west virginia department of environmental protection

Groundwater Programs and Activities

Biennial Report to the West Virginia 2014 Legislature

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Table of Contents

Table of Contents

GROUNDWATER BIENNIAL REPORT TO THE 2014 LEGISLATURE

I. EXECUTIVE SUMMARY

The Groundwater Protection Act, West Virginia Code Chapter 22, Article 12, Section 6.a.3, requires the West Virginia Department of Environmental Protection (WVDEP) to submit 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 holds groundwater regulatory responsibility. This is the eleventh Groundwater Biennial Report to the legislature since the passage of the Act in 1991, and covers the period from July 1, 2011 through June 30, 2013.

The WVDEP Division of Water and Waste Management (DWWM) Groundwater Program is responsible for compiling and editing the information contained in this report. The WVDEP, the West Virginia Department of Agriculture (WVDA), and the West Virginia Department of Health and Human Resources (WVDHHR) all have groundwater regulatory responsibility and have contributed to this report. The boards and standing committees that share the responsibility for developing and implementing rules, policies, and procedures for the Ground Water Protection Act are: the Environmental Quality Board, the Groundwater Coordinating Committee, the Groundwater Protection Act Committee, the Groundwater Monitoring Well Drillers Advisory Board, the Well Head Protection Committee, and the Non-Point Source Coordinating Committee.

The purpose of this report is to provide a concise, yet thorough, overview of the programs charged with the responsibility of protecting and ensuring the continued viability of groundwater resources in West Virginia and to express the challenges faced, and the goals accomplished as the agencies, programs, and committees work together to protect and restore West Virginia's water resources.

Research regarding specific hydrogeologic information about the state's groundwater, such as regional and local potentiometric surfaces (water levels), groundwater quality, groundwater flow studies, and access to statewide dedicated groundwater monitoring data continues. As more regulated development occurs, especially pertaining to stormwater discharge, the WVDEP continues to compile a database of constituents found in stormwater that can be utilized to protect groundwater resources. As more stormwater discharge sites come under regulation, a clearer picture begins to emerge of potential contaminants found in stormwater.

The Ambient Groundwater Quality Monitoring Network was established by DWWM in cooperation with the United States Geological Survey (USGS) in 1992, and is an ongoing project. This network provides valuable data critical to the management of West Virginia's groundwater resources. The major objective of the study is the assessment of the ambient groundwater quality of major systems (geologic units) within

the state, and the characterization of the individual systems. Characterization of the quality of water from the major systems will help to (1) determine which water quality constituents are problematic, (2) determine which systems have potential water quality problems, (3) assess the severity of water quality problems in respective systems, and (4) prioritize these concerns. Only by documenting the present ambient groundwater quality of the major systems can regulatory agencies assess where water quality degradation has occurred and where potential degradation is a result of natural processes or human activity.

The USGS West Virginia Water Science Center, in cooperation with the West Virginia Department of Environmental Protection's Division of Water and Waste Management, collects and analyzes water samples and interprets the analytical results of these samples as part of the Ambient Groundwater Program. The program alternates between long-term monitoring of a set of 26 "sentinel" wells and focused topical studies that examine factors that may influence groundwater quality.

The sentinel wells, selected to represent important environmental settings in West Virginia, are sampled every five years to evaluate trends in groundwater quality. Samples from these wells are analyzed for major ions, metals, trace elements, and nutrients. Analyses for organic compounds are performed on samples from sites susceptible to such contamination, based on previous studies (Chambers and others, 2012; http://pubs.usgs.gov/sir/2012/5186/). The first round of sentinel well samples was collected in 2010 with a second round scheduled for 2015.

Topical studies are conducted in the four years between rounds of sentinel well sampling. In topical studies water-quality samples are collected, analyzed, and the results presented in a USGS Scientific Investigation Report. Since 2011 the USGS has collected samples to determine baseline water-quality conditions in Upper Monongahela River Basin, an area of Marcellus Shale gas development. Groundwater samples from 41 wells and baseflow samples from 50 surface-water sites were collected and analyzed for major ions, metals, trace elements, and naturally-occurring radioactive materials. The results of these analyses will be published in a USGS report to be completed by September 2014.

While many challenges remain, much has been done to provide protection and continued viability of West Virginia's groundwater resources. The WVDEP, WVDA, WVDHHR, and USGS continue to work closely to fulfill the mission of the Department of Environmental Protection, "Promoting a healthy environment".

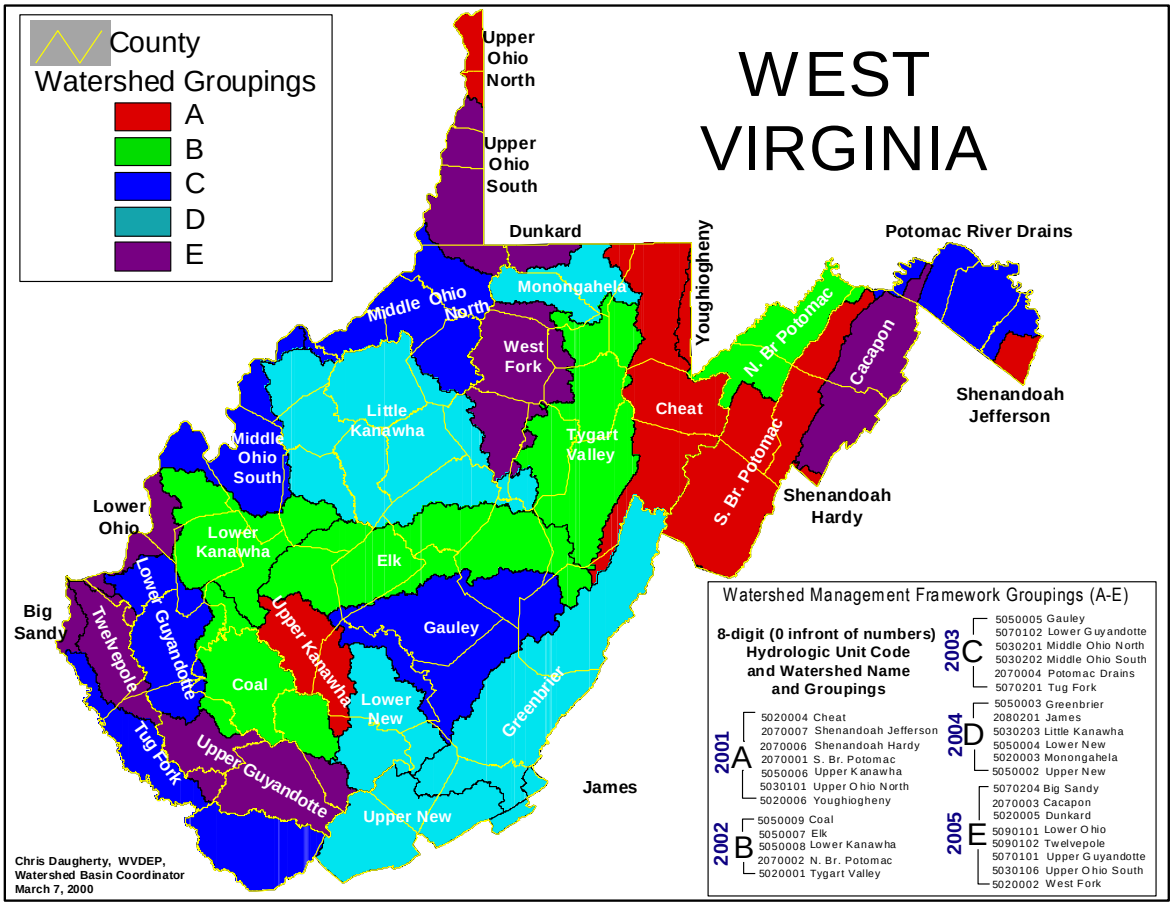
II. GROUNDWATER PROTECTION and WATERSHED MANAGEMENT

Under the guidance of the United States Environmental Protection Agency (EPA) and the signing of the West Virginia Watershed Management Framework Document (signed in 1997), a new approach to management of the state's groundwater has begun. Total watershed management strives to bring a holistic approach to protecting the waters of the state. The signing of this document by the 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. WVDEP has chosen to participate as a partner and stakeholder in watershed management in West Virginia.

Agencies having groundwater regulatory authority and responsibility provide repositories for ground and surface water data collected about those facilities under their authority. As stated in this report's executive summary, compilation of the available groundwater data into a collective database continues as a work in progress, providing a picture of the state's groundwater protection activities and the contributions of the associated programs.

Eventually, all groundwater data that is generated by these activities and facilities will be housed in a central data repository overseen by senior scientists from each agency under the guidance of the WVDEP's Groundwater Coordinating Committee and Information Technology Office. We anticipate that population of the central database will be implemented using a watershed approach. Each watershed is comprised of smaller divisions called sub-watersheds from which data will be gathered and entered systematically until the larger picture emerges.

West Virginia Watershed Groups



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).

West Virginia Environmental Quality Board

Appellate Activities

The Board is authorized by *W.Va. 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:

Andrew and Karen Zetts
Appeal No. 08-02-EQB
Filed: January 7, 2008
Dismissed: March 5, 2013

Appalachian Power Company/dba American Electric Power
Appeal No. 08-30-EQB
Filed: November 5, 2008
Agreed Order: October 26, 2011

Gypsy, LLC
Appeal No. 10-35-EQB
Filed: September 9, 2010
Pending

Jim Probst
Appeal No. 11-06-EQB
Filed: February 7, 2011
Final Order: March 29, 2012

Stevan Hudock
Appeal No. 11-10-EQB
Filed: February 24, 2011
Final Order: February 13, 2012

WVA Manufacturing LLC
Appeal No. 11-23-EQB
Filed: June 29, 2011
Agreed Order: March 29, 2012

Koppers, Inc.
Appeal No. 13-03-EQB
Filed: February 11, 2013
Pending

Dennis V. Garrison, III
Appeal No. 13-11-EQB
Filed: April 10, 2013
Withdrawn: July 10, 2013

Constellium Rolled Products
Appeal No. 13-15-EQB
Filed: May 15, 2013
Pending

Independent Oil and Gas Association of West Virginia, Inc.
Appeal No. 13-17-EQB
Filed: June 12, 2013
Pending

Review of Civil Administrative Penalties

W. Va. 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 of the agency. There were four appeals filed during the reporting period pursuant to this section.

IV. WEST VIRGINIA DEPARTMENT OF AGRICULTURE

Regulatory and Environmental Affairs Division
Water Quality Protection

A. Pesticide Regulatory Programs

A pesticide is defined as any substance or mixture of substances intended for preventing, destroying, repelling or mitigating any pest. Often misunderstood to refer only to insecticides, the term pesticides also applies to herbicides, fungicides, rodenticides and various other substances used to control pests. Pesticides can cause harm to humans, animals, or the environment because they are designed to kill potential disease-causing organisms and control insects, weeds, and other pests. This presents a risk benefit scenario where humans, animals and the environment, including water are at risk to be adversely affected. Therefore, it is deemed necessary to regulate and control pesticides by their registration, use and application.

The Pesticide Regulatory Programs Unit regulates and controls pesticides through ARTICLE 16A- WEST VIRGINIA PESTICIDE CONTROL ACT and the following legislative and procedural rules:

TITLE 61 SERIES 12 - FEE STRUCTURE FOR THE PESTICIDE CONTROL ACT OF 1990

TITLE 61 SERIES 12A -CERTIFIED PESTICIDE APPLICATOR RULES AND REGULATIONS

TITLE 61 SERIES 12B -LICENSING OF PESTICIDE BUSINESSES

TITLE 61 SERIES 12C -WOOD DESTROYING INSECT TREATMENT STANDARDS

TITLE 61 SERIES 12D -AERIAL APPLICATION OF HERBICIDES TO UTILITY RIGHTS-OF-WAY

TITLE 61 SERIES 12E -REGISTRY OF PERSONS WITH HEALTH SENSITIVITY TO PESTICIDE DRIFT

TITLE 61 SERIES 12F - ASSESSMENT OF CIVIL PENALTIES AND PROCEDURES FOR CONSENT AGREEMENT OR NEGOTIATED SETTLEMENT

TITLE 61 SERIES 12G - GENERAL GROUNDWATER PROTECTION FOR PESTICIDES

TITLE 61 SERIES 12H -BULK PESTICIDE OPERATIONAL RULES

TITLE 61 SERIES 12I - NON-BULK PESTICIDE RULES FOR PERMANENT OPERATIONAL AREAS

TITLE 61 SERIES 12J - INTEGRATED PEST MANAGEMENT PROGRAMS IN SCHOOLS AND DAY CARE CENTERS

TITLE 61 SERIES 22 - GENERIC STATE MANAGEMENT PLAN FOR PESTICIDES AND FERTILIZERS IN GROUNDWATER

TITLE 61 SERIES 22A -BEST MANAGEMENT PRACTICES AT TEMPORARY OPERATIONAL AREAS FOR NON-BULK PESTICIDE MIXING AND LOADING LOCATIONS

CHAPTER 22 ARTICLE 12. GROUNDWATER PROTECTION ACT

In addition to enforcing the above regulations, the Pesticide Regulatory Programs works with the United States Environmental Protection Agency (USEPA) Office of Pesticide Programs (OPP) and the Office of Enforcement and Compliance Assurance (OECA) through a cooperative agreement to enforce the Federal Insecticide Fungicide and Rodenticide Act (FIFRA). As outlined in guidance and written in the agreement, the Pesticide Regulatory Programs works with EPA Region 3 to establish priorities and demonstration of progress towards the protection of water resources from pesticides. This program is known as the Pesticides in Water Program.

The goal of WVDAs Pesticides in Water Program is to insure that pesticides do not adversely affect the nation's water resources. In order to manage pesticides in water the Pesticide Regulatory Programs utilizes a three-tier approach:

1. Evaluate Pesticides of Interest over time.

2. Take actions (actively manage beyond the pesticide label) to reduce or prevent contamination from pesticides of concern over time.

3. Demonstrate the progress of the management strategy in reducing or maintaining concentrations below reference points.

Tier 1 Pesticides of Interest: Pesticides of interest are those pesticides that have been identified by the States in the survey conducted by States FIFRA Issues Research and Evaluation Group in 2005 (Appendix 1). Other pesticides of interest could be added if they cause water quality impairments under the Clean Water Act §303(d) as listed, or become an interest of the West Virginia Department of Agriculture (WVDA).

Pesticides of interest are those pesticides that have the potential to occur in ground or surface water at concentrations approaching or exceeding a human health or ecological reference point. It may be based on a Maximum Contaminant Level (MCL), drinking water health advisory, surface or ground water quality standard (which can address human or aquatic life toxicity), EPA reference dose, EPA drinking water level of concern, or another benchmark adopted by regulation or policy. A pesticide of interest could be an active ingredient alone or the active ingredient collectively with degradates of toxicological concern.

Tier 2 Pesticides of Concern: Pesticides that are identified as a concern from Step 1 must be managed. A pesticide is actively "managed" when activities are carried out to prevent or reduce contamination of water by a particular active ingredient so that it is prevented from reaching a specified reference point as mentioned above.

An example of a tier 2 pesticide is the herbicide Atrazine. Atrazine's widespread use on corn and high solubility in water chemistry led to detections nationwide of the parent compound and its break down products, (also known as degradates) in both surface and ground water.

WVDA relies heavily on public outreach and user education to manage pesticides of concern. The pesticide applicator certification process continuously addresses concerns of pesticides in water. This includes study material supplied for written examinations as well as initial certification training sessions. All commercial applicators using general or restricted use pesticides and all private applicators must maintain certification by attending recertification training sessions. Recertification training sessions are another opportunity to manage pesticides of concern.

Routine agricultural use inspections by Pesticide Regulatory Officers address existing water quality-related label restrictions and State regulations. Adherence to label specified setbacks from surface water and field drainage sites is emphasized. Under the existing enforcement process first time violators are notified by letter. Additional violations can result in monetary fines or license revocation.

WVDA works very closely with the West Virginia Conservation Agency in the promotion of and adoption of voluntary Best Management Practices (BMP) shown to reduce impacts by pesticides. Examples include riparian buffer zones, filter strips and no till cultivation.

Tier 3 Demonstration of progress: After a pesticide has advanced through the first two tiers, progress toward reductions in concentrations below a previously exceeded reference point should be demonstrated. At this stage the steps taken to manage a pesticide of concern in order to keep (or return) pesticide concentrations in water to below a reference point should be outlined or the certification of widespread adoption of control measures should be demonstrated. Progress toward reduction or maintenance of concentrations below the reference point could be demonstrated by:

- Targeted monitoring of water samples from vulnerable use areas that determines that mitigation measures are preventing residue levels from approaching or exceeded a reference point.

- Downward trends in concentration levels established by monitoring data in geographic areas where the pesticide of concern is being used (data from USGS, registrant, USDA, or other sources).

- The results of targeted surveys or inspections that document the wide adoption of voluntary or regulatory measures which have been proven via research to protect water quality.

While monitoring is not required under Tier 3 it is the most reprehensive method of showing a decrease in a particular pesticides occurrence in water. WVDA has historically referenced studies from allied agencies such as the United States Geological Service. In addition, WVDA closely observes the data provided by the West Virginia Department of Environmental Protection's Ambient Water Quality Monitoring (AWQM) Network.

Cancellation of a pesticide's use in the state would be the most severe action taken under tier 3. Historically Tier 3 actions have involved the re-classification of a general use pesticide (as classified by USEPA) to a State restricted use pesticide (RUP). Use of State RUPs require that applicators become certified under state licensing programs before the product can be bought and used. Other conditions could be placed on the restricted use license such as product specific training.

WVDA is confident that the uniformity of the development of its environmental programs, the continued interagency cooperation, and the reliance on successfully demonstrated management practices will facilitate the accountability tier of the management program.

Pesticides in Water Program – Reporting Requirements

Activities related to the Pesticides in Water Program are reported under the web based Pesticides of Interest Tracking System (POINTS). POINTS is a national reporting system funded by USEPA and can be found at http://points.wsu.edu.

From the POINTS system data, USEPA expects to be able to:

- Determine how pesticides of interest were evaluated.
- Identify pesticides of concern (pesticides that approach or exceed reference points).
- Identify pesticides of concern that are being actively managed and which may need more effective management at the national level e.g., label changes, special studies.
- Identify pesticides for which national water quality standards, aquatic life criteria, or other national regulatory standards or reference points are needed.
- Demonstrate that state and tribal water quality management programs are effective at reducing pesticide risks to water quality *locally*.

- ❖ Identify states in which the FIFRA lead agency is using its resources to address pesticide impaired waters under CWA §303(d).

Other activities that advance the goal of developing and carrying out programs to protect water resources from pesticide risks:
Plastic Pesticide Container Recycling Program

More than 20,000 lbs. of plastic pesticide containers were collected for recycling in the 2011 and 2012 growing seasons. WVDA maintains pesticide collection container facilities in Berkeley, Greenbrier, Hardy, Kanawha, Lewis, Jefferson, Mason and Ohio counties. Sea containers have historically been rented to store the plastic for recycling. In 2012, two sea containers were purchased in order to reduce the costs of rental units in the coming years. The continuation of this program is a legitimate protection of ground water in that it requires the triple rinsing or pressure rinsing of containers and therefore reduces the number of plastic pesticide containers that may enter the waste stream containing residues of pesticides. Containers are shred and remanufactured into shipping pallets, drainage tile, composite lumber or other low contact nonfood containing plastic items.

Properly rinsed pesticides containers being put into storage for subsequent recycling.

Pesticide Waste Disposal Program

A total of 23,050 lbs. of waste and unwanted pesticides were collected and disposed of in the past two years. The ongoing collection and annual disposal of waste and unwanted pesticides is another program aimed at reducing the potential of pesticides to reach water. In addition to fielding phone calls to pick up unwanted pesticides the program specialist worked with the representatives of the West Virginia University Extension Service and WV Conservation Agency in the South Branch of the Potomac River watershed to dispose of unwanted pesticides. Extension and conservation offices distributed,

advertised and collected disposal inventory. Pesticides were collected in Grant, Hardy, Hampshire, and Pendleton counties. In addition, the program manager worked with the Berkeley County (Martinsburg, WV) solid waste authority to conduct a countywide homeowner waste pesticide collection on a Saturday where 2,532 lbs. contributed to the overall total.

Waste pesticide collected for disposal.

Bulk Pesticides Storage Facilities

Bulk pesticides storage facilities are inspected annually. In addition to the secondary containment having an adequate capacity to capture a catastrophic spill the Bulk Operational Rules (§61-12H) require that pumps, transfer lines and other appendages be inspected and maintained in good operational condition and written emergency and discharge response plan be in place. A recent enforcement action resulted in a civil penalty of $600 for failure to comply with components of the Bulk Pesticide Operational Rules. Secondary containment for bulk pesticide storage and operational area containment (mix and load area) were not liquid tight and the facility lacked a current and complete written emergency and discharge response plan.

Secondary containment at a bulk pesticide facility.

Appendix 1

State List of Pesticides of Water Quality Concern

Source: State Survey for Water Resource Monitoring Programs and Analytical Parameters
October 2005 - Conducted by the SFIREG WQ/PD Working Committee
Includes chemicals of concern for both ground and surface water

2,4-D	Isoxaflutole
Acetochlor (+ ESA, OXA	Lambda-cyhalothrin
Alachlor (+ ESA)	Lindane (Voluntarily cancelled, use of existing stocks permitted until October 1, 2009)
Aldicarb (+ degradates)	Malathion
Atrazine (+ DEA, DIA, DACT, Hydroxy)	Mesotrione
Azinphos-methyl	Metalaxyl
Bentazon	Metsulfuron Methyl
Bromacil	Metolachlor (+ ESA, OXA, S-Metolachlor)
Carbaryl	Metribuzin (+ DA, DADK, DK)
Carbofuran (Cancellation being prepared)	MSMA + other arsenical herbicides
Chlorothalonil	Napropamide
Chlorpyrifos (+ TCP)	Norflurazone (+ degradates)
Clopyralid	Pendimethalin
Copper Pesticides	Phenoxy herbicide group
Dacthal (+ degradates) (Cancellation being Prepared)	Phosmet
DBCP	Picloram
Diazinon	Prometon
Dicamba	Prometryn
Dimethenamid	Propazine
Diuron	Propiconazole
Endosulfan	Simazine (+ DACT, DIA)
Esfenvalerate	Sulfometuron (et. al.)
Ethoprop	Tebuthiuron
Glyphosate (+ AMPA)	Terbacil
Hexazinone (+ Metabolite B)	Thiamethoxam
Imazamethabenz	Tralkoxydim
Imazapyr	Triallate
Imidacloprid	Triclopyr
	Trifluralin

Groundwater Projects – Moorefield Environmental Programs

Several programs are in place at the Moorefield Agricultural Center to monitor and improve water quality. The Environmental Programs section continues to monitor surface water quality in West Virginia. Environmental staff collects approximately 3,200 water quality samples per year on seventeen (17) streams in West Virginia's eastern panhandle including Lost River, New Creek, Cabin Run, Little Cacapon River, Patterson Creek, Opequon Creek, Sleepy Creek, South Branch of the Potomac River, Mill Creek (Hampshire County), North Fork of the South Branch of the Potomac River, South Fork of the South Branch of the Potomac River, Mill Creek (Grant County), Patterson Creek, Bullskin Run, Elk Branch, Elks Run, and Rockymarsh Run.

These water quality samples are analyzed for parameters such as pH, Temperature, Conductivity, Dissolved Oxygen, Nitrate, Nitrite, Ammonia, Orthophosphate, Total Phosphorous, Turbidity, and Total Suspended Solids. Water quality analysis has been provided to interested watershed organizations and other state agencies.

Environmental Programs staff works with area farmers to promote Best Management Practices (BMPs) that reduce nutrient and sediment runoff and increase farm productivity. They are also working with farmers to identify and report non cost share BMPs that currently exist on agricultural operations.

One BMP that the Department specifically promotes is a Nutrient Management Plan (NMP) which specifies cropping recommendations for all acreage to which commercial fertilizer, litter or manure is applied. Results of soil tests, coupled with specific crop yields or soil utilization, are used to develop recommendations concerning amounts of fertilizers to be applied to each field. To facilitate Nutrient Management Plan implementation, the WVDA Nutrient Management Laboratory in Moorefield routinely analyzes over 200 litter/manure samples per year.

West Virginia's Watershed Implementation Plan (WIP) has a goal of 90,000 acres under Nutrient Management Plans. To assist poultry growers, educational meetings and workshops are routinely conducted by Environmental Programs staff and the West Virginia University Cooperative Extension Service. In an effort to incorporate nutrient management into all existing poultry operations, the staff of the West Virginia Conservation Agency and USDA Natural Resources Conservation Service provides technical assistance to local integrators in developing nutrient management plans. There are currently over 100 certified Nutrient Management Planners in the State of West Virginia.

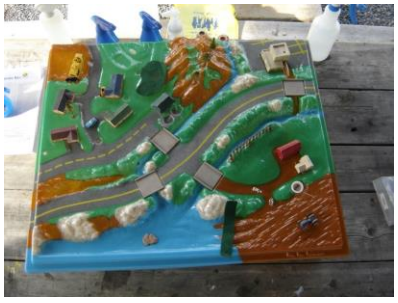
The Environmental Programs Section participates in several education and outreach events each year. Staff attends County fairs in the Eastern Panhandle to inform citizens about environmental issues related to local waters

and the Chesapeake Bay. Additionally, staff proactively takes part in Chesapeake Bay conferences and forums to understand critical issues while asserting West Virginia's water quality goals.

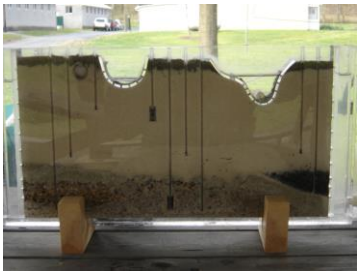
Water quality putt-putt was a fun and well received tool at this year's Tri-County fair:

WVDA staff takes an active role planning and implementing the West Virginia Envirothon. At this event, teams of West Virginia high school students gather to compete in knowledge of forestry, soils, aquatics, wildlife and current environmental topics. WVDA is collaborating with the West Virginia Conservation Agency and the WVU Davis College of Agriculture, Natural Resources and Design to develop the 2014 contest.

Staff also attends 4-H camps and works throughout the school year to inform youth about point and non-point source pollution and how pollution affects ground and surface waters. This is accomplished by using hands on activities such as the EnviroScape and the Groundwater Model.



The EnviroScape shows students where pollution can come from and the difference between point and non-point source pollution. The model shows students how pollution can be reduced from reaching our streams, our groundwater and the Chesapeake Bay.



The Groundwater Model shows a cross section of soil and shows how groundwater moves through the soil profiles. The Groundwater Model is used to show students how a leaking polluted lake, septic tank, lagoon or groundwater can pollute not only the water in our streams but also the water that we consume.

Fertilizer Rules – Agricultural Materials Section

The West Virginia Department of Agriculture is monitoring fertilizer through legislative and procedural rules. These rules include:

61 CSR 6B	Primary and Secondary Containment of Fertilizer
61 CSR 22B	Best Management Practices for Fertilizers and Manures

61 CSR 6B. The Primary and Secondary Containment of Fertilizer rule establishes standards for the purpose of protecting the groundwater resources of the State of West Virginia.

Facilities regulated by this rule must submit a design plan and specifications for construction to the Commissioner for approval. This applies to both liquid and dry fertilizers. The operator of a storage facility shall prepare a written Discharge Response Plan for the storage facility for each type of bulk fertilizer stored that includes procedures used in controlling and recovering, or otherwise responding, to a discharge. Yearly inspections are completed to ensure compliance.

61 CSR 22B. Best Management Practices for Fertilizers and Manures (BMP's) is a procedural rule to prevent or minimize the entry of nutrients from fertilizers and manures into groundwater while maintaining and improving the soil and plant resources of the State. Best Management Practices for Fertilizers and Manures calls for fertilizers to be stored inside a sound structure or device having a cover or roof top, side walls, and a base sufficient to prevent contact with precipitation and surface water. Manure is to be stored in a facility that meets or exceeds the standards of the Soil Conservation Service Field Office Technical Guide.

Regulatory Officers with the West Virginia Department of Agriculture routinely pull samples for quality assurance and label compliance monitoring of commercial fertilizers through Legislative Rule 61-6 – Sale and Distribution of Fertilizer.

IV. DEPARTMENT of AGRICULTURE

B. West Virginia Conservation Agency

The West Virginia Conservation Agency (WVCA) focuses its resource conservation efforts on the maintenance and/or improvement of water quality relative to natural resource use with a primary focus on agriculture and construction activities. The main concern is for surface water quality but activities impacting groundwater resources are addressed through conservation programs that implement Best Management Practices (BMPs), provide technical support, and involve educational outreach to the citizens throughout the state.

The WVCA continues it's "Conservation Partnerships" with state, federal and local agencies as well as the private sector and many non-profit organizations. This cooperative approach provides benefits such as funding for projects, technical expertise and enables citizen input assisting our agency to pinpoint and target specific problems in specific areas. "Conservation Partnerships" continue to be an effective way to address West Virginia's concerns and in providing the resources vital in the solutions and/or prevention of water quality degradation issues.

Our state has a diversity of terrain and geology that challenges natural resource conservationists with a multitude of issues that must be confronted by methods that are both effective and sensitive to the specific location and individuals affected.

The West Virginia Conservation Agency (WVCA) undertook the following activities which either directly or indirectly protect West Virginia's groundwater resources during the reporting period of July 1, 2011 through June 30, 2013.

Agricultural Activities

Cost share programs have been a significant contributor to encourage landowners to develop conservation practices on their property.

- WVCA works with the United States Department of Agriculture Natural Resources Conservation Service (USDA NRCS) and farmers to assist with riparian buffers through the Conservation Reserve Enhancement Program (CREP) on 73 farms protecting 106,169 linear feet of streambank, 1,642 acres of karst geology with estimated sediment load reduction of 129,752.17 tons/year. Fifty-nine agricultural conservation plans and 127 nutrient management plans for 8,110.68 acres were reviewed or written. Through these plans approximately 309,985.6 pounds of nitrogen (N) and 311,511 pounds of phosphorus (P) were properly managed and applied to agriculture lands, reducing the potential for leaching of these nutrients into groundwater

resources.

- ❖ WVCA works with NRCS and farmers to assist with riparian buffers through CREP on 71 farms protecting 101,149 linear feet of stream bank, 2608 acres of karst geology with estimated sediment load reduction of 182,053.98 tons/year. Sixty agricultural conservation plans were written and 116 nutrient management plans for 5,261.1 acres were reviewed or written. Through these plans approximately 274,062 pounds of nitrogen and 397,711 pounds of phosphorus were properly managed and applied to agriculture lands, reducing the potential for leaching of these nutrients into groundwater resources.

- ❖ WVCA serves as a technical resource on the West Virginia Concentrated Animal Feeding Operation Committee.

- ❖ WVCA serves on the WV Nutrient Management Committee that oversees planner certification and develops resource management practices concerning chemical fertilizer, livestock manure and poultry litter utilization.

Sediment

In construction assistance, the WVCA reviewed 48 sediment and erosion control plans for construction sites less than one acre in size; facilitating the conservation of an estimated 1,011.76 tons of soil. Plans are reviewed for the appropriate best management practices to prevent sedimentation of the state's waters and underground aquifers.

The WVCA provided technical stormwater management assistance to 182 construction projects by providing recommendations for BMPs to alleviate problem areas. BMPs include sediment catchment and erosion prevention systems on small construction sites so water is contained as long as possible and released slowly into natural waterways or allowed to infiltrate into the ground. Reduction of these pollutants reduces the overall need for filtration and potential contamination of pathogens in both public and private water supplies.

Additionally, a total of 38,967 feet of severely eroding streambanks were restored saving 14,985 tons of sediment from entering the streams and underground aquifers each year. Twenty-three watershed associations throughout the state were provided technical and educational outreach support for sediment and construction related issues.

Management of Organic Animal Waste and Chemical Fertilizers

WVCA serves as a technical resource role on the West Virginia Concentrated Animal Feeding Operations Committee that worked to develop

rules to reduce or eliminate the nonpoint source pollution to surface and ground water due to animal agriculture operations. The Committee is working on ways to educate farmers, involved in animal agriculture, manage their small operations to prevent water pollution and continue to operate without having to obtain a CAFO permit. Recommendations are also being developed for the recommendations of set-back distances for the application of manures and fertilizer to prevent ground and surface water contamination.

WVCA serves on the West Virginia Nutrient Management Committee that oversees planner certification and develops resource management practices concerning chemical fertilizer, livestock manure and poultry litter utilization. The proper use of chemicals and fertilizers and improved animal waste management assures that only what can be used by pasture plants at one time is applied and no leaching of excess material is available to the groundwater.

- Soil sampling procedure training provided to WVCA Watershed and Conservation sections staff.

- 274 farmers were provided advice and information on soil sampling, programs available to assist them with their operations and/or developing farm plans.

- 517 Soil Samples were pulled on 7,229 acres.

- 2 poultry litter samples and 1 dairy manure sample sent for nutrient analysis.

- 2 WVCA Conservation Specialists received their Nutrient Management Certification.

- Provided BMP manure storage calculations to the West Virginia Department of Health regarding a dairy farm and information needed in order to permit the operation.

- Worked with WVU Extension to locate a farm with a liquid manure system to serve as a demonstration project for a Conservation Innovation Grant to deal with nutrient capture and better distribution of the nutrients; visited 2 farms and one was selected to participate in the research.

Pesticide Management

The Integrated Pest Management and Pesticide Management Programs focus on pesticide effect on the environment and alternatives to pesticide use. Many pesticides have soil residual effects and can leach into underground aquifers if not properly applied.

- One staff member received certification as a Certified Public Pesticide

Applicator in December 2012.

- 4 Educational programs on Pest Management were provided to commercial pesticide applicators.

- Provided information to Conservation District Cooperators on the control of invasive plants and herbicide use precautions to prevent non-target and water pollution problems.

- Pesticide Collection Program was held in cooperation with WVU Extension and Department of Agriculture in Hampshire, Hardy and Pendleton counties; a total of 3,699 lbs (1997 lbs. of pesticide liquid and 1702 lbs. pesticide solids) collected.

Pre-side Dress Nitrogen Testing Program

Soil sampled to determine application rates to achieve yield goals for corn farmers. Nitrogen is often over applied and can leach into both ground and surface water sources. This program provides farmers with information on how much nitrogen is needed to achieve their yield goal without over applying.

- 74 samples pulled on 3,501 acres, recommended nitrogen application rates reduced by 118,081 pounds.

- Worked with WVU Extension on a pilot program using a new method of nitrogen content in corn using a chlorophyll method.

- Pre-sidedress nitrogen testing done on 129 acres, 90 acres required no additional N to achieve yield goals, reducing the total needs for the acreage by 6,217 pounds. WVCA recommended additional nitrogen in the plan was 1,460 pounds or less than 40 pounds per acre.

The Agriculture Enhancement

The purpose of the Agriculture Enhancement Program is to promote the wise use of resources and improve water quality within watersheds impacted by agricultural activities. Technical and cost-share assistance is offered as an incentive to encourage producers to implement sound soil conservation practices that benefit production as well as environmental quality. These practices have direct and indirect beneficial effects on ground water quality by promoting healthier pastures and crop areas that reduce surface runoff and allow for greater infiltration of rain water. Practices that the program offers are:

Summary per practice		
Practice	**Unit Totals**	**Number of Paid Applications**
Cover Crop	2,343 acres	131
Exclusion Fence	6,098 feet	6
Frost Seeding	2,551 acres	53
Heavy Use Protection Area	11 areas	11
Invasive Species Management*	1,727 acres	71
Lime	12,191 acres/28,593 tons	358
Nutrient Management	2,970 acres	158
Pasture Division Fence	31,663 feet	21
Pasture Seeding	210 acres	8
Pond Clean Out	3 ponds	3
Stream Protection	5,783 feet	3
Urban Agriculture	5 units	5
Watering System	36 systems/components	36
Woodland Access Road	4 roads	4
*ISM acres include brush acres		**868**
Number of cooperators	**631**	

Educational Activities Specific to Groundwater

WVCA held 133 educational programs attended by 7,712 students, members of the public, producers, agency personnel and watershed association members. Twenty-five agricultural field days were held with 1,700 attendees. Other outreach activities included West Virginia Save Our Streams (WV SOS) training for 25 people, WVCA is still leading the WV SOS monitoring on 69 stations, and instructing a watershed management class at the West Virginia Conservation Camp for 200 students.

West Virginia Source Water Protection

The West Virginia Bureau of Public Health invited WVCA to be on the West Virginia Source Water Assessment/Wellhead Protection Program's Review and Liaison Committee. The committee is working to coordinate agencies and their programs in an effort to protect ground and surface water used for public drinking water.

WVCA cooperated with the West Virginia Bureau of Public Health and local stakeholders with the organization of a Source Water Protection Committee in Preston County.

Stormwater Management

WVCA provides technical advice regarding stormwater management quality and/or quantity issues to clients throughout the state. The primary method to control stormwater discharges is the use of best management practices (BMPS). WVCA provided 832 clients with a variety of BMP recommendations to control runoff. BMPs recommended included: tree plantings, swales, rain gardens, permeable pavers, wetlands, articulated blocks, vegetation plans, bioretention structures, erosion matting, stone berm, filter strips, rainwater harvesting, and streambank stabilization, diversion ditch, culvert outlet, culvert inlet protection, grading slopes, check dams, channel lining, detention pond, and increasing concentrated flows with increased stand of grass or herbaceous material on a critical area.

Marcellus Shale Natural Gas Play

WVCA provides information and assistance in selection of BMPs available, technical advice with water and land management schemes for landowners, agencies and development companies in order to protect the natural resources of the state while helping provide for the energy needs of our country. A total of 121 clients were assisted with soil amendments, vegetation recommendations, seed selection, water bars, invasive plant control and nutrient management for vegetation establishment.

- Worked with WVDEP Special Reclamation at a strip mine bond forfeiture site providing technical advice in regard to the establishment of a good cover of vegetation, soil sampling and general growing conditions assessment.

- Provided 1 farmer extensive information about establishing a productive pasture on a former strip mine and managing the pasture for long term sustainability.

- Worked with USDA NRCS Plant Materials Center to obtain and plant Red Osier Dogwoods, Dwarf Sand Cherries, and Dwarf Willows on a streambank project at Harrisville; approximately 1,240 feet of bank was planted.

- Worked with the Teays Valley Conservation District to develop a series of educational programs for landowners and farmers who are or may be dealing with horizontal drilling activities. WVCA made a presentation about the farm adjustments and planning needed to continue to operate during and after the well pads and / or pipelines are active on the farm.

- Triallate 3 gas well pad site evaluations and risk assessments were made with recommendations to prevent associated problems with the well pad developments from affecting the farm operations surrounding the sites, which could lead to some short and long duration problems.

WVCA Conservation Specialist Functions as 319 Incremental Project Managers

Lost River 319 Incremental – Hardy County

- 3651 linear feet of stream bank restored through natural stream restoration techniques, including livestock exclusion fencing which reduced nitrogen by 332 lbs. /yr., phosphorus by 340 lbs./yr. and sediment by 179 tons/yr.

- Two feedlot relocations on the mainstem of the Lost River reducing nitrogen loading by 1,287 lbs./yr., phosphorus 156.5 lbs./yr. and sediment by 24 tons/yr.

- Three and a half (305) acres were enrolled in a long-term buffer contract-N 215 lbs./yr., P20.9 lbs./yr. and sediment 4 tons/yr.

Mill Creek of the South Branch 319 Incremental – Hampshire County

- Three feedlot relocations reducing N by 3861 lbs. /yr. and P by 469 lbs./yr.

- Riparian buffer implementation on 386 acres reducing N by21, 864 lbs./yr., and P by 2,124 lbs. yr.

- Livestock exclusion fencing implementation of 52,464 linear feet reducing N by 776,467 lbs./yr. and P by 73,449 lbs./yr.

Muddy Creek 319 Incremental – Greenbrier County

The goal of the Muddy Creek 319 Incremental Project is to reduce the fecal coliform loads within the watershed from agricultural operations and failing septic systems. Projects completed to date include:

- 16 Septic System Upgrades

- 23 Septic System Pumpings

- 9 Agricultural BMP Projects



Alternative Water Spring Development

Kitchen Creek 319 Incremental - Monroe County

- 15,000 feet of exclusion fence
- 5 alternative watering systems
,
- 600 acres of conservation planning

Back Creek 319 Incremental - Monroe County

- 800 acres of conservation planning
- 4 alternative watering systems

Milligan Creek 319 Incremental - Greenbrier County

- 8500 feet of exclusion fence
- 4 alternative watering systems
- 2000 acres of conservation planning

South Fork of Potts Creek and Sweet Springs Creek of the James River 319 Incremental – Monroe County

- Began initial discussions with landowners regarding Ag BMP Projects after receiving grant award notice.

- ❖ Survey of pipeline and trough locations and development of Conservation Plan for Furrow Project.

- ❖ Complete Furrow Project (cooperative project with US Fish and Wildlife providing the funding source) – Installed 3,200 feet of pipeline, 1,200 gallon reservoir tank, and 6 tire troughs.

- ❖ Collected soil samples for landowner conservation plan.

- ❖ Assisted WVDA and local citizens with Potts Rail Trail signage project.

Second Creek / Karnes 319 Incremental – Monroe

- ❖ Provided technical assistance with project planning for alternative watering systems and fence projects.

Program Environmental Goals - The environmental goals of the 319 Incrementals in the Greenbrier Valley are to improve water quality by reducing the source of fecal coliform bacteria from entering waterways. Watersheds where TMDLs have indicated high impairments are targeted and numerous BMPs are installed.

Protection of Public/Private Water Supplies – Second creek is the source for water through much of Monroe County and has been targeted in tributaries where there is a tremendous livestock presence.

Challenges faced – Landowners perception of BMPs is the most challenging obstacle to overcome.

Proposed programs and projects – projects that implement BMPs and comprehensive conservation planning for grassland and nutrient management on karst land in the second creek and Milligan Creek / Davis Spring watersheds are proposed to directly impact groundwater.

Use of GIS – GIS is utilized for precision nutrient management planning, surveying for implementing watering systems, and identifying water monitoring sites.

Program Needs – One piece of equipment that would greatly enhance our program would be a ground penetrating radar unit. One to the highest cost of installing pipeline for water systems and the greatest unknown is the amount of hidden rock. Knowing the location of this rock could cut the cost of a watering system in half if it could be avoided. Additionally, the area was very active in farming for hundreds of years and has many hidden cemeteries without markers; this unit could prevent disturbing any unknown graves. Another aspect of the program that would benefit from this type of equipment would be using it to find

hidden fissures in the karst geology where sink holes will form and cause direct access to ground water.

WVCA is a full partner in the Chesapeake Bay Program. Chesapeake Bay efforts include:

The West Virginia Chesapeake Bay Program is an effort by the West Virginia Conservation Agency, West Virginia Department of Environmental Protection and West Virginia Department of Agriculture along with several other state, federal and local partners to implement the Chesapeake Bay **Total Maximum Daily Load** (TMDL), released by EPA on December 29, 2010.

The Chesapeake Bay Total Maximum Daily Load (TMDL) is a comprehensive "pollution diet" to restore the health of the Bay and its local streams, creeks and rivers. The Chesapeake Bay TMDL – the largest such cleanup plan ever developed by the U.S. Environmental Protection Agency (EPA) – sets limits on nitrogen, phosphorus and sediment pollution necessary to meet water quality standards in the Bay and its tidal rivers. The Chesapeake Bay TMDL was prompted by insufficient restoration progress and continued poor water quality in the Bay and its rivers. The TMDL is designed to ensure that all pollution control measures needed to fully restore the Bay and its tidal rivers are in place by 2025, with at least 60 percent of pollution reductions completed by 2017. West Virginia is charged with reducing nitrogen by 33%, phosphorus by 35% and sediment by 6% across the sectors. Watershed Implementation Plans (WIPs) detail how and when the six Bay states and the District of Columbia will meet their pollution allocations.

West Virginia developed and released its Phase II **Watershed Implementation Plan** (WIP) on March 30, 2012. The document describes how federal, state and local governments will achieve the pollution load reductions and sets the timeline for the required reductions. The Phase II WIP strategies address new, existing, and expanded sources of nutrients and sediments with detailed information. Reducing nitrogen, phosphorus, and sediment in local creeks and rivers will mean healthier water resources that are better able to sustain tourism, fishing, drinking water supplies, wildlife habitat, and other uses. These reductions are anticipated to come from a variety of sectors including point sources such as municipal wastewater treatment plants and industry, and nonpoint sources such as agriculture, forestry, urban, and suburban land uses. Two year draft milestones are set biennially for each pollution sector. The 2013-2014 milestones for reductions were favorably accomplished for the state. New 2014-2015 milestones will be set mid-January of 2014

A Watershed Program Coordinator is employed by the WVCA and serves as a liaison between federal, state and local partners to assist in the coordination and implementation of best management practices, providing technical and

financial assistance, delivering education and outreach resources, and data collection to meet the federal reporting guidelines. The agency has been the recipient of federal funding through the Chesapeake Bay Implementation Grant (CBIG) and the Chesapeake Bay Regulatory and Accountability Grant (CBRAP). Funds have been directed toward technical resource staffing, implementation and educational efforts of agricultural and stormwater best management practices (BMPs) through the local conservation districts. Currently, in addition to the Program Coordinator, there are five Conservation Specialists who deliver non-point source program assistance within Bay drainage. Program highlights are outlined below:

Priority Watersheds

Watershed based plans have been completed in the following priority drainage areas: **Lost River (I & II), Mill Creek of the South Branch, Anderson Run, Sleepy Creek (I & II), Sweet Spring & Potts Creek (James River), Elks Run, Back Creek.** Section 319 Non-Point Source funds have been secured in these project areas and Conservation Specialists are providing technical and financial resources to landowners to assist in meeting the local TMDLs as well as the Bay TMDL.

AgEP Supplement

Chesapeake Bay Implementation Grant funds have also been directed to assist agricultural producers with the installation of cover crops, stream bank exclusion fencing, alternative watering sources, and riparian buffer development through the Eastern Panhandle and Potomac Valley Conservation Districts. State funds are currently being directed toward the installation of heavy use and protection (HUAP) plans around poultry houses and litter sheds to better manage manure.

Nutrient Management

During the summers of 2011 and 2012, The West Virginia Conservation Agency employed two part-time, temporary positions within the Eastern Panhandle Conservation District and Potomac Valley Conservation District. These individuals were responsible for providing nutrient management technical assistance and outreach thereby soliciting voluntary participation in the state's program. The majority of the technician's time was spent in the field collecting soil samples, manure samples and organizing the appropriate farm maps suitable for the completion of a West Virginia Certified Nutrient Management Plan. Over 15,393 acres of soil sampling was completed by these two interns.

WVCA sponsored the spring 2011 Potomac Valley Nutrient Management Workshop designed for WV Certified Nutrient Management Planners to earn continuing education credits. The program was attended by 51 resource staff and focused on topics including: vegetative buffers around poultry houses, the use of phytase and enzymes in poultry feed to reduce phosphorus content in litter, use of precision agriculture, new 590 standards, cover crops and adaptive management in planning.

Historical Data Collection

Reductions from agriculture in the Potomac drainage are required to meet the Bay TMDL and West Virginia has been consistently working to both install best management practices (BMPs) where needed and also to accurately account for existing BMPs on the ground. In an effort for West Virginia and our farmers to obtain full credit for agricultural BMPs that are in place, it was necessary for the state to be able to document and verify these practices. During the summer of 2012 a project was launched to allow WVCA and NRCS to work cooperatively to obtain funding to hire an intern to collect specific information on animal waste management and mortality disposal systems installed on West Virginia farms in the Potomac drainage. This information was aggregated at the county level and reported to the Chesapeake Bay Program in October of 2013 to ensure West Virginia is receiving full credit for installed BMPs. The data is currently under review by the Bay Program.

West Virginia Chesapeake Bay Website and Quarterly Newsletter

WVCA hosts and maintains the official website for West Virginia's Bay activities. This site is located at www.wvca.us/bay and is kept updated by the Program Coordinator as well as the agencies IT staff. Public announcements, updates, opportunities, success stories, and resources are all posted here. An e-newsletter is generated and distributed quarterly to over one thousand stakeholders regarding West Virginia's progress in meeting the TMDL. Citizens can click on a link within the Bay page to sign up for the newsletter.

Stream Scholars

With support from the WVCA, over 28 junior and high school students have had the opportunity to participate in a trip to the Chesapeake Bay for a hands-on, two day learning experience with the University of Maryland and Cacapon Institute's Stream Scholars. Students are selected based upon their application to attend the educational event and have the chance to work in the University's laboratory, spend a day on the water in a research vessel and also assist in the replanting of submerged aquatic vegetation.

Water Quality Workshops

Agricultural- CAFO- WVCA sponsored a series of six agricultural water quality workshops during the winter of 2012-13 in cooperation with WVU Extension Service. The meetings were geared toward farmers within the eight counties of the drainage who wanted to learn about the latest information on practices they could install to assist in preventing being classified as a Concentrated Animal Feeding Operation (CAFO). Both livestock and poultry producers were educated on practices that could be implemented to remove any discharge coming from their operations. Four hundred-forty two poultry producers attended the meetings as well as dozens of livestock producers. Featured speakers included Paul Bredwell, Vice President of Environmental Affairs with the US Egg and

Poultry Association and Dr. Joshua Faulkner, WVU Agriculture Engineering Specialist.

CREP-The West Virginia Conservation joined with the USDA Farm Service Agency and other signatories to organize a two day comprehensive CREP training for all partnering field staff on May 15 & 16, 2012. The training targeted federal and state field employees who play a role in the program within West Virginia's Chesapeake Bay drainage. Forty-six field staff attended the two day training in Moorefield, WV. The goal of the training was to increase communication and define roles between partners, train new staff and provide updates on environmental challenges in the area and how West Virginia producers are obligated to meet these requirements.

Stormwater- The West Virginia Division of Highways (WVDOH) has been a long-standing partner in reducing stormwater impacts. WVCA and WVDOH united to bring their engineering staff together in several workshops this period. An on-site field day was held along Corridor H Highway demonstrating the latest in stormwater technology. WVDOH put thirty-eight of their staff through this training. WVDOH was again a partner and participant in a seminar to introduce the new West Virginia Stormwater Management and Design Manual. Local planners, private engineers, and contractors (48) also participated in this event which was funded by WVCA and delivered by the Center for Watershed Protection.

Bay Videographer

A reporter and videographer from the Chesapeake Bay Foundation visited the area during the spring of 2013 to gain some insight on some of the projects West Virginia has initiated to help clean up the Bay. WVCA played host and coordinated a tour and interview at the newly designed and under construction Moorefield Regional Wastewater Facility and Misty Mountain Livestock and Cattle Farm. Both were featured in videos produced by the Foundation and can be viewed at **http://www.chesapeakebay.net/videos** .

Demonstrations

Several water quality demonstrations have been put on the ground including bio retention and infiltration practices, poultry house vegetative screens, riparian buffers and switchgrass plantings.

The West Virginia Conservation Agency's Watershed Resource Center

The Watershed Resource Center (WRC) focuses resources on providing training, information transfer, and assistance on all aspects of water quality efforts throughout West Virginia. WRC provides specific training and educational needs to better understand watershed and nonpoint source and point source impacts and solutions. During the WV Contractors Exposition, the WRC presented an educational display and workshop geared toward stormwater management. The workshop was a one-hour session on: "Stormwater Management and Soil Interpretations" with 100 contractors, agency staff, and general public in attendance.

Stormwater Management and Soil Interpretations: The WVCA Watershed Resource Center and Conservation Services section educated over 100 participants at their sponsored session during 2013 EXPO. Sherry Wilkins, WVDEP presented the new Stormwater Management Manual and how MS4's can utilize the tools WVDEP has made available. Rob Pate, USDA-NRCS explained soil interpretations for stormwater infiltration systems, where and how to access this public information, and how to download the information to your own GIS system. An educational display, slideshow, and fact sheets were developed on Low Impact Development and distributed to approximately 1,500 visitors at the booth. Conservation Specialist's provided technical information to attendees as requested. Information was provided on the various programs that WVCA provides as well as the Nonpoint Source Program and water conservation.

The Watershed Resource Center maintains a website dedicated to the education and training on nonpoint source pollution problems and solutions. The website includes upcoming trainings, links to participating agencies / organizations, Water Net publications, funding opportunities, riparian resources, available outreach materials, and a showcase gallery for successful projects across the state. The WRC started using social media on Facebook and Twitter to reach a wider audience in 2012. Daily updates are posted on the social media sites.

The WRC provides support to the Annual Mid-Atlantic Chapter of International Erosion Control Association Environmental Conference, Workshop & Trade Show. The MAC/IECA disseminates information to over 200 members

and public attendees in the fields of sediment and erosion control, stormwater management, wetland mitigation, and stream stabilization through technical workshops and the attendance of approximately 20 vendors at their annual conference.

The WRC provides educational outreach on nonpoint source pollution at educational field days, community events, and expositions. During this reporting period, the WRC designed and distributed the Agriculture Enhance Program (AgEP) brochures for all 14 Conservation Districts and the statewide brochure for the program. Over 1,500 brochures were distributed through West Virginia's 14 Conservation Districts and at the WV State Fair. The WRC provided assistance to the 2013 EPA Volunteer Monitoring Conference.

The WRC Publishes the Water Net Newsletter quarterly to over 400 volunteers and agency staff statewide. The newsletter features pertinent information on the latest news of watershed activities around West Virginia, technical resource and contact information, upcoming trainings, and available resources for water quality related issues throughout the state.

- 1000 Ag BMP Manuals, 500 Water Conservation Ideas, 500 Rain Barrel brochures, distributed at the WV State Fair for handouts.

- Distributed 1,000 Water Conservation Ideas books statewide.

- Distributed 1,000 Rain Garden brochures to watershed associations.

- 500 WV Best Management Practices for Conservation Standards distributed statewide.

- Enviroscape presentation to 50 students / 25 teachers at Camp Virgil Tate during this period for the Annual Conservation Field Day.

- 110 Stormwater Management and Design Guides, Web Soil Survey information, and WV MS4 Stormwater Compliance Spreadsheets distributed on USB drives to EXPO workshop participants.

- 200 Take the Stormwater Runoff Challenge brochures distributed at EXPO booth.

- 250 CREP brochures distributed statewide.

- 300 CAFO/Ag Water Quality folders prepared and distributed.

- 40 CAFO information brochures and handouts distributed at CAFO meeting.

- Distributed 26 Farm Education Activity Books for 1st grade Ag Field Day.

- Assembled 200 outreach packets containing rain garden, rain barrel, solutions to nonpoint source pollution, and water conservation ideas packets.

- Updated riparian buffers brochure for the Buchanan River Watershed Association – 1,500 distributed.

- 250 Muddy Creek Cost-Share brochures developed and distributed.

- Rain barrel PowerPoint presentation developed for Potomac Valley Conservation District workshop.

- 500 Stormwater management brochures designed and distributed to homeowners and concerned citizens.

- WIP II Bay Display designed for Chesapeake Bay are events.

V. 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. Protection of groundwater is of utmost importance and is achieved through the permitting, inspection and enforcement of exploration, production, plugging and injection activities of the industry. Over 61,000 active wells are maintained by the OOG. Regulations aimed at protecting groundwater have been in existence since 1929. Additional regulations have been added in subsequent years 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 and 35CSR8-9.2

Operators must set fresh water casing 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. With the passage of the Horizontal Well Act on December 14, 2011 and with its Rule going into effect on July 1, 2013 at least 300 feet of freshwater casing must be ran and cemented to surface on the applicable horizontal wells, known as H6A wells. The freshwater casing may be extended deeper to cover know aquifers or to cover a coal seam prior to drilling below sea level (elevation) and must be cemented to surface. 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. Operators must set fresh water casing 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. With the passage of the Horizontal Well Act on December 14, 2011 and with its Rule going into effect on July 1, 2013 at least 300 feet of freshwater casing must be ran and cemented to surface on the applicable horizontal wells, known as H6A wells. The freshwater casing may be extended deeper to cover known aquifers or to cover a coal seam prior to drilling below sea level (elevation) and must be cemented to surface. The operator shall use practices and procedures necessary to minimize damage or disturbance to strata including groundwater until casing has been set.

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Water Supply Testing- 35CSR4-19 and 35CSR8-15

Operators are required to notify landowners within 1,000 feet of a proposed drill site for a well. At the request of the landowner, the operator shall sample and analyze water from any wells or springs within this 1,000 feet. If no requests are made, then the operator shall choose an existing well or spring from within the 1,000 feet to sample and analyze. Operators are required to move out to 2,000 feet if there are no wells or springs within 1,000 feet. 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. For H6A wells, at the request of the surface owner or water purveyor, the operator shall sample and analyze water from any existing water wells or developed springs used within 1500 feet from the center of the proposed pad.

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 active inventory consists of approximately 54 private and 16 commercial brine disposal wells, over 400 secondary recovery wells and 12 solution mining wells. Primary focus of this program is the protection of groundwater from injection operations. Operators are required to submit reports monthly of daily activity for each injection well. UIC permits are issued for five-year periods and must be renewed for injection to continue. During the permitting process operators are required to sample and analyze water wells, springs and surface water bodies within a quarter-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 to100 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. Some of the contaminants that may affect groundwater quality include such things as 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 that 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 that 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. The primary function of the general permit is the prevention of pollution to the waters of the state relating to the handling and disposing of these wastes.

Spill Prevention and SPCC Plans 35CSR1

To prevent discharged oil from reaching waters of the state, all operators are to have adequate containment or diversionary structures in place at each well or facility. 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 CWA to protect waters of the state from discharged oil.

Groundwater Data Collection

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 1,000 feet and/or 2,000 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 on paper form and kept on file with its corresponding permit.

Operators applying for a UIC permit are required to sample and analyze all water wells, springs and surface water bodies within quarter- mile radius of the proposed facility. Parameters are the same as those mentioned above. Results are submitted on paper 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 on paper and kept in the corresponding investigation file.

A computer tracking system has been established for the chloride content of streams receiving discharges of produced water associated with stripper oil wells. 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 on a paper Discharge Monitoring Report. However, electronic filing will be encouraged in the near future. The point at which the effluent enters the stream has been identified by GPS for all active facilities.

To date, the OOG has collected GPS data on over 3,000 wells. This data is used on the GIS data viewer to allow for incorporation with other GIS data to assist with well locations and investigations of all types.

V. DEPARTMENT OF ENVIRONMENTAL PROTECTION

B. Division of Water and Waste Management

1. Office of Waste Management Solid Waste Permitting Unit (SWPU)

The SWPU regulates solid waste facilities under the Solid Waste Management Rule, 33CSR1. This includes the review of applications for various permitting activities for new and existing facilities such as permit issuance, renewal, or closure. The SWPU reviews applications to accept special waste, to alter groundwater monitoring systems, and also reviews statistical groundwater monitoring reports, conducts construction quality assurance and quality control inspections, and compliance assistance to waste generators.

Description	Permitted Facilities
Active Municipal Solid Waste Landfills (Class A & B)	18
Closed Municipal Solid Waste Landfills (Class A & B)	34
Construction/Demolition Waste Facilities (Class D and D-1)	15
Yard Waste Composting Facilities	23
Transfer Stations	19
Waste Tire Facilities	3
Recycling Facilities (Class E)	30
Sewage Sludge Processing Facilities	0
Mixed Waste Processing Facilities	0

Permitted landfills must sample groundwater-monitoring wells twice each year 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 (OEE) takes any necessary enforcement action.

In an effort to protect groundwater, the Solid Waste Management Rule requires an impermeable liner system for solid waste municipal solid waste landfills. This multiple layer liner system includes a leak detection zone that will alert the facility should there be a failure in the liner. If contamination has been detected by routine detection monitoring, the landfill may be required to begin corrective action to clean up the groundwater.

Although some releases have been detected, the statistical groundwater-monitoring program is in need of improvement. The Division of Water and Waste Management (DWWM) has compliance section to monitor groundwater sampling and analytical data has been verified through split sampling. The facilities are notified in writing for any improvement to sampling. As improved statistical methods are introduced, contamination caused by poor sampling techniques will become more apparent.

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.

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

The proper management of waste reduces the likelihood of groundwater contamination by reducing the amount and controlling the types of contaminants in leachate. This is achieved by special waste requests which are reviewed by the SWPU and either approved or denied for disposal.

The SWPU is responsible for ensuring that facilities are properly designed by reviewing plans and granting permit modifications for expansion. During construction at these facilities, the SWPU conducts quality assurance/quality control (QA/QC) inspections to assure that facilities are built according to specifications and accepted industry practices.

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.

Through the Landfill Closure Assistance Program (LCAP), the WVDEP is currently monitoring the 32 closed solid waste landfills in West Virginia. Under this program, the emphasis is on the capping of these facilities to minimize groundwater impact. Active solid waste landfill facilities have an on-going program to identify and address any groundwater releases. The LCAP Program utilizes consultants who follow the procedures outlined in 33CSR1 to sample, analyze, and identify groundwater and any associated problems. The SWPU has assisted LCAP by providing geological assistance on program priorities.

2. Hazardous Waste Permitting 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 System (HWMS), are the regulations promulgated to regulate the storage, treatment, and disposal of hazardous wastes generated and managed in

West Virginia. The HWMS 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 pertain 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 EPA. In general, as a summary of the relationship between the two agencies, 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 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.

All RCRA facilities will have chosen remedies and remediation, and construction completion by 2020, with contamination under engineering control and stabilized to prevent additional contamination to groundwater and eliminate further migration of contaminated groundwater.

Mechanisms to Regulate and Protect Groundwater at Permitted Units

The Groundwater monitoring regulations in 40 CFR 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, disposal and any SWMU under the Corrective Action Program. 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 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, contaminants in the groundwater, 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 SWMUs. 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 section 264.98, 264.99, and 264.100.

The general requirements for groundwater monitoring programs at permitted facilities are found in Subpart 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 semi-annually).

The goal of the Subpart F corrective action program is to bring regulated units and/or SWMU 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 down gradient property boundary, and beyond the facility boundary where necessary to protect human health and the environment.

Mechanisms for 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. For 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, the 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 the 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 one of primarily four ways. 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 toward 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 SWMUs

- ❖ 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 and phases could consist of any logically connected set of actions performed sequentially over time or concurrently at different parts of a site.

Facilities with On-going Corrective Action

The following chart lists the West Virginia facilities that are currently performing corrective actions. It lists the facility, if the facility has human health (HH) and groundwater (GW) under control, and where each facility stands with its cleanup status.

This chart is periodically updated and can be viewed on the Internet at:

http://www.epa.gov/reg3wcmd/ca/wv.htm

Additional information can be seen about site history and project detail if you go to the Web site and click on the facility name.

West Virginia
RCRA Baseline Facilities
EPA Region 3

Facility fact sheets and the Environmental Indicator forms are Adobe Acrobat PDF files.

For additional facility information, go to the following links:
- Click on the facility name to view the facility fact sheet
- Click on the "YES" to view the facility's completed Environmental Indicator form
- Click on the location name to view a map of the area

Cleanup Initiated	**Complete Without Controls**
Remedy Selected	**Complete With Controls**
Construction Complete	

Facility Name	EPA ID#	Location	Environmental Indicators		Cleanup Status
			HE	GW	
AEP Kanawha River Plant (Appalachian Power)	WVD980554588	Glasgow	YES	YES	Complete Without Controls
Airco Welding	WVD980554760	Chester	YES	YES	Construction Complete
Appalachian Timber Service	WVD063461958	Sutton	YES	YES	Remedy Selected
Bayer Cropscience LP (Rhone Polenc, Aventis)	WVD005005509	Institute	YES	IN	Cleanup Initiated
Bayer Polymers LLC (Miles)	WVD056866312	New Martinsville	YES	YES	Cleanup Initiated
Beazer-Colliers (Koppers-Colliers)	WVD980707178	Colliers	YES	YES	Construction Complete
Crompton Corporation - South Plant (G E Specialty Chemicals 1)	WVD061776977	Morgantown	YES	IN	Cleanup Initiated
Crompton Corporation - North Plant (G E Specialty Chemicals 2)	WVD980552384	Morgantown	YES	IN	Cleanup Initiated
Cytec	WVD004341491	Willow Island	YES	IN	Cleanup Initiated
Dupont - Belle	WVD005012851	Belle	YES	IN	Cleanup Initiated
Dupont Martinsburg - Potomac River Works	WVD041952714	Martinsburg	YES	YES	Cleanup Initiated
Dupont - Washington	WVD045875291	Washington	YES	YES	Cleanup Initiated
Flexsys America L.P. (Solutia Inc., Monsanto)	WVD039990965	Nitro	YES	IN	Remedy Selected
FMC - So. Charleston	WVD005005079	South Charleston	YES	YES	Complete Without Controls
GE Silicones (Crompton, Witco Corp,, CK Witco, OSi)	WVD004325353	Friendly	YES	YES	Complete Without Controls
General Electric Co (GE Plastics, GE Chemicals)	WVD088911854	Washington	YES	YES	Cleanup Initiated
General Motors Corp. (G M C Martinsburg)	WVD044145209	Martinsburg	YES	YES	Complete Without Controls
Great Lakes Chemicals Corp (FMC)	WVD005005087	Nitro	YES	YES	Cleanup Initiated

KACC Spl. Pile (Kaiser Aluminum & Chemical Co. - Spent Potliner Pile)	WVD988766127	Ravenswood	YES	YES	
Koppers-Follans (Beazer East)	WVD004336749	Follansbee	YES	YES	
Koppers - Green Spring (CSXT)	WVD003080959	Green Spring	YES	YES	
Occidental Chem Corp	WVD005010277	Belle	YES	IN	
P P G Industries	WVD004336343	New Martinsville	YES	YES	
Pechiney Rolled Products Inc. (Century Alum., Ravenswood)	WVD009233297	Ravenswood	YES	YES	
PTO-UCC-Dow (Union Carbide - PTO)	WVD000739722	Nitro	YES	IN	
Quaker State-Congo	WVD057634776	Newell	YES	IN	
SMR Technologies (BF Goodrich)	WVD980555395	Fenwick	YES	YES	Done
St. Marys Refining (Quaker State)	WVD004337135	St. Marys	YES	YES	
UCC-South Charleston (Union Carbide-So. Charleston	WVD005005483	South Charleston	IN	IN	
UCC Tech Center (Union Carbide Tech Center)	WVD060682291	South Charleston	YES	IN	
Weirton Steel	WVD000068908	Weirton	IN	IN	
Wheeling - Pittsburgh Steel	WVD004319539	Follansbee	IN	IN	
XSYS Print Solutions, LLC (BASF - Huntington)	WVD000068601	Huntington	YES	YES	

DEFINITIONS

HE - Current Human Exposures Under Control Environmental Indicator (CA725)

GW - Migration of Contaminated Groundwater Under Control Environmental Indicator (CA750)

YES - The Environmental Indicator has been met

IN - More information is needed

Cleanup Started - Initiation of a facility-wide investigation and cleanup.

Cleanup Initiated - Initiation of a facility-wide investigation and cleanup

Remedy Selected - The regulator has selected final cleanup objectives to address contamination and exposures.

Construction Complete - All components of the final remedy are in place and operating as designed.

Complete without Controls - Final cleanup objectives are met for all media, and no further activity or controls are necessary.

Complete with Controls - Final cleanup objectives are met but on-going operation, maintenance and/or monitoring of controls are necessary to ensure protection of human health and the environment.

Groundwater Data Collection and Management

Most groundwater data is collected by facilities or environmental firms on the facilities' behalf. Occasionally samples are collected by DWWM personnel for the purpose of comparison. Regardless of who is collecting groundwater samples, sampling methodology and analytical testing procedures must comply with the protocols prescribed by the appendices to 40CF261. All samples must be analyzed by laboratories certified by the DWWM.

Permits do not have a database for the management of groundwater data. Currently, facility groundwater data is submitted in paper form and reviewed by hazardous waste personnel assigned to the facility. In the future groundwater data will be submitted electronically and managed in EQuIS. EQuIS will allow data to be stored, managed and shared among the divisions of WVDEP and other agencies with groundwater certification. Some access will be available to the public as well. In addition to data screening and management, EQuIS links to a wide variety of other scientific software such as GIS. During the reporting period, Hazardous Waste has acquired groundwater modeling software and a GPS unit and associated software. Hazardous Waste needs GIS software such as ArcView.

The DWWM as a whole needs more GPS units and the necessary training to obtain accurate locational data.

Program Consideration and Needs

There are difficulties inherent with trying to clean areas to pristine levels where industry has been associated with business activities for decades. There are economic and technical obstacles that need to be considered in areas that will probably never be utilized for drinking water. However, that must be balanced with the ideal that our groundwater is a valuable resource not to be taken for granted. There are many who have a stake in the decisions on how best to manage the environment. In the future, policy and decision making must be addressed by administration in a manner that each operating unit is clear as to the direction and in the manner these issues are to be decided.

3. Groundwater Program

a. SUMMARY OF GROUNDWATER QUALITY IN WEST VIRGINIA
Prepared by the Division of Water and Waste Management - Groundwater Program in conjunction with the U.S. Geological Survey (USGS)

Background

Beginning in 2010, a new approach was undertaken for the Ambient Groundwater Project with the WV DWWM. The decision was made to establish a sentinel network of groundwater sample sites that would be resampled on a five- year cycle to detect trends in groundwater quality. Sample sites were selected from previously sampled wells or springs in an effort to cover a variety of aquifer types, topographic settings, and land uses. These sites include 53 wells, mostly public supply wells, but also include USGS monitoring wells, and six springs.

Parameters

Fifty three surface water and 41 groundwater locations were sampled during the reporting period from July 1, 2011 through June 30, 2013. All sites were sampled for a base set of analytes that included major ions, metals, field determinations, and radionuclides. If data already existed for a given site, it was not resampled for a given analyte group.

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 2,300 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 53 locations show that background levels of parameters tested occur at concentrations far below action levels set by groundwater quality standards, with a few exceptions.

Concerns

Two major concerns are the high concentrations of radon in certain watersheds and the presence of pharmaceuticals and endocrine disrupting chemicals in groundwater. Radon is a naturally occurring element found in many soils and rock types.

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; their presence appears to be ubiquitous in the environment. Bioassays of fish in the Potomac River found intersex characteristics in the fish sampled. One such mutation is the presence of eggs in the testes of male fish. Another concern is the presence of certain antibiotics in ground and surface waters. As many of these compounds are known endocrine disruptors, their presence even at low concentrations warrant additional scrutiny.

The practice of land applying biosolids from waste treatment facilities and livestock operations on agricultural areas must be reevaluated in light of recent research, as these biosolids have been shown to be laden with a wide variety of pharmaceuticals, endocrine disrupting chemicals, and especially, antibiotics. At this time, more study needs to be done in this area to determine the appropriate course of action needed to address this concern.

USGS Groundwater sampling data

Groundwater sampling data collected by the USGS for the ambient groundwater quality study show concentrations of aluminum, iron, and manganese above the Secondary Drinking Water Regulation (SWDR) limit were found in many of the 41 sites sampled. Exceedences of aluminum above the 200 µg/L SWDR limit were found at three sampling (sites 2, 3, and 36). Iron above the 300 µg/L SWDR limit were found in 12 of the sites sampled. Although not a threat to public health, high concentrations of iron, and aluminum may render groundwater unsuitable for domestic use due to aesthetic reasons in some locations. These concentrations of dissolved iron, aluminum, and manganese are naturally occurring and are found sporadically throughout the state.

No concentrations of radioactive alpha or beta activity were found at the sites sampled. No exceedences of uranium isotopes or other radionuclides were found.

USGS Surface Water sampling data

Surface water data collected by the USGS for the ambient groundwater quality study show concentrations of sulfate, and iron above the SWDR limit were found in several of the 53 sites sampled. Exceedences of sulfate above the 250 µg/L SWDR limit were found at six sampling (sites 28, 31, 32, 43, 45, and 52). Iron above the 300 µg/L SWDR limit was found in only one site (35). These concentrations of dissolved

iron, and aluminum are naturally occurring and are found sporadically throughout the state.

Concentrations of radioactive alpha, beta activity above the 4 millirem maximum exposure level were found at four of the fifty three sites sampled (site #27, 7.4 mrem, site #37, 4.3mrem, site #41, 5.1 mrem, and site #45, 6.1 mrem). These are naturally occurring isotopes. No concentrations of radioactive alpha activity were found at the sites sampled. No exceedences of uranium isotopes or other radionuclides were found.

b. 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 Chapter 29 Article 3 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.

During this reporting period, there have been no new requests for any groundwater quality standard variances. The five year variances granted to American Electric Power and Allegheny Energy have now expired and are currently under review.

c. Groundwater Protection Regulations - Title 47 Series 58

Groundwater Protection Plans (GPP) for 162 facilities in West Virginia have been received and 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 162 facilities and the date(s) of their GPP approval(s) 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 DWWM. Therefore, some facilities have received a waiver from the requirement to develop and maintain GPPs. In lieu of a site-specific GPP, the facility must complete and submit a registration form certifying that it does not have service bays, does not provide mechanical service, does not have above ground storage tanks, and does not have outside bulk storage of materials with the potential to harm groundwater.

One hundred sixty two Groundwater Protection Plans Approved July 1, 2011 through June 30, 2013. The GPPs issued during the reporting period are presented in the table below.

Groundwater Protection Plans Approved	
Facility	**Date(s) approved**
Mitchell Auto Parts	9/29/2011
Shady Grove MHP	9/29/2011
McDowell County Commission	9/29/2011
Peer's Sanitation	9/29/2011
AMI Environmental	9/29/2011
United Wreckers and Excavators Inc	9/30/2011
Empire Builders, Inc.	9/30/2011
Middleway VFD	10/28/2011
Center for Positive Aging	10/28/0211
Exxon Mobil #29270	10/31/2011
Exxon Mobil #25375	10/31/2011
Former Exxon Mobil #28844	10/31/2011
Exxon Mobil #29449	10/31/2011
Exxon Mobil #28062	10/31/2011
Shaka, Inc	10/31/2011
Solutia, Inc	10/31/2011
Erogon	10/31/2011
130th Airlift Wing	10/31/2011
Summit Point Automotive Research Center	10/31/2011
Reclaim Company Class D Landfill	10/31/2011
W.E.L. Incorp Class D Landfill	11/1/2011
Dominion Generation North Branch Power Station	11/2/011
B/E Aerospace, Inc	11/2/2011
Union Carbide Corp Tech Park	11/2/2011
Brenntag Mid-South, Inc	11/4/2011
Holly River State Park	12/2/2011
Jackson County Board of Education	12/5/2011
Joe Blosser Construction Class D	12/5/2011
Kanawha State Forest	12/7/2011
Katara’s Deli Parking	12/13/2011

Groundwater Protection Plans Approved	
Facility	**Date(s) approved**
West Virginia Demolition Inc	1/6/2012
S E Cemeteries of WV	1/6/2012
Plastics Coatings Corp	1/24/2012
South Preston K-8 School	1/26/2012
Ed Arey and Sons Inc	2/1/2012
Echo Inc.	2/3/2012
Popescu Subdivision	2/9/2012
Exxon Mobil Corp.	2/14/2012
Harpers Ferry Middle School Tank Remediation	2/17/2012
KACF Campground	2/27/2012
City of Lewisburg	2/29/2012
Sheetz Convenience Store #143	3/5/2012
Appalachian Timber Services	3/8/2012
Empire Salvage & Recycling, Inc	3/9/2012
B&J Truck Wash	3/9/2012
Animal Friends of Barbour County	3/19/2012
Pocahontas BOE	3/19/2012
Kunkel Addition Multi-Family Development	3/22/2012
Burns Motor Freight	3/23/2012
Former Little General #302	3/28/2012
Solo Crane Inc.	3/29/2012
Union Carbide Corp Tech Park	4/4/2012
Lewisburg Wal-Mart	4/6/2012
Beech Fork State Park Swimming Pool	4/18/2012
Kimble's Farm Family Campground	4/18/2012
Creekside Camping	5/11/2012
Hess Roofing Company, Inc.	5/11/2012
City of Clarksburg	5/11/2012
Gary Solomon	5/14/2012
Rish Equipment	5/14/2012
Asbury United Methodist Church	5/15/2012
Gould's Electric Motor Repair Inc.	5/17/2012
Smoke Hole RV Park and Campground	5/29/2012
Boxley Aggregates of WV	6/4/2012
Reclaim Company	6/4/2012
WVDOH- King Coal/Bluefield UIC Permit	6/6/2012
Wetzel County Schools Bus Garage	6/7/2012
WVDNR- Bluestone State Park	6/7/2012

Groundwater Protection Plans Approved	
Facility	**Date(s) approved**
Bingamon Corporation C & D Landfill	6/8/2012
Laurita Excavating C&D Landfill	6/11/2012
Hart Campground	6/14/2012
Western Express former shop	6/14/2012
Morgantown Excavators C&D Landfill	6/29/2012
West Virginia CVS	6/29/2012
George Glaize	6/29/2012
S&K Campground	7/5/2012
Ronald White Campground	7/5/2012
Beckley Water Company	7/6/2012
Fesco, Ltd	7/11/2012
Powell Construction Company	7/17/2012
Berkeley County Parks and Rec	7/17/2012
Parsons Opequon Motors	7/26/2012
Lynn Camp Birdge	8/6/2012
Nationwide Insurance Office	8/7/2012
Sheetz at Tabler Station Business Park	8/7/2012
K&W Campground	8/8/2012
Ferrell Gas-Williamson	8/9/2012
Camping at the Grove	8/13/2012
Fenwick Diner	8/21/2012
Cunningham Excavating LLC	8/24/2012
Extreme Impressions	8/27/2012
Virginia Asphalt Paving	8/29/2012
Dollar General Store, Inwwod	8/30/2012
Great Plains Oilfield Rental LLC	8/30/2012
Super 8 Motel Developers, Inc	9/5/2012
EXXON MOBIL #28977 Big Chimney	9/6/2012
Alpine Shores Campground	9/7/2012
Empire Builders, Inc.	9/12/2012
City of Martinsburg	9/25/2012
City of Bluefield	9/25/2012
Bank of Charles Town	9/25/2012
Arbogast Trailer Court	9/26/2012
Greenbrier Meadworks, LLC	9/26/2012
Gateway 219 Storm Water LLC	10/5/2012
Logan County Commission	10/9/2012

Groundwater Protection Plans Approved	
Facility	**Date(s) approved**
Former Peytons Marathon	10/9/2012
Former Exxon Mobil #28844	10/9/2012
W.E.L. Incorp Class D Landfill	10/23/2012
Reclaim Company	10/24/2012
ATV at the Rock	10/26/2012
United Wreckers and Excavators Inc	11/8/2012
Robert Peer Class D Landfill	11/14/2012
AMI Environmental	11/19/2012
Whitten Construction D Landfill	11/20/2012
Town of Kermit	11/26/2012
Constellium Rolled Products	11/28/2012
Summersville Motor Inn Class D Landfill	11/28/2012
Ridge Care LLC	12/5/2012
Viars Car Wash	12/11/2012
Giovannis of Elizabeth	12/12/2012
Williamson Yard	12/13/2012
K&D Family Diner	1/2/2013
MPM Silicones	1/3/2013
B&B Transit	1/7/2013
Joe Blosser Construction Company	1/25/2013
Casteel's Dairy King	2/1/2013
Earthworks Enterprises	1/30/2013
Concrete Pipe and Precast LLC	2/11/2013
QC Printing II	2/13/2013
Empire Salvage and Recycling Inc.	2/14/2013
Echo Inc.	2/15/2013
West Virginia Demolition Inc.	2/15/2013
URS Corporation - Shell Service Station #171201	2/21/2013
The Great Outdoors Marine	1/23/2013
JB Butcher - Class D Landfill Levisee Cr Rd	3/4/2013
Cossin's Car Wash	3/6/2013
Buzzo Landfill monongalia County (Tim Buzzo Trucking)	3/25/2013
Mountain State Renovations C and D Landfill	3/27/2013
Seneca Rocks RV Resort	4/8/2013
Ellenboro Lamberton PSD uic gpp	4/8/2013
James Stewart (Plum Run Disposal Taylor Co.)	4/10/2013
Greenbrier River Campground Greenbrier County	4/16/2013

Groundwater Protection Plans Approved	
Facility	**Date(s) approved**
TK Stanley (Lewis County)	4/15/2013
Hacker Valley Elementary uic gpp	5/3/2013
Empire Salvage and Recycling - Fayette County	5/3/2013
Crown Wastewater Treatment Plant	5/6/2013
Flat Top Compressor Station (Columbia Gas Transmission)	5/6/2013
Hess Roofing Company C & D Landfill - Kanawha Co.	5/8/2013
Mike Ferrell Ford Lincoln Mercury	5/9/2013
Laurita Excavating Inc. (C & D Landfill - Monongalia Co.)	5/15/2013
Hawks Nest Hydro Electric Power	5/20/2013
Key Contracting - Stewartstown Disposal Facility Class D Landfill	5/22/2013
Gary Solomon C & D Landfill (Solomon Construction Fill Osage)	6/4/2013
Joe Hall Campground	6/13/2013
Reclaim Company - Class D Landfill Marion Co.	6/13/2013
New River Health Association - Lisa Elliot Center	6/13/2013
J.C. Bosley Construction-Bosley Landfill ClassD (Wood Co)	6/17/2013
City of Clarksburg Class D Landfills Reg. No. 17-001-12 (Harrison Co)	6/28/2013

d. Monitoring Well Driller Certification/Recertification Program

The Monitoring Well Driller Program (MWDP) instructs and certifies monitoring well drillers in the design, construction, alteration, and abandonment of monitoring wells and boreholes. This program, as authorized by 47 CSR 59 Monitoring Well Regulations, was established to ensure industry, well owners, and the regulatory community that all monitoring wells installed or abandoned meets a minimum set of standards.

Although the WVDEP 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. The OEHS has a long established water well driller certification program and is ideally suited for providing these services to WVDEP, eliminating the need for increased staffing.

As of June 30, 2013, the MWDP has certified 538 monitoring well drillers. There are currently 216 active monitoring well drillers, 30 of which were certified during this reporting period.

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

To track the driller certification and recertification process, the WVDEP's Information Technology Office developed a monitoring well driller module to the Environmental Resource Information System (ERIS). ERIS is a flexible client/server system of Windows programs, which allows WVDEP 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 modular. The driller database contains a listing of drillers who are currently certified and those whose certification has expired. As of June 30, 2013 there are 216 active drillers and 322 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.

e. 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 47 CSR 60, *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 47 CSR 60.

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 alternatives 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. The electronic submission of the *Monitoring Well Construction Documentation Forms* and *Abandonment Documentation for Monitoring Well/Borehole Forms* became available as of 2003. The format for the electronic submission consists of drop-down menus for choices of materials and procedures and areas for written comments. The information is now being 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, 2011 and Dec. 31, 2012	Totals
Monitoring Well Construction Forms	786
Monitoring Well Abandonment Forms	397
High Risk Borehole Abandonment Forms	4

The forms were reviewed for completeness and correct information. The major deficiencies noted were incomplete or incorrect latitudes and longitudes, incomplete physical site information, incorrect or missing installation materials and procedures. The electronic submission of the forms has eliminated several of these problem areas.

Complaints and Calls

The Division of Water and Waste Management's Monitoring Well Drillers Program responded to approximately 312 calls/requests for information concerning monitoring well driller's certification and recertification, monitoring well design standards, documentation, variances, and enforcement. This does not include minor telephone call requests for basic information.

f. Underground Injection Control (UIC) Program

The SDWA of 1974 established the UIC program to ensure that fluids injected underground will not endanger drinking water sources. Applying the UIC regulations (47CSR13) promulgated under the authority of Chapter 22, Article 11 of the state code, the DWWM's UIC program mainly regulates the subsurface emplacement of effluents 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. UIC permits for Class 5 wells fall into four broad categories:

- **Industrial/Commercial**
  This includes groundwater remediation re-injection wells, where contaminated groundwater is pumped out, treated to meet groundwater quality standards, then re-injected. It also includes various industrial/commercial facilities that dispose of certain types of wastewater into subsurface distribution systems, including facilities that inject sanitary waste from restrooms co-mingled with other wastewater constituents into a septic tank and leachfield system.

- **Stormwater**
  Disposal of stormwater into a well or directed into a naturally occurring sinkhole may be permitted if it can be reasonably demonstrated that no underground sources of drinking water will be adversely impacted.

- **UIC septic permits**
  These class 5 wells typically dispose of solely sanitary waste into a septic tank and leachfield system (solely sanitary waste <u>not</u> co-mingled with any other fluid).

- **UIC Mining**
  These class 5 wells typically dispose of fluids associated with mining into underground mine pools.

Most all non-residential facilities injecting fluids into the subsurface fall under the regulation of the UIC Program. This includes small business injecting fluids into the subsurface through a septic tank and leachfield system, or other such subsurface waste disposal system. This includes any place other than a private residential home, even if the waste stream is comprised of solely sanitary waste, provided the system has the capacity to serve 20 or more persons per day. Residential dwellings are exempt from UIC regulations with the exception of residential multiple dwellings. Examples of residential multiple dwellings include: garage apartments not connected to the residence, mobile homes, trailer parks, apartment complexes, campgrounds, etc.; or two or more single family residences sharing a common septic system.

UIC permit applications are promptly processed and no current backlog of applications exist. Currently, the only bottle neck 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 is complete and has enhanced the efficiency of the permitting process, fee tracking, and sharing of data with other WVDEP programs and the public.

The requirement of submitting discharge monitoring reports (eDMRs) electronically for required reports and water samples began July 1, 2011. Several permit applications are required to be submitted electronically through the ePermitting system as an (electronic) ePermit. UIC permits are not required to be submitted electronically at this point, but there are plans to implement this procedure in the near future. Information regarding the ePermitting system can be found at the DEP webste: https://apps.dep.wv.gov/eplogin.cfm.

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 to insure that all injected fluids meet WVDEP groundwater quality standards, MCLs established by the EPA, health advisory limits, or other risk-based limits as appropriate. 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. These refinements in UIC permits insure the greatest degree of protection to human health and the environment.

One of the greatest challenges faced by the UIC program continues to be in designing environmentally sound methods of permitting stormwater disposal in karst and other environmentally sensitive areas. During the past two years, the UIC Program has again seen a large increase in the number of permit applications for disposal of stormwater underground. The UIC program has worked closely with state and local government officials to develop BMPs that keep potential contamination from entering the subsurface distribution systems to the greatest extent possible. This has included the development of emergency response plans 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.

The UIC program continues to refine and improve its role in the protection of the state's water resources. Works in progress include the development of environmentally sound methods of permitting wastewater disposal from smaller commercial/industrial operations in unsewered areas that depend on subsurface injection of wastewater. The

UIC program is regarded among its peers in other states and the EPA as a model of excellence despite challenges faced by a lack of staff and funding. The position of Groundwater Program Manager remains vacant at this time. When a new Groundwater Program Manager is appointed, a review of policies will be conducted to insure the Groundwater/UIC Program retains its position as a leader of innovative and far sighted policies of environmental protection of water resources. The UIC staff consists of one geologist permit writer, two Environmental Resources Specialist permit writers, and two UIC field inspectors for the entire state.

Groundwater/UIC Program – Mining and Quarrying

As stated 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, is ubiquitous in West Virginia, protecting the quality and quantity of the groundwater from adverse impacts due to these activities is imperative both to the environment and to 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.

Protecting Water Supplies and the Environment:

Groundwater protection at mine sites was begun 13 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's DWWM and DMR to enforce it. The resulting changes in the management of surface activities and substances at mine sites have protected many public and private water sources, both present and potential, from damage due to mining, and have mitigated many of the impacts that occurred prior to or despite those changes.

The Underground Injection Control (UIC) Program, as established under Legislative Rule Title 47 CSR 13, *Underground Injection Control*, applies to mining primarily through 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 ensure 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.

SCR-15 and UIC:

In 2006 the West Virginia Legislature authorized SCR-15, a comprehensive two-phase study on the potential effects of underground injection of coal slurry on the environment (Phase 1) and human health (Phase 2). A team whose members include

personnel from West Virginia Department of Environmental Protection's DMR (Division of Mining and Reclamation) and Division of Water and Waste Management (DWWM), the West Virginia Department of Health and Human Resources-Bureau of Public Health, and Office of Surface Mining Reclamation and Enforcement conducted the first phase of this study.

An analysis of the chemical composition of coal slurry, including an inventory of organic and inorganic constituents, was conducted at six locations across the State. With input from the environmental and industry groups, six sites were selected from the 13 active coal slurry injection sites in the state. The study sites included are: Southern Minerals, Panther LLC, Marfork Coal Company, Power Mountain, Loadout LLC, and Coresco, LLC.

A detailed hydrogeologic evaluation of the migration of coal slurry and its constituents from injection wells into the ground and surface waters was conducted at four of the six sites. The assessment sites include the coal preparation facilities where the underground injection of coal slurry took place. The sites are Southern Minerals, Panther LLC, Loadout LLC and Power Mountain. All four assessment sites are located in the southern coal fields and have mines which are considered below or mostly below-drainage (mines workings are located below surface drainage features). Water samples collected from surrounding surface and ground water were analyzed for over 170 organic and inorganic chemical constituents. All the sites sampled reflect a "snapshot" of the site-specific hydrologic conditions that surround the slurry injection sites.

The completed WVDEP Phase I SCR-15 study can be found at the WVDEP website at: http://www.dep.wv.gov/dmr/studies%20and%20investigations/Documents/Slurry%20UIC%20Investigation.pdf. The findings of this study have been officially presented to the Senate Committees on "Government and Finance" and "Water Resources".

As part of the implementation on the recommendations of the SCR-15 study the management of mining related UIC permits is being taken over by the Division of Mining and Reclamation and will no longer reside in the WVDEP Groundwater program. This includes all mining related UIC permitting activity and all tracking and enforcement of UIC related violation. Two full-time mining UIC employees have been hired by DMR and are presently being trained. More details on the WVDEP plans to improve mining related UIC issues can be found in the "Recommendations" section of SCR-15 at: http://www.dep.wv.gov/dmr/studies%20and%20investigations/Documents/Slurry%20UIC%20Investigation.pdf.

The second part of SCR-15 was conducted by the West Virginia Division of Health and Human Resources, who has contract West Virginia University. SCR-15 Phase II concentrated on the human health aspects of the underground injection of coal slurry. This study was finished in July of 2010 and can be found at its official website maintained by WVU at http://wvwri.org/programs-and-projects/retired-programs/geo-22/.

Use of the ERIS Database:

Every UIC – Mining application will continue to be tracked in the ERIS Database. As information is received it will be added into the database by members of the Division of Mining and Reclamation.

Use of the TAGIS Database:

Every UIC – Mining application has been digitized as a Shapefile. This includes all injection points, monitoring points and mine pools receiving injection for all permits approved under the modern UIC program.

Statistics:

Permitted Coal Slurry Injection Sites	12
Permitted AMD Sludge Injection Sites	40

A full summary of all known historic underground injection of Coal Slurry can be found in SCR-15 Phase I.

UIC Industrial/Commercial permitting

Without abundant resources of clean groundwater, there will be no economic growth, no industrial base, and no preservation of the quality of life that is the foundation of our culture. Limiting and controlling underground injection ensures that groundwater and underground sources of drinking water will remain viable for future use. Once groundwater becomes contaminated, it is very difficult or even impossible to remove the pollution. The cost of groundwater remediation can be enormous, with no certain outcome of how effective the final results will be. Since the water moves so slowly, the pollutant is able to stay very concentrated in higher levels in certain areas instead of dispersing over the entire area as surface water does. The pollutants could remain in an area, making the water unusable for a period of many years or decades. After a period of time, the contamination in the groundwater will spread to the surface water as well through its natural outlets.

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.

Significant improvements to UIC industrial/commercial permits continue to be made by close scrutiny of each application in regards to injection well design and maintenance, potential toxicity of proposed injectates, fate and transport of the injectate,

site hydrogeology, and a careful attention to monitoring the sites discharge reports on an ongoing basis. All such sites are currently the responsibility of one hydrogeologist. As the number of industrial/commercial permits continues to increase, support for this portion of the UIC Program must also increase to keep pace with growing development and the need for oversight to ensure responsible methods of fluid injection into the subsurface. Nineteen industrial/commercial permits and sixteen UIC stormwater permits have been issued during this reporting period, in addition to eight Rule Authorizations for the injection of ambient air and injection of subsurface releasing compounds at groundwater remediation sites.

Rule Authorizations

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. Other Rule Authorizations may be issued for use of approved septic systems in process of obtaining a class V UIC sewage permit.

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 break down hydrocarbons and certain other compounds *in situ*. In many situations, 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 other situations, active bioremediation is enhanced by the addition of sulfate, magnesium, and ferric compounds. Other sites are treated with injections of food grade molasses, or other nutrients may be used.

In addition to remediating hydrocarbons, other SRCs may be used to remediate chlorinated hydrocarbons, other metals, and chlorinated biphenyls using hydrogen releasing compounds. Rule Authorizations for eight sites have been granted during this reporting period.

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.

UIC Sewage Permitting

The UIC program promotes new technology to make on-site wastewater cleaner, more efficient and environmentally friendly. UIC staff works closely with the county health departments and the Office of Environmental Health to achieve this goal. If a UIC permit is needed for a facility, UIC staff assists applicants in the completion of the UIC permit application process. All sewage tanks involved with sewage systems, with the exception of holding tanks and receptacles, privy vaults and self-contained excreta disposal facilities, must be registered with WVDEP. The WVDEP has a program that offers the county health departments the option of processing the registration fees under a contract and receiving a portion of the money back to the county.

UIC staff participates and interacts with the State Sewage Advisory Board, which makes recommendations to the Bureau of Public Health (BPH) on technical and procedural issues relating to West Virginia's Sewage Disposal Program, mediates unresolved issues between the sewage industry and regulatory agencies and makes recommendations in other areas of policy modification or development as so directed by the Commissioner of the BPH.

The UIC Program realizes the need for continued public education in regards to the UIC Program and the separate, but equally important issues of each component of the program, such as issues regarding sewage systems, industrial and mining permits.

A major challenge is a lack of groundwater mapping. A major achievement has been the groundwater team's focus on groundwater protection plans for campgrounds. Due to the upsurge in drilling of natural gas wells, the number of campgrounds has skyrocketed. Many of the campgrounds fall outside the UIC permitting criteria due to the number of people served by the septic system. UIC Program personnel worked closely to gather information that led to whether or not a UIC permit would be needed, and what comprised the combined waste stream of sanitary and chemical waste.

Sanitarians and developers were educated regarding UIC Program requirements and research was conducted regarding the potential contamination of recreational vehicle (RV) waste. The result was the development of GPPs that keep chemicals out of the groundwater. The UIC Program is developing a standard operating procedure, in conjunction with the state health department wherein it describes the role of UIC Program and sanitarians and possible situations to ensure consistency of decisions regarding the application of UIC regulations.

Data is collected from sanitarians, manufacturers, waste disposal system installers, designers, labs, concerned citizens, applicants, and potential permittees. UIC field inspectors and applicants supply GIS info which goes to the health department database for source water protection purposes. A challenge we face in the groundwater program is mapping known permitted sites and comparing to this data to drinking water sources.

The UIC Program uses ERIS to manage large amount of information related to responsible parties, financial matters, environmental reports, permit transfers, and to track applications and approved/closed permitted activities.
The UIC Program continues implementing refinements in providing information to potential applicants from the DEP.

Fifty UIC sewage permits were issued during this reporting period.

Enforcement

The enforcement of UIC regulations is primarily dependent on UIC staff with some assistance from the Office of Environmental Enforcement (OEE). Although the major enforcement steps are outlined in 47CSR13, “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 percent. When an informal enforcement does not result in a satisfactory outcome, WVDEP has other enforcement tools at its disposal. Currently, two Environmental Resources Specialists conduct all UIC inspections and UIC enforcement actions. Duties include reviewing and updating Standard Operating Procedures (SOP) for UIC inspections. During this reporting period the EPA UIC reporting definition for high priority wells was changed to state wide instead of well head protection areas.

Inspections

The UIC inspections are conducted at all business facilities (non-residential/multiple dwellings i.e. trailer parks, campgrounds, schools and apartment complexes not serviced by public sewage disposal plants). These inspections are conducted in selected watershed areas, which rotate on a five - year basis. The county sanitarians in selected watersheds are contacted for the areas that are not serviced by a public sewage disposal plant. Inspections are focused on wellhead-protected areas. The regional Environmental Enforcement Inspector is contacted to let him/her know that the UIC program will be conducting UIC inspections in the area and arrange for him/her to accompany the inspector if desired.

In addition to the routine inspection of permitted facilities, suspected Class 5 wells are inventoried and inspected to determine proper classification. Information on suspected disposal wells comes from the Class 5 inventory and database, complaints, request for permits, referrals from other agencies, or discovered upon the routine inspection. During the inspections, which are sometimes multimedia with other programs or agencies, a UIC inspection form is completed on site. The owner/operator is verbally informed of the status of the well. If the facility has a Class 5 well that is not permitted, the owner/operator is given the option to apply and obtain a permit for the well or a closure plan will be implemented. If there are other environmental concerns the owner/operator is given guidelines to obtain compliance. BMPs are reviewed with the facility owner/operator for groundwater protection. BMP implementation not only helps protect the environment, it also enables the facility to operate more efficiently by

reducing the amount of waste generated. The UIC inspector collects locational data on UST'S and AST'S for Health Department (info. for wellhead protected areas) and Waste Management Underground Storage Section. A Review the facility GPP/ or collection of information for facility to obtain a GPP is also done during the inspection.

The UIC Program collects location data on underground storage tanks and above ground storage tanks for the BPH and the Underground Storage Tank Section. As part of the inspection process, GPS locational data is downloaded and data bases updated. Even though the facility may not have a UIC well, other programs or agencies are notified if other environmental concerns exist. The permitting process or enforcement actions are initiated as necessary. UIC inspectors also review the facility's GPP or collects information for the facility to obtain a GPP.

During this reporting period:

- 440 UIC inspections were conducted
- Data on 17 UST'S and 110 AST'S at 84 facilities were collected
- 65 Motor Vehicle Waste Disposal Wells (MVWDWs) were eliminated in vehicle service areas by plugging with cement
- 5 MVWDWs were connected to Public Service District Wastewater Treatment Plant
- A total of 91 verbal/written enforcements were given to owners/operators of facilities.
- Information was collected for 151 Groundwater GPPs

UIC Outreach

The UIC program personnel provide technical assistance to all Owners/Operators of Facilities, WVDEP, OEHS, and WVDA personnel throughout the state. UIC program personnel are working with county sanitarians and educating them on the types of injection wells that require oversight by the UIC program.

g. Groundwater Program Remediation Activities

Since 1991, the remediation section of the Groundwater Program has worked on 347 sites, approximately 58 of which were active during this reporting period.

These sites vary between equipment yards, above-ground releases (such as from truck wrecks), petroleum bulk terminals and refineries, railyards, and manufacturing plants. Some of the sites are active facilities, but many are physically abandoned (as opposed to legally abandoned) and are nothing more than empty lots or fields. Most of the contamination is some type of hydrocarbon, usually diesel fuel or fuel oil; however, other sites have benzene, chloride, or chlorinated solvent problems.

The Groundwater Program is the lead state agency at many of these locations, while we give advice to other DEP programs at others. In general, the Groundwater Program handles those sites with groundwater and soil contamination that do not fit easily under some other regulatory authority. We are for the most part a voluntary program, so compliance with our suggested remedial strategies depends a great deal on the individual company's willingness to complete the work.

To date, 148 No Further Action letters have been provided by the Groundwater Program to those sites where the contamination has been successfully remediated. The Groundwater Program has also provided advice on 107 other sites, and has referred 30 sites to other WVDEP groups. As of the end of June 2013, 32 sites are active with on-going investigation or remediation.

The following is a list of the sites that the Groundwater Program worked on between April 1, 2011 and June 30, 2013.

AEP Point Pleasant Service Center (*Mason County, Middle Ohio River Basin, alluvium, hydraulic oil contamination*): This is a site where a hydraulic lift leaked, and AEP was unable to remove all the contaminated soil without compromising the foundation of their building. The Groundwater Program required groundwater monitoring, which subsequently found no contamination, and the site was provided with a No Further Action letter in May of 2013.

Barton Gasoline Spill (*Pocahontas County, Greenbrier River Basin, colluvium, gasoline*): This is a site where a truck wrecked, spilling gasoline, and where the Groundwater Program provided advice to Environmental Enforcement as to the effectiveness of the resulting soil removal.

Bluewell Family Dollar Store (*Mercer County, Upper New River Basin, colluvium, fuel oil*): This is a site where the construction of a new building uncovered fuel-oil contamination, which the company successfully excavated. The Groundwater Program provided a No Further Action letter in February of 2012.

Bobby Seal Residence (*Jefferson County, Potomac River Basin, karst, fuel oil*): This was a residence where someone stole the copper line leading from a basement fuel tank, which allowed fuel oil to drain into an unimproved basement. Environmental Enforcement had the insurance company remove as much soil as possible; however, this did not resolve the problem. The Groundwater Program required that additional soils removed, after the house foundation was stabilized, and that an oxygen-releasing compound be applied, and this resolved the problem. A No Further Action letter was then issued in November of 2012.

Bunker Hill Fuel Oil Spill (*Berkeley County, Potomac River Basin, karst, fuel oil*): The Groundwater Program provided advice to Environmental Enforcement at this site, where a home tank had leaked fuel oil near a large spring that provides the community's water.

Burns Motor Freight Diesel Spill (*Randolph County, Tygart Valley River Basin, alluvium, diesel fuel*): This is a site where a rusting underground pipeline leaked a large amount of diesel fuel into the subsurface, filling caves with fuel and contaminating the nearby Tygart Valley River. The Groundwater Program was asked to provide advice to Environmental Enforcement, and

subsequently wrote several letters defining what remedial strategies should be employed. The company has completed no serious remedial work at this site to date.

CSX Brooklyn Junction Railyard (*Wetzel County, Middle Ohio River Basin, alluvium, diesel fuel*): This is a site where a locomotive wrecked, but CSX could not excavate all the contaminated soils without undermining their mainline railroad track. The Groundwater Program required groundwater monitoring, which found no contamination. A No Further Action letter was issued in December of 2011.

CSX Clarksburg Diesel Spill (*Harrison County, West Fork River Basin, colluvium, diesel spill*): This is a site where a locomotive wrecked, but where CSX could not remove all of the contaminated soils because of an excessively steep slope. CSX asked for No Further Action after their excavation work; however, the Groundwater Program denied this request and instead required that an oxygen-releasing compound be applied to those areas still contaminated.

CSX Fairmont Railyard (*Marion County, Monongahela River Basin, alluvium, old hydrocarbon*): This is an abandoned yard where CSX removed the worst of the contaminated soils. This also eliminated the site's free product problem, but the groundwater remained contaminated in several areas. Additional remedial strategies (such as liquid extraction) had no effect on this contamination, but it decreased over time and a No Further Action letter was provided by the Groundwater Program in March of 2013.

CSX Grafton Railyard Engine Refueling Area (*Taylor County, Tygart Valley River Basin, alluvium, old hydrocarbon*): This is an active yard where CSX has excavated some contaminated soils and removed free product, but where groundwater contamination continues. The company is currently monitoring the groundwater to determine if the contamination will decrease to acceptable concentrations.

CSX Grafton Railyard Roundhouse Area (*Taylor County, Tygart Valley River Basin, alluvium, solvents*): This is an abandoned area within active yard where CSX has applied an anaerobic-enhancing compound on several occasions, and where they are currently monitoring the groundwater to determine if the contamination will decrease to acceptable concentrations.

CSX Handley Railyard Engine Refueling Area (*Kanawha County, Upper Kanawha River Basin, alluvium, old hydrocarbon*): This is an abandoned yard with a free product problem, groundwater and soil contamination, and where there were hydrocarbon seeps into the adjacent river. CSX has excavated some contaminated soils, recovered a large amount of free product, operated a long-term vapor-extraction system, and maintained a lengthy groundwater monitoring program. The river seeps have been eliminated, and CSX is currently completing additional subsurface investigations.

CSX Handley Railyard Roundhouse Area (*Kanawha County, Upper Kanawha River Basin, alluvium, solvents*): This is an abandoned yard where CSX has applied an anaerobic-enhancing compound on several occasions and attempted several other remedial strategies (such as air sparging), all to no effect. They are currently monitoring the groundwater to determine if the problem will resolve naturally.

CSX Keyser Railyard Roundhouse Area (*Mineral County, North Branch of the Potomac River Basin, alluvium, solvents*): This is an abandoned yard where CSX has removed contaminated soils and applied an anaerobic-enhancing compound on several occasions. CSX is currently

monitoring the groundwater to determine if the contamination will decease to acceptable concentrations (which it appears to be doing).

CSX Maryland Junction Railyard (*Mineral County, North Branch of the Potomac River Basin, alluvium, old hydrocarbon*): This is an abandoned yard where CSX has removed some contaminated soils, recovered free product, and applied an oxygen-releasing compound in the problem area. They are currently monitoring the groundwater to determine if the contamination will decease to acceptable concentrations.

CSX Peach Creek Railyard (Logan County, Guyandotte *River Basin, alluvium, old hydrocarbon*): This is an active railyard where CSX has removed some contaminated soils and recovered free product. They are currently monitoring the groundwater to determine if the contamination will decease to acceptable concentrations.

Cummings Fairmont Service Center (*Harrison County, West Fork River Basin, colluvium, old hydrocarbon*): This is a site where the company has removed some contaminated soils. The Groundwater Program has repeatedly requested a summary report from the company, but this has not been forthcoming to date.

Dry Cave (*Greenbrier County, Greenbrier River Basin, karst, no contamination*): The Groundwater Program provided advice to the Health Department regarding this cave and its nearby geology, as the cave at one time provided drinking water to the local community and to the Greenbrier Resort at White Sulphur Springs.

Ernie's Salvage Yard (*Berkeley County, Potomac River Basin, karst, hydrocarbon contamination*): This was a site where hydrocarbon contamination resulted from the improper handling of waste materials. Environmental Enforcement corrected the handling problem that caused the problem, and the Groundwater Program required excavation of the contaminated soils, followed by groundwater and surface water sampling. This found that the soil removal had been effective, and a No Further Action Letter was issued in April of 2013.

Happy Handy Gasoline Station (*Nicholas County, Gauley River Basin, colluvium, diesel fuel contamination*): This was a site where the Groundwater Program provided advice to Environmental Enforcement, and where the company proposed a very low cost remedial strategy. The Groundwater Program first objected to this strategy, as we did not feel it would be effective, but we later agreed to it, as the company did not have the money to implement anything more aggressive. The company ultimately moved off the site and did nothing.

Harpers Ferry Middle School (*Jefferson County, Shenandoah River Basin, colluvium, fuel oil contamination*): This is a site where fuel oil contamination (from an underground tank) was discovered both before and during construction of new school facilities. The Groundwater Program required both soil excavation and groundwater monitoring, both of which has been implemented at the site.

Hinkleville General Store (*Upshur County, Tygart Valley River Basin, colluvium, hydrocarbon contamination*): This is a gasoline station with aboveground storage tanks that were overfilled, and where the fuel then flowed into a diked-in area with a cracked floor. Environmental Enforcement and the Groundwater Program required soil removal, followed by groundwater and surface water monitoring to insure that the remedial strategy was effective. This provided to be the case, and a No Further Action letter was issued in July of 2011.

I-68 Mile-Marker 1.5 Diesel Fuel Spill (*Monongalia County, Monongahela River Basin, colluvium, diesel fuel contamination*): This was a site where a truck wrecked, spilling its fuel into the interstate-highway ditch. Environmental Enforcement required as much soil excavation as possible. The Groundwater Program then evaluated the data, and a No Further Action letter was issued in July of 2011.

I-68 Mile-Marker 5.0 Diesel Fuel Spill (*Monongalia County, Monongahela River Basin, colluvium, diesel fuel contamination*): This was a site where a truck wrecked, spilling its fuel into the interstate-highway ditch. Environmental Enforcement required as much soil excavation as possible, and the Groundwater Program then required an oxygen-releasing compound be applied to those areas where the soils could not be removed. A No Further Action letter was issued in February of 2012.

I-77 Mile-Marker 5.0 Diesel Fuel Spill (*Mercer County, Upper New River Basin, colluvium, diesel fuel contamination*): This was a site where a truck wrecked, spilling its fuel at two locations (on each side of an interstate bridge), and ultimately contaminated five locations. The Groundwater Program and Environmental Enforcement required as much soil excavation as possible, including an area leading to the nearby creek, followed by soil sampling to insure that the problem had been resolved. A No Further Action letter was issued in November of 2012.

I-77 Mile-Marker 38.0 Diesel Fuel Spill (*Raleigh County, Upper New River Basin, colluvium, diesel fuel contamination*): This was a site a truck axle shattered, gutting the truck's fuel tank. Environmental Enforcement required as much soil excavation as possible, and the Groundwater Program then required an oxygen-releasing compound be applied to those areas where the soils could not be removed. A No Further Action letter was issued in April of 2012.

I-81 Mile-Marker 0.5 Diesel Fuel Spill (*Berkeley County, Potomac River Basin, karst, diesel fuel contamination*): This was a site where a truck wrecked, spilling its fuel into the roadside ditch. Environmental Enforcement required as much soil excavation as possible, and the Groundwater Program reviewed the data, asked that the one on-site groundwater monitoring well be property abandoned, and then issued a No Further Action letter in April of 2013.

Jerry's Salvage Yard (*Lewis County, West Fork River Basin, colluvium, old hydrocarbon contamination*): This is a company that is attempting to improve their facility so that there is less liquid spillage, and where they have excavated soils that require remediation. Personnel from the Groundwater Program visited the site and made recommendations, and then provided Environmental Enforcement with a written memo delineating these suggestions.

KRT site (*Putnam County, Lower Kanawha River Basin, alluvium, hydrocarbon contamination*): This is a site with hydrocarbon contamination that originated from a leaking aboveground tank. Personnel from the Groundwater Program visited the site and provided advice to Environmental Enforcement; however, the company has not instigated any of our suggested remedial strategies.

M&A Trucking Diesel Spill (*Wood County, Little Kanawha River Basin, colluvium, diesel fuel contamination*): This was a site where a truck wrecked, spilling its fuel. Environmental Enforcement required as much soil excavation as possible, and the Groundwater Program reviewed the soil-sampling data and issued a No Further Action letter in August of 2012.

Marathon Kenova Krout Creek Site (*Wayne County, Lower Ohio River Basin, alluvium, benzene contamination*): This is a site that had very severe soil and groundwater benzene

contamination, which resulted from a broken valve on a railroad tank car. Marathon excavated as much contaminated soil as possible, and then instigated an extensive and long-term groundwater monitoring program. This program was terminated in 2012, after nine quarters of no detect data, and a No Further Action letter was issued in November of 2012.

Marathon Kenova Ohio River Seeps (*Wayne County, Lower Ohio River Basin, alluvium, hydrocarbon contamination*): This is a site where old oil has been seeping into the Ohio River. Marathon removed the remaining infrastructure (which was no longer in use), and instigated groundwater monitoring and free product recovery programs. Work at this site continues in two areas, as the free product is proving difficult to remove.

Marathon Kenova Tank 46 Area (*Wayne County, Lower Ohio River Basin, alluvium, hydrocarbon contamination*): This is a single groundwater monitoring well with free product that cannot be attributed to any particular contamination problem. Marathon has sampled the well and the nearby storm sewer, and has proposed a subsurface investigation to better define the problem (which the Groundwater Program has approved).

Miller Chrysler Dealership (*Berkeley County, Potomac River Basin, karst, hydrocarbon contamination*): This is a site where the company discovered hydrocarbon contamination while replacing a buried oil-water separator. Environmental Enforcement required as much soil excavation as possible, along with the removal of contaminated groundwater, and the Groundwater Program required that an oxygen-releasing compound be applied in the open excavation. A No Further Action letter was issued in May of 2013.

Moore Residence (*Berekley Berkeley County, Potomac River Basin, karst, fuel oil contamination*): This was a trailer where a leaking fuel oil tank contaminated the nearby soils. Environmental Enforcement required that the contaminated soils be excavated, and the environmental consultant injected an oxygen-releasing compound into the subsurface. The Groundwater Program inspected the site and provided advice to Enforcement.

NS Bluefield Railyard Fuel Transloading Area (*Mercer County, Upper New River Basin, karst, hydrocarbon contamination*):This is an area within an active yard that has historical hydrocarbon contamination, where NS has removed contaminated soils, implemented a vapor-extraction system, recovered free product, and maintained a long-term groundwater monitoring program. The free product appears to have been eliminated and the groundwater contamination has decreased to the point that a No Further Action letter may soon be issued.

NS Bluefield Railyard Locomotive Fueling Area (*Mercer County, Upper New River Basin, alluvium, hydrocarbon contamination*): This is a site within an active yard where NS had refurbished their infrastructure, recovered free product, and maintained a long-term groundwater monitoring program. The free product appears to have been eliminated, and the groundwater contamination has decreased to the point that a No Further Action letter may soon be issue.

NS Dickinson Railyard (Kanawha *County, Upper Kanawha River Basin, alluvium, hydrocarbon contamination*): This is a small active yard with a free product problem and groundwater and soil contamination. NS is recovering the product and maintaining a groundwater monitoring program.

NS Mullens Railyard (*Wyoming County, Guyandotte River Basin, alluvium, hydrocarbon contamination*): This is an abandoned yard with both soil and groundwater contamination, and where hydrocarbon has historically seeped into the adjacent Guyandotte River. NS has

eliminated these seeps, and is operating a vapor-extraction system at the site. They are also monitoring the groundwater to determine if the remedial strategies have been successful.

NS Williamson Railyard (*Mercer County, Upper New River Basin, alluvium and karst, hydrocarbon contamination*): This is an area within an active yard where the Groundwater Program has repeatedly asked for additional groundwater remediation, but where NS has argued that the infrastructure work completed at the yard will ultimately result in the contamination concentrations decreasing. This deadlock was broken this summer, when these concentrations markedly decreased. Groundwater monitoring continues, and if the contamination concentrations stay at their current low levels, a No Further Action letter may soon be issued.

Pantry Store #2 (*Harrison County, West Fork River Basin, colluvium, hydrocarbon contamination*): This is a gasoline station with aboveground tanks that are repeated overfilled, resulting in both gasoline and diesel contamination. The Groundwater Program has asked for an aggressive remedial plan for this site on several occasions, but the company only implemented limited liquid extraction with continued groundwater monitoring. The property was then sold, and the new owner excavated a large amount of contaminated soils. The removed groundwater monitoring wells were reinstalled, and the recent groundwater monitoring has shown decreased contamination in most (but not all) of the wells.

Porter Falls Diesel Fuel Spill (*Wetzel County, Middle Ohio River Basin, roadside fill, diesel fuel contamination*): This was a site where a truck wrecked in a bad turn, spilling its fuel. Environmental Enforcement required that the contaminated soils be excavated, and the Groundwater Program required an oxygen-releasing compound be applied to remediate those soils under the adjacent highway. A No Further Action letter was issued in June of 2013.

Rogers Residence (*Jefferson County, Potomac River Basin, karst, fuel oil contamination*): This was a home where a leaking fuel oil tank contaminated the soils under the basement floor. Environmental Enforcement required that the contaminated soils be excavated, and the Groundwater Program required an oxygen-releasing compound be applied to remediate the remaining contamination. A No Further Action letter was issued in May of 2012.

R.T. Rogers Bulk Terminal (*Summer County, Lower New River Basin, alluvium, hydrocarbon contamination*): This is a site with soil and groundwater contamination, where the company removed some soils and instigated a liquid-recovery system (which has since been terminated). Groundwater monitoring continues, but the contamination does not appear to be decreasing.

Rutledge Residence (Monongalia *County, Monongahela River Basin, colluvium fuel oil contamination*): This was a home where a leaking fuel oil tank had contaminated the soils surrounding the house. Environmental Enforcement required that the contaminated soils be excavated, and the Groundwater Program asked that additional soils be removed. This resolved the problem and a No Further Action letter was issued in August of 2011.

Speedway Site Bridgeport (*Harrison County, West Fork River Basin, colluvium, hydrocarbon contamination*): This is a site where the Groundwater Program was asked to review the soil and groundwater data already collected, and where we recommended additional remediation (which has not been implemented).

State Route 16 Diesel Fuel Spill (Pleasants *County, Middle Ohio River Basin, colluvium, diesel fuel contamination*): This was a site where a truck wrecked in a bad turn, spilling its fuel.

Environmental Enforcement required that the contaminated soils be excavated, and the Groundwater Program was asked to evaluate the result. We required additional soil sampling and soil removal, not only from the main spill area, but also from an adjacent hillside area. The company complied with these additional recommendations, followed by extensive soil sampling (which found no significant contamination), and a No Further Action letter was issued in July of 2013.

Stonewall Jackson Resort (*Lewis County, West Fork River Basin, colluvium, no contamination*): This was a site where groundwater monitoring wells had been installed to evaluate the runoff from the resort's golf course. The Groundwater Program reviewed the collected data in late 2011, and a No Further Action letter was provided to the site in January of 2012.

T.K. Stanley Site (*Lewis County, West Fork River Basin, alluvium, diesel fuel contamination*): This is a site where an aboveground tank leaked diesel fuel. Environmental Enforcement required the company to remove some soils and sample the excavation walls and bottom, and then asked the Groundwater Program to evaluate the results. We did this, and required more soil removal followed by additional soil sampling. This was completed, but the problem was still not resolved, and a third excavation and soil sampling was required. This resolved the problem, and a No Further Action letter was issued in July of 2013.

Unocal (Chevron) Cabin Creek East Refinery Site (*Kanawha County, Upper Kanawha River Basin, alluvium, hydrocarbon contamination*): This is a site with soil and groundwater contamination, as well as a free product problem (in one groundwater monitoring well). Unocal (and now Chevron, the new owner) has employed phytoremediation to resolve the problem. Groundwater monitoring and free product recovery continues.

Unocal (Chevron) Cabin Creek Pipeline Site (*Kanawha County, Upper Kanawha River Basin, alluvium, hydrocarbon contamination*): This is a site with both soil and groundwater contamination, and where Unocal (and now Chevron, the new owner) has employed soil-venting and vapor-extraction to resolve the problem. Contaminant concentrations have reached the point where this site will be issued a No Further Action letter.

Unocal (Chevron) Cabin Creek West Bulk Terminal Site (*Kanawha County, Upper Kanawha River Basin, alluvium, hydrocarbon contamination*): This is a site with both soil and groundwater contamination, and where Unocal (and now Chevron, the new owner) has employed phytoremediation (with long-term groundwater monitoring) to resolve the problem. Contaminant concentrations have decreased to the point that this site may soon be issued a No Further Action letter.

VA Hospital Martinsburg (*Berkeley County, Potomac River Basin, karst, fuel oil contamination*): This is a site that had both soil and groundwater hydrocarbon contamination, as well as a free product problem, which resulted from a leaking underground fuel line. The hospital had employed soil excavation, free product recovery, and applying an oxygen-releasing compound to resolve the problem. Groundwater monitoring showed that the contaminant concentrations had been reduced to acceptable levels, and a No Further Action letter was issued in February of 2013.

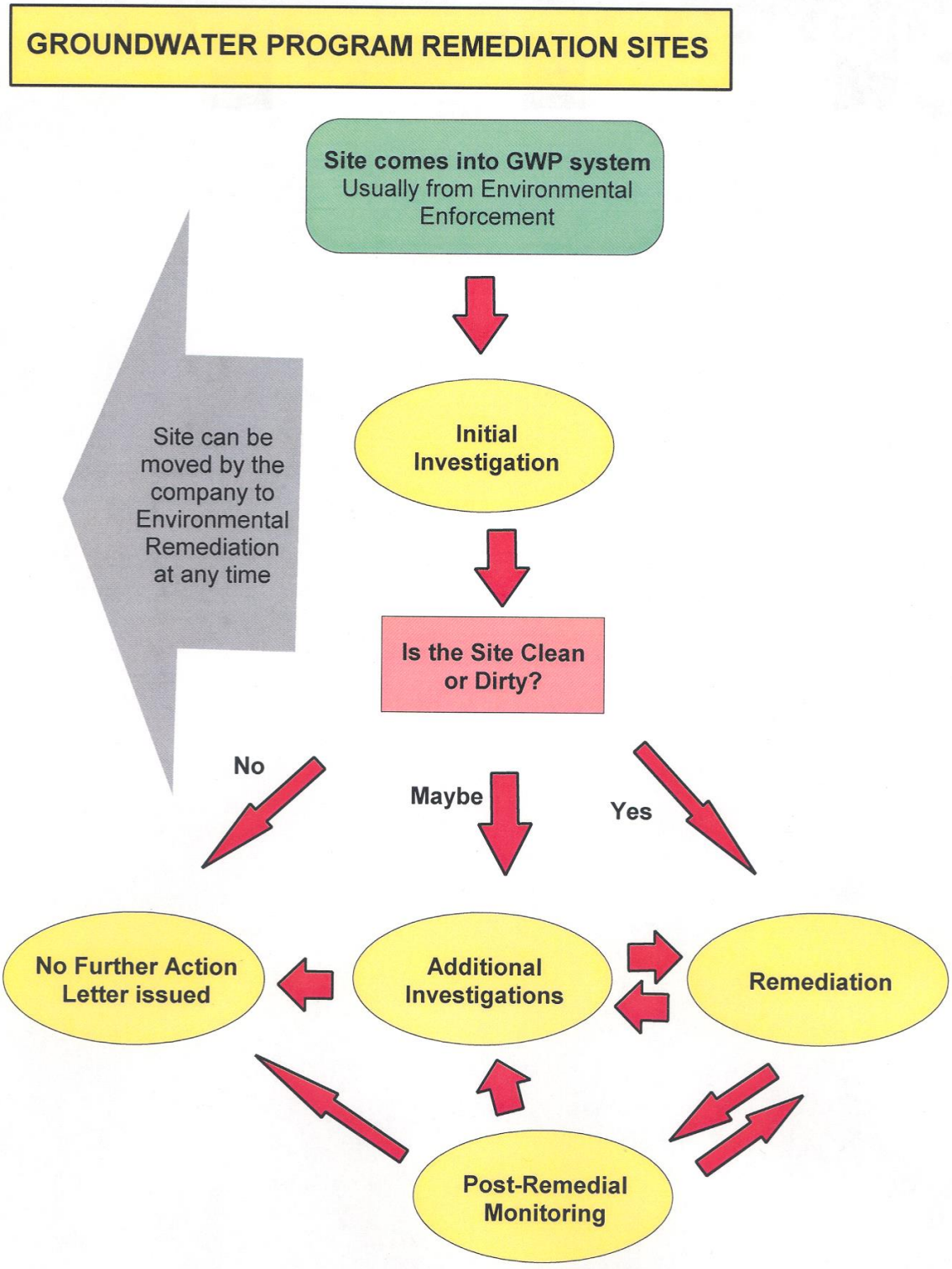
VA Hospital Martinsburg (*Berkeley County, Potomac River Basin, karst, solvent contamination*): This is a facility with solvent groundwater contamination, where the hospital is working to locate the source and resolve the problem. Groundwater monitoring continues.

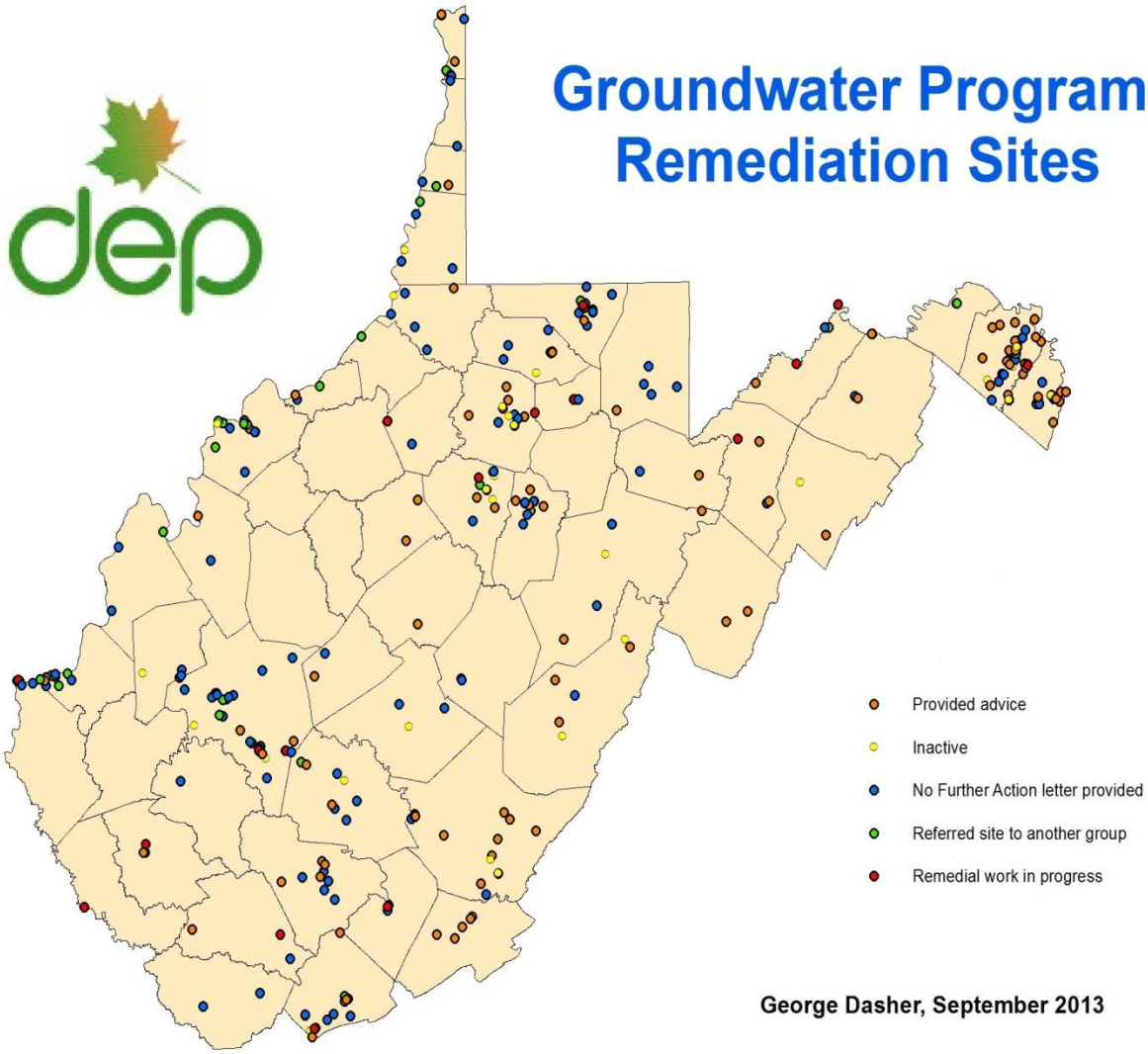
VEPCO Mount Storm Power Plant (*Grant County, North Branch of the Potomac River Basin, colluvium, hydrocarbon contamination*): This is a facility with a free product and groundwater contamination, where the company continues to recover product.

Williams Cameron Pipeline Break (*Marshall County, Upper Ohio River Basin, colluvium, natural gas contamination*): This is a site where a tiny landslide caused a break in a natural gas pipeline. Environmental Enforcement required that the contaminated soil be excavated and properly disposed of. They then asked for the Groundwater Program to evaluate the soil-sample data, and we issued a No Further Action letter in July of 2013.

Williams Fuharty Pipeline Break (*Wetzel County, Middle Ohio River Basin, colluvium, hydrocarbon contamination*): This is a site where a landslide caused a break in a natural gas pipeline. Environmental Enforcement required that the contaminated soil be excavated. They then asked for the Groundwater Program's advice, and was issued a No Further Action letter in April of 2013.

Williams Proctor Pipeline Break (*Wetzel County, Middle Ohio River Basin, colluvium, hydrocarbon contamination*): This is a site where a large landslide caused a break in a natural gas pipeline. Environmental Enforcement required soil excavation, and personnel from the Groundwater Program visited the site andCtogether with Enforcement proposed both a soil-sampling strategy and groundwater monitoring plan. This was completed and no significant contamination was found. A No Further Action letter was issued in April of 2013.


GROUNDWATER PROGRAM REMEDIATION SITES
Site comes into GWP system
Usually from Environmental Enforcement
Initial Investigation
Is the Site Clean or Dirty?
Site can be moved by the company to Environmental Remediation at any time
No
Maybe
Yes
No Further Action Letter issued
Additional Investigations
Remediation
Post-Remedial Monitoring


Groundwater Program
Remediation Sites
dep
Provided advice
Inactive
No Further Action letter provided
Referred site to another group
Remedial work in progress
George Dasher, September 2013

Groundwater Sampling

Employing air sparging, left and a bio-venting, right at groundwater cleanup sites

At left, a Geoprobe unit injects oxygen release compounds at a bio-remediation site. At right, a high vacuum pump truck extracts hydrocarbons.

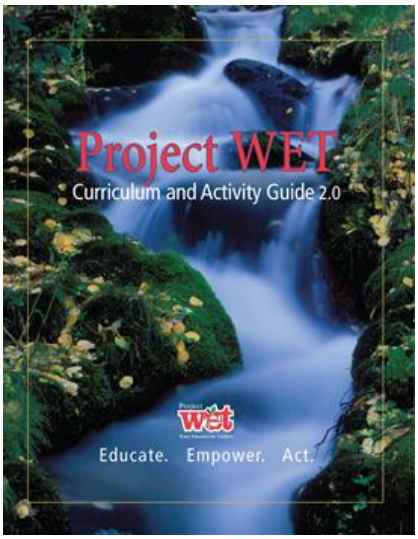
Hydrocarbon sheen on a stream with absorbent pads being used to keep the contamination from entering the stream.

A sinkhole filled with trash - a direct conduit for contamination to enter groundwater in Karst areas.

4. Education and Outreach

Project WET (Water Education for Teachers) Program

Project WET is an international, interdisciplinary water science and education program for educators of all sorts—public and private school teachers, water resource professionals, youth club leaders and many others.



The Project WET curriculum was developed through collaboration of teachers, scientists, and resource professionals. The program correlates with appropriate state and national standards of learning.

Project WET believes that educators hold the key to empowering people to effect sustainable, positive change in local communities for the benefit of all water users.

The program addresses atmospheric water, surface water, groundwater, cultural and historical uses of water, and contemporary water management issues such as stormwater management and nonpoint source pollution.

Project WET makes water education FUN and helps educators meet their objectives in an innovative way. The activities are designed to complement existing curricula rather than displace or add additional concepts in the classroom. Project WET activities are interdisciplinary, hands-on, and engaging to make water education fun for students and teachers.

Project WET Programs and Workshops

Project WET is sponsored by the West Virginia Department of Environmental Protection. The workshops are FREE and conducted throughout the state.

West Virginia Project WET provides 3 basic workshop types:

Teacher Training – For educators of grades K-12, both formal and non-formal, these workshops are 6 hour trainings designed to introduce teachers to Project WET and to familiarize them with both the book and the activities so that they can confidently take the program back to their students.

Facilitator Training – These workshops are designed to train water educators to conduct Project WET Teacher Trainings.

Specialized Workshops – Stormwater Managers around the state, in particular, have been seeking out Project WET for help implementing their stormwater outreach and education permit requirements.

West Virginia Water Festivals

Throughout 2013, the West Virginia Department of Environmental Protection, in collaboration with the National Park Service and a wide variety of other federal, state, local, and volunteer organizations, coordinated a total of 7 West Virginia Water Festivals.

A Water Festival is a one-day water education event for 5th grade students, designed to heighten awareness about precious water resources and the role that every person has in protecting the health of our watersheds and the health of our planet.

The event strives to meet existing curriculum standards for 5th grade, and provide teachers with up-to-date information about natural resources as well as access to innovative approaches for teaching these concepts in their own classrooms.

The festival is also a unique opportunity for 5th graders to be introduced to a wide variety of careers and employment opportunities, which exist in their own community.

- Water Quality
- Pollution
- Aquatic Species
- Habitat
- Conservation
- Water Cycle
- Stormwater
- Water Safety
- Trash/Recycling
- Sedimentation
- Acid Rain
- Flooding
- Healthy Habits

Outreach

West Virginia Project WET strives to reach as many West Virginia residents as possible with water education. Although the program's primary focus is to conduct workshops for educators who will use the curriculum in their teaching year after year, Project WET does participate in outreach events throughout the state when possible. Project WET also cultivates an interactive, online water education community through social media. This site can be found at: http://www.facebook.com/WestVirginiaProjectWet.

TABLE 1. PROJECT WET WORKSHOPS

Workshop Type	Workshop Location	County	Date	number of participants
Water Festival Presenter Training	DEP Headquarters, Charleston	Kanawha and Putnam	March 28, 2012	14
Educator Training	WV American Water	Kanawha	April 12, 2012	2
Educator Training	Boys and Girls Club of Charleston and St. Albans	Kanawha	May 30, 2012	22
Wonders of Wetlands	Ward Hollow Wetland, DOW Chemical, Charleston	Kanawha	June 5, 2012	22
K-2 Project WET Intro	Upshur County Headstart	Upshur	Sept. 6, 2012	25
Facilitator Training	Tygart Lake	Taylor	Sept. 8-9, 2012	9
Water Festival Presenter Training	Concord University	Mercer	Sept. 13, 2012	10
Educator/Water Festival Training	Coal River Group, Tornado	Kanawha	Nov. 10, 2012	16
Stormwater Educator Training	Charleston, WV	Kanawha	Jan. 31, 2013	23
Educator Training	Oglebay Resort Wheeling WV	Ohio	Feb. 16, 2013	21
Educator Training	West Virginia Wesleyan College Buckhannon, WV	Upshur	Feb. 23, 2013	8
Facilitator Training	Charleston, WV	Kanawha	Feb. 28, 2013	5
Educator Training	Martinsburg, WV	Berkeley	Mar. 9, 2013	26
Facilitator Training	Martinsburg, WV	Berkeley	Mar. 10, 2013	12
Educator Training	Beckley, WV	Raleigh	Mar. 23, 2013	8
Pre-service Teacher Training	Morgantown, WV	Monongalia	April 2-4, 2013	50
Facilitator Training	Oak Hill, WV	Fayette	Apr. 29, 2013	2
Stormwater Educator Training	Fairmont, WV	Marion	May 9, 2013	13
Wonders of Wetlands Teacher Training	Charleston, WV	Kanawha	June 6, 2013	12
Educator Training	Cacapon Berkeley Springs, WV	Morgan	June 17, 2013	13
Stormwater Educator Training	Moundsville, WV	Marshall	June 19, 2013	8
TOTAL = 321 participants				

West Virginia Water Festivals

Festival Name	Festival Location	County	Date	number of participants
Hurricane Water Festival	Hurricane, WV	Putnam	May 3 and 4, 2012	500
Boys and Girls Club Water Festival	Coal River Group Park	Kanawha	June 29, 2012	150
Charleston Water Festival	Capitol Complex	Kanawha	Sept. 14, 2012	250
Wyoming County Water Festival	RD Bailey Lake	Wyoming	Sept. 20, 2012	300
Fayette County Water Festival	Fayette County Park	Fayette	Sept. 21, 2012	200
Nicholas County Water Festival	Carnifex Ferry State Park	Nicholas	Sept. 27, 2012	300
McDowell County Water Festival	Linkous Park	McDowell	Sept. 28, 2012	225
Grandview Water Festival	Grandview State Park	Raleigh	Oct. 4 and 5, 2012	400
TOTAL = 2325 students				

Project WET Outreach

Event	Location	County	Date	Activity/Presentation	Number of participants
DEP Day at the Legislature	Capitol Complex, Charleston	Kanawha	February 15, 2012	Groundwater Model	200
Loan of Project WET Supplies	McKinley Middle School, St. Albans	Kanawha	March 1, 2012	Enviroscape/ Groundwater Model	100
Envirothon	Flatwoods, WV	Braxton	April 20, 2012	Monitor Water Quality Testing Site	150
Earth Day	Clay Center, Charleston	Kanawha	April 21, 2012	Rainsticks	100
Earth Day	Salem Elementary, Salem WV	Harrison	April 23, 2012	Sum of the Parts	150
DEP Take Your Child To Work Day	Charleston DEP Headquarters	Kanawha	April 26, 2012	Incredible Journey	30

Project WET Outreach

Event	Location	County	Date	Activity/Presentation	Number of participants
Wastewater Treatment Plant Education and Site Visit	New River Gorge Learning Co-Op	Fayette	May 16, 2012	Sum of the Parts/Wastewater Treatment Facility Site Visit	7
Piney Creek Watershed Celebration	Little Beaver State Park	Raleigh	June 22, 2012	Surface Tension Activity	100
New River Festival	New River Gorge	Fayette	Aug. 11, 2012	Surface Tension Activity	50
Envirothon Teacher Training	Flatwoods	Braxton	October 15, 2012	Seeing Watersheds	25
Enviroscape Loan	JE Robins Elementary, Charleston	Kanawha	November 5, 2012	Enviroscape, non-point source pollution	50
Stormwater Education Meeting	City of Charleston Engineers	Kanawha	November 13, 2012	Enviroscape, Sum of the Parts	4
MS4 Meeting	Charleston	Kanawha	January 30, 2013	Presentation on Project WET Stormwater Activities/Workshops	40
Water Festival Mentoring Meeting	Morgantown	Monongalia	February 11, 2013	Mentoring/Planning Meeting on how to conduct a West Virginia Water Festival	3
Madison Middle School Outreach	Madison	Boone	March 12, 2013	Seeing Watersheds	200
Rainbarrel Workshop	Charleston	Kanawha	May 29, 2013	Assist with rainbarrel instruction and assembly	25
New River Festival	New River Gorge	Fayette	June 8, 2013	Fish prints	50
TOTAL = 1284 people					

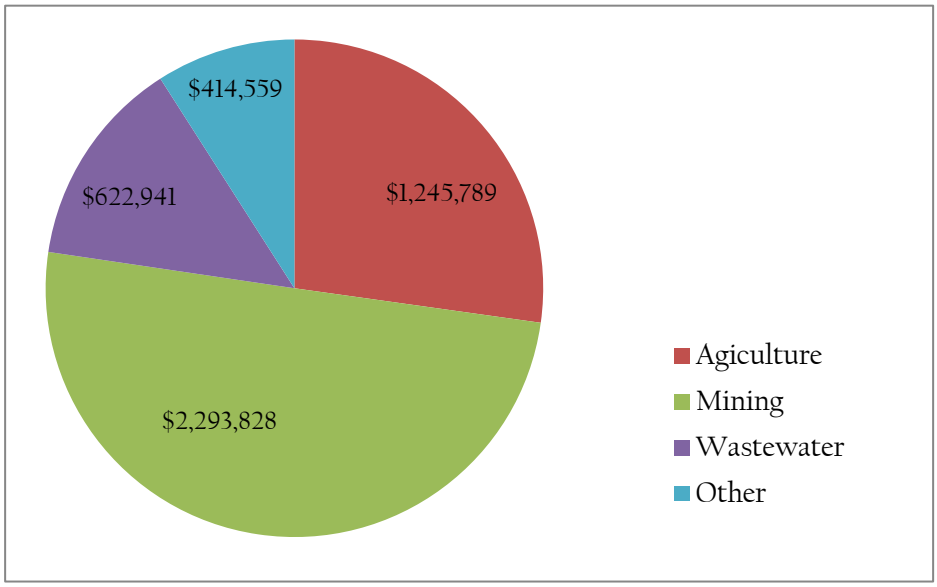
The mission of Project WET is to “reach children, parents, educators, and communities of the world with water education”. West Virginia Project WET used fun, engaging, interactive activities to bring water education to a total of **3930 West Virginia residents** between the dates of July 1, 2011 and June 30, 2013.

5. Non-Point Source Program

Non-Point Source Program (NPS) Summary

The NPS Program continues to expand its efforts to restore and protect our state's streams impacted or threatened by nonpoint source pollution. Since these impacts are not regulated there are always challenges when implementing these types of programs. In fiscal year 2012 the 2008 projects were closed-out. The NPS Program provided oversight on 67 projects, 57 of which used 319 funds. 35% of 319 projects were additional grant opportunity (AGOs) projects. These funds are budgeted annually but can also include left-over money from staffing, and other program funds that were not spent. AGOs offer the NPS Program the opportunity to fund a wide variety of efforts related to the mission of the program, they support incremental efforts, build capacity, and provide opportunities for new partnerships for future incremental projects.

Categories of NPS pollutants



Of the 57 319 funded projects, about 45% have been completed. The most common categories are shown in the pie chart. The categories were determined by the 319 funding provided to each. It should be noted that many of the projects have multiple pollutant reduction goals and objectives but the chart provides a good base for comparison.

Significant progress was made in the reduction of pollutants that are tracked on a national level; these are sediment and nutrients (nitrogen and phosphorous). Most of the sources of these pollutants are from agricultural and stormwater sources. West Virginia does not have large scale agricultural operations, and as a whole is still largely un-developed. Many of our urban areas are small when compared to the larger urban areas within EPA Region III.

However, efforts initiated by the Chesapeake Bay Program have provided us new opportunities to explore projects that reduce sediment and nutrients. In other parts of the state, the NPS Program and WVCA explored nutrient reduction opportunities from projects that require fecal coliform reductions from agricultural sources. The Table

below provides a summary of the load reductions either achieved or expected over the past year.

Load reductions achieved or expected from NPS projects

Mining		**Agriculture/Wastewater/NSD**	
Acidity	445,641 lbs/year	Nitrogen	137,584 lbs/year
Aluminum	31,600 lbs/year	Phosphorous	75,315 lbs/year
Iron	121,863 lbs/year	**Total nutrients**	14,364 lbs/year
Manganese	10,683 lbs/year	Sediment	641 tons/year
Total metals	**164**,**146** lbs/year	Fecal coliform	3.5E+15 cfu

The ultimate goals of any restoration efforts are to restore the stream so that all water quality conditions are met and maintained and the uses are attained. Depending on the type of pollutant and impairment this task can be extremely difficult especially for nonpoint sources of pollution. The US EPA has developed a criterion for Success Stories that show improvements and in some cases complete restoration. These stories are displayed on an EPA website, which is updated annually. This site provides a picture of the benefits of NPS funding and show the results of these efforts.

Success stories can be accessed at: http://water.epa.gov/polwaste/nps/success319/.

States are required to submit at least one success story annually to their EPA Region. In 2012 the West Virginia NPS Program had several options due to significant progress being made in the Potomac Direct Drains, Cheat, and Tygart Valley watersheds. We chose to submit Sovern Run, a small trout stream in the Lower Cheat River, a stream significantly impacted by past mining. Although not completely healed, the stream is showing remarkable recovery. Not only is water chemistry improving, fish have been observed in reaches where they have not appeared for many years and local residents and others are taking advantage of its recovery by making it a hiking and camping destination. More information about the Sovern Run recovery is provided later in this report.

In addition to Sovern Run, Indian Creek a tributary of Sleepy Creek in the Potomac has been de-listed from the 303(d) list, showing no evidence of fecal coliform impairments. The implementation of the 2008 Sleepy Creek incremental project was primarily responsible for this success, and definitely a near future success story. Passive acid mine drainage (AMD) projects on Smooth Rock Lick in the Tygart Valley watershed have also shown a great deal of promise. The discharges from all the projects are now alkaline and the stream is responding positively to the improvements.

It is important to understand that NPS restoration efforts are a long term commitment. In some cases these streams have been impaired for decades and restoration efforts must continue and be consistent if there is hope for the future. In addition to 319 funds, the State should examine all possibilities so that additional effort

can be made toward improving and protecting our water quality for future generations. The progress since 1989 should not be slowed simply because a reduction or loss of federal funding.

Relationship to groundwater

None of the program's projects are focused on groundwater although indirect groundwater improvements are assumed. Below is a list of project types that have some groundwater relationships. These types of projects are highlighted in the attached table.

- Septic pumping/repair projects improve the performance of faulty septic systems;

- Stormwater projects such as rain gardens and wetland restoration use natural infiltration and treats surface runoff by allowing it to slowly move into the groundwater.

No monitoring of groundwater occurs in the program; however in the near future we plan to work closely with DEP Program to develop acceptable monitoring protocols four our decentralized and other alternative wastewater systems that have been and are being currently installed with §319 funds. The national goals of the program set by EPA focus on TMDL implementation and removal of impaired streams from the 303(d) list. There is no documentation of the effects of these activities on public or private water supplies but restoring the designated use of "drinking water" is a part of TMDL implementation.

The table below is a list of active projects in FY 2012.

Project Name	Category	County	HUC8	Program	FY	Costs	Organization
Ury Septic field/bank repairs	Bacteria	Wyoming	Upper Guyandotte	NPS/SRF	2008	$195,000	Upper Guyandotte Watershed Assoc.
Muddy Creek Phase 2	Metals	Preston	Cheat River	NPS/SRF	2008	$192,535	Friends of Cheat
North Fork Greens Run	Metals	Preston	Cheat River	NPS	2008	$250,000	Friends of Cheat
Pringle Run/Pase	Metals	Preston	Cheat River	NPS	2008	$250,000	Friends of Cheat
Sleepy Creek	Bacteria	Morgan	Potomac Direct Drains	NPS	2008	$487,587	Sleepy Creek Watershed Assoc.
Kitchen Creek III Phase 2	Bacteria	Monroe	Greenbrier River	NPS	2008	$130,000	WV Conservation Agency
Smooth Rock Lick #1 & 2	Metals	Upshur	Tygart Valley River	NPS	2008	$122,930	Buckhannon River Watershed Assoc.
Mulch and Skid Road repairs	Sediment	Pocahontas	Elk River	AGO	2008	$36,988	WVU - Appalachian Hardwood Center
Widmyer Wetland construction	Stormwater	Morgan	Potomac Direct Drains	AGO	2008	$11,162	Eastern Panhandle Conservation District
Water in Karst	Outreach	Greenbrier	Greenbrier River	AGO	2008	$10,200	Greenbrier River Watershed Assoc.
Baltimore St. raingardens	Stormwater	Berkeley	Potomac Direct Drains	AGO	2008	$33,614	Opequon Project Team
Virginia Chapel pervious pavement	Stormwater	Kanawha	Upper Kanawha River	AGO	2008	$20,000	Town of Cedar Grove
Watershed Celebration Day	Outreach	Kanawha	Statewide	Various	2008	$15,927	Various stakeholders
Total number of projects	13				**Total**	**$1,755,943**	100% Complete
Reed Mine & Valley Point 12	Metals	Preston	Monongahela River	NPS	2009	$269,000	Friends of Deckers Creek
Kitchen Creek II	Bacteria	Monroe	Greenbrier River	NPS	2009	$108,523	WV Conservation Agency
Mill Creek of South Branch	Bacteria	Hardy	South Branch Potomac	NPS	2009	$174,000	WV Conservation Agency
Mill Creek of Opequon	Bacteria	Berkeley	Potomac Direct Drains	NPS	2009	$448,000	Canaan Valley Institute
Lamberts Run Guinn Portal	Metals	Harrison	West Fork River	NPS	2009	$150,000	WVU - WV Water Research Institute

Project Name	Category	County	HUC8	Program	FY	Costs	Organization
Cane Fork of Cabin Creek	Metals	Kanawha	Upper Kanawha	NPS	2009	$150,000	WVU - WV Water Research Institute
Sovern Run Clark	Metals	Preston	Cheat River	SRF	2009	$192,213	Friends of Cheat
Muddy Creek Schwab	Metals	Preston	Cheat River	SFR	2009	$41,575	Friends of Cheat
Morgan Run DeAntonis	Metals	Preston	Cheat River	SRF	2009	$47,522	Friends of Cheat
SDC rain garden	Stormwater	Jefferson	Potomac Direct Drains	AGO	2009	$8,645	Shepherdstown Daycare Center
Potter Ave rain garden	Stormwater	Randolph	Tygart Valley River	AGO	2009	$6,000	Woodland Development
Year of Karst	Outreach	Monroe	Upper New River	AGO	2009	$7,862	Indian Creek Watershed Assoc.
Appalachian Watershed Stream Monitors	Monitoring	Pendleton	South Branch Potomac	AGO	2009	$45,000	The Mountain Institute
Streambank evaluations	Monitoring	Monongalia	Monongahela River	AGO	2009	$10,230	Friends of Deckers Creek
Watershed Celebration Day	Outreach	Tucker	Statewide	Various	2009	$18,006	Various stakeholders
Total number of projects	15				**Total**	**$1,676,576**	47% Complete
Burch High School NSD	Restoration	Mingo	Tug Fork River	SRF	2010	$138,873	Canaan Valley Institute
Pigeon Creek NRCS	Restoration	Mingo	Tug Fork River	SRF	2010	$22,000	Natural Resource Conservation Service
Slabcamp Run	Metals	Preston	Monongahela River	NPS	2010	$491,800	Friends of Deckers Creek
Back Creek Ag BMPs	Bacteria	Monroe	Greenbrier River	NPS	2010	$192,381	WV Conservation Agency
Winding Gulf OSLP	Bacteria	Raleigh	Upper Guyandotte	NPS	2010	$229,600	Canaan Valley Institute
N Fork Elkhorn OSLP	Bacteria	McDowell	Tug Fork River	NPS	2010	$317,900	McDowell County Wastewater Coalition
Summerlee Bioremediation	Metals	Fayette	Lower New River	NPS	2010	$90,760	Plateau Action Network
West Run Phase 1	Metals	Monongalia	Monongahela River	NPS	2010	$73,850	WVU - WV Water Research Institute
Kitchen Creek III Phase 1	Bacteria	Monroe	Greenbrier	NPS	2010	$245,586	WV Conservation Agency
Lost River Stream Restoration	Sediment	Hardy	Cacapon River	NPS	2010	$125,000	WV Conservation Agency
State Fair rain gardens	Stormwater	Greenbrier	Greenbrier River	AGO	2010	$17,462	WV Conservation Agency
Pet waste/Rain gardens	Stormwater	Raleigh	Lower New River	AGO	2010	$17,462	Piney Creek Watershed Assoc.

Project Name	Category	County	HUC8	Program	FY	Costs	Organization
Riparian Restoration	Sediment	Morgan	Potomac Direct Drains	AGO	2010	$7,134	Warm Springs Run Watershed Assoc.
State of the Watershed Report	Outreach	Greenbrier	Greenbrier River	AGO	2010	$4,200	Friends of Lower Greenbrier
Watershed Celebration Day	Outreach	Raleigh	Statewide	Various	2010	$12,370	Various stakeholders
Total number of projects	15				**Total**	**$1,986,378**	41% Complete
Slabcamp Tributary	Metals	Preston	Monongahela River	NPS	2011	$274,089	Friends of Deckers Creek
Kitchen Creek II	Bacteria	Monroe	Greenbrier River	NPS	2011	$82,534	WV Conservation Agency
Muddy Creek Greenbrier	Bacteria	Greenbrier	Greenbrier River	NPS	2011	$369,980	WV Conservation Agency
Lambert Site 7	Metals	Harrison	West Fork River	NPS/SRF	2011	$641,557	WVU - WV Water Research Institute
Tuscarora Creek	Bacteria	Berkeley	Potomac Direct Drains	NPS	2011	$95,890	Canaan Valley Institute
Elks Run	Bacteria	Jefferson	Potomac Direct Drains	NPS	2011	$100,700	WV Conservation Agency
FOLG rain garden	Stormwater	Greenbrier	Greenbrier River	AGO	2011	$15,000	Friends of Lower Greenbrier
Watershed Education	Outreach	Grant	Potomac Direct Drains	AGO	2011	$15,129	Potomac Valley Audubon Society
Monitoring and Mapping	Monitoring	Preston	Cheat River	AGO	2011	$45,000	Friends of Cheat
Clean Creek Program	Monitoring	Monongalia	Monongahela River	AGO	2011	$15,000	Friends of Deckers Creek
Watershed Celebration Day	Outreach	Lewis	Statewide	Various	2011	$10,700	Various stakeholders
Total number of projects	11				**Total**	**$1,665,579**	27% Complete
Potts Creek	Bacteria	Monroe	James River	NPS	2012	$565,440	WV Conservation Agency
Kitchen Creek III	Bacteria	Monroe	Greenbrier River	NPS	2012	$114,529	WV Conservation Agency
Milligan Creek BMPs	Bacteria	Greenbrier	Greenbrier River	NPS	2012	$205,100	Friends of Lower Greenbrier
Cup Run Stream Restoration	Restoration	Pocahontas	Elk River	NPS	2012	$334,800	Elk Headwaters Watershed Assoc.
Fayette Square	Stormwater	Fayette	Lower New River	NPS	2012	$139,619	Plateau Action Network
Roaring Creek Mars Portal	Metals	Randolph	Tygart Valley River	NPS	2012	$315,302	WVU - WV Water Research Institute

Project Name	Category	County	HUC8	Program	FY	Costs	Organization
Sovern Run - Titchnell/Sands	Metals	Preston	Cheat River	SRF	2012	$316,490	Friends of Cheat
West Run Phase 2	Metals	Monongalia	Monongahela River	NPS	2012	$441,141	WVU - WV Water Research Institute
Herods Run	Metals	Upshur	Tygart Valley River	SRF	2012	$357,193	WVU - WV Water Research Institute
Roaring Creek/Mars Portals 2	Metals	Randolph	Tygart Valley River	SRF	2012	$315,302	WVU - WV Water Research Institute
Watershed Celebration Day	Outreach	Kanawha	Statewide	Various	2012	$14,435	Various stakeholders
North Fork Greens Run Refuse	Metals	Preston	Cheat River	SRF	2012	$111,523	Friends of Cheat
Summerlee Stream Restoration	Restoration	Fayette	Lower New River	SRF	2012	$236,853	Plateau Action Network
Total number of projects	13			**Total**		**$3,230,874**	
Total number of projects 2008-2012	**67**			**Overall total**		**$10,315,350**	Overall 45% Complete

6. National Pollutant Discharge Elimination System (NPDES) Permit Program

The NPDES Individual Permit Program is continuing its efforts in implementing the requirements of its recently adopted Combined Sewer Overflow (CSO) Policies. The new policies provide specific requirements and direction to the CSO communities in developing and implementing their nine minimum controls and long-term control plans. New requirements are being implemented in permits and administrative orders.

For groundwater-related issues at industrial facilities, the staff members closely work with the groundwater section personnel to provide necessary technical assistance. For discharge of groundwater generated because of groundwater clean-up activities, the section issues the required permit modifications or permits.

The General WV/NPDES Water Pollution Control Permit for Discharges Associated with the Remediation of Petroleum Contaminated Sites was reissued in 2013, and expires in May of 2018, helps to expedite groundwater cleanup by providing the permit coverage.

The General WV/NPDES Water Pollution Control Permit for Discharges from the Water Treatment Plants was first issued in 2000 to provide permit coverage for discharges from water treatment plants. The permit was reissued in July of 2013. This general permit requires submission of a GPP from the applicants.

NPDES permits for industrial facilities also require submission of GPP plans which promote improved housekeeping practices, improved diking for storage facilities, improved loading/unloading practices for chemicals etc. Thus, GPP plans help to protect groundwater at industrial sites. Similarly, in the case of storm water discharges from industrial sites, stormwater pollution prevention plans (SWPPP) are required for NPDES permits and in the stormwater general permit. These plans also help indirectly to protect groundwater at industrial sites.

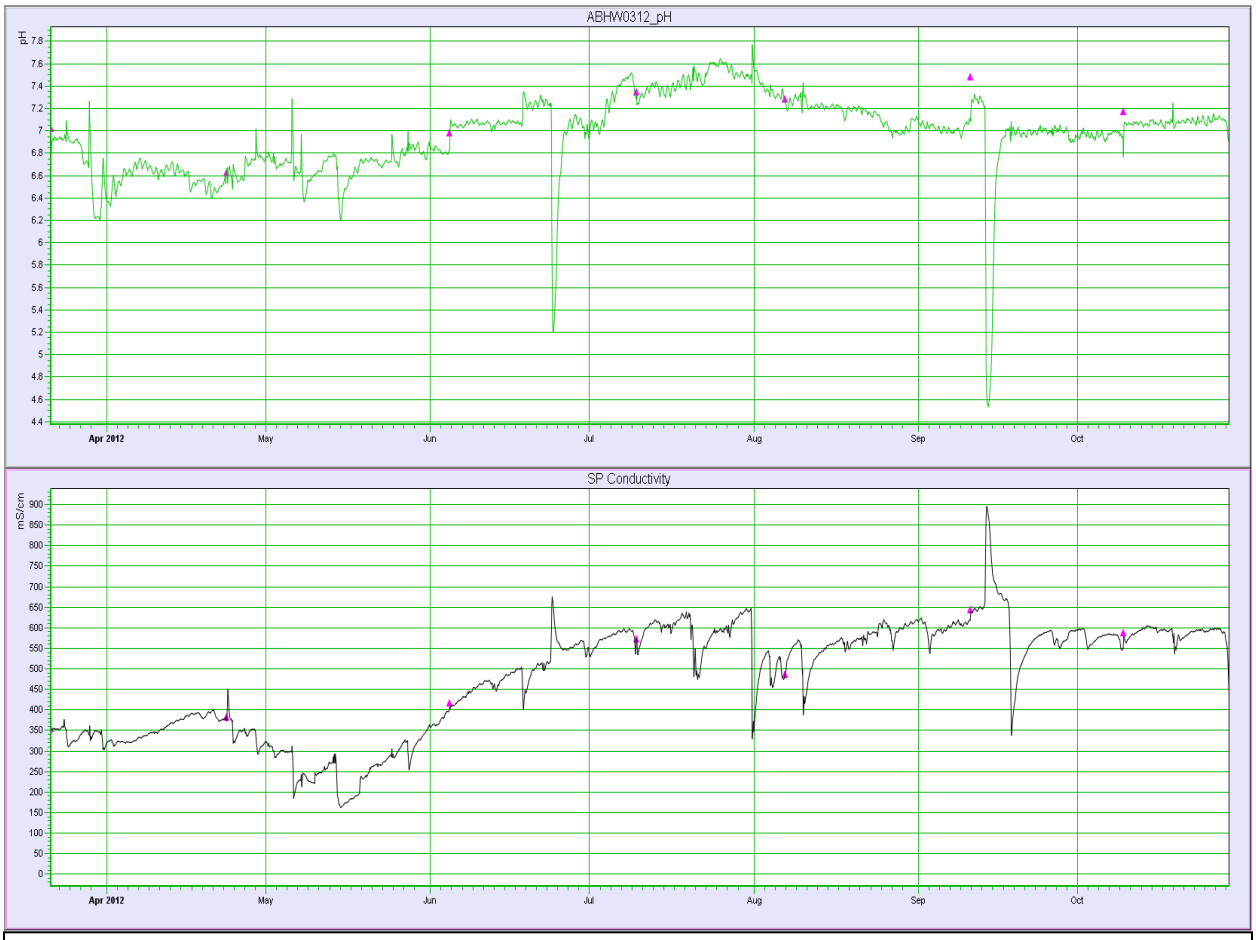
7. Watershed Assessment Branch

The Watershed Assessment Branch (WAB) was created in March 2002 from the joining of two existing programs, the Watershed Assessment Section (WAS) and the Total Maximum Daily Load (TMDL) Section. The WAB consists of biologists, environmental specialists, and analysts whose primary focus is to measure and assess the physical, chemical, and biological integrity of WV's streams, rivers, and lakes. Although this water quality information is used for a myriad of purposes, a major effort is placed on the preparation of The West Virginia Integrated Water Quality Monitoring and Assessment Report (IR). This report, required by U.S. EPA every 2 years, combines the 303(d) list of impaired waterbodies with the 305(b) assessment, a report that focuses on the overall quality of West Virginia's waters.

The WAB utilizes a specific combination of physical, chemical, and biological variables to help assess the health of streams and lakes in WV. These measures also help identify potential stressors and how they may be affecting the aquatic life communities of these waterbodies.

The WAB uses a variety of programs to assess and monitor WV's waterbodies. These include a stratified probabilistic monitoring design or "random" sampling design; a targeted sampling design; a long-term or "ambient" site network (mainly in WV's largest streams and rivers); a continuous monitoring design using deployable water quality meters (dataloggers); and a thorough pre-TMDL development sampling design to meet

the objectives of assessing the water quality of waterbodies throughout WV. In 2007, WAB added the 'LiTMuS' monitoring program, which entails annual sampling of



Continuous pH and specific conductance data recorded in a stream with a deployed datalogger. *WV DEP Watershed Assessment Branch*

wadeable streams throughout the state to better understand annual variation and track changes in different stream types with different stressors.

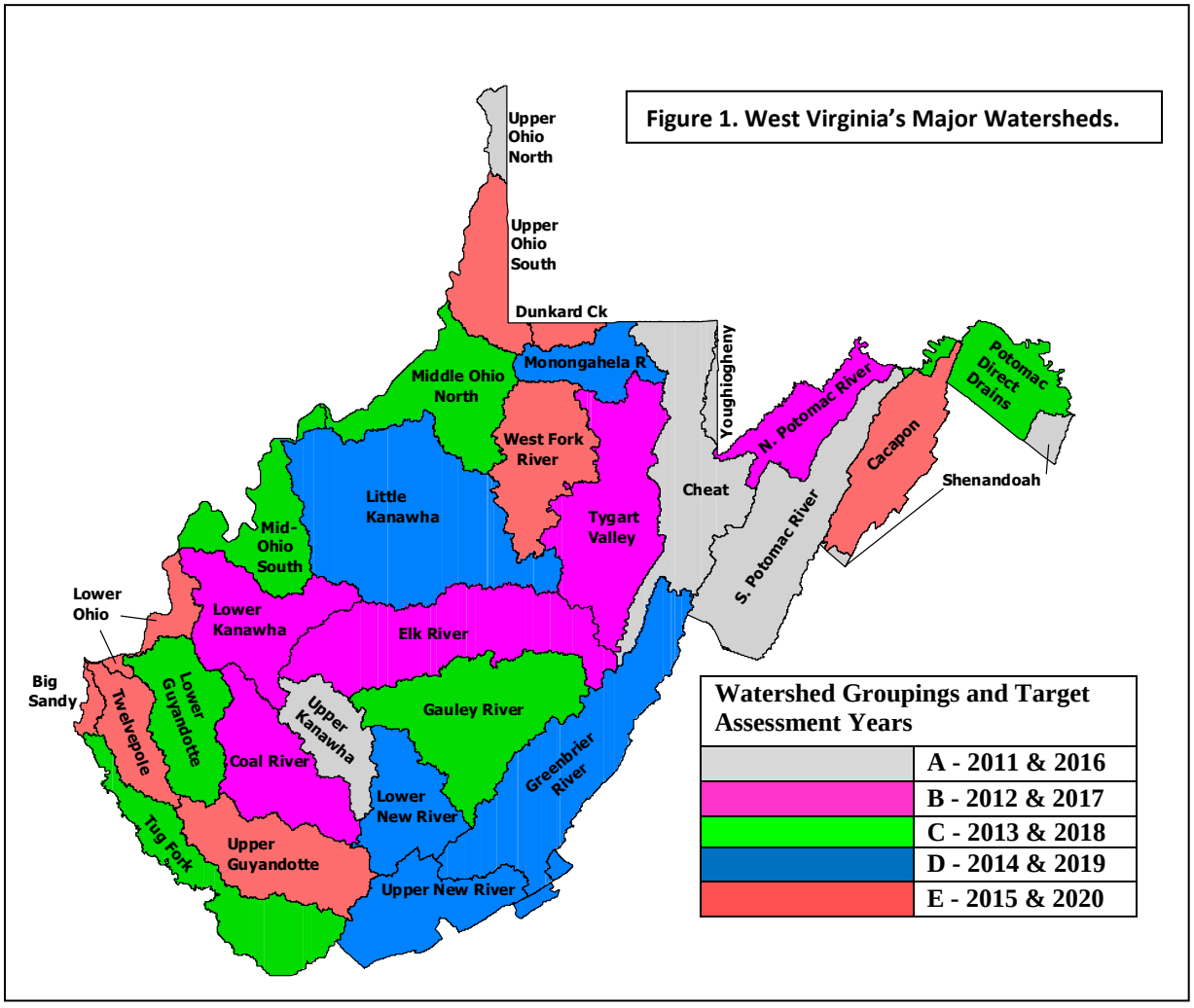
In 2012, the LiTMuS program was expanded to include research on the effects of climate change on streams in WV. This research is a collaborative effort with the United States Environmental Protection Agency (US EPA) Global Change Assessment group, along with other states and US EPA offices from various regions, to develop Regional Monitoring Networks (RMNs) that can detect small, progressive changes in stream aquatic life communities that may be associated with climate change. Two major components of this study are the collection of temperature and stream discharge data, each being significantly related to groundwater. It is predicted that groundwater will help buffer streams from increases in air temperatures, at least in the near future. Furthermore, it is believed that streams with more groundwater contribution during base flow will be less sensitive to temperature increases. The WAB has established six

climate change monitoring stations on six different WV streams, all with exceptional water quality, that are being monitored for temperature, discharge, and aquatic life status as part of this collaborative study.

WAB staff installing continuous temperature and water level dataloggers in East Fork/Greenbrier River as part of U.S. EPA's Regional Monitoring Network for climate change studies.

In general, 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. Each watershed is assessed every five years, according to the state's Watershed Management Framework. The targeted and pre-TMDL sampling programs are based on this five-year rotating basin schedule, whereas the Ambient, Probabilistic and LiTMuS programs collect data statewide annually.

A map depicting the 32 watersheds and the hydrologic groupings is shown below in Figure 1.



From July 1, 2011 through June 30, 2013, WAB personnel conducted assessments that resulted in the collection of 9,516 water quality samples from 1,170 sites on 725 distinct streams, rivers, and lakes. This number includes samples from 18 coal mine discharges and one spring. These sites are shown in Figure 2.

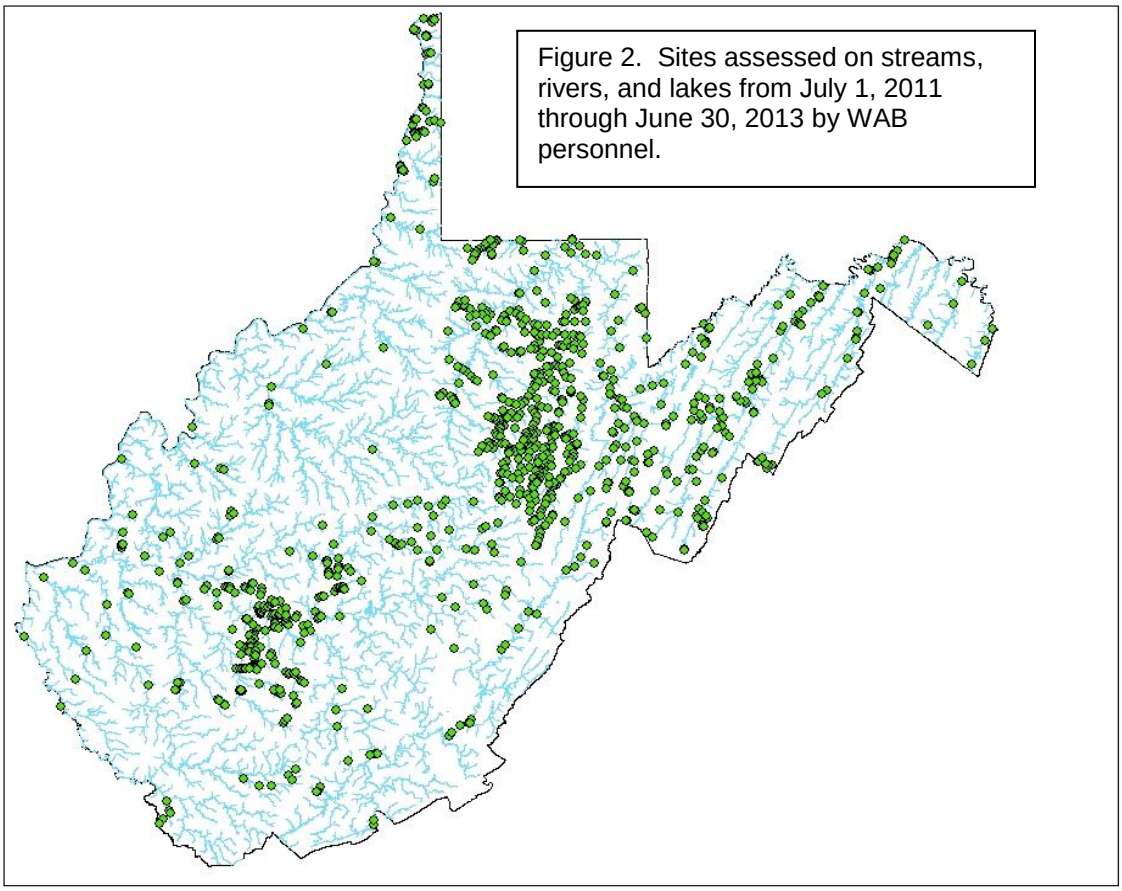


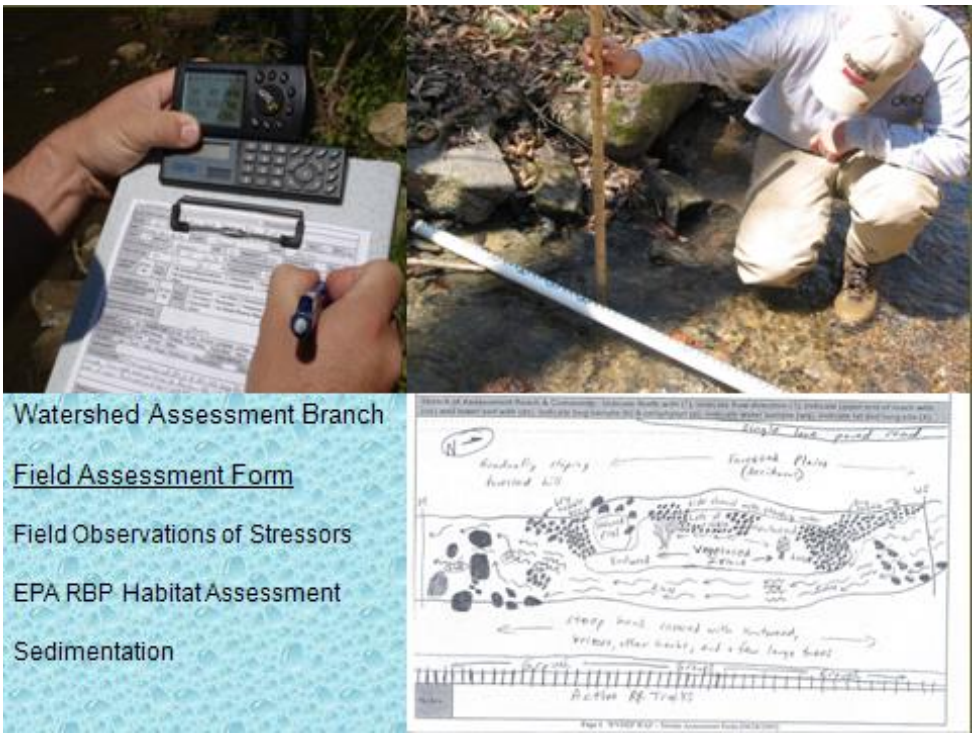
Figure 2. Sites assessed on streams, rivers, and lakes from July 1, 2011 through June 30, 2013 by WAB personnel.

The WAB measures a variety of physicochemical parameters in waterbodies that are evaluated in the field or determined via laboratory analysis. Table 1 includes some of the more common parameters that are measured.

Table 1. Analytes frequently measured by WAB.	
Alkalinity	Lead
Aluminum	Magnesium
Ammonia Nitrogen	Manganese
Beryllium	Nitrite-Nitrate
Bromide	pH
Calcium	Potassium
Chloride	Selenium
Chlorophyll A	Sodium
Copper	Specific Conductance
Dissolved Oxygen	Sulfate
Dissolved Solids (TDS)	Suspended Solids (TSS)
Fecal Coliform (MF)	Total Acidity
Hardness	Total Phosphorus
Iron	Temperature
Kjeldahl Nitrogen	Zinc

Habitat evaluations are important to waterbody assessments because they reflect the physical conditions that support aquatic life communities. WAB utilizes U.S.

EPA's Rapid Bioassessment Protocol (RBP) for measuring the quality of in-channel and riparian habitat in streams and rivers. Channel flow status is evaluated as part of the RBP protocol. During drought conditions, groundwater discharges are important for maintaining a healthy channel flow status, and therefore the water levels necessary to support aquatic life.



The physical and chemical properties of water, as well as habitat quality are important in the overall assessment of waterbody health. However, the biological monitoring of aquatic life communities such as benthic macroinvertebrates and fishes, provides WAB a more comprehensive evaluation of ecological integrity. This is especially true for benthic macroinvertebrates (animals without backbones that live on the bottom of streams such as insects, crayfish, snails, worms) because they are diverse in species, live in all stream sizes, have a wide range of tolerances to pollutants and stressors, and unlike a grab samples of water that represent an instant in time, reflect past water quality conditions. For example, water quality measures like dissolved oxygen is important, but, may only reflect recent fluctuations in environmental conditions. A sudden spill or periodic discharge of toxic substances, which flowed past an assessment site a week ago, for example, would likely be revealed in an impaired benthic macroinvertebrate community, but likely would not be detected in the analysis of a water sample.

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, WAB holds an annual spring training session before the biological sampling season begins each year. This training focuses on recalibration for seasoned field personnel and introduces established assessment methodologies to inexperienced field staff. The fundamental objective is to ensure that all staff members are adhering to WAB's standard assessment protocols

The WAB tries to identify pollutants and their sources, 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 are major stressor on the groundwater and surface waters in West Virginia. By identifying streams with violations of the criteria for fecal coliform bacteria, WAB has identified sub-watersheds with groundwater that is likely impaired by fecal coliform bacteria. Since fecal coliform bacteria is usually filtered out by groundwater seeping 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 groundwater pollution has occurred "upstream".

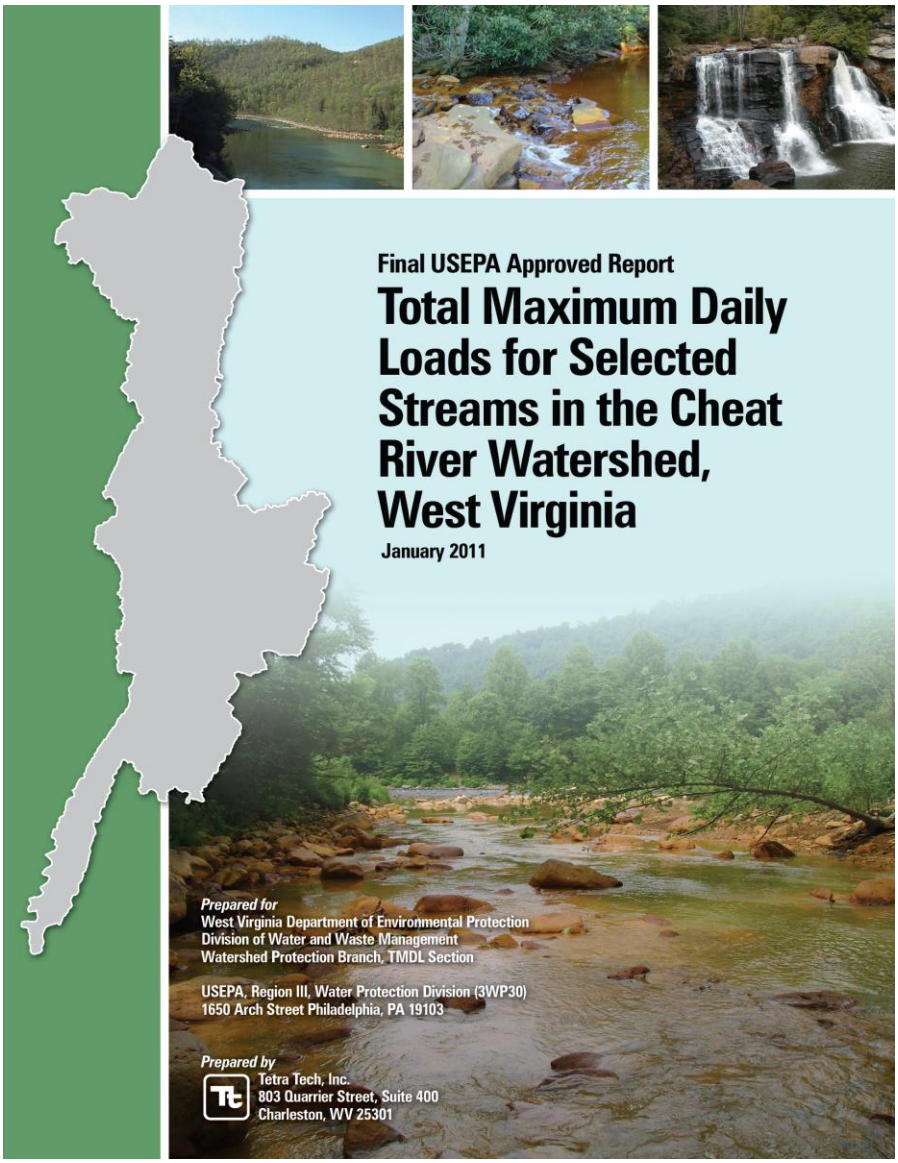
By identifying streams impacted by acid mine drainage, WAB has identified areas where the groundwater also is likely impaired. By helping identify these areas, WAB has made it possible to target remediation efforts lessening the negative effects on fish and benthic communities.

The WAB 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 WAB.

TMDLs (Total Maximum Daily Load) are required by the federal CWA. In simple terms, a TMDL is a plan of action used to clean up streams that are not meeting water quality standards. The plan includes pollution source identification and strategy development for contaminant source reduction or elimination. Originally, TMDLs were developed under the 1997 settlement of the lawsuit, *Ohio Valley Environmental Coalition, Inc., West Virginia Highlands Conservancy, et. al. v. Browner, et. al.*, which sought state and federal aid to improve and maintain West Virginia's water quality. The lawsuit resulted in a consent decree between the plaintiffs and the EPA. The consent decree established a rigorous schedule for TMDL development, requiring the federal agency to develop over 500 TMDLs from West Virginia's 303(d) list of impaired streams by March 2006 (extended to September 30, 2009).

After settlement of the lawsuit in 1997 and the resulting consent decree, the EPA began developing TMDLs for West Virginia streams, with the DEP providing onsite logistical and technical support. However, beginning with the Upper Kanawha River watershed in 2001, WVDEP assumed the lead in developing TMDLs for state waters. In 2009, WVDEP completed TMDL development for all remaining streams listed in the

1997 consent decree. Currently, WVDEP has TMDL projects in various stages of development in 7 major watersheds in West Virginia.



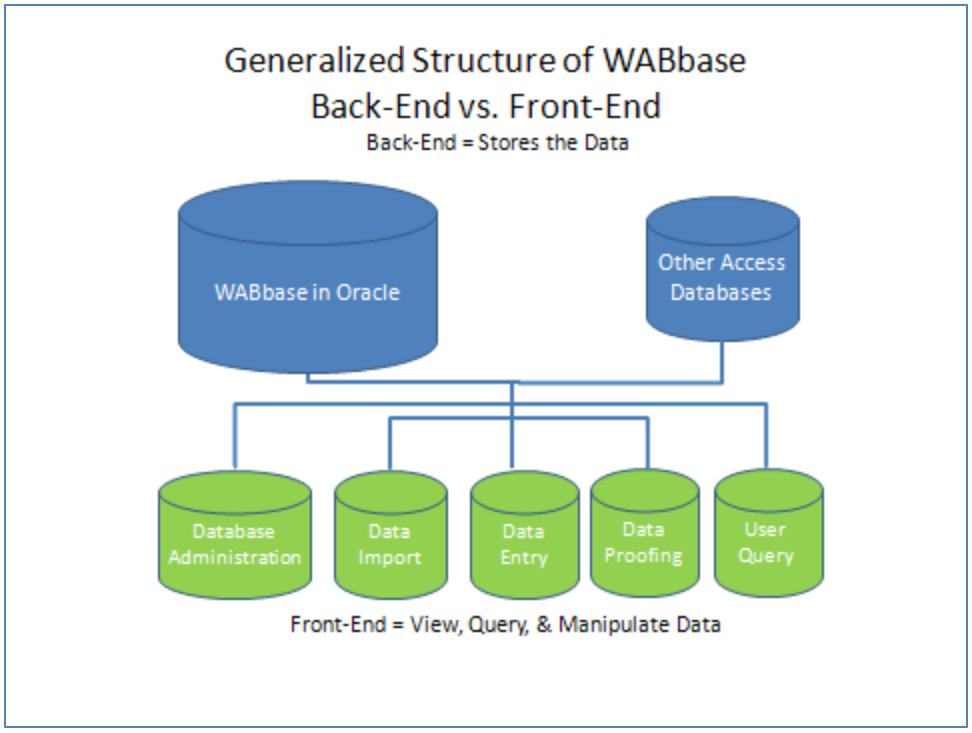
In future years it is possible that additional cases of stream contamination documented on the 303(d) list will be traced back through groundwater to their original sources. WAB will then be able to suggest remediation and restoration activities to improve groundwater and surface water quality in West Virginia.

Although not a significant portion of its assessment and monitoring activities, the WAB does coordinate and participate with wetland monitoring activities in WV. Such monitoring activities include; 1) National Wetland Condition Assessment (USEPA), 2) Wetland Delineations, 3) support of the WVWRAP – West Virginia Wetland Rapid Assessment Protocol (WV DNR), & 4) communication with wetland alteration permitting agencies (WV DEP/WV DNR/US ACOE).

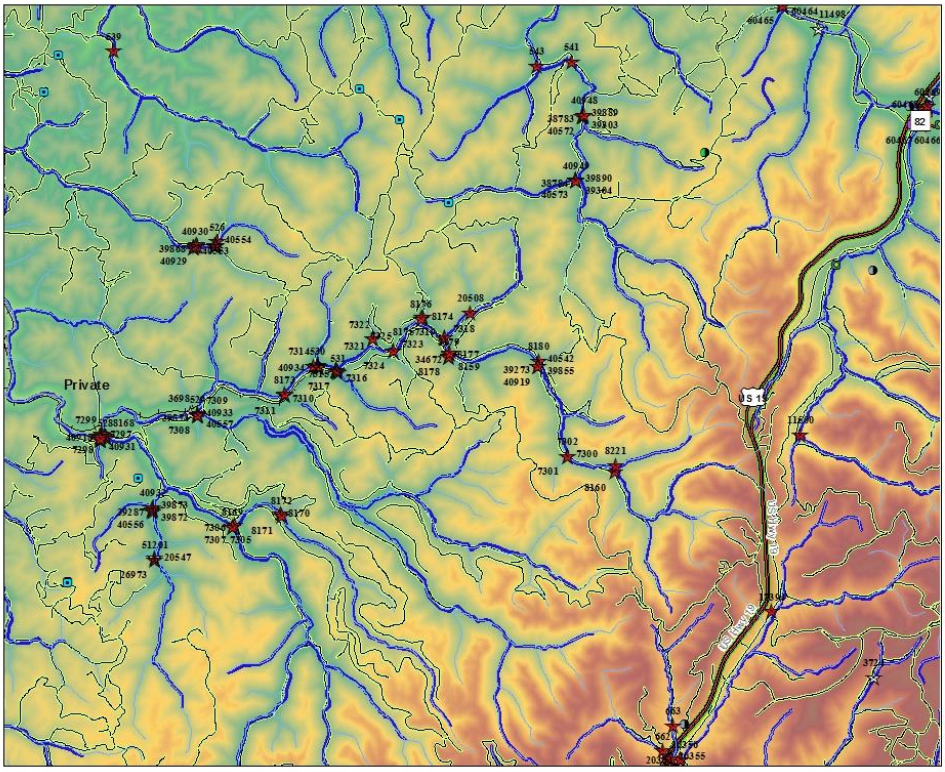
The importance of and interaction between groundwater and wetlands has been well known for several years (Darcy's Law). Many of WV's wetlands are commonly fed by groundwater sources and serve ecological functions (Recharge and Discharge Wetlands) for the improvement of groundwater by the chemical or elemental transport/concentration/interaction, filtering, and sustainability of the resulting outflow water. Some of WV's highly sensitive or rare wetlands are a result of groundwater being the primary influence such as fens (slope wetlands with organic soils fed by mineral rich groundwater). Wetland monitoring and the resulting quality or function of said wetland has often been used as surrogate to make generalized statements about the quality of the groundwater source(s).

Watershed Assessment Branch conducting a National Wetland Assessment with assistance from WV DNR.

Currently, all assessment and monitoring data is stored and managed in a database called WABbase. WABbase is a custom, in-house designed database that utilizes Oracle as a back-end with multiple Microsoft Access front-ends. Currently, a portion of the data is entered manually. However, some certified laboratories have been submitting lab analyzed water quality results electronically. In the future, plans have been made for all WVDEP certified labs to submit results electronically. Additionally, WAB currently uses EPA's STORET database to store surface water quality information.



WAB uses ArcGIS (ArcMap) to strategically plan the location of sampling sites, to identify the geologic and land use patterns upstream from the sampling sites, and to establish a list of potential waterbody stressors associated with both surface and underground activities and disturbances. WAB also uses this program to print maps showing the geographic distribution of violations in a watershed.



WAB has cooperated with the rest of WV DEP in the development and implementation of a database that intends to provide a clear picture of water quality based on physical and chemical characteristics and the biological life existing in all of West Virginia's waters, both groundwater and surface waters. Discussions are currently ongoing regarding a new agency wide database that will organize and centralize all of the agency's water quality related information.

8. 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 nonpoint sources in surface waters and groundwater. In FY2012 and FY2013 approximately $147 million dollars of assistance was expended from the SRF program to build and replace wastewater collection and treatment systems. In many of these projects, unsewered areas of West Virginia were provided with centralized or, in some cases, decentralized sewer systems that eliminated direct wastewater discharges and failing or marginally functional onsite septic systems. The failing systems and direct discharges contribute to polluting the groundwater in the state. For example, the Lubeck Public Service District extended service to 81 new customers eliminating the failing septic systems and/or straight pipe discharges into Vaughts Run and Lake Washington.

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 helps protect public and private water supplies.

The DEP's Agriculture Water Quality Loan Program is also administered through the SRF program and provided seven loans totaling $110,794 in FY2012 and seven loans totaling $447,961 in FY2013. This program was established in 1997 and continues to provide loans to correct nonpoint source pollution. Most of the loans are made to the poultry industry in the Eastern Panhandle to assist in alleviating groundwater pollution from the poultry farms. The SRF will provide $150,000 as a set-aside for this program for FY2014.

A pilot program was started in 2000 called the Onsite Systems Loan Program. The purpose of this nonpoint source program is to eliminate existing health hazards and water quality problems due to direct sewage discharges from houses and malfunctioning septic tank systems. Many problems and barriers have prevented this program from being successful to date, but program revisions have been made to make it a more viable program. During the 2007 legislative session, the SRF statute was amended to allow other entities to act as an intermediary lender for this program. The WV Housing Development Fund and the SAFE Housing and Economic Development, Inc. (SHED) have entered into an agreement with the SRF to provide low interest loans to homeowners to correct failing onsite sewage systems. The program provided 33 loans totaling $219,172 in FY 2012 and 26 loans totaling $194,945 in FY2013 from this program and will provide $500,000 as a set-aside for this program for FY2014.

9. Environmental Enforcement

The Environmental Enforcement (EE) office is primarily responsible for inspection and enforcement of the state and federal solid waste, hazardous waste, underground storage tank 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 and Standard Operating Procedures for Groundwater Sampling Revision No. 1 (effective August 5, 2009) 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.

Collection of groundwater samples is accomplished by compressed air operated bladder pumps as well as bailers. All organics are collected by teflon bailers. All samples are collected, preserved and analyzed in accordance with 40 CFR. Groundwater samples are analyzed by State certified laboratories.

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.

Training that focuses on the complex interaction of groundwater, geology, and chemistry must be provided to EE staff. This training must include all staff, but prioritize

newly hired inspectors. Classroom style training accompanied with ample practical (hands on) training exercises with a focus on sample collection and preservation would be most beneficial. This training program will result in environmental inspectors that are both effective and safety conscious in their field work.

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.

Both the Hazardous Waste Management Act and the Underground Storage Tank (UST) act are, in part, groundwater protection acts. The Hazardous Waste Management Act requires long term groundwater monitoring at permitted disposal sites. EE Inspectors conduct Groundwater Monitoring Inspections every three years at every hazardous waste land disposal facility in the state. These Inspections involve evaluating the facility's sampling protocols and "splitting" samples with the company to conduct an independent analysis of the groundwater.

The UST act requires release detection, corrosion protection, overfill protection and spill prevention at UST sites to ensure protection of the groundwater. The Energy Policy Act of 2005 has increased the regulations applicable to USTs installed within 1,000 feet of existing community water systems or potable drinking water wells. The act requires states to perform on-site inspections at all UST facilities every three (3) years. This is a significant increase in the required frequency of inspections. In addition, the act includes additional regulations related to secondary containment, delivery prohibition and operator training at UST sites.

Additionally, in fiscal years 2012 and 2013, EE personnel investigated 1110 spills and 2,787 complaints that had the potential to impact our groundwater.

V. DEPARTMENT of ENVIRONMENTAL PROTECTION

C. Office of Abandoned Mine Lands and Reclamation

In reviewing surface mining legislation in the mid-1970s, Congress found that more than 1.5 million acres of land had been directly disturbed by coal mining and more than 11,500 miles of streams were polluted by sedimentation or acidity from surface or underground mines. In response to the problems associated with inadequate reclamation of coal mining sites, Congress enacted the Surface Mining Control and Reclamation Act of 1977 (SMCRA).

The two main purposes of SMCRA are (1) to establish a nationwide program to protect society and the environment from the adverse effects of surface mining operations while assuring that the coal supply essential to the nation's energy requirement is provided and (2) to promote the reclamation of mined areas left without adequate reclamation before SMCRA was passed. Title V of SMCRA deals with active mining, Title IV deals specifically with the problems associated with inadequate reclamation of abandoned mine lands (AML).

In Title IV, Congress established the Abandoned Mine Reclamation Fund to be used for the reclamation and restoration of areas affected by past mining. The fund is derived from a reclamation fee collected from coal mining operators on each ton of coal mined since SMCRA was enacted.

West Virginia received primacy of the AML program February 21, 1981, and the WVDEP was designated by the governor to operate this program with funding provided from the AML Reclamation Fund. The Office of Abandoned Mine Lands and Reclamation (AML&R) was established within the WVDEP.

The mission statement of the Office of AML&R is "to protect public health, safety, and property from past coal mining and enhance the environment through reclamation and restoration of land and water resources".

The program's vision statement is to, "efficiently and effectively use all available resources to achieve a long term benefit to public health, safety, property and general welfare while restoring the environment to pre-mining conditions.

AML&R Organizational Structure

AML&R is divided into groups: Administration & Financial, Realty, Planning, Design and In - House Design, Construction and Emergency. The state is divided into northern and southern regional offices. The responsibilities of those groups are:

1. *Administration & Financial* - This group performs the accounting function for the office. The group tracks expenditures as they relate to administrative and construction functions responsible for management of grants, budgets and financial

administration of AML&R. Furthermore, the group oversees the Stream Restoration section that is mandated to perform all program, pre-construction, post-construction and compliance, and water monitoring functions.

2. Realty - This group gains rights of entry from property owners so that exploration and construction can be conducted to address abandoned mine land problems. Also, the group's responsibility includes determining if before and after appraisals are necessary for the purposes of lien actions.

3. Planning - The Planning group identifies abandoned mine land problems. Each requires preparation of environmental assessments to be in compliance with the National Environmental Policy Act (NEPA), creation of a description of each project, and development of a preferred alternative for correcting the problem. The group also maintains the West Virginia Abandoned Mine Land Inventory.

4. Design & In - House Design - This group approves all consultant plans and specifications involving abandoned mine land projects. It also evaluates and selects a design consultant to perform all necessary preparation of plans and specifications for projects. This group also administers exploratory drilling, aerial mapping, surveying contracts, and prepares plan and specification on selected projects in-house.

5. Construction - The main task of the Construction group is contract administration and oversight of abandoned mine land construction projects. This includes site inspections during construction. The group conducts pre-bid and pre-construction conferences and performs final inspections.

6. Emergency - This group administers and conducts the Emergency Reclamation program.

AML Public Health and Safety Issues

SMCRA defined eligible sites under Title IV as those sites which were mined for coal and left in an inadequate state of reclamation prior to August 4, 1977, and for which there is no continuing reclamation responsibility under state or federal law. The definition of eligibility was extended in 1992 to sites mined for coal after August 4, 1977. These sites were abandoned before the date the secretary of the U.S. Department of the Interior approved a regulatory program for the state in which the sites are located.

The expenditures of monies from the fund on lands and water eligible shall reflect the following priorities stated in Section 403 (a) in the Surface Mining Control and Reclamation Act Amendments of 2006:

1. (A) The protection of public health, safety, and property from extreme dangers of adverse effects of coal mining practices;

(B) the restoration of land and water resources and the environment that –

(i) have been degraded by the adverse effects of coal mining practices; and

(ii) are adjacent to a site that has been or will be remediated under subparagraph (A)

2. (A) The protection of public health and safety from adverse effects of coal mining practices;

(B) the restoration of land and water resources and the environment that -

(i) have been degraded by the adverse effects of coal mining practices; and

(ii) are adjacent to a site that has been or will be remediated under subparagraph (A); and

3. The restoration of land and water resources and the environment previously degraded by adverse effects of coal mining practices including measures for the conservation and development of soil, water (excluding channelization), woodland, fish and wildlife, recreation resources, and agricultural productivity.

The SMCRA Amendments of 2006 stated that any state or tribe may extend funds allocated to such state and tribe in any year through the grants for the purpose of protecting, repairing, replacing, constructing, or enhancing facilities related to water supply, including water distribution facilities and treatment plants, to replace water supplies adversely affected by coal mining practices.

The U.S. Office of Surface Mining (OSM) maintains an inventory of abandoned mine problems known as the Abandoned Mine Lands Inventory System (AMLIS). OSM maintains the system to provide information to meet the objectives of Title IV specified in Section 403(a).

When a problem area is entered into AMLIS along with the estimated cost of repairing the area, not including design, inspection, and program administration costs, the estimated cost is entered in the unfunded category. When a problem area on the inventory is funded, it is moved to the funded category. Later, when the actual construction is completed, the problem is again moved, this time to the completed category. In this manner, a complete history of the abandoned mine land problems are maintained in AMLIS. The total unfounded costs of all priorities in West Virginia as of September 4, 2013 are $1,358,419,447.

AML&R Accomplishments

AML&R has completed the problem areas (PA) and the associated problem types. The PA and the problem type accomplishments have been entered into AMLIS and moved from the funded to completed category.

Problem Type	Total Accomplishment
Clogged Streams (Miles)	67
Dangerous Highwall (Feet)	286,504
Dangerous Impoundments (Count)	1,401
Dangerous Piles & Embankments (Acres)	5,838
Dangerous Slides (Acres)	639
Hazardous Equipment & Facilities (Count)	705
Industrial/Residential Waste (Acres)	49
Portals (Count)	2,899
Polluted Water: Agriculture. & Industrial (Count).	90
Polluted Water: Human Consumption (Count)	22,846
Subsidence (Acres)	523
Surface Burning (Acres)	516
Vertical Opening (Count)	191

V. DEPARTMENT of ENVIRONMENTAL PROTECTION

D. Division of Land Restoration

Office of Environmental Remediation

The Office of Environmental Remediation (OER) was created in 1997 to consolidate the agency's remediation programs. The organizational structure allows the office to focus its energy and technical talent on the remediation sciences and procedures used to restore contaminated sites. The office is primarily organized along a project management function, which oversees site activities, and a technical support function, which provides specialized technical support.

OER operates five sections:

Voluntary Remediation/Brownfield - This section encourages voluntary remediation activities and brownfield revitalization. The Voluntary Remediation and Redevelopment Act (VRRA) was one of the first voluntary cleanup or brownfield laws in the nation. The VRRA section is characterized by uniform, predictable processes with flexible cleanup standards based on future land uses that are protective of human health and the environment.

Leaking Underground Storage Tanks (LUST) - This section provides oversight of the cleanup from leaking underground storage tanks, including release from the tanks, their piping, spills or overfills. This section also administers the federal and state leaking underground storage tank response funds. These funds enable state cleanups, where the responsible party is unwilling or does not have the financial means to respond to the leak. The agency received authorization from the EPA in 1997 to assume the regulatory lead for the leaking underground storage tank program in West Virginia.

Superfund - This section coordinates with the EPA and as applicable, the U.S. Department of Defense, at Superfund cleanups. Recent federal efforts have also focused on recognizing and supporting the successful state brownfield and voluntary cleanup programs.

Rehabilitation Environmental Action Plan (REAP) - This was a strategic initiative signed into law by Governor Joe Manchin in 2005. The governor's bill combined elements of the WVDEP and the Division of Natural Resources into a more effective and streamlined system for the direction of environmental remediation programs. The program provides oversight of litter removal, statewide recycling, and open dump cleanups.

Landfill Closure Assistance Program (LCAP) - This program provides landfill closure assistance to owners/permittees of landfills which were required to cease operations pursuant to certain statutory closure deadlines for non-composite lined facilities. The program designs and constructs all closure-related activities necessary to provide

sufficient leachate management, sediment and erosion control, gas management, groundwater monitoring and a final cover cap on non-composite lined landfills.

OER accomplishments in FY 2012 & 2013 (July 1, 2011 – June 30, 2013)

The REAP Program eliminated 2,820 dumps from West Virginia's landscape. This led to the proper disposal of over 13,478 tons of litter/waste. REAP was also responsible for the proper disposal of over 723,237 waste tires. Many of these tires were pulled from the 334 miles of rivers and streams that REAP cleaned during this time.

- REAP's Pollution Prevention Open Dump Program (PPOD) reclaimed 2,733 acres of land through the eradication of 2,741 dumps. PPOD also removed over 426 appliances from the landscape and recycled more than 384 tons of scrap metal.

- REAP's Make It Shine Program coordinated the efforts of more than 10,924 volunteers. These volunteers worked to remove 440 tons of litter and debris. The volunteers removed litter from 940 acres of park, 79 miles of streams, and 101 miles of trails.

- REAP's Adopt-A- Highway Program had more 47,139 volunteers in more than 2,269 active groups. They worked to remove more than 800 tons of litter from more than 7,727 miles of roadway.

- The REAP Litter Control Grant Program, which provides grants to counties and municipalities for litter control and cleanup programs, funded 52 projects totaling $117,770.61

- The REAP West Virginia Recycling Assistance Grant Program, which provides grants for recycling to public and private entities, awarded 72 grants totaling $3,002,094.76.

- The REAP Covered Electronic Device Grant Program, which offers grants to counties and municipalities wishing to implement electronic device recycling programs or e-cycling events, issued 53 grants totaling $410,736.06.

- The REAP West Virginia Public Employees Office Paper Collection Program collected over 655 tons of paper from state offices.

- The Voluntary Remediation and Redevelopment Act program accepted 17 new applications for properties to participate in the program. The program issued 29 Certificates of Completion for voluntary remediation sites, which opened more than 159.26 acres of land ready for reuse. Cumulatively, the program has issued 136 Certificates of Completion, which opened more than 1,336.85 acres.

- OER completed petroleum brownfields assessments at Coex-Plastics in Cabell County, Elkins City Garage in Randolph County and Hatcher Property in Summers County.

- OER completed hazardous substance assessments at Logan High School in Logan County, Mount Hope Middle School in Fayette County, Mullens Water Treatment Building in Wyoming County, Urling Building in Wayne County, Morgan County Recreational Complex, Sycamore Campground in Mingo County, Morris Creek Watershed property in Kanawha County, Corbin Property in Wayne County, East End Park in Kanawha County, Montgomery IOOF Building in Kanawha County, and Brooke Glass in Brooke County.

- OER provided oversight of the investigation and cleanup of 135 new leaking underground storage tank sites, in addition to completing investigations and closing the active files on 210 leaking underground storage tank sites. OER also removed 16 abandoned underground storage tanks from 7 different sites.

- OER continues to work with EPA Region 3 on the Superfund actions at Morgantown Ordnance Works, the Big John's Salvage site and Sharon Steel/Fairmont Coke site near Fairmont, the Fike-Artel Chemical site in Nitro, the Pantasote site in Point Pleasant, the Allied-Hanlin-Olin Chemical site near New Martinsville, the Vienna well field in Wood County, the Ravenswood PCE site, and Allegheny Ballistics Laboratory in Mineral County. OER worked collaboratively with EPA Region 3 and the U.S. Army Corps of Engineers at West Virginia Ordnance Works (WVOW) in Point Pleasant.

- OER is working with EPA Region 3 to assess potential Superfund sites via the Pre-Remedial Program. Currently there are 20-plus sites in the preliminary assessment and site investigation program.

- In addition to WVOW, OER continues to work with the U.S. Army Corps of Engineers on other Formerly Used Defense Sites (FUDS) in the former West Virginia Maneuver Area located in the north-central highlands, including Dolly Sods and Camp Dawson in Preston County.

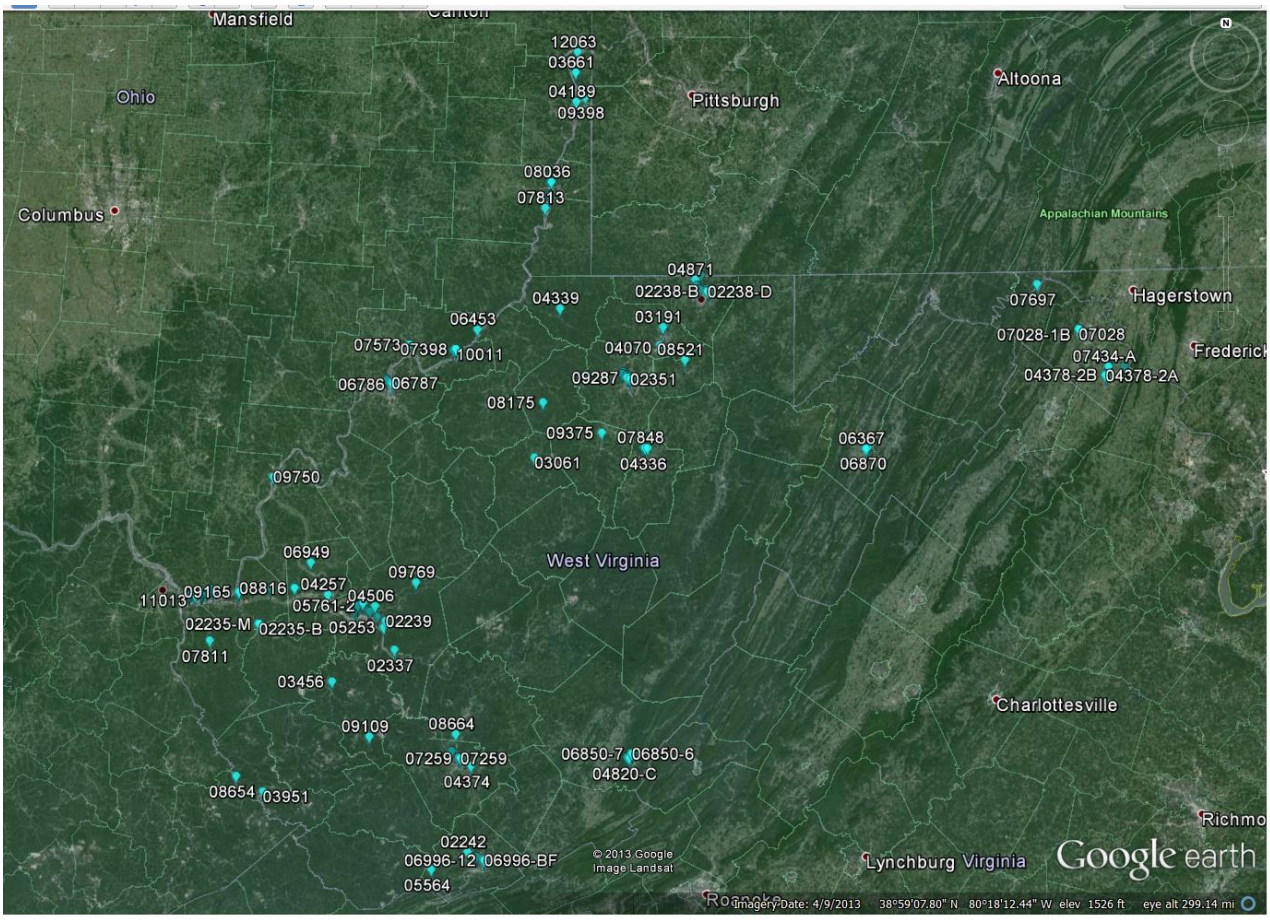
- OER continues to work collaboratively with EPA Region 3 and has taken the role as the lead regulatory agency on the 42 RCRA Corrective Action sites in WV.

- OER completed site assessment activities at eleven priority hazardous substance sites and continued site assessment activities at one other site.

- OER completed closure construction activities at Moundsville Landfill in Marshall County and removal of waste and site reclamation was completed at Big Bear Lake Landfill in Preston County. Closure work was being finalized at the Morgan County Landfill and Capon Springs Landfill under the Landfill Closure Assistance Program.

❖ OER received and processed 2,303 notifications of excavation from WV 811 to provide protections from uncontrolled exposures at properties with established environmental covenants under the Voluntary Remediation and Superfund programs.

Voluntary Remediation and Redevelopment Act Sites (with Land Use Covenants)



V. DEPARTMENT of ENVIRONMENTAL PROTECTION

E. Information Technology Office (ITO)

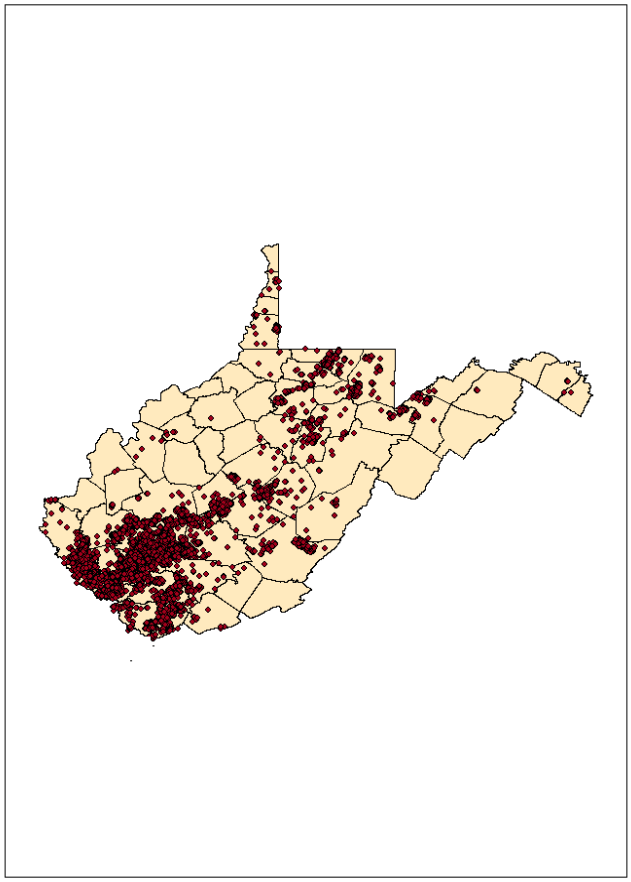
Technical Applications and Geographic Information Systems (TAGIS)
Application Development and Support (ADS)

EarthSoft's Environmental Quality Information System (EQuIS -- written for the Microsoft Windows operating system--) historically provided a common database management system for all organizations involved in the data collection, processing, management and evaluation aspects of environmental project work. However, the EQuIS database was unable to link to WVDEP's permitting database (ERIS). Both EQuIS and ERIS are being replaced by CGI's COMPASS and TEMPO products respectively. This will allow the same functionality while allowing the ability to link the two environments.

Historically, all data collected and analyzed by WVDEP resided in a myriad of places and formats. EQuIS was the beginning of a central repository and a uniform format for the data collected, WVDEP's goal was to expedite the transfer of information and data between WVDEP personnel and WVDEP data providers. The next logical step is to provide the agency with integrated systems for both permitting and sample data. Therefore WVDEP has begun the IRIS project. IRIS is the implementation of COMPASS and TEMPO products customized to WVDEP's needs. Each environmental program will be able to evaluate or cross reference WVDEP data. This will increase efficiency by allowing WVDEP data providers to fully understand WVDEP requirements, and to communicate these requirements to its employees and contractors.

While EQuIS serves as a central store, its interface impedes both analysis and the communication of such The COMPASS system will use ESRI's ArcMap as a 'data broker' to serve data to several different analysis applications within a GIS environment. The COMPASS ArcMap GIS Interface will provide a flexible yet simple means of accessing, analyzing, and viewing geology and environmental chemistry from within ESRI's ArcMap GIS. COMPASS will store Chemistry, Geology and Air data making available many options for 1D, 2D, and 3D visualization and modeling, as well as reporting and enhanced labeling options. The COMPASS interface will allow management to more readily make effective and timely decisions without the complication of needing to process data for the modeling programs used.

The size of the database will grow as more users are brought online. To date, 1,285 facilities are registered in the database. The facilities have a total of 193,886 sampling locations a mixture of surface and groundwater locations. There are 2,747,709 test results recorded in the EQuIS database, which will be migrated into COMPASS. This will be one of the agency's the largest databases. It will also be accessible to WVDEP employees and the public. The map below shows EQuIS Locations.



To date, the Division of Mining and Reclamation has the most data stored in EQuIS. The one project, OMR Trendstation, is the single largest facility in EQuIS. Data has been collected at 236 locations monthly since October 2002 and currently has 695,518 test results. Other groups within the Department of Environmental Protection storing data in EQuIS are the Closed Landfill Program (LCAP) and the Voluntary Remediation Program (VolRem).

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 (PHSD). These 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 PHSD provides technical assistance to local health departments with regard to interpretation of the Design Standards and Rules for individual water wells individual and onsite sewage systems. Individual Water Well Regulations and Design Standards were revised 2008 for the first time since 1984.

Individual Water Supply Program

Local Health Departments (LHDs) collect water samples upon request to determine bacteriological and chemical conditions of individual and public water groundwater supplies. Complaints related to groundwater protection which are not regulated by state or local health departments are referred to the WVDEP 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 utilizing on-site sewage disposal have a suitable on-site sewage disposal reserve area that will accommodate the initial system and have space for future repairs, and 3) correct failing systems to prevent a public health hazard. LHDs are responsible for on-site systems up to 3,000 gallons per day (plan review, site evaluation, permitting, inspection, and approval), however they consult with the PHSD on systems >1000 gpd. The PHSD issues permits for surface discharge systems (under 600 gallons per day) that qualify for an 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 current individual sewer system design standards, which were presented to the Legislature and were approved became effective on July 1, 2003 and 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 rapidly 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 has been faced with many new challenges over the past few years. The use of more advanced treatment technologies coupled with the fact that most of the good sewage sites are already occupied creates a tremendous taxation on 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. Review of the current Design Standards is underway, which once submitted and approved, will better address many of the issues we are currently facing.

VI. DEPARTMENT of HEALTH and HUMAN RESOURCES
Office of Environmental Health Services

B. Well Head Protection Program

Groundwater Protection Goals

As of June 30, 2013, the Source Water Assessment and Protection (SWAP) / Wellhead Protection (WHP) program has completed nearly 100 percent (delineation through public availability) of the community and non-community public water supply systems of the approximate 1,108 surface and groundwater intakes serving the State's 1,000 public water systems. The SWAP/WHP programs target water systems for protection on a county or local basis. In many communities, ground water is the only source of drinking water. Once ground water is contaminated it is very expensive to treat or replace.

The EPA approved the WHP program in 1992 and Department of Health and Human Resources/Bureau for Public Health/Office of Environmental Health Services (OEHS) staff have been working with ground water systems since that time. The WHP program includes public participation, source delineations, the potential contaminant survey, and management directives complementing the SWAP program. SWAP/WHP programs are the practice of assessing the quality of our water resources, and implementing programs that reduce pollutants and chemical contaminants which could potentially negatively impact these resources. Protecting water resources from contaminants also can eliminate the need for supplementary treatment procedures, and can delay the cost of new infrastructure and related increases in water rates. It is our hope that this work accomplished in West Virginia and across the United States will be a valuable tool to a public water supply/community and will help in planning and building future capacity for economic growth.

The OEHS staff continues to complete SWAP/WHP studies for new Public Water Supply systems and helps revise existing plans within the state by prioritizing efforts, program resources, education and outreach efforts in developing and implementing protection measures. Implementation of the SWAP/WHP builds on other environmental assessment and protection programs, and requires integrated linkage and cooperation of the WVDEP. Moving to a protection plan phase will require a multifaceted approach that will require continued financial support within West Virginia. OEHS 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 groundwater of the state and the health of the people of West Virginia. Implementation of the SWAP/WHP builds on other environmental assessment and protection programs and requires integrated linkage and cooperation with many associated entities. Follow up assistance and a continuing source of funding for activities will likely be required for sustainability.

The SWAP/WHP programs maximize the use of existing information, require integration with existing state and federal programs and use Geographic Information System to map delineations and assessments and the emphasis on the local partnerships.

Program Milestones and Future Priorities

During this reporting cycle, the SWAP/WHP programs continued to pursue the following:

Building Partnerships-Inter-agency cooperation and other alliances:

- Continuation of the SWAP/WHP Memorandum of Understanding (MOU) that has been signed by a number of state groundwater regulatory agencies. The MOU establishes a coordinated effort by all agencies to protect ground water in delineated SWAP/WHP areas. The MOU enhances the SWAP/WHP program's ability to protect groundwater utilized by public water systems.

- Continue to participate and build voluntary protection efforts by prioritizing efforts, program resources, education and outreach efforts in developing and implementing voluntary protection measures not only to the local water systems but also to local governments, councils, planners, and other stakeholders.

- Provide funding for the WVDEP's UIC Class 5 program to locate UIC Class 5 wells in source water protection and sensitive hydrological areas within West Virginia. This work also includes an inventory of underground and above ground storage tanks in the SWAP/WHP area.

- Continue participation and provide funding for the Potomac Drinking Water Source Protection Partnership. This partnership is composed of water utilities and the various governmental agencies responsible for drinking water protection in the Potomac River Basin.

- Continue participation with the Ohio River Valley Water Sanitation Commission (ORSANCO) work group on source water protection. This work group is composed of water utilities and the various governmental agencies responsible for drinking water protection in the Ohio River basin.

- Continue a working relationship between the federal Safe Drinking Water Act and the Clean Water Act programs within the state to provide the most accurate and representative assessment of source waters, based on available data which the state believes best reflects the quality of the resources.

- Continue to work with the West Virginia Rural Water Association (WVRWA), through a joint project with the U.S. Department of Agriculture (USDA) Farm

Service Agency (FSA) is working with the local SWAP and WHP areas within the state.

- ❖ Continue to use hydrogeologic information provided from the USGS to help define SWAP/WHP delineation areas.

Public Outreach/Educational Activities:

- ❖ OEHS Staff provides help in developing a protection program, and assessing potential sources of contamination.

- ❖ Participation with the WVDEP on Project WET (Water Education for Teachers), a nonprofit water education program for educators and young people ages 5-18. In conjunction with this program, the SWAP program has developed a program to loan groundwater models to schools and local county health departments. The SWAP group uses a groundwater flow model within Project WET workshops and other educational outreach events to demonstrate groundwater and surface water and how both can be affected by precipitation, the pumping of wells, and human activities above or below the land surface. It is the intent that within the public school platform, more teachers and more students will have the tools and content to learn about water resources effectively.

- ❖ The West Virginia Bureau for Public Health (WVBPH) website (http://www.wvdhhr.org/oehs/eed/swap/) continues to provide information on the SWAP/WHP programs (educational materials, posters and brochures) and guide municipalities, water suppliers, or other groups through developing a local SWAP program. In addition, a link is available to a website that provides copies of the initial SWAP/WHP susceptibility assessments reports for the community water systems.

- ❖ WVBPH Source Water Protection GIS website (http://157.182.212.211/DHHR/Default.aspx) disseminates relevant source water information to PWSs, state agencies, federal agencies and local governments to further source water protection.

- ❖ Installation of source water protection signage along the perimeter of wellhead protection areas. Public water supplies can use the signs for municipality and non-highway use. 64 signs have been delivered to PWSs for appropriate use.

Other Actions for Protection of Sources of Drinking Water

- ❖ Establishment of the River Alert Information Network (RAIN) that uses 10 source water monitoring panels to be installed in 10 public water systems in or just outside of the Monongahela River Basin. These monitors will serve as early detection and warning of degradation of source water for public water supply member systems, as well as the general public.

- ❖ Continue to evaluate new public water supply water wells or intakes to assure they are located in areas where contamination threats are minimal. Permits for new public water wells now require an initial survey for potential sources of contamination within 2000 feet of proposed well location with site-specific information used when available.

- ❖ Continue to use the Alternative Monitoring Strategy Program (AMSP), which determines future monitoring frequency reductions, is dependent on having a SWAP/WHP program in place, which requires consistent revisions and updates.

- ❖ Continue to participate in the development of regulations and design standards for water supply wells, private water wells and monitoring wells for the prevention of groundwater contamination.

- ❖ Continue to evaluate public water supply wells to determine whether groundwater sources are under the direct influence of surface water (GWUDI).

- ❖ Continue to support the efforts of the WVDEP, DWWM and the USGS with its groundwater 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.

- ❖ Continue to implement the revised regulations and design standards for private water wells, approved April 2, 2008, for the protection of groundwater.

- ❖ Provided grant funding to the West Virginia Consumer Drug Return Partnership (WVCDRP), website at http://www.wvrivers.org/WVCDRP/overview.html, to address needed expansion of their existing program, educational and outreach program efforts within WV. The goal of this program is to have a drug return collection center accessible to all WV citizens.

Ground Water Data Collection and Management:

The WHP/SWAP programs acquire 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. This data continues to be collected through field data collection activities, contractor services, as well as programs within federal, state, and local agencies.

Future Program Needs

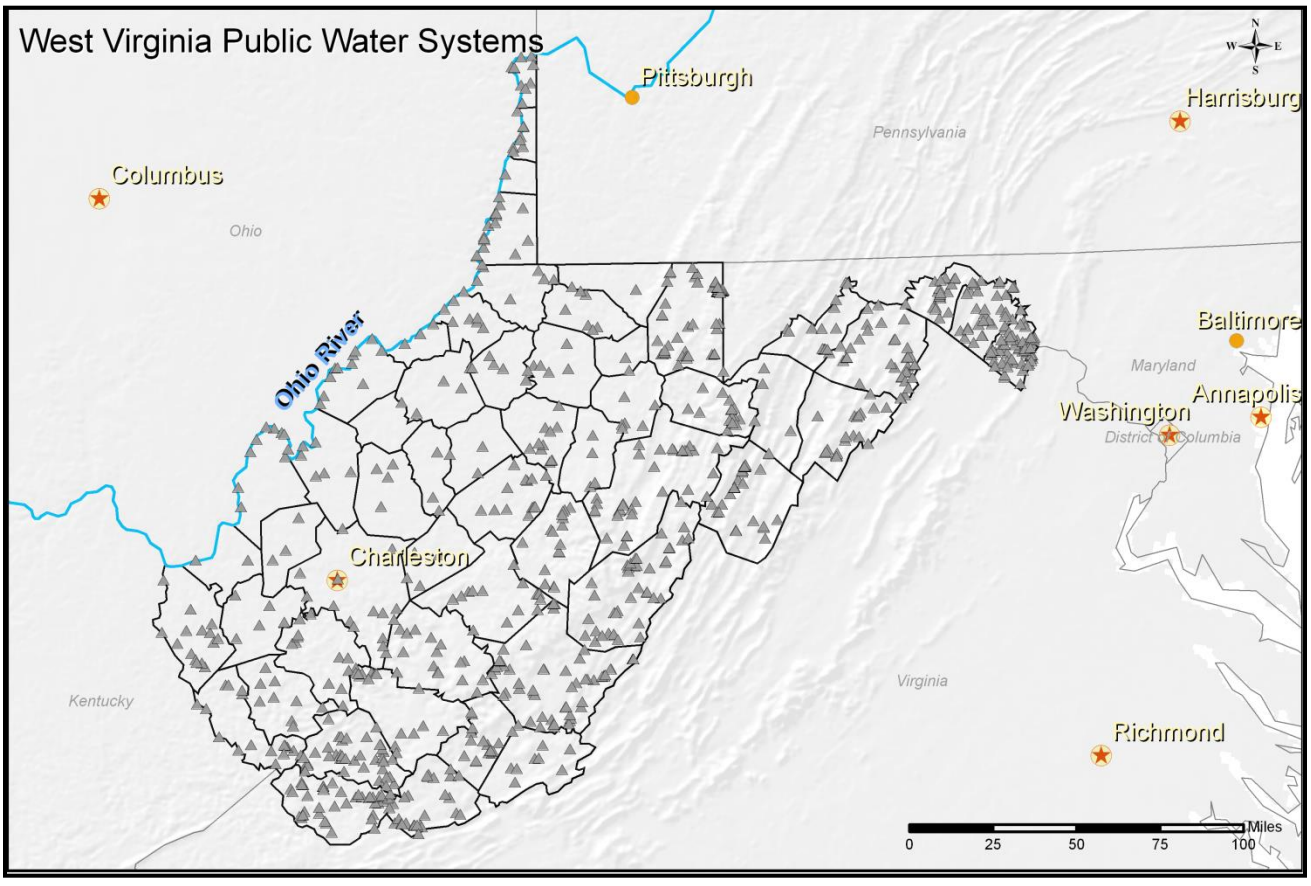
OEHS to date has hired additional staff and spent a significant amount of time in developing the WHP/SWAP programs, creating a GIS program for the storage and display of geologic/hydrologic and regulatory site data, delineations, and existing

significant contaminant source inventories. Potential future Source Water Protection program needs are as follows:

- ❖ Source water education materials designed to identify, assess, prioritize, and address local needs in the area of source water protection and contamination prevention.

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

- ❖ Continued groundwater quality monitoring to support activities mandated by the SDWA and the CWA.



Appendix A
Regulatory Agencies with Groundwater Responsibility and Authority

Department of Agriculture

1900 Kanawha Blvd., E.
Charleston, WV 25305
(304) 558-3708

Department of Environmental Protection

601 57th Street, SE
Charleston, WV 25304

Office of Oil and Gas
(304) 926-0450

Division of Land Restoration
(304) 926-0455

Division of Water and Waste Management
(304) 926-0495

Office of Information Technology
(304) 926- 0499, Ext. 1615

Department of Health and Human Resources

350 Capital Street
Charleston, WV 25301

Office of Environmental Health Services
(304) 558-2981

Environmental Engineering Division
(304) 558-2981

Public Health Sanitation Division
(304) 558-2981

Appendix B

Division of Water and Waste Management - Groundwater Program, Department of Health and Human Resources - Office of Environmental Health Services, and the United States Geological Survey Study of Ambient Groundwater Quality in West Virginia

Data Tables From 2011 and 2012

Note: Maximum Contaminant Levels are noted where such standards have been established for a particular parameter. Maximum Contaminant Levels are standards of quality and purity, established by the WVDEP in 47CSR12.

Appendix B (continued)

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 surface water sampling sites- 2012 Monongahela Watershed

Site	County	Sampling Location	Site	County	Sampling Location
1	Randolph	Roaring Creek at Norton, WV	16	Upshur	Right Fork at Hwy 28/1 Bridge Near Kedron WV
2	Monongalia	Indian Creek At Crown, WV	17	Upshur	Sand Run Near Buckhannon WV
3	Preston	Buffalo Creek Near Rowlesburg, WV	18	Randolph	Leading Creek at Hwy 3 Bridge Near Kerns WV
4	Randolph	Tygart Valley Rd at Hwy 15 Bridge at Valley Head WV	19	Lewis	Polk Creek at Hwy 33 Bridge at Weston WV
5	Randolph	Becky Cr at Hwy 56 Bridge Near Huttonsville WV	20	Upshur	Pecks Run at Hwy 1/13 Bridge at Teter WV
6	Randolph	Buckhannon Rd at Hwy 46 Bridge at Czar WV	21	Lewis	Hackers Creek at Hwy 14 Bridge Near Jane Lew WV
7	Randolph	Mill Creek at Hwy 46 Bridge at Mill Creek WV	22	Lewis	Freemans Creek at Bridge Valley Chapel WV
8	Upshur	Buckhannon Rd at Hwy 48 Bridge at Newlonton WV	23	Tucker	North Fork Blackwater River at Hwy 27 Bridge at Coketon WV
9	Upshur	Buckhannon Rd at Hwy 9 Bridge at Palace Valley WV	24	Tucker	Clover Run at Hwy 21 Bridge at St. George WV
10	Randolph	Files Creek at Hwy 219 Bridge at Beverly WV	25	Harrison	Gnatty Creek at Hwy 20/20 Bridge at Romines Mills WV
11	Lewis	West Fork Rd at Hwy 44 Bridge at Walkersville, WV	26	Tucker	Minear Run at Hwy 5 Bridge at St. George WV
12	Upshur	Laurel Fork at Hwy 20/10 Bridge Near Adrian, WV	27	Harrison	Lost Creek atHwy 27/2 Bridge at Lost Creek WV
13	Upshur	French Creek at Hwy 20 Bridge at French Creek WV	28	Harrison	Elk Creek at Hwy 57/2 Bridge Near Romines Mills WV
14	Randolph	Glady Fork at Hwy 33 Bridge at Alpena WV	29	Tucker	Horseshoe Run at Hwy 9 Bridge r at Lead Mine WV
15	Randolph	Chenoweth Creek at Hwy 23 Bridge at Elkins Airport	30	Barbour	Teter Creek at Hwy 92 Bridge Near Nestorville WV

Appendix B (continued)

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 surface water sampling sites- 2012 Monongahela Watershed

Site	County	Sampling Location	Site	County	Sampling Location
31	Harrison	Brushy Fork at Hwy 42 Bridge Near Stonewood WV	42	Monongalia	Whiteday Creek at Hwy 36 Bridge Near Smithtown WV
32	Taylor	Simpson Creek at Hwy 13/13 Bridge at Rosemont WV	43	Marion	Paw Paw Creek at Hwy 17 Bridge at Grant Town WV
33	Harrison	Tenmile Creek at Hwy 31 Bridge at Maken WV	44	Marion	Pyles Fork at Hwy 250/5 Bridge Near Metz WV
34	Harrison	Salem Creek at Hwy 5/9 Bridge Near Maken WV	45	Monongalia	Indian Creek at Hwy 45/2 Bridge at Osgood WV
35	Preston	Little Sandy Cr at Hwy 92/14 Bridge at Evansville WV	46	Preston	Sandy Creek at Hwy 3/4 Bridge Near Brandonville WV
36	Preston	Saltlick Creek at Railroad Bridge at Rowlesburg WV	47	Preston	Laurel Run at Hwy 73/73 Bridge Near Laurel Run WV
37	Harrison	Tenmile Creek at Hwy 20 Bridge at Rosebud WV	48	Preston	Laurel Run at Hwy 73/73 Bridge Near Laurel Run WV
38	Taylor	Hustead Fork at Hwy 3/16 Bridge at Boothsville WV	49	Preston	Laurel Run at Hwy 73/73 Bridge Near Laurel Run WV
39	Harrison	Bingamon Creek at Hwy 8 Bridge at Pine Bluff WV	50	Preston	Laurel Run at Hwy 73/73 Bridge Nr Laurel Run WV
40	Marion	Pricketts Creek at Hwy 73 Bridge at Meadowdale WV	51	Monongalia	West Virginia Fork at Hwy 7 Bridge at Wanna WV
41	Preston	Deckers Creek at Hwy 27 Bridge at Reedsville WV	52	Monongalia	Miracle Run at Hwy 7 Bridge at Bula WV
			53	Monongalia	Dolls Run at Hwy 7 Bridge Near Core WV

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 groundwater sampling sites- 2011 Monongahela Watershed

Site	County	Sampling Location	Geological Formation	Well Depth (ft.)
1	Monongalia	Chestnut Ridge Campground	Pottsville Formation	190
2	Preston	Big Bear Lake #20	Pottsville Formation	179
3	Preston	Big Bear Lake #50	Pottsville Formation	145
4	Preston	Arthurdale Well No. 1	Conemaugh Formation	200
5	Randolph	Brazen Head Inn	Hampshire Formation	320
6	Randolph	Kumbrabow SP Superintendent Res	New River Formation	220
7	Randolph	Hulls Store	Kanawha Formation	80
8	Upshur	Upshur County Youth Camp No. 2	Kanawha Formation	158
9	Randolph	Private well	Kanawha Formation	105
10	Marion	Fairview #1	Dunkard Group	107
11	Marion	Private well	Dunkard Group	70
12	Taylor	Private well	Conemaugh Formation	113
13	Harrison	Lake Floyd Golf Club well	Dunkard Group	70
14	Lewis	Broken Wheel CG Well	Monongahela Formation	60
15	Harrison	Private well	Conemaugh Formation	75
16	Randolph	Coalton Water Department	Pottsville Formation	155
17	Randolph	Norton Harding Jimtown PSD	Kanawha Formation	500
18	Randolph	North Spring at Bowden	Greenbrier Limestone	

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 groundwater sampling sites- 2011 Monongahela Watershed

Site	County	Sampling Location	Geological Formation	Well Depth (ft.)
19	Monongalia	Chestnut Ridge Campground	Pottsville Formation	120
20	Preston	Big Bear Lake #20	Chemung Formation	60
21	Preston	Big Bear Lake #50	Greenbrier Limestone	100
22	Preston	Arthurdale Well No. 1	Greenbrier Limestone	45
23	Randolph	Brazen Head Inn	Pocono Formation	222
24	Randolph	Kumbrabow SP Superintendent Res	Greenbrier Limestone	250
25	Randolph	Hulls Store	Chemung Formation	205
26	Upshur	Upshur County Youth Camp No. 2	Pocono Formation	100
27	Randolph	Private well	Conemaugh Formation	57
28	Marion	Fairview #1	Hampshire Formation	200
29	Marion	Private well	Chemung Formation	100
30	Taylor	Private well	Conemaugh Formation	100
31	Harrison	Lake Floyd Golf Club well	Monongahela Formation	100
32	Lewis	Broken Wheel CG Well	Conemaugh Formation	45
33	Harrison	Private well	Conemaugh Formation	180
34	Randolph	Coalton Water Department	Greenbrier Limestone	145
35	Randolph	Norton Harding Jimtown PSD	Greenbrier Limestone	207
36	Randolph	North Spring at Bowden	Allegheny Formation	65

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 groundwater sampling sites- 2011 Monongahela Watershed

Site	County	Sampling Location	Geological Formation	Well Depth (ft.)
37	Preston	Preston County 4-H Camp	Conemaugh Formation	
38	Barbour	Private well	Conemaugh Formation	52
39	Harrison	Private well	Monongahela Formation	150
40	Taylor	Private well	Conemaugh Formation	160
41	Barbour	Private well	Conemaugh Formation	

Appendix B (continued)

Field Parameters groundwater sampling sites- 2011

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

Site	Geologic Unit	Depth to Water (mean sea level)	Depth of Well (ft.)	Water Temp. (Deg C)	Water pH (Whole Field, Standard Units)
1	Pottsville Formation	22	190	15.6	7
2	Pottsville Formation	19	179	11	4.7
3	Pottsville Formation	11	145	10.6	4.7
4	Conemaugh Formation		200	13.1	9.1
5	Hampshire Formation	7	320	13.4	9.4
6	New River Formation	9	220	11.4	7
7	Kanawha Formation	11	80	14.8	6.9
8	Kanawha Formation		158	12.5	7.8
9	Kanawha Formation	3	105	12.6	6.8
10	Dunkard Group		107	13.4	7.2
11	Dunkard Group		70	16.4	7.9
12	Conemaugh Formation	7	113	13.7	6.3
13	Dunkard Group		70	14.7	8.2
14	Monongahela Formation	3	60	14.1	6.8
15	Conemaugh Formation	2	75	15.5	7.6
16	Pottsville Formation		155	13.1	6.9
17	Kanawha Formation		500	15.5	6.8
18	Greenbrier Limestone			11.9	7.4
19	Pottsville Formation		120	14.1	7.2
20	Chemung Formation	6	60	13.6	8.3
21	Greenbrier Limestone		100	10.9	7.7
22	Greenbrier Limestone	7	45	10.5	7.8
23	Pocono Formation		222	11.7	8.1
24	Greenbrier Limestone	14	250	10.6	8.2
25	Chemung Formation		205	15.5	7.5
26	Pocono Formation		100	12.8	7.2
27	Conemaugh Formation	1	57	13.3	7.9

Appendix B (continued)

Field Parameters groundwater sampling sites- 2011

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

Site	Geologic Unit	Depth to Water (mean sea level)	Depth of Well (ft.)	Water Temp. (Deg C)	Water pH (Whole Field, Standard Units)
28	Hampshire Formation	20	200	11.9	7.3
29	Chemung Formation		100	13.7	8.2
30	Conemaugh Formation	12	100	13.8	7.6
31	Monongahela Formation	13	100	14	7.8
32	Conemaugh Formation	1	45	14.8	8
33	Conemaugh Formation		180	15.3	7.7
34	Greenbrier Limestone		145	12.1	7.8
35	Greenbrier Limestone		207	12.2	7.3
36	Allegheny Formation		65	14.4	4.7
37	Allegheny Formation	6		11.7	6.6
38	Conemaugh Formation		52	15.7	7.1
39	Conemaugh Formation	3	150	14.5	7.2
40	Monongahela Formation	9	160	13.6	7
41	Conemaugh Formation	14		15.4	6.4

Appendix B (continued)

Field Parameters groundwater sampling sites- 2011

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

Site	Turbidity (nephritic turbidity ratio NTU)	Specific Conductance (Us/Cm)	Hardness Non-carbonate (mg/L as $CaCO_3$)	Acidity (mg/L as H^+)	Alkalinity (mg/L as $CaCO_3$)
1	0.9	200	95	0.00025	67.7
2	0.5	44	8.06	0.03187	1.9
3	2.1	46	6.49	0.03187	4.8
4	0.3	480	3.5		254
5	0.5	794	2.24		316
6	0.6	127	48.2	0.0002	48.1
7	1.8	158	43.2	0.00032	34.8
8	1	403	39.2	0.00002	106
9	0.2	201	35.5	0.00022	54.6
10	11	487	151	0.0002	150
11	0.5	613	70.6	0.00001	298
12	360	103	30	0.00098	28.3
13	0.4	680	12.9	0.00001	313
14	1.3	741	307	0.00019	159
15	0.3	410	161	0.00005	221
16	0.1	147	55.4	0.0002	37
17	0.2	235	69.7	0.0002	61.9
18	0.5	110	49.2	0.00008	44.1
19	2	224	41.8	0.00006	81.9
20	0.1	192	45.4	0.00001	68.3
21	0.8	314	155	0.00007	149
22	0.2	393	186	0.00006	180
23	1.6	407	85.2	0.00001	130
24	0.1	295	124	0.00001	
25	0.5	349	123	0.0001	
26	0.4	146	45.1	0.00017	
27	0.2	174	47.4	0.00001	
28	0.1	160	52.6	0.00011	69.8

Appendix B (continued)

Field Parameters groundwater sampling sites- 2011

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

Site	Turbidity (nephritic turbidity ratio NTU)	Specific Conductance (Us/Cm)	Hardness Non-carbonate (mg/L as $CaCO_3$)	Acidity (mg/L as H^+)	Alkalinity (mg/L as $CaCO_3$)
29	0.1	396	15.2		140
30	0.4	485	197	0.00004	208
31	0.8	327	98.7	0.00003	138
32	0.4	548	82.6	0.00001	
33	17	782	141	0.00004	
34	0.5	225	109	0.00003	
35	2.7	323	129	0.00009	
36	0.1	233	24	0.02907	
37	9.6	117	35.3	0.00046	
38	36	380	178	0.00023	
39	4.1	550	240	0.00016	
40	1.2	226	97.2	0.00018	
41	1.7	67	27	0.00101	

Appendix B (continued)

Field Parameters and Ions groundwater sampling sites- 2011

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

Site	Total Dissolved Solids Residue At 180 Deg. C (mg/L)	CO_2 (mg/L)	Dissolved Oxygen, (mg/L)	Bicarbonate (mg/L as HCO_3)	Calcium (mg/L as Ca)	Magnesium, (mg/L as Mg)
1	116	32	7.1	82.6	24.6	8.15
2	12	58.9	8.6	2.3	2.12	0.662
3	27	53.6	8.1	5.9	1.96	0.376
4	282	0.3	0.3	235	1.16	0.137
5	467	0.9	0.3	77.7	0.672	0.105
6	75	24.9	0.2	58.7	12.5	4.05
7	103	28.2	6.2	42.4	14.7	1.57
8	221	8.3	6.6	129	11.2	2.58
9	98	29.9	0.9	66.6	10.1	2.42
10	313	59	1.7	182	42.4	10.8
11	359	5.8	0.7	364	22.7	2.99
12	54	55	4.9	34.5	7.04	3
13	410	4.1	0.5	382	3.81	0.684
14	522	58	1.7	194	91	19.1
15	235	21	0.2	270	48	9.74
16	84	14	1.7	45.1	14.5	4.54
17	134	24	1.2	75.4	19	5.14
18	61	2.5	2.5	53.7	16.9	1.66
19	115	0.8	0.8	99.8	12.6	2.36
20	130	1.2	1.2	83.3	14.7	1.99
21	179	7.4	7.4	181	55.4	4.07
22	220	5.5	5.5	219	66	5.11
23	226	0.1	0.1	159	26.2	4.56
25	200	0.3	0.3		39.6	5.68
26	97	0.6	0.6		11.6	3.9
27	101	1.3	1.3		11.3	4.28
28	90	1.4	1.4	85	13.7	4.35

Appendix B (continued)

Field Parameters and Ions groundwater sampling sites- 2011

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

Site	Total Dissolved Solids Residue At 180 Deg. C (mg/L)	CO_2 (mg/L)	Dissolved Oxygen, (mg/L)	Bicarbonate (mg/L as HCO_3)	Calcium (mg/L as Ca)	Magnesium, (mg/L as Mg)
29	220	0.2	0.2	170	4.5	0.903
30	277	0.2	0.2	254	60.7	10.7
31	183	1.7	1.7	168	30.9	4.95
32	337	1.9	1.9		24.9	4.89
33	493	4.4	4.4		48.3	4.81
34	131	2.6	2.6		39.7	2.29
35	131	5.5	2.8		39.7	2.29
36	200	18	7.2		40.1	6.92
37	113	225	2.1		6.62	1.78
38	65	46	2.2		9.01	3.02
39	213	69	0.3		55.3	9.49
40	344	73	1.4		74.8	12.8
41	124	38	8.8		28.4	6.27

Appendix B (continued)

Ions groundwater sampling sites- 2011

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

Site	Potassium, (mg/L as K)	Sodium (mg/L as Na)	Bromide (mg/L as Br)	Chloride (mg/L as Cl)	Fluoride (mg/L as F)	Sulfate (mg/L as SO^{-}_{4})
				SWDR = 250 mg/L	SWDR = 2.0 mg/L	SWDR = 250 mg/L
1	1.48	0.1	0.01			
2	0.43	2.09	0.01	0.94	< 0.04	13
3	0.49	1.36	0.01	1.46	< 0.04	13.5
4	0.6	0.05	0.01	4.96	1.32	10.4
5	1	0.15	0.598	67.6	1.85	4.39
6	1.53	2.27	0.012	1.32	< 0.04	7.25
7	0.79	0.45	0.015	17	< 0.04	6.66
8	2.55	0.76	0.461	48.4	0.42	< 0.09
9	1.19	0.53	0.033	20.5	0.1	0.25
10	1.61	1.11	0.066	12.2	0.12	83.6
11	1.09	0.56	0.156	42.9	0.7	< 0.09
12	0.99	8.7	0.019	1.05	0.09	10.9
13	0.92	0.73	0.107	39.1	0.59	0.21
14	1.59	1.42	0.035	6.48	0.42	231
15	1.36	4.52	0.109	10.9	0.2	13.3
16	2.9	4.41	0.01	1.49	0.1	11.6
17	2.45	0.07	0.018	20.9	0.09	22
18	0.5	0.42	0.015	2.08	< 0.04	5.13
19	1.71	2.09	0.119	14.5	0.33	< 0.09
20	0.55	1.36	0.081	11	0.07	10.7
21	0.54	0.05	0.065	3.16	0.04	9.97
22	0.48	0.15	0.024	12	0.04	11.7
23	2.26	2.27	0.163	40.8	0.18	9.63
24	0.88	0.45	0.014	3.21	< 0.04	8.92
25	0.88	0.76	0.071	21	0.05	6.1
26	1.34	0.53	0.01	7.03	0.05	13.2

MCL = Maximum Contaminant Level; SWDR = Secondary Drinking Water Reg.
< = less than

Appendix B (continued)

Ions groundwater sampling sites- 2011

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

Site	Potassium, (mg/L as K)	Sodium (mg/L as Na)	Bromide (mg/L as Br)	Chloride (mg/L as Cl)	Fluoride (mg/L as F)	Sulfate (mg/L as SO^{-}_{4})
				SWDR = 250 mg/L	SWDR = 2.0 mg/L	SWDR = 250 mg/L
27	1.25	1.11	0.029	5.83	0.07	0.46
28	1.31	0.56	0.015	3.75	0.07	14.4
29	1.2	8.7	0.384	45.5	0.22	< 0.09
30	1.74	0.73	0.078	27.1	0.16	< 0.09
31	1.01	1.42	0.034	8.44	0.24	12.7
32	1.07	4.52	0.027	2.19	0.29	39.2
33	0.81	4.41	0.112	49.3	0.72	53.4
34	0.64	0.07	0.01	2.75	< 0.04	6.21
35	1.79	0.42	0.019	21.2	0.08	20.1
36	1.52	2.46	0.021	53.6	0.07	14.1
37	0.96	0.64	0.019	3.24	0.11	0.76
38	1.17	0.31	0.036	10.4	0.12	23.4
39	1.56	0.81	0.019	1.86	0.14	59.8
40	1.65	0.32	0.033	3.78	0.16	1.63
41	0.68	0.04	0.01	0.57	< 0.04	7.6

MCL = Maximum Contaminant Level; SWDR = Secondary Drinking Water Reg.
< = less than

Appendix B (continued)

Metals groundwater sampling sites- 2011

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

Site	Aluminum, (µg/L as Al)	Antimony, (µg/L as Sb)	Arsenic (µg/L as As)	Barium (µg/L as Ba)	Beryllium, (µg/L as Be)
	SWDR = Max. 200 µg/L	MCL = 6 µg/L	MCL = 10 µg/L	MCL = 2000 µg/L	MCL = 4 µg/L
1	< 1.7	0.042	0.09	53.9	0.007
2	563	< 0.027	< .02	37.6	0.206
3	979	< 0.027	< 0.02	35.8	0.134
4	4.5	< 0.027	0.05	31.7	< 0.006
5	4.4	0.09	5.3	125	0.008
6	< 1.7	< 0.027	2.1	172	0.031
7	< 1.7	0.063	0.05	37.5	< 0.006
8	< 1.7	< 0.027	0.11	439	< 0.006
9	< 1.7	< 0.027	0.19	267	0.037
10	5.7	0.056	0.35	104	0.013
11	< 1.7	< 0.027	0.45	1350	< 0.006
12	2.5	< 0.027	4.1	81.7	0.016
13	< 1.7	< 0.027	0.1	528	0.007
14	< 1.7	< 0.027	1.5	62.4	0.027
15	< 1.7	< 0.027	1.2	236	0.006
16	2.1	< 0.027	0.08	400	0.039
17	< 1.7	< 0.027	0.18	660	0.041
18	4.2	< 0.027	0.09	30.8	< 0.006
19	< 1.7	< 0.027	< 0.02	430	0.009
20	7.1	< 0.027	1	514	< 0.006
21	5.2	< 0.027	0.13	44.6	< 0.006
22	1.7	< 0.027	0.18	207	< 0.006
23	< 1.7	0.03	0.31	563	< 0.006
24	7.9	0.036	1.2	262	< 0.006
25	< 1.7	< 0.027	5.7	645	0.01
26	< 1.7	< 0.027	1.1	112	0.016
27	< 1.7	< 0.027	0.97	1400	< 0.006

MCL = Maximum Contaminant Level; SWDR = Secondary Drinking Water Reg.
< = less than

Appendix B (continued)

Metals groundwater sampling sites- 2011

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

Site	Aluminum, (µg/L as Al)	Antimony, (µg/L as Sb)	Arsenic (µg/L as As)	Barium (µg/L as Ba)	Beryllium, (µg/L as Be)
	SWDR = Max. 200 µg/L	MCL = 6 µg/L	MCL = 10 µg/L	MCL = 2000 µg/L	MCL = 4 µg/L
28	< 1.7	< 0.027	2.8	292	0.022
29	< 1.7	< 0.027	1	228	< 0.006
30	< 1.7	0.039	0.73	1250	< 0.006
31	< 1.7	< 0.027	6.3	618	< 0.006
32	< 1.7	< 0.027	2.7	238	< 0.006
33	4	0.048	0.29	93.9	< 0.006
34	1.8	0.035	0.28	60.2	< 0.006
35	< 1.7	0.047	2.3	159	< 0.006
36	696	< 0.027	0.07	186	0.495
37	< 1.7	< 0.027	0.12	206	0.017
38	< 1.7	< 0.027	0.6	346	< 0.006
39	< 1.7	< 0.027	1.2	192	< 0.006
40	< 1.7	< 0.027	0.39	392	0.03
41	10.4	< 0.027	0.03	22.1	0.063

MCL = Maximum Contaminant Level; SWDR = Secondary Drinking Water Reg.
< = less than

Appendix B (continued)

Metals groundwater sampling sites- 2011

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

Site	Boron (µg/L)	Cadmium (µg/L as Cd)	Chromium (µg/L)	Cobalt (µg/L)	Copper (µg/L as Cu)	Iron, (µg/L as Fe)
		MCL = 5 µg/L	MCL = 100 µg/L		SWDR = 1000 µg/L	SWDR = 300 µg/L
1		< 0.016	0.14	0.033	1.9	3.9
2		0.174	0.21	3.32	21.3	7.7
3		0.347	0.12	2.5	2.8	3.6
4		< 0.016	< 0.06	0.153	0.5	3.2
5		< 0.016	< 0.06	0.02	0.5	3.2
6		< 0.016	< 0.06	2.04	0.5	3240
7		0.026	< 0.06	0.302	1.3	10.2
8		< 0.016	< 0.06	0.113	0.5	83
9		< 0.016	< 0.06	0.091	0.5	7910
10		< 0.016	< 0.06	0.615	0.5	574
11		< 0.016	< 0.06	0.046	0.5	84
12		< 0.016	0.1	4.3	0.5	7830
13		< 0.016	< 0.06	0.251	0.5	27.7
14		< 0.016	< 0.06	1.36	0.5	11600
15		< 0.016	< 0.06	0.024	0.5	751
16		< 0.016	< 0.06	0.359	0.5	3100
17	14	< 0.016	< 0.06	0.175	0.5	5240
18	6	0.032	0.11	0.051	0.5	3.2
19	33	< 0.016	< 0.06	0.035	0.5	890
20	31	< 0.016	< 0.06	0.055	0.5	10.9
21	5	< 0.016	0.28	0.027	0.75	3.2
22	6	< 0.016	0.2	0.049	0.5	3.2
23	52	< 0.016	< 0.06	0.154	0.5	31.6
24	14	< 0.016	0.18	0.026	0.5	3.2
25	91	< 0.016	< 0.06	0.058	0.54	1560
26	17	< 0.016	< 0.06	0.541	0.5	1440

MCL = Maximum Contaminant Level; SWDR = Secondary Drinking Water Reg.
< = less than

Appendix B (continued)

Metals groundwater sampling sites- 2011

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

Site	Boron (µg/L)	Cadmium (µg/L as Cd)	Chromium (µg/L)	Cobalt (µg/L)	Copper (µg/L as Cu)	Iron, (µg/L as Fe)
		MCL = 5 µg/L	MCL = 100 µg/L		SWDR 1000 µg/L	SWDR = 300 µg/L
27	108	< 0.016	< 0.016	0.02	0.5	6.4.4
28	15	< 0.016	< 0.016	0.027	0.5	1690
29	101	< 0.016	< 0.016	0.02	0.5	46.1
30	22	< 0.016	< 0.016	0.894	0.5	666
31	21	< 0.016	< 0.016	0.578	0.8	84.4
32	40	< 0.016	< 0.016	0.753	0.8	905
33	77	< 0.016	0.75	0.423	1.4	8.4
34	6	< 0.016	0.09	0.435	0.85	3.7
35	18	< 0.016	< 0.016	20.6	0.81	1360
36	11	0.658	0.7	0.106	0.84	14.5
37	12	< 0.016	< 0.016	0.341	0.8	1920
38	15	< 0.016	< 0.016	0.327	0.86	1050
39	34	< 0.016	< 0.016	0.434	0.8	775
40	16	< 0.016	< 0.016	0.548	0.8	1940
41	7	0.027	0.15	0.73	0.5	3.2

MCL = Maximum Contaminant Level; SWDR = Secondary Drinking Water Reg.
< = less than

Appendix B (continued)

Metals groundwater sampling sites- 2011

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

Site	Lead, (µg/L as Pb)	Manganese, (µg/L as Mn)	Molybdenum (µg/L)	Nickel (µg/L)	Selenium, (µg/L as Se)
	MCL = 15 µg/L				MCL = 50 µg/L
1	0.05	0.29	0.041	0.2	< 0.03
2	1.64	84.9	< 0.014	5.8	0.17
3	0.619	61.4	< 0.014	2.3	0.11
4	< 0.015	2.57	0.208	< 0.09	< 0.03
5	< 0.015	3.52	1.13	< 0.09	< 0.03
6	< 0.015	279	0.069	0.89	< 0.03
7	0.389	0.77	0.026	0.82	0.27
8	0.016	16.2	0.05	0.21	< 0.03
9	< 0.015	348	0.023	0.09	< 0.03
10	0.017	184	0.175	0.49	0.1
11	0.016	32.6	1.56	< 0.09	< 0.03
12	< 0.015	290	0.07	4.4	< 0.03
13	< 0.015	8.96	0.686	0.09	< 0.03
14	< 0.015	1670	0.394	0.97	< 0.03
15	< 0.015	145	0.327	< 0.09	< 0.03
16	0.019	148	< 0.014	0.49	< 0.03
17	< 0.015	356	0.146	0.146	< 0.03
18	< 0.015	0.23	0.07	0.07	0.07
19	< 0.015	49.4	0.014	0.014	< 0.03
20	< 0.015	70.9	0.158	0.158	< 0.03
21	0.037	< 0.13	0.154	0.154	0.1
22	0.033	< 0.13	0.054	0.054	0.1
23	< 0.015	28	0.816	0.816	0.04
24	0.043	1.26	0.817	0.817	0.27
25	0.017	416	0.127	0.127	< 0.03
26	< 0.015	149	0.144	0.144	< 0.03

MCL = Maximum Contaminant Level; SWDR = Secondary Drinking Water Reg.
< = less than

Appendix B (continued)

Metals groundwater sampling sites- 2011

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

Site	Lead, (µg/L as Pb) MCL = 15 µg/L	Manganese, (µg/L as Mn)	Molybdenum (µg/L)	Nickel (µg/L)	Selenium, (µg/L as Se) MCL = 50 µg/L
27	< 0.015	61	0.088	0.088	< 0.03
28	0.023	621	0.272	0.272	< 0.03
29	< 0.015	11.6	0.174	0.174	< 0.03
30	< 0.015	194	0.418	0.418	< 0.03
31	0.026	141	1.25	0.1	< 0.03
32	< 0.015	131	1.93	< 0.09	< 0.03
33	0.099	12.2	2.4	0.59	0.06
34	0.016	0.14	0.328	0.17	0.15
35	0.04	256	0.865	0.85	0.13
36	3.74	291	< 0.014	8.1	0.09
37	< 0.015	263	0.022	1.1	0.04
38	< 0.015	420	0.215	0.24	< 0.03
39	< 0.015	353	0.164	0.27	< 0.03
40	0.036	185	0.017	0.52	< 0.03
41	< 0.015	2.99	< 0.014	1.7	0.05

MCL = Maximum Contaminant Level; SWDR = Secondary Drinking Water Reg.
< = less than

Appendix B (continued)

Metals groundwater sampling sites- 2011

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

Site	Silver (µg/L)	Strontium, (µg/L)	Zinc, (µg/L as Zn)
	SWDR = 100 µg/L		SWDR = 5000 µg/L
1	< 0.005	91	26.1
2	0.014	13.2	87.9
3	< 0.005	9.6	24.5
4	< 0.005	15.7	< 1.4
5	< 0.005	34.3	< 1.4
6	< 0.005	178	13.5
7	< 0.005	39	10.7
8	< 0.005	288	< 1.4
9	< 0.005	91.3	4.9
10	< 0.005	355	5.4
11	< 0.005	507	< 1.4
12	< 0.005	21.8	6
13	< 0.005	197	< 1.4
14	< 0.005	752	2.5
15	< 0.005	555	1.4
16	< 0.005	197	2.2
17	< 0.005	508	2
18	< 0.005	36.4	1.5
19	< 0.005	234	1.6
20	< 0.005	102	< 1.4
21	< 0.005	105	4.4
22	< 0.005	115	< 1.4
23	< 0.005	526	< 1.4
24	< 0.005	495	10.6
25	< 0.005	212	7.5
26	< 0.005	91	3.2

MCL = Maximum Contaminant Level; SWDR = Secondary Drinking Water Reg.
< = less than

Appendix B (continued)

Metals groundwater sampling sites- 2011

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

Site	Silver (µg/L)	Strontium, (µg/L)	Zinc, (µg/L as Zn)
	SWDR = 100 µg/L		SWDR = 5000 µg/L
27	< 0.005	558	3.1
28	< 0.005	172	1.5
29	< 0.005	57.8	< 1.4
30	< 0.005	773	< 1.4
31	< 0.005	705	17.7
32	< 0.005	176	1.4
33	< 0.005	244	3.2
34	< 0.005	63	7
35	< 0.005	152	2.2
36	0.015	37.4	78.8
37	< 0.005	131	5.1
38	< 0.005	182	13
39	< 0.005	787	1.7
40	< 0.005	222	48.2
41	< 0.005	16.8	2.9

MCL = Maximum Contaminant Level; SWDR = Secondary Drinking Water Reg.
< = less than

Appendix B (continued)

Radionuclides groundwater sampling sites- 2011

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

Site	Alpha activity, 230 pCi/L	Beta activity, 137 pCi/L	Radon 224 (pCi/L)	Radon 226 (pCi/L)	Radon 228 (pCi/L)
	MCL = 15 pCi/L	4 millirems /yr		MCL = 5 pCi/L	MCL = 5 pCi/L
1	0.3 R	0.6 R	0.5	0.21	0.2 R
2	6.8	5.1	3.9	1.9	3.2
3	2.5	1	0.8	0.79	0.83
4	0.5 R	0.4 R	0.1 R	0.2	
5	1.2 R	0.8 R	0.1 R	0.2	
6	0.1 R	1.1	-0.1 R	-0.16 R	
7	0.2 R	2.3	0.2 R	0.15	
8	0.1 R	1.7	-0.1 R	0.15	
9	0.9	1.3	0.2 R	0.29	
10	-0.4 R	1.7	0.3 R	0.22	
11	1.2	0.8	0.4 R	0.5	
12	1.5	1.1	0 R	0.14	
13	2.7	1.1	0.2 R	0.27	
14	1.1	1.7	0.2 R	0.39	
15	0.9 R	0.1 R	0.29 R	0.28	
16	1.9	3.3	0.16 R	0.15	
17	1.5	3.3	0.34	0.3	0.44
18	0.6 R	1 R	0.05 R	0.03 R	
19	1.1	2.6	0.03 R	0.2	
20	0.7	0.9 R	0.03 R	0.2	
21	0.3 R	0.6 R	0 R	0.26	
22	1.9	0.3	0.14	0.05 R	-0.15
23	-0.1 R	2.1	0.4	0.31	0.3
24	0.6 R	1.4	0.03 R	0.08	
25	-0.2 R	1.5	0.42	0.48	0.5
26	0.8	1.4	0 R	0.73	
27	3.6	1.8	0.25 R	0.85	

MCL = Maximum Contaminant Level; pCi/L = pico Curies/Liter.
R = Radiochemistry non-detect, result below sample specific critical level

Appendix B (continued)

Radionuclides groundwater sampling sites- 2011

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

Site	Alpha activity, 230 pCi/L	Beta activity, 137 pCi/L	Radon 224 (pCi/L)	Radon 226 (pCi/L)	Radon 228 (pCi/L)
	MCL = 15 pCi/L	4 millirems /yr		MCL = 5 pCi/L	MCL = 5 pCi/L
28	0.7	1.2	0.12 R	0.15 R	
29	-0.6 R	1.1	0 R	1	
30	1 R	2.7	0.33	0.65	0.49
31	1	0.6 R	0.2 R	0.3	
32	0.6	0.5 R	0.34	0.5	0.12 R
33	2	-0.5 R	0.25	0.14	0.06 R
34	0.1 R	0.9	-0.11 R	0.33	
35	2	1.5	-0.16 R	0.1 R	
36	6	4.8	2.2	1.5	2.48
37	1	0.4	0.23	0.23	0.21 R
38	2	1.4 R	-0.09 R	0.8	
39	0.7 R	2	0.8	0.8	0.4
40	1.1	2.9	0.4	0.59	0.55
41	0.9	0.2 R		0.07 R	

MCL = Maximum Contaminant Level; pCi/L = pico Curies/Liter.
R = Radiochemistry non-detect, result below sample specific critical level

Appendix B (continued)

Radionuclides groundwater sampling sites- 2011

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

Site	Uranium (µg/L) MCL = 30 µg/L	Uranium as U-234 (µg/L)	Uranium as U-235 (µg/L)	Uranium as U-238 (µg/L)
1	0.164	0.04	0 R	0.016 R
2	0.041	0.033	0.005 R	0.041
3	0.022	0.011 R	-0.004 R	0.011
4	0.011	0.07	0.005 R	0.039
5	0.043	0.13	0.009 R	0.025
6	< 0.004			
7	0.005	0.03	-0.007 R	0.033
8	< 0.004			
9	< 0.004			
10	0.166			
11	0.005	0.011 R	0.003 R	0.011
12	< 0.004			
13	< 0.004			
14	< 0.004			
15	< 0.004			
16	< 0.004			
17	< 0.004			
18	0.074	0.028 R	-0.007 R	0.015
19	< 0.004			
20	< 0.004			
21	0.487	0.22	0.021	0.12
22	0.421	0.28	0.005 R	0.12
23	0.122	0.13	0.009 R	0.043
24	0.518	0.34	0.004 R	0.16
25	0.007	0.03	0.005 R	0.004 R
26	< 0.004			
27	< 0.004			

MCL = Maximum Contaminant Level; pCi/L = pico Curies/Liter.
< = less than
R = Radiochemistry non-detect, result below sample specific critical level

Appendix B (continued)

Radionuclides groundwater sampling sites- 2011

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

Site	Uranium (µg/L) MCL = 30 µg/L	Uranium as U-234 (µg/L)	Uranium as U-235 (µg/L)	Uranium as U-238 (µg/L)
28	< 0.004			
29	< 0.004			
30	< 0.004			
31	0.039	0.02	0.006 R	0.012
32	0.062	0.034	-0.003 R	0.012
33	0.682	0.43	0.025	0.24
34	0.237	0.109	0.008 R	0.067
35	0.205	0.084	0.009	0.079
36	0.025	0.024	0 R	0.007 R
37	< 0.004			
38	0.017	0.024	0.009 R	0.007 R
39	0.085	0.035	0 R	0.011
40	< 0.004			
41	0.029	0.01 R	0.003 R	0.005 R

MCL = Maximum Contaminant Level; pCi/L = pico Curies/Liter.
< = less than
R = Radiochemistry non-detect, result below sample specific critical level

Appendix B (continued)

Field Parameters surface water sampling sites- 2012

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

Site	Water Temp. (Deg C)	Water pH (Whole Field, Standard Units)	Specific Conductance (Us/Cm)	Hardness Non-carbonate (mg/L as $CaCO_3$)	Acidity (mg/L as H^+)	Alkalinity (mg/L as $CaCO_3$)
1	19.2	5.4	274	112	0.00411	0.1
2	21.3	8.3	5380	1090		337
3	10.5	7.3	75	29.1	0.00005	26.9
4	17.2	8	176	76	0.00001	73.4
5	22.1	7.7	105	47	0.00002	41.7
6	22.6	8.2	256	30.8	0.00001	83.5
7	22.4	7.5	81	38.5	0.00003	31.6
8	20.6	8.6	113	25.2		36
9	16.6	7.2	57	20.2	0.00006	14.8
10	20.5	7.2	102	42.2	0.00007	40
11	22.8	7	200	68	0.00009	58.1
12	17.2	7.4	101	40.6	0.00005	30.9
13	18.1	7	118	47.3	0.00009	42.9
14	20.1	7.2	56	23.5	0.00006	20
15	23.9	7.7	239	88.4	0.00002	79.2
16	20.7	7.4	103	46	0.00004	39.4
17	20.4	7.6	305	137	0.00002	31.8
18	28.1	7.2	115	42.5	0.00006	38.2
19	19.6	7.8	466	189	0.00002	141
20	14.4	7.6	751	386	0.00003	109
21	25.7	8.7	701	280		125
22	23.7	7.9	360	174	0.00001	110
23	12.5	8.1	165	72.1	0.00001	38.4
24	16.4	7.2	62	24	0.00006	18.5
25	20.9	8.2	1220	500	0.00001	244
26	16.6	7.2	63	24.1	0.00007	20
27	19.6	7.6	557	230	0.00003	119

Appendix B (continued

Field Parameters surface water sampling sites- 2012

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

Site	Water Temp. (Deg C)	Water pH (Whole Field, Standard Units)	Specific Conductance (Us/Cm)	Hardness Non-carbonate (mg/L as $CaCO_3$)	Acidity (mg/L as H^+)	Alkalinity (mg/L as $CaCO_3$)
28	19.3	8	769	378	0.00001	126
29	12.1	7.5	68	25.8	0.00003	20.8
30	10.3	7.6	96	39.7	0.00002	31.8
31	21.8	8.1	843	453	0.00001	133
32	19.8	8	1120	534	0.00001	92
33	18.4	7.4	378	150	0.00005	145
34	20.8	7.9	499	151	0.00001	111
35	9.6	4.8	305	106	0.01561	5.8
36	11.2	7.6	126	52.7	0.00002	39
37	23.1	8.1	1080	418	0.00001	190
38	23.2	8.2	285	122	0.00001	65.7
39	25.2	8.4	1110	259		158
40	25.3	8.5	316	127		103
41	11.5	7.4	611	314	0.00004	53.1
42	25.3	8.6	136	53.8		43.3
43	19.6	7.7	1080	276	0.00002	184
44	21.9	7.8	366	95	0.00002	116
45	21.2	8.3	4080	889		241
46	9.3	7.7	236	85.6	0.00002	38
47	21.9	7.9	125	37.6	0.00001	23.4
48	21.9	7.9	125	37.6	0.00001	23.4
49	6.7	7.3	113	36.7	0.00005	21.2
50	6.7	7.3	113	36.7	0.00005	21.2
51	18.9	7.6	435	121	0.00002	160
52	20.4	8	985	193	0.00001	154
53	21.3	8.3	415	147	0.00001	145

Appendix B (continued)

Field Parameters and Ions surface water sampling sites- 2012

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

Site	Total Dissolved Solids Residue At 180 Deg. C (mg/L)	CO_2 (mg/L)	Dissolved Oxygen, (mg/L)	Bicarbonate (mg/L as HCO_3)	Calcium (mg/L as Ca)	Magnesium, (mg/L as Mg)
1	168	2.6	8.8	0.4	28.3	10
2	4380	3.2	11.3	401	291	86.3
3	44	2.7	10.5	32.8	8.94	1.63
4	102	1.5	8.9	88.4	25.7	2.85
5	73	1.6	8.4	50.8	15.2	2.17
6	165	0.9	8.4	101	9.63	1.61
7	55	1.9	7.9	38.5	12.6	1.72
8	66	0.2	8.6	43.7	7.68	1.45
9	37	1.8	9	18	5.51	1.55
10	77	5.1	7.3	48.7	13.3	2.16
11	113	11	4.6	70.9	21	3.74
12	69	2.7	9.1	37.6	13.2	1.8
13	72	7.7	5.6	52.2	14.6	2.63
14	45	2.3	8.3	24.4	7.3	1.26
15	144	3.3	7.6	95.7	28.4	4.2
16	60	3.4	7.5	48	15.6	1.72
17	195	1.5	8.8	38.6	28.9	15.6
18	63	4.2	7.4	46.5	12.9	2.47
19	278	4.8	7.9	170	53.1	13.7
20	495	5.5	10.4	133	105	29.8
21	486	0.5	13.6	152	74.9	22.4
22	225	2.7	8.6	134	48.1	13.1
23	98	0.6	10.1	46.7	21.4	4.49
24	44	2	9.1	22.5	6.63	1.81
25	908	3.3	8.7	0.4	126	44.9
26	44	2.6	8.7	286	6.5	1.89
27	334	6.5	6	24.4	65	16.3
28	622	2.7	8.7	145	97.1	32.8

Appendix B (continued)

Field Parameters and Ions surface water sampling sites- 2012

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

Site	Total Dissolved Solids Residue At 180 Deg. C (mg/L)	CO_2 (mg/L)	Dissolved Oxygen, (mg/L)	Bicarbonate (mg/L as HCO_3)	Calcium (mg/L as Ca)	Magnesium, (mg/L as Mg)
29	49	1.2	10	154	7.33	1.8
30	64	1.5	11	25.4	12.3	2.15
31	615	2	8.7	38.8	120	37.2
32	872	1.7	8.6	160	145	41.2
33	216	13	4.9	111	44.4	9.36
34	280	2.5	8.8	174	46.7	8.28
35	190	208	10.2	134	31.2	6.78
36	71	1.8	10.4	8.3	15.6	3.3
37	744	3.1	9.4	47.6	125	25
38	174	0.7	9.9	228	37.7	6.71
39	762	1.2	10.1	79.5	69.7	20.2
40	192	0.6	9.2	192	40	6.56
41		4	10.3	123	104	13.5
42	441	0.2	9	64.6	16.9	2.76
43	80	7.1	5.9	52.3	75.2	21.3
44	725	4.1	6	223	28.8	5.55
45	211	2.2	9.4	141	227	77.4
46	3300	1.4	11	290	23.6	6.48
47	139	0.6	9.3	46.3	11.8	1.93
48	74	0.6	9.3	28.4	11.8	1.93
49	74	2.2	11.2	28.4	11.4	1.97
50	58	2.2	11.2	25.9	11.4	1.97
51	58	7.7	4.8	25.9	35.1	7.91
52	263	2.8	8.1	194	50.3	16.4
53	626	1.5	9.5	184	43.2	9.46

Appendix B (continued)

Ions surface water sampling sites- 2012

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

Site	Potassium, (mg/L as K)	Sodium (mg/L as Na)	Bromide (mg/L as Br)	Chloride (mg/L as Cl)	Fluoride (mg/L as F)	Sulfate (mg/L as SO^{-}_{4})
				SWDR = 250 mg/L	SWDR = 2.0 mg/L	SWDR = 250 mg/L
1	1.33	3.99	0.027	0.027	< 0.04	112
2	8.85	949	0.692	0.692	0.26	2640
3	1.36	2.91	0.016	0.016	< 0.04	6.76
4	1.14	6.26	0.018	0.018	< 0.04	5.52
5	1.08	1.93	0.021	0.021	< 0.04	5.79
6	1.13	45	0.024	0.024	0.1	34.5
7	0.92	0.89	0.018	0.018	< 0.04	4.17
8	0.78	14	0.02	0.02	< 0.04	13.3
9	0.66	2.65	0.025	0.025	< 0.04	7.64
10	1.29	3.26	0.018	0.018	< 0.04	5.86
11	2.76	11.9	0.083	0.083	< 0.04	8.32
12	1.34	3.75	0.048	0.048	0.05	5.84
13	1.76	4.37	0.031	0.031	0.05	6.36
14	0.88	1.27	0.015	0.015	< 0.04	3.42
15	1.93	12.7	0.04	0.04	< 0.04	13.5
16	1.04	2.02	0.026	0.026	< 0.04	6.7
17	2.18	4.24	0.03	0.03	0.05	101
18	1.98	4.61	0.027	0.027	< 0.04	5.24
19	4.9	25.7	0.069	0.069	0.13	40.2
20	3.59	22.8	0.035	0.035	0.16	280
21	3.31	50	0.045	0.045	0.18	220
22	3.85	6.25	0.031	0.031	0.1	60.1
23	1.6	5.04	0.026	0.026	0.06	26.8
24	1.06	2.06	0.017	0.017	< 0.04	5.69
25	3.93	102	0.039	0.039	0.23	433
26	1.26	1.72	0.018	1.88	0.04	5.98
27	3.55	26.7	0.052	40.3	0.12	82.2

MCL = Maximum Contaminant Level; SWDR = Secondary Drinking Water Reg.
< = less than

Appendix B (continued)

Ions surface water sampling sites- 2012

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

Site	Potassium, (mg/L as K)	Sodium (mg/L as Na)	Bromide (mg/L as Br)	Chloride (mg/L as Cl)	Fluoride (mg/L as F)	Sulfate (mg/L as SO^{-}_{4})
				SWDR = 250 mg/L	SWDR = 2.0 mg/L	SWDR = 250 mg/L
28	3.1	50	0.038	7.29	0.14	309
29	1.23	2.45	0.014	3.81	< 0.04	5.95
30	1.4	3.35	0.014	4.09	< 0.04	7.45
31	4.33	17.6	0.041	6.39	0.15	301
32	3.53	56.1	0.038	5.39	0.25	470
33	3.92	24.6	0.035	9.02	0.1	23
34	5.07	41.2	0.069	63.1	0.14	23.7
35	2	7.5	0.018	8.15	0.09	144
36	1.33	4.02	0.019	6.06	< 0.04	12.6
37	4.72	93.8	0.049	10.8	0.27	363
38	2.81	8.96	0.036	11	0.09	42
39	3.45	151	0.164	26.6	0.22	369
40	2.59	16.7	0.029	13.9	0.11	31.1
41	5.12	8.31	0.036	10.7	0.18	261
42	1.76	5.15	0.018	6.38	0.06	11.8
43	3.38	134	0.259	41.5	0.2	302
44	1.88	40.5	0.156	21.8	0.17	28.6
45	7.05	697	0.459	71.2	0.27	2040
46	2.36	12.9	0.037	17.4	0.06	43.7
47	0.9	8.29	0.022	14.2	0.05	12.1
48	0.9	8.29	0.022	14.2	0.05	12.1
49	1.09	7.11	0.02	12.7	< 0.04	11.1
50	1.09	7.11	0.02	12.7	< 0.04	11.1
51	2.86	49.8	0.051	14.4	0.15	41.3
52	3.09	151	0.21	42	0.17	284
53	282	32.2	0.067	14.6	< 0.14	43.9

MCL = Maximum Contaminant Level; SWDR = Secondary Drinking Water Reg.
< = less than

Appendix B (continued)

Metals surface water sampling sites- 2012

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

Site	Aluminum, (µg/L as Al)	Antimony, (µg/L as Sb)	Arsenic (µg/L as As)	Barium (µg/L as Ba)	Beryllium, (µg/L as Be)
	SWDR = Max. 200 µg/L	MCL = 6 µg/L	MCL = 10 µg/L	MCL = 2000 µg/L	MCL = 4 µg/L
1	99.8	< 0.027	0.07	51.3	0.245
2	< 6.6	< 0.081	0.37	18.1	< 0.018
3	4.8	0.051	0.2	50.8	< 0.006
4	< 2.2	0.075	0.33	49.8	< 0.006
5	2.9	< 0.027	0.22	36.5	< 0.006
6	19.8	0.04	0.2	43	< 0.006
7	22.7	0.035	0.16	41.9	< 0.006
8	8.7	0.053	0.13	43.4	0.006
9	5.6	0.031	0.06	35.5	0.008
10	3.2	0.066	0.35	48	< 0.006
11	3.6	0.086	0.54	84.6	0.006
12	38.8	0.07	0.18	74.5	0.025
13	10.8	0.108	0.58	49.5	0.009
14	9.1	0.069	0.34	37	0.006
15	3.9	0.124	0.63	58.7	0.006
16	8.1	0.043	0.16	67.3	0.014
17	10.5	0.067	0.18	51.7	0.007
18	19.1	0.14	1.1	57.7	0.011
19	2.7	0.144	0.97	71.6	< 0.006
20	61.9	0.112	0.24	58.5	0.012
21	12.2	0.103	0.71	64.9	< 0.006
22	6.9	0.198	0.83	70.8	< 0.006
23	35.7	0.139	0.21	35.1	0.01
24	3.6	< 0.027	0.19	27.6	< 0.006
25	10.2	0.086	0.57	54.8	< 0.006
26	5.1	0.047	0.23	30	< 0.006
27	4.9	0.218	0.83	95	< 0.006

MCL = Maximum Contaminant Level; SWDR = Secondary Drinking Water Reg.
< = less than

Appendix B (continued)

Metals surface water sampling sites- 2012

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

Site	Aluminum, (µg/L as Al)	Antimony, (µg/L as Sb)	Arsenic (µg/L as As)	Barium (µg/L as Ba)	Beryllium, (µg/L as Be)
	SWDR = Max. 200 µg/L	MCL = 6 µg/L	MCL = 10 µg/L	MCL = 2000 µg/L	MCL = 4 µg/L
28	14.2	0.067	0.28	49	< 0.006
29	5	0.053	0.2	32.3	< 0.006
30	4.6	0.038	0.16	42.3	< 0.006
31	5.6	0.151	0.63	65.9	< 0.006
32	41	0.077	0.24	36.7	< 0.006
33	11.5	0.118	0.96	98.4	< 0.006
34	10.8	0.285	1.4	86.5	0.039
35	4420	0.027	0.25	47.3	1.8
36	4420	0.079	0.14	47	< 0.006
37	< 2.7	0.071	0.26	59	< 0.006
38	13.1	0.106	0.51	66	< 0.006
39	8	0.11	0.29	62	< 0.006
40	7.1	0.134	0.51	68	< 0.006
41	13.9	0.072	0.22	79	< 0.006
42	4.2	0.083	0.29	37	< 0.006
43	25	0.343	0.65	56	0.007
44	9.5	0.136	0.92	70	< 0.006
45	15.9	0.072	0.35	83	< 0.012
46	6.5	0.054	0.12	21	0.01
47	13	0.033	0.14	48	0.012
48	23	0.033	0.14	49	0.012
49	23	0.051	0.11	49	0.01
50	8.6	0.051	0.11	38	0.01
51	8.6	0.146	1.3	38	< 0.006
52	11.4	0.165	0.81	84	< 0.006
53	10.2	0.093	0.51	72	< 0.006

MCL = Maximum Contaminant Level; SWDR = Secondary Drinking Water Reg.
< = less than

Appendix B (continued)

Metals surface water sampling sites- 2012

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

Site	Boron (µg/L)	Cadmium (µg/L as Cd)	Chromium (µg/L)	Cobalt (µg/L)	Copper (µg/L as Cu)	Iron, (µg/L as Fe)
		MCL = 5 µg/L	MCL = 100 µg/L		SWDR = 1000 µg/L	SWDR = 300 µg/L
1	13	< 0.188	< 0.07	< 2.9	< 0.8	32.6
2	312	< 0.048	0.21	0.52	< 2.4	10
3	13	< 0.016	< 0.07	0.224	< 0.8	23.4
4	10	< 0.016	< 0.07	0.323	< 0.8	4.9
5	10	< 0.016	< 0.07	0.043	< 0.8	< 3.2
6	27	< 0.016	0.07	0.346	< 0.8	87.9
7	8	< 0.016	< 0.07	0.107	< 0.8	66.8
8	14	< 0.016	< 0.07	0.194	< 0.8	70.2
9		0.034	< 0.07	0.09	0.8	11.7
10	14	< 0.016	< 0.07	0.324	< 0.8	93.9
11	18	< 0.016	< 0.07	0.727	< 0.8	596
12	11	0.017	< 0.07	0.524	< 0.8	158
13	15	< 0.016	0.08	0.788	0.83	505
14	7	0.017	< 0.07	0.347	< 0.8	72.5
15	24	< 0.016	< 0.07	0.507	< 0.8	185
16	9	< 0.016	< 0.07	0.416	< 0.8	177
17	13	< 0.016	< 0.07	0.348	< 0.8	59.3
18	22	0.019	0.07	1.11	0.8	662
19	42	< 0.016	0.07	0.64	1.4	64.8
20	34	0.067	< 0.07	3.99	0.85	41.7
21	35	< 0.016	< 0.07	0.224	0.81	13.6
22	23	< 0.016	< 0.07	0.862	0.84	29.6
23	19	< 0.016	0.11	1.5	< 0.8	134
24	9	< 0.016	< 0.07	0.078	0.86	12.6
25	54	< 0.016	< 0.07	0.337	< 0.8	9.3
26	11	< 0.016	< 0.07	0.08	< 0.8	10.4
27	32	< 0.016	< 0.07	0.894	< 0.8	37.5

MCL = Maximum Contaminant Level; SWDR = Secondary Drinking Water Reg.
< = less than

Appendix B (continued)

Metals surface water sampling sites- 2012

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

Site	Boron (µg/L)	Cadmium (µg/L as Cd)	Chromium (µg/L)	Cobalt (µg/L)	Copper (µg/L as Cu)	Iron, (µg/L as Fe)
		MCL = 5 µg/L	MCL = 100 µg/L		SWDR 1000 µg/L	SWDR = 300 µg/L
28	38	< 0.016	< 0.07	0.272	< 0.8	18.8
29	9	< 0.016	< 0.07	0.461	< 0.8	9.9
30	10	< 0.016	< 0.07	0.157	< 0.8	98.9
31	35	< 0.016	< 0.07	0.578	0.7	12.3
32	58	< 0.016	< 0.07	0.753	< 0.8	5.7
33	39	< 0.016	< 0.07	0.423	< 0.8	45.8
34	65	< 0.016	< 0.07	0.435	1.8	32.6
35	14	0.053	0.1	20.6	3.7	1040
36	18	0.21	0.37	0.106	< 0.8	5
37	79	< 0.016	< 0.07	0.341	< 0.8	6.6
38	26	< 0.016	< 0.07	0.327	1	16
39	57	< 0.016	< 0.07	0.434	< 0.8	8.8
40	39	< 0.016	< 0.07	0.548	< 0.8	31.5
41	25	0.025	< 0.07	1.01	1.1	32.9
42	19	< 0.016	< 0.07	0.311	< 0.8	57.9
43	106	< 0.016	< 0.07	0.681	< 0.8	19.4
44	44	0.022	< 0.07	0.483	< 0.8	89.8
45	217	0.033	< 0.14	0.401	0.99	16.7
46	17	< 0.016	< 0.07	0.304	1.16	150
47	15	< 0.016	< 0.07	0.081	< 0.8	29.5
48	15	0.017	< 0.07	0.081	< 0.8	29.5
49	15	0.017	< 0.07	0.449	< 0.8	30.5
50	15	0.019	< 0.07	0.449	< 0.8	30.5
51	49	0.019	< 0.07	0.599	0.81	88.9
52	81	< 0.016	< 0.07	0.769	1.1	43.7
53	38	< 0.016	< 0.07	0.172	< 0.8	22.9

MCL = Maximum Contaminant Level; SWDR = Secondary Drinking Water Reg.
< = less than

Appendix B (continued)

Metals surface water sampling sites- 2012

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

Site	Lead, (µg/L as Pb)	Manganese, (µg/L as Mn)	Molybdenum (µg/L)	Nickel (µg/L)	Selenium, (µg/L as Se)
	MCL = 15 µg/L				MCL = 50 µg/L
1	< 0.025	351	0.014	< 18.5	0.57
2	< 0.075	91.1	0.442	< 1.2	0.2
3	0.048	3.5	0.06	< 0.34	< 0.03
4	< 0.025	5.95	0.23	< 0.22	0.04
5	< 0.025	1.66	0.077	< 0.14	0.04
6	< 0.025	14.8	0.222	< 0.43	0.08
7	0.032	12.8	0.041	< 0.27	0.03
8	0.025	21.3	0.077	< 0.42	0.07
9	0.039	6.06	0.078	< 0.28	0.06
10	0.032	21.2	0.075	< 0.35	0.03
11	0.071	441	0.194	< 0.62	0.11
12	0.048	26.8	0.098	< 1.1	0.08
13	0.104	155	0.137	< 0.75	0.11
14	0.055	22.1	0.067	< 0.38	0.04
15	0.031	37.3	1.45	< 0.44	0.15
16	0.044	20.3	0.039	< 0.75	0.07
17	0.028	24.4	0.068	< 0.99	0.12
18	0.201	108	0.205	< 0.98	0.1
19	0.051	258	1.25	< 1.3	0.18
20	< 0.025	473	0.234	< 5.5	0.23
21	< 0.025	67	0.619	< 0.75	0.22
22	0.06	132	1.05	< 0.93	0.19
23	0.11	18.6	0.248	< 1.8	0.26
24	0.028	1.78	0.035	< 0.14	< 0.03
25	< 0.025	64	0.843	< 1.1	0.31
26	< 0.025	2	0.035	< 0.2	< 0.03
27	0.056	349	1.04	< 1	0.16

MCL = Maximum Contaminant Level; SWDR = Secondary Drinking Water Reg.
< = less than

Appendix B (continued)

Metals surface water sampling sites- 2012

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

Site	Lead, (µg/L as Pb) MCL = 15 µg/L	Manganese, (µg/L as Mn)	Molybdenum (µg/L)	Nickel (µg/L)	Selenium, (µg/L as Se) MCL = 50 µg/L
28	< 0.025	45.1	0.466	< 0.96	0.15
29	0.048	4.43	0.039	< 0.27	< 0.03
30	< 0.025	5.54	0.169	< 0.4	0.06
31	< 0.025	50.5	0.901	< 1.3	0.2
32	< 0.025	124	0.259	< 2.6	0.14
33	0.065	278	1.4	< 0.64	0.16
34	0.13	45.5	1.06	0.94	0.49
35	0.387	401	0.019	< 34	0.08
36	< 0.025	3.09	0.099	< 0.25	< 0.03
37	0.025	83.4	0.64	< 1.1	0.1
38	0.031	14	0.787	< 0.77	0.13
39	< 0.025	21.8	1.03	< 1.6	0.16
40	0.06	11.4	0.804	< 0.87	0.12
41	< 0.025	174	0.131	< 2.6	0.09
42	0.042	13.4	0.265	< 0.72	0.11
43	0.044	383	2	< 0.99	0.22
44	0.111	45.7	1.4	< 0.5	0.13
45	< 0.05	49.6	0.548	< 1.1	0.15
46	1.21	18.9	0.107	< 1.6	0.08
47	< 0.025	19.7	0.109	< 0.66	0.06
48	< 0.025	19.7	0.109	< 0.66	0.06
49	0.034	12.7	0.053	< 0.7	0.04
50	0.034	12.7	0.053	< 0.7	0.04
51	0.11	240	1.35	< 0.63	0.2
52	0.062	50.2	2.21	< 2.5	0.22
53	< 0.025	15.8	0.787	< 0.47	0.14

MCL = Maximum Contaminant Level; SWDR = Secondary Drinking Water Reg.
< = less than

Appendix B (continued)

Metals surface water sampling sites- 2012

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

Site	Silver (µg/L)	Strontium, (µg/L)	Zinc, (µg/L as Zn)
	SWDR = 100 µg/L		SWDR = 5000 µg/L
1	< 0.005	71.9	33.7
2	< 0.015	4470	< 4.2
3	< 0.005	39.3	< 1.4
4	< 0.005	75.2	< 1.4
5	< 0.005	45.9	< 1.4
6	< 0.005	49.6	< 1.4
7	< 0.005	27.1	< 1.4
8	< 0.005	28.3	< 1.4
9	< 0.005	23.6	< 1.4
10	< 0.005	43.2	< 1.4
11	< 0.005	118	< 1.4
12	< 0.005	73.7	< 1.4
13	< 0.005	61.1	< 1.4
14	< 0.005	23.8	< 1.4
15	< 0.005	106	< 1.4
16	< 0.005	36.9	< 1.4
17	< 0.005	54.9	< 1.4
18	< 0.005	50.9	< 1.4
19	< 0.005	215	< 1.4
20	< 0.005	448	2.6
21	< 0.005	494	< 1.4
22	< 0.005	197	< 1.4
23	< 0.005	141	1.7
24	< 0.005	26.8	< 1.4
25	< 0.005	960	< 1.4
26	< 0.005	25.5	< 1.4
27	< 0.005	228	< 1.4
28	< 0.005	633	< 1.4

MCL = Maximum Contaminant Level; SWDR = Secondary Drinking Water Reg.
< = less than

Appendix B (continued)

Metals surface water sampling sites- 2012

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

Site	Silver (µg/L)	Strontium, (µg/L)	Zinc, (µg/L as Zn)
	SWDR = 100 µg/L		SWDR = 5000 µg/L
29	< 0.005	28.8	< 1.4
30	< 0.005	43.7	< 1.4
31	< 0.005	568	< 1.4
32	< 0.005	971	< 1.4
33	< 0.005	253	< 1.4
34	0.037	245	< 1.4
35	< 0.005	149	85.4
36	< 0.005	86.8	< 1.4
37	< 0.005	1720	< 1.4
38	< 0.005	117	< 1.4
39	< 0.005	930	< 1.4
40	< 0.005	152	< 1.4
41	< 0.005	278	2.3
42	< 0.005	65	< 1.4
43	< 0.005	689	< 1.4
44	< 0.005	195	< 1.4
45	0.01	3210	2.8
46	< 0.005	66.8	< 1.4
47	< 0.005	31.2	< 1.4
48	< 0.005	31.2	< 1.4
49	< 0.005	28.4	1.6
50	< 0.005	28.4	1.6
51	< 0.005	254	< 1.4
52	< 0.005	400	< 1.4
53	< 0.005	228	< 1.4

MCL = Maximum Contaminant Level; SWDR = Secondary Drinking Water Reg.
< = less than

Appendix B (continued)

Radionuclides surface water sampling sites- 2012

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

Site	Alpha activity, 230 pCi/L	Beta activity, 137 pCi/L	Radon 224 (pCi/L)	Radon 226 (pCi/L)	Radon 228 (pCi/L)
	MCL = 15 pCi/L	4 millirems /yr		MCL = 5 pCi/L	MCL = 5 pCi/L
1	0.7	2	0.52	0.1 R	0.29
2	1 R	7.4	0 R	0 R	
3	-0.2 R	1.4	0.14 R	0.08 R	
4	0.2 R	1	0.07 R	0.037 R	
5	-0.04 R	0.6	0.06 R	-0.05 R	
6	0.9	1.5	0.18	0.09 R	0.16 R
7	0.03 R	1.4	0 R	0.09	
8	0.4	1.4	0.07 R	0.04 R	
9	-0.1 R	1.1	0.08 R	0.15 R	
10	0 R	1.9	0.07 R	0.05 R	
11	-0.29 R	2.7	-0.06 R	-0.1 R	
12	0.5	1.2	-0.16 R	0 R	
13	0.1 R	1.7	0 R	0.13 R	
14	0.3 R	1.4	0 R	0.1 R	0.29 R
15	0.7	2.2	-0.18 R	0.05 R	
16	0.4	1.4	0.09 R	0.26 R	
17	0.3 R	2.5	-0.08 R	0 R	
18	0.3 R	2.1	-0.14 R	0.06 R	
19	0.6 R	3.7	0.12 R	0.1 R	
20	0.3 R	3.1	0.18 R	0 R	
21	2	3.4	0 R	0.12 R	
22	0 R	3.8	0.11 R	0 R	
23	0.8	1.8	0.11 R	0 R	
24	-0.09 R	0.9	-0.06 R	0.14 R	
25	1.1 R	3.6	0.08 R	-0.08 R	
26	-0.33 R	1.2	-0.05 R	0 R	
27	0.1 R	3.7	0 R	-0.06 R	
28	1.1	3.3	0.8 R	3	0 R
29	0.4	0.7 R	0 R	0.05 R	
30	-0.1 R	0.3 R	0.05 R	0.038 R	

MCL = Maximum Contaminant Level; pCi/L = pico Curies/Liter.
R = Radiochemistry non-detect, result below sample specific critical level.

Appendix B (continued)

Radionuclides surface water sampling sites- 2012 Division of Water and Waste Management - Groundwater Program - United States Geological Survey Study of Ambient Groundwater Quality in West Virginia

Site	Alpha activity, 230 pCi/L	Beta activity, 137 pCi/L	Radon 224 (pCi/L)	Radon 226 (pCi/L)	Radon 228 (pCi/L)
	MCL = 15 pCi/L	4 millirems /yr		MCL = 5 pCi/L	MCL = 5 pCi/L
31	2.6	3.9	0 R	-0.05 R	
32	0.9 R	3.8	0 R	0.1 R	
33	0.7 R	3.1	0.22 R	0.12 R	
34	-0.4 R	3.4	0.06 R	0.02 R	
35	0.8	1.6	0.66	0.25 R	0.08 R
36	0.5	1	0 R	0.02 R	
37	1.9	4.3	0.3 R	-0.15 R	
38	0.1 R	2.4	-0.09 R	0.13	
39	0.2 R	3.7	0.13 R	0.11	0.07 R
40	0.6	2.8	0 R	0.11	
41	-0.7 R	5.1	-0.06 R	0.05 R	
42	0.4 R	2.1	0.11 R	0.07	
43	2	3.6	0 R	0.02 R	
44	0.5 R	2.2	-0.02 R	0.07	
45	-4 R	6.1	0 R	0.16	
46	-0.1 R	2.2	-0.2 R	0.04 R	
47	0.6	1.3	0.28	0.11	0.41
48	0.6	1.3	0.28	0.11	0.41
49	0.2 R	1.1	0.07 R	0.02 R	
50	0.2 R	1.1	0.07 R	0.02 R	
51	0.8	2.4	0.04 R	0.06 R	
52	1 R	2.6	0.13 R	0.02 R	
53	1.2	3.1	0.12 R	0.08	0.05 R

MCL = Maximum Contaminant Level; pCi/L = pico Curies/Liter.
R = Radiochemistry non-detect, result below sample specific critical level.

Appendix B (continued)

Radionuclides surface water sampling sites- 2012

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

Site	Uranium (µg/L) MCL = 30 µg/L	Uranium as U-234 (µg/L)	Uranium as U-235 (µg/L)	Uranium as U-238 (µg/L)
1	0.011	0 R	0.005 R	0 R
2	0.51	0.26	-0.008 R	0.18
3	0.006			
4	0.079	0.009 R	0.011	0 R
5	0.014	0.002 R	0 R	0 R
6	0.066	0.036	-0.005 R	0.023
7	0.011	0.006 R	0.004 R	0.009 R
8	0.006			
9	< 0.004			
10	0.01	-0.009 R	0.011	-0.009 R
11	0.043	0.014 R	0 R	0.01 R
12	0.013	0.01 R	0 R	0.02
13	0.023	0.007 R	-0.009 R	0.004 R
14	0.007			
15	0.182	0.11	0.012 R	0.058
16	0.012	0.006 R	0.004 R	0.03
17	0.033	-0.009 R	0 R	0.028
18	0.024	-0.017 R	0.01	-0.009
19	0.651	0.27	0.01 R	0.2 R
20	0.369	0.17	0.013	0.16
21	0.785	0.34	0.021	0.26
22	0.7	0.4	-0.005 R	0.24
23	0.043	0.063	0 R	0.054
24	< 0.004			
25	1.39	0.55	0.03	0.39
26	< 0.004			
27	0.816	0.33	0.01	0.19
28	0.83	0.31	0 R	0.27

MCL = Maximum Contaminant Level; pCi/L = pico Curies/Liter.
< = less than
R = Radiochemistry non-detect, result below sample specific critical level.

Appendix B (continued)

Radionuclides surface water sampling sites- 2012

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

Site	Uranium (µg/L) MCL = 30 µg/L	Uranium as U-234 (µg/L)	Uranium as U-235 (µg/L)	Uranium as U-238 (µg/L)
29	< 0.004			
30	0.023	0 R	-0.003 R	0.003 R
31	1.3	0.59	0.027 R	0.44
32	0.447	0.2	-0.006 R	0.15
33	0.676	0.28	0 R	0.17
34	0.582	0.2	0 R	0.18
35	0.255	0.09	-0.006 R	0.1
36	0.005			
37	0.521	0.21	0.017	0.18
38	0.22	0.14	-0.004 R	0.077
39	0.512	0.17	0.02 R	0.14
40	0.432	0.17	0 R	0.13
41	0.058	0.042	0.008 R	0.04
42	0.064	0.023	0 R	0.011
43	0.773	0.35	0 R	0.32
44	0.365	0.12	-0.01 R	0.1
45	0.452	0.16	-0.005 R	0.12
46	0.046	0 R	-0.004 R	0.02
47	0.012	-0.02 R	-0.005 R	0.012 R
48	0.012	-0.02 R	-0.005 R	0.012 R
49	0.006			
50	0.006			
51	0.602	0.27	0 R	0.18
52	0.779	0.31	0.017	0.25
53	0.547	0.3	0 R	0.17

MCL = Maximum Contaminant Level; pCi/L = pico Curies/Liter.
< = less than
R = Radiochemistry non-detect, result below sample specific critical level.