Group A-1996/2001	Group B-1997/2002	Group C-1998/2003	Group D-1999/2004	Group E-2000/2005
Cheat River	Elk River	Tug Fork River	Greenbrier River	Cacapon River
Shenandoah River 1 & 2	Coal River	Lower Guyandotte River	James River	Upper Guyandotte River
South Branch of Potomac River	Lower Kanawha River	Gauley River	Little Kanawha River	Twelvepole Creek
Upper Kanawha River	North Branch of Potomac River	Middle Ohio River North	Upper New River	Upper Ohio River South
Northern Upper Ohio River	Tygart Valley River	Middle Ohio River South	Lower New River	Lower Ohio
Youghiogheny River		Potomac River Direct Drains	Monongahela River	Big Sandy River
				West Fork River
				Dunkard Creek

The subsequent analysis of the data and drafting of reports is proceeding much slower than the collection of samples. As of June 2003, reports for the 1996 & 1997 watersheds are complete.

A number of sites are selected for duplicate sampling to provide for quality assurance/quality control checks on sampling techniques, sample handling procedures and sample analysis procedures. In addition, the Watershed Assessment Section holds a spring refresher training session before the sampling season each year to ensure all samplers are obtaining water quality and biological samples in a consistent manner at all sites.

Brushing macroinvertebrates from stream cobble into net for later identification.

The Watershed Assessment Section tries to identify the source, both regulated and non-regulated, and the severity of impacts on streams in watersheds throughout the state. For instance, fecal coliform bacteria from open pipe discharges, failing septic systems, failing sewer lines, inappropriate animal waste management techniques, and "collect and dump" sewage treatment activities is a major stressor on the groundwater and surface waters in West Virginia. By identifying streams with violations of the criterion for fecal coliform bacteria, the Watershed Branch has identified sub-watersheds with groundwater that is likely impaired by fecal coliform bacteria. Since much of the fecal coliform bacteria is filtered out of the surface water as it seeps through dirt, sand and rock, additional studies must be conducted to confirm the potential impairment of groundwater. However, in karst areas, where groundwater is not subjected to as much filtering, the presence of fecal coliform bacteria in streams is a clear indicator that some groundwater pollution has occurred "upstream".



By identifying streams impacted by acid mine drainage, the Watershed Assessment Section has identified areas where the groundwater is also impaired by acid mine drainage. By helping identify these areas the Watershed Branch has made it possible to target remediation efforts in areas before massive "blow-outs" of mine waters occur with the resulting destruction of fish and benthic communities.

The Watershed Assessment Section has developed and maintains the 303(d) list of impaired waters. These impaired waters have, in some cases, been linked to contaminated groundwater. This, perhaps, is the single greatest contribution to groundwater protection by the Watershed

Assessment Section. For example, the dioxin found in the Lower Kanawha River has been traced to groundwater seeping through abandoned hazardous waste dumps. The United States Environmental Protection Agency has recently completed a Total Maximum Daily Load (TMDL) for dioxin on this river segment.

TMDL Development Program

Since its inception with initial funding provided by the 2000 West Virginia Legislature, the West Virginia Department of Environmental Protection's (WVDEP) TMDL program has grown significantly. Subsequent funding increases allowed the program to become fully staffed and begin implementation of a state-directed TMDL program.

The WVDEP program encompasses a fifteen-year plan that systematically and efficiently addresses statewide TMDL development needs. Individual TMDLs are developed over a 48-month process that includes the generation of recent and robust water quality and pollutant source information, state-of-the-art water quality modeling and four opportunities for stakeholder involvement in the process.

Impaired waters are annually selected to begin the TMDL development process. The selection process is strongly linked with the West Virginia Watershed Management Framework (WMF), so that TMDL development activities are synchronized with the framework timeframes for watershed assessment, prioritization and restoration. To maximize efficiency, the WVDEP attempts to address all known impairments when scheduling TMDL development in a specific geographical area. Preliminary selections are advertised and public comment is accepted regarding the streams and impairments proposed for TMDL development.

After waters are selected, a pre-TMDL monitoring plan is formulated and a one-year period of intensified water quality monitoring and pollutant source identification and characterization ensues. This data forms the basis for the hydrologic and water quality modeling that is used to define the existing and desired conditions, and the pollutant reduction strategies that will restore water quality. Prior to their implementation, the pre-TMDL monitoring plans are presented in public meetings in the affected watersheds, along with general educational information regarding the TMDL development process and upcoming activities in the watershed.

TMDL modeling and report development is accomplished contractually. The WVDEP facilitates water quality and pollutant source information transfer to the contractor and manages the contracts to ensure timely completion of required activities. Interim work products are reviewed and revisions are directed. The WVDEP provides water quality management decisions to the contractor as necessary throughout the process. An additional public outreach effort is conducted at the time that the agency is making critical pollutant allocation decisions. Public meetings are conducted and specific information is presented relative to local impairments, causative sources and the proposed pollutant reduction strategy.

The last year of the process includes the preparation of final draft TMDLs that are made available for public review. Informational public meetings are conducted in conjunction with a

formal public notice/public comment process. After consideration and documentation of public comment, and direction of resultant final revisions, the TMDLs are forwarded to EPA for approval.

Common impairments associated with West Virginia waters include exceedence of numeric water quality criteria for fecal coliform, iron, aluminum, manganese and pH and general biological impairment as determined by direct assessment of instream benthic macroinvertebrate communities.

The WVDEP began work on its first batch of TMDLs in March 2001, addressing selected impaired waters from the WMF Hydrologic Group A. This work is concentrated in the Upper Kanawha River and Upper Ohio River North watersheds. The development process for this first batch has matured to the point that the initial model results became available in July 2003 and a series of public meeting to address allocation are scheduled for late September 2003. These "2004 TMDLs" will be finalized December 31, 2004.

A second batch of TMDL development began in March 2002 for selected impaired waters from the WMF Hydrologic Group B. Work is concentrated in the Coal, North Branch Potomac and Lower Kanawha River watersheds. Pre-TMDL monitoring concluded in June 2003. WVDEP is now compiling available data and will transfer the information to its contractor in a TMDL development work directive that will be executed in October 2003. These "2005 TMDLs" will be finalized December 31, 2005.

In March 2003, the WVDEP selected waters in the Gauley and Potomac Direct Drains watersheds for TMDL development (WMF Hydrologic Group C). Pre-TMDL monitoring began in July 2003 and will continue through June 2004. These "2006 TMDLs" will be finalized December 31, 2006.

In January 2004, the WVDEP will begin the "2007 TMDL" stream selection process. Selections will be made from impaired waters of the Watershed Management Framework Hydrologic Group D (Greenbrier, New, Little Kanawha and Monongahela River watersheds). "2008 TMDL" stream selection will begin in January 2005 with streams selected from Hydrologic Group E.

During the next two years it is likely that additional cases of stream contamination documented on the 303(d) list will be traced back through groundwater to their original sources. Watershed Branch personnel will then be able to propose remediation and restoration activities to improve groundwater and surface water quality in West Virginia.

Watershed Branch personnel do not directly collect data on groundwater quality or quantity. However, Watershed Branch may make use of data supplied by the WV DEP Groundwater Program's *Ambient Groundwater Quality Monitoring Network*. This data is collected by USGS and stored in the STORET database on the Internet for access by interested parties.

Watershed Branch personnel use ESRI/ArcView software to identify the location of sampling sites, geologic and land use patterns upstream from the sampling sites, and similar data. The

group also uses this program to print maps showing the geographic distribution of violations in a watershed.

Data collection and management could be improved by developing a series of shared "read-only" databases on the internal network accessible to all DEP employees. Development of separate databases available only to selected programs or selected people within programs will never be an acceptable option.

Watershed Branch personnel are cooperating with the rest of DEP in the development and implementation of a database (EQuIS) that will provide a clear picture of the water quality based on the physical and chemical characteristics and the biological life existing in all of West Virginia's waters, both groundwater and surface waters.

V. DEPARTMENT OF ENVIRONMENTAL PROTECTION
D. Information Technology Office (ITO)

DEP's Water Quality Samples database system - EQuIS

Our Purpose:

EarthSoft's Environmental Quality Information System (EQuIS) -- residing in an Oracle database platform -- provides an integrated suite of applications and a common database management system for all organizations involved in data collection, processing, management and evaluation of environmental project work. EQuIS has historically resided on a stand-alone desktop platform. WV DEP, in conjunction with EarthSoft, has implemented an agency wide Enterprise system for EQuIS, a first in the nation.

In the past environmental samples collected and analyzed by WV DEP resided in a myriad of places and formats. By implementing a central repository and a uniform format for environmental data, WV DEP's goal is to expedite the transfer of information and data between WV DEP personnel and WV DEP data providers. For the first time in the history of the agency, all of the environmental programs will be able to evaluate or cross reference each programs data for a given facility or project. This will increase efficiency by allowing WV DEP data providers to fully understand WV DEP requirements, and to communicate these requirements to its employees and contractors.

Along with being a central repository for environmental information, EQuIS provides an interface to many scientific software packages used for analyzing environmental conditions. The EQuIS system uses ESRI's ArcGIS as a 'data broker' to serve data to multiple analysis and modeling applications within a Geographic Information System (GIS) environment. The EQuIS ArcGIS Interface provides a flexible and powerful means of accessing, viewing, and analyzing geology and environmental chemistry from within the ArcGIS system. EarthSoft's EQuIS Chemistry and EQuIS Geology extensions make available many options for visualization and modeling, as well as reporting and enhanced labeling options. The EQuIS interface will allow management to make effective and timely decisions based upon best available technology.

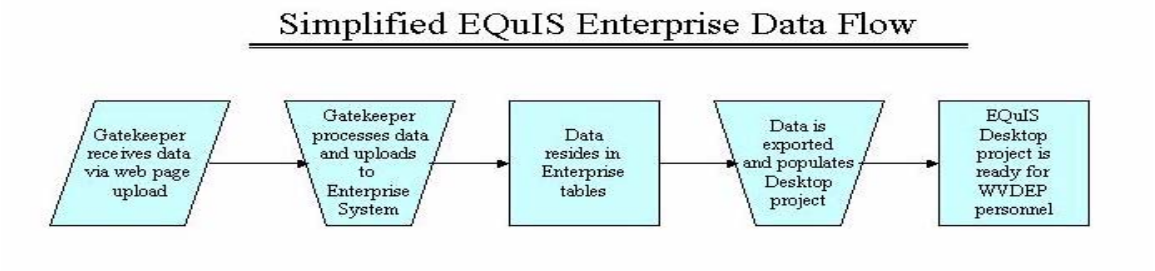
The Process:

Data will be delivered to WV DEP via a web page in an electronic data deliverable (EDD) format. These are a series of tab-delimited files which are pre-defined by WV DEP. WV DEP has adopted EDD formats also adopted by several EPA regions including Regions 1, 2, 3, and 5 along with several other states. By adopting the data deliverable formats accepted by other federal and state agencies, WV DEP can readily share and transfer data with these other entities.

A complete initial EDD submission will include 3 distinct sections (Facility, Geology, and Chemistry) with anywhere from 7 to 20 files depending upon the complexity of the project.

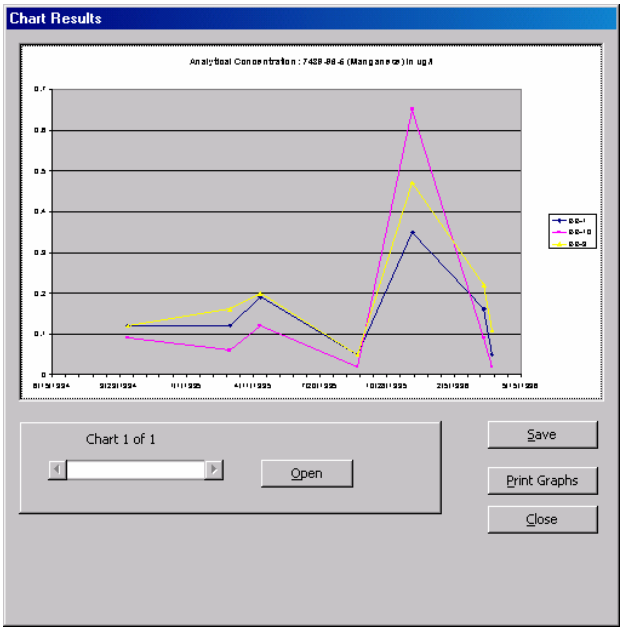
These three data sets fully describe the area being investigated, the underlying geology of the area to be investigated, and the nature of the samples and analytical results produced by the investigation.

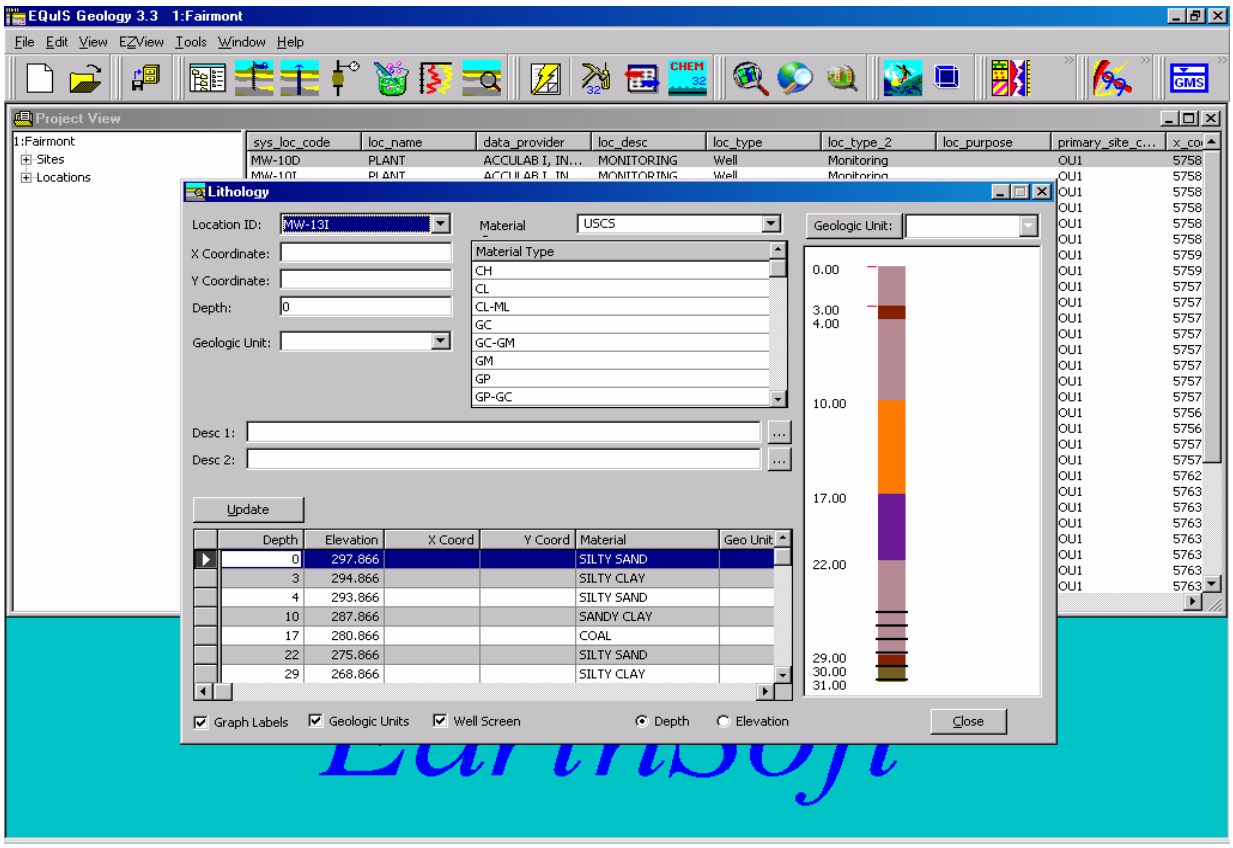
Once EDDs are submitted, a Gatekeeper will process the files and upload them into EQuIS Enterprise. Data that does not adhere to specified standards will not be allowed into the Enterprise tables. If any errors are found in the data, it will be returned to the data provider for correction. Approved data can be exported from the Enterprise tables to populate an EQuIS desktop project. WV DEP personnel can then utilize the power of EQuIS and its data broker capabilities with third party software systems as a means of accessing, analyzing, and reviewing geology and environmental chemistry data in order to make quick and informed decisions.



EQuIS Output Products:

Within the EQuIS Chemistry and EQuIS Geology Desktop systems, users are able to create simple reports and graphs with a few clicks of the mouse. The EQuIS created reports and graphs can then be saved in Excel format and used in other media:

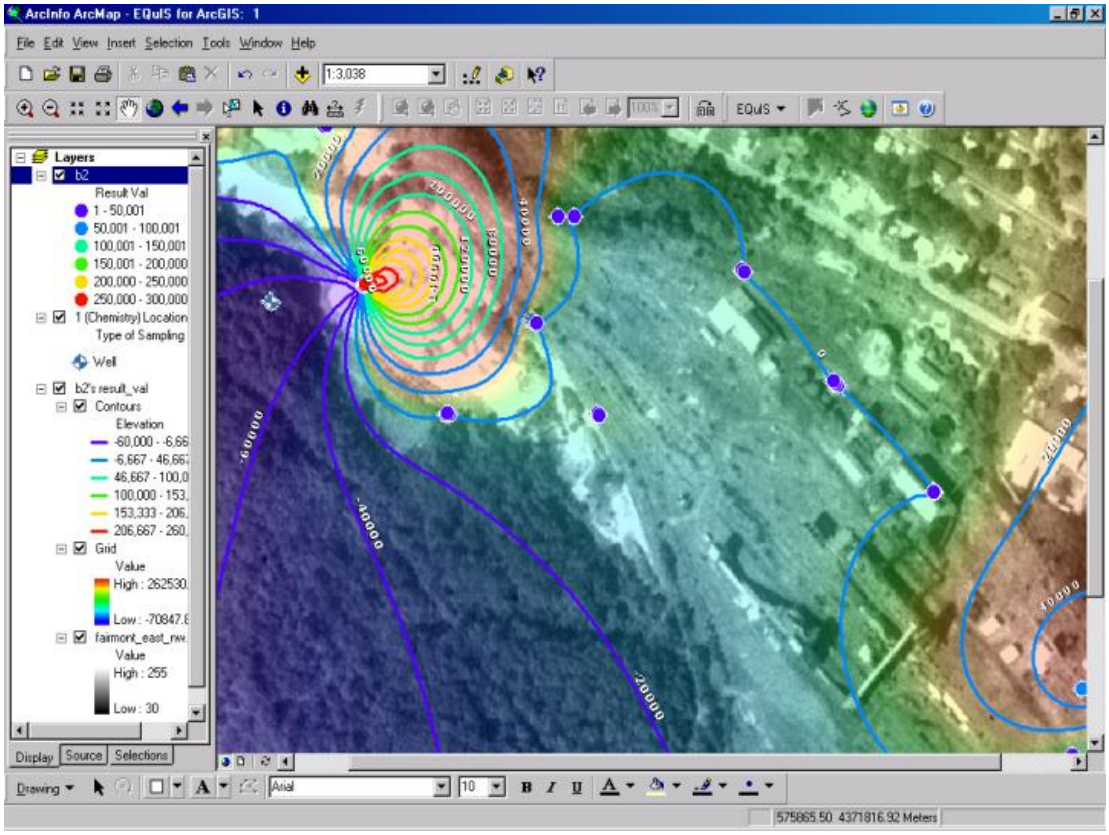




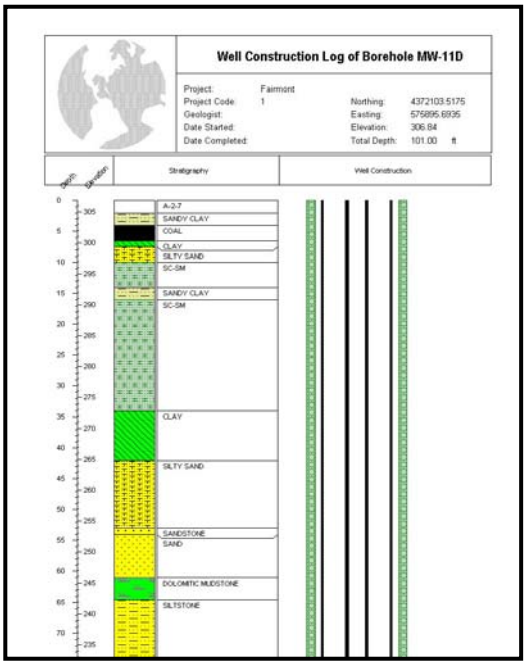
Screen Capture showing a Lithographic Column generated by EQuIS

EQuIS Interface Outputs:

A user can make a more detailed analysis of the data by utilizing the “data broker” capabilities of the EQuIS system. By launching EQuIS for ArcGIS module, the user is capable of viewing the data in a spatial relationship. An EQuIS toolbar allows the seamless transfer of data into other third party software packages for further analysis. Commonly used other third party software packages used by WV DEP include: LogPlot, Rockworks, Surfer, GMS, and EarthVision. These packages can allow the user to view analyte concentrations, detailed log plots, 3D contaminant plumes, and quick statistical analysis.



Screen capture showing Benzene contaminant plume.



Screen capture showing a constructed well log

Underground Storage Tank Integration

Successful implementation of Underground Storage Tank / Leaking Underground Storage Tank tracking within DEP's Environmental Resource Information System took place March 19, 2003. This project includes the automated invoicing of annual UST tank fees. Using this newly integrated UST data, the first automated invoicing from ERIS was completed on 26 March 2003.

This data was previously managed in stand-alone desktop systems and was therefore unavailable to anyone outside the UST unit, but Underground Storage Tank data can now be made available to all those with any need to use this information. This achievement is important because, obviously, leaking underground storage tanks are a major contributor to ground water degradation.

June 16, 2003 Flood recovery effort

On the morning of June 16, 2003, very heavy spring rainfall caused the overflow of Elk Two-Mile Creek, effectively destroying the Division of Water and Waste Management's headquarters building, as well as the Federal Express distribution center across the street. Following this disaster, as soon as new office space was leased, ITO staff were called upon to install information technology infrastructure at the new Summers Street location.

Action taken by ITO in support of DWWM included completely cabling the Summers Street facility, installing servers, PCs recovered from the flooded Greenbrier Street facility, newly ordered replacement PCs, printers, Video Conference equipment and a comprehensive Voice over Internet Protocol (VoIP) telephone system.

ERIS Implementation work

Software to enable Septic Tank and Health Department Certificate tracking in the ERIS system was implemented. This brings together data from a variety of sources both inside and outside DEP to provide a comprehensive statewide look at septic system installations. As part of this project, one time billing for unpaid Septic Tank Seal fees was accomplished, as well as continuing billing for the seals. Tracking of data from inspection and enforcement activity for additional types of UIC facilities within ERIS was also implemented.

Monitoring Well Construction Details

On-line web pages were created for tracking all required construction details of ground water monitoring wells. This information will be captured in the EQuIS Enterprise database so that it can be accessed and used by anyone with a need for monitoring well construction or location information.

Monitoring Well construction details are especially important when ground water contamination has been detected. Modeling programs used by geologists can import EQuIS-resident data to generate a fate and transport model. These models can predict the growth direction and

speed of the plume of contamination, which helps in planning the remediation of the leak's consequences.

Custom Data Requirements Support

The Information Technology Office has a wide variety of skill sets available to support everyone in DEP who has a need for advanced support in dealing with any information-related problem. From replacing an out-dated desktop application with functionality built-in to one of the Agency's enterprise systems to preparing exhibits to support litigation, ITO's experts are available to DEP at any time. When disaster strikes, ITO will pitch-in to overcome any obstacles faced by anyone in DEP anywhere.

Continuing support of ad hoc data requirements as well as major system enhancement and expansion, custom reports, and creation of Geographic output (such as map layers and datasets regarding water impact for a hydrologic region or watershed) are commonly fulfilled for a wide variety of DWWM staff, including engineers, geologists, hydrologists and biologists. ITO provides virtually any data or communication related service needed to support the Department's mission, no matter what the complexity of the request or the time frame is.

V. DEPARTMENT OF ENVIRONMENTAL PROTECTION
E. State Water Pollution Control Revolving Fund (SRF)

The SRF program environmental goals are to reduce and/or eliminate water quality violations caused by sanitary wastewater and non-point sources in surface waters and groundwater. In FY2002 and FY2003 over 58 million dollars was expended from the SRF program to projects to build and replace wastewater collection and treatment systems. In many of these projects unsewered areas of West Virginia were provided with central sewer collection systems eliminating direct wastewater discharges and failing or marginally functional on site septic systems. The failing systems and direct discharges contribute to polluting the groundwater in the state. In Berkeley County alone approximately 3,000 septic systems were eliminated with the Inwood (Phase IIA) project. Several thousand feet of sewer line was replaced, which allowed sewage to leak out into the groundwater.

Design standards for the SRF program are included in the Legislative Rules, Title 47-Series 31 and include restrictions on constructing sewer lines within 10 horizontal feet of a drinking water reservoir, 50 feet of any well or spring utilized for a public drinking water system, 50 feet of a private or individual homeowner's drinking water system, or within 10 feet of a homeowner's well. The enforcement of these regulations help protect the public and private water supplies.

The WV Agriculture Water Quality Loan Program is also administered through the SRF program and expended $366,767 in FY2002 and $325,770 in FY2003. This program established in 1997 continued to provide loans to fund projects to correct non-point source pollution. Most of the loans are made to the poultry industry in the eastern panhandle, which assist in alleviating groundwater pollution from the poultry farms.

A pilot program was started in 2000 called the On Site Systems Loan Program. The purpose of this non point source program is to eliminate existing health hazards and water quality problems due to direct sewage discharges from houses and malfunctioning septic tank systems. This is a cooperative venture between the DEP and the County Health Departments. The SRF will provide $100,000 as set aside for this program for FY 2004. Many problems and barriers have prevented this program from being successful to date, but the program is still being reviewed and modifications considered to make it viable.

V. DEPARTMENT OF ENVIRONMENTAL PROTECTION
F. Environmental Enforcement

The Environmental Enforcement (EE) office is primarily responsible for inspection and enforcement of the state and federal solid waste and water pollution control laws. EE's groundwater objective is to investigate all reports of contamination that fall within its jurisdiction and to refer all reports of contamination which are not under its jurisdiction to the appropriate authority.

The Compliance Monitoring Unit of the Environmental Enforcement Section of DEP has been assigned the responsibility to conduct Groundwater Sampling Inspections (GSI's) at various facilities throughout the State. Primarily, these facilities are active and inactive municipal and industrial landfill sites. The sites selected for sampling comes from requests from DEP's permitting staff, regional inspectors/supervisors and the discretion of the Compliance Monitoring unit.

At present, only one position has been funded to do groundwater sampling inspections (GSI's). Additional staffing is needed to adequately address all the groundwater sites within the State. DEP's present grant commitment is for six (6) GSI's per year. With the low level of staffing in the Monitoring Unit, it will be hard to do any more than the commitment numbers with all the other job responsibilities assigned to this unit.

The Department of Environmental Protection's Quality Assurance/Quality Control Plan for Standard Operating Procedures for Groundwater Sampling 2000 is used by the Monitoring Unit as a guide when conducting GSI's.

Generally, all landfill sites will have a minimum of four (4) groundwater monitor wells. The number of wells per site will depend on the size of the landfill and could be as high as twenty (20) or more. Data collected from these wells depend upon whether it is an industrial or a municipal landfill. All municipal landfills generally have the same parameters (Phase I) as outlined in 33CSR Appendix I.

Groundwater data collection methods are primarily by compressed air operated bladder pumps as well as manual bailers. All organic compounds are collected by teflon bailers. All samples are collected, preserved and analyzed in accordance with 49 CFR. Groundwater samples are analyzed by State certified laboratories.

The groundwater collection equipment has been recently upgraded. The old style bladder pumps were replaced by micro-purge electric pumps. Additional training on this equipment will be completed autumn of 2003.

The Pre-Closure Program continues the review of industrial facilities that are in the process of ceasing operations. The review process allows EE to ensure that all known contamination is remediated. All groundwater wells present at the sites are sampled during this process. When

any contaminated soil is identified at the facility, remediation is required under the Groundwater Protection Act.

The complex interaction of groundwater, geology, and chemistry need to be addressed on a more frequent basis with technical training to all staff, and newer staff in particular. Hands on experience with groundwater monitoring and sample preservation would be of assistance.

EE recognizes the need for a centralized database system that is accessible to all inspectors and other agency staff. EE maintains hard copy files on groundwater complaints, investigations, Notice of Violations (NOV's), enforcement actions, spills, Well Head Protection Areas, reports on groundwater flow mapping, groundwater quality data, and monitoring well data for landfills and industrial sites. Due to storage limitations, this information cannot be maintained in accessible files for extended periods of time. Currently, the only utilization of the ERIS data base is for permit information. EE plans to utilize the EQUIS data base to store data generated by EE personnel.

In addition, EE personnel respond to hundreds of spills and complaints, many having the potential to impact our groundwater. During this reporting period, EE responded to:

- Responded to 1,166 inspections (including repeat visits) related to surface and subsurface spills of contaminants.
- Groundwater inspections/investigations performed – 103
- Spills investigated – 872
- Collected in administrative enforcement, $19,250 for violations of the Groundwater Protection Act.
- Performed 17 Groundwater Sampling Inspections (GSI) at state municipal landfills.
- Pre-closure inspections on Industrial sites – 12

EE is currently working with agency staff to purchase compatible GPS equipment. This new equipment will be used to locate and map effluent points, spills, illegal discharges and some contaminated sites.

During the last 2 years, salvage yards throughout the state have been inspected for contaminated soil and required WV/NPDES Permits. The inspections resulted in several site remediation and enforcement actions.

Priorities over the past 2 years include landfill inspections with emphasis on Groundwater Protection Plans (GPP). Records and plans are inspected for compliance and effectiveness. Timely clean up of spills and soil remediation is also included.

Compliance with secondary containment requirements is now included in <u>all</u> facility inspections, both water and waste.

The photo below shows Groundwater Sampling Inspections at a local landfill seen in the photo on the right. The lower left photo shows a seep below a monitoring well; the lower right photo shows an underdrain seep.

EE continues to be challenged by an ever-increasing workload, with the same amount of staff.

VI. DEPARTMENT OF HEALTH AND HUMAN RESOURCES
Office of Environmental Health Services

A. Public Health Sanitation Division

Two Groundwater Protection Programs are operated by the Public Health Sanitation Division. They include the permitting and approval of individual water supplies and individual sewage systems. The goal of the individual water supply program is to insure that individual water wells are properly constructed and located at the required distances from potential pollution sources. This program is carried out through local health departments and includes permitting, inspections, and water sampling. The Public Health Sanitation Division provides technical assistance to local health departments and assists with complaint investigations.

Individual Water Supply Program

Local health departments collect water samples as requested to determine bacteriological and chemical conditions of individual and public water supplies. Complaints related to groundwater protection which are not regulated by state or local health departments are referred to the appropriate agency for response.

Individual Sewage Program

The individual on-site sewage program involves the plan review, site evaluation, inspection, and complaint investigation of on-site sewage systems in West Virginia. The goal of this program is threefold: 1.) protect the groundwater, 2.) insure all new building sites (planning on-site sewage disposal) have a suitable on-site sewage disposal reserve area to install the initial system and have space for future repairs to the system, and 3.) correct failing systems to prevent a health hazard. Local health departments are responsible for on-site systems up to 3,000 gallons per day (plan review, site evaluation, permitting, inspection, and approval). The Public Health Sanitation Division issues permits for surface discharge systems (under 600 gallons per day) which qualify for a N.P.D. E.S. Permit, conducts training and certification of septic installers, develops and interprets rules and design standards, develops operating procedures and guidelines, investigates complaints, and reviews new technology.

The Public Health Sanitation Division revised the individual sewer system design standards which will be presented to the Legislature, at a future session, for review and approval. These proposed design standards include the following groundwater protection measures:

- Eliminates homemade septic tanks and metal septic tanks, which are prone to leaking into the groundwater.

- Prohibits standard soil absorption systems in rapid permeable soils, which would not properly filter the effluent before discharging to groundwater.

- ❖ Addresses new treatment technologies not contained in the 1983 Design Standards.

The Individual Sewage Program will be faced with many new challenges in the coming year. The use of new treatment technologies coupled with the Agood@ sewage sites already occupied creates a tremendous amount of taxation of the minds and creative abilities of the Health Department personnel employed to address these problems. Diligence and perseverance will be needed to meet these challenges.

VI. DEPARTMENT OF HEALTH AND HUMAN RESOURCES
Office of Environmental Health Services

B. Well Head Protection Division

Section I - Ground Water Protection Goals

West Virginia's Wellhead Protection (WHP) and the Source Water Assessment and Protection (SWAP) programs are innovative programs to protect West Virginia ground and surface water from future contamination. The Environmental Engineering Division (EED) of the Office of Environmental Health Services (OEHS), Bureau for Public Health (BPH) of the West Virginia Department of Health and Human Resources (DHHR) is the lead agency for implementation and administration of these federally mandated programs. The EED relies on participation and involvement of federal, state, local agencies, industry, agriculture, environmental groups, public water supplies and the public at many levels to protect the surface and ground waters of the State and the health of the people of West Virginia.

The federal *Safe Drinking Water Act* (SDWA) amendments of 1986 required states to develop and implement the WHP program for all public ground water supplies wells. West Virginia WHP program was approved by the United States Environmental Protection Agency (US EPA) on December 17, 1992. The WHP program will continue during and after the SWAP program inventories and assessment reports are completed. In 1996, amendments to the SDWA required states to develop and implement the SWAP program requiring assessments for both surface and ground water sources of all public drinking water supplies. The US EPA in November 1999 approved West Virginia's SWAP program. Source water assessments will be conducted for 1,272 public water systems, of which 889 are ground water systems and 393 are surface water systems or ground water systems under the direct influence (GWUDI) of surface water. This initial assessment must be completed by 2003, and will involve the cooperation of many federal, state, and local agencies. The SWAP/WHP programs do not impose any new mandates or regulations for protecting sources of public drinking water. However, the completed assessment reports will be used to encourage local communities to develop protection activities to protect their drinking water supplies.

The overall goal of the SWAP/WHP programs is to gather and utilize meaningful information to assist source water protection efforts and the overall drinking water program in the State. There are approximately 1,378 surface and ground water intakes serving the State's public water systems. Efforts to identify significant potential sources of contamination will focus on the greatest threats to drinking water and guide future source water protection efforts. The SWAP/WHP programs maximize the use of existing information, require integration with existing state and federal programs and emphasize building local partnerships with public water supplies and municipalities.

Section II - Program Milestones and Future Priorities

Each WHP assessment:

- Defines the area (land) that may contribute water to the drinking water supply (source area delineation);
- Identifies the potential significant contaminant sources of drinking water contamination in those areas (contaminant source inventory);
- Determines the likelihood of the water supply to become contaminated (susceptibility analysis). The finished susceptibility assessment will indicate the direction and intensity of subsequent source water protection efforts; and
- Provides the local communities and water supply systems, working in cooperation with state agencies information to create a broader source water protection program to address current problems and prevent future threats to the quality of the drinking water supplies (emergency planning and land management).

West Virginia WHP program accomplishments for active ground water systems are as follows:

- Delineations for the Wellhead protection areas have been developed for 782 systems;
- Potential contaminant surveys have been approved for 746 of these systems;
- Susceptibility analysis have been completed for 365 systems; and
- Emergency/Contingency and land Management Plans have been approved for 198 systems.

Some public water supply systems have already initiated protection activities, like the Wellhead Protection Program, to protect their source water areas. Capitalizing on efforts already implemented will enable the community to achieve a greater level of detail, revision to their existing plans and a more accurate delineation. Participation directly with the activity will place the community in a key position to lead local efforts designed to safeguard the source water facility investment.

Several aspects of the WHP program that are of interest to public water supplies and local officials are:

- Wellhead Protection assessments will help municipalities that own or operate public water systems plan wellhead protection efforts;
- Completing wellhead protection assessments may support relief from certain water monitoring requirements, thereby reducing associated costs; and

- ❖ Completing wellhead protection assessments will better define source water areas, including those that transect political and/or other inter jurisdictional boundaries.

The WHP program has continued to participate in joint ground water protection efforts with the following groups:

- ❖ Working under a US EPA grant through the National Rural Water Association, a ground water technician from West Virginia Rural Water Association (WVRWA) has helped in initiating many local wellhead protection programs and has helped those programs with their potential contaminant surveys. WVRWA has provided data used in WHPA delineations and the inventory of potential contaminants to EED. Also, public meetings and seminars were jointly held and coordinated with WVRWA.

- ❖ Supporting the efforts of the Underground Injection Control (UIC) Program with the DEP in inspecting and inventorying any potential Class Five injection wells and underground storage tanks within the wellhead or source water protection area.

- ❖ Volunteer groups have been another significant source of assistance in the development of local WHP programs. Volunteers have contributed much valuable time in completing potential contaminant surveys. Many community leaders volunteered for wellhead protection committees. Without their assistance, the local WHP programs could not have progressed beyond the initiation stage.

- ❖ A Memorandum of Understanding (MOU), co-signed by the state ground water regulatory agencies, has resulted in coordinated efforts by all of the agencies to protect ground water in the delineated WHP area. These areas are top priorities in the regulatory efforts of the various agencies. The MOU has thus enhanced the WHP program's ability to protect the ground water used by potable water supply systems. The existing MOU's have been updated to include the addition of the Source Water Protection Plan.

- ❖ The WHP program has a technical committee composed of agency representatives from various federal and state agencies.

In addition, the WHP program has helped protect the integrity of the State's ground water sources in a number of other ways:

- ❖ Participate or develop regulations and design standards for water supply wells and monitoring wells.

- ❖ Certification program for water well drillers, based upon driller experience, examinations, and bonding/letter of credit requirements.

- ❖ Permits for new public water wells now require an initial survey of potential sources of contamination within 2,000 feet of proposed well location with site specific information used when available.

- ❖ Developed a method for determining whether ground water sources are under the direct influence (GWUDI) of surface water.

- ❖ Developed a new procedural guide template for the WHPP to assist communities and consultants in preparing plans for both ground and surface water public water supply systems (PWSS). The templates describe what level of detail should be provided for an acceptable plan.

- ❖ A web site was developed which contains information on the WHP program and a copy of the approved SWAP program plan. Currently developing a secured website for conveyance of WHP information to various state and federal agencies.

- ❖ The EED is committed to working with interested communities to protect their water supplies. Particularly as the source water assessments are completed, the EED will make the information available to the public water supply and make staff available to discuss the results of the assessments and the need for additional protection efforts. The assessment reports will help prioritize those communities where protection efforts are most critical. The EED also intends to explore ways to get counties involved in the WHP process.

- ❖ The EED is supporting efforts to develop advanced WHP delineations for communities in the state. The United States Geological Survey (USGS) has been instrumental in development of Modflow ground water models in the state where there have been suitable geologic conditions for modeling.

- ❖ Continue to support the efforts of the West Virginia DEP and the USGS with its ground water ambient water quality studies. This program has strived to benchmark raw water quality data for West Virginia aquifers. West Virginia is trying to identify the impacts of various land uses on water quality. This information will help West Virginia avoid future contamination events.

Section III - Ground Water Data Collection and Management:

The WHP program requires a variety of data, including locations and characteristics of public water supply sources, point of entry, potential contaminant sources, and description of watersheds, hydrogeologic settings and

aquifer parameters. These data will be collected through field data collection activities, contractor services, as well as programs within federal, state, and local agencies.

Locational data is an important aspect of the WHP program. The Environmental Engineering Division (EDD) has developed an effective Global Positioning System (GPS) program to accurately determine locations of features such as wells and potential contaminant sources. Readings are taken with portable receivers then differentially corrected using base stations within West Virginia to compute and calibrate locations from signals from a network of twenty-four satellites.

Field information collection includes various types of information. These data include GPS locations of drinking water wells, surface intakes, and potential contaminant sources within the source water protection area. Information will be collected for the ground water sources including the hydrologic setting.

The organization, manipulation, analysis and interpretation of pertinent data for assessments will be accomplished primarily through use of Geographic Information System (GIS). The GIS is a database management system comprised of components for acquiring, processing, storing, and managing spatial data and related attribute information on a geographic basis. ARC/Info and ArcView will be used to help perform the source water assessments. Once geographic locations and ancillary well, geologic, and hydrologic data has been obtained for drinking water wells and surface intakes, the data will be converted to GIS layers for analysis. Data will be analyzed to determine aquifer sensitivity. Use of GIS will also facilitate the presentation and sharing of the assessment reports with stakeholders, the public, and local governments.

Many of the databases used by the EED reside on stand-alone computers, or use data formats that cannot be accessed or manipulated by ARC/Info or ArcView. EED is moving toward the goal of an integrated database and making it available to all department programs. The potential contaminant database will be extracted and stored in a GIS compatible format for use in the WHP program. The most significant EED databases are programmed in Oracle and can be queried by ARC/Info. These databases include the Safe Drinking Water Information System (SDWIS) database and the WHP/SWAP water databases. The EED is continuing to participate with the DEP in organizational and developmental meetings concerning the Environmental Quality Information System (EQUIS) for better inter-agency communication and data transfer of information.

Section IV - Future Program Needs

West Virginia BPH to date has hired additional staff and spent a significant amount of time in developing the WHP program, creating a GIS program for

collection and storage of geologic/hydrologic data, the regulatory site data, delineations, and existing significant contaminant source inventories. Potential future WHP program needs are as follows:

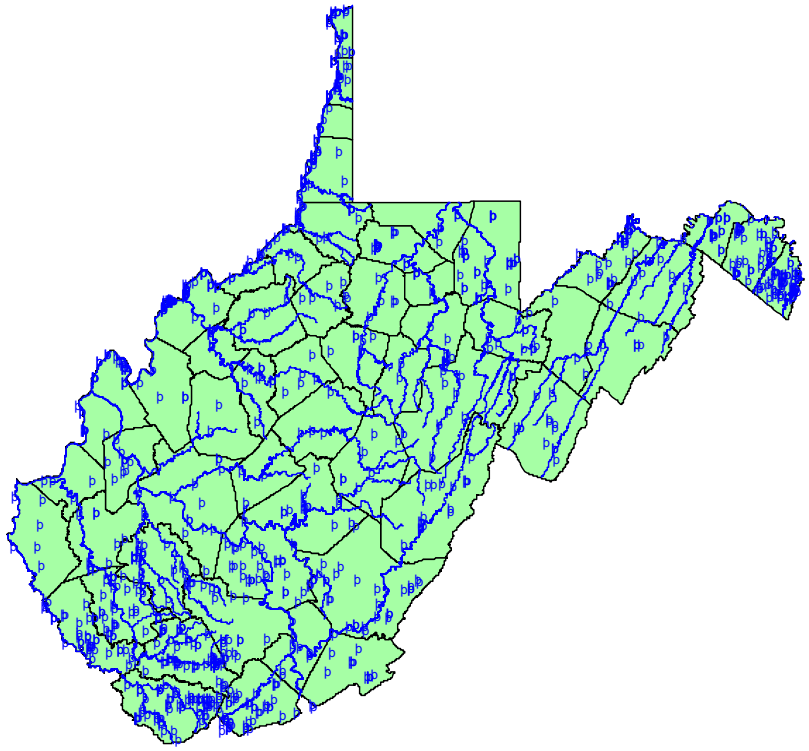
- Grants to local communities for ground water protection activities such as establishment of Wellhead Protection Programs and pursuing protection plan development and implementation. Protection strategies are the most critical aspect of the program and need to be funded in the future**.**

- Pollution prevention technical assistance to small businesses located within wellhead protection areas to balance Brownfields redevelopment with local water protection/restoration efforts.

- Public education efforts such as groundwater components for natural resource curriculum for grades K-12.

- Ground Water quality monitoring to support activities mandated by the SDWA and the Clean Water Act.

Public Water Wells in West Virginia



N

20 0 20 40 Miles

Public Water Supplys
Major Streams

Appendix A
Regulatory Agencies with Groundwater Responsibility and Authority

Department of Agriculture
Pesticides Section
Building 11
Guthrie Agricultural Center
Charleston, WV 25305
(304) 348-2209

Department of Environmental Protection

Division of Mining and Reclamation
10 McJunkin Road
Nitro, WV 25143-2506
(304) 759-0510

Office of Abandoned Mine Lands and Reclamation
10 McJunkin Road
Nitro, WV 25143-2506
(304) 759-0521

Office of Oil and Gas
1356 Hansford Street
Charleston, WV 25301
(304) 558-6075

Division of Waste Management
1356 Hansford Street
Charleston, WV 25301
(304) 558-5929

Site Identification and Remediation (SIR) Section
1356 Hansford Street
Charleston, WV 25301
(304) 558-2745

Environmental Restoration Section
1356 Hansford Street
Charleston, WV 25301
(304) 558-7763

Appendix A
Regulatory Agencies with Groundwater Responsibility and Authority

Department of Environmental Protection

Solid Waste Management Section
1356 Hansford Street
Charleston, WV 25301
(304) 558-6350

Division of Water and Waste Management
414 Summers Street
Charleston, WV 25301
(304) 558-2108

Groundwater Program
414 Summers Street
Charleston, WV 25301
(304) 558-2108

Environmental Education
414 Summers Street
Charleston, WV 25301
(304) 558-3614

Non-point Source Program
414 Summers Street
Charleston, WV 25301
(304) 759-0583

National Pollutant Discharge
Elimination System (NPDES)
Permit Program/Sludge Program
414 Summers Street
Charleston, WV 25301
(304) 558-8855

Watershed Branch
414 Summers Street
Charleston, WV 25301
(304) 558-2108

Appendix A
Regulatory Agencies with Groundwater Responsibility and Authority

Department of Environmental Protection

Office of Administrative Services
Information Technology Office
10 McJunkin Road
Nitro, WV 25143-2506
(304) 759-0519

Environmental Enforcement
1356 Hansford Street
Charleston, WV 25301
(304) 558-2497

Department of Health and Human Resources

Office of Environmental Health Services
815 Quarrier Street, Room 418
Charleston, WV 25301
(304) 558-2981

Environmental Engineering Division
815 Quarrier Street, Room 418
Charleston, WV 25301
(304) 558-2981

Public Health Sanitation Division
815 Quarrier Street, Room 418
Charleston, WV 25301
(304) 558-2981

Appendix B

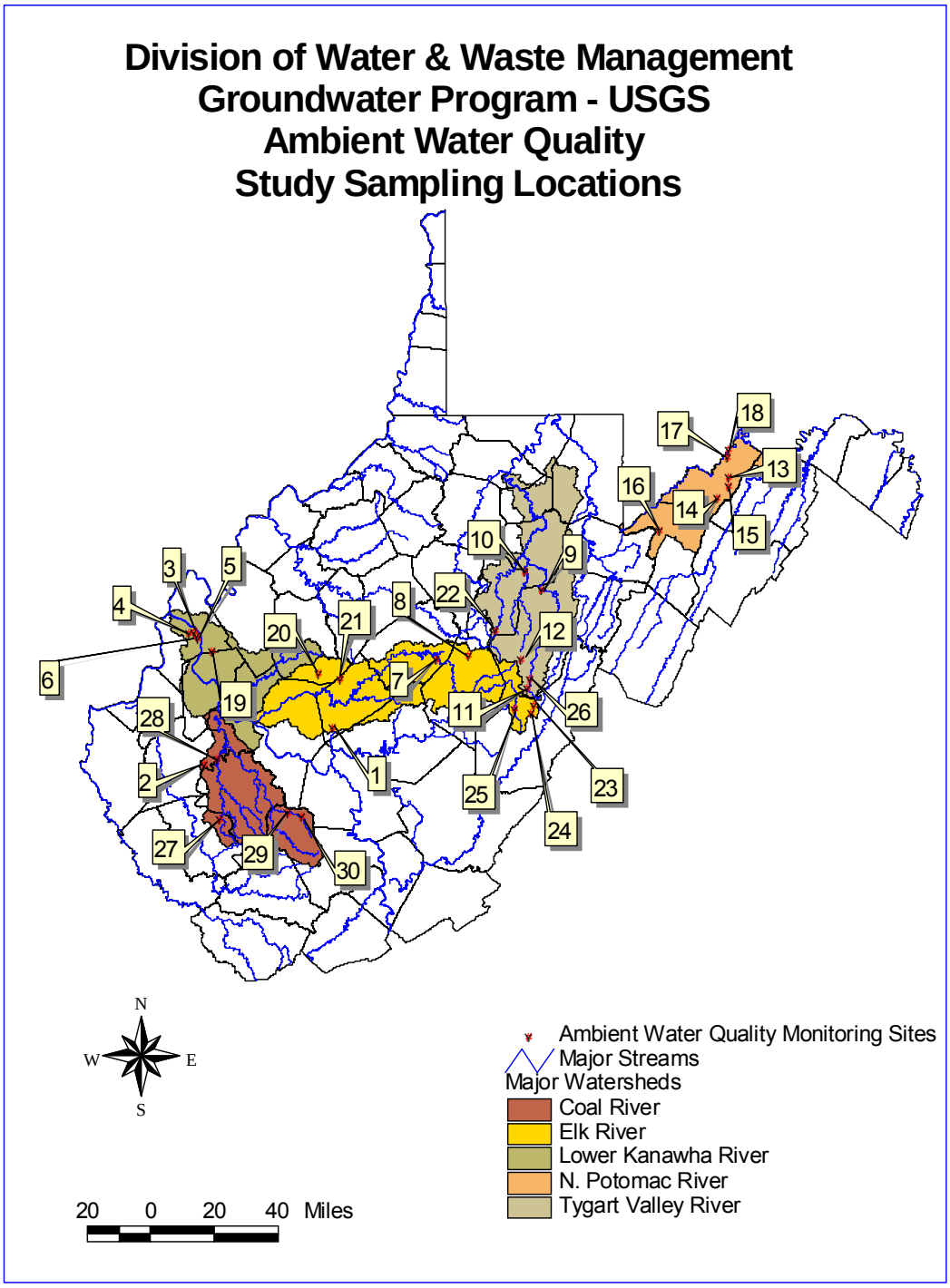
Division of Water and Waste Management Groundwater Program - United States Geological Survey Study of Ambient Groundwater Quality in West Virginia

Data Tables From 2001-2003

Note: Groundwater Quality Standards are noted where Groundwater Quality Standards have been established for a particular parameter. Groundwater Quality Standards are standards of quality and purity, established by the Environmental Quality Board in 46 CSR 12.

Division of Water and Waste Management Groundwater Program - United States Geological Survey Study of Ambient Groundwater Quality in West Virginia Data Tables - Key to the sampling sites – 2001 - 2003

Site	County	Watershed	Geologic Unit	Geologic Age	Total Depth of Well (feet)	Elevation (ft.above mean sea level)
1	Clay	Elk River	Kanawha	Pennsylvainian	58	1020
2	Lincoln	Coal River	Kanawha	Pennsylvainian	107	740
3	Mason	Lower Kanawha	Monongahela	Pennsylvainian	90	600
4	Mason	Lower Kanawha	Monongahela	Pennsylvainian	96	620
5	Mason	Lower Kanawha	Monongahela	Pennsylvainian	50	570
6	Mason	Lower Kanawha	Monongahela	Pennsylvainian	80	575
7	Braxton	Elk River	Kanawha	Pennsylvainian	120	1040
8	Webster	Elk River	Kanawha	Pennsylvainian	130	1480
9	Randolph	Tygart Valley	Kanawha	Pennsylvainian	500	1870
10	Upshur	Tygart Valley	Kanawha	Pennsylvainian	120	1740
11	Randolph	Tygart Valley	Hampshire	Devonian	320	2620
12	Randolph	Tygart Valley	New River	Pennsylvainian	220	3220
13	Mineral	N. Branch Potomac	New River	Pennsylvainian	75	700
14	Mineral	N. Branch Potomac	Mahantango	Devonian	150	750
15	Mineral	N. Branch Potomac	Brallier & Harrell Shales	Devonian	150	690
16	Grant	N. Branch Potomac	Conemaugh	Pennsylvainian	197	3260
17	Mineral	N. Branch Potomac	Oriskany	Devonian	420	1500
18	Mineral	N. Branch Potomac	Oriskany	Devonian	560	790
19	Mason	Lower Kanawha	Dunkard	Pennsylvainian	50	690
20	Roane	Elk River	Conemaugh	Pennsylvainian	110	670
21	Clay	Elk River	Conemaugh	Pennsylvainian	56	800
22	Upshur	Tygart Valley	Kanawha	Pennsylvainian	158	1920
23	Pocahontas	Elk River	Mauch Chunk	Mississippian	140	3260
24	Pocahontas	Elk River	Mauch Chunk	Mississippian	460	3200
25	Pocahontas	Elk River	Greenbrier	Mississippian	50	2700
26	Randolph	Tygart Valley	Chemung	Devonian	100	2380
27	Logan	Coal River	Kanawha	Pennsylvainian	87	860
28	Boone	Coal River	Allegheny	Pennsylvainian	140	630
29	Raleigh	Coal River	Kanawha	Pennsylvainian	84	1020
30	Raleigh	Coal River	New River	Pennsylvainian	180	1350


Division of Water & Waste Management
Groundwater Program - USGS
Ambient Water Quality
Study Sampling Locations
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20 0 20 40 Miles
Ambient Water Quality Monitoring Sites
Major Streams
Major Watersheds
Coal River
Elk River
Lower Kanawha River
N. Potomac River
Tygart Valley River

Division of Water and Waste Management Groundwater Program - United States Geological Survey Study of Ambient Groundwater Quality in West Virginia Data Tables - Field Parameters – 2001 - 2003

Site	Oxidation-Reduction Potential (MV)	Water Temp. (Deg C)	Barometric Pressure (mm of Hg)	Turbidity (NTU)	Specific Conductance (Us/Cm)	Water pH (Whole Field, Standard Units)
1	241	14.6	735	4.6	165	6.4
2	102	14.4	746	13	363	6.7
3	127	13.8	748	5.9	764	6.7
4	173	15.1	744	13	920	7.5
5	108	15.6	747	3.9	395	6.4
6	97	14.1	746	1.1	616	7.3
7	238	13.4	741	1.7	108	5.6
8	117	13.4	727	0.7	221	6.7
9	140	12.3	718	1.4	226	6.7
10	122	12.3	718	1.1	227	6.7
11	-51	12.4	695	1.4	1040	9.0
12	165	10.3	680	18	122	6.5
13	168	13.2	749	1.6	878	6.7
14	153	13.0	748	1.8	631	6.7
15	151	13.3	746	78	1600	6.7
16	184	9.7	682	1.9	321	7.0
17	363	12.7	729	1.2	399	7.0
18	395	12.3	744	2.4	618	6.9
19	271	14.3	747	5.2	475	7.4
20	84	15.4	741	2.1	796	7.0
21	96	14.5	740	1.7	616	6.9
22	98	12.2	715	1.8	377	7.6
23	151	9.5	685	2.1	267	7.5
24	738	13.0	683	1.7	359	7.7
25	346	11.5	697	1.7	150	7.9
26	-20	14.2	702	2.0	381	8.3
27	90	14.0	741	1.9	428	7.2
28	23	16.6	739	3.9	1080	7.4
29	112	13.9	739	1.8	270	6.8
30	150	15.0	730	2.8	213	6.0

Division of Water and Waste Management Groundwater Program - United States Geological Survey Study of Ambient Groundwater Quality in West Virginia Data Tables - Field Parameters, Bacteria, and Acidity, – 2001 - 2003

Site	Dissolved Oxygen, (mg/L)	Total Coliform, (Colonies/ 100 ml)	Organic Carbon (mg/L)	Fecal Coliform, (Colonies/ 100 ml)	E. Coli (Colonies/ 100 ml)	Hardness noncarb. (mg/L as $CaCO_3$)	Acidity (mg/L as H^+)	Acidity (mg/L as $CaCO_3$)
1	1.5	32	0.2	6 (est.)	10	--	0.1	5
2	0.4	4 (est.)	0.6	<1	<1	--	0.5	25
3	1.4	82	1.4	6 (est.)	4	--	1.1	55
4	0.5	97	1.2	<1	<1	--	0.4	20
5	1.3	<1	0.2	<1	<1	48	1.5	74
6	0.6	2 (est.)	0.5	<1	<1	--	0.5	25
7	1.6	6 (est.)	0.4	<1	<1	16	0.6	30
8	0.6	<1	0.4	<1	<1	--	0.2	9.9
9	0.4	1 (est.)	0.6	<1	<1	19	2.2	109
10	0.4	<1	0.5	<1	<1	--	0.2	9.9
11	0.2	5 (est.)	0.3	<1	<1	--	<0.1	--
12	0.5	<1	0.4	<1	<1	--	0.2	9.9
13	0.8	<1	0.7	<1	<1	213	0.5	25
14	0.9	44	0.5	<1	<1	137	0.5	25
15	1.0	<1	0.9	<1	<1	551	0.8	40
16	0.6	2 (est.)	0.8	<1	<1	10	0.3	15
17	7.8	<1	0.3	<1	<1	39	0.3	15
18	12.2	21	0.8	<1	<1	60	0.4	20
19	9.5	10 (est.)	0.5	<1	<1	--	<0.1	--
20	0.6	<1	1.1	<1	<1	--	0.5	25
21	1.0	<1	1.5	<1	<1	--	0.5	25
22	0.7	<1	0.6	<1	<1	--	<0.1	--
23	0.2	3 (est.)	0.5	<1	<1	14	0.1	5
24	0.6	<1	0.3	<1	<1	--	<0.1	--
25	4.3	220	0.6	<1	<1	--	0.2	9.9
26	0.2	<1	0.9	<1	<1	--	<0.1	--
27	0.3	<1	1	<1	<1	--	0.2	9.9
28	0.2	16 (est.)	0.8	<1	<1	--	0.2	9.9
29	0.3	<1	0.7	<1	<1	--	1	50
30	1.1	<1	0.3	<1	<1	12	0.2	9.9

Division of Water and Waste Management Groundwater Program - United States Geological Survey Study of Ambient Groundwater Quality in West Virginia Data Tables - Alkalinity and Dissolved Solids – 2001 - 2003

Site	Bicarbonate (mg/L as HCO_3)	Carbonate (mg/L as CO_3)	Alkalinity (mg/L as $CaCO_3$)	Dissolved Carbon Dioxide (mg/L as CO_2)	Total Solids Residue at 105 Deg. C, (mg/L)	Total Dissolved Solids Residue At 180 Deg. C (mg/L)
1	87	<1	71	44	46	89
2	112	<1	92	34	199	200
3	372	<1	305	117	463	451
4	486	<1	399	24	570	551
5	116	<1	95	19	208	175
6	256	<1	210	20	374	374
7	34	<1	28	68	64	58
8	93	<1	76	28	122	120
9	68	<1	56	20	136	131
10	115	<1	94	37	135	126
11	321	<1	334	0.6	616	614
12	66	<1	54	32	90	88
13	260	<1	213	87	654	613
14	179	<1	147	58	473	448
15	222	<1	182	73	1240	1240
16	173	<1	142	31	210	187
17	202	<1	166	34	285	264
18	317	<1	260	66	421	427
19	250	<1	205	16	291	286
20	229	<1	188	38	433	438
21	191	<1	157	50	334	344
22	196	<1	161	6.2	230	227
23	130	<1	107	7	168	168
24	212	<1	174	6.7	220	218
25	77	<1	63	1.7	110	196
26	144	<1	118	1.2	230	228
27	246	<1	202	23	271	252
28	224	<1	184	15	655	632
29	119	<1	98	32	184	157
30	66	<1	54	66	127	114

Division of Water and Waste Management Groundwater Program - United States Geological Survey Study of Ambient Groundwater Quality in West Virginia Data Tables - Ions - 2001- 2003

Site	Bromide (mg/L as Br)	Chloride (mg/L as Cl)	Fluoride (mg/L as F)	Sulfate (mg/L as SO^{-}_{4})	Nitrogen, Nitrite (mg/L as N)	Nitrogen, NO_2+NO_3 (mg/L as N)	Nitrogen, Ammonia (mg/L as N)
			GQS = 4.0 mg/L	(secondary) GQS = 250 mg/L	GQS = 10 mg/L	GQS = 10 mg/L	
1	0.1	9.9	0.2	1.6	<0.1	<0.2	0.24
2	0.2	54	0.1	1.3	<0.1	<0.2	0.49
3	0.4	63	0.2	16	<0.1	<0.2	1.1
4	0.3	48	0.8	27	<0.1	<0.2	0.21
5	0.1	47	<0.1	30	<0.1	<0.2	0.32
6	0.2	50	0.3	45	<0.1	<0.2	0.82
7	<0.1	1.4	<0.1	23	<0.1	<0.2	0.24
8	0.1	18	0.1	6.4	<0.1	<0.2	0.39
9	0.1	18	<0.1	23	<0.1	<0.2	0.39
10	<0.1	14	0.2	0.1	<0.1	<0.2	0.19
11	1.4	129	2.2	3	<0.1	<0.2	0.15
12	<0.1	0.6	<0.1	8	<0.1	<0.2	0.21
13	<0.1	6.9	0.2	248	<0.1	<0.2	0.1
14	<0.1	11	0.2	165	<0.1	<0.2	<0.01
15	<0.2	8.6	0.2	**659**	<0.1	<0.2	0.34
16	0.4	5.4	0.2	7.9	<0.1	0.9	0.18
17	<0.1	2.1	<0.1	31	<0.1	260	<0.01
18	<0.1	11	0.2	62	<0.1	0.57	<0.01
19	0.1	21	0.2	19	<0.1	<0.2	0.07
20	0.8	130	0.3	<0.1	<0.1	<0.2	0.46
21	0.5	66	0.2	<0.1	<0.1	<0.2	0.6
22	0.5	47	0.4	0.1	<0.1	<0.2	0.35
23	<0.1	7.2	<0.1	18	<0.1	<0.2	0.03
24	0.1	6.5	0.1	17	<0.1	0.14	<0.01
25	<0.1	2.3	<0.1	7.3	<0.1	0.49	<0.01
26	0.4	44	0.2	0.1	<0.1	<0.2	0.13
27	0.2	28	0.3	0.1	<0.1	<0.2	0.34
28	0.9	167	0.7	80	<0.1	<0.2	0.66
29	0.1	23	0.1	3.2	<0.1	<0.2	0.2
30	<0.1	17	<0.1	20	0.3	<0.2	0.07

GQS = Groundwater Quality Standard; **Bold** indicates GQS exceedance

Division of Water and Waste Management Groundwater Program - United States Geological Survey Study of Ambient Groundwater Quality in West Virginia Data Tables - Ions - 2001- 2003

Site	Nitrogen, Ammonia (mg/L as Nh_4)	Calcium (mg/L as Ca)	Magnesium, (mg/L as Mg)	Sodium (mg/L as Na)	Potassium, (mg/L as K)
1	0.31	11	3.6	13	1.5
2	0.63	20	4	42	2.4
3	1.42	44	12	110	2.1
4	0.27	17	4.1	200	1.3
5	0.41	22	4.1	18	1.3
6	1.06	33	6.1	95	1.8
7	0.31	6.9	3.2	2	1.1
8	0.5	19	5.2	13	1.4
9	0.5	20	5	11	2.5
10	0.24	13	2.3	31	1.7
11	0.19	0.92	0.16	230	1.2
12	0.27	12	3.9	4.2	1.6
13	0.13	128	29	22	1.1
14	--	83	19	17	0.7
15	0.44	202	57	68	1.1
16	0.23	52	9.3	0.5	2.4
17	--	67	12	1.5	0.7
18	--	105	17	5.8	1.3
19	0.09	39	7.9	53	1.4
20	0.59	29	6.2	120	3.5
21	0.77	48	9.1	56	2.7
22	0.45	11	2.7	67	2.4
23	0.04	44	4.7	4.2	0.4
24	--	29	12	32	0.5
25	--	22	3.2	2.5	0.6
26	0.17	4.5	0.92	79	1.2
27	0.44	25	7.8	57	1.5
28	0.85	9.7	2.9	210	2.8
29	0.26	21	6.2	26	1.3
30	0.09	9.9	5.2	10	1.4

Division of Water and Waste Management Groundwater Program - United States Geological Survey Study of Ambient Groundwater Quality in West Virginia Data Tables - Ions and Metals -2001- 2003

Site	Phosphorus (mg/L as P)	Aluminum, (µg/L as Al)	Antimony, (µg/L as Sb)	Arsenic (µg/L as As)	Barium, (µg/L as Ba)
			GQS = 6 µg/L	GQS = 10 µg/L	GQS = 2000 µg/L
1	0.13	<3	<1	< 4	190
2	0.05	<3	<1	< 4	440
3	0.54	16	<1	24	810
4	<0.02	117	<1	4	140
5	0.25	<3	<1	< 4	210
6	0.06	3	<1	8	190
7	0.06	23	<1	< 4	100
8	0.1	<3	<1	< 4	500
9	0.05	<3	<1	< 4	760
10	0.05	<3	<1	< 4	430
11	0.08	9	<1	6	180
12	<0.02	<3	<1	< 4	160
13	<0.02	<3	<1	< 4	19
14	0.03	<3	<1	< 4	16
15	<0.02	<3	<1	< 4	15
16	<0.02	<3	<1	< 4	270
17	<0.02	<3	<1	< 4	35
18	<0.02	25	<1	< 4	45
19	<0.02	12	<1	5	500
20	0.06	<3	<1	< 4	**2770**
21	0.11	<3	<1	< 4	1750
22	0.05	<3	<1	< 4	430
23	<0.02	<3	<1	< 4	61
24	<0.02	<3	<1	< 4	130
25	<0.02	18	<1	< 4	38
26	0.08	3	<1	< 4	230
27	0.04	<3	<1	< 4	460
28	0.07	88	<1	< 4	450
29	0.08	<3	<1	< 4	560
30	0.07	<3	<1	< 4	200

GQS = Groundwater Quality Standard; **Bold** indicates GQS exceedance

Division of Water and Waste Management Groundwater Program - United States Geological Survey Study of Ambient Groundwater Quality in West Virginia Data Tables – Ions and Metals -2001- 2003

Site	Beryllium, (µg/L as Be)	Cadmium (µg/L as Cd)	Chromium (µg/L as Cr)	Cyanide (µg/L)	Iron, (µg/L as Fe)
	GQS = 4 µg/L	GQS = 5 µg/L	GQS = 10 µg/L	GQS = 200 µg/L	(secondary) GQS = 300 µg/L
1	< 1	< 5	< 1	<0.01	**8250**
2	< 1	< 5	< 1	<0.01	**4750**
3	< 1	< 5	< 1	<0.01	**3540**
4	< 1	< 5	< 1	<0.01	**611**
5	< 1	0.8	< 1	<0.01	**40000**
6	< 1	< 5	< 1	<0.01	**599**
7	< 1	< 5	< 1	<0.01	**9370**
8	< 1	< 5	< 1	<0.01	**1750**
9	< 1	< 5	< 1	<0.01	**4800**
10	< 1	< 5	< 1	<0.01	**809**
11	< 1	< 5	< 1	<0.01	18
12	< 1	< 5	< 1	<0.01	**2700**
13	< 1	< 5	< 1	<0.01	**1140**
14	< 1	< 5	< 1	<0.01	**1240**
15	< 1	0.6	< 1	<0.01	**9220**
16	< 1	< 5	< 1	<0.01	**433**
17	< 1	< 5	< 1	<0.01	4
18	< 1	< 5	< 1	<0.01	22
19	< 1	< 5	< 1	<0.01	**314**
20	< 1	< 5	< 1	<0.01	**2860**
21	< 1	< 5	< 1	<0.01	**4480**
22	< 1	< 5	< 1	<0.01	169
23	< 1	< 5	< 1	<0.01	103
24	< 1	< 5	< 1	<0.01	4
25	< 1	< 5	< 1	<0.01	15
26	< 1	< 5	< 1	<0.01	97
27	< 1	< 5	< 1	<0.01	**816**
28	< 1	< 5	< 1	<0.01	**903**
29	< 1	< 5	< 1	<0.01	**424**
30	< 1	< 5	< 1	<0.01	**15700**

GQS = Groundwater Quality Standard; **Bold** indicates GQS exceedance

Division of Water and Waste Management Groundwater Program - United States Geological Survey Study of Ambient Groundwater Quality in West Virginia Data Tables - Metals - 2001 - 2003

Site	Lead, (µg/L as Pb)	Manganese, (µg/L as Mn)	Mercury (µg/L as Hg)	Nickel (µg/L as Ni)	Selenium (µg/L as Se)
	GQS = 15 µg/L	(secondary) GQS = 50 µg/L	GQS = 2 µg/L		GQS = 50 µg/L
1	< 2	**249**	<0.1	<1	<4
2	4	**207**	<0.1	<1	<4
3	< 2	**284**	<0.1	<1	<4
4	< 2	**199**	<0.1	<1	<4
5	< 2	**2860**	<0.1	<1	<4
6	< 2	**129**	<0.1	<1	<4
7	< 2	**306**	<0.1	12	<4
8	< 2	**153**	<0.1	<1	<4
9	< 2	**373**	<0.1	<1	<4
10	< 2	46	<0.1	<1	<4
11	< 2	6	<0.1	<1	<4
12	< 2	**252**	<0.1	<1	<4
13	< 2	**517**	<0.1	7	<4
14	< 2	**592**	<0.1	2	<4
15	2	**1800**	0.1	<1	<4
16	< 2	**58**	<0.1	<1	<4
17	< 2	<1	<0.1	<1	<4
18	2	<1	<0.1	<1	<4
19	2	**202**	<0.1	<1	<4
20	< 2	**191**	<0.1	<1	<4
21	< 2	**393**	<0.1	<1	<4
22	< 2	19	<0.1	<1	<4
23	< 2	**74**	<0.1	<1	<4
24	< 2	2	<0.1	<1	<4
25	< 2	<1	<0.1	8	<4
26	3	17	<0.1	<1	<4
27	< 2	**73**	<0.1	<1	<4
28	< 2	**63**	<0.1	<1	<4
29	< 2	**147**	<0.1	<1	<4
30	< 2	**1000**	<0.1	<1	<4

GQS = Groundwater Quality Standard; **Bold** indicates GQS exceedance

Division of Water and Waste Management Groundwater Program - United States Geological Survey Study of Ambient Groundwater Quality in West Virginia Data Tables – Metals and Organic Compounds - 2001 - 2003

Site	Thallium (µg/L as Tl)	Zinc, (µg/L as Zn)	Radon - 222 (pCi/L)	2,6, Di-Ethyl Aniline (µg/L)	CIAT Deethyl Atrizine (µg/L)	Acetochlor (µg/L)
	GQS = 2 µg/L	(secondary) GQS = 500 µg/L	GQS = 300 pCi/L			
1	<2	23	110	--	--	--
2	<2	176	70	--	--	--
3	<2	56	**940**	<0.006	<0.006	<0.006
4	<2	4	**3200**	--	--	--
5	<2	31	90	<0.006	<0.006	<0.006
6	<2	7	**3100**	<0.006	<0.006	<0.006
7	<2	74	70	--	--	--
8	<2	<2	20	--	--	--
9	<2	<2	30	--	--	--
10	<2	<2	40	--	--	--
11	<2	4	380	--	--	--
12	<2	14	70	--	--	--
13	<2	53	60	--	--	--
14	<2	12	70	--	--	--
15	<2	457	90	--	--	--
16	<2	3	**320**	--	--	--
17	<2	32	**800**	<0.006	<0.006	<0.006
18	<2	313	**700**	--	--	--
19	<2	69	**590**	--	--	--
20	<2	35	**790**	--	--	--
21	<2	29	260	--	--	--
22	<2	<2	50	--	--	--
23	<2	8	230	--	--	--
24	<2	82	210	--	--	--
25	<2	5	**1100**	--	--	--
26	<2	11	110	--	--	--
27	<2	15	60	--	--	--
28	<2	12	40	--	--	--
29	<2	2	70	--	--	--
30	<2	3	80	--	--	--

GQS = Groundwater Quality Standard; **Bold** indicates GQS exceedance

Division of Water and Waste Management Groundwater Program - United States Geological Survey Study of Ambient Groundwater Quality in West Virginia Data Tables – Organic Compounds - 2001 - 2003

Site	Alachlor (µg/L) GQS = 2 µg/L	Alpha HCH (µg/L)	Atrazine (µg/L) GQS = 3 µg/L	Azinphos Methyl (µg/L)	Benfluralin (µg/L)	Butylate (µg/L)
1	--	--	--	--	--	--
2	--	--	--	--	--	--
3	< 0.004	< 0.005	< 0.007	< 0.05	< 0.01	< 0.02
4	--	--	--	--	--	--
5	< 0.004	< 0.005	< 0.007	< 0.05	< 0.01	< 0.02
6	< 0.004	< 0.005	< 0.007	< 0.05	< 0.01	< 0.02
7	--	--	--	--	--	--
8	--	--	--	--	--	--
9	--	--	--	--	--	--
10	--	--	--	--	--	--
11	--	--	--	--	--	--
12	--	--	--	--	--	--
13	--	--	--	--	--	--
14	--		--	--	--	--
15	--	--	--	--	--	--
16	--	--	--	--	--	--
17	< 0.004	< 0.005	< 0.007	< 0.05	< 0.01	< 0.02
18	--	--	--	--	--	--
19	--	--	--	--	--	--
20	--	--	--	--	--	--
21	--	--	--	--	--	--
22	--	--	--	--	--	--
23	--	--	--	--	--	--
24	--	--	--	--	--	--
23			--	--	--	--
26	--	--	--	--	--	--
27	--	--	--	--	--	--
28	--	--	--	--	--	--
29	--	--	--	--	--	--
30	--	--	--	--	--	--

GQS = Groundwater Quality Standard

Division of Water and Waste Management Groundwater Program - United States Geological Survey Study of Ambient Groundwater Quality in West Virginia Data Tables – Organic Compounds - 2001 - 2003

Site	Carbaryl (µg/L)	Carbofuran (µg/L) GQS = 4 µg/L	Chlor-Pyrifos, Dissolved (µg/L)	CIS Permethrin (µg/L)	Cyanazine (µg/L)	DCPA (Dacthal) (µg/L)
1	--	--	--	--	--	--
2	--	--	--	--	--	--
3	< 0.041	< 0.02	< 0.05	< 0.06	< 0.018	< 0.03
4	--	--	--	--	--	--
5	< 0.041	< 0.02	< 0.05	< 0.06	< 0.018	< 0.03
6	< 0.041	< 0.02	< 0.05	< 0.06	< 0.018	< 0.03
7	--	--	--	--	--	--
8	--	--	--	--	--	--
9	--	--	--	--	--	--
10	--	--	--	--	--	--
11	--	--	--	--	--	--
12	--	--	--	--	--	--
13	--	--	--	--	--	--
14	--	--	--	--	--	--
15	--	--	--	--	--	--
16	--	--	--	--	--	--
17	< 0.041	< 0.02	< 0.05	< 0.06	< 0.018	< 0.03
18	--	--	--	--	--	--
19	--	--	--	--	--	--
20	--	--	--	--	--	--
21	--	--	--	--	--	--
22	--	--	--	--	--	--
23	--	--	--	--	--	--
24	--	--	--	--	--	--
25	--	--	--	--	--	--
26	--	--	--	--	--	--
27	--	--	--	--	--	--
28	--	--	--	--	--	--
29	--	--	--	--	--	--
30	--	--	--	--	--	--

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Site	Diazinon (µg/L)	Di-Eldrin (µg/L)	Disul-Foton (µg/L)	EPTC (S-Ethyl Di-Propylthio-Carbamate) (µg/L)	Ethal-Fluralin (µg/L)	Etho-Prop (µg/L)
1	--	--	--	--	--	--
2	--	--	--	--	--	--
3	< 0.05	< 0.05	< 0.02	< 0.002	< 0.009	< 0.05
4	--	--	--	--	--	--
5	< 0.05	< 0.05	< 0.02	< 0.002	< 0.009	< 0.05
6	< 0.05	< 0.05	< 0.02	< 0.002	< 0.009	< 0.05
7	--	--	--	--	--	--
8	--	--	--	--	--	--
9	--	--	--	--	--	--
10	--	--	--	--	--	--
11	--	--	--	--	--	--
12	--	--	--	--	--	--
13	--	--	--	--	--	--
14	--	--	--	--	--	--
15	--	--	--	--	--	--
16	--	--	--	--	--	--
17	< 0.05	< 0.05	< 0.02	< 0.002	< 0.009	< 0.05
18	--	--	--	--	--	--
19	--	--	--	--	--	--
20	--	--	--	--	--	--
21	--	--	--	--	--	--
22	--	--	--	--	--	--
23	--	--	--	--	--	--
24	--	--	--	--	--	--
25	--	--	--	--	--	--
26	--	--	--	--	--	--
27	--	--	--	--	--	--
28	--	--	--	--	--	--
29	--	--	--	--	--	--
30	--	--	--	--	--	--

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Site	Fonofos (µg/L)	Dissolved Lindane (µg/L) GQS = 0.2 µg/L	Linuron (µg/L)	Malathion (µg/L)	Methyl Parathion (µg/L)	Metolachlor (µg/L)
1	--	--	--	--	--	--
2	--	--	--	--	--	--
3	< 0.003	< 0.004	< 0.035	< 0.027	< 0.006	< 0.013
4	--	--	--	--	--	--
5	< 0.003	< 0.004	< 0.035	< 0.027	< 0.006	< 0.013
6	< 0.003	< 0.004	< 0.035	< 0.027	< 0.006	< 0.013
7	--	--	--	--	--	--
8	--	--	--	--	--	--
9	--	--	--	--	--	--
10	--	--	--	--	--	--
11	--	--	--	--	--	--
12	--	--	--	--	--	--
13	--	--	--	--	--	--
14	--	--	--	--	--	--
15	--	--	--	--	--	--
16	--	--	--	--	--	--
17	< 0.003	< 0.004	< 0.035	< 0.027	< 0.006	< 0.013
18	--	--	--	--	--	--
19	--	--	--	--	--	--
20	--	--	--	--	--	--
21	--	--	--	--	--	--
22	--	--	--	--	--	--
23	--	--	--	--	--	--
24	--	--	--	--	--	--
25	--	--	--	--	--	--
26	--	--	--	--	--	--
27	--	--	--	--	--	--
28	--	--	--	--	--	--
29	--	--	--	--	--	--
30	--	--	--	--	--	--

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Site	Metribuzin (µg/L)	Moliunate (µg/L)	Napropamide (µg/L)	P,P', DDE (µg/L)	Parathion (µg/L)	Pebulate (µg/L)
1	--	--	--	--	--	--
2	--	--	--	--	--	--
3	< 0.006	< 0.002	< 0.007	< 0.003	< 0.01	< 0.004
4	--	--	--	--	--	--
5	< 0.006	< 0.002	< 0.007	< 0.003	< 0.01	< 0.004
6	< 0.006	< 0.002	< 0.007	< 0.003	< 0.01	< 0.004
7	--	--	--	--	--	--
8	--	--	--	--	--	--
9	--	--	--	--	--	--
10	--	--	--	--	--	--
11	--	--	--	--	--	--
12	--	--	--	--	--	--
13	--	--	--	--	--	--
14	--	--	--	--	--	--
15	--	--	--	--	--	--
16	--	--	--	--	--	--
17	< 0.006	< 0.002	< 0.007	< 0.003	< 0.01	< 0.004
18	--	--	--	--	--	--
19	--	--	--	--	--	--
20	--	---	--	--	--	--
21	--	--	--	--	--	--
22	--	--	--	--	--	--
23	--	--	--	--	--	--
24	--	--	--	--	--	--
25	--	--	--	--	--	--
26	--	--	--	--	--	--
27	--	--	--	--	--	--
28	--	--	--	--	--	--
29	--	--	--	--	--	--
30	--	--	--	--	--	--

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Site	Pendimethalin (µg/L)	Phorate (µg/L)	Prometon (µg/L)	Pronamide (µg/L)	Propanil (µg/L)	Propargite (µg/L)
1	--	--	--	--	--	--
2	--	--	--	--	--	--
3	< 0.022	< 0.011	< 0.01	< 0.004	< 0.011	< 0.02
4	--	--	--	--	--	--
5	< 0.022	< 0.011	< 0.01	< 0.004	< 0.011	< 0.02
6	< 0.022	< 0.011	< 0.01	< 0.004	< 0.011	< 0.02
7	--	--	--	--	--	--
8	--	--	--	--	--	--
9	--	--	--	--	--	--
10	--	--	--	--	--	--
11	--	--	--	--	--	--
12	--	--	--	--	--	--
13	--	--	--	--	--	--
14	--	--	--	--	--	--
15	--	--	--	--	--	--
16	--	--	--	--	--	--
17	< 0.022	< 0.011	< 0.01	< 0.004	< 0.011	< 0.02
18	--	--	--	--	--	--
19	--	--	--	--	--	--
20	--	--	--	--	--	--
21	--	--	--	--	--	--
22	--	--	--	--	--	--
23	--	--	--	--	--	--
24	--	--	--	--	--	--
25	--	--	--	--	--	--
26	--	--	--	--	--	--
27	--	--	--	--	--	--
28	--	--	--	--	--	--
29	--	--	--	--	--	--
30	--	--	--	--	--	--

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Site	Propachlor (µg/L)	Simazine (µg/L) GQS = 4 µg/L	Tebuthiuron (µg/L)	Terbacil (µg/L)	Terbufos (µg/L)	Thiobencarb (µg/L)
1	--	--	--	--	--	--
2	--	--	--	--	--	--
3	< 0.01	< 0.05	< 0.02	< 0.034	< 0.02	< 0.05
4	--	--	--	--	--	--
5	< 0.01	< 0.05	< 0.02	< 0.034	< 0.02	< 0.05
6	< 0.01	< 0.05	< 0.02	< 0.034	< 0.02	< 0.05
7	--	--	--	--	--	--
8	--	--	--	--	--	--
9	--	--	--	--	--	--
10	--	--	--	--	--	--
11	--	--	--	--	--	--
12	--	--	--	--	--	--
13	--	--	--	--	--	--
14	--	--	--	--	--	--
15	--	--	--	--	--	--
16	--	--	--	--	--	--
17	< 0.01	< 0.05	< 0.02	< 0.034	< 0.02	< 0.05
18	--	--	--	--	--	--
19	--	--	--	--	--	--
20	--	--	--	--	--	--
21	--	--	--	--	--	--
22	--	--	--	--	--	--
23	--	--	--	--	--	--
24	--	--	--	--	--	--
25					--	--
26	--	--	--	--	--	--
27	--	--	--	--	--	--
28	--	--	--	--	--	--
29			--	--	--	--
30	--	--	--	--	--	--

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Site	Triallate (µg/L)	Trifluralin (µg/L)	1,1,1, Trichloro-ethane (µg/l)	1-1 Dichloro-ethane µg/L)	1,1, Dichloro-ethene µg/L)	CFC Freon 113 (µg/L)
			GQS = 200 µg/L		GQS = 7 µg/L	
1	--	--	<0.1	<0.1	<0.1	<0.1
2	--	--	<0.1	<0.1	<0.1	<0.1
3	< 0.02	< 0.09	<0.1	<0.1	<0.1	<0.1
4	--	--	<0.1	<0.1	<0.1	<0.1
5	< 0.02	< 0.09	<0.1	<0.1	<0.1	<0.1
6	< 0.02	< 0.09	<0.1	<0.1	<0.1	<0.1
7	--	--	<0.1	<0.1	<0.1	<0.1
8	--	--	<0.1	<0.1	<0.1	<0.1
9	--	--	<0.1	<0.1	<0.1	<0.1
10	--	--	<0.1	<0.1	<0.1	<0.1
11	--	--	<0.1	<0.1	<0.1	<0.1
12	--	--	<0.1	<0.1	<0.1	<0.1
13	--	--	<0.1	<0.1	<0.1	<0.1
14	--	--	<0.1	<0.1	<0.1	<0.1
15	--	--	<0.1	<0.1	<0.1	<0.1
16	--	--	<0.1	<0.1	<0.1	<0.1
17	< 0.02	< 0.09	<0.1	<0.1	<0.1	<0.1
18	--	--	<0.1	<0.1	<0.1	<0.1
19	--	--	<0.1	<0.1	<0.1	<0.1
20	--	--	<0.1	<0.1	<0.1	<0.1
21	--	--	<0.1	<0.1	<0.1	<0.1
22	--	--	<0.1	<0.1	<0.1	<0.1
23	--	--	<0.1	<0.1	<0.1	<0.1
24	--	--	<0.1	<0.1	<0.1	<0.1
25	--	--	<0.1	<0.1	<0.1	<0.1
26	--	--	<0.1	<0.1	<0.1	<0.1
27	--	--	<0.1	<0.1	<0.1	<0.1
28	--	--	<0.1	<0.1	<0.1	<0.1
29	--	--	<0.1	<0.1	<0.1	<0.1
30	--	--	<0.1	<0.1	<0.1	<0.1

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Site	1, 2, Di-Chloro-benzene (µg/L)	1,2, Di-Chloroethane (µg/L)	Total 1,2, Di-Chloropropane (µg/L)	1,3, Di-Chloro-Benzene (µg/L)	1,4, Di-Chloro-Benzene (µg/L)	Benzene (µg/L)
		GQS = 5 µg/L	GQS = 5 µg/L			GQS = 5 µg/L
1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1
2	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1
3	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1
4	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1
5	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1
6	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1
7	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1
8	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1
9	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1
10	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1
11	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1
12	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1
13	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1
14	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1
15	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1
16	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1
17	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1
18	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1
19	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1
20	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1
21	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1
22	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1
23	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1
24	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1
25	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1
26	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1
27	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1
28	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1
29	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1
30	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1

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Site	Bromo-Di-Chloro-Methane (µg/L)	Chloro-Benzene (µg/L)	Cis-1,2, - Di-Chloro-ethene (µg/L) GQS = 7 µg/L	Total Di-Chloro-Di-Bromo-Methane (µg/L)	Total Di-Chloro-Di-Fluoro-Methane (µg/L)	Di-Chloro-Methane (µg/L)
1	0.2	<0.1	<0.1	<0.2	<0.2	<0.2
2	<0.1	<0.1	<0.1	<0.2	<0.2	<0.2
3	<0.1	<0.1	<0.1	<0.2	<0.2	<0.2
4	<0.1	<0.1	<0.1	<0.2	<0.2	<0.2
5	<0.1	<0.1	<0.1	<0.2	<0.2	<0.2
6	<0.1	<0.1	<0.1	<0.2	<0.2	<0.2
7	<0.1	<0.1	<0.1	<0.2	<0.2	<0.2
8	<0.1	<0.1	<0.1	<0.2	<0.2	<0.2
9	<0.1	<0.1	<0.1	<0.2	<0.2	<0.2
10	<0.1	<0.1	<0.1	<0.2	<0.2	<0.2
11	<0.1	<0.1	<0.1	<0.2	<0.2	<0.2
12	<0.1	<0.1	<0.1	<0.2	<0.2	<0.2
13	<0.1	<0.1	<0.1	<0.2	<0.2	<0.2
14	<0.1	<0.1	<0.1	<0.2	<0.2	<0.2
15	<0.1	<0.1	<0.1	<0.2	<0.2	<0.2
16	<0.1	<0.1	<0.1	<0.2	<0.2	<0.2
17	<0.1	<0.1	<0.1	<0.2	<0.2	<0.2
18	<0.1	<0.1	<0.1	<0.2	<0.2	<0.2
19	<0.1	<0.1	<0.1	<0.2	<0.2	<0.2
20	<0.1	<0.1	<0.1	<0.2	<0.2	<0.2
21	<0.1	<0.1	<0.1	<0.2	<0.2	<0.2
22	<0.1	<0.1	<0.1	<0.2	<0.2	<0.2
23	<0.1	<0.1	<0.1	<0.2	<0.2	<0.2
24	<0.1	<0.1	<0.1	<0.2	<0.2	<0.2
25	<0.1	<0.1	<0.1	<0.2	<0.2	<0.2
26	<0.1	<0.1	<0.1	<0.2	<0.2	<0.2
27	<0.1	<0.1	<0.1	<0.2	<0.2	<0.2
28	<0.1	<0.1	<0.1	<0.2	<0.2	<0.2
29	<0.1	<0.1	<0.1	<0.2	<0.2	<0.2
30	<0.1	<0.1	<0.1	<0.2	<0.2	<0.2

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Site	Di-Ethyl Ether (µg/L)	Di-Iso-Propyl Ether, (µg/L)	Total Ethyl-Benzene (µg/L)	Ether Tert-Pentyl Methyl µg/L)	Meta/Para-Xylene (µg/L)	O-Xylene (µg/L)
			GQS = 7 µg/L			GQS = 10 µg/L
1	<0.2	<0.2	<0.1	<0.2	<0.2	<0.1
2	<0.2	<0.2	<0.1	<0.2	<0.2	<0.1
3	<0.2	<0.2	<0.1	<0.2	<0.2	<0.1
4	<0.2	<0.2	<0.1	<0.2	<0.2	<0.1
5	<0.2	<0.2	<0.1	<0.2	<0.2	<0.1
6	<0.2	<0.2	<0.1	<0.2	<0.2	<0.1
7	<0.2	<0.2	<0.1	<0.2	<0.2	<0.1
8	<0.2	<0.2	<0.1	<0.2	<0.2	<0.1
9	<0.2	<0.2	<0.1	<0.2	<0.2	<0.1
10	<0.2	<0.2	<0.1	<0.2	<0.2	<0.1
11	<0.2	<0.2	<0.1	<0.2	<0.2	<0.1
12	<0.2	<0.2	<0.1	<0.2	<0.2	<0.1
13	<0.2	<0.2	<0.1	<0.2	<0.2	<0.1
14	<0.2	<0.2	<0.1	<0.2	<0.2	<0.1
15	<0.2	<0.2	<0.1	<0.2	<0.2	<0.1
16	<0.2	<0.2	<0.1	<0.2	<0.2	<0.1
17	<0.2	<0.2	<0.1	<0.2	<0.2	<0.1
18	<0.2	<0.2	<0.1	<0.2	<0.2	<0.1
19	<0.2	<0.2	<0.1	<0.2	<0.2	<0.1
20	<0.2	<0.2	<0.1	<0.2	<0.2	<0.1
21	<0.2	<0.2	<0.1	<0.2	<0.2	<0.1
22	<0.2	<0.2	<0.1	<0.2	<0.2	<0.1
23	<0.2	<0.2	<0.1	<0.2	<0.2	<0.1
24	<0.2	<0.2	<0.1	<0.2	<0.2	<0.1
23	<0.2	<0.2	<0.1	<0.2	<0.2	<0.1
25	<0.2	<0.2	<0.1	<0.2	<0.2	<0.1
26	<0.2	<0.2	<0.1	<0.2	<0.2	<0.1
27	<0.2	<0.2	<0.1	<0.2	<0.2	<0.1
28	<0.2	<0.2	<0.1	<0.2	<0.2	<0.1
29	<0.2	<0.2	<0.1	<0.2	<0.2	<0.1
30	<0.2	<0.2	<0.1	<0.2	<0.2	<0.1

GQS = Groundwater Quality Standard

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Site	Styrene (µg/L)	Tertiary Butyl Ethyl Ether (µg/L)	Methyl Tertiary Butyl Ether (µg/L)	Tetrachloro-Ethylene (µg/L)	Tetra-Chloro-Methane (µg/L)	Toluene (µg/L)
	GQS = 100 µg/L		GQS = 20 µg/L	GQS = 5 µg/L		GQS = 1000 µg/L
1	<0.1	<0.1	<0.2	<0.2	<0.2	<0.1
2	<0.1	<0.1	3.5	<0.2	<0.2	<0.1
3	<0.1	<0.1	<0.2	<0.2	<0.2	<0.1
4	<0.1	<0.1	<0.2	<0.2	<0.2	<0.1
5	<0.1	<0.1	<0.2	<0.2	<0.2	<0.1
6	<0.1	<0.1	<0.2	<0.2	<0.2	<0.1
7	<0.1	<0.1	<0.2	<0.2	<0.2	<0.1
8	<0.1	<0.1	<0.2	<0.2	<0.2	<0.1
9	<0.1	<0.1	<0.2	<0.2	<0.2	<0.1
10	<0.1	<0.1	<0.2	<0.2	<0.2	<0.1
11	<0.1	<0.1	<0.2	<0.2	<0.2	<0.1
12	<0.1	<0.1	<0.2	<0.2	<0.2	<0.1
13	<0.1	<0.1	<0.2	<0.2	<0.2	<0.1
14	<0.1	<0.1	<0.2	<0.2	<0.2	<0.1
15	<0.1	<0.1	<0.2	<0.2	<0.2	<0.1
16	<0.1	<0.1	<0.2	<0.2	<0.2	<0.1
17	<0.1	<0.1	<0.2	<0.2	<0.2	<0.1
18	<0.1	<0.1	<0.2	<0.2	<0.2	<0.1
19	<0.1	<0.1	<0.2	<0.2	<0.2	<0.1
20	<0.1	<0.1	<0.2	<0.2	<0.2	<0.1
21	<0.1	<0.1	<0.2	<0.2	<0.2	<0.1
22	<0.1	<0.1	<0.2	<0.2	<0.2	<0.1
23	<0.1	<0.1	<0.2	<0.2	<0.2	<0.1
24	<0.1	<0.1	<0.2	<0.2	<0.2	<0.1
23	<0.1	<0.1	<0.2	<0.2	<0.2	<0.1
25	<0.1	<0.1	<0.2	<0.2	<0.2	<0.1
26	<0.1	<0.1	<0.2	<0.2	<0.2	<0.1
27	<0.1	<0.1	<0.2	<0.2	<0.2	<0.1
28	<0.1	<0.1	<0.2	<0.2	<0.2	<0.1
29	<0.1	<0.1	<0.2	<0.2	<0.2	<0.1
30	<0.1	<0.1	<0.2	<0.2	<0.2	<0.1

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Site	Trans 1, 2, Di-Chloro-Ethene (µg/L)	Tri- Bromo-Methane (µg/L)	Tri-Chloro-Ethene (µg/L)	Tri- Chloro-Fluoro-Methane (µg/L)	Tri-Chloro-Methane (µg/L)	Vinyl Chloride (µg/L)
			GQS = 5 µg/L			GQS = 2 µg/L
1	<0.1	<0.2	<0.1	<0.2	0.8	<0.2
2	<0.1	<0.2	<0.1	<0.2	<0.1	<0.2
3	<0.1	<0.2	<0.1	<0.2	<0.1	<0.2
4	<0.1	<0.2	<0.1	<0.2	<0.1	<0.2
5	<0.1	<0.2	<0.1	<0.2	<0.1	<0.2
6	<0.1	<0.2	<0.1	<0.2	<0.1	<0.2
7	<0.1	<0.2	<0.1	<0.2	<0.1	<0.2
8	<0.1	<0.2	<0.1	<0.2	<0.1	<0.2
9	<0.1	<0.2	<0.1	<0.2	<0.1	<0.2
10	<0.1	<0.2	<0.1	<0.2	<0.1	<0.2
11	<0.1	<0.2	<0.1	<0.2	<0.1	<0.2
12	<0.1	<0.2	<0.1	<0.2	<0.1	<0.2
13	<0.1	<0.2	<0.1	<0.2	<0.1	<0.2
14	<0.1	<0.2	<0.1	<0.2	<0.1	<0.2
15	<0.1	<0.2	<0.1	<0.2	<0.1	<0.2
16	<0.1	<0.2	<0.1	<0.2	<0.1	<0.2
17	<0.1	<0.2	<0.1	<0.2	<0.1	<0.2
18	<0.1	<0.2	<0.1	<0.2	<0.1	<0.2
19	<0.1	<0.2	<0.1	<0.2	<0.1	<0.2
20	<0.1	<0.2	<0.1	<0.2	<0.1	<0.2
21	<0.1	<0.2	<0.1	<0.2	<0.1	<0.2
22	<0.1	<0.2	<0.1	<0.2	<0.1	<0.2
23	<0.1	<0.2	<0.1	<0.2	<0.1	<0.2
24	<0.1	<0.2	<0.1	<0.2	<0.1	<0.2
23	<0.1	<0.2	<0.1	<0.2	<0.1	<0.2
25	<0.1	<0.2	<0.1	<0.2	<0.1	<0.2
26	<0.1	<0.2	<0.1	<0.2	<0.1	<0.2
27	<0.1	<0.2	<0.1	<0.2	<0.1	<0.2
28	<0.1	<0.2	<0.1	<0.2	<0.1	<0.2
29	<0.1	<0.2	<0.1	<0.2	<0.1	<0.2
30	<0.1	<0.2	<0.1	<0.2	<0.1	<0.2

GQS = Groundwater Quality Standard