STATE OF WEST VIRGINIA

1993-1995

305(b) Report

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PART I: EXECUTIVE SUMMARY/OVERVIEW

This report has been prepared to meet the requirements of section 305(b) of the federal Clean Water Act (CWA). It is compiled from data collected by a number of state, interstate and federal agencies, including the WV Division of Environmental Protection, WV Division of Natural Resources, WV Department of Health, Ohio River Valley Water Sanitation Commission, U.S. Geological Survey, U.S. Forest Service and U.S. Army Corps of Engineers. It provides a general assessment of the quality of the state's surface and groundwater resources.

The report addresses public health/aquatic life concerns and provides updated assessments on West Virginia's lakes, wetlands, and nonpoint source programs. It also discusses special state concerns and describes existing programs for the monitoring and control of water pollution. In addition, the report provides a list of recommendations for the improvement of water quality management in West Virginia.

There are more than 9,000 streams in West Virginia, comprising a total length of more than 32,000 miles (>21,000 miles perennial; >11,000 miles intermittent). Only a broad overview can be included in an assessment of this type. More specific information on individual streams can be found in the various basin plans published by the Division of Environmental Protection.

During this reporting period, 517 streams totaling 6,614 miles were assessed for attainment of Clean Water Act goals. The 6,614 stream miles assessed represent about 20 percent of the state's total stream miles. If intermittent streams are excluded from the totals, then the percentage of stream miles assessed exceeds 30 percent. The 6,614 stream miles assessed in this report exceeds

the number assessed in the 1992 report by a little over 240 miles.

The majority of data used in the 1996 report is less than ten years old, thus it provides a reasonably current and accurate account of the quality of the states assessed waters. One of the goals for future reporting is to increase the number of miles of assessed waters. This will be accomplished by increasing monitoring efforts in priority watersheds as well as searching for new sources of monitoring data both inside and outside the agency.

Of the stream miles assessed during this reporting period, 28 percent (1,881 miles) fully supported their designated uses, 8 percent (493 miles) were fully supporting but threatened, 53 percent (3,514 miles) were partially supporting, and 11 percent (726 miles) were not supporting. About 80 percent (25,664 miles) of the state's stream mileage was not assessed. However, this number includes over 11,000 miles of intermittent streams. If intermittent streams are excluded from the totals, then about 69 percent of the state's streams (14,500 miles) were not assessed in 1996.

It is important to note that many of the streams selected for monitoring during this reporting period were not selected in random fashion, but were sampled because of known or suspected pollution problems. Because sampling of streams in West Virginia is generally not performed in random fashion, it is prudent not to make general inferences about the quality of West Virginia streams based solely upon the data used in this report.

State lakes and reservoirs also were evaluated in accordance with section 314 of the Act. Of the 21,522 lake acres assessed, 11 percent (2,282 acres) fully supported their designated uses, 21 percent (4,504 acres) were fully supporting but threatened, and 68 percent (14,736 acres) were partially supporting. No lakes were

assessed as non-supporting. During the 1994 reporting period, Cheat Lake (1,730 acres) was assessed as non-supporting. However, due to a partial recovery from the effects of acid mine drainage, the lake now supports aquatic life and has fair water quality.

Ninety-three of the state's 108 public lakes were evaluated during this reporting period. There are approximately 15 newly constructed or acquired public lakes in West Virginia that have not yet been assessed.

The top five major causes of impairment to state streams were identified as metals, fecal coliform, siltation, low pH, and priority organics. The top five major sources of stream impairment were identified as agriculture, abandoned mine drainage, construction/land development activities, urban runoff, and combined sewer overflows. A breakdown of the various causes and sources of pollution impacts to streams is contained in this report.

The major causes of impairment to state lakes were identified as metals, organic enrichment, total toxics, and siltation. The major sources of lake impairment were identified as abandoned mine drainage, silviculture, and petroleum activities.

A variety of streams and lakes were monitored for toxics during this reporting period. By definition, toxics refers to any member of a class of compounds listed in the federal register, Section 40 cfr Part 122, Appendix D, Tables II and III. The list includes a variety of organic compounds, pesticides, PCB's, heavy metals, cyanide, and phenols.

The majority of ambient toxics monitoring currently conducted in West Virginia waters is for heavy metals. Other toxic chemicals are monitored less frequently and usually in response to specific concerns.

Of the 6,614 stream miles assessed during this reporting period, 1,832 (28 percent) were monitored for toxics. Of the 1,832 stream miles monitored for toxics, 914 (50 percent) were found to contain elevated levels (i.e. levels exceeding state water quality criteria). Although 42 percent of the stream miles monitored for toxics contained elevated levels, it is important to note that most of the streams chosen for toxics monitoring were not selected in random fashion, but instead were selected because they were suspected of being polluted.

Of the 21,522 lake acres assessed, 14,986 (70 percent) were monitored for toxics. Of the 14,986 acres monitored for toxics, 6,948 (46 percent) were found to contain elevated levels. The lakes found to contain elevated levels of toxics were limited to a few of the large U.S. Army Corps of Engineers reservoirs, which had elevated levels of heavy metals in the hypolimnion (bottom waters). No toxic metals were found to exceed criteria in the surface waters of any lakes monitored for toxics. It is important to note that accumulation of toxic metals in the bottom waters of large flood control reservoirs is a common phenomenon, since lakes typically act as sinks for watershed pollution. Various tables that relate toxic impacts to public health and aquatic life are contained in this report.

West Virginia's wetlands (102,000 acres) comprise less than 1 percent of the state's total acreage. The state takes great interest in the management of these areas. Such management efforts are mainly geared toward protection of wetlands either by regulatory proceedings or acquisition. West Virginia has an active Section 401 certification program. However, permitting authority for activities impacting wetlands (Section 404) lies with the U.S. Army Corps of Engineers.

West Virginia's wetlands management and regulatory process are administered through DEP's Office of Water Resources and DNR's Wildlife Resources Section. In August 1992, DEP received a grant from U.S. EPA to initiate and aid in the development of wetland water quality standards. The new standards were made a part of Title 46, Regulations Governing Water Quality Standards, in August, 1993.

Groundwater in West Virginia is, on the average, both abundant and of adequate quality. This is true largely due to the rural nature of the state. Groundwater quality in developed, industrialized, or mined areas of the State often reflects the strong influence man has on his environment. It is common in these areas to find elevated levels of organics, inorganics, or bacteria.

Major sources of ground water contamination in the state include surface impoundments, septic tanks, coal mining, oil and gas brine pits, and injection wells. The Groundwater Protection Act passed in June 1991 by the state Legislature provides West Virginia with the necessary framework to effectively manage the State's groundwater resources. The legislation provides authority to collect fees for program operations and remediation efforts, grants authority to the Water Resources Board to set groundwater quality standards, and allows for the creation of groundwater protection practices.

Passage of the Groundwater Protection Act will have a significant positive impact on the way the resource will be managed in the future. A substantial amount of the groundwater information contained in this report will focus on the issues surrounding passage of the new law.

Water pollution control in the state is primarily achieved through the National Pollutant Discharge Elimination System (NPDES)

permitting system. These permits emphasize the use of either the best available technology approach to point source control, or water quality based requirements, particularly on smaller streams. Water pollution control encompasses facility inspections, complaint investigations, compliance monitoring, biological monitoring and chemical monitoring. Inspections of the various activities covered under the nonpoint control program also are performed and are intended to reduce this source of pollution. The vast majority of these inspections have been directed toward silviculture and construction activities.

West Virginia's surface water monitoring program is comprised of compliance inspections, intensive biological and/or chemical surveys on a site-specific basis, ambient chemical and biological monitoring, citizens monitoring, special surveys and investigations, and the use of benthic and toxicity data to assess environmental perturbations.

Site-specific fish tissue evaluation is carried out on an annual basis in order to respond to human health concerns. Whenever necessary, fish consumption advisories are issued. A list of current fish consumption advisories is contained in this report.

In this report, a cost/benefit assessment is provided not only to give an idea of some of the costs involved in maintaining acceptable water quality, but also to provide information relating to the benefits resulting from clean water.

Specific State water quality concerns include:

Abandoned mine drainage - This is the most serious water quality problem facing the state, affecting at least 484 streams totaling 2,852 miles.

Lack of domestic sewage treatment - Some rural areas of the state, particularly those with extremely depressed economies, remain without sewage collection and treatment systems. The result is the improper disposal of domestic sewage into the surface and groundwater.

Lack of land use policies - Development in small watersheds must be carefully controlled to assure the receiving waters are capable of assimilating any wastewater resulting from such development.

Upper Ohio River hydropower licensing - Potential impacts to the water quality of the upper Ohio River are a result of licenses issued for 16 hydroelectric projects by the Federal Energy Regulatory Commission (FERC) on the upper Ohio basin. The potential consequences of the development and operation of the hydropower projects not only include a decline in water quality, but a reduction in the wasteload assimilative capabilities of the river.

Monitoring programs - Many of the state's water quality monitoring programs have been scaled back due to insufficient funds and/or shortages in manpower. This includes compliance inspection and enforcement activities. The state is currently only able to monitor a very small percentage of its total stream miles.

Agricultural development in karst regions - Agricultural development has increased dramatically in certain parts of the state over the past few years. This presents special problems in areas characterized by karst geology, such as the Potomac and Greenbrier River valleys. Potential problems include nutrient and bacterial contamination of both surface and groundwater.

Recommendations for the improvement of water resources management include:

Nonpoint sources - Nonpoint source pollution is a major problem currently affecting the state's waters. EPA, along with other federal, state and local agencies are encouraged to continue their efforts in addressing these pollution sources.

Boundary waters - EPA must take the lead in resolving interstate concerns on border waters in order to meet wasteload allocations for these waters and to ensure that states do not work independently on facility permit issuance.

Establishment of human health risk criteria - Establishment of such criteria cannot be achieved at the state level. EPA, FDA (Food and Drug Administration) and other federal agencies should not only take the responsibility of establishing such criteria, but also ensure their implementation.

Watersheds impacted by mining - Special concern and consideration must be given to those watersheds in the state that are characterized by coal seams associated with geologic strata that are acidic and laden with metals and other pollutants.

Water quality monitoring - Development of a statewide monitoring strategy should be a priority for the Office of Water Resources so that it can adequately assess the quality of the state's surface and groundwater resources.

Sludge management - Both EPA and the State should continue to promote land application as a disposal option for municipal sludge. This will reduce the need for costly land filling while providing a low cost alternative to soil additives and fertilizers.

Citizen monitoring - Volunteer water quality monitoring has become a very popular activity in the state and has been an important tool in increasing the public's environmental awareness. This activity needs to have the continued logistical and financial

support from both EPA and DEP.

Enforcement activities - More manpower is needed for adequate enforcement of state water quality regulations and criteria. This can only be accomplished with adequate federal and state funding.

Part II: BACKGROUND

The West Virginia Division of Environmental Protection (DEP), Office of Water Resources (OWR) has prepared this report in accordance with Section 305(b) of the Clean Water Act (PL 92-500, as amended). The report provides a general assessment of West Virginia's groundwater, lakes, and streams (excluding the mainstem Ohio River). The assessment of the Ohio River mainstem is provided in the Ohio River Valley Water Sanitation Commission's report (ORSANCO, 1996)(Appendix A).

This assessment of West Virginia's surface and groundwater quality is developed from information collected during the period July 1993 through June 1995. The assessment is based on current data obtained from monitoring stations maintained by the Office of Water Resources, State Department of Health, ORSANCO, U.S. Geological Survey, U.S. Army Corps of Engineers, and specific surveys. Additional assessment information in this report is based upon data provided by the U.S. Forest Service, National Park Service, DEP's Office of Mining and Reclamation, DNR's Wildlife Resources Section, and the state sponsored Save Our Streams citizen monitoring program. A portion of the information contained in the previous 305(b) report also was carried over into this report. Carried over information includes assessment data on mine drainage impacted streams, as well as other streams that have been monitored within the past ten years.

This assessment does have limitations that must be taken into consideration when interpreting the sampling data used to determine water quality status for basins, sub-basins and streams. A brief description of the major limitations follows: 1) A majority of the water quality data used in this assessment are, at best, from

monthly sampling stations. Comparison of these data with water quality standards conditioned upon monthly means (e.g., fecal coliform bacteria) requires a degree of judgement. 2) There are more than 9,000 streams, totaling more than 32,000 miles in West Virginia. The majority of these were not sampled during this reporting period. Therefore, this assessment is not comprehensive in its coverage. 3) Streams sampled as part of special studies are normally chosen because of known or suspected pollution problems. This deliberate, non-random selection of polluted streams for monitoring may actually skew the assessment data and lead to somewhat negative conclusions about the general status of water quality in the state. 4) In many instances when assessing a waterbody, professional judgement must be used in order to determine use support status. This is especially true in cases where the monitoring protocols (e.g., sampling frequencies) do not follow those recommended in the 305(b) guidance document.

The major river basins discussed in this report are the Ohio, Guyandotte, Big Sandy/Tug Fork, Kanawha, Elk, Little Kanawha, New, Greenbrier, Gauley, Monongahela and Potomac. Three river systems form borders with other states and, as such, present special water quality management problems. These border rivers are the Big Sandy and Tug Fork rivers with 128 border miles, the Ohio River with 277 border miles, and the North Branch of the Potomac and Potomac River with 214 border miles. The state river basins contain more than 9,500 streams, that collectively total about 32,278 miles.

The most recent inventory of West Virginia lakes (U.S. EPA, 1991) indicates that there are about 574 of these waterbodies totaling 15,753 acres. This information, which is taken from Digital Line Graph (DLG) data supplied by the U.S. Geological Survey, actually underestimates the total lake acreage for the

state. By themselves, the 108 public impoundments in West Virginia total 22,373 acres. All information regarding lakes in this report is based on an assessment of publicly owned waterbodies and does not take into consideration privately owned lakes and ponds.

The most recent inventory of freshwater wetlands (Tiner, 1996) indicates there are at least 57,000 acres of various types of wetlands in the state. Previous estimates placed the wetland acreage at about 102,000 acres (U.S. Fish and Wildlife Service, 1974). However, this number is now thought to be an over-estimate. The true wetland acreage probably lies somewhere between 57,000 and 102,000 acres (< 1 percent) of the state's land area.

The state has a surface area of 24,282 square miles. The most recent figures available indicate that this surface area is allocated to the following general land uses: 79 percent forest; 12 percent agriculture; 6 percent developed (industrial, commercial, urban, roads, etc.); 2 percent mining; and 1 percent wetlands.

West Virginia's 1990 census population of 1,793,477 represents an 8 percent decrease from the 1980 census population. More than 50% of West Virginia's population is classed as rural. A large portion of this rural population resides in small communities in narrow valleys. The population decline, along with unfavorable economic conditions and a limited amount of land available for commercial and residential development, too often result in direct discharge of sewage and/or improperly installed and maintained on-lot sewage disposal systems.

Because of the state's mountainous topography and unfavorable soils, mining, oil and gas exploration, and timbering operations also are of major concern, due to nonpoint pollutant contributions to many streams. Nonpoint pollution problems are particularly

acute in the Big Sandy/Tug Fork, Guyandotte, Coal, Kanawha, Elk, Potomac, Pocatalico, and Little Kanawha watersheds.

Agricultural waste handling and runoff are a concern mainly in the Potomac watershed, due to the number of agricultural operations and the area's limestone geology. Agricultural activities also are concentrated in portions of the Greenbrier River Basin and along portions of the mainstem Ohio and lower Kanawha rivers.

Concern over industrial (non-coal related) discharges is confined, for the most part, to parts of the Ohio, Kanawha, and Monongahela river watersheds.

Because of the monitoring network design, West Virginia's larger streams account for the greatest percentage of monitoring effort expenditures. Small streams are usually not monitored as intensively or frequently. Many small streams receive treated and/or abandoned mine waste and treated or untreated sewage. In addition, some are impacted by logging operations, oil and gas production and exploration, or farming and are generally more vulnerable to environmental perturbations than the larger streams.

Oftentimes, small polluted streams do not impair the uses of the larger streams they flow into. So while the ambient monitoring network may indicate that most of the state's larger streams are meeting their designated uses, many smaller streams remain severely degraded because of their size and the proportion of their flow to that of the incoming wasteload. In summary, while the ambient monitoring network generally indicates that the state's waterbodies support or partially support their designated uses, a number of small streams and segments of small streams are degraded and do not support their uses. A more comprehensive determination of the status of these small streams can be found in documents such as the 303(e) basin plans for the Monongahela, Little Kanawha, New,

Greenbrier, Elk, Gauley, Big Sandy/Tug Fork, Guyandotte, Ohio, and Potomac basins; the acid mine drainage reports for the Cheat, Tygart, Monongahela, West Fork, portions of the Ohio basins; and the mini-ambient network reports. The state's Nonpoint Source Assessment (August, 1989) also may be referenced for such information.

The state's geology and topography limit the number and extent of wetlands, which cover only about 100 square miles (0.4 percent) of the state's total surface area. Thus, West Virginia is very concerned about the preservation of its limited wetland resources.

The Wildlife Resources Section of the Division of Natural Resources updated its wetlands inventory in 1996. Current wetland information is described in a booklet entitled "West Virginia's Wetlands...Uncommon, Valuable Wildlands" (Tiner, 1996). This publication is available from the West Virginia Wildlife Resources Section, Technical Support Unit, P. O. Box 67, Elkins, WV, 26241, (304) 637-0245.

A brief inventory of West Virginia's water resources is provided in Table II-1.

Summary of Classified Uses

As outlined in the State Water Resources Board's Requirements Governing Water Quality Standards (46 CFR 1, Title 46, Legislative Rule, Series 1), "Unless otherwise designated by these rules, at a minimum all waters of the State are designated for the Propagation and Maintenance of Fish and Other Aquatic Life (Category B) and for Water Contact Recreation (Category C) consistent with Clean Water Act goals. When a discharge permit is to be issued all uses shall be assumed present unless the applicant demonstrates that the designated uses do not apply to the stream segment in question."

Table II-1

Water Resources Atlas

State population (1990)	1,793,477
State surface area (square miles)	24,282
Number of water basins (according to state subdivisions)	32
Total number of river and stream miles	32,278
Number of perennial river miles (subset)	21,114
Number of intermittent stream miles (subset)	11,164
Number of ditches and canals (subset)	18
Number of border miles (subset)	619
Number of lakes/reservoirs/ponds (publicly-owned)	108
Acres of lakes/reservoirs/ponds (publicly-owned)	22,373
Square miles of estuaries/harbors/bays	0
Number of ocean coastal miles	0
Number of Great Lakes shore miles	0
Acres of freshwater wetlands	102,000
Acres of tidal wetlands	0

The following use categories have been designated for West Virginia's streams (note: these uses are also applicable to lakes.):

Category A - Water Supply, Public - This category is used to describe waters which, after conventional treatment, are used for human consumption. This category includes:

All community domestic water supply systems;

All non-community domestic water supply systems (i.e., hospitals, schools, etc.);

All private domestic water systems; and

All other surface water intakes where the water is used for human consumption.

Category B - Propagation and Maintenance of Fish and Other Aquatic Life. This category includes:

Category B1 - Warm Water Fishery Streams. Streams or stream segments which contain a fish population composed overwhelmingly of warm water species. (These are primarily sport fisheries and may be stocked with trout seasonally.)

Category B2 - Trout Waters. As defined in Section 2.14

Category B3 - Small Non-Fishable Streams. Streams or stream segments which, because of their size or flow patterns, do not offer sport fishing; they generally contain only minnows, darters, and other small baitfish.

Category B4 - Wetlands. As defined in Section 2.17. Stream criteria may not be appropriate for application to wetlands.

Category C - Water Contact Recreation. This category includes swimming, fishing, water skiing and certain types of pleasure boating such as sailing in very small craft and outboard motor boats.

Category D - Agriculture and Wildlife Uses.

Category D1 - Irrigation. This category includes all

stream segments used for irrigation.

Category D2 - Livestock Watering. This category includes all stream segments used for livestock watering.

Category D3 - Wildlife. This category includes all stream segments and wetlands used by wildlife.

Category E - Water Supply Industrial, Water Transport, Cooling and Power. This category includes cooling water, industrial water supply, power production, commercial and pleasure vessel activity, except those small craft included in category C.

Category E1 - Water Transport. This category includes all stream segments modified for water transport and having permanently maintained navigation aides.

Category E2 - Cooling Water. This category includes all stream segments having one or more users for industrial cooling.

Category E3 - Power Production. This category includes all stream segments extending from a point 500 feet upstream from the intake to a point one half (1/2) mile below the wastewater discharge point.

Category E4 - Industrial. This category is used to describe all stream segments with one or more industrial users. It does not include water for cooling.

A few major changes in water use classification have occurred during this reporting period. These changes are described in the current water quality standards (August, 1995) Section 46-1-4: Anti-Degradation Policy. At the urging of U. S. EPA, the state's anti-degradation policy was clarified and strengthened to afford varying levels of protection to streams based on their existing quality. A system was established whereby streams were placed into one of four categories, or tiers. These are described as follows:

Tier 1: Existing water uses and the level of water quality necessary to protect the existing uses shall be maintained and

protected. This tier includes all streams that are not covered under Tiers 2, 2.5, and 3.

Tier 2: Existing high quality waters of the state must be maintained at their existing high quality unless it is determined after satisfaction of the intergovernmental coordination of the state's continuing planning process and opportunity for public comment and hearing that allowing lower water quality is necessary to accommodate important economic or social development in the area in which waters are located. If limited degradation is allowed, it shall not result in injury or interference with existing stream water uses. Tier 2 includes the following waters:

(a) Streams designated under the Natural Stream Preservation Act, pursuant to W. Va. Code 22-13-5.

(b) Streams listed in West Virginia High Quality Streams, Fifth Edition, prepared by the Wildlife Resources Division, Department of Natural Resources (1986).

(c) Streams or stream segments which receive annual stockings of trout but which do not support year-round trout populations.

Tier 2.5: In waters which constitute a water of special concern, no activities which result in the reduction of ambient water quality shall be allowed. Tier 2.5 includes the following waters:

(a) All federally designated rivers under the "Wild and Scenic Rivers Act" Public Law 95-542 as amended, 16 U.S.C. 1271, et. seq.

(b) All naturally reproducing trout streams.

(c) All streams and other bodies of water in State and National Forests and Recreation Areas.

(d) National Rivers. "National Parks and Recreation Act of 1978." Public Law 95-625, as amended. 16 U.S.C. 1, et. seq.

Tier 3: In all cases, waters which constitute an outstanding national resource shall be maintained and protected and improved where necessary. Tier 3 includes, but is not limited to, all

streams and rivers within boundaries of Wilderness Areas designated by The Wilderness Act (16 U.S.C. 1131, et. seq.) within the state.

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PART III: SURFACE WATER ASSESSMENT

Chapter One: Summary Data

Methodology

Use support of the state's waters was determined using criteria established by EPA in the 305(b) guidelines (May, 1995). Waters are classified as fully, partially or not supporting. Fully supporting waters are those that do not exceed criteria in greater than 10 percent of measurements or do not have any pollution sources present that could interfere with the use. Partially supporting waters are those that exceed criteria in 11-25 percent of measurements, or that have pollution sources present that result in only partial attainment of the use. Waters classified as not supporting exceed criteria in greater than 25 percent of measurements, or have a magnitude of pollution sources likely to impair the use or exceed criteria.

Biological information was also used in the determination of use support. In some instances, interpretation of biological data would "override" the water quality criteria. For example, if an infertile stream exceeded the water quality standard for pH more than 25% of the time (i.e., not supporting) yet was found to support a higher quality biological community, then the stream would receive a higher use support classification. The professional judgement of state biologists was used in such instances.

The achievement of recreational use goals of the Clean Water Act is primarily based on the actual utilization of water contact recreation, with consideration given to fecal coliform bacteria and/or waterborne diseases. The state Health Department has restricted recreational use in the past due to such reasons.

However, no closures were reported by the Health Department during this reporting period. In many instances, professional judgement was utilized to determine recreational use support in streams impaired by raw and/or improperly treated sewage. In addition, streams were not considered suitable for water contact recreation if they were seriously impaired by toxicants such as acid mine drainage. If available, biological data also was considered in making use support determinations for waters containing toxicants. For example, if toxicants were detected one or more times in a three year period (i.e., not supporting), yet the waterbody supported a healthy population of aquatic life, then it was considered partially supporting.

Monitored assessments are based on current biological and/or chemical data. These data include ambient water quality data from various agencies, fishery surveys, benthic surveys, mussel surveys, and special studies. Water quality monitoring information from the Office's mini-network and the New River cooperative monitoring project also were utilized in this report.

Most water quality data used for this report was collected between 1993 and 1995. However, a portion of data from the previous preporting period also was used.

Determining whether a stream or stream segment supports or partially supports a designated use involves more than just an evaluation of objective data. It is also based on interviews with professional staff both within and outside the agency, including biologists, inspectors, and permit engineers. Professional judgement by knowledgeable individuals is a valuable means of assessing a waterbody, particularly in cases where water quality data conflict, or are not comprehensive enough to truly indicate use support status.

Water Quality Summary

During the 1996 reporting period, a total of 6,614 miles of rivers and streams were assessed for designated uses. This is approximately 20 percent of the state's total stream mileage. Of the total stream miles assessed, 28 percent were fully supporting, 8 percent were fully supporting but threatened, 53 percent were partially supporting, and 11 percent were non-supporting. Information on overall use support for rivers and streams is contained in Table III-1.

The current barometer used to assess overall stream health is the Aquatic Life Support use. As mentioned previously, the fishable goal of the Clean Water Act is now assessed in two parts: Aquatic Life Support and Fish Consumption Support. Of the total stream miles assessed for Aquatic Life Use, 37 percent were fully supporting, 8 percent were fully supporting but threatened, 44 percent were partially supporting, and 11 percent were non-supporting. Of the total stream miles assessed for Fish Consumption Use, 23 percent were fully supporting, 76 percent were partially supporting, and 1 percent were non-supporting. The Fish Consumption Use data may be somewhat misleading since, as a general rule, only streams suspected to be contaminated are normally sampled for this use. Due to this biased sampling design, the results will more often than not indicate an impaired stream condition.

The swimmable goal of the CWA, like the fishable goal, also is assessed in two parts: Swimmable Use and Secondary Contact Recreation Use. Of the total stream miles assessed for the Swimmable Use, 73 percent were fully supporting, 1 percent were fully supporting but threatened, 14 percent were partially supporting, and 12 percent were non-supporting. No streams were

Table III-1

Overall Designated Use Support Summary

Waterbody type: Rivers

Total number of assessed rivers: 517

Total number of monitored rivers: 504

Total number of evaluated rivers: 13

(All size units in miles)

Degree of use support	Evaluated	Monitored	Total
Fully supporting	28.65	1,852.26	1,880.91
Supporting but threatened	0.00	492.88	492.88
Partially supporting	56.77	3,457.51	3,514.28
Not supporting	6.62	718.89	725.51
Not attainable	0.00	0.00	0.00
Total size assessed	92.04	6,521.54	6,613.58
Not assessed	0.00	0.00	25,664.42

assessed for Secondary Contact Recreation Use this reporting period because this use is not recognized in the state's water quality standards. Generally, if the swimmable use for a stream is fully supporting, then the Clean Water Act swimmable goal is considered met.

Detailed information on individual designated uses is provided in Table III-2. Additionally, use support information for lakes is contained in Part III of Chapter 3 of this report.

The stream identification system used for the waterbodies in West Virginia is an alpha-numeric system. Each river basin or major sub-basin is assigned a capital letter. The tributaries are numbered from the mouth to the headwaters consecutively and their tributaries lettered and numbered accordingly. The numbers used for stream identification are not mile points upstream, but represent the point in the order of the tributaries. Following is a table which may be used as a reference to aid in the correlation of stream code numbers with their respective river basins. The basin cataloging unit (reach file) numbers also are indicated to aid in cross referencing.

Basin Name	State Basin Code	Reach File Number
Big Sandy River	BS	05070204
Tug Fork	BST	05070201
Elk River	KE	05050007
Gauley River	KG	05050005
Cranberry River	KGC	05050005-046
Williams River	KGW	05050005-049
Greenbrier River	KNG	05050003
Guyandotte River	OG	05070101
Guyandotte River	OG	05070102

Mud River	OGM	05070102-020
Clear Fork	OGC	05070101-040
Kanawha River	K	05050006
Kanawha River	K	05050008
Coal River	KC	05050009
Pocatalico River	KP	05050008-018
Little Kanawha River	LK	05030203
Hughes River	LKH	05030203-011
Spring Creek	LKS	05030203-022
West Fork	LKW	05030203-030
Monongahela River	M	05020003
Cheat River	MC	05020004
Shavers Fork	MCS	05020004-011
Tygart River	MT	05020001
Buckhannon River	MTB	05020001-016
Middle Fork River	MTM	05020001-025
West Fork River	MW	05020002
New River	KN	05050002
Bluestone River	KNB	05050002-016
Ohio River	O	05030000
Ohio River	O	05090000
Middle Island Creek	OMI	05030201
Potomac River	P	02070003
Cacapon River	PC	02070003-013
North Branch	PNB	02070002
South Branch	PSB	02070001
Shenandoah River	S	02070004
Youghiogheny River	Y	05020006
James River	J	02080201

Table III-2

Use Support Matrix Summary Table

Waterbody type: Rivers

(All size units in miles)

Use	Supporting	Supporting but Threatened	Partially Supporting	Not Supporting	Not Attainable	Not Assessed
Overall use support	1,880.91	492.88	3,514.28	725.51	0.00	64.28
Aquatic life support	2,532.72	560.78	2,981.82	715.63	0.00	64.28
Fish consumption	154.95	0.00	494.56	4.00	0.00	0.00
Cold water fishery (Trout)	693.10	258.82	283.32	300.47	1.75	14.27
Warm water fishery	1,261.53	326.10	2,558.22	509.51	0.00	65.59
Bait minnow fishery	293.32	97.03	498.70	263.19	0.00	12.42
Contact recreation	732.64	0.00	656.80	132.50	0.00	0.00
Swimmable	4,900.74	66.15	963.03	812.09	0.00	97.68
Secondary contact recreation	0.00	0.00	0.00	0.00	0.00	0.00
Drinking water supply	1,630.31	10.00	534.02	357.10	72.00	21.55
Industrial use	617.00	0.00	0.00	0.00	0.00	0.00
Livestock watering	0.52	0.00	0.00	0.00	0.00	0.00

Causes and Sources of Nonsupport of Designated Uses

Cause/source information for streams that do not fully support designated uses is summarized in the following sections, while information pertaining to lakes may be found in Part III, Chapter 3.

Relative Assessment of Causes

The principal causes of major impacts to West Virginia's streams are metals (942 miles), fecal coliform (898 miles), siltation (895 miles), and low pH (656 miles). These four parameters have historically had a significant impact on state streams. Additionally, priority organics (437 miles), turbidity (417 miles), total toxics (335 miles), and organic enrichment/low D.O. (306 miles) pose a major threat to state waters.

The chief causes of moderate/minor impacts to state streams are siltation (1,900 miles), metals (1,440 miles), organic enrichment/low D.O. (767 miles), and nutrients (674 miles). Additionally, fecal coliform (408 miles), low pH (379 miles), and turbidity (186 miles) pose moderate/minor threats to state streams. A detailed summary of the various pollution causes for streams is provided in Table III-3.

Relative Assessment of Sources

The principal sources of major impacts to West Virginia's streams include agriculture (943 miles), abandoned mine drainage (836 miles), construction/land development (550 miles), urban runoff (537 miles), and combined sewer overflows (492 miles). Additional sources of major impacts to streams include raw sewage (384 miles), industrial point sources (335 miles), and petroleum activities (259 miles).

The largest sources of moderate/minor impacts to state streams are agriculture (1,800 miles), silviculture (1,294 miles),

Table III-3

305(b) Relative Assessment of Causes

Sizes of waterbodies not fully supporting uses affected by various cause categories

Waterbody type: Rivers

(All size units in miles)

Cause Categories	Major Impact	Moderate/Minor Impact
Cause unknown	23.69	42.17
Unknown toxicity	8.32	8.40
Pesticides	277.00	0.00
Priority organics	436.85	4.83
Nonpriority organics	6.20	0.00
Metals	942.27	1,439.84
Unionized Ammonia	10.00	1.75
Chlorine	3.80	8.97
Other inorganics	92.91	269.77
Nutrients	274.06	673.72
pH	656.34	378.89
Siltation	895.16	1,899.68
Organic enrichment/Low DO	306.30	767.32
Salinity/TDS/chlorides	0.00	16.47
Thermal modifications	2.00	47.90
Flow alteration	29.50	182.31
Other habitat alterations	17.10	70.00
Pathogens	0.00	47.90
Oil and grease	0.40	8.97
Suspended solids	0.00	8.52
Filling and draining	0.00	5.00
Total toxics	335.50	0.00
Turbidity	416.56	185.55
Discoloration	0.00	1.25
Sludge deposits	0.00	3.80
Odor	0.40	0.10
Fecal coliform	898.12	407.61
Diesel Fuel/gasoline	87.50	0.00

abandoned mine drainage (1,141 miles), and municipal point sources (1,105 miles). Additional sources of moderate/minor impacts include urban runoff (780 miles), construction/land development (735 miles), industrial point sources (700 miles), onsite wastewater systems/septic tanks (653 miles), and petroleum activities (485 miles). Detailed information on pollution source categories for streams is provided in Table III-4. In addition, a list of streams impaired by drainage from abandoned mine lands is provided in Appendix C. Drainage from abandoned coal mines poses a significant threat to water quality in West Virginia and warrants special recognition.

Table III-4

305(b) Relative Assessment of Sources

Sizes of waterbodies not fully supporting uses affected by various source categories

Waterbody type: Rivers

(All size units in miles)

Source Categories	Major Impact	Moderate/Minor Impact
Industrial point sources	334.55	699.75
Municipal point sources	231.16	1,105.38
Package plants (small flows)	1.80	0.00
Combined sewer overflow	492.30	274.78
Agriculture	316.74	1,227.40
Nonirrigated crop production	271.83	218.44
Pasture land	326.75	345.87
Riparian grazing	0.00	8.20
Animal operations	5.92	0.00
Off-farm animal holding/ management areas	22.00	218.44
Silviculture	243.71	992.50
Logging road construction/ maintenance	264.96	301.09
Construction	373.06	593.48
Highway/road/bridge	1.06	13.30
Land development	175.80	128.56
Urban runoff/storm sewers	536.44	779.72
Other urban runoff	0.40	0.00
Abandoned mine drainage	835.92	1,140.68
Surface mining	0.00	33.00
Subsurface mining	0.00	6.65
Petroleum activities	259.40	485.16
Mine tailings	30.17	37.50
Land disposal	24.90	314.50
Sludge	3.16	0.50
Landfills	3.16	0.50
Industrial land treatment	0.00	1.75
Onsite wastewater systems (septic tanks)	103.21	652.55
Hydromodification	5.50	229.55
Channelization	0.00	5.00
Streambank modification/ destabilization	55.18	134.76
Drainage/filling of wetlands	0.00	5.00
Raw sewage	383.66	142.27
Atmospheric deposition	217.42	88.54
Waste storage/storage tank leaks	0.00	1.75
Highway maintenance and runoff	0.00	149.36
Spills	257.65	113.20
Contaminated sediments	19.45	0.00
Natural sources	2.80	2.28
Upstream impoundment	0.50	0.00
Source unknown	195.19	144.44
Beaver activity	3.00	0.00

Chapter Two: Public Health/Aquatic Life Concerns

Size of Waters Affected by Toxics

In general, only a small percentage of state waters are monitored for toxics in any given year, primarily due to the high cost of laboratory analytical work. Also, toxics monitoring is rarely performed in random fashion, as many of the lakes and streams monitored for toxics are already suspected of being impaired. Many conventional pollutants that are known to produce toxic effects are monitored through the state's ambient network. In actuality, any chemical parameter may produce a toxic effect if present at a high enough concentration. However, for purposes of this discussion, toxics monitoring only refers to streams sampled for priority pollutants listed in Section 307 of the Clean Water Act.

Toxic pollutants included in the state water quality criteria established by the Water Resources Board are monitored in a variety of ways. One method involves analyzing water samples collected as part of an ambient network, such as those maintained by the Office of Water Resources, ORSANCO, and U.S. Army Corps of Engineers. Toxics monitoring also is performed through the Office's compliance sampling and toxicity testing programs. A self-monitoring program also is administered by way of the Office's NPDES permitting system. This self-monitoring program requires permittees to submit water quality information, including toxics, to the Office on a weekly or monthly basis. When appropriate, pollutant "action levels" established by the U.S. Food and Drug Administration are utilized, particularly in the development of fish consumption advisories.

The State Environmental Quality Board has adopted numeric criteria for the following toxic pollutants (effective August 15,

1995):

Ammonia	Chlorine, Total Residual
Antimony	Chlordane
Arsenic	DDT
Barium	Aldrin-Dieldrin
Beryllium	Endrin
Cadmium	Toxaphene
Copper	PCB
Cyanide	Methoxychlor
Hexavalent Chromium	Benzene
Lead	Hexachlorobenzene
Mercury	Chloroform
Nickel	1,2-dichloroethane
Phenolic Material	1,1,1-trichloroethane
Selenium	1,1,2,2-tetrachloroethane
Silver	1,1-dichloroethylene
Thallium	Trichloroethylene
Zinc	Tetrachloroethylene
Toluene	Phthalate Esters
Carbon Tetrachloride	Polynuclear Aromatic
Halomethanes	Hydrocarbons

A summary of state waters monitored for toxics may be found in Table III-5. This summary shows that elevated levels of toxics were present in 914 stream miles and 6,948 acres of lakes. These totals do not reflect streams impacted by acid mine drainage (more than 2,800 stream miles). It is important to note that toxics monitoring is usually only conducted on waters that are already suspected of being impaired. Because of this, it is erroneous to make general assumptions concerning the extent of

Table III-5

Summary of Total Waterbody Size Affected by Toxics

Waterbody type/units	Size monitored for toxics	Size with elevated levels of toxics
Rivers (miles)	1,831.56	913.78
Lakes (acres)	14,986.00	6,948.10
Estuaries	0.00	0.00
Fresh wetlands	0.00	0.00
Oceans	0.00	0.00
Great Lakes	0.00	0.00
Coastal waters	0.00	0.00
Tidal wetlands	0.00	0.00

toxic contamination in state waters.

The identification and characterization of toxic pollution problems is enhanced by a fish tissue monitoring program administered by the Office of Water Resources. The fish tissue sampling program is used to measure substances not readily detected in the water column, to monitor spatial and temporal trends, determine the biological fate of specific chemicals, and when appropriate, to provide information to support human health risk assessment. During a typical year, samples for metals, pesticides, and other organics are collected from 20 to 25 sites (two samples per site, each comprised of five fish) throughout the state.

Public Health/Aquatic Life Impacts

All fish consumption advisories and/or revisions are based on extensive data collection by state, interstate, and federal agencies. Risk assessment information and FDA action levels are taken into consideration when developing advisories. Details of all current fish consumption advisories are contained in Table III-6.

The eight streams with current fish consumption advisories comprise a total affected area of 439 miles. All advisories listed in the 1994 305(b) report have undergone either revision or reissuance. Reissued advisories include those on the following streams: Kanawha River (dioxin), Ohio River (chlordane, PCB's), Shenandoah River (PCB's), and Flat Fork Creek (PCB's). Advisories that have undergone revision include the following: Pocatalico River and Armour Creek (dioxin), revised from all fish to bottom feeders only; and Potomac and North Branch Potomac rivers (dioxin), revised from bottom feeders to non-sport fish.

Table III-6

Toxic Contamination/Public Health Impacts
Category of Impact: **Fish Consumption Advisories**

Name of Waterbody (Code)	Pollutant(s) of Concern	Source(s) of Pollutant(s)	Size Affected (miles)	Comments
Kanawha River (O-20)	Dioxin	Unknown	46.00	Issued 3-1-86 Bottom Feeders Reissued 4-06-94
Pocatalico River (K-29)	Dioxin	Unknown	2.00	Issued 3-1-86 All Fish Revised 4-06-94 Bottom Feeders
Armour Creek (K-30)	Dioxin	Unknown	2.00	Issued 3-1-86 All Fish Revised 4-06-94 Bottom Feeders
Ohio River (O)	Chlordane, PCB's	Unknown	277.00	Issued 9-07-89 Catfish and Carp Reissued 8-94
Shenandoah River (S)	PCB's	Avtex, Front Royal, VA	19.45	Issued 9-7-89 All Fish Revised 1-24-90 Channel Catfish, Suckers, Carp Reissued 4-06-94
North Br. Potomac (P-20)	Dioxin	Westvaco Pulp Mill, Luke Md.	50.50	Issued 9-7-89 Bottom Feeders Revised 10-30-92 Non-sport Fish
Potomac River (P)	Dioxin	Westvaco Pulp Mill, Luke Md.	38.00	Issued 9-7-89 Bottom Feeders Revised 10-30-92 Non-sport Fish
Flat Fork Creek (KP-33)	PCB's	Spencer Transformer Harmony, WV	5.00	Issued 2-4-91 Suckers, Carp Channel Catfish Reissued 4-06-94

Information on public drinking water supply/bathing beach closures was obtained from the state Department of Health. During this reporting period, no bathing beach closures were documented. However, 13 public water supplies were closed on a total of 23 separate occasions. The principal pollutants forcing these closures were ammonium nitrate (from truck wrecks), turbidity (from coal mining), and raw sewage (from CSO's). Information pertaining to water supply closures is detailed in Table III-7.

Information pertaining to pollution-caused fish kills is maintained by the Division of Natural Resources' Wildlife Resources Section. The nature and extent of the fish kill is determined by the district fishery biologist, often in cooperation with the local Water Resources inspector. Cause, severity, and area affected are extremely variable. During this reporting period, fish kills occurred in 11 streams affecting 19.1 miles, and one lake (affected acreage undetermined). A combined total of 41,398 fish (both game and non-game) were killed. This represents a significant decrease in both the number of incidents and fish killed compared with the 1991-1993 reporting period. Table III-8 may be referenced for additional details. In accordance with the 305(b) guidance, the remaining impacts are addressed briefly:

Fish tissue contamination - Coincides with advisories.

Fishing ban in effect - Commercial fishing banned statewide due to dioxin contamination in Ohio and Kanawha Rivers.

Pollution-related fish abnormalities - None observed.

Shellfish restrictions - Not applicable.

Sediment contamination - No information obtained during reporting period.

Bathing area closure(s) - None reported.

Waterborne disease incident(s) - None reported.

Table III-7
Toxic Contamination/Public Health Impacts
Category of Impact: **Water Supply Closure**

Name of Waterbody (Code)	Pollutant(s) of Concern	Source(s) of Pollutants	Number of Closures	Comments
Pond Fk/ Coal River (KC-10-U)	PCB's	Electric Transformers	1	WV American Water Co. at Madison
Spruce Fk/ Coal River (KC-10-T)	Ammonium Nitrate	Truck Wreck	1	WV American Water Co. at Madison
Coal River (K-34)	Ammonium Nitrate	Truck Wreck	1	Lincoln PSD
Guyandotte River (O-4)	Unknown	Tire Fire Runoff	1	Gilbert Water
Tug Fork (BST)	Diesel Fuel	N&S Railroad Runoff	3	Williamson Water
Kanawha River (O-20)	Oil/Diesel	Montgomery Area Manufacturer	2	Cedar Grove Water
Elk River (K-43)	Raw Sewage	Unknown	1	Pinch PSD
Coal River (K-34)	Turbidity	Coal Company Sludge Pond	1	St. Albans Water
Guyandotte River (O-4)	Turbidity	Coal Company Sludge Pond	1	Logan Water
Guyandotte River (O-4)	Turbidity	Coal Company Sludge Pond	1	Logan Co. PSD-Greenville
Potomac River (P)	Raw Sewage	CSO's Cumberland, MD	1	Town of Paw Paw advised not to pump raw water 11/29/94-11/30/94
Potomac River (P)	Oil	Oil Spill Cumberland, MD Area	2	Town of Paw Paw advised not to pump raw water 4/14/95-4/20/95

Table III-7 continued...
Toxic Contamination/Public Health Impacts
Category of Impact: **Water Supply Closure**

Name of Waterbody (Code)	Pollutant(s) of Concern	Source(s) of Pollutants	Number of Closures	Comments
Potomac River (P)	Raw Sewage	CSO's Cumberland, MD	3	Town of Paw Paw advised not to pump raw water 5/30/95-6/5/95
North Fk/ Cherry Rv (KG-34-H)	Ammonium Nitrate	Truck Wreck	2	Richwood 7/22/94 & 1/13/95
Muddlety Creek (KG-26)	Petroleum Product	Tank Release	1	Summersville 5/11/95
Laurel Fk (OGC-16)	Diesel Fuel	Truck Wreck	1	Oceana Water

Table III-8

Toxic Contamination/Public Health Impacts
Category of Impact: **Fish Kills**

Name of Waterbody (County)	Date	Cause	Fish Killed Number	%Game	Severety Miles	Degree
Black Fork of Cheat River (Tucker)	7-12-93	Acid Mine Drainage	22,093	16	6.3	Heavy
Laurel Fork (Mingo)	7-13-93	Industrial Chemical	2,349	9	2.5	Heavy
Scary Creek (Putnam)	7-16-93	Pesticide	1,252	0.2	0.5	Heavy
R.D.Bailey Lk (Wyoming)	9-15-93	Unknown	1,200	0	NA	Light
Kellys Creek (Kanawha)	9-21-93	Industrial Chemical	306	0	1.5	Moderate
Aarons Fork (Kanawha)	4-21-94	Green Concrete	209	0	0.7	Total
Rockcastle Ck (Wyoming)	7-1-94	Raw Sewage	5,125	3.0	1.0	Heavy
Hurricane Ck (Putnam)	7-9-94	Raw Sewage	818	31.3	1.4	Total
Kanawha Two Mile Creek (Kanawha)	7-31-94	Acid Mine Drainage	5,705	7.3	3.0	Total
Craven Run (Randolph)	8-12-94	Pesticide	1,386	10.0	1.0	Total
Georges Creek (Kanawha)	3-20-95	Green Concrete	702	0	0.6	Moderate
Gilbert Creek (Mingo)	4-21-95	Green Concrete	253	0	0.6	Moderate

West Virginia is keenly aware of the current emphasis on the protection and monitoring of wetlands. The State is active in wetlands protection (see Part III, Chapter 5); However, it has not been able to establish any actual wetlands monitoring program, particularly as it would relate to public health/aquatic life concerns. Currently, aquatic life concerns are addressed through habitat protection.

Section 303(d) Waters

Table III-9 provides an update of the state's primary 303(d) stream list. In addition, Table III-10 is a secondary, or sublist of lower priority waters impaired by mine drainage. Water quality limited (i.e., 303(d)) waters are streams and lakes that do not, or are not expected to, meet applicable water quality standards with technology based controls alone. The current primary 303(d) list contains 51 waterbodies (40 streams and 11 lakes) while the AMD sublist contains 469 streams. The 40 streams on the primary list comprise 1,424 miles while the 11 lakes total 1,966 acres. These waterbodies are listed in order of priority. The 469 streams on the 303(d) sublist comprise 1,988 miles. These streams are listed in alphabetical order by stream code.

The state is currently developing TMDL's (Total Maximum Daily Loads) for a subset of its water quality limited streams.

Table III-9

West Virginia
1996 303(d) Stream List
Water Quality Limited Waters

(Note: Streams are listed in order of priority)

STREAM NAME	CODE	MILES AFFECTED	SOURCE(S)	POLLUTANT(S) OF CONCERN
1. Ohio River	O	277.00	Undetermined	Lead
		"	"	PCB's*
		66.00	"	Chlordane*
		32.80	"	Dioxin*
2. Guyandotte River	O-4	102.00	Mine Drainage	Metals
3. Tug Fork River	BST	155.00	Mine Drainage	Metals
4. Cheat River	MC	20.00	Mine Drainage	Metals, pH
5. West Fork River	M-26	103.00	Mine Drainage Metals Tailings	Metals
6. Rich Fork/ Two Mile Creek	K-41-D.5	1.52	Don's Disposal Charleston, WV	Metals
7. Stony River	PNB-17	24.50	Mine Drainage	Metals, pH, Unionized Ammonia
8. Ten Mile Creek	MTB-25	5.40	Mine Drainage	Metals, pH
9. Armour Creek	K-30	2.00	Undetermined	Dioxin*
10. Heizer Creek	KP-1	9.18	Mine Drainage	Metals, pH
11. Turkey Run	MTB-10	7.04	Buckhannon Landfill Buckhannon, WV	Metals
12. Pocatalico River	K-29	2.00	Undetermined	Dioxin*
13. Manilla Creek	KP-1-A	7.37	Mine Drainage	Metals, pH
14. Buffalo Creek	BST-31	5.64	Mingo Co. Landfill Williamson, WV	Metals
15. Harmon Creek	O-97	0.80	Weirton Steel Weirton, WV	Temperature, Iron
16. Middle Fork River	MT-33	20.80	Mine Drainage	Metals, pH

Table III-9 continued...
West Virginia
1996 303(d) Stream List

STREAM NAME	CODE	MILES AFFECTED	SOURCE(S)	POLLUTANT(S) OF CONCERN
17. Lunice Creek	PSB-26	7.50	Undetermined	Fecal coli
18. Lost River	PC-24	26.03	Undetermined	Fecal coli
19. Mill Creek	PSB-25	2.36	Undetermined	Fecal coli
20. Anderson Run	PSB-18	4.94	Undetermined	Fecal coli
21. Lower Blackwater River	MC-60-D	11.00	Mine Drainage	Metals, pH
22. Paint Creek	K-64	34.71	Mine Drainage, Highway Runoff	Metals, pH
23. Kanawha River	O-20	45.50 67.60	Undetermined "	Dioxin*, Lead
24. Potomac River	P	38.00	In-place Contaminants	Dioxin*
25. Monongahela River	M	37.50	Mine Drainage	Metals
26. Dunloup Creek	KN-22	15.80	Mine Drainage	Metals, pH
27. North Branch Potomac River	P-20	50.00	Mine Drainage, In-place Contaminants	Metals, pH, Dioxin*
28. Ridenhour Lake	K(L)-30-A-(1)	27 acres	Domestic Sewage, Construction, Agriculture, Urban Runoff	Nutrients, Metals, Siltation
29. Hurricane WS Reservoir	K(L)-22-(1)	12 acres	Domestic Sewage, Construction, Urban Runoff	Nutrients, Siltation, Metals
30. Mountwood Park Lake	LK(L)-10-(1)	48 acres	Construction, Streambank Modif., Highway Maintenance	Siltation
31. Bear Rocks Lake	O(L)-88-D-2-F-(1)	8 acres	Agriculture, Construction	Nutrients, Siltation, Organics

Table III-9 continued...
West Virginia
1996 303(d) Stream List

STREAM NAME	CODE	MILES AFFECTED	SOURCE(S)	POLLUTANT(S) OF CONCERN
32. North Fk. So. Br. Potomac River	PSB-28	45.77	Undetermined	Fecal coliform
33. Summit Lake	KG(L)-34-H-5-(1)	43 acres	Atmospheric Dep, Natural Acidity	pH, Metals
34. Tomlinson Run Lake	O(L)-102-(1)	30 acres	Agriculture, Construction	Siltation, Organic
35. Burches Run Lake	O(L)-83-C-(1)	16 acres	Agriculture, Domestic Sewage	Metals, Nutrients, Siltation
36. Buckhannon River	MT-31	16.74	Mine Drainage, Highway Runoff	Metals, pH
37. Cheat Lake	M(L)-2-(1)	1730 acres	Mine Drainage	Metals, pH, Siltation
38. Saltlick Pond #9	K(L)-95-(1)	15 acres	Silvicuture, Petroleum Activities	Metals, Siltation
39. South Fk. So. Br. Potomac River	PSB-21	73.99	Undetermined	Fecal coliform
40. Flat Fork Creek	KP-33	5.00	Spencer Transformer Harmony, WV	PCB's*
41. Dry Run	LK-3	3.05	Northwestern Landfill Parkersburg, WV	Metals
42. Castleman Run Lake	O(L)-92-L-(1)	22 acres	Agriculture	Siltation
43. New River	K-81	87.00	Unknown	Cadmium
44. Turkey Run Lake	O(L)-37-(1)	15 acres	Petroleum Activities	Siltation, Metals
45. Shenandoah River	S	19.45	Avtex Fibers Front Royal, VA	PCB's*

Table III-9 continued...
West Virginia
1996 303(d) Stream List

STREAM NAME	CODE	MILES AFFECTED	SOURCE(S)	POLLUTANT(S) OF CONCERN
46. South Branch Potomac River	P-21	36.00	Undetermined	Fecal coliform
47. Wiggins Run	P-14-A	3.42	Morgan Co. Landfill Berkeley Sprgs., WV	Metals
48. Pats Branch	BST-40-E	0.87	Inco Alloys Huntington, WV	Metals
49. Unnamed Tributary Monongahela River	M-23.5	0.50	Sharon Steel Fairmont, WV	Iron
50. Upper Blackwater River	MC-60-D	23.40	Municipal Point Sources	Low D.O.
51. Tygart River	M-27	70.20	Mine Drainage	Metals, pH

* Contaminant found in fish tissue only.

NOTE: This 303(d) list includes all water quality limited waters in West Virginia for which there is sufficient data to make such a determination. Although many other streams and lakes in the state have been assessed as less than fully supporting designated uses, such assessments were made based upon limited data.

As a general rule, less than fully supporting waters were not included in the 303(d) list if the assessment was based primarily upon:

1) Best professional judgement
2) Citizen collected data
3) Monitoring data greater than ten years old
4) Cursory monitoring data (i.e., limited parameters or infrequent sampling)

A subset of mine drainage impacted streams (469) is included as a sublist to the primary 303(d) list. These generally are small streams that are lower in priority than streams on the primary list. The primary list contains 15 higher priority waterbodies that are mine drainage impaired.

Streams on the primary list were prioritized based upon severity of impairment. However, it is not necessarily the order in which TMDL's will be initiated. TMDL prioritization will take into account other factors such as funding availability, feasibility of restoration, permitting cycles, and watershed prioritization.

Table III-10

WEST VIRGINIA

1996 303 (D) STREAM SUBLIST

NON-PRIORITY MINE DRAINAGE IMPACTED WATERS

(Note: This list contains all known mine drainage impacted waters in the state except the 15 priority AMD streams that appear on the primary 303(d) list.)

OBS	CODE	STREAM	LENGTH (miles)	CAUSE
1	BST-100	LITTLE INDIAN CK	2.12	METALS
2	BST-102	JED BR	0.95	METALS
3	BST-103	ROCK NARROWS BR	1.7	METALS
4	BST-104	HARRIS BR	1.15	METALS
5	BST-105	MITCHELL BR	2.1	METALS
6	BST-106	SUGARCAMP BR	2.58	METALS
7	BST-107	GRAPEVINE BR	0.51	METALS
8	BST-109	SANDLICK CK	5.25	METALS
9	BST-109-A	RIGHT FK/SANDLICK CK	2.95	METALS
10	BST-109-B	LEFT FK/SANDLICK CK	2.18	METALS
11	BST-11O	ADKIN BR	2.15	METALS
12	BST-111	BELCHER BR	1.45	METALS
13	BST-112	TURNHOLE BR	2.2	METALS
14	BST-113	HARMON BR	3.1	METALS
15	BST-115	SOUTH FK/TUG FK	5.72	METALS
16	BST-115-A	TEA BR	1.14	METALS
17	BST-115-B	MCCLURE BR	1.25	METALS
18	BST-115-D	JUMP BR	1.67	METALS
19	BST-115-E	SPICE CK/SOUTH FK	3.18	METALS
20	BST-115-F	LAUREL BR/SOUTH BR	2.42	METALS
21	BST-115-G	ROAD FK/SOUTH FK	1.25	METALS
22	BST-116	BELCHER BR	1.75	METALS
23	BST-117	LOOP BR	1.38	METALS
24	BST-118	MILL BR	2	METALS
25	BST-119	DRY BR/TUG FK	0.95	METALS
26	BST-120	LITTLE CK	4.2	METALS
27	BST-120-A	INDIAN GRAVE BR	2.08	METALS
28	BST-120-B	PUNCHEONCAMP BR/LITTLE CK	2.05	METALS
29	BST-121	MILLSEAT BR	1.4	METALS
30	BST-122	BALLARD HARMON BR	2.03	METALS
31	BST-123	SAMS BR	1.85	METALS
32	BST-24	PIGEON CK	30.76	pH/METALS
33	BST-24-O	MILLSTONE BR/PIGEON CK	1.78	METALS
34	BST-3	POWDERMILL BR	2.27	METALS
35	BST-32	SUGARTREE CK	2.42	METALS

WEST VIRGINIA 1996 303(d) STREAM SUBLIST continued...

OBS	CODE	STREAM	LENGTH (miles)	CAUSE
36	BST-33	WILLIAMSON CK	1.52	METALS
37	BST-38	SPROUSE CK	1.6	METALS
38	BST-40	MATE CK	9.9	METALS
39	BST-40-B	RUTHERFORD BR	2	pH/METALS
40	BST-40-C	MITCHELL BR/MATE CK	2.82	METALS
41	BST-40-D	CHAFIN BR	0.87	METALS
42	BST-42	THACKER CK	2.95	pH/METALS
43	BST-42-A	SCISSORSVILLE BR	1.9	pH/METALS
44	BST-42-B	MAUCHLINVILLE BR	1.78	pH/METALS
45	BST-43	GRAPEVINE CK	2.56	METALS
46	BST-43-A	LICK FK/GRAPEVINE CK	1.1	METALS
47	BST-60	PANTHER CK	9.4	METALS
48	BST-60-D	CUB BR/PANTHER CK	0.7	METALS
49	BST-70-F	GRAPEVINE BR/DRY FK	1.75	METALS
50	BST-70-I	BEARTOWN BR	1.7	METALS
51	BST-70-O	ATWELL BR	1.93	METALS
52	BST-76	CLEAR FK/TUG FK	11	METALS
53	BST-78-B	SHABBYROOM BR	2.1	METALS
54	BST-78-D	HONEYCAMP BR	1.67	METALS
55	BST-78-E	COONTREE BR/SPICE CK	0.95	METALS
56	BST-78-F	STONECOAL BR/SPICE CK	1.33	METALS
57	BST-78-G	BADWAY BR	1.33	METALS
58	BST-78-H	NEWSON BR	1.05	METALS
59	BST-78-I	MOORECAMP BR	0.91	METALS
60	BST-85-A	LEFT FK/DAVY BR	2.46	METALS
61	BST-94	SHANNON BR	3.1	METALS
62	BST-95	UPPER SHANNON BR	2.45	METALS
63	BST-98-A	PUNCHEONCAMP BR/BROWNS CK	3	METALS
64	K-53-A	LEFT FK/LENS CK	2.13	METALS
65	K-57-D	COUNTERFEIT BR	0.75	pH/METALS
66	K-58	FIELDS CK	5.55	METALS
67	K-58-A	MILL BR/FIELDS CK	1.18	METALS
68	K-58-B.1	WOLFPEN HL	0.98	pH/METALS
69	K-58-B.8-1	NEW WEST HL/MILL BR/FIELDS CK	1.14	METALS
70	K-59	CARROLL BR	2.76	pH/METALS
71	K-60	SLAUGHTER CK	6.02	METALS
72	K-61	CABIN CK	21.14	pH/METALS
73	K-61.5	HICKS HL	0.95	pH/METALS
74	K-61-G	GREENS BR	1.98	pH/METALS
75	K-61-I	BEAR HL/CABIN CK	1.63	pH/METALS
76	K-61-J	CANE FK/CABIN CK	2.67	pH/METALS
77	K-61-L	TENMILE FK/ CABIN CK	6.02	METALS
78	K-61-O	FIFTEENMILE FK/CABIN CK	3.59	pH/METALS
79	K-61-O-1	ABBOTT CK	2.25	pH/METALS
80	K-61-0-2	LONG BR/FIFTEENMILE FK	2.85	pH/METALS
81	K-62	WATSON BR	1.24	pH/METALS

WEST VIRGINIA 1996 303(d) STREAM SUBLIST continued...

OBS	CODE	STREAM	LENGTH (miles)	CAUSE
82	K-63	MILE BR	1.31	METALS
83	K-65-C	JONES BR	1.43	METALS
84	K-65-DD	PACKS BR/PAINT CK	3.8	METALS
85	K-65-DD-2	BIG FK/PACKS BR	1.24	METALS
86	K-65-E	FOURMILE FK/PAINT CK	1.31	METALS
87	K-65-M	TENMILE FK/ PAINT CK	34.71	pH/METALS
88	K-65-M-1	LONG BR/TENMILE FK	1.43	pH/METALS
89	K-65-P	HICKORY CAMP BR	3.8	pH/METALS
90	K-65-R	FIFTEENMILE CK/PAINT CK	1.24	METALS
91	K-65-W	LYKINS CK	4.62	pH/METALS
92	K-65-Y-2	LONG BR/MOSSY CK	2.43	METALS
93	K-68.5	WEST HL	4.05	METALS
94	K-70	MORRIS CK	4.85	METALS
95	K-71	STATEN RN	1.22	METALS
96	K-72	SMITHERS CK	7.03	METALS
97	K-72-A-1	FISHHOOK FK	1.52	METALS
98	K-73	ARMSTRONG CK	8.4	METALS
99	K-73-D	JENKINS FK	2.13	pH/METALS
100	K-73-E	POWELLTON FK	4.39	pH/METALS
101	K-73-E-1	LAUREL FK/POWELLTON FK	1.23	METALS
102	K-73-F	RIGHT FK/ARMSTRONG CK	2.51	METALS
103	K-73-G	LEFT FK/ARMSTRONG CK	2.89	METALS
104	K-74	BOOMER BR	2.55	pH/METALS
105	K-75	JARRETTBR	1.58	METALS
106	K-76	LOOP CK	19.5	METALS
107	K-76-D	BEARDS FK	4.28	METALS
108	K-76-D-1	RIGHT FK/BEARDS FK	2.32	METALS
109	K-76-E	ROBINSON BR	1.6	METALS
110	K-76-G	MOLLY KINCAID BR	1.25	METALS
111	K-76-J	CAMP BR/LOOP CK	2	METALS
112	K-76-K	INGRAM BR	1.24	METALS
113	KC-46-D	SHUMATE CK	3.23	METALS
114	KC-46-G	PEACHTREE CK	3.76	METALS
115	KC-46-G-1	DREWS CK	4.48	METALS
116	KC-46-G-2	MARTIN FK/PEACHTREE CK	3.01	METALS
117	KC-46-Q-5	JEHU BR	1.71	METALS
118	KC-47	CLEAR FK	21.55	METALS
119	KC-47-G	LONG FK/CLEAR FK	2.55	METALS
120	KC-47-G-1	DOW FK	1.29	METALS
121	KC-47-L	TONEY FK	2.36	METALS
122	KC-47-O	WORKMAN CK/CLEAR FK	3.46	METALS
123	KE-50	BUFFALO CK	23.81	METALS

WEST VIRGINIA 1996 303(d) STREAM SUBLIST continued...

OBS	CODE	STREAM	LENGTH (miles)	CAUSE
124	KE-50-T	PHEASANT RN	1.5	pH/METALS
125	KG-1	SCRABBLE CK	3.1	METALS
126	KG-13	PETERS CK	17.65	METALS
127	KG-13-F	JERRY FK/PETERS CK	2.35	METALS
128	KG-13-K	BUCK GARDEN CK	5.13	METALS
129	KG-19-Q	SEWELL CK	14.07	METALS
130	KG-19-V	LITTLE CLEAR CK	16.26	METALS
131	KG-24-E-2	BRUSHY MEADOW CK	5.95	METALS
132	KG-24-I	COLT BR	2.15	METALS
133	KG-26	MUDDLETY CK	27.02	METALS
134	KG-26-E	FOCKLER BR	2.69	METALS
135	KG-26-I	MCMILLION CK/MUDDLETY CK	6.99	METALS
136	KG-26-K-1	LOWER SPRUCE RN	1.57	METALS
137	KG-26-K-1-A	SPRUCE RN/LOWER SPRUCE RN	1.5	METALS
138	KG-26-O	CLEAR FK	4.01	METALS
139	KG-27	PERSINGER CK	4.9	METALS
140	KG-30	BIG BEAVER CK	16.42	METALS
141	KG-30-E	LITTLE BEAVER CK	6	METALS
142	KG-30-L	BEARPEN FK/ BEAVER CK	2.53	METALS
143	KG-32	PANTHER CK	8.55	METALS
144	KN-17-B	FLOYD CK	3	METALS
145	KN-21	ARBUCKLE CK	6.2	pH/METALS
146	KN-22-B	MEADOW FK/DUNLOUP CK	4	pH/METALS
147	KN-26-A	BATOFF CK	3.6	pH/METALS
148	KN-26-K-2	WINDING GULF	?	METALS
149	KN-26-M	BOWYER CK	4.4	METALS
150	KN-26-N	LAUREL CK/PINEY CK	5.5	METALS
151	KNB-18	RICH CK	10.9	METALS
152	KP-13	TUPPER CK	6.82	pH/METALS
153	LK-82	DUCK CK	3.69	METALS
154	LK-85	LYNCH RN	2.42	METALS
155	LK-88	DUSKCAMP RN	3.48	METALS
156	M?	UT @ MONTANA/MONON RV	1	pH/METALS
157	M?	UT @ MILLERSVILLE/MONON	1	pH/METALS
158	M?	CAMP RN	3.2	pH/METALS
159	M?	UT @ BAKERS RIDGE/MONON RV	1	pH/METALS
160	M-1	DUNKARD CK	16	METALS
161	M-2.7	LAUREL RN/MONON RV	1.9	pH/METALS
162	M-10	BOOTHS CK	9.6	pH/METALS
163	M-10?	UT#2/BOOTHS RN	?	pH/METALS
164	M-10-D	OWL CK	4.05	pH/METALS
165	M-10-E	MAYS RN	2.1	pH/METALS

WEST VIRGINIA 1996 303(d) STREAM SUBLIST continued...

OBS	CODE	STREAM	LENGTH (miles)	CAUSE
166	M-11	BRAND RN	2.4	pH/METALS
167	M-14	FLAGGY MEADOW RN	3	pH/METALS
168	M-15	BIRCHFIELD RN	2.3	pH/METALS
169	M-17	INDIAN CK	9.4	METALS
170	M-17-A	LITTLE INDIAN CK	5.6	pH/METALS
171	M-20	PARKER RN	2.6	pH/METALS
172	M-21	PHARAOH RN	3.3	pH/METALS
173	M-22-C	ROBINSON RN/PAWPAW CK	4.4	pH/METALS
174	M-22-K	SUGAR RN/PAWPAW	2.2	pH/METALS
175	M-23	BUFFALO CK	30.2	METALS
176	M-23-B	FINCHS RN	4	METALS
177	M-23-E	DUNKARD MILL RN	4.8	pH/METALS
178	M-23-I	PLUM RN	6.2	METALS
179	M-23-K	MOD RN	4	METALS
180	M-23-N-1	FLEMING FK	1.5	METALS
181	M-23-O	PYLES FK	11	METALS
182	M-23-O-3-A	LLEWELLYN RN	2.6	METALS
183	M-23-Q	WHETSTONE RN	2.6	pH/METALS
184	M-23-R	JOES RN/BUFFALO CK	1.8	pH/METALS
185	M-3	WEST RN	6.4	pH/METALS
186	M-4	ROBINSON RN	4.4	pH/METALS
187	M-4?	CRAFTS RN	?	pH/METALS
188	M-4?	UT#1/ROBINSON RN	?	pH/METALS
189	M-6	SCOTT RN	6	pH/METALS
190	M-7	DENTS RN	9.2	pH/METALS
191	M-7?	UT#2/DENTS RN	?	pH/METALS
192	M-8	DECKERS CK	24.7	pH/METALS
193	M-8?	DILLAN CK	?	pH/METALS
194	M-8?	UT#2/DECKERS CK	?	pH/METALS
195	M-8-D	GLADY RN/DECKERS CK	1.4	pH/METALS
196	M-8-F	SLABCAMP RN	1.4	pH/METALS
197	M-8-G	DILLAN CK	5.4	METALS
198	M-8-H	LAUREL RN/DECKERS CK	3.4	pH/METALS
199	M-8-I	KANE CK	4.8	pH/METALS
200	M-8-O.5	HARTMAN RN/DECKERS CK	1.6	pH/METALS
201	MC?	U . T .#1/CHEAT LK	?	pH/METALS
202	MC?	U . T .#2/CHEAT LK	?	pH/METALS
203	MC?	U.T.#3/CHEAT LK	?	pH/METALS
204	MC-11	BULL RN	6.2	pH/METALS
205	MC-11-A	MIDDLE RN/BULL RN	1.7	pH/METALS
206	MC-11-B	MOUNTAIN RN/BULL RN	2.4	pH/METALS
207	MC-11-C	LICK RN/BULL RN	1.5	pH/METALS

WEST VIRGINIA 1996 303(d) STREAM SUBLIST continued...

OBS	CODE	STREAM	LENGTH (miles)	CAUSE
208	MC-12	BIG SANDY CK	19	pH/METALS
209	MC-12?	U.T./BIG SANDY CK	?	pH/METALS
210	MC-12-B	LITTLE SANDY CK	14	pH/METALS
211	MC-12-B-0.5	WEBSTER RN/LITTLE SANDY CK	3	pH/METALS
212	MC-12-B-1	BEAVER CK/LL SANDY CK	7.4	pH/METALS
213	MC-12-B-1-A	GLADE RN/BEAVER CK/L. SANDY CK	2.8	pH/METALS
214	MC-12-B-1?	U.T.#2/BEAVER CK/L. SANDY CK	?	pH/METALS
215	MC-12-B-3	HOG RN/LL SANDY CK	4.6	pH/METALS
216	MC-12-B-5	CHERRY RN	3	pH/METALS
217	MC-12-C	HAZEL RN	5.6	pH/METALS
218	MC-12-O.5	SOVERN RN/BIG SANDY CK	4.7	pH/METALS
219	MC-13.5	CONNER RN/CHEAT RV	2.9	pH/METALS
220	MC-16	GREENS RN	8.2	pH/METALS
221	MC-16-A	SOUTH FK/GREEN RN	4.3	METALS
222	MC-17	MUDDY CK	15.6	pH/METALS
223	MC-17-A	MARTIN CK	2.6	pH/METALS
224	MC-17-A-0.5	FICKEY RN	2.8	pH/METALS
225	MC-17-A-1	GLADE RN/MARTIN CK	3.6	pH/METALS
226	MC-18	ROARING CK	9.2	pH/METALS
227	MC-23	MORGAN RN	4.6	pH/METALS
228	MC-23-A	CHURCH CK/MORGAN RN	4	pH/METALS
229	MC-24	HEATHER RN	3.4	pH/METALS
230	MC-25	LICK RN	4	pH/METALS
231	MC-26	JOES RN	2.8	METALS
232	MC-27	PRINGLE RN	4.7	pH/METALS
233	MC-3	CRAMMEYS RN	1.4	METALS
234	MC-60-D-2	TUB RN	2.8	pH/METALS
235	MC-60-D-3	NORTH FK/BLACKWATER RV	4	pH/METALS
236	MC-60-D-3-B	MIDDLE RN/NO FK/BLACKWATER RV	1.8	pH/METALS
237	MC-60-D-3-C	SNYDER RN/NO FK/BLACKWATER RV	2.8	pH/METALS
238	MC-60-D-5	BEAVER CK/BLACKWATER RV	13.8	pH/METALS
239	MC-60-D-5-C	HAWKINS RN	2	pH/METALS
240	MT?	U.T./TYGART VALLEY RV	?	pH/METALS
241	MT-11	BERKELY RN	7.2	pH/METALS
242	MT-11-A	SHELBY RN	3.6	pH/METALS
243	MT-11-B	LONG RN/BERKELEY RN	3.6	pH/METALS
244	MT-11-B-1	BERRY RN	1.5	pH/METALS
245	MT-12	THREEFORK CK	19	pH/METALS
246	MT-12-C	RACCOON CK/THREEFORK CK	8.8	pH/METALS
247	MT-12-C-2	LITTLE RACOON RN	2.6	METALS
248	MT-12-G-2	BRAINS CK/FIELDS CK	4.9	pH/METALS
249	MT-12-H	BIRDS CK	5.5	pH/METALS

WEST VIRGINIA 1996 303(d) STREAM SUBLIST continued...

OBS	CODE	STREAM	LENGTH (miles)	CAUSE
250	MT-12-I	SQUIRES CK	4.5	pH/METALS
251	MT-18	SANDY CK	16.4	pH/METALS
252	MT-18-C	GLADE RN/SANDY CK	2.9	pH/METALS
253	MT-18-E	LITTLE SANDY CK	10.6	pH/METALS
254	MT-18-E-1	MAPLE RN	4.8	pH/METALS
255	MT-18-E-3	LEFT FK/LL SANDY CK	5.4	pH/METALS
256	MT-18-G	LEFT FORK/SANDY CK	8	METALS
257	MT-24-A	FROST RN	2.2	pH/METALS
258	MT-26-B	FOXGRAPE RN	3.4	METALS
259	MT-26-C	LITTLE HACKERS CK	1.6	METALS
260	MT-27	FORD RN	2.7	pH/METALS
261	MT-29	ANGLINS RN	2.6	pH/METALS
262	MT-36	ISLAND RN	1.2	pH/METALS
263	MT-37	BEAVER CK	4.6	pH/METALS
264	MT-39	LAUREL RN	3.4	pH/METALS
265	MT-4	GOOSE CK	2.6	pH/METALS
266	MT-41	GRASSY RN	2.8	pH/METALS
267	MT-42	ROARING CK	15	pH/METALS
268	MT-5	LOST RN	8.6	pH/METALS
269	MTB-10	TURKEY RN	7.04	pH/METALS
270	MTB-10-A	SUGAR RN	1.73	pH/METALS
271	MTB-11	FINK RUN	8.17	pH/METALS
272	MTB-11-B	MUDLICK/FINK RN	2.37	pH/METALS
273	MTB-11-B.7	BRIDGE RN/FINK RN	2.47	pH/METALS
274	MTB-18	FRENCH CK	18.47	METALS
275	MTB-18-A	CROOKED RN	1.38	METALS
276	MTB-18-B	BULL RN	3.9	METALS
277	MTB-18-B-2	BLACKLICK RN	2.09	METALS
278	MTB-18-B-3	MUDLICK RN	1.14	pH/METALS
279	MTB-27	PANTHER FK	6.4	pH/METALS
280	MTB-29	SWAMP RN	1.68	pH/METALS
281	MTB-3	BIG RN	6.01	pH/METALS
282	MTB-30	HERODS RN	2.62	pH/METALS
283	MTB-32	LEFT FK/BUCKHANNON RV	17.9	METALS
284	MTB-5	PECKS RN	8.2	pH/METALS
285	MTB-5?	U.T./PECKS RN	?	pH/METALS
286	MTB-5-B	LITTLE PECKS RN	2.49	pH/METALS
287	MTB-5-C	MUD RN/PECKS RN	1.18	pH/METALS
288	MTB-8	BIG RN	1.89	pH/METALS
289	MTM-16	CASSITY CK	6.4	pH/METALS
290	MTM-16-A	PANTHER RN	5.8	pH/METALS
291	MTM-4	DEVIL RN	2.33	pH/METALS

WEST VIRGINIA 1996 303(d) STREAM SUBLIST continued...

OBS	CODE	STREAM	LENGTH (miles)	CAUSE
292	MTM-6	HELL RN	3.23	pH/METALS
293	MTM-8	WHITEOAK RN	1.92	pH/METALS
294	MW?	U.T.#4 @ HUTCHINSON	?	pH/METALS
295	MW?	U.T.#3 (@ VIROPA	?	pH/METALS
296	MW?	U.T.#2 @ VIROPA	?	pH/METALS
297	MW?	U.T.#l @ GYPSY	?	pH/METALS
298	MW-10	BROWNS RN	1	METALS
299	MW-11	SHINNS RN	6.6	pH/METALS
300	MW-12	ROBINSON RN	5.4	METALS
301	MW-12?	U.T./ROBONSON RN	?	METALS
302	MW-12-A	PIGEON RN	1.2	METALS
303	MW-13	TENMILE CK	26.4	METALS
304	MW-13.5-A	JACK RN/TENMILE CK	1	METALS
305	MW-13?	U.T./TENMILE CK	?	METALS
306	MW-13-A	JONES CK	8.8	METALS
307	MW-13-B	LITTLE TENMILE CK	13	METALS
308	MW-13-B?	U.T.#l/LITTLE TENMILE CK	?	METALS
309	MW-13-B-1	PETERS RN	1.2	METALS
310	MW-13-B-2	BENNETT RN	2.4	pH/METALS
311	MW-13-B-4	LAUREL RN/LL TENMILE CK	2	METALS
312	MW-13-B-6	ELK CK/LL TENMILE CK	3	METALS
313	MW-13-B-9	MUDLICK RN/LL TENMILE CK	2.4	pH/METALS
314	MW-13-C	ISAACS CK	2.8	METALS
315	MW-13-C-1	LITTLE ISAACS CK	0.6	METALS
316	MW-13-D	GREGORY RN	2.4	METALS
317	MW-13-E	KATYS LICK CK	2.8	METALS
318	MW-13-F	ROCKCAMP RN	6.8	METALS
319	MW-13-F-1	LITTLE ROCKCAMP RN	4.2	METALS
320	MW-13-I-2	CHERRYCAMP RN	3.2	METALS
321	MW-13-I-3	PATTERSON FK	2.4	METALS
322	MW-13-N	COBURY FK	4.2	pH/METALS
323	MW-13-N-1	SHAW RN	1	pH/METALS
324	MW-15	SIMPSON CK	28	pH/METALS
325	MW-15?	U.T.#6/SIMPSON CK	?	pH/METALS
326	MW-15?	U.T.#5/SIMPSON CK	?	pH/METALS
327	MW-15?	U.T.#4/SIMPSON CK	?	pH/METALS
328	MW-15?	U.T.#3/SIMPSON CK	?	pH/METALS
329	MW-15?	U.T.#2/SIMPSON CK	?	pH/METALS
330	MW-15?	U.T.#l/SIMPSON CK	?	pH/METALS
331	MW-15-A	JACK RN/SIMPSON CK	1.6	pH/METALS
332	MW-15-B	SMITH RN/SIMPSON CK	2	pH/METALS
333	MW-15-H	JERRY RN	2.6	pH/METALS

WEST VIRGINIA 1996 303(d) STREAM SUBLIST continued...

OBS	CODE	STREAM	LENGTH (miles)	CAUSE
334	MW-15-I	BERRYRN	3.3	pH/METALS
335	MW-15-J	RIGHT FK/SIMPSON CK	3.6	pH/METALS
336	MW-15-J-1	BUCK RN	2.7	pH/METALS
337	MW-15-J-2	SAND LICK RN	3.2	pH/METALS
338	MW-15-J-3	GABE FK	5.5	pH/METALS
339	MW-15-K	BARTLETT RN	1.8	pH/METALS
340	MW-15-L	WEST BR/SIMPSON CK	3.4	pH/METALS
341	MW-15-L?	RT BR/WEST BR/SIMPSONCK	?	pH/METALS
342	MW-15-L?	U.T.#1/WEST BR/SIMPSON CK	?	pH/METALS
343	MW-15-L-1	STILLHOUSE RN	1	pH/METALS
344	MW-15-M	CAMP RN/SIMPSON CK	1.8	pH/METALS
345	MW-16	LAMBERT RN	4.4	pH/METALS
346	MW-17	JACK RN	2.4	METALS
347	MW-18	FALL RN	1.2	pH/METALS
348	MW-19	CROOKED RN	2.5	pH/METALS
349	MW-2	BOOTHS CK	8.6	METALS
350	MW-2?	U.T.#1/BOOTHS CK	?	pH/METALS
351	MW-2?	U.T.#2/BOOTHS CK	?	pH/METALS
352	MW-2?	U.T.#3/BOOTHS CK	?	METALS
353	MW-2-A	HOG LICK RN	1.4	METALS
354	MW-2-C	SWEEP RN	1.1	METALS
355	MW-2-D	HORNERS RN	2.6	pH/METALS
356	MW-2-D-1	PURDYS RN/HORNERS RN	1.4	pH/METALS
357	MW-20-A	LIMESTONE RN	1.4	METALS
358	MW-21	ELK CK	29	METALS
359	MW-21-A	MURPHY RN	2	pH/METALS
360	MW-21-D	NUTTER RN	1.36	METALS
361	MW-21-E	TURKEY RN/ELK CK	1.7	METALS
362	MW-21-F	HOOPPOLE RN	1.4	METALS
363	MW-21-G	BRUSHY FK	14	METALS
364	MW-21-G-1	COPLIN RN	1.8	METALS
365	MW-21-M	GNATTY CK	8.88	METALS
366	MW-21-M-5	RIGHT BR/GNATTY CK	2.7	METALS
367	MW-21-M-5-A	CHARITY FK	1.9	METALS
368	MW-21-O	BIRDS RN	1.8	METALS
369	MW-21-P	ARNOLD RN	2.8	METALS
370	MW-21-Q	ISAACS RN/ELK CK	2	METALS
371	MW-21-S	STEWART RN	3.4	METALS
372	MW-22-A	WASHBURNCAMP RN/DAVISSON RN	1.4	METALS
373	MW-23	BROWNS CK	5	pH/METALS
374	MW-24	COBUN CK	3.2	METALS
375	MW-25	SYCAMORE CK	5.7	METALS

WEST VIRGINIA 1996 303(d) STREAM SUBLIST continued...

OBS	CODE	STREAM	LENGTH (miles)	CAUSE
376	MW-26	LOST CK	11.4	METALS
377	MW-26?	U.T./LOST CK	?	METALS
378	MW-26-A	BONDS RN	1.4	METALS
379	MW-27	BUFFALO CK	4.7	METALS
380	MW-3	COONS RN	?	pH/METALS
381	MW-31	HACKERS CK	25.4	pH/METALS
382	MW-36-C.5	MARE RN/FREEMANS CK	2.2	METALS
383	MW-38-E	GRASS RN/ STONECOAL CK	1.4	METALS
384	MW-44	STONE LICK	1	METALS
385	MW-5	TEVEBAUGH CK	4.6	METALS
386	MW-50-C	FITZ RN	1.2	pH/METALS
387	MW-50-D	WARD RN	1	METALS
388	MW-7	BINGAMON CK	14.8	METALS
389	MW-7-C	ELKLICK	1.2	METALS
390	MW-7-D	CUNNINGHAM RN	2.4	METALS
391	MW-8	LAUREL RN	1.2	METALS
392	MW-9	MUDLICK RN	2.9	pH/METALS
393	O-2-Q-8	CAMP CK	0.91	pH/METALS
394	O-2-Q-8-A	LEFT FK/CAMP CK	4.43	pH/METALS
395	O-83-A-1.5	WELLS RUN/MD GRAVE CK	1.14	pH/METALS
396	O-88-B	LONG RN	4.25	pH/METALS
397	O-88-B-1	WADDLES RN/LONG RN	2.84	pH/METALS
398	O-88-B-2	POGUE RN/LONG RN	0.9	pH/METALS
399	O-88-E.9	BRITT RN	2.42	pH/METALS
400	O-88-H.5	HOLLIDAYS HL	1.74	pH/METALS
401	O-97-A	SAPPINGSTON RN	2.92	pH/METALS
402	O-97-B	ALEXANDERS RN	3.35	pH/METALS
403	O-101	DEEP GUT RN	4.27	METALS
404	O-7-Z-C	MECHLING RN	1.74	METALS
405	OG-110	INDIAN CK	18.85	METALS
406	OG-110-A	BRIER CK/INDIAN CK	4.77	METALS
407	OG-110-A-2	MARSH FK/BRIER CK	2	METALS
408	OG-124	PINNACLE CK	26.6	METALS
409	OG-124-D	SMITH BR/ PINNACLE CK	2.08	METALS
410	OG-124-H	LAUREL BR/PINNACLE CK	2.05	METALS
411	OG-124-I	SPIDER CK	3.54	METALS
412	OG-127	CABIN CK	3.64	METALS
413	OG-128	JOE BR	1.61	METALS
414	OG-129	LONG BR	2.05	METALS
415	OG-130	STILL RN	5.27	METALS
416	OG-131	BARKERS CK	8	METALS
417	OG-131-B	HICKORY BR/BARKERS CK	2.08	METALS

WEST VIRGINIA 1996 303(d) STREAM SUBLIST continued...

OBS	CODE	STREAM	LENGTH (miles)	CAUSE
418	OG-131-F	GOONEY OTTER CK	6.78	METALS
419	OG-131-F-1	JIMS BR/ GOONEY OTTER CK	1.36	METALS
420	OG-131-F-2	NOSEMAN BR	2.27	METALS
421	OG-134	SLAB FK	15.11	METALS
422	OG-134-D	MEASLE FK	3.3	pH/METALS
423	OG-135-A	LEFT FK/ ALLEN CK	2.6	METALS
424	OG-137	DEVILS FK	4.89	METALS
425	OG-139	STONECOAL CK	10.15	METALS
426	OG-48	LIMESTONE BR	1.78	pH/METALS
427	OG-49-A	ED STONE BR/BIG CK	2.35	pH/METALS
428	OG-49-A-1	NORTH BR/BIG CK	0.75	pH/METALS
429	OG-53	GODBY BR	1.52	pH/METALS
430	OG-61	BUFFALO CK	3.14	pH/METALS
431	OG-65	ISLAND CK	18.1	METALS
432	OG-65-A	COAL BR/ISLAND CK	2.05	pH/METALS
433	OG-65-B	COPPERAS MINE FK	9.32	pH/METALS
434	OG-65-B-1	MUD FK	7.5	pH/METALS
435	OG-65-B-1-A	LOWER DEMPSEY BR	2.05	pH/METALS
436	OG-65-B-1-B	ELLIS BR/MUD	1.63	pH/METALS
437	OG-65-B-1-E	UPPER DEMPSEY BR	1.33	pH/METALS
438	OG-65-B-4	TRACE FK/COPPERAS MINE FK	3.83	pH/METALS
439	OG-75-C.5	PROCTOR HL/BUFFALO	1.55	pH/METALS
440	OG-76	HUFF CK	21.21	METALS
441	OG-76-L	TONEY FK/HUFF CK	4.17	METALS
442	OG-77-A-5	OLDHOUSE BR/ROCKHOUSE CK	1.1	pH/METALS
443	OG-92-I	MUZZLE CK	3.33	METALS
444	OG-92-K	BUFFALO CK/LITTLE HUFF CK	3.14	pH/METALS
445	OG-92-K-1	KEZEE FK	0.76	METALS
446	OG-92-K-2	MUDLICK FK/BUFFALO CK	0.68	METALS
447	OG-92-Q	PAD FK	4.13	METALS
448	OG-92-Q-1	RIGHTHAND FK/PAD FK	2.12	METALS
449	OG-96	BIG CUB CK	8.67	METALS
450	OG-96-A	STURGEON BR	1.55	METALS
451	OG-96-B	ROAD BR	1.59	METALS
452	OG-96-C	ELK TRACE BR/BIG CUB CK	1.97	METALS
453	OG-96-F	TOLER HOL	1.14	METALS
454	OG-96-H	MCDONALD FK	1.33	METALS
455	OG-99	REEDY BR	2.84	METALS
456	OGC-12	LOWER ROAD BR	2.46	METALS
457	OGC-16	LAUREL FK	23.5	METALS
458	OGC-16-M	MILAM BR	4.88	METALS
459	OGC-16-P	TROUGH FK	3.55	METALS

WEST VIRGINIA 1996 303(d) STREAM SUBLIST continued...

OBS	CODE	STREAM	LENGTH (miles)	CAUSE
460	OGC-19	TONEY FK	6.63	METALS
461	OGC-26	CRANE FK	4.32	METALS
462	PNB-10	SLAUGHTERHOUSE RN	2.17	pH/METALS
463	PNB-11	MONTGOMERY RN	2.81	pH/METALS
464	PNB-12	PINEY SWAMP RN	5.51	pH/METALS
465	PNB-16	ABRAM CK	18.50	pH/METALS
466	PNB-16-A	EMORY RN	2.25	pH/METALS
467	PNB-16-C	GLADE RN	3.04	pH/METALS
468	PNB-16-D	LITTLE CK	0.68	pH/METALS
469	PNB-22	DEAKIN RN	1.15	pH/METALS

Chapter Three: Lake Water Quality Assessment

Background

Data for this reporting period was derived primarily from DEP's 1994 and 1995 lake water quality assessments (LWQA). For the 1994 assessment, 15 select public lakes were sampled three times...one each in spring, summer, and fall. For the 1995 assessment, 15 lakes were sampled in the spring; However, only eight were sampled in the summer due to budget constraints caused by closure of the water resources analytical laboratory. In the fall of '95, only four lakes were samples due to budget constraints and bad weather.

During this reporting period, all but one of the state's original 13 priority lakes were sampled. The only one not sampled was Mountwood Park Lake in Wood County, which was already being monitored by a consultant as part of a Phase II Clean Lakes project.

In addition to the priority lakes, a subset of non-priority lakes was sampled during 1994-95. The non-priority lakes chosen for monitoring were those that demonstrated potential water quality problems during initial screening in 1989.

Data for ten U.S. Army Corps of Engineers' (COE) Reservoirs also was evaluated as part of this assessment. This data was obtained from COE district offices.

In addition to in-lake monitoring, sampling also was conducted on 23 tributary inflows in order to obtain a better understanding of tributary water quality.

The assessment objectives remain consistent with those established for the 1989 LWQA. These are:

1) To enhance the current database of lake water quality information.

2) To establish solid baseline data from which to perform future trend analysis.

3) To determine the trophic status of all publicly owned lakes.

4) To establish a list of priority lakes to target for future restoration.

A variety of chemical and physical parameters were evaluated in order to determine general water quality, use support status, and trophic condition (i.e., fertility) of each waterbody. Parameters were selected to help determine the impacts from sedimentation, nutrient enrichment, acid mine drainage, natural acidity, atmospheric deposition, and toxics. A list of sample parameters is provided in Table III-11.

By state definition, a significant publicly owned lake is any lake, reservoir, or pond owned by a government agency or public utility, at which recreational access is readily provided to the general public. Although not eligible for Clean Lakes funding, the U.S. Army Corps of Engineers' reservoirs are still considered significant publicly-owned lakes.

Presently, there are 108 publicly owned lakes in West Virginia, totalling 22,373 surface acres. The current inventory of lakes is presented in Appendix D-1. A list of priority lakes in order of ranking is provided in Table III-12.

Trophic Status

A trophic status summary for West Virginia's public lakes is included in Table III-13. Of the 81 lakes assessed for trophic status during this reporting period, 33 (41 percent) were classified as eutrophic (fertile), 31 (38 percent) were mesotrophic (moderately fertile), and 17 (21 percent) were oligotrophic (infertile). Twenty- seven lakes were not evaluated

Table III-11

Sample Parameters for 1993 WV Lake Water Quality Assessment

Lakes

Nitrate-Nitrite Nitrogen	Aluminum
Orthophosphorous	Iron
Suspended Solids	Manganese
Alkalinity	Temperature
Acidity	PH
Ammonia Nitrogen	Dissolved Oxygen
Total Kjeldahl Nitrogen	Conductivity
Total Phosphorous	Chlorophyll A
Secchi Depth	

Tributaries

Nitrate-Nitrite Nitrogen	Aluminum
Orthophosphorous	Iron
Suspended Solids	Manganese
Alkalinity	Temperature
Acidity	PH
Ammonia Nitrogen	Dissolved Oxygen
Total Kjeldahl Nitrogen	Conductivity
Total Phosphorous	

TABLE III-12

West Virginia Priority Lakes

OBS	NAME	CODE	PROBLEM	ACRES	USE*
1	Cheat Lake	M(L)-2-(1)	Acid Mine Drainage	1730	N
2	Summit Lake	KG(L)-34-H-5-(1)	Natural Acidity	43	P
3	Mount Storm Lake	PNB(L)-17-(1)	Acid Mine Drainage	1200	P
4	Tomlinson Run Lake	O(L)-102-(1)	Siltation	30	P
5	Laurel Lake	BST(L)-24-E-(1)	Siltation	29	P
6	Hurricane Lake/W S Res	K(L)-22-(1)	Siltation	12	P
7	Turkey Run Lake	O(L)-37-(1)	Siltation	15	P
8	Bear Rocks Lake	O(L)-88-D-2-F-(1)	Siltation	8	P
9	Castleman Run Lake	O(L)-92-L-(1)	Siltation	22	P
10	Saltlick Pond Number 9	LK(L)-95-(1)	Siltation	137	P
11	Burches Run Lake	O(L)-83-C-(1)	Siltation	16	P
12	Mountwood Lake	LK(L)-10-(1)	Siltation	48	P
13	Ridenour Lake	K(L)-30-A-(1)	Siltation	27	P
			Total	3317	

* N = Not Supporting
P = Partially Supporting

Table III-13

Trophic Status of Publicly-Owned Lakes in West Virginia

Trophic Status *	Number of Lakes	Acreage
Oligotrophic	17	7,723.60
Mesotrophic	31	5,334.50
Eutrophic	33	8,365.30
Hypereutrophic	0	0.00
Dystrophic	0	0.00
Unknown Trophic Status	11	92.10
Trophic Status Not Assessed	1	7.00
Totals	93	21,522.50

* Based upon the trophic state indices devised by Carlson (1977).

for trophic status either due to insufficient data or the fact they were not sampled. The trophic state indices devised by Carlson (1977) were utilized to determine trophic status. This method was selected due to its relative ease of use and widespread acceptability.

Carlson's indices can be calculated from any of several parameters, including secchi depth, chlorophyll A, and total phosphorus. The calculated index values range on a scale of 0 to 100, with higher numbers indicating a degree of eutrophy (enrichment) and lower numbers indicating a degree of oligotrophy (sterility). For this assessment, the following delineation was used: 0-39 = oligotrophic, 40-50 = mesotrophic, and 51-100 = eutrophic.

For lakes sampled during this reporting period, trophic state indices were determined utilizing summer chlorophyll A, total phosphorus, and secchi depth. Correlation was generally good among the three parameters; however, values calculated from secchi depth were not considered accurate in lakes with high non-algal turbidity (i.e., muddy lakes).

Trophic state indices for non-priority lakes were determined from either winter total phosphorus or summer secchi depth data. Since only a limited amount of data was available for trophic status assessment of these lakes, the results should be viewed with some degree of caution. More data collection will be necessary in order to increase the level of confidence in the trophic status assessment of non-priority lakes.

Control Methods

Currently, few procedures for pollution control are being utilized specifically to improve lake water quality. Point source pollution, both industrial and municipal, is controlled

primarily through the NPDES permitting process. Only two lakes, Cheat and Mount Storm, receive direct industrial discharges. Municipal discharges (i.e., package plant) are present on many of the U.S. Army Corps of Engineer impoundments, as well as on Cheat Lake.

In general, the Office of Water Resources Section is reluctant to allow municipal discharges into public lakes, especially the smaller impoundments. Currently, there are no discharges, either municipal or industrial, into any public lakes smaller than 630 surface acres. Although few lakes overall contain direct point source discharges, discharges into feeder streams above reservoirs may potentially affect lake water quality. Many of the state's smaller impoundments and a few of the larger ones are impacted to varying degrees by domestic sewage discharges in their respective watersheds.

Overall, nonpoint source pollution has a far greater effect on West Virginia's public lakes than point source pollution. Unfortunately, there are few nonpoint source control projects specifically designed to benefit lakes. One such project exists at Laurel Lake in Mingo County, where stormwater management along with sedimentation basins are being employed to reduce the effects of runoff from surface mining. In addition, two nonpoint source demonstration projects funded under Section 319 have been designed to help improve water quality at two of the state's priority lakes, Hurricane and Tomlinson Run. Agricultural and construction best management practices (BMP's) are being employed in these watersheds in an effort to curb runoff pollution. A summary of pollution control techniques is provided in Table III-14.

Table III - 14

Lake Rehabilitation (Control) Techniques

Rehabilitation Technique	Technique Has Been Used In: Number of Lakes	Total Lake Size
Watershed Treatments		
23 Animal waste management	1	48.00
27 Stormwater management	1	29.00
28 Shoreline erosion controls/Bank stabilization	2	78.00
60 State Lake Management Programs	1	48.00

Table III - 15

Lake Rehabilitation (Restoration) Techniques

Rehabilitation Technique	Technique Has Been Used In: Number of Lakes	Total Lake Size
In-Lake Treatments		
06 Artificial Circulation to increase oxygen	1	720.00
12 Drawdown	1	48.00
20 Application of Aquatic Plant Herbicides	1	12.00
23 Fertilization	1	1200.00
24 Liming (in-lake)	3	1261.00
26 Liming (watershed)	1	25.00

In July, 1992, the state initiated a NPDES stormwater permitting program. This program requires that a permit be obtained by any individual disturbing three acres or more of land during a construction related activity. Contingent upon receiving the permit, an individual must submit and have approved by DEP an erosion control plan. For land disturbances under three acres, no permit is required. However, an individual still must not violate state turbidity standards with construction activity. All individuals are encouraged to submit erosion control plans, regardless of the size of the project. With the enactment of statewide erosion control laws during this reporting period for both construction and timbering activities, agriculture is left as the only nonpoint source category not governed by some type of erosion control regulation.

The state Water Resources Board is responsible for promulgating water quality criteria to protect the state's streams. Stream criteria also are applicable to lakes, since there are currently no standards specifically designed to protect lake water quality.

Restoration Efforts

Prior to 1989, the Office of Water Resources did not have a formal lake management program. Before the current Clean Lakes Program was initiated, lake management was primarily a function of the DNR's Wildlife Resources Section and focused mainly on management of fisheries.

The current management program will focus on restoring the state's most degraded lakes. Sampling conducted as part of the general lake water quality assessment will enable the state to determine the causes and magnitude of pollution problems associated with public lakes. Once the assessment data

establishes the water quality status, an attempt will be made to determine the contributing sources. This will involve field investigations of the contributing watersheds, review of existing ambient water quality data, examination of existing land uses, and identification of point and nonpoint source impacts. This information will provide a basis for identifying those lakes for which additional funding support through phase I, II and III grants could be requested. The Office of Water Resources will offer guidance and technical support to any state or local agency sponsoring a lake related project. If Clean Lakes funding is involved, the Office will act as a liaison between the local sponsor and EPA.

Restoration Methods

Many methods are currently being utilized to restore the water quality of public lakes. In lakes affected by high acidity, liming is routinely employed to neutralize pH. This technique has been utilized in Summit, Boley, Spruce Knob, and Mt. Storm lakes. In lakes with aquatic vegetation problems, chemical controls (i.e., aquatic herbicides) are sometimes utilized. Grass carp also have been employed as a biological control in at least one lake (Warden). At Mountwood Park Lake, winter drawdown has been implemented in an effort to freeze the sediments and destroy certain aquatic plant species. Dredging is periodically conducted in a number reservoirs affected by high siltation. At one U.S. Army Corps of Engineers' Reservoir (Beech Fork), artificial circulation with destratification fans is currently being used in an effort to improve water quality by increasing dissolved oxygen levels in the bottom waters. A summary of lake restoration techniques is presented in Table III-15.

Experience has shown that it is always best to focus on controlling pollution at the source rather than combatting it once it has occurred. In realization of this fact, the main focus of all state lake management efforts will be on pollution source control.

To date, the state has overseen the completion of four Phase I diagnostic-feasibility studies: Mountwood Park Lake in Wood County, Hurricane Lake in Putnam County, Tomlinson Run Lake in Hancock County, and Summit Lake in Greenbrier County. Mountwood Park, Hurricane, and Tomlinson Run lakes are impaired by sedimentation while Summit Lake suffers from natural acidity.

To date, two Phase II projects have been funded, one at Mountwood Park Lake and the other at Hurricane Lake. These ongoing projects both involve the establishment of watershed BMP's to help reduce the impacts of sedimentation.

Impaired and Threatened Lakes

The overall designated use support status for public lakes is presented in Table III-16. Of the 21,522 lake acres assessed, 2,282 (11 percent) fully supported their designated uses, 4,504 (21 percent) were fully supporting but threatened, and 14,736 (68 percent) were partially supporting. During this reporting period, Cheat Lake (1,730 acres) was upgraded from non-supporting to partially supporting status due to improvement in water quality.

A summary of specific designated uses is provided in Table III-17. This table includes information formerly reported in a separate table depicting the attainment of fishable/swimmable goals of the Clean Water Act. The fishable goal is now reported under two categories: aquatic life support and fish consumption.

Table III-16

Overall Designated Use Support Summary

Waterbody type: Lakes

Total number of assessed lakes: 93

Total number of monitored lakes: 91

Total number of evaluated lakes: 2

(All size units in acres)

Degree of use support	Evaluated	Monitored	Total
Fully supporting	3.10	2,279.30	2,282.40
Supporting but threatened	0.00	4,504.00	4,504.00
Partially supporting	2.00	14,734.10	14,736.10
Not supporting	0.00	0.00	0.00
Not attainable	0.00	0.00	0.00
Total size assessed	5.10	21,517.40	21,522.50
Not assessed	0.00	0.00	0.00

Table III-17

Use Support Matrix Summary Table

Waterbody type: Lakes

(All size units in acres)

Use	Supporting	Supporting but Threatened	Partially Supporting	Not Supporting	Not Attainable	Not Assessed
Overall use support	2,282.40	4,504.00	14,736.10	0.00	0.00	0.00
Aquatic life support	2,283.90	4,504.00	15,734.60	0.00	0.00	0.00
Fish consumption	91.00	0.00	0.00	0.00	0.00	0.00
Cold water fishery (Trout)	1,016.50	2,725.00	121.60	0.00	0.00	0.00
Warm water fishery	2,117.40	4,479.00	14,655.00	0.00	0.00	0.00
Swimmable	21,522.50	0.00	0.00	0.00	0.00	0.00
Secondary contact recreation	21,475.00	0.00	47.50	0.00	0.00	0.00
Drinking water supply	5,037.00	1,750.00	0.00	0.00	0.00	0.00
Industrial use	1,980.00	0.00	0.00	0.00	0.00	0.00
Wildlife	38.00	0.00	0.00	0.00	0.00	0.00

The swimmable goal also is reported under two categories: swimming and secondary contact recreation. Up until the 1992 reporting period, the state was very lenient in its assessment of the Clean Water Act fishable goal.

Generally, any lake that supported what was judged to be an adequate population of game fish was considered to fully support the fishable goal, regardless of the water quality status. For the current reporting period, however, water quality status is an important component in the overall assessment of the fishable goal. Under current federal guidelines, violations of state water quality criteria above a certain frequency level are automatically assumed to affect a lake's fishability.

For the aquatic life support use, 2,284 (11 percent) of the lake acres assessed were fully supporting, 4,504 (21 percent) were fully supporting but threatened, 14,735 (68 percent) were partially supporting, and 1,730 (8 percent) were non-supporting. Four lakes: Tygart, Laurel, Summersville, and Spruce Knob comprise the 4,504 acres of threatened waters. Tygart is threatened by acid mine drainage, Laurel is threatened by siltation from strip mining, and Summersville and Spruce Knob are both threatened by atmospheric deposition.

Only 91 lake acres were assessed for fish consumption use, as very few fish were collected for tissue analysis during this reporting cycle. All lake acres assessed for fish consumption use were fully supporting.

All 21,522 lake acres assessed during this reporting period fully supported the swimmable use. For the secondary contact recreation use, 21,455 acres (99.8 percent) were fully supporting while 48 acres (0.2 percent) were partially supporting. Lakes which partially supported the secondary contact recreation use

Table III-18

305(b) Relative Assessment of Causes

Sizes of waterbodies not fully supporting uses affected by various cause categories

Waterbody type: Lakes

(All size units in acres)

Cause Categories	Major Impact	Moderate/Minor Impact
Metals	6,372.10	3,265.50
Chlorine	0.00	5.50
Nutrients	8.00	2,868.50
pH	61.00	0.00
Siltation	2,005.50	9,962.00
Organic enrichment/Low DO	3,628.00	75.50
Salinity/TDS/Chlorides	0.00	2,630.00
Thermal modifications	1,200.00	0.00
Oil and grease	0.00	2,630.00
Noxious aquatic plants	58.50	1.00
Total toxics	3,270.00	0.00
Turbidity	30.00	217.00
Algal blooms	968.00	2,630.00

had some type of physical impairment such as silt bars or aquatic macrophytes that impeded activities such as recreational boating.

Pollution cause categories for lakes classified as less than fully supporting are listed in Table III-18. Considering both major and moderate/minor impacts, siltation was found to have the greatest impact on lakes, followed by metals, organic enrichment/low dissolved oxygen, and algal blooms. Other significant factors causing lake impairment were pH, nutrients, salinity/TDS/chlorides, oil and grease, and total toxics.

Pollution source categories for lakes classified as less than fully supporting are provided in Table III-19. Overall, abandoned mine drainage affected more lake acres than any other activity, followed by petroleum activities, silvicuture, and agriculture. Domestic sewage and industrial point sources (i.e, thermal pollution) also affect a sizable amount of lake acreage.

Water quality standards promulgated by the state Water Resources Board for streams also are applicable to lakes. Impaired or threatened status of lakes is determined by evaluating several factors, including violations of water quality criteria, physical alteration of habitat, and impairment of biological productivity.

Physico-chemical characteristics of lakes and tributaries monitored in 1994 and 1995 are given in Appendix D-2, with violations of state water quality criteria (West Virginia State Water Resources Board, 1990) footnoted.

Most violations of state water quality criteria noted during this assessment were for iron, manganese, and aluminum. These metals tend to accumulate in reservoirs and are frequently found in high concentrations, particularly in the hypolimnion (i.e., bottom waters). Accumulation of metals and other pollutants in

Table III-19

305(b) Relative Assessment of Sources

Sizes of waterbodies not fully supporting uses affected by various source categories

Waterbody type: Lakes

(All size units in acres)

Source Categories	Major Impact	Moderate/Minor Impact
Industrial point sources	1,200.00	0.00
Municipal point sources	0.00	33.50
Agriculture	39.50	3,398.50
Silviculture	2,617.00	3,366.50
Construction	138.50	8.00
Urban runoff/storm sewers	39.00	0.00
Petroleum activities	1,174.50	5,147.00
Abandoned Mine Drainage	3,687.00	4,228.00
Streambank modification/ destabilization	48.00	0.00
Domestic sewage	0.00	2,801.00
Atmospheric deposition	43.00	18.00
Highway maintenance and runoff	0.00	48.00
Natural sources	61.00	0.00
Source unknown	583.10	0.00

reservoirs is not an unusual phenomenon, since reservoirs by their very nature act as sinks for pollution originating in the watershed.

PH was found to violate water quality criteria in several lakes impacted by either natural acidity or acid mine drainage. The lowest recorded in-lake pH was 5.8 in Boley Lake, which is impaired by natural acidity and atmospheric deposition. The lowest recorded inflow pH (3.5) was measured in Laurel Run, a relatively minor tributary of Mt. Storm Lake.

Many of the lakes sampled during this assessment experienced hypolimnetic oxygen depletion in the summertime, with several also experiencing low D.O. in the spring. The lakes containing low hypolimnetic D.O. in the spring were ones which were sediment and/or nutrient enriched. It is important to realize that low bottom dissolved oxygen is a common phenomenon in many reservoirs due to thermal stratification. Although violations of state dissolved oxygen criteria were noted, special consideration must be given to lakes due to their unique physical nature. For the purpose of this assessment, lakes were not considered impacted by low dissolved oxygen unless: 1) a decrease of >10 mg/l D.O. occurred between the surface and six foot depth (indicating severe stratification) or 2) the concentration was less than 5.0 mg/l D.O. for any reading taken between the surface and four foot depth.

Acid Effects on Lakes

Ninety-three (86 percent) of the 108 public lakes in West Virginia were assessed for high acidity. No information, however, is available on toxic substances mobilization as a result of high acidity.

Table III-20

Acid Effects on Lakes

	Number of Lakes	Acreage of Lakes
Assessed for Acidity	93	21,522.50
Impacted by High Acidity	2	61.00
Vulnerable to Acidity	5	7,405.00
Not Impacted by Acidity	86	14,056.50

Table III-21

Trends in Lakes

	Number of Lakes	Acreage of Lakes
Assessed for Trends	11	15,195.00
Improving	4	6,900.00
Stable	7	8,295.00
Degrading	0	0.00
Trend Unknown	0	0.00

Two lakes totalling 61 acres are considered to be affected by high acidity. An additional five lakes totalling 7,405 acres were considered threatened by acidity, but not significantly impaired. The primary measure used to determine acidic condition is pH. Acid affected lakes are those that have been shown to routinely violate the state water quality standard for pH, which has a lower limit of 6.0 standard units. A summary of acid effects on lakes is given in Table III-20.

Specific sources of lake acidity can be divided into three categories: acid mine drainage (AMD), acid precipitation, and natural acidity. AMD affects Bloomington Lake (952 acres), while Summit and Boley lakes (61 acres) are impacted by both acid precipitation and natural acidity. All three of these lakes partially support their aquatic life use.

Tygart, Mount Storm, Summersville, Spruce Knob, and Cheat lakes are threatened by high acidity, but are not considered significantly impaired. Tygart, Mount Storm, and Cheat lakes (4,680 acres) are threatened by watershed AMD while Summersville and Spruce Knob lakes (2,725 acres) are threatened by acid precipitation and natural acidity. Cheat Lake once was sterile due to AMD, but has improved significantly over the past five years to the point that the pH rarely falls below 6.0 standard units.

Many methods are being employed to mitigate the harmful effects of high acidity. In the Cheat, Tygart, Mount Storm, and Bloomington lake watersheds, AMD effects are being reduced through reclamation of abandoned and inactive coal mines. Also, at Mount Storm lake, a permit variance granted to West Virginia Power Company allows it to discharge highly alkaline water (pH 10-11) into the lake for the purpose of neutralizing the acidity.

This has led to the establishment of a viable fishery.

Generally speaking, state lakes affected by acid precipitation also lie in areas where soils are naturally low in alkalinity. Such soils have little or no capacity to buffer acidic runoff. Summit and Boley lakes must be routinely limed in order to neutralize acidity so that trout can be stocked. Summit Lake is treated annually and Boley Lake about every three years. The watershed of Spruce Knob Lake is limed once every eight years in order to buffer runoff from the alkaline poor soils. This stabilizes lake pH enough to permit trout stocking. Although the lakes mentioned above are naturally acidic and infertile, atmospheric deposition tends to exacerbate the problem.

Currently, no methods are being employed specifically to remove toxic metals or other toxic substances mobilized by high acidity. However, liming to increase pH also has the ancillary benefit of decreasing the toxic effects of many heavy metals.

Toxic Effects on Lakes

Currently, no publicly-owned lakes are included on the state 304(l) list, which are waters not meeting state standards due to 307(A) toxics. The magnitude of state lakes affected by toxics is summarized in Table III-5.

During this reporting cycle, the only lakes monitored for toxics were the 10 U.S. Army Corps of Engineers' impoundments and two of the state's priority lakes...Summit and Mountwood Park. Of the 14,986 lake acres monitored for toxics, 3,270 (21.8 percent) were considered to have elevated levels (i.e., levels exceeding state water quality criteria). The affected lakes were Bloomington, Beech Fork, Burnsville and R.D. Bailey (all Corps of Engineers' impoundments). Bloomington contained high levels of the priority metals cadmium, lead, and zinc. Beech Fork,

Burnsville, and R.D. Bailey all had high concentrations of zinc. The highest concentrations of these metals occurred in samples collected from the hypolimnion (bottom waters). As previously mentioned, accumulation of heavy metals in the bottom waters of large reservoirs is a rather common phenomenon because reservoirs typically act as sinks for watershed runoff pollution.

The source of toxic pollutants in the four lakes with elevated levels of toxics has not been determined with certainty. However, it is thought to be related to mine drainage.

The overall effect of toxics on West Virginia lakes is not well documented. Additional sampling must be conducted to obtain a better understanding of toxic impacts.

Trends in Lake Water Quality

Due to a lack of historical water quality data for most publicly-owned lakes in West Virginia, very little can be accomplished in the way of trend analysis. Only Cheat, Mount Storm, and nine of the 10 U.S. Army Corps of Engineers' reservoirs have sufficient data available for an accurate trend assessment.

Of the 11 lakes with sufficient data for trend analysis, seven can be categorized as having stable water quality while the remaining four are improved. None of the lakes show a trend toward degradation. All of the lakes classified as improved have recovered to some degree from the effects of acid mine drainage.

For this assessment, trends were determined primarily by statistical analysis of water quality parameters; however, change in designated use support status also was taken into account. An approximate time frame of 10 years was chosen to substantiate trend analysis. A summary of trends in lakes is provided in Table III-21.

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Chapter Four: Estuary and Coastal Information

Not applicable to West Virginia.

Chapter Five: Wetlands Information

Background

The West Virginia Wetlands Conservation Plan (WVWCP) was developed by the Division of Natural Resources' Wildlife Resources Section in November, 1987. Much of the information provided in this chapter has been taken from that document. The WVWCP may be found in Appendix B.

Historical data on the state's wetlands is scarce and incomplete. Tiner (1987) indicated the presence of about 102,000 acres of wetlands (excluding reservoirs) in West Virginia. However, a more recent analysis of aerial photographs as part of the National Wetlands Inventory revealed about 57,000 acres of welands in the state (Tiner, 1996). The original rough projection of 102,000 acres is now thought to be an over-estimate.

West Virginia's wetlands can be broken down into five major types: Ponds (29%), Forested (22%), Emergent (21%), Shrub (11%), Mixed Shrub-Emergent (10%), and Other Non-Vegetated (7%). These wetland types comprise about 0.4 percent of the state's land surface area. Deepwater habitats (lakes, reservoirs, and rivers) comprise an additional 0.7 percent of the state's land surface area. Thus, aquatic habitats combined represent only about 1 percent of the state.

Wetland distibution is not uniform in West Virginia. Most of the state's wetlands can be found in Tucker County's Canaan Valley. Greenbrier County, with the Meadow River Wetlands, is the second ranked County. About 30 percent of the state's wetlands occur in these two counties.

Ironically, the greatest threat to protection of wetland resources in West Virginia has come with the proposed federal guidelines for wetland identification and delineation published in the August 14, 1991, issue of the Federal Register. The proposed guidelines place the wetland burden of proof on the resource agencies. For classification as wetlands, evidence of inundation for 15 days and saturation for 21 days (annually,during growing season) must be provided. The evidence must include 5 years of high resolution aerial photography or 3 years of groundwater monitoring during years of normal precipitation in addition to physical evidence at the time of the field determination.

West Virginia's wetland areas that may be most significantly affected are transitional zones between inundated wetlands and upland ecosystems and wetlands dominated by vegetation categorized as facultative upland species (e.g., red spruce). The Office of Water Resources provided in-depth comments in regard to the proposed guidelines and estimated that without substantial revision to the proposal, the state may lose about 50 percent of its transitional wetlands.

The federal Delineation Manual is important in protection of the state's wetlands as it is the method used by the U.S. Army Corps of Engineers (COE) to determine wetland areas that may be impacted by a permit application pursuant to Section 404 of the Clean Water Act. The Division's primary wetland protection avenue is through the Section 401 Certification Program for such federal licenses and permits. As the COE has primacy for administration of Section 404, the Division does not have the authority to identify and delineate wetlands for federal permits purposes.

Table III-22

Extent of Wetlands, by Type

WETLAND TYPE	Emergent	Shrub	Mixed Shrub-Emergent	Deciduous Forested	Evergreen Forested	Ponds	Shallow Zone Lakes	Exposed River Shores
ACREAGE	12,096	6,373	5,751	10,351	2,081	16,152	2,421	1,439
PERCENT OF TOTAL	21	11	10	18	4	29	4	3

Table III-23

Development Status of State Wetland Water Quality Standards

	In Place	Under Development	Proposed
Use Classification	X		
Narrative Biocriteria	X		
Numeric Biocriteria		X	
Anti-degradation	X		
Implementation Method	X		

Extent of wetland resources

Table III-22 denotes the extent of wetland resources in West Virginia. Due to inaccurate historical data on state wetlands, it is difficult to accurately assess changes (i.e., losses, gains) over time. With the aid of wetlands grant funding, in addition to more accurate assessment techniques, the state will be able to assess its wetland resources more thoroughly in the future and determine trends over time.

Even though we do not have accurate statistics for West Virginia, we do know that many marshes and wet meadows have been drained for cropland and many seasonally flooded bottomland forests cleared and drained for farms or pastures. To a lesser degree, urban development along major rivers has filled wetlands. Regardless of the magnitude of these losses, West Virginia's wetlands are an extremely limited resource and one worthy of protection and restoration.

Integrity of Wetland Resources

West Virginia does not have uses designated for wetlands. Therefore, use attainment information is not applicable. Futhermore, the state does not have a formal wetland monitoring program.

Development of Wetland Water Quality Standards

A summary of the development status of wetland water quality standards is provided in Table III-23.

In general, there are two widely used approaches to protect wetlands: (1) regulation of wetland uses and (2) acquisition of wetlands. More recently, wetland restoration has emerged as a third approach to increase wetland acreage and/or the functions of degraded wetlands. A fourth option - private stewardship - is one that should be pursued. The U. S. Fish and Wildlife Service's

"Partners for Wildlife" and the U. S. Department of Agriculture's "Wetland Reserve" programs are examples of what can be done to protect wetlands.

The primary focus of West Virginia's wetland management program is on acquisition and protection through regulation. State water quality standards define wetlands to "include such areas as swamps, marshes, bogs, and other land subject to frequent saturation or inundation, and which normally support a prevalence of vegetation typically found where wet soil conditions prevail." Under state law (Chapter 20, Section 5A-2. Definitions), wetlands are included as waters of the state and since August, 1993 have been classified as a separate water use category.

Currently, West Virginia's wetlands are regulated through the federal Clean Water Act. The state has no specific state wetland protection laws, unlike most northeastern states. To help protect wetlands, West Virginia has developed state laws and regulations to implement Section 401 of the Clean Water Act. Specific state water quality standards must be maintained as a basis for state water quality certification.

Nationally, the U. S. Army Corps of Engineers, with program oversight by the U. S. Environmental Protection Agency, regulates uses of wetlands to varying degrees under Section 404 of the Clean Water Act. Depositing fill in wetlands and excavating wetlands have typically required a federal permit. More recently, draining wetlands also needs to be permitted before commencing work. Certain activities are exempt from permit requirements.

The Office of Water Resources received a grant in May, 1990 to initiate and aid in the development of wetland water quality standards. Since that time, several proposed revisions to Title 46, Regulations governing Water Quality Standards, have been

submitted to teh Environmental Quality Board. The proposals include a revision of 3.2.i of the conditions not allowable in state waters, which as amended states:

> "Any other condition, including radiological exposure, which adversely alters the integrity of the waters of the state including wetlands; no significant adverse impact to the chemical, physical, hydrologic, or biological components of aquatic ecosystems shall be allowed".

This language was adopted into law in August, 1993. Also adopted into law in 1993 was a proposed amendment to the water use categories which specifically includes wetlands in Category B - "Propogation and Maintenance of Fish and Other Aquatic Life". The amendment states:

> "6.3.d Category B4 - Wetlands - as defined in Section 2.17; stream criteria may not be appropriate for application to wetlands".

Also in 1993, category D (Agriculture and Wildlife uses) was revised to include wetlands, in addition to all stream segments, as areas used by wildlife.

The anti-degradation policy has not been revised to specifically address wetlands; However, as wetlands are classified as waters of the state, they are protected by the policy.

Additional Wetland Protection Activities

As stated at the beginning of this chapter, West Virginia has developed a conservation plan for the protection of wetland resources (WVWCP, Appendix B). This plan was prepared in response to the Emergency Wetlands Resources Act of 1986 (P.L. 99-645) and focuses on various means of wetland acquisition, securing additional funding for acquisition, enforcement of and participation in Sections 404 and 401 of the regulatory process, and the establishment of effective state laws and regulations to control the degradation and destruction of riparian wetlands.

Additional goals for fulfillment of the wetland grant mentioned in the previous section include:

a) Acquiring base information on specific wetland communities in West Virginia (i.e., vegetation, flora, fauna, and functions and values) in order to assess critical and/or unique characteristics not presently documented.

b) Implementing wetland evaluation techniques.

c) Initiating development of a use-based wetland classification system.

d) Developing a mitigation policy for wetland impacts.

e) Assisting state wetland watch groups.

f) Developing informational brochures emphasizing the importance of wetlands and wetland protection efforts.

Efforts to incorporate wetland protection into other water management programs have not been extensive. Monitoring efforts on open channel (streams/rivers) wetlands have been conducted in conjunction with the 401 certification program. These efforts have resulted in the identification of wetland habitat for freshwater mussels (including endangered species) and fish spawning areas. Other programs such as Clean Lakes and Groundwater are relatively new activities for West Virginia and have not evolved enough to incorporate wetland protection. The state's nonpoint source management plan does identify all types of wetlands as areas for protection. However, this program has only recently expanded to actively pursue this intent. There is no requirement nor support by the state for wetland resource inventories by local jurisdictions.

The DEP's Office of Water Resources administers the state's wetland protection activities through the 401 certification program. This program is coordinated through DNR's Wildlife Resources Section. The state Division of Forestry advises loggers to avoid streams and wet areas on silviculture operations, while relying upon

the support of Office of Water Resources for enforcement of water quality violations resulting from these operations.

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Tiner, R. W. 1996. West Virginia's Wetlands. Uncommon, Valuable Wildlands. U. S. Fish and Wildlife Service, Ecological Services, Northeast Region, Hadley, MA. 20 pp.

PART IV : GROUND WATER QUALITY

BACKGROUND

"Ground water in West Virginia is, on the average, both abundant and of adequate quality" (WVDNR, 1988). The opening statement remains true largely due to the rural nature of West Virginia.

The Groundwater Protection Act (GWPA), passed in June 1991, provides West Virginia with a framework to manage the state's ground water resources. The GWPA states "... that it is the public policy of the state of West Virginia to maintain and protect the state's ground water so as to support the present and future beneficial uses and further to maintain and protect ground water at existing quality where the existing quality is better than that required to maintain and protect the present and future beneficial uses" (WV GWPA 1991).

Ground water is an important resource that is used throughout West Virginia for public, domestic, and industrial supply. The water supply for about 40-45 percent of the State's population is derived from ground water sources - wells, springs, coal mines, and limestone mines. Although most of the urban areas in the State obtain water for public supply from surface water sources, 90 percent of the rural population depends on ground water for domestic use. More than one-half of all ground water used for public supply requires treatment to meet drinking water standards established by the US EPA. Ground water usage for drinking water has decreased somewhat over the last several years due to an increase in public water supply systems. Many of these larger systems rely more on surface waters as their water source.

"Increased water use and contamination of the ground water resources in West Virginia have made evaluation of the quality of ground water necessary. Planning, management, and regulatory agencies need reliable hydrologic information to effectively manage and protect the State's water resources. Long-term records of ground water quality are needed to provide a uniform database that can be used to evaluate the effects of development and change in water use, and to aid in the prediction of changes in the quality and quantity of ground water. Because of past and present contamination of ground water, baseline water quality data are needed as a background with which to assess the extent of contamination" (Ground Water Quality Monitoring Program for West Virginia, USGS, March 1992).

WEST VIRGINIA AQUIFER GROUPS

"There are two major types of aquifers in West Virginia, unconsolidated alluvial deposits and sedimentary bedrock. Major alluvial deposits are located along the Ohio and Kanawha Rivers and in the Teays Valley. Approximately 55 percent of all ground water used for public supply are from alluvial deposits along the Ohio River. The bedrock aquifer system is typically composed of alternating layers of sedimentary rock such as sandstone, siltstone, shale, limestone, and coal. Movement of water in these rocks primarily is through fractures, bedding-plain separations, and, in limestone areas, solution openings" (Ferrell, 1987) (Figure IV-1).

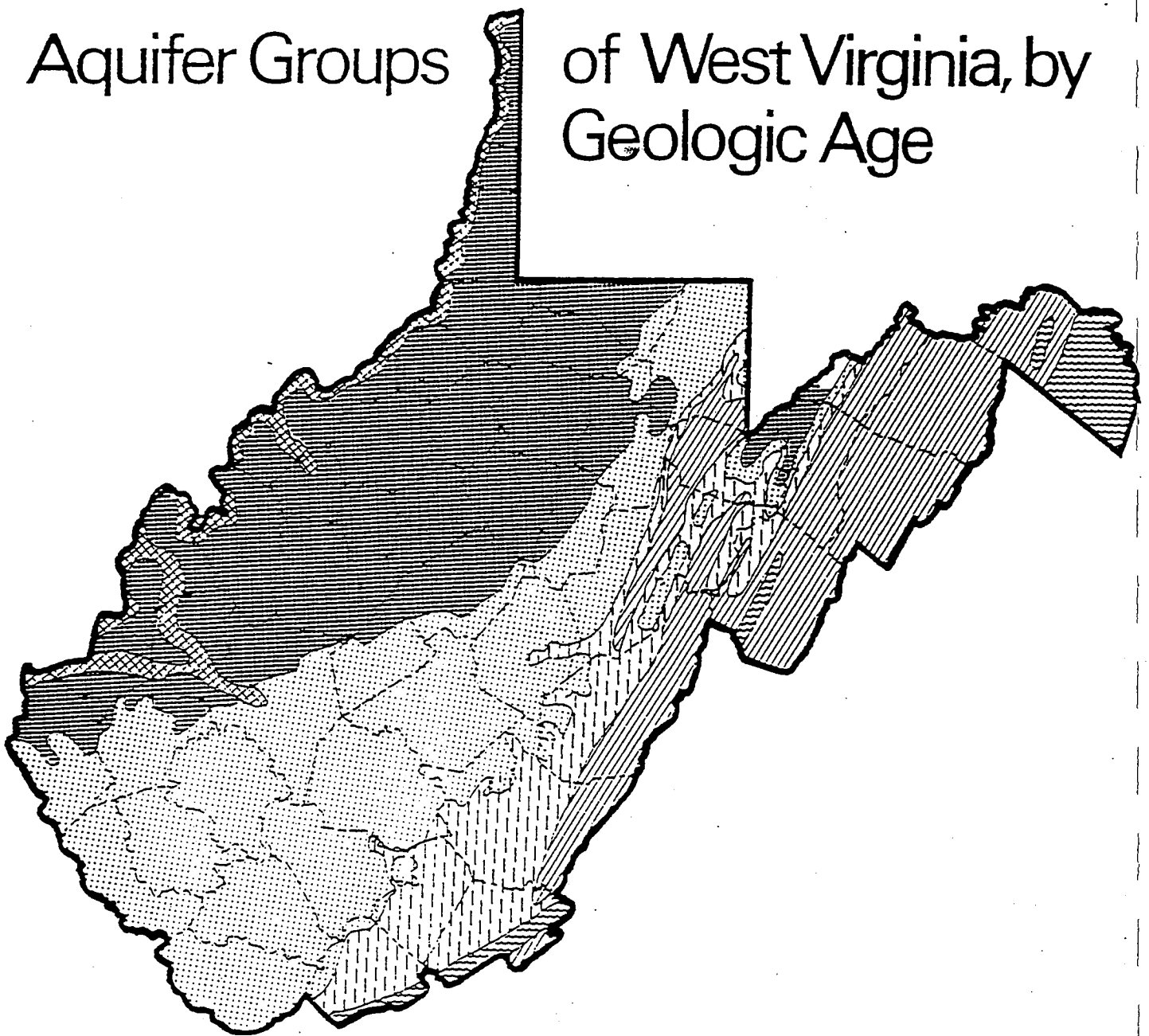
LEGISLATION:

Ground Water Protection Act

The Division of Environmental Protection was designated as the lead agency for ground water protection and is charged with

FIGURE IV - 1

Aquifer Groups of West Virginia, by Geologic Age



Alluvial aquifers - Sand and gravel, interbedded with silt and clay. Used as source for public and industrial supplies along the Ohio and Kanawha rivers.

SEDIMENTARY BEDROCK AQUIFERS.

Upper Pennsylvanian - Predominantly shale, with sandstone, siltstone, coal and limestone. Used mainly for domestic and farm supplies.

Lower Pennsylvanian - Predominantly sandstone, with shale, coal and limestone. Used mainly for domestic and farm supplies.

Mississippian - Predominantly sandstone and limestone with shale. Adequate yields for domestic and farm supplies. Springs in limestone units tend to yield larger amounts of water, often producing adequate yields for larger commercial and industrial supplies.

Devonian and Silurian - Shale, siltstone, limestone and sandstone. Adequate yields for domestic, farm, and small to moderate industrial and public supplies.

Ordovician and Cambrian - Sandstone, shale and limestone. Adequate yields for domestic, farm, and moderate to large industrial and public supplies

maintaining the state's ground water management strategy, developing a central ground water data management system, providing a biennial report to the legislature on the status of the state's ground water and ground water management programs, and developing rules regarding the monitoring and analysis of ground water.

The Groundwater Protection Act also gave the state Environmental Quality Board (EQB) the exclusive authority to set statewide ground water standards. The standards can be no less stringent than EPA's safe drinking water standards. However, the standards can be more stringent if the state sees fit. If background quality is better than the standard, the background quality will be the standard and cannot be altered unless a variance is granted. In essence, West Virginia has adopted an antidegradation policy that allows for variances for specific activities. Regulatory agencies agreed that the EQB should adopt EPA Primary Drinking Water Standards as a minimum for the WV GWPA Standards. The EQB agreed with this and adopted as a minimum the Federal Safe Drinking Water Standards as promulgated in April 1992 with the exception of Lead. The Ground Water Program felt that since approximately half of the state's residents derive their drinking water from ground water supplies, that a need existed for a standard to protect the ground water resource long before the contaminant reached the tap. A minimum lead standard of 0.015 ppm was adopted for ground water quality. During the public meeting concerning ground water quality standards, a considerable amount of verbal comment was directed towards the dioxin standard, thus the dioxin standard was lowered from the proposed MCL of 30 ppq to a limit of 5 ppq. Table IV-1 contains the Ground Water Quality Standards which were put into effect August 23, 1993.

TABLE IV-1 : GROUND WATER QUALITY STANDARDS
APPENDIX A of the WV Legislative Rule
Title 46, Series 12
Requirements Governing Ground Water Standards

Constituent	Maximum (mg/l)	Constituent	Maximum (mg/l)
Alachlor	0.002	Antimony	0.006
Asbestos (fibers/l < 10 ug/l)	7 MFL*	Atrazine	0.003
Barium	2.0	Benzene	0.005
Benzo (a) pyrene (PAH)	0.0002	Beryllium	0.004
Cadmium	0.005	Carbofuran	0.04
Carbon Tetrachloride	0.005	Chlordane	0.002
Chromium (total)	0.1	Cyanide	0.2
2,4-D	0.07	Dalapon	0.2
Di-2-ethylhexyl]adipate	0.4	Dichlorobenzene p-	0.075
Di-2-ethylhexylphthalate	0.006	Dichlorobenzene o-	0.6
Dibromochloropropane	0.0002	Dichlorobenzene m-	0.6
Dichloroethane (1,2)	0.005	Dichloromethane	0.005
Dichloroethylene 0.07 (cis-1,2-)		Dichloroethylene (trans-1,2-)	0.1
Dichloroethylene (1,1-)	0.007	Dinoseb	0.007
Dichloropropane (1,2-)	0.005	Diquat	0.02
Endothall	0.1	Endrin	0.002
Ethylbenzene	0.7	Fluoride	4.0
Ethylene dibromide (EDB)	0.00005	Glyphosate	0.7
Heptachlor	0.0004	Heptachlor epoxide	0.0002
Hexachlorobenzene	0.001	Lead	0.015
Hexachlorocyclopentadiene	0.05	Lindane	0.0002
Mercury (inorganic)	0.002	Methoxychlor	0.04
Monochlorobenzene	0.1	Nickel	0.1
Nitrate (as N)	10.0	Nitrite (as N)	1.0
Total Nitrate and Nitrite (both as N)	10.0	Oxamyl (Vydate)	0.2
Pentachlorophenol	0.001	Picloram	0.5
Polychlorinated biphenyls	0.0005	Selenium	0.05
Simazine	0.004	Styrene	0.1
2,3,7,8-TCDD (Dioxin)	0.000000005		
Tetrachlorethylene	0.005	Thallium	0.002
Toluene	1.0	Toxaphene	0.003
2,4,5-TP (Silvex)	0.05	Trichloroethylene	0.005
Trichlorobenzene (1,2,4-)	0.07	Vinyl Chloride	0.002
Trichloroethane (1,1,1-)	0.2	Xylenes (total)	10.0
Trichloroethane (1,1,2-)	0.005		
Radionuclides			
Beta particle and photon activity			4 mrem**
Gross alpha particle activity			15 pCi/L***

* MFL = million fibers per liter
** mrem = millirem (rem = roentgen-equivalent-man)
*** pCi = picocurie.

DIVISION OF ENVIRONMENTAL PROTECTION

The West Virginia Groundwater Protection Act designated the Division of Environmental Protection as the lead Agency for ground water protection. Following are ground water regulations:

Chapter 22 Article 12 - Groundwater Protection Act

This Act authorized the Division of Environmental Protection to be the lead ground water regulatory agency and to take the lead role in coordinating ground water protection activities.

Title 47 Series 55 - Groundwater Protection Act Fee Schedule (effective June 1, 1994)

Reauthorizes a schedule of fees for the ground water protection fund. The rule is applicable to any person who owns or operates facilities or conducts activities subject to the provisions of the GWPA. The fees are based on the potential to pollute ground water. The fee formula is based on pollutant quantity and quality and reflects the cost that the division and other agencies would incur in providing certification, compliance and enforcement services imposed by statute.

Title 47 Series 56 - Assessment of Civil Administrative Penalties (effective June 1, 1994)

Sets forth criteria and procedures to be used in assessing administrative penalties for ground water quality violations. These penalties may be used instead of civil or criminal action to address violations of the GWPA. However, they do not inhibit or prohibit due process because the violator retains the option of appealing the penalty order.

Title 47 Series 57 - Groundwater Quality Standard Variance (effective June 1, 1994)

Establishes criteria for variances and deviations from the requirements of the GWPA that would otherwise obligate sources to assure compliance with existing quality, ground water quality standards of the state Water Resources Board and preventative action limits imposed by ground water regulatory agencies.

Title 47 Series 58 - Groundwater Protection Regulations (effective June 1, 1994)

Establishes a series of practices that must be followed by any person who owns or operates facilities, or conducts activities subject to the provisions of the GWPA. The practices are designed to prevent ground water contamination from facilities and activities that are subject to regulatory requirements by the DEP's Office of Waste Management and Office of Water Resources.

Title 47 Series 59 - Groundwater Monitoring Well Driller Certification Program (effective June 1, 1994)

The rule was established for the certification of monitoring drillers and monitoring well installations, alterations, and abandonment. Certification procedures and policies are being developed and this program should be in operation once the Monitoring Well Design Standards have passed through the State Legislature and become effective.

Title 47 Series 60 - Monitoring Well Design Standards (effective June 1, 1994)

This is a proposed rule that establishes a minimum set of design, installation and abandonment criteria for monitoring wells. This rule does not prohibit more stringent criteria for

monitoring wells existing in other regulatory programs. Passage of this rule is anticipated for the Spring 1996 State Legislature and this and the Driller Certification programs should be implemented and in operation January 1997.

Title 47 Series 13 - Underground Injection Control (effective August 25, 1993)

These rules establish criteria and standards for the requirements which apply to the State Underground Injection Control (UIC) Program. The UIC permit program regulates underground injections by five classes of wells which are defined within this rule. All persons must be authorized by permit or rule to operate a underground injection well.

Chapter 22 Article 3 - Surface Mining and Reclamation Act

This Act regulates coal mining activities, requires the mine site to be bonded, requires a regular inspection frequency, and requires replacement of a ground water source when impacted by coal mining.

Title 38 Series 2F - Groundwater Protection Regulations Coal Mining Operations (effective June 1, 1994)

This rule establishes a series of practices for the protection of ground water which are to be followed by any person who conducts coal mining operations. Every permitted coal operation is required to prepare and implement a Groundwater Protection Plan detailing potential contamination sources, prevention measures, cleanup and reporting of spills, and training of personnel by June 1, 1995.

Chapter 22 Article 10 - Abandoned Well Act

The Abandoned Well Act of 1992 for oil and gas wells established a program to address the responsibility issue of abandoned wells and how the priority system for plugging works.

Title 38 Series 18 - Oil and Gas Wells and Other Wells
(effective July 1, 1993)

These rules contain ground water regulations for the oil and gas industry. Water sampling and analysis must now be done in an area prior to drilling an oil and gas well.

DEPARTMENT OF AGRICULTURE

The West Virginia Groundwater Protection Act designates the West Virginia Department of Agriculture as the groundwater regulatory agency for the purposes of regulating the use or application of pesticides and fertilizers. At the time of passage of the Groundwater Protection Act, existing Department legislation for the regulation of pesticides and fertilizers included Chapter 19, Article 16A - pesticides; Chapter 19, Article 15 - fertilizers; Chapter 19, Article 15A - liming materials; and Chapter 19, Article 13 - apiary pesticides. Using the authority in existing legislation and the Groundwater Protection Act, the Department developed procedural and legislative rules that are protective of the groundwaters of the State.

Procedural rules protective of ground water were promulgated in accordance with state requirements and became effective as follows:

Generic State Management Plan for Pesticides and Fertilizers in Groundwater - Title 61, Series 22 (effective November 1, 1992)

This rule establishes the overall program of the WVDA for the protection of ground water. This rule gives guidance for the development of procedures, practices and rules for the program.

Best Management Practices at Temporary Operational Areas for Non-bulk Pesticide Mixing and Loading Locations - Title 61, Series 22A (effective November 1, 1992)

This rule establishes requirements for the operation of facilities where quantities of pesticides over 300 gallons of liquid or 3,000 pounds of dry weight are stored on a temporary basis and establishes voluntary rules for the recovery, storage and use of any discharge form the containment area.

Best Management Practices for Fertilizers and Manures - Title 61, Article 22B (effective December 5, 1992)

This rule provides for a voluntary program of education and practice for all persons who apply fertilizers and manures in this state. The intent of this rule is to prevent ground water pollution from these sources.

Primary and Secondary Containment of Fertilizer - Title 61, Series 6B (effective July 1, 1993)

This rule requires that facilities storing fertilizers in quantities over 5,000 gallons liquid or 25 tons dry weight in bulk shall have the capability of keeping spills within the containment site. Should a discharge of fertilizers occur from the containment area, the facility is required to have plans to clean up the discharge. An annual Fertilizer Storage Facility Permit is

required for regulated facilities.

General Ground Water Protection Rules for Fertilizers and Manures - Title 61, Series 6C (effective July 1, 1993)

This rule establishes requirements for manure handling, establishes the duties and powers of the commissioner and requires the commissioner to make voluntary practices for the application of fertilizer and manure mandatory when found to be ineffective to protect ground water from residues of fertilizer or manure.

General Ground Water Protection Rules for Pesticides - Title 61, Series 12G (effective July 1, 1993)

This rule establishes guidance and best management practices for the transportation storage and use of pesticides. This rule relates all relevant pesticide rules to the Groundwater Protection Act and establishes the powers and duties of the Commissioner of Agriculture for the enforcement of the pesticide rules relevant to the protection of ground water.

Bulk Pesticide Operational Rules - Title 61, Series 12H (effective July 1, 1993)

This rule establishes requirements, including primary and secondary containment, for the operation of facilities storing and repackaging quantities of pesticides greater than 300 gallons liquid or 3,000 pounds of dry material in bulk containers (individual undivided containers greater than 55 gallons liquid or 100 pounds dry); establishes a bulk pesticide facility registry for bulk storage; establishes rules for the recovery, storage and use of any discharge from the containment area; and sets transportation standards.

Non-bulk Pesticide Rules for Permanent Operational Areas - Title 61, Series 12I (effective July 1, 1993)

This rule establishes requirements for containment and the recovery, storage and use of discharges from containment areas for facilities where either pesticide concentrates or use dilution mixtures in excess of 300 gallons liquid or 3,000 pounds of dry weight are transferred, loaded, unloaded, mixed, repackaged, refilled, or cleaned, washed, or rinsed from containers or application equipment over a 30 day period either consecutive or cumulative during a calendar year.

GENERAL

Passage of the Groundwater Protection Act is expected to have a positive impact on ground water in West Virginia. The law provides regulatory agencies with the funding and guidance to obtain, maintain, and analyze the data necessary to provide an objective, quantitative, and spatial representation of the actual condition of the state's ground water.

Weaknesses in current regulations should be strengthened, consistency in program regulation/enforcement should be achieved, and cooperation among agencies is now mandated. If the concepts outlined in the Groundwater Protection Act all come to fulfillment, West Virginia's ground water should indeed become a well managed and closely monitored resource.

GROUND WATER QUALITY

West Virginia's mountains contain abundant natural resources. West Virginia is one of the nations leading producers of fossil fuels (coal, oil, and natural gas). The state also has numerous chemical plants, industrial facilities, limestone and gravel quarries, and commercial farm operations. Today most activities

that threaten ground water quality are regulated in some manner. West Virginia has 43,000 known active oil and gas wells, 14,000 plugged oil and gas wells, and 49,000 known "orphaned" oil and gas wells. According to the Mining and Reclamation Office, there are 3406 active mining permits with 2183 being coal mines and other active resource mines. The other 1223 permits are associated with hauling roads, processing, etc. There are also 969 permitted facilities (including stormwater permits, NPDES, and landfill discharges) with industrial discharges, and approximately 250 municipal plant and 1200 package plant dischargers of municipal wastewater. On an annual basis, the state registers 6500 pesticides; deposits two million tons of solid waste; generates 40,000 tons of hazardous waste; and issues permits for 7500 septic tank installations/ modifications. In addition, the state manages 645 class II and III injection wells, more than 1400 Class V injection wells, and over 21,900 underground storage tanks.

Table IV-2 lists the major sources of ground water contamination while Table IV-3 gives a breakdown of major ground water contaminants.

Table IV-2

MAJOR SOURCES OF GROUND WATER CONTAMINATION

Source	Incidents Reported (X = Yes)	Highest Priority	Factors Considered	Contaminants Considered
Agricultural Activities				
Agricultural Chemical Facilities	X			
Animal Feedlots	N/A			
Drainage Wells				
Fertilizer Applications	X			
Irrigation Practices	X			
Pesticide Applications	X			
Storage and Treatment Activities				
Land Application/treatment		X		
Material Stockpiles				
Storage Tanks (above ground)		X		
Storage Tanks (underground)	X	X	D,F,G	D
Waste Piles				
Waste Tailings				
Disposal Activities				
Deep Injection Wells (all not Class V)		X		
Shallow Injection Wells (Class V)	X	X	A,D,G	C,D,H,J,N
Landfills - Municipal	X	X	A,D,G	A,B,C,H,J,M
Landfills - On-site Industrial (excluding pits, lagoons, surface impoundments)	X	X	A,D,G	A,B,C,D,H,J,M
Septic Tanks (Systems)	X			
Surface Impoundments (excluding oil and gas brine pits)	X	X	A,C,D,E,G	B,C,H,M
Oil and Gas brine pits	X			
Other landfills	X			
Other				
Abandoned Wells (all kinds)	X	X	A,C,D,E,G	C,G,H
Hazardous Waste Generators				
Abandoned Hazardous Waste Sites	X	X	A,C,D	C,D,H
Regulated Hazardous Waste Sites	X	X	A,C,D	C,D,H
Industrial Facilities	X	X	D	A,B,C,D,H,M
Material Transfer Operations				
Mining and Mine Drainage	X	X	B,D,F	H,N
Pipelines and Sewer Lines				
Salt Storage and Road Salting		X		
Salt-water Intrusion	X			
Spills	X			
Transportation of Materials				
Urban Runoff				

Table IV-2 continued...

CODES USED IN TABLE IV-2

FACTORS CONSIDERED:
A-Human health and/or environmental risk (toxicity)
B-Size of the population at risk
C-Location of the sources relative to drinking water sources
D-Number and/or size of contaminant sources
E-Hydrogeologic Sensitivity
F-State findings, other findings
G-Other criteria (see narrative)

CONTAMINANTS CONSIDERED:
A-Inorganic Pesticides B-Organic Pesticides
C-Halogenated Solvents D-Petroleum Compounds
E-Nitrate F-Fluoride
G-Salinity/Brine H-Metals
I-Radionuclides J-Bacteria
K-Protozoa L-Viruses
M-Organics (industrial) N-Inorganics/Nutrients in general

Table IV-3
GROUND WATER CONTAMINATION SUMMARY

The numbers in the following table are state-wide figures.
Data reporting period is for July 1, 1993 through June 30, 1995.

Source Type	Sites w/ Confirmed Releases	Sites w/ Confirmed GW Contamination	Contaminants Found at these Sites
NPL	5	4	chloromethanes, sodium hydroxide, mercury, coal tar, phenol, ammonium sulfate, benzene, toluene, zylene, trichloroethane (TCE), tetrachloroethane (PCE)
CERCLIS (Non-NPL)			see under NPL
DOD/DOE	3	2	TCE, PCE, explosive compounds and their derivitives
LUST	579	166	benzene, toluene, ethylbenzene, xylene, and other petroleum products
(state lead sites)			
active	8		
inactive	40		
RCRA			
Corrective Action	25		organics, solvents, metals
Under investigation	13		organics, solvents, metals
Underground Injection			
State Sites			
Nonpoint Sources			

Monitoring well data from many of these facilities/ activities is collected as part of the permitting/regulatory process, but is not readily available for analysis because the data is not in computerized form. Therefore, some information for the given tables is unavailable. Table IV-2 is largely subjective and based mainly on conversations with numerous regulatory personnel and on factors presumed to be of importance. A database initiative is being formed. Due to inadequate funding, this process has moved slower than anticipated. Funding is being sought for a computer database programmer at this time and interim data management efforts are being studied. Enforcement personnel (primarily waste/water inspectors) have identified the following facilities as posing the greatest risk for ground water contamination:

1. Petroleum bulk plants, terminals and gas stations
2. Salvage/Junk yards and recycling centers
3. Natural gas compressor stations

Again, because of the lack of a centralized data management system, as well as the fact that most information is contained in hard copy form in file folders, the tables were not completed as specified. Attempts were made at completing the tables with available information on a state-wide basis, not by specific aquifers. There has not been much study done on an aquifer by aquifer basis, and hopefully, in the future, this approach can be taken with the watershed initiative in mind.

Due to insufficent available data, Table IV-4 (Aquifer Monitoring Data) was not completed in the format suggested in the 1996 305(b) guidance document. Instead it was reproduced using only the column titles that were applicable for the available information and includes sites sampled with springs. Due to the lack of available data, this table provides a state-wide summary

TABLE IV-4

AQUIFER MONITORING DATA
FOR THE AMBIENT GROUND WATER MONITORING NETWORK

NUMBER OF WELLS THAT HAVE:

Number of Wells	Parameter Group	No Detections above MDLs	No Detections above MDLs with NO3 <or= 5	Detections above MDLs <or= MCL	Detections above MCLs	Removed from Service
27	VOC	24	24	1	2	1
27	SOC	0	0	24	3	1
27	NO3	3	3	24	0	1
27	Sulfate	1	1	26	0	1
27	Chloride	0	0	27	0	1
27	Dis Solids	0	0	23	4	1
27	Fluoride	1	1	26	0	1
27	Aluminum	0	0	20	7	1
27	Antimony	20	20	6	1	1
27	Arsenic	3	3	24	0	1
27	Barium	1	1	24	2	1
27	Cadmium	24	24	3	0	1
27	Chromium	14	14	13	0	1
27	Copper	6	6	21	0	1
27	Iron	0	0	12	15	1
27	Lead	0	0	25	2	1
27	Manganese	1	1	11	16	1
27	Mercury	20	20	7	0	1
27	Nickel	12	12	15	0	1
27	Selenium	22	22	5	0	1
27	Silver	11	11	16	0	1
27	Beryllium	16	16	5	6	1
27	Zinc	0	0	27	0	1
26	Bacteria	9	9	7	10	1

instead of a breakdown by specific aquifers. Background water quality in most cases has not been determined, therefore the columns that deal with background water quality have been omitted as well as the columns that are optional.

STATE GROUND WATER PROGRAMS

The three state ground water regulatory agencies are the Department of Health and Human Resources' Office of Environmental Health Services, the Department of Agriculture, and the Division of Environmental Protection.

Department of Agriculture

DOA continues a water well sampling program to monitor ground water for pesticide residues. The sample analysis is being used to characterize the types, amounts, and distribution of pesticides in ground water. Persistent detections of Atrazine were identified at four sites in the Eastern Panhandle. Although detectable amounts were found, levels were only found to be above ground water quality standards at one of the four sites.

Other activities conducted by DOA that are protective of ground water and help to educate the public include: 1) development and distribution of a "Rinse It's Worth It" packet of information for the promotion of proper rinsing of pesticide containers for disposal and recycling; 2) sponsoring of two collection days to collect and recycle plastic agricultural pesticide containers; 3) conducting an excess pesticide disposal project in the Eastern Panhandle where 50,000 pounds of old and unwanted pesticides were collected and properly disposed; 4) initiaing five Section 319 watershed improvement programs for reducing non-point agricultural contaminants; and 5) offering educational and technical assistance on water quality to farmers.

Department of Health and Human Resources, Office of Environmental Health Services

The Office of Environmental Health Services (OEHS) is responsible for three areas of ground water protection: 1)

implementation and enforcement of the WV Water Well Regulations, 2) implementation and enforcement of the WV Water Well Design Standards, and 3) implementation of the WV Wellhead Protection Program. The OEHS is also the lead agency for the Safe Drinking Water Act.

As of June 30, 1995, local wellhead protection programs (WHPPs) have been initiated for 158 community water supply systems. These systems serve approximately 284,000 persons (81% of the state's population using community public water supplies with ground water sources). Wellhead protection areas (WHPAs) have been delineated for 101 of the 158 local programs. The 101 systems for which WHPAs have been delineated serve approximately 258,000 persons (65% of population using community public water supplies with ground water sources). Forty-eight of these systems have received OEHS approval for their surveys of potential contaminant sources (120,000 persons and 30% public ground water supply).

Presentations of the WHPPs were made at various forums: League of Women Voters Seminars, Governor's Ground Water Task Force, WV Water Quality Advisory Committee, State/Local Environmental Health Liason Committee, Annual WV Exposition, Interstate Environmental Health Seminar, Annual WV Rural Water Association Technical Committee, Wellhead Protection Inter-Agency Coordinating Committee, American Water Works Association-WV Section, and Local Wellhead Protection Committees.

The Public Health Sanitation Section of the OEHS is actively pursuing adoption of proposed amendments for the Sewage System Rules and the Sewage System Design Standards. This section administers the implementation and enforcement of septic system installation permitting processes.

Division of Environmental Protection

The Division of Environmental Protection (DEP) has been designated as the lead ground water regulatory agency for the State of West Virginia. DEP consists of the following offices with ground water regulatory authority - Water Resources, Mining and Reclamation, Oil and Gas, and Waste Management.

The Office of Mining and Reclamation (OMR) administers various regulatory programs requiring the protection of ground water and defining practices for mining operations. The Hydrologic Protection Unit in OMR has developed a program requiring every permitted coal operation to prepare a Groundwater Protection Plan (GPP) detailing potential contamination sources, prevention measures, cleanup and reporting of spills, and the training of personnel. GPPs of individual operations, enforcements and penalties, and specific ground water protection policies and procedures are tracked.

The Office of Oil and Gas (OOG) oversees West Virginia's oil and natural gas industry for the purpose of protecting both surface and ground water resources. This is accomplished through permitting, inspection, and regulatory enforcement of exploration and production activities of the industry. Abandoned wells continue to be the most problematic area of the office's ground water protection program. Most problems date back many years when the technology was inferior to what it is today. Although the Office places a high priority on its abandoned well plugging program, insufficient funding continues to plague the program. Fewer problems with ground water contamination are expected from current drilling and production operations due to the new regulations which include annual inspection and water quality testing requirements.

The Office of Waste Management (OWM) is divided into several sections: Hazardous Waste Management, Compliance Monitoring and Enforcement, Site Investigation and Response, Solid Waste Management, and Underground Storage Tank (UST)/Leaking Underground Storage Tank. All of these sections have ground water regulatory responsibilities. OWM's ground water responsibilities include RCRA remediation projects and studies, tracking, inspection, enforcement, management of UST sites including any clean-up or remediation due to leaking USTs, certification of UST installers and removers, addressing any ground water contamination at Comprehensive Environmental Response and Compensation Liability Act (CERCLA) (Superfund) sites including National Priority List (NPL) sites, maintaining the Landfill Closure Assistance Program which assists qualified permittees with closure related requirements, and inspection and enforcement at waste generator sites.

The Office of Water Resources (OWR) is also broken down into various sections that have ground water regulatory responsibilities. These sections include the Ground Water Program, Non-point Source Program, Sludge Program, and NPDES Permitting Section. The Ground Water Program provides technical assistance to other ground water regulatory agencies on contamination and enforcement issues, reviews applications for variances and/or deviations, prepares variance rules for legislative considerations, is in the process of developing an organizational system with other ground water regulatory agencies to address remediation projects throughout the state, is in the process of developing a database to track and store data derived from remediation projects, assists in the development of remediation guidelines for ground water and soil clean-up

standards, oversees ground water and soil remediation at certain non-permitted industrial sites, samples and maintains the ambient ground water monitoring network, coordinates complaint call investigations, maintains ground water data from the ambient network, and provides technical support in the creation of a centralized data management system. A computerized system for invoice production, fee collection and tracking of ground water protection and remediation fees has been created and implemented.

The Underground Injection Control Program for class V injection wells has incorporated the GPP requirement into its permitting process. The Non-point Source (NPS) Program identifies and controls pollution from diffuse sources, such as runoff from agriculture, forestry, urban land development, and abandoned mine sites.

The NPS program assists in the establishment of "best management practices" which also incorporates ground water protection practices. The NPDES Construction general permit for stormwater associated with construction activities requires that an applicant planning to develop in the state must comply with the Groundwater Protection Act. Ground water protection plans may be necessary to fully comply with the general permit requirements. Another project developed for the protection of ground water is the WV Nutrient Analysis Facility Project (WVNAF). Nutrient management plans will be developed for poultry farmers and land owners to better utilize animal litter and help reduce pollutants.

State and Federal Sewage Sludge Management Regulations are designed to regulate the storage and disposal of stabilized sewage sludge. Land application will be better managed by using application rate calculations to protect soils, plant life, and ground water quality, while supplying valuable nutrients and

macronutrients to crops grown for animal feed and reclamation of disturbed land.

More details concerning the above activities can be found in the publication "Ground Water Programs and Activities Biennial Report to the 1996 West Virginia Legislature".

Table IV-5 outlines some of the programs that West Virginia maintains. A section of explanatory notes follows the table.

Table IV-5

SUMMARY OF STATE GROUND WATER PROTECTION PROGRAMS

Programs or Activities	Check	Implementation Status	Responsible State Agency
Active SARA Title III Program	X	implemented	OES
Ambient Ground Water Monitoring System	X	implemented/note	DEP
Aquifer vulnerability assessment			
Aquifer mapping	X	see note	
Aquifer characterization			
Comprehensive data management system	X	see note	DEP
EPA-endorsed CSGWPP		progress is on-going	DEP
Ground water discharge permits			
Ground water best management practices	X	see note	DEP,DOA, DHHR
Ground water legislation	X	see note	DEP,DOA DHHR
Ground water classification			
Ground water quality standards	X	implemented/note	DEP
Interagency coordination for ground water initiatives	X	implemented	DEP
Nonpoint source controls			
Pesticide state management plan	X	implemented	DOA
Pollution prevention program	X	implemented	DEP
RCRA primacy			
State Superfund	X	implemented	DEP
State RCRA program with more stringent requirements			
State septic system regulations	X	implemented	DHHR
Underground storage tank installation requirements	X	implemented	DEP
Underground storage tank permit program	X	implemented/note	DEP
Underground injection control program	X	implemented	DEP
Vulnerability assessment for drinking water/wellhead protection	X		DHHR
Well abandonment regulations	X		DHHR,DEP
Wellhead protection program (EPA-approved)	X	implemented	DHHR,DEP
Well installation regulations	X	implemented/note	DHHR,DEP

Table IV-5 continued...

NOTES FOR TABLE 5:

Ambient ground water monitoring system -
The Ground Water Program of the Office of Water Resources, Division of Environmental Protection has created and maintained an ambient monitoring network. This is described in more detail in the following section of this report. There are also various monitoring/sampling activities within the different ground water regulatory agencies per regulation requirements.

Aquifer Mapping -
Basically the aquifer mapping is based on general information and consists of ground water hydrology maps of various basins within West Virginia. These maps are delineated using 12 major basins within WV.

Comprehensive data management system -
At this time, a comprehensive data management system is being studied and has been given priority status. Due to inadequate funding, this process has moved slower than anticipated. Funding is being sought for a computer database programmer, and interim data management efforts are being considered.

Ground water best management practices (BMPs) -
Almost all the ground water regulatory agencies have developed legislation, guidance, and/or BMPs to strengthen the State ground water pollution prevention efforts. As other activities or facilities warrant the need for protection practices, legislation will be promulgated.

Ground water legislation -
West Virginia has promulgated ground water legislation as described above under "Legislation" and as mentioned in the individual agency program descriptions.

Ground water quality standards -
See under "Legislation", Table 1 - Groundwater Quality Standards.

Interagency coordination for ground water protection initiatives -
The Ground Water Program at the Office of Water Resources, Division of Environmental Protection was initiated to aid in the coordination of the various ground water activities and efforts among the State ground water regulatory agencies. The Groundwater Coordinating Committee was formed and is comprised of senior managers from the ground water regulatory agencies. The purpose of this committee is to consult, review, and make recommendations on the implementation of the Groundwater Protection Act (GWPA) by ground water regulatory agencies. The committee is authorized and empowered to promulgate legislative rules as may be necessary to implement the GWPA. The committee also reviews programs for compliance and recommends necessary changes.

Table IV-5 continued...

Underground storage tank (UST) installation requirements -
The State has adopted Federal regulations and requirements for this.

Underground storage tank permit program -
The State does not have a "permit program" per say, but rather an UST registration program.

Well abandonment regulations -
The Department of Health and Human Resources, Office of Environmental Health Services (OEHS) has responsibility for regulating water well installation and abandonment. The BPH has also established a water well driller certification program.

The Division of Environmental Protection (DEP) has regulatory responsibility for monitoring well and oil and gas well installation and abandonments. See the Abandoned Well Act under "Ground Water Regulations" section. New legislation was introduced into the 1996, spring Legislature which clarifies the obligation and responsibility of plugging a well, defines confusing terms, and establishes the orphan well plugging fund.

DEP introduced legislation into the spring 1996 legislative session concerning Monitor Well Design Standards. This rule establishes a minimum set of design, installation, and abandonment criteria for monitoring wells. DEP also administers a monitoring well driller certification program.

Wellhead protection program -
For more details, see "State Programs" in the Department of Health and Human Resources, Office of Environmental Health Services section.

AMBIENT GROUND WATER MONITORING NETWORK (AGWMN)

The Groundwater Protection Act mandates in Section 6(c)(4) that "the Division of Environmental Protection, Bureau of Public Health, and Department of Agriculture are hereby authorized:

> "To conduct groundwater sampling, data collection, analysis and evaluation with sufficient frequency so as to ascertain the characteristics and quality of ground water, and the sufficiency of the groundwater protection programs established pursuant to this article" (WV GWPA, 1991).

An ambient ground water monitoring network was thus established. The purpose and goal of the ambient monitoring network is to characterize the background quality of WV's major aquifers. With the network data, a ground water quality baseline will be established for the state. This data can then be used for comparison when ground water quality issues such as contamination and clean up arise.

The Ambient Ground Water Monitoring Network (AGWMN) was created through cooperative efforts. The Office of Water Resources received assistance from US Geological Survey (USGS) to develop the monitoring program. Sites were chosen and a sampling strategy was developed. There were some constraints set by the Office of Water Resources (OWR) in determining location of sites. The criteria used to pick sites for inclusion into the network were:

1. Areal coverage of the state
2. Coverage of WV's major aquifers- Carbonate, Non-Carbonate bedrock, and river valley alluvial aquifers
3. Selection of various land usage- agriculture, industrial, mining, forest, urban, commercial, and rural areas

4. Since funding was not available to drill new monitoring wells, existing wells with pumps and springs were used.

5. Long term, year-round accessibility and availability

In early 1993 twenty-six (26) sites spanning the state had been established to begin the AGWMN. These sites cover 25 counties and various aquifers. The idea was to sample these sites every quarter for three (3) years, then twice a year for two (2) years, then annually. As the frequency of these initial sites decreases, new site locations will be established to meet all criteria and restrictions. These 26 sites are made up of state parks and forests (10), federal fish hatcheries (4), public supply wells (9), and existing springs (3).

Parameters that are monitored in the network are volatile and semi-volatile organics, inorganics (e.g., metals), and nutrients. Water temperature, air temperature, barometric pressure, pH, conductivity and dissolved oxygen are all measured in the field. The pH, Conductivity and Dissolved Oxygen parameters are measured using a Corning Deluxe Field System water testing meter.

Table 6 lists the site names, STORET station ID codes, and the county location. Most of these sites were monitored eight times, once/quarter for the July 1, 1993 to June 30, 1995 reporting period.

TABLE IV-6: AMBIENT GROUND WATER MONITORING SITES WITH STORET ID CODES

SITE NAME	COUNTY	STATION ID
Lefevre Spring	Berkeley	GWAMBNET003-01
Follansbee Well	Brooke	GWAMBNET009-01
Fayetteville Well	Fayette	GWAMBNET019-01
Davis Spring	Greenbrier	GWAMBNET025-01
White Sulphur Springs	Greenbrier	GWAMBNET025-02
Oakland PSD	Hancock	GWAMBNET029-01
Lost River State Park	Hardy	GWAMBNET031-01
Waters Smith State Park	Harrison	GWAMBNET033-01
Harpers Ferry Spring	Jefferson	GWAMBNET037-01
Kanawha State Forest	Kanawha	GWAMBNET039-01
Chief Logan State Park	Logan	GWAMBNET045-01
Welch Water Well	McDowell	GWAMBNET047-01
Point Pleasant Well#4	Mason	GWAMBNET053-01
Chestnut Ridge Park	Monongalia	GWAMBNET061-01
Berkeley Springs	Morgan	GWAMBNET065-01
Edray Fish Hatchery	Pocahontas	GWAMBNET075-01
Cannery Lane Well	Putnam	GWAMBNET079-01
Bowden Fish Hatchery	Randolph	GWAMBNET083-01
Wallback PHA Well	Roane	GWAMBNET087-01
Pipestem State Park	Summers	GWAMBNET089-01
Sand Spring, Canaan Valley	Tucker	GWAMBNET093-01
Beall-Cortland Lane Spring	Tucker	GWAMBNET093-02
Cabwaylingo State Forest	Wayne	GWAMBNET099-01
Holly River State Park	Webster	GWAMBNET101-01
New Mantinsville	Wetzel	GWAMBNET103-01
Palestine Fish Hatchery	Wirt	GWAMBNET105-01
Parkersburg Well	Wood	GWAMBNET107-01

DATA MANAGEMENT:

In Section 6(a)(2) of the Groundwater Protection Act it states that the lead agency (Office of Water Resources) is "to develop, as soon as practical, a central groundwater data management system for the purpose of providing information needed to manage the state's groundwater program" (WV GWPA 1991).

The Act also states {22-12-2(c)(2)(vi)} that the ground water management program is to "provide for the mapping and analysis of the state's groundwater resources and coordination of the agencies involved" (WV GWPA 1991).

At this time there is no centralized database. A centralized database will serve to store all ground water data from all agencies and programs. Data from investigations, compliance monitoring, ambient sampling, etc. will be included in this database. This database will also be linked to the Geographic Information System, or GIS, which will fulfill our "mapping" obligations.

For the time being, until this database is constructed, the Ambient Ground Water Monitoring Network data has been and is being stored in an EPA water quality database called STORET (short for storage and retrieval). Data from the ambient network is readily available in LOTUS spreadsheets. There is also a LOTUS file set up to transfer data from the LOTUS format into STORET (courtesy of Florida's Environmental Quality Agency).

A Ground Water Database subcommittee was formed to tackle the issue of creating a centralized data management system. This subcommittee compiled the necessary information required for the development of an acceptable, manageable, and accessible database for all of the ground water regulatory agencies. Database needs include data fields, data field formats, retrieval and

operational needs. The subcommittee will further evaluate the database needs for each agencies' programs and evaluate the current database. A document listing modifications, additions, and deletions will be created and implemented as resources become available. Due to budgetary constraints, this process has been slow to materialize.

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PART V. WATER POLLUTION CONTROL PROGRAM

Chapter One: Point Source Control Program

The objectives of the point source control program are the control and reduction of water pollution. These objectives are met by ensuring that discharges from facilities meet the applicable Clean Water Act effluent limitations and, further, that they do not violate water quality standards.

The primary mechanism for carrying out this program is the WV/NPDES permit. The permit includes effluent limits and requirements for facility operation and maintenance, discharge monitoring and reporting.

Due to these requirements and emphasis on issuing major industrial permits, the best available technology (BAT) approach to point source control has resulted in substantial pollution reduction in all state waters, particularly in the area of conventional pollutants. It also has provided states greater latitude in requiring additional reductions in effluent loadings of these pollutants. BAT limits are generally adequate to protect water quality since the majority of major dischargers are located on large rivers which have the capacity to assimilate wastewater. Water quality on the state's large rivers has shown a gradual improvement over the past few decades.

On smaller streams, the combination of BAT and water quality-based permit limits has generally provided the greatest degree of pollutant control, particularly in relation to toxic substances.

In addition to enabling the Office of Water Resources to correct problems, state regulations contain approval procedures for proposed industrial wastewater connections to publicly owned treatment works (POTWs). This allows the Office to evaluate

proposals and require the installation of pretreatment facilities where necessary, or otherwise approve with conditions.

Each permitted facility is required to monitor its discharges and submit regular reports. These reports are reviewed and, where noncompliance exists, administrative actions are generally required. These may include warning letters, notices to comply, enforcement orders, or referrals for civil action.

The Office maintains a quality assurance/quality control (QA/QC) laboratory inspection program. This program provides a mechanism for reviewing the analytical testing procedures used by various laboratories serving WV/NPDES permittees across the State. The maintenance of acceptable QA/QC procedures is imperative to insure the analytical information submitted to the Office is accurate. During this reporting period (July 1989-June 1991) about 146 laboratories (coal, commercial, industrial, and municipal) were inspected by Water Resources personnel.

To address the discharge of toxic pollutants, the state Water Resources Board has adopted several additional numeric water quality criteria for organic constituents. These criteria supplement existing criteria for a variety of other organics and heavy metals.

Another major effort within the Office to address toxic discharges is an increase in the toxicity testing program. Testing is performed by the Program Management/Technical Support (PM/TS) Branch in coordination with the Permits Branch. This effort serves to provide toxics information as it relates to a particular discharge. The results give the permitting engineer an indication of the presence or absence of toxicity in a discharge. This has led to the reduction of toxic pollutants in the permit reissuance process, and an increased use of toxicity testing.

To date, the point source permitting program has been effective in controlling the amount of toxic pollutants discharged into state waters. Section 304(l) of the Clean Water Act requires states to list all waters that do not meet standards due to point source toxics. Currently, no streams or lakes in the state qualify for listing under Section 304(l).

The Office of Water Resources supports a field inspection staff as part of the agency's Environmental Enforcement unit. This unit is responsible for a variety of pollution control tasks. The inspectors maintain close contact with permitted facilities and conduct activities that have an immediate and long-term effect on the state's water quality.

One of the inspectors' highest priorities is the investigation of fish kills and spills. Investigations must be thorough to determine the cause and, if necessary, to carry out enforcement procedures. Typical investigation procedures include location of a source, sampling, and contacting the responsible official or company. A quick assessment of downstream drinking water intakes is made by the inspector and steps are taken to notify and protect the users. Types of spill investigations include truck wrecks, chemical accidents, and train derailments.

Routine facility inspections occupy the largest portion of the inspector's time. Inspections of permitted facilities are conducted and include solid waste, municipal and industrial facilities. Most of these are reconnaissance inspections and are performed on a regular basis. The field staff also conducts more detailed compliance evaluation inspections (CEI) where facilities' sampling and reporting procedures are checked. Activities also include inspection of open dumps (solid waste) and the initiation of enforcement actions necessary in the removal of such dumps.

When needed, enforcement action is initiated to correct problems. This may consist of a notice of violation, an administrative action, a notice to comply, or a criminal complaint. Inspectors may recommend the initiation of civil action for some pollution problems. In such cases, a recommendation is forwarded to the Attorney General's office. This type of enforcement action is very time consuming and is usually taken as a last resort.

Inspection of activities covered under the erosion control program is another important function of the field inspector. Activities related to construction and timbering sites and agricultural activities can potentially cause much soil disturbance. Unless proper erosion control measures are instituted on a site-by-site basis, soil erosion will occur causing excess sedimentation in streams and violation of water quality standards. Inspector activities in this area are closely coordinated with the PM/TS Branch's nonpoint source personnel.

Screening of complaints is conducted at the local level to determine if immediate response is needed. Complaints originate primarily from private citizens or emergency personnel such as fire departments, sheriff's departments, and state police. Serious complaints are investigated immediately and procedures are much the same as for spills.

A summary of inspector activities during the two-year report period is given in Table V-1. Inspections of coal-related and other resource extraction activities are the responsibility of the Office of Mining and Reclamation.

Table V-1

Environmental Enforcement Activities

July 1991 - June 1993

(grant commitment number in parentheses)

	Activity	Number
A.	Report:	
	- Enforcement letters and notices issued	2,396
	- Criminal enforcement actions initiated	160
	- Administrative actions recommended	26
	- Civil actions recommended	0
B.	Prepare:	
	- Reports of Investigation	179
	- Administrative Penaly Orders	138
	- Monthly prosecution reports (24)	24
	- Monthly enforcement letter reports (24)	24
C.	Investigate:	
	- Complaints	4,895
	- Spills	979
	- Aquatic life kills	79
D.	Conduct:	
	- Field reviews of permit applications	323
	- Compliance Evaluation Inspections (220)	261
	- Sewage treatment plant walk through inspections (2,660)	6,040
	- Industrial waste treatment plant walk through inspections (810)	1,641
	- Solid Waste Facilities	2,042

Chapter Two: Nonpoint Source Control Program

The Water Quality Act of 1987 mandated that states develop and implement programs for the control of nonpoint sources of pollution. With the enactment of Section 319 of the Act, new direction and significant federal financial assistance for the implementation of state nonpoint source (NPS) programs was authorized. The Act required two major reports to be prepared by the states: (1) a State Assessment Report describing NPS water quality related problems, and (2) a State Management Program explaining how NPS problems will be addressed in the future.

The Nonpoint Source Assessment Report was completed and approved by EPA during 1989. In this report, nonpoint source impacts were identified in 1,673 streams. Further land use assessments identified 29 priority watersheds with agricultural or construction activities impacting water quality and 23 watersheds impacted due to a high incidence of repeat forest fire burns.

The most imposing water quality problem is abandoned coal mine drainage. Ninety six (96) watersheds were found to be suffering from mine drainage impacts.

The Nonpoint Source Management Program Plan also was completed and approved by EPA during 1989, thereby meeting the second part of Section 319 requirements of the Water Quality Act of 1987. The management plan is composed of several stand-alone documents prepared for the categories of silviculture, resource extraction, agriculture and construction. Each management program contains objectives designed to increase industry's understanding and awareness about protecting water quality during operations. The management program's purpose is to establish the mechanisms within the infrastructure of government that can be

used to deal with the complex problem of nonpoint source pollution.

The DEP's Office of Water Resources, as the lead agency for the state's nonpoint source program, works with other cooperating state agencies to assess nonpoint source impacts, then develops and implements projects designed to reduce pollutant loads from agricultural, silvicultural, resource extraction, and construction activities. The Office of Water Resources is organized in such a way that the Clean Lakes Program, the 305(b) process, and the Ambient Water Monitoring Program are under the Nonpoint Program, which facilitates data transfer and communication among these related programs. Program initiatives are based upon education, technical assistance, financial incentives, demonstration projects, and regulation.

Under new guidance prepared by EPA for the 319 Program, grant funds are split between a Base Program and Competitive Projects designed to address specific watershed NPS problems.

West Virginia's base program supports the overall administration and coordination of the Nonpoint Source Program in the participating state agencies: Office of Water Resources (lead agency), Office of Mining and Reclamation, Soil Conservation Committee, and Division of Forestry. Update of the Management Plan this year will include urban nonpoint sources and hydromodification. There are specific activities in agriculture, construction, and silviculture funded under the base program. Following is a description of each base program component:

State NPS Program Administration and Coordination

This project funds the Program Administrator and Adminitrative Assistant, who's responsibilities include

preparing, reviewing, and approving nonpoint source pollution control plans; preparing guidelines, regulations, and policies for implementing plans; delegating program activities to state and federal agencies through negotiations of interagency agreements; oversight of other agency progress in implementing related work; providing water quality monitoring; analysis and evaluation of water quality and the impact of nonpoint source pollution through field compliance investigations.

Middle Fork River Watershed National Pilot Project and WVDEP Stream Restoration Program

This project funds the NPS coordinator, who's responsibilites include assisting in the management of the state's NPS Program for the Resource Extraction category. Major responsibilities include revising the resource extraction section of the state NPS Assessment Report and NPS Management Program Plan, and coordinating the implementation of the Resource Extraction Nonpoint Program. The coordinator will assist in writing abatement and/or prevention plans; work with other agencies involved in the NPS program regarding complaints; conduct field evaluations of ongoing projects; and manage program policy. The project workplan is intended to provide for the overall coordination and water quality monitoring support to determine both watershed-wide improvement and site-specific effectiveness of the innovative alternative AMD treatment practices.

State NPS Silviculture Program Administration and Coordination

The goal of this project is to strengthen the cooperative effort and involvement of state and federal agencies, environmental groups, forest industries, woodland owners, and the

general populace toward preventing and correcting water quality problems associated with the harvesting and processing of forest products along with problems created by hot forest fires and repeat fires which commonly occur within a ten county area in southern West Virginia.

State NPS Agriculture and Construction Program Administration and Coordination

This project supports the agriculture and construction nps coordinator, who is responsible for the state's related NPS program. The goal of this position is to improve water quality and prevent NPS impacts through activities such as implementation of BMP's, research, financial assistance and coordination with regulatory entities.

NPS Resource Management Training Center at Cedar Lakes

This project supports the continuation of an environmental resources training center that provides information on water quality enhancement to all groups of land users. Specific training sessions are available for anyone whose profession involves land disturbance activities. The facility houses a modern technology transfer center including a library of pertinent publications, videos, and samples of modern erosion control materials. The center also includes on-site demonstration plots showing properly installed erosion control materials and best management practices as well as a plant material demonstration.

Dunloup Creek Comprehensive Watershed Project

The Dunloup Creek watershed, within the demonstration area, has been developed by the state NPS Technician for a watershed

education, monitoring and restoration project. It has evolved into a cooperative effort involving many citizen groups, schools, and government agencies. Educational forums on water quality, streambank, and habitat restoration activies and monitoring by volunteers and government agencies have all been incorporated into the project. out to educate landowners about the problem of sedimentation from eroding streambanks. Various biological and mechanical streambank stabilization practices will be explained and tested.

Kanawha River Direct Drainage Watershed Project

An NPS Technician conducts workshops for contractors, developers, engineers, and landowners, instructing them on erosion control techniques. Presentations on volunteer stream monitoring have also resulted in many streams being adopted by citizens in the project area.

Big Sandy Creek Comprehensive Watershed Project

This project will focus the efforts of an NPS technician on the nutrient management issues related to dairy farming within the watershed. The primary activities will involve educational workshop training and nutrient management planning. Secondary activities will include working with AMD issues as well as erosion and sediment control.

Wheeling Creek/Tomlinson Run Watershed Project

An NPS technician conducts workshops for contractors, developers, engineers, and landowners on the topic of erosion control. Presentations by the technician on volunteer stream monitoring have resulted in many streams being adopted by local citizens.

Teays Valley/Hurricane Creek Watershed Project

An NPS technician conducts workshops for contractors, developers, engineers, and landowners on the topic of erosion control. In addition, many local citizens have adopted and are monitoring streams as a result of training conducted by the technician.

The competitive projects in West Virginia cover the categories of resource extraction, agriculture, volunteer stream monitoring, and education. Following is a description of these projects:

Kittle Flats (AMD Abatement Project)

This project funds the assessment and design work needed to develop an anoxic limestone drain for the Kittle Flats site located within the Middle Fork River Watershed National Pilot Project study area. The goal is to neutralize acid mine drainage from the site.

Volunteer Citizens Water Quality Monitoring Program

This project provides a central contact program and entity for the mobilization, training, utilization, and coordination of citizen monitoring groups. Also fosters the creation of monitoring groups and supports data QA/QC objectives.

Studies of Limestone Treatment of AMD Affected Streams

The project objective is to monitor the environmental results of new and innovative AMD treatment techniques such as limestone sanding of streams and limestone drum technology.

North & South Mill Creek Poultry & Resource Management

This project implements an information and education program for water quality issues associated with plant nutrient and pesticide usage, with particular emphasis on potential impacts to agriculture and water quality. An environmental scientist will assist in proper management of the vast amount of animal waste generated by the local agricultural community. The scientist will educate the public and provide technical assistance for erosion abatement throughout the watershed.

Lunice Creek-Poultry Production and Resource Management

Project responsibilities are same as Mill Creek Project above.

West Virginia Nutrient Analysis Facility

This project addresses the state's need for a nutrient analysis laboratory that can provide an optimum level of service and turnaround time. The facility will provide support to several ongoing Section 319 projects that deal with nutrient management. The majority of funding will be used to purchase necessary laboratory equipment. Staff and facilities have been worked out via other agreements.

Based on the need for water quality improvement, special emphasis will be placed on increasing implementation efforts in those watersheds identified in the state NPS Assessment. The Office of Water Resources and its cooperating agencies will:

> conduct intensive water quality surveys to provide baseline data

> locate and map individual nonpoint sources within the watershed

> use intensive application of existing programs to push implementation of appropriate BMP's

> conduct follow-up water quality surveys to measure the success of efforts

The process utilized for selecting priority watersheds involved several key resources. The main body of information was obtained from the 1989 West Virginia nonpoint source assessment report. Numerous state and federal government agencies, along with citizens and environmental groups participated in compiling and approving the information documented in the Nonpoint Source Assessment.

Data generated from several DEP monitoring programs that was utilized to update the NPS Assessment report was reviewed by three OWR staff members with over 40 years combined work experience in water quality monitoring. The result of the above efforts was the establishment of a prioritized listof NPS watersheds and associated sources of impairment.

Two important premises upon which the process was based are 1) that streams with relatively few nonpoint source problems, but with high potential for degradation, should be protected and 2) that streams which are currently suffering extensive harm from nonpoint sources should be addressed so that mitigative measures can be determined.

A key consideration in development of the priority list is the policy of the state of West Virginia to maintain water quality standards and designated stream uses as approved by the state Water Resources Board consistent with 1) public health and public enjoyment thereof and 2) the propagation and protection of animal, bird, fish, and other aquatic and plant life.

Nonpoint source pollutant sources are numerous and varied in West Virginia just as they are in the rest of the world. Nonpoint pollutant sources which were considered in the prioritization process include: Logging (existing), logging (potential), habitat degradation, acid mine drainage (metals), acid mine drainage (acidity), mining (potential), oil & gas extraction (existing), oil & gas extraction (potential), chemical seepage and runoff, construction activities (existing), construction activities (potential), agricultural activities (including animal feed lots, crop production, animal husbandry, and application of chemicals and animal waste to the land), state Soil Conservation District agriculture and construction priority, highway construction runoff, and acid deposition.

Other factors considered in development of the NPS priority list include: Streams which harbor endangered species or that have particularly diverse biological communities, amount of available water quality data, regional and interstate importance of the watersheds, the significance of groundwater impacts, and the presence of citizen monitoring groups interested in particular watersheds.

Table V-2 contains a list of NPS watersheds that are in the top 20 percent of watersheds threatened or impacted by nonpoint sources. This list is not static, but is subject to periodic revision as situations warrant. It is intended only as a reference for annual submittal of NPS priority comprehensive watershed projects. The watersheds themselves are not ranked in any particular order. Numbers appearing beside the watershed names are identification numbers assigned by the U.S.D.A. Soil Conservation Service. The geographical location of each watershed is provided in Figure V-1.

Table V-2. NPS PRIORITY WATERSHED LIST

WATERSHED	SUB	ACREAGE	ELOG	PLOG	HABD	AMDM	AMDA	PMIN	EOGE	POGE	CHSR	ECON	PCON	AGRA	SCAC	HWCR	ADEP	BIOS	RIIM	GRWS
S. Branch Potomac	25	218000											X	X	X				X	
Potomac Direct	17	25500										X	X	X					X	X
Potomac Direct	19	47400										X	X	X					X	X
Lower Cacapon R.	5	38300		X									X	X				X	X	
North River	6	130800		X									X	X				X	X	
Cacapon River	7	117200		X									X	X				X	X	
Lost River	8	117200		X									X	X				X	X	
Trout Run	9	30000		X									X	X				X	X	
Upper Middle Fork	52	50350	X	X				X		X				X			X	X		
Buckhannon River	53	94800	X	X				X		X				X			X	X		X
Lower Middle Fork	54	45650	X	X				X		X				X			X	X		X
Big Sandy Creek	62	48650	X	X		X	X	X		X				X		X	X		X	X
Little Sandy Ck.	64	34100	X	X		X	X	X		X				X		X	X		X	
Muddy Creek	65	100900	X	X		X	X	X		X				X		X	X		X	
Blackwater River	74	90150	X	X		X	X	X		X				X		X	X		X	
Patterson Creek	1	181250	X	X		X	X	X						X	X		X		X	
Potomac Direct	20	25200	X	X		X	X	X						X			X		X	X
Stony River	21	37250	X	X		X	X	X						X			X		X	X
Abram Creek	22	49860	X	X		X	X	X						X			X		X	
Roaring Creek	61	18750	X	X	X	X	X	X	X	X			X	X				X		X
Dunloup Creek	193	31150	X	X	X	X		X		X		X	X	X		X	X	X		
Spruce Laurel Fk.	248	84900	X	X	X	X	X	X			X	X	X					X		
Manns Creek	195	36350	X	X	X	X	X	X				X						X		
Wheeling Creek	120	88570	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	
Little Sandy Ck.	228	32450	X	X					X	X		X	X			X		X		X
Big Sandy Creek	231	86850	X	X	X				X	X		X	X	X		X		X		X
Buffalo Creek	236	72950	X	X	X	X	X	X	X	X		X	X				X			X
Blue Creek	229	50800	X	X	X	X	X	X	X	X		X	X							X
Tygart Direct	42	54300	X	X		X	X	X	X	X		X	X	X		X	X	X		X
Three Forks Ck.	43	64100	X	X		X	X	X	X	X		X	X	X		X	X	X		
Sandy Creek	44	56300	X	X		X	X	X	X	X		X	X	X		X	X	X		
Kanawha R. Direct	162	26250	X	X	X	X	X	X			X	X	X	X		X		X		X
Kanawha R. Direct	169	21850	X	X	X	X	X	X			X	X	X	X		X		X		X
Laurel Creek	47	35400	X	X		X	X	X	X	X		X	X	X		X	X	X		
Tygart Direct	48	52950	X	X		X	X	X	X	X		X	X	X		X	X	X		X
Shooks Run	59	1900	X	X		X	X	X	X	X		X	X	X		X	X	X		
French Creek	60	31400	X	X		X	X	X	X	X		X	X	X		X	X	X		
Gauley R. Direct	211	81100	X	X	X	X		X		X		X	X	X		X	X	X		X
Hominy Creek	216	66250	X	X	X	X		X		X		X	X	X	X	X	X	X		X
Muddlety Creek	217	42250	X	X	X	X		X		X		X	X	X		X	X	X		
Beaver Creek	219	24850	X	X	X	X		X		X		X	X	X		X	X	X		
Kanawha R. Direct	163	31900	X	X	X	X	X	X			X	X	X	X	X	X		X		X
Goose Creek	91	43100	X	X					X			X	X	X		X				
Hughes R. Direct	92	50450	X	X					X			X	X	X		X				
Bonds Creek	93	9450	X	X					X			X	X	X		X				
Little Kan. Dir.	113	105000	X	X				X		X				X			X	X		
W.V.Fork-Fish Ck.	126	17850	X	X	X	X	X	X	X	X	X	X	X	X		X		X	X	
PA.Fork-Fish Ck.	125	79900	X	X	X	X	X	X	X	X	X	X	X	X		X		X	X	
Lower Meadow R.	214	101300	X	X	X	X		X		X		X	X	X		X	X	X		
So.Fk. Hughes R.	96	113850	X	X					X			X	X	X		X				
Teays Valley	168	51150	X	X	X	X	X	X			X	X	X	X	X	X		X		
Old Town Ck.	150	27400	X	X	X				X	X	X	X	X	X		X		X	X	X
report total		3175480																		

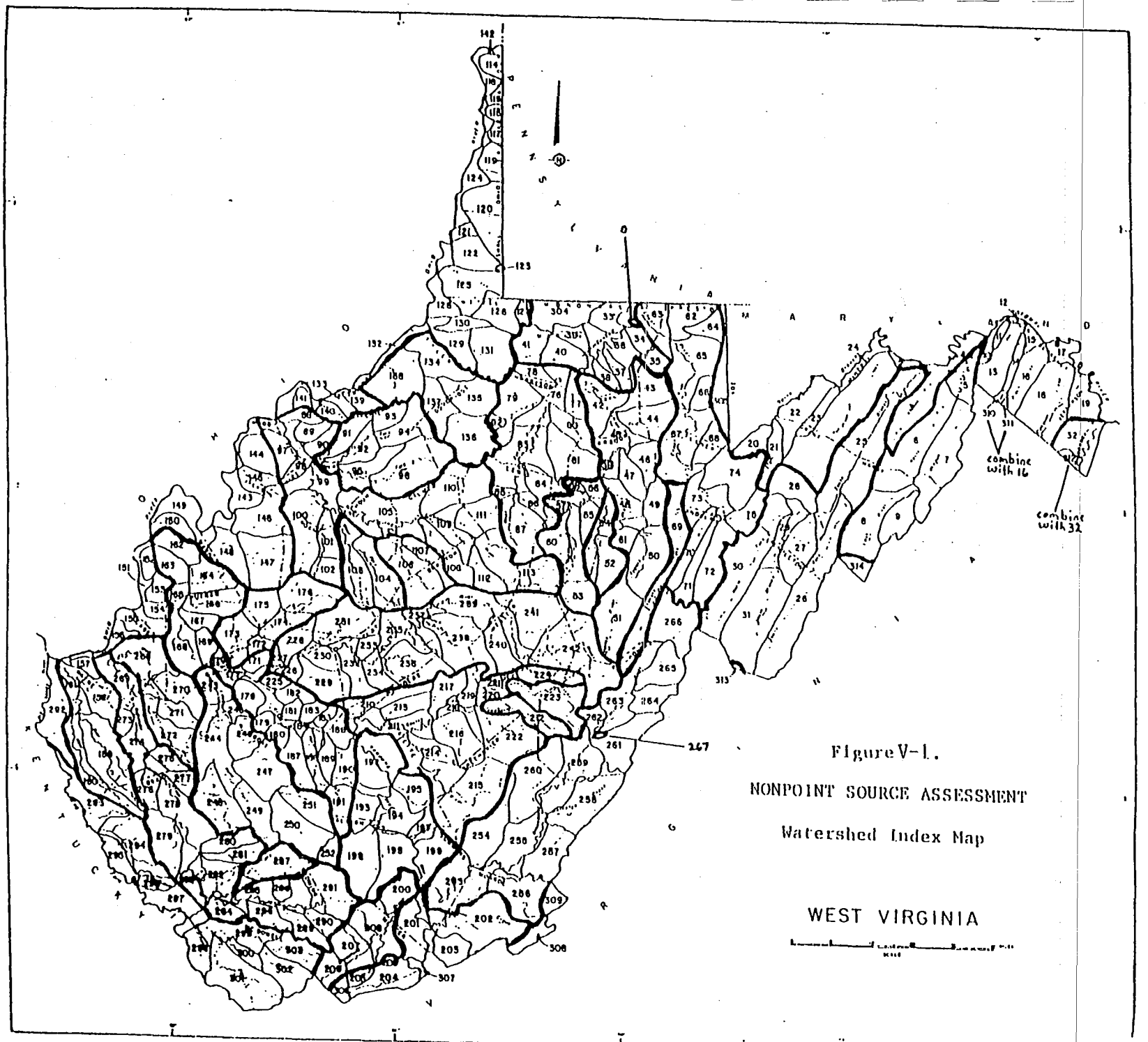

Figure V-1.

NONPOINT SOURCE ASSESSMENT

Watershed Index Map

WEST VIRGINIA

Chapter Three: Cost/Benefit Assessment

The cleanup of wastewater from municipalities and public service districts in West Virginia has progressed at a moderate pace since 1972, when the Clean Water Act was passed. Between 1972 and 1995, 229 projects were constructed consisiting of 131 treatment plants and 98 separate sewage collection systems. The total cost for all projects was more than $1 billion. EPA grants and WV State Revolving Fund loans provided more than $670 million of the total funding.

Since 1991, the EPA Construction Grants Program closeout has continued. Final closeout of all funded projects is expected to be completed by 1998. To replace the grants program, the new WV State Revolving Fund low interest loan program has been established as the primary funding source for municipal wastewater projects. Since the first loan was made in November, 1991, the SRF has committed over $80 million to 42 projects.

Another indication of progress in water pollution control is the treatment status of the state's 39 major municipal facilities (one million gallons-per day (MGD) flow or more). In 1972, 76 percent of these major facilities were not in compliance with the federal Water Pollution Control Act. Now, 38 of the 39 facilities have constructed at least secondary treatment. The remaining facility has received a grant to upgrade to secondary standards. As a result of better sewage treatment, an increase in game fish populations and recreational use has been achieved on many streams.

During the 1993-1995 reporting period, 14 sewage treatment plants were either constructed or upgraded at a total cost of $35 million. In addition, 17 sewage collection sytems were either built or renovated at a total cost of $42 million. These 31 projects mentioned above were partially funded using $35 million in

EPA grants and $42 million in State Revolving Fund loans. OWR's Construction Assistance Branch administers these two programs.

In West Virginia, the majority of water pollution control activities (permitting) are administered through various State agencies. DEP's Office of Water Resources oversees the administration and enforcement of water pollution control (NPDES) permits not related to coal mining. In addition, the office administers Section 401 (Water Quality Certification) permits, with comments provided by DNR's Wildlife Resources Section. The Office of Mining and Reclamation handles coal related NPDES permits. The Office of Waste Management issues NPDES permits associated with solid waste facilities. The state Health Department has input on municipal facilities and oversees all activities associated with home septic systems in cooperation with county sanitarians. The state Environmental Quality Board (EQB) establishes water quality standards and acts as an appellate board on some water pollution control activities. The Office of Water Resources also contributes to two interstate commissions dealing with water pollution: The Ohio River Valley Water Sanitation Commission (ORSANCO) and The Interstate Commission on the Potomac River Basin (ICPRB). Following is a breakdown of various state agency expenditures for FY-95:

Division of Environmental Protection	
Office of Administration	$ 3,391,907
Office of Information Services	1,220,015
Office of Water Resources (includes Revolving Loan Fund)	40,797,784
Office of Waste Management	21,846,580
Office of Mining and Reclamation	12,003,753
Office of Abandoned Mine Lands & Reclamation	33,476,472
Office of Oil & Gas	2,067,712
Division of Natural Resources	
Wildlife Resources Section	134,345
Bureau of Public Health (includes County Sanitarians)	3,000,000
Environmental Quality Board	113,856
TOTAL	$ 118,052,424

Improvement in the water quality of state rivers and streams has had numerous benefits, particulary for the larger rivers such as the Ohio, Kanawha, and Monongahela. In these waterbodies, a recovery of the sport fishery has coincided with an increase in other water-based recreational activities such as boating, skiing, and swimming.

The Division of Natural Resources, Wildlife Resources Section maintains figures on the economic impact of hunting and fishing in West Virginia. According to a survey conducted by the U.S. Fish and Wildlife Service and the U.S. Bureau of the Census, state anglers spent $104,329,000 for fishing in 1991. According to a report released by the Sport Fishing Institute, the total economic impact of these expenditures amounted to $178,140,000. The same report indicated that this impact maintained 3,380 jobs and generated wages amounting to $51,133,000. In addition, expenditures generated $6,260,000 in state sales taxes and $972,000 in income taxes. The DNR Annual Report revealed that fishing (and related) licenses generated $4,099,145 in 1991. Excise tax apportionment was approximately $3,500,000. In summary:

WV Tax Income	=	$ 7,232,000
DNR Income	=	7,599,145
Impact on WV Government	=	$14,831,145

Obviously, these revenues are greatly dependent upon water quality supportive of the sport fishery.

Chapter Four: Surface Water Monitoring Program

General activities of the state's surface water monitoring program include conducting compliance inspections, performing intensive site-specific surveys, collecting ambient water quality data, monitoring contaminant levels in aquatic organisms, utilizing benthic and toxicity data to assess perturbations, and conducting special surveys and investigations.

The primary function of the monitoring program is to determine whether or not state waters support their designated uses. A secondary function of the program is to determine the degree of impairment of waters that do not fully support their uses. Monitoring data are used to support the agency's permitting, enforcement, and planning activities.

General monitoring activities (ambient and mini-ambient networks, biological network, fish tissue sampling, groundwater characterization, lake assessment, and intensive surveys) are coordinated by individual programs within the Office of Water Resources. DEP's Office of Environmental Enforcement (OEE) oversees all enforcement related water pollution control activities, including complaint investigation, spill response, and compliance monitoring of NPDES dischargers.

Following is a summary of monitoring activities conducted by the Office of Water Resources. Details on benthic surveys, toxicity tests, and fish tissue sampling are contained in Appendix E.

Fish Tissue Sampling

The fish tissue sampling program is used to measure substances not readily detected in the water column, to monitor spatial and temporal trends, determine the biological fate of specific

chemicals, and when appropriate, to provide information to support human health risk assessment evaluations. During a typical year, samples for metals and pesticide analyses are collected from 20-25 sites (two samples per site, each comprised of five fish) throughout the state. As a result of the inability to obtain in-house analytical work, this program has in essence been restricted to those waters posing a threat to human health by way of fish consumption. Fish tissue sampling results may be found in Appendix F.

Ambient Water Quality Monitoring

Ambient water quality continued to be monitored monthly at 27 fixed sites (Table V-2) across the state during the reporting period. The information gathered is useful in assessing long-term trends and measuring differences between upstream and downstream stations on several rivers. Chemical constituents that are indicative of problems associated with sewage, mining, oil and gas drilling, agriculture, and several classes of industries are evaluated at each site.

The 27-site, long-term water quality network is supplemented by several other monitoring programs. The implementation of regional "mini-networks" has taken place over the past eight years. This program focuses on water quality in small streams, rather than major rivers (as with the long-term trend network), providing monthly data for a continuous 12-month period for each station sampled. Thirty-seven sites were sampled during this reporting period. Mini-network samples are usually collected by OEE field inspectors in each district where a stream has been targeted. At the end of each one-year sampling period, efforts are shifted to new streams for which recent data do not exist. Parameter coverage

Table V-3

Sample Locations
Ambient Water Quality Network

WV CODE	DESCRIPTION
LK-28	Little Kanawha R. at WV Rt. 5 bridge at Elizabeth (midstream)
K-31	Kanawha R. at Winfield Locks (near L. bank)
K-73	Kanawha R. at Chelyan bridge (midstream)
KC-11	Coal R. at Kanawha Co. Rt. 9 bridge in Tornado (midstream)
KE-004	Elk R. in outside bend about 50 yds. upstream of Coonskin Br. (L. bank)
KG-08	Gauley R. at Nicholas Co. Rt. 39/1 bridge in Beech Glen (midstream)
KN-01	New R. at C&O RR bridge, Gauley Bridge (near L. Bank)
KNG-006	Greenbrier R. at WV Rt. 3 bridge, Hilldale (midstream)
OG-3	Guyandotte R. at Cabell Co. Rt. 26 bridge, Huntington (midstream)
BST-000	Tug Fork at WV Rt. 37 bridge, Fort Gay (midstream)

Table V-3 continued...

WV CODE	DESCRIPTION
M-07	Monongahela R. at U.S. Rt. 19 bridge in Star City (midstream)
MC-32	Cheat River at WV Rt. 26 bridge, Albright (midstream)
MC-79	Cheat R. at Tucker Co. Rt. 1 bridge below Parsons (midstream)
MT-006	Tygart Valley River, Rt. 62 bridge, Colfax (midstream)
MT-091	Tygart Valley River at U.S. Rts. 219 and 250 bridge above Beverly (midstream)
MW-12	West Fk. R. at Harrison Co. Rt. 19/2 bridge off U.S. Rt. 19 in Enterprise (midstream)
PSB-13	So. Br. of Potomac R. at Hampshire Co. Rt. 3 bridge near Springfield (midstream)
S-001	Shenandoah R. at U.S. Rt. 340 bridge in Harpers Ferry (midstream)
PC-6	Cacapon R. at Morgan Co. Rt. 7 bridge near Great Cacapon (midstream)

Table V-3 continued...

Ohio River (8 locations):

Ohio River Stations are contracted to ORSANCO. These sites are all CORE stations and are spread throughout the the West Virginia portion of this major waterway; they effectively bracket several target areas influenced by major industrial complexes, municipalities, and tributaries. Locations are described below (mile points from headwaters at Pittsburgh):

Ohio R. along right bank at East Liverpool Water Works - M.P. 40.2

Ohio R. at Pike Island L & D - M.P. 84.2

Ohio R. at Hannibal L & D - M.P. 126.4

Ohio R. at Willow Island L & D - M.P. 161.8

Ohio R. at Belleville L & D - M.P. 203.9

Ohio R. at Addison, Ohio - M.P. 260.0

Ohio R. at Gallipolis L & D - M.P. 279.2

Ohio R. at Showboat Marina dock 1/4 mile upstream of WV American - M.P. 306.6

The following water quality constituents are measured at each location in the ambient network:

Temperature	Manganese
Dissolved Oxygen	Aluminum
Flow	Suspended Solids
Hot Acidity	Fecal Coliform Bacteria
Total Alkalinity	Iron
Sulfates	TKN
Conductivity	(NO2 + NO3)-N
PH	Total Phosphorus

is very similar to that for the long-term trend network except that additional metals samples are collected during the months of July, August, and September. The state believes this program provides information that is extremely valuable for use in the preparation of this report.

Biological Monitoring

Ambient biological monitoring was conducted during the reporting period on a statewide basis. The long-term biological network consists of 42 sites at which aquatic invertebrates are collected biennially (Table V-3). A number of these sites overlap with the 27 long-term chemical monitoring sites, enabling DEP to make comprehensive evaluations on many of the state's waters. This biological information is stored on EPA's mainframe in the BIOS data system.

A number of benthic (aquatic invertebrate) surveys were conducted during the period to address a variety of concerns. Sampling of this type is generally conducted upstream and downstream of a suspected influence to water quality. Changes in water quality are reflected in the aquatic community. A typical survey involves collection and identification of all invertebrates within a defined area at each sample site along with a representative water sample for chemical analyses. A habitat assessment is also performed at each site. Eighteen benthic surveys were conducted during the two-year reporting period. The majority of this work was done in support of NPDES permit issuance. The field methods utilized generally follow those outlined in EPA's Rapid Bioassessment Protocols (U.S. EPA, 1989).

Table V-4

Macroinvertebrate Sampling Stations

Basin/ WV Code	Station Location
OHIO RIVER	
0-233	Ohio River at Newell, WV
0-232	Ohio River at Pike Island L & D*
0-191	Ohio River at Hannibal L & D
0-155	Ohio River at Willow Island L & D
0-113	Ohio River at Belleville L & D
0-057	Ohio River at Addision, OH
0-037	Ohio River at Gallipolis L & D
0-012	Ohio River at Huntington, WV
0G-003	Guyandotte River at Huntington, WV
0G-034	Guyandotte River at Branchland, WV
0G-135	Guyandotte River at Wyoming, WV
LITTLE KANAWHA RIVER	
LK-015	Little Kanawha River at Slate, WV
KANAWHA RIVER	
K-02	Kanawha River at Henderson, WV
K-31	Kanawha River at Winfield L & D
K-83	Kanawha River at London L & D
KP-008	Pocatalico River at Lanham, WV
KC-11	Coal River at Tornado, WV
KE-004	Elk River at Mink Shoals, WV
KG-008	Gauley River at Jodie, WV
KN-01	New River at Gauley Bridge, WV
KN-95	New River at Glen Lyn, VA
KNG-006	Greenbrier River at Hilldale, WV
KNG-136	Greenbrier River at Cass, WV
KNB-23	Bluestone River below Brush Creek

Table V-4 continued...

Basin/ WV Code	Station Location
MONONGAHELA RIVER	
M-07	Monongahela River at Star City, WV
MC-32	Cheat River at Albright, WV
MC-79	Cheat River at St. George, WV
MCB-04-01	Blackwater River at mouth
MCB-04-11	Blackwater River at Blackwater Falls State Park
MCS-00	Shavers Fork at mouth
MW-12	West Fork River at Enterprise, WV
MT-006	Tygart Valley River at Colfax, WV
MT-023	Tygart Valley River below Tygart Lake
MT-091	Tygart Valley River at Beverly, WV
MTB-07	Buckhannon River at Hall, WV
MTM-33	Middle Fork Tygart Valley River near Adolph, WV
POTOMAC RIVER	
S-001	**Shenandoah River at Harpers Ferry, WV
PSB-013	**S. Branch Potomac River at Springfield, WV
PSB-054	**S. Branch Potomac River at Moorefield, WV
P-030-02	**Opequon Creek near Bedington, WV
PNB-076-06	Stony River near Mt. Storm, WV
BIG SANDY RIVER	
BST-000	Tug Fork River at Fort Gay, WV

* L & D = Locks and Dam.

**Phytoplankton samples also collected at site.

Black Fly Control Program

The black fly control program was initiated in the mid-1980's to control nuisance populations of these biting flies. Black fly larvae are aquatic and reside in the rapids of streams and rivers. The adults are small gnats, which must have a blood meal to become reproductively mature. The black fly populations have the highest density in the Hinton area of Summers County, where three large rivers (New, Greenbrier, and Bluestone) converge.

A bacterium called Bti (Bacillus thuringiensis isrealensis) is used to control the black flies in the aquatic larval stage. When Bti is consumed by an organism having an alkaline gut pH, a chemical reaction occurs, resulting in the destruction of the digestive tract. Few aquatic organisms beside black flies and mosquitoes have an alkaline gut pH.

Beginning in March of each year, biologists monitor streams in the Hinton area to evaluate the growth of the black fly larvae. Black flies are most active feeders during their fifth growth stage, or instar, and it is during the fifth instar that Bti application will have the greatest impact on the larvae. Biologists use such factors as larval size and stream temperature to estimate the best date for Bti application.

The Bti is applied via helicopter to fixed sites on the Greenbrier, New, and Bluestone Rivers. Water Resources biologists tell the pilot how much Bti to apply and which sites need to be treated. Since adult black flies from outlying areas can migrate into the treatment area and quickly repopulate the streams, Bti applications must be repeated throughout the summer. Typically, seventeen applications are performed between March and October.

INTENSIVE SURVEYS/SPECIAL STUDIES

Miscellaneous Mussel Surveys

In 1993, OWR personnel assisted the U.S. Fish and Wildlife Service in mussel sampling on the Ohio River. The sampling was conducted to help determine the impact of acid mine water entering the river via a tributary which had been polluted by a mine discharge operated by a subsidiary of Appalachian Electric Power (AEP).

A population of James spinymussel (Pleurobema collina) in South Fork of Potts Creek was checked several times in a continuing effort to assess the health of this endangered species. The investigation included water quality monitoring.

Water quality monitoring was conducted on Hackers Creek and Dunkard Creek in 1994 and 1995 in an effort to develop a water quality database for these two mussel refugia.

Upper Little Kanawha River Study

The headwaters of the Little Kanawha River were sampled for benthos in 1994 to complement water quality monitoring that had been conducted in 1992 and 1993. The river and its tributaries above Burnsville Lake are characterized by low alkalinity, depressed pH, low conductivity, and low temperature.

Mid-Atlantic Highlands Assessment (MAHA)

West Virginia biologists, along with counterparts in Virginia, Maryland, Pennsylvania, Delaware, and Washington D.C., participated in this study. MAHA combines a number of monitoring designs and will ultimately provide environmental assessment tools that will integrate such diverse factors as land cover, man-made impacts, and aquatic and terrestrial ecosystems so that a "hilltop to hilltop"

assessment of a given stream segment can be evaluated. These new assessment tools will ultimately result in improved environmental management. West Virginia's involvment in the field research phase of MAHA ended in 1994.

Kanawha River Lead Study

In 1994 and 1995, ambient network stations in the Kanawha River drainage were sampled for total and dissolved lead. Data from this effort may help determine sources of lead detected in previous studies.

Kanawha State Forest Watershed Monitoring

Sampling was conducted in 1994 as part of a water quality improvement project in Kanawha State Forest. BMP's are to be implemented in the Davis Creek watershed on gas well access roads, horse stable area, and trails. Monitoring is designed to characterize water quality before and after BMP's are in place.

Meadow River Wetland Complex

An extensive study of the Meadow River Wetland Complex was initiated in October 1994 to determine the biological quality of selected streams. This study was a single component of a larger assessment initiated by the WV Division of Natural Resources to evaluate the overall environmental importance of individual wetland parcels in the Upper Meadow River basin. The objective of the DEP portion of the study was to provide a baseline of data describing the status of the macroinvertebrate community and the associated habitat within the Meadow River Wetland Complex.

Twenty-one sampling stations were included in this investigation and eighteen were selected for full biological assessment. Six of the biological sampling sites were located on

the Meadow River mainstem; the remaining sites were situated on tributaries. The biological condition and habitat of each of these stations was evaluated, scored, and classified as being in good, fair, or poor condition. Fifteen of the sites exhibited good biological condition; three sites were considered to be in fair condition. Eight stations exhibited good habitat quality, nine sites were rated fair, and one site was classified as having poor habitat quality.

Monitoring Related Activities

Toxicity testing efforts continued throughout the reporting period. This work is generally conducted in conjunction with compliance sampling inspections. About 150 tests are run each year. Fathead minnows and water fleas are used for bioassay tests, which measure the degree of toxicity of effluents and/or ambient waters. In most of the tests, organisms are subjected to a 48-hour exposure period.

Performance audit inspections were conducted on laboratories that perform toxicity tests for West Virginia's NPDES permittees. The purpose of these audits is to assure that the laboratories are conducting tests according to standard EPA/State protocols, and that they are qualified for state certification. Two laboratories were audited. One of these was a new facility which was not in full operation at the time of the audit. The other was granted certification for acute testing only. Proficiency testing will be necessary before chronic testing certification can be granted.

LITERATURE CITED

Plafkin, J.L., M.T. Barbour, K.D. Porter, S.K. Gross, R.M. Hughes. 1989. Rapid Bioassessment Protocols for Use in Streams and Rivers. EPA-444/4-89-001. U.S. Environ. Prot. Agency, Washington, D.C.

Chapter Five: Special State Concerns and Recommendations

Special State Concerns

Following is a list and description of the state's major concerns regarding water quality and pollution control.

A. Abandoned Mine Drainage

Drainage from abandoned coal mines continues to be a serious water pollution problem throughout West Virginia. Mine drainage not only renders receiving streams useless by acidification, but also may be a source of toxic metals, sulfates, and other pollutants. This problem is most severe in the Monongahela River Basin, for which assessment reports have been prepared for the Monongahela River mainstem (1985), West Fork River (1983), Tygart Valley River (1982) and Cheat River (1981). The State's 1989 Nonpoint Source Assessment indicates that a minimum of 484 streams totaling 2,852 miles are affected by mine drainage. Approximately 1,900 of these stream miles are affected by low pH. Abandoned mine drainage is undoubtedly the most serious water quality problem facing the State.

West Virginia realizes the solution to this problem is both complex and extremely costly. Unfortunately, the state cannot single-handedly address this problem due to the magnitude of the reclamation costs involved. A great deal more could be accomplished through improved interagency cooperation, chiefly among the DEP, federal Office of Surface Mining (OSM), and U. S. EPA.

Significant progress has been made, however, with the recent reauthorization of the Surface Mining Control and Reclamation Act (SMCRA). OSM is now making an effort to address water quality concerns by setting aside 10 percent of the annual AML grants for water quality improvement projects. The state believes this is a

step in the right direction, although it may not completely address the pervasive problem of water quality degradation from abandoned mine lands.

B. Lack of Domestic Sewage Treatment

The majority of the state has progressed in the construction of sewage treatment plants with the aid of the Construction Assistance Program. However, the southwest portion of the state, (mainly the Guyandotte and Big Sandy/Tug Fork basins), is significantly lacking adequate sewage treatment facilities, and therefore suffers major stream impairment. These impacts are especially evident in many small streams that have very little waste assimilitive capacity.

The Office's Guyandotte River Basin Plan (1987) found that 86 (20 percent) of the streams surveyed were in violation of the state water quality standard for fecal coliform. This problem is of even greater magnitude in the Big Sandy/Tug Fork Basin, as 77 (35 percent) of the streams surveyed in 1986 were reported in violation of the fecal coliform standard. This data is corroborated by the ambient water quality data collected by the Office during this reporting period. The Guyandotte River at Huntington violated the fecal coliform standard in 81 percent of the samples collected. Likewise, the Tug Fork River at Fort Gay displayed a 62 percent violation frequency. In both of these basins, the primary source of the problem is the direct discharge of untreated domestic sewage into the streams. The improper disposal of domestic sewage also is evident in other river basins in the state. One alarming example is presented in the ambient monitoring data from the West Fork River at Enterprise, which displayed fecal coliform violations in 92 percent (22 of 24) of the samples taken during this reporting period. Other ambient network streams with fecal coliform

violations occurring on a regular basis (i.e., > 25 percent) include the Tygart Valley River above Beverly (58 percent), Coal River at Tornado (50 percent), and Kanawha River at Winfield Locks and Dam (29 percent).

In addition to the above streams, several tributaries of the New River within the boundaries of the New River Gorge National River have been found to regularly violate the state fecal coliform standard. Sewage from these areas also is apparently having an impact on water quality in the New River mainstem, as several mainstem sites have been found to frequently violate the fecal coliform standard.

This sewage contamination is expected to continue due to the extremely depressed economy in certain counties of the state. The problem also will be compounded due to the discontinuation of EPA's grants program for sewage treatment facilities. In an effort to make money available for such construction, the state has developed a revolving loan program to provide assistance for the construction of sewage treatment facilities. This loan program is administered by the Office's Construction Assistance Branch. It is essential that the state appropriate the annual matching funds necessary for the operation of this low or zero interest loan program.

C. Lack of Land Use Policies

Most counties in West Virginia have no formal plans that address the accommodation of future development. The lack of such planning is of particular concern in the state's eastern panhandle (Potomac River drainage). Several counties in this area are experiencing rapid growth as a result of "urban sprawl" from the Washington, D.C. area. During development of an area, consideration must be given not only to the proper treatment of

municipal and industrial wastes, but also to the waste assimilative capacities of receiving waters. Development of areas in small watersheds, therefore, must be given additional consideration due to the low assimilative capacities of these streams. Over-development, if allowed, can obviously create severe water quality problems. Potential groundwater contamination also must be considered, particularly in areas of karst geology present in this part of the state.

The Office of Water Resources is continually confronted with questions regarding land use in the issuance of permits. Therefore, the Office is of the opinion that the creation of a planning strategy for the development of these areas should be highly prioritized by local and/or county governments in order to assure the maintenance of high quality water.

D. Sludge Management

Sludge management and disposal from municipal facilities is currently addressed by the Office of Water Resources sludge management program. Municipal facilities with approved sludge management programs receive authorization to dispose of sludges through transport to permitted landfills, incineration at permitted facilities, or land application. Of the approximately 135 facilities that have sludge disposal needs, 120 have received approval under the program. Language in the NPDES permit requires the permittee to use sludge disposal methods approved by the Office Chief. Those facilities currently operating without an approved sludge management program will be addressed under the administrative procedures provided in the NPDES program.

Municipal facilities approved for land application are providing a beneficial resource to the landowners who choose to accept the material and use it according to established guidelines.

Sewage sludge is a great additive for soils and provides a source of nutrients for the crops that grow on them. Sludge applied to fields can provide a portion of the nitrogen and phosphate that crops and forages need. Because sludge is primarily organic matter, sludge additions improve the soil's aeration, fertility, and water-holding capacity. Research has shown that sludge is actually better than commercial fertilizer for increasing crop yields.

The Office of Water Resources will continue to promote this disposal option as an environmentally acceptable method, in addition to providing a low cost alternative to soil additives and fertilizers.

E. Licensing of Hypdropower Projects

The Federal Energy Regulatory Commission (FERC) issued licenses for 16 hydroelectric projects on the Monongahela, Allegheny, and Ohio rivers on September 27, 1989. The Order issuing the licenses was the outcome of the FERC Environmental Impact Statement (EIS), FERC Docket No. EL85-19-114.

The State natural resources agencies in West Virginia, Ohio and Pennsylvania, the U. S. Fish and Wildlife Service, U. S. Environmental Protection Agency, Ohio River Valley Water Sanitation Commission, as well as others, provided on-going comments and recommendations during the EIS proceedings, including the initial scoping sessions. The draft and final EIS were released for review in May and October of 1988, respectively. The West Virginia Division of Natural Resources (WVDNR) subsequently responded to each with filings of lengthy comments/recommendations regarding fish, wildlife and recreational impacts as well as objections related to water quality. Additional recommendations and or responses regarding water quality and/or fish and wildlife issues

were submitted to FERC on three separate occasions (January, May, and August) in 1989. While some fishery recommendations were accepted, in each instance FERC failed to adopt an approach that would address all of the outstanding concerns and comply with applicable State law (i.e., at a minimum, water quality standards and state certification regulations).

As a result of the FERC licensing action of September 27, 1989, which failed to include WVDNR recommendations, a formal petition was filed with FERC on October 27, 1989, requesting a rehearing of the licensing action. Further, WVDNR filed a similar rehearing petition for each of the eight projects located within the State's border. In addition to the rehearing request, WVDNR asked for a stay of the licenses until such time that the rehearing and other outstanding issues are resolved.

FERC reviewed and denied the request for rehearing of the licenses on June 5, 1990. In August 1990, the states of West Virginia and Pennsylvania, the U.S. Department of Interior, American Rivers, and Friends of the Earth subsequently filed petitions with the U.S. Court of Appeals for the District of Columbia requesting review of the FERC Order. As of the end of this reporting period, federal court action was pending.

Should the petitions not result in amendment of the present licenses, the following are potential consequences of the development and operation of the hydropower projects:

1. Reduction of dissolved oxygen concentrations throughout the Upper Ohio River Basin.
2. Violation of West Virginia's Anti-degradation Policy requiring the maintenance of existing DO (dissolved oxygen) concentrations.
3. Limitation or decline in the attainment of National Water Quality Goal Uses including:

a. Public Water Supply
b. Water Contact Recreation
c. Propagation and Maintenance of Fish and Aquatic Life

4. Reduction in wasteload assimilative capabilities of the Ohio and Monongahela rivers in West Virginia.

5. Revision of present municipal and industrial wasteload allocations in river reaches where an allocation would result in a violation of the State and EPA mandated water quality standard of 5.0 mg/L for DO.

6. Denial of NPDES permits requiring wasteload allocations in river reaches where an allocation would result in a violation of the State and EPA mandated water quality standard for DO.

7. Limitation of future economic and industrial development in the Upper Ohio River Basin.

F. Monitoring Programs

Many of the Section's water quality monitoring programs have had to be scaled back due to insufficient funds and/or shortages in manpower. For example, the state routinely monitors only 27 sites as part of its ambient chemical monitoring network. This provides very limited coverage on a statewide basis, considering there are more than 9,000 streams in West Virginia totalling over 32,000 miles. Stream and groundwater monitoring are crucial for gauging the effectiveness of the state's water pollution control programs. The importance of an adequate monitoring program cannot be overemphasized.

G. Agricultural Development in Karst Regions

Agricultural development, particularly poultry farming, has increased dramatically in the state over the past few years. This development presents special problems in regions of the state characterized by karst geology, such as the Potomac and

Greenbrier River valleys. Potential problems that may stem from unchecked agricultural development are nutrient and bacterial contamination of both surface and groundwater.

Recommendations

Following is a list of recommendations concerning water quality issues of great importance to the state.

A. Nonpoint Sources

Nonpoint source pollution is a major problem affecting the state's waters. The extent and impact of this type of pollution has been documented in numerous water quality reports. EPA has responded to the nonpoint source problem through Section 319 of the CWA, as amended. This was an important step in addressing the nonpoint source pollution problem. EPA, along with other federal, state, and local agencies should continue its interest and involvement in the nonpoint program.

An active program addressing and correcting water quality problems from abandoned mines should be a top priority for implementation. Other important NPS problems that will require a concerted effort to address are erosion and sedimentation, agricultural runoff, and oil and gas impacts. The state Nonpoint Source Assessment (August, 1989) may be referenced for specific concerns.

A statewide erosion and sediment control law would be very beneficial in helping to control siltation, perhaps the most pervasive of all water quality problems. Agricultural pollution is becoming a major problem in certain areas of the state, particularly the Potomac and Greenbrier River valleys, where a burgeoning poultry industry threatens both water quality and quantity. This particular problem should be addressed through NPS

programs covered by the various state and federal agricultural and soil conservation agencies. Impacts from oil and gas exploration can be minimized with an effective permitting and enforcement program administered by the newly created state Office of Oil & Gas.

B. Boundary Waters

Boundary or interstate waters present difficult and somewhat unique problems for permit writers to address. Waters that form territorial boundaries between states obviously have the potential to receive waste water from both states. This is especially true for larger, more industrialized waters such as the Ohio River.

In West Virginia, permit allocations for the total daily load from a facility are based on a seven-day low flow, 10 year return frequency (7/Q/10) situation. Other states may also use this flow regime as a basis for issuing permits. In deriving wasteload allocations for these waters, discharge information from adjoining states apparently is not used or is not available for consideration. This presents the possibility of overallocating some wastes for the receiving stream. Such is the case with the Ohio River in West Virginia. The Ohio is a major stream which displays levels of concern for various toxic and conventional pollutants. Second round WV/NPDES permits have, for the most part, been issued with Best Available Technology/Best Professional Judgement (BAT/BPJ) controls. Wasteload allocations utilizing TMDL's (total maximum daily load) have not been developed for any of West Virginia's waters. While existing permitting practices adequately address wasteloads for waters totally within state boundaries, concern does exist for border waters possibly receiving excessive amounts of pollutants due to an adjacent state's independent permitting actions.

This is a problem which cannot be solved at the state level. EPA must take the lead in resolving interstate concerns about border waters in order to meet wasteload allocations for these waters and to ensure that states do not work independently on permit issuance. EPA is encouraged to utilize existing interstate agencies or commissions, such as ORSANCO for the Ohio River, to facilitate this need.

C. Establishment of Human Health Risk Criteria

The need to establish human health risk criteria for substances known to pose a human health threat, and guidance for criteria use in water quality management, is imperative. The establishment of these criteria and guidance cannot be achieved at the state level. As an example, an effort to establish a policy for risk assessment guidance for fish consumption was made by ORSANCO and its member states during the 1990 reporting cycle. Unfortunately, this policy development proved unsuccessful. In establishing these criteria, consideration must be given to situations such as interstate waters (discussed above) and multi-media (air and water) exposure for some compounds.

West Virginia utilizes risk criteria at the 10 to the minus 6 (1 in 1 million) level in developing discharge limitations for suspected and/or known human carcinogens based on a seven-day, 10 year return frequency low flow (7/Q/10) event. The state Environmental Quality Board is considering adopting the use of flow based on a harmonic mean for future permitting of these carcinogens. The use of the harmonic mean (as opposed to the 7/Q/10 flow) is currently utilized by a number of states and gives long-term consideration for carcinogen exposure in water quality management.

The need to emphasize the utilization of risk-related criteria among states appears obvious. Therefore, EPA, FDA (Food and Drug Administration) and other federal agencies should not only take the responsibility of establishing these criteria on a national or regional level, but also ensure their implemention.

D. Watersheds Impacted by Mining

In the 1988 305(b) report, a recommendation concerning the protection of fragile watersheds was made. Special concern was expressed for the Stony and Buckhannon River watersheds. Both the Buckhannon and Stony River watersheds are characterized by coal seams associated with geologic strata that are acidic and laden with heavy metals. Based on the water quality impacts and frequent fish kills experienced, it is obvious that proper control of mine drainage is difficult to achieve in these areas, even with best available technology. Therefore, it is recommended that these watersheds be given special attention toward addressing these impacts. This action would not only alleviate some immediate concerns, but also would help assure that West Virginia's existing water quality problems associated with mine drainage will not be compounded in the future.

E. Water Quality Monitoring

Development of a statewide monitoring strategy should be a priority for the following programs: Nonpoint Source, Clean Lakes, Groundwater, Ambient and Mini-ambient, and Biology. Increased funding should be made available to the state so that it can adequately monitor and assess its surface and groundwater resources.

F. Citizen Monitoring

Volunteer water quality monitoring has become a very popular activity in West Virginia and has been an important tool for

increasing the environmental awareness of the state's citizens. This activity needs to receive the continued logistical and financial support from both EPA and the state, as such support is critical to the program's success.

STATEMENT OF POLICY REGARDING THE EQUAL OPPORTUNITY TO USE AND PARTICIPATE IN PROGRAMS

It is the policy of the West Virginia Division of Environmental Protection to provide its facilities, accommodations, services, and programs to all persons without regard to sex, race, color, age, religion, national origin, or handicap. Proper licenses/registration and compliance with official rules and regulations are the only sources of restrictions for facility use or program participation. Complaints should be directed to: Director, WV Division of Environmental Protection, 10 McJunkin Road, Nitro, West Virginia, 25143-2506.

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