WEST VIRGINIA
Division of Environmental Protection

An Ecological Assessment of **The Northern Upper Ohio River Watershed**

Office of Water Resources

An Ecological Assessment of the

Northern Upper Ohio River Watershed

WEST VIRGINIA
Watershed Assessment Program

An Ecological Assessment of the Northern Upper Ohio River Watershed, West Virginia - 1996

prepared by

Watershed Assessment Program

Office of Water Resources

West Virginia Division of Environmental Protection
1201 Greenbrier Street, Charleston, WV 25311

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Summary

Assessment teams visited a site near the mouths of all 36 named streams in the Northern Upper Ohio River watershed (USGS HUC # 05030101) during February and May, 1996. On site, they recorded qualitative observations of man-caused disturbances and other landuses, streamside and instream habitat conditions, and obvious indicators of water quality. Selected physical, chemical, and biological indicators of water quality were measured quantitatively either on site or in the laboratory.

Two-thirds of the sites were discharging water with concentrations of fecal coliform bacteria that exceeded the standard for safe water-contact recreation. The following 5 sites yielded the highest unsafe levels: Holbert Run, Kings Creek, Turkey Foot Run, Langfitt Run, and Marks Run. Herron, Deep Gut, Parmar, Ebenezer, and Alexanders runs had the lowest safe counts.

Measurements of pH and dissolved oxygen concentration at all 36 sites met the water quality standards.

All sites were evaluated by comparing them to a reference site within the watershed in 2 ways: (a) the degree to which the site's habitat supported designated uses and (b) the intactness of its bottom-dwelling animal community. Three sites contained habitats that fully support their designated uses and support nonimpaired benthic communities: White Oak Run, North Fork, and Kings Creek; while 3 sites had severely impaired communities: Allegheny Steel Run, Harmon Creek, and Deep Gut Run.

The reasons why individual sites were healthy or degraded varied among streams.

With regard to the state's 303(d) list of water quality limited streams, the Program recommends the following actions: retain Harmon Creek, study Alexanders and Sappingtons runs for possible deletion, and add Deep Gut and Allegheny Steel runs.

Acknowledgements

Funding for this watershed assessment was provided by the US Environmental Protection Agency's 319 and 104(b)(3) programs and by the WV Division of Environmental Protection. James Harvey, Superintendent of Tomlinson Run State Park, and Roger Pauls, Inspector in DEP's Northwest Region, reflected on the health of various streams. Brenda Fullick, staff writer at the *Herald-Star,* Steubenviile, Ohio provided Chuck Saus' photographs. River Network graciously shared Sarah Lauterbach's watershed drawing. DEP's TAGIS unit generated the maps. Jim Adkins entered our data into STORET. During this project, the Watershed Assessment Program's staff consisted of Patrick Campbell (manager), Michael Arcuri, Jeffrey Bailey, George Constantz (lead author of this report), Alvan Gale, Karen Maes, Michael Nowlin, Michael Puckett, Janice Smithson, Charles Surbaugh, Michael Whitman, John Wirts, and Douglas Wood. Thanks to all.

Watersheds and their Assessment

Let's start with a bit of history. In 1959, the West Virginia Legislature created the State Water Commission, predecessor of today's Office of Water Resources (OWR). The OWR has since been charged with balancing (a) the human needs of economic development and water consumption and (b) restoring and maintaining the quality of the state's surface and ground waters.

At the federal level, the U.S. Congress enacted the Clean Water Act of 1972 and subsequent amendments to restore the quality of our nation's surface waters. For 25 years, the Act's National Pollutant Discharge Elimination System (NPDES) has stimulated reductions in pollutants piped to surface waters. There is a broad consensus that, because NPDES permits have reduced the amounts of contaminants in point sources, the water quality of our nation's streams has improved significantly.

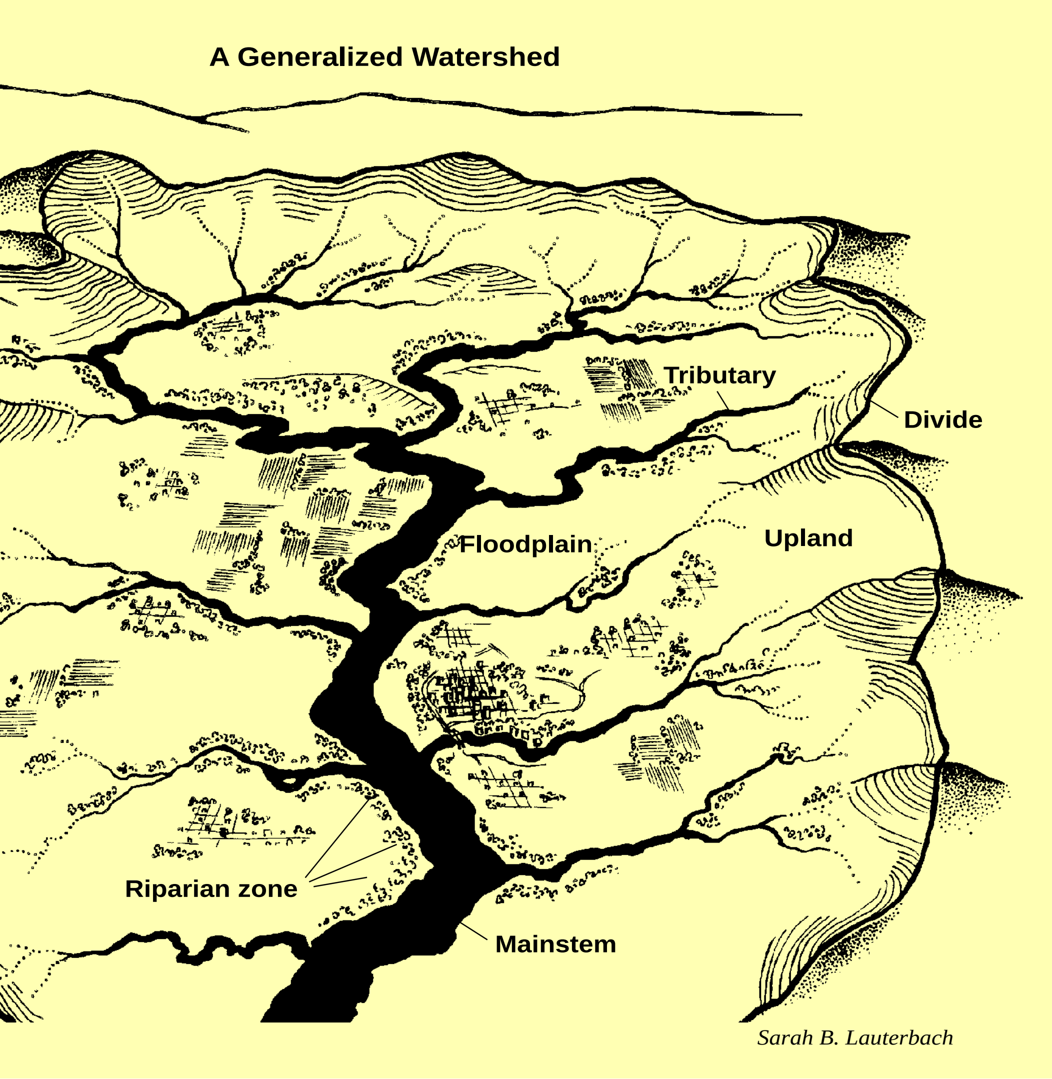
Each state was given the option of managing the NPDES process within its borders. In 1982, West Virginia assumed this primacy and charged its Water Resources Board [renamed the Environmental Quality Board (EQB) in 1994] with developing water quality criteria for each kind of designated use (see box). The

Designated Uses - uses specified in the water quality standards *(Code of State Regulations Title 46, Series 1)* for each water body or segment whether or not they are being attained. Unless otherwise designated by the regulations, at a minimum all waters of the State are designated for the propagation and maintenance of fish and other aquatic life and for water-contact recreation. Other designated uses include public water supply, agriculture and wildlife uses, and industrial uses.

EQB's anti-degradation policy charges the OWR with maintaining surface waters at sufficient quality to support each stream's highest designated use.

Even with significant progress, by the early 1990s, many streams were still not supporting their designated uses. Consequently, environmental managers began looking beyond point sources, and started evaluating pollutants flushing broadly off the landscape. Recognizing the negative impacts of these non-point sources (NPS) of pollution, which do not originate at clearly identifiable points, was a conceptual step that catalyzed today's holistic watershed approach to improving water quality.

In West Virginia, the current approach to watershed management started in 1993, when the state government's executive branch received a U.S. Environmental Protection Agency (EPA) wetlands grant to develop a strategic plan for managing its watersheds. That planning process



was overseen by an interagency team of two officials from each of three state agencies (divisions of Parks & Tourism, Natural Resources, and Environmental Protection).

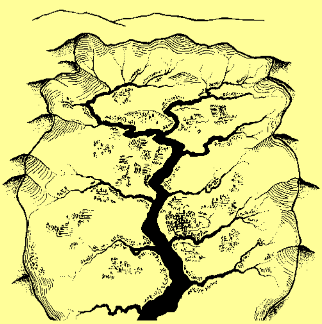
West Virginia's Watersheds

Currently, a variety of watershed projects are being implemented by several DEP units, including the Watershed Assessment Program (herein referred to as the Program). Located within the OWR, the

Program consists of 12 scientists charged with evaluating the health of West Virginia's watersheds.

The Program uses the U.S. Geologic Survey's 8-digit hydrologic units to divide the state into 32 watersheds (see map). Some of these watershed units are entire stream basins bounded by natural hydrologic divides (e.g., Upper Guyandotte River watershed). Other watershed units were delineated for manageability: (1) clusters of small tributaries that individually drain directly into a larger mainstem stream (e.g., Potomac River direct drains watershed) and (2) the West Virginia parts of interstate basins (e.g., Tug Fork watershed). A goal of the Program is to assess each watershed unit every 5 years, an interval coinciding with the reissuance of NPDES permits.

A watershed can be envisioned as an aquatic bush, a system of upwardly branching, successively smaller streams. An ideal watershed assessment would document changes in the quality of water flowing down every stream, at all water



Watershed - In several dictionaries, the first definition of "watershed" is the divide between adjoining drainage areas. In this report, though, watershed is defined as all the land surface that drains water to a specific point. For example, the Paint Creek watershed includes those parts of Raleigh, Fayette, and Kanawha counties from which water drains to the mouth of Paint Creek at its confluence with the Kanawha River.

levels, in all seasons, from headwater reaches to the exit point of the watershed unit. Landuses throughout the watershed would also be quantified. However, this approach is prohibitively expensive.

Instead, the Program assesses a watershed's health via the general stategy of evaluating the condition of as many of its streams as possible, as close to their mouths as possible. The sampling strategy can be broken into several steps:

- The names of streams within the watershed are retrieved from EPA's waterbody system database (EPA 1995).
- Assessment teams visit as many named streams as possible.
- Assessment teams sample as close to the streams' mouths as allowed by road access.

When the list of potential sampling sites must be pared, the less accessible sites are dropped. To evaluate trends in water quality, the Program tries to sample sites that have been previously assessed. The Program has scheduled each watershed for study during a particular year of the 5-year cycle. Advantages of this pre-set schedule include: (a) synchronizing study dates with permit cycles; (b) ease of adding stakeholders to the information-gathering process; (c) insuring assessment of all watersheds; (d) buffering the assessment process against special interests; and (e) improving OWR's ability to plan.

In broad terms, the Program assesses watersheds in 5 phases:

Phase 1 - For an initial cursory view, the Program's assessment teams sample many of a watershed's streams for indicator parameters.

Phase 2 - Combining pre-existing information, new Phase 1 data, and stakeholders' input, the Program produces a list of streams of concern.

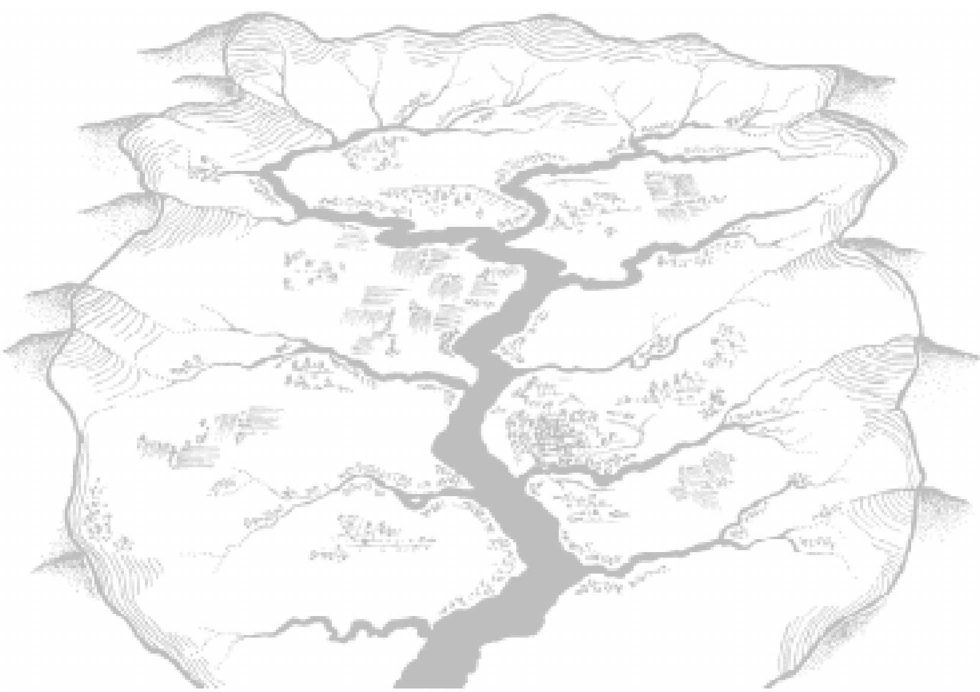
Phase 3 - From the list of streams of concern, the Watershed Approach Steering Committee develops a smaller list of priority streams for more detailed, intense study.

Phase 4 - Depending on the situation, teams within or outside the Program (e.g., USGS, private consultants) intensively study the priority streams.

Phase 5 - The Program issues recommendations for improvement; if applicable, develops total maximum daily loads (see box on page 9)

and amends the state's 303(d) list of water quality limited streams; and provides data to local watershed associations and citizen monitoring teams.

This document, which reports Phase 1 findings, has been prepared for a wide variety of users, including elected officials, environmental consultants, teachers, and natural resources managers.



Total Maximum Daily Load - the total volume of a particular pollutant allowed to enter a waterbody. The term "total maximum daily load" (TMDL) originates in the Clean Water Act, which requires that degraded streams be restored to their designated uses.

The TMDL process involves biennially preparing a 303(d) list. Prior to adding a stream to the list, technology-based controls (TBC) must have been implemented or it must be concluded that even after implementating TBCs a waterbody would not meet its designated use. West Virginia's 1996 303(d) list includes 51 streams on the primary list and 469 on a sublist of smaller waterbodies affected only by acid mine drainage.

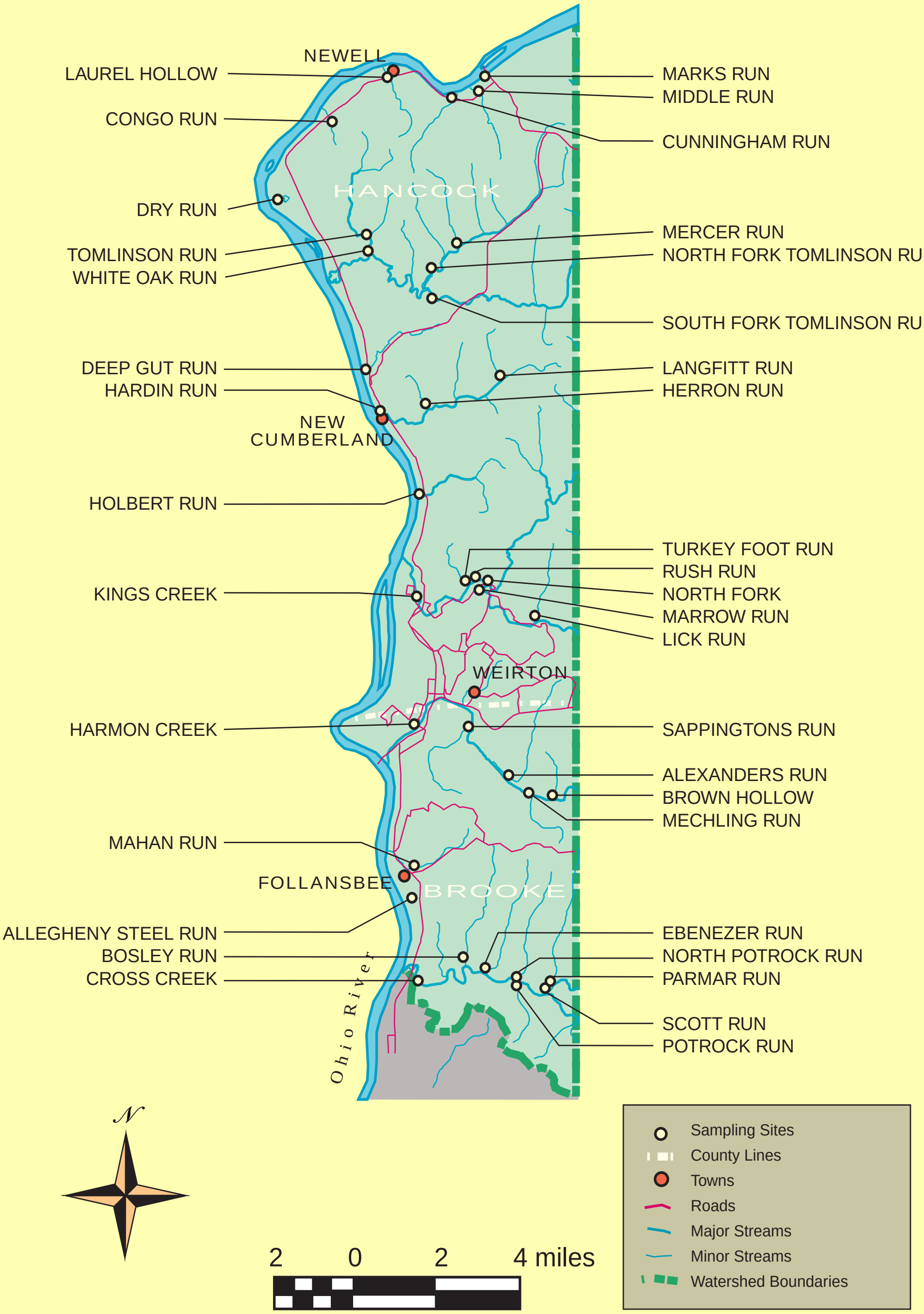
Mathematically, TMDL is the sum of the allocations of a particular pollutant from point and nonpoint sources, plus a margin of safety. Restoration begins by calculating a TMDL, which involves several steps:

- define when a water quality problem is occurring (e.g., at what flow regime)
- calculate how much of a particular contaminant a waterbody is capable of assimilating and still meet water quality criteria
- allocate the total load to point and nonpoint sources
- implement pollution reduction controls to meet designated uses.

The Watershed Assessment Program was designed in part to determine whether a waterbody belongs on the 303(d) list. In some cases, this can be determined readily, e.g., a stream without benthic life because of AMD. Most waterbodies are more difficult to place on the list, though, because of data that are conflicting, lacking, too old, or of questionable quality. In general, if more than 25% of the samples in an adequate, valid data set violate the state water quality standards for any parameter, that waterbody should be placed on the list. Again, TBCs should be considered in the decision.

The Program's Phase 1 screening process provides a fresh start for making decisions on listing. A broader interagency process, the West Virginia Watershed Management Approach, enables diverse stakeholders to collectively decide which waterbodies will be studied more intensively for possible 303(d) listing.

The Northern Upper Ohio River Watershed



Maps courtesy of *TAGIS - Technical Applications and Geographic Information Systems*, West Virginia Division of Environmental Protection

Chuck Saus

The Northern Upper Ohio River Watershed

The Ohio River flows southwesterly along the western edge of West Virginia, forming the Ohio-West Virginia border from Pennsylvania to the mouth of the Big Sandy River in Wayne County, WV. The West Virginia portion of the Ohio River basin lies primarily in the Appalachian Plateau physiographic province, which is characterized by steep slopes, deeply incised streams, and narrow valleys. The majority of the rocks are shale, sandstone, siltstone, limestone, and coal. The Ohio River Basin Plan (DNR 1988) provides more details of the area's topography, climate, population, minerals and raw materials, forest, agriculture, water resource developments, transportation and utilities, recreation, and economy.

Located in the northern tip of West Virginia's northern panhandle, the Northern Upper Ohio River Watershed (hydrologic unit # 05030101, hereafter called the Watershed) is a circumscribed cluster of tributaries flowing through Hancock and Brooke counties directly into the Ohio River. The headwaters of many of these streams lie in Pennsylvania. Within West Virginia, this Watershed is about 20 miles long (north-to-south) by 4.5 miles wide (east-to-west).

One of West Virginia's most industrialized areas, the Watershed includes chemical and steel production, as well as coal mining. Many of the streams are polluted by both domestic and industrial discharges. The Watershed has 60 NPDES discharge permits (Table 1).

The Watershed contains some streams that are notably healthy and others that are highly degraded. High quality streams provide significant, even irreplaceable, resources for fish and wildlife, and for recreational users (DNR 1986). Assessment teams studied the following 3 high quality streams :

Cross Creek
Kings Creek
Tomlinson Run.

Within this Watershed, 1 stream, shown below with its stressors, is on the 1996 303(d) primary list (DEP undated a):

Harmon Creek - high temperature, high iron;

while 3 streams appear on the 303(d) sublist for AMD (DEP undated b):

Sappingtons Run
Alexanders Run
Deep Gut Run.

Assessment team biologist sampling benthos in Tomlinson Run


photo by Chuck Saus

Assessment Methods

Given its charge and resources, the Program's scientists have chosen a specific combination of physical, chemical, and biological indicator variables to evaluate stream health.

The sample of bottom-dwelling animals is the centerpiece of each site's assessment. This is because the benthic community reflects water quality and habitat conditions over an extended period

Chuck Saus

The Stream Assessment Form

before the site visit. Other parameters, like chemical concentrations, though complementary, indicate instantaneous conditions. A recent pollution spill, for example, may not be revealed by water sampling but would be reflected by the benthos.

Following a specific protocol, detailed in the Program's "Stream Assessment Form" (Table 2), field teams of 2 people each evaluated the health of each of the watershed's 36 named streams (Table 3) during 26 Feb and 22-26 May 96. All fields of all 8 pages of the form were filled out at each study site, which was a reach 100 meters long.

Appendix 1 provides details of materials and methods, including field methods, laboratory analytic procedures, animal identifications, and data management.

To evaluate the health of a stream site, assessment teams recorded data of several categories, including man-caused disturbances and other local landuses, habitat conditions, and water quality. In terms of water quality, the Program studied a variety of physical, chemical, and biological indicators. This report first focuses on the biological findings, then uses observations in the other categories to help explain the biological results.

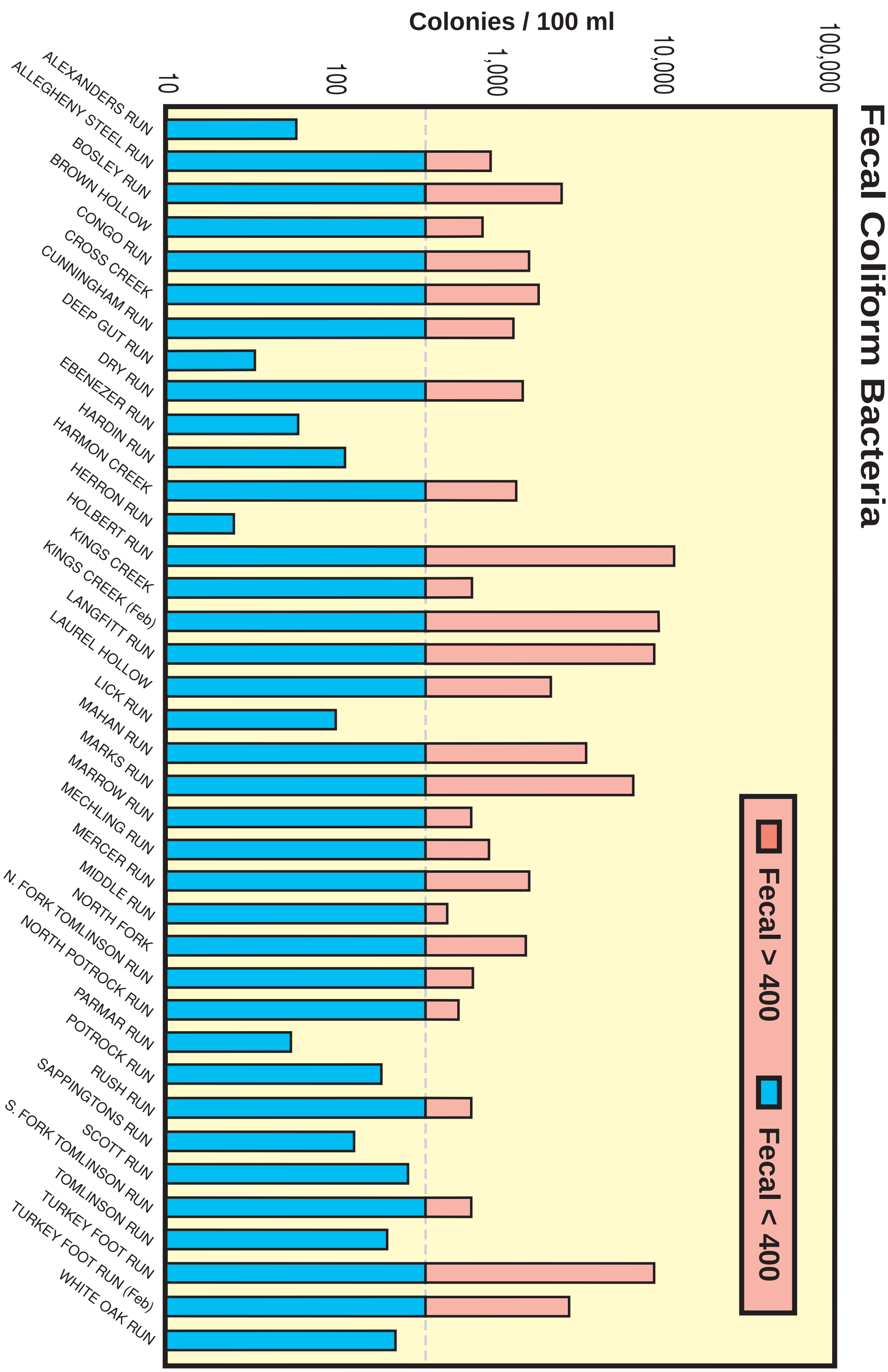
Findings

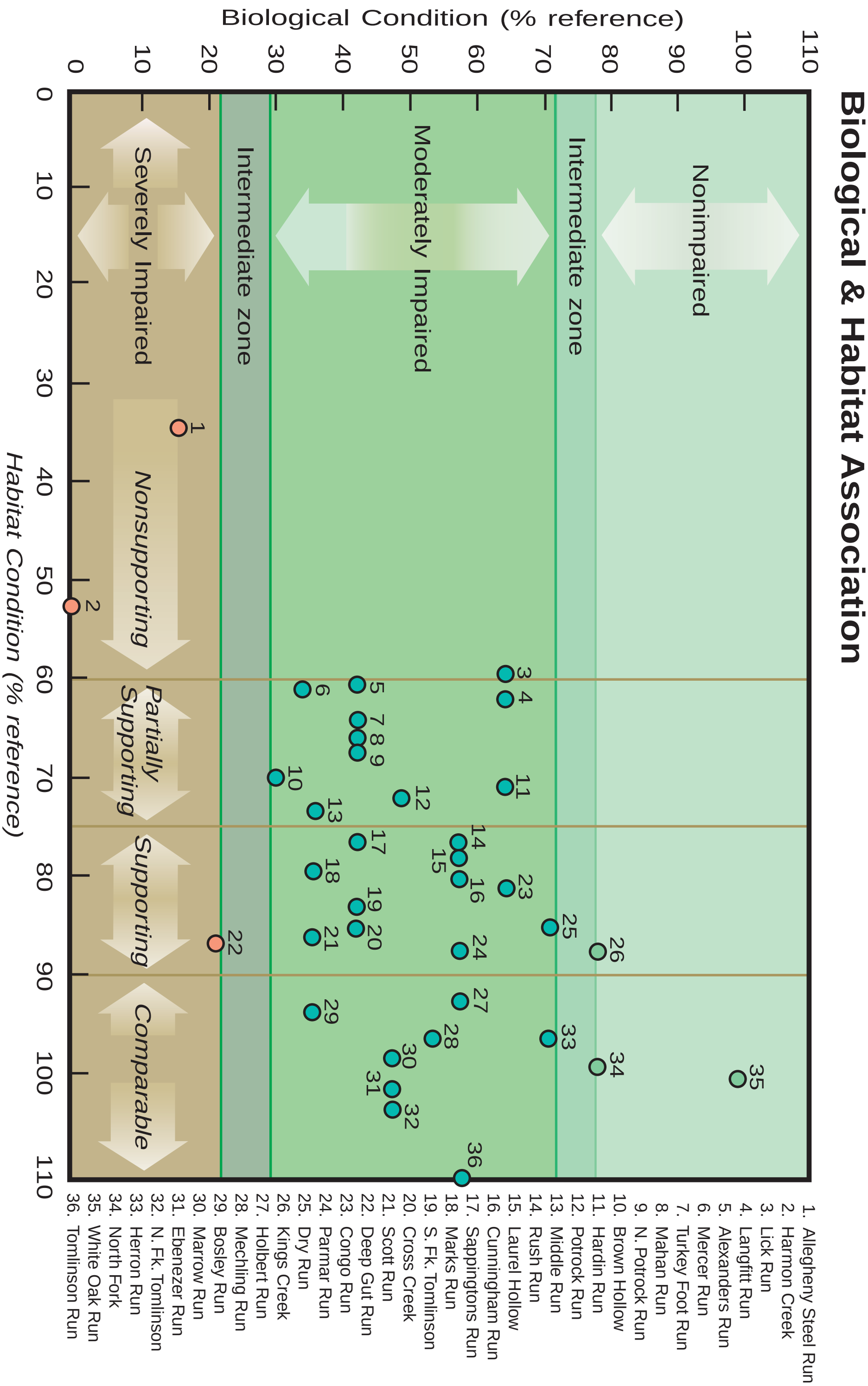
The Program evaluated 2 biological indicators of water quality, one addressing the potential for public health threats and another indicating the stream's ability to support its aquatic life designated use.

Fecal Contamination

The water quality standards state that for primary contact recreation (e.g., swimming, boating, fishing) the concentration of fecal coliform bacteria is not to exceed 400 colonies/100 ml in more than 10% of all samples taken during a month. Restated simply, water with a count greater than 400 is generally considered to be unsafe. On the day sampled, 12 (33%) sites met (i.e., were equal to or less than, did not violate, were safe relative to) the standard (see facing graph & Table 24) (listed in ascending order):

Herron Run - *lowest count*
Deep Gut Run
Parmar Run
Ebenezer Run
Alexanders Run
Lick Run
Hardin Run
Sappingtons Run
Potrock Run
Tomlinson Run
White Oak Run
Scott Run.


Fecal Coliform Bacteria
Colonies / 100 ml
10
100
1,000
10,000
100,000
Fecal > 400
Fecal < 400
ALEXANDERS RUN
ALLEGHENY STEEL RUN
BOSLEY RUN
BROWN HOLLOW
CONGO RUN
CROSS CREEK
CUNNINGHAM RUN
DEEP GUT RUN
DRY RUN
EBENEZER RUN
HARDIN RUN
HARMON CREEK
HERRON RUN
HOLBERT RUN
KINGS CREEK
KINGS CREEK (Feb)
LANGFITT RUN
LAUREL HOLLOW
LICK RUN
MAHAN RUN
MARKS RUN
MARROW RUN
MECHLING RUN
MERCER RUN
MIDDLE RUN
NORTH FORK
N. FORK TOMLINSON RUN
NORTH POTROCK RUN
PARMAR RUN
POTROCK RUN
RUSH RUN
SAPPINGTONS RUN
SCOTT RUN
S. FORK TOMLINSON RUN
TOMLINSON RUN
TURKEY FOOT RUN
TURKEY FOOT RUN (Feb)
WHITE OAK RUN


Biological & Habitat Association
Biological Condition (% reference)
Habitat Condition (% reference)
Nonimpaired
Intermediate zone
Moderately Impaired
Intermediate zone
Severely Impaired
Nonsupporting
Partially Supporting
Supporting
Comparable
1. Allegheny Steel Run
2. Harmon Creek
3. Lick Run
4. Langfitt Run
5. Alexanders Run
6. Mercer Run
7. Turkey Foot Run
8. Mahan Run
9. N. Potrock Run
10. Brown Hollow
11. Hardin Run
12. Potrock Run
13. Middle Run
14. Rush Run
15. Laurel Hollow
16. Cunningham Run
17. Sappingtons Run
18. Marks Run
19. S. Fk. Tomlinson
20. Cross Creek
21. Scott Run
22. Deep Gut Run
23. Congo Run
24. Parmar Run
25. Dry Run
26. Kings Creek
27. Holbert Run
28. Mechling Run
29. Bosley Run
30. Marrow Run
31. Ebenezer Run
32. N. Fk. Tomlinson
33. Herron Run
34. North Fork
35. White Oak Run
36. Tomlinson Run

Twenty-four (67%) of the water samples exceeded (i.e., failed, violated, were unsafe compared to) the standard (descending order):

Holbert Run - highest count
Kings Creek
Turkey Foot Run
Langfitt Run
Marks Run
Mahan Run
Bosley Run
Laurel Hollow
Cross Creek
Mercer Run
North Fork
Dry Run
Congo Run
Harmon Creek
Cunningham Run
Allegheny Steel Run
Mechling Run
Brown Hollow
Rush Run
South Fork Tomlinson Run
North Fork Tomlinson Run
Marrow Run
North Potrock Run
Middle Run.

Fecal Coliform Bacteria - bacteria that naturally live in the intestines of birds and mammals, including humans.

Released to the environment in feces, pathogens often accompany fecal coliforms. Thus, the presence of fecal coliform bacteria in a water sample indicates the *potential* presence of human pathogens.

A stream could have a high concentration of fecal coliforms due to a variety of sources, including human sewage, livestock herds with free access to the stream, field-applied manure, and concentrated wildlife.

Reference Site - a sampling location that serves as a standard against which other sites in the watershed are compared.

The reference represents the least negatively impacted condition, as inferred from (1) the conditions of both stream-side and instream habitats and (2) a general comparison of macroinvertebrate community indices. The Program's procedures of selecting and using a reference site follow established protocol (EPA 1990).

Association between Habitat and Biological Conditions

For every site, the Program plotted habitat and biological conditions as percents of the reference site, in this case White Oak Run (See graph on page 18).

Each of the 36 sites fell into 1 of 12 categories, ranging from (a) comparable, non-impaired (most ecologically intact compared to the reference site) to (b) non-supporting, severely impaired (most degraded).

Shown as green dots, 3 sites had nonimpaired benthic communities and the accompanying habitat status:

White Oak Run-comparable to reference
North Fork-comparable to reference
Kings Creek-supporting.

In contrast, the 3 red sites had severely impaired benthic communities and the accompanying habitat status:

Allegheny Steel Run - nonsupporting
Harmon Creek - nonsupporting
Deep Gut Run - supporting.

The remaining 30 (81%) sites supported moderately impaired benthic communities. Of those, 1 (Lick Run) had non-supporting habitat, 10 were partially supporting, 11 were fully supporting, and 8 had habitat comparable to the reference site.

"Looks like a fairly decent little stream."
comment about White Oak Run by James Harvey, Superintendent,
Tomlinson Run State Park

Explaining the Findings

What caused sites to be healthy or degraded? Water quality measurements other than fecal coliform bacteria provide few clues as no site violated state standards for the parameters tested (Table 22). One observation is provocative, though: Conductivity increased as benthic condition decreased. How variation of conductivity could have affected benthic animal communities is unclear.

In contrast to water quality, field observations on landuses (Tables 5-10) and habitat conditions (Table 11-18) suggest some answers. In the following list, each of the 3 healthiest and most degraded sites are matched to relevant field observations.

Healthiest Sites

- White Oak Run - no residential landuses, intact riparian ground cover, abundant stream shade, good instream habitat
- North Fork - good instream habitat
- Kings Creek - intact riparian canopy, abundant stream shade, low silt; but high fecal coliform level

"It's in very bad shape, a lot of oil and grease."
comment about Harmon Creek by Roger Pauls, Inspector,
WV DEP, Wheeling

Most Degraded Sites

- Allegheny Steel Run - drain pipes, rip-rap, channelization, fill, degraded riparian canopy, degraded riparian understory, degraded riparian groundcover, poor instream habitat, sediment with slight oil
- Harmon Creek - heavy erosion, NPS pollution, drain pipe, road, bridge culvert, rip-rap, channelization, fill, barest riparian soil, poor instream habitat, sediment with petroleum and chemical odor, sediment with profuse oil, sludge, metal hydroxides in sediment, black mud, water with petroleum and chemical odor, water with surface oils, opaque water
- Deep Gut Run - heavy erosion, industrial plant, road, bridge culvert

In the above listing, no single trait, much less a suite of traits, is common to all 3 healthiest or to all 3 most degraded sites.

Because generalities are not apparent, each stream must be evaluated individually. First, let's consider traits that seem to contribute to healthy sites. In the case of White Oak Run, the reference site, the combination of acceptable water quality, good instream habitat, and moderately intact riparia seem to be key elements supporting this healthy site. For North Fork, acceptable water quality and good instream habitat are important. The combination of acceptable water quality and low silt support Kings Creek's healthy condition.

Second, let's consider traits associated with degraded sites. Allegheny Steel Run emerged as the most degraded site because of channelization, absent riparia, lack of habitat for benthic animals, and chemical contaminants. Harmon Creek was extremely degraded because of industrial pollutants, heavy sediments, and lack of habitat. In the case of Deep Gut Run, heavy erosion and industry have degraded the site.

Comparing Watersheds

Because this is the first assessment to be published by the Program, inter-basin comparisons are premature. For future comparisons, though, the following percentages will be useful (See facing graph). Two-thirds (67%) of the sites yielded fecal coliform counts that exceeded the standard for water-contact recreation. In terms of habitat condition, 28% of the sites were comparable to the reference site, 47% supported their aquatic life designated use, 19% were judged to be partially supporting, and 6% were non-supporting. In terms of the condition of their biological (=benthic) communities, 3% were non-impaired, 89% were moderately impaired, and 8% were severely impaired.

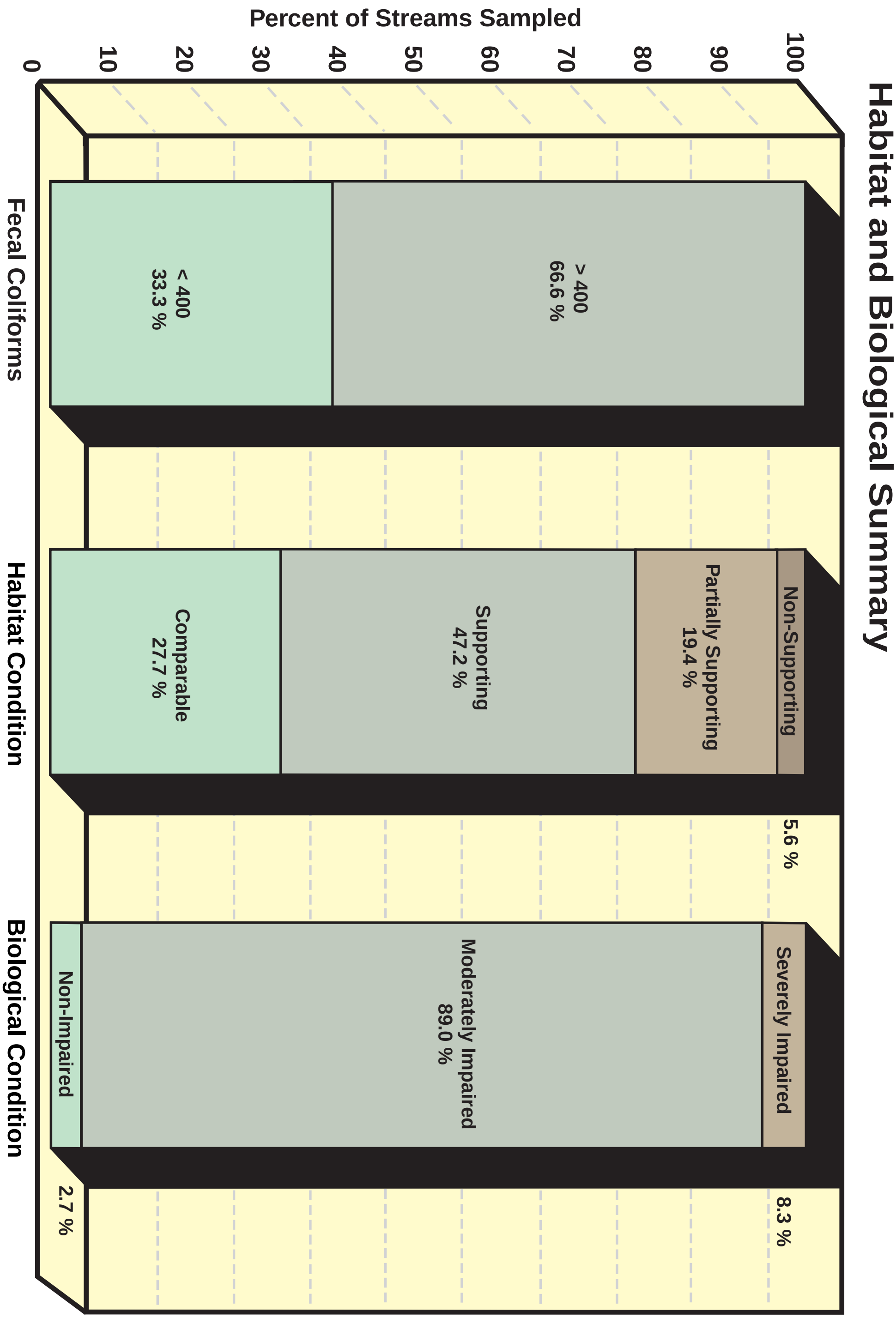
It will also be useful to compare the relative rank of benthic taxa among watersheds. The 5 most frequent taxa (Table 26) in this Watershed were (descending order):

Chironomidae- collected in all 36 streams
Oligochaeta
Gammaride
Hydropsychidae
Elmidae - found in 24 streams,

while the least abundant were:

Pyralidae - found in 1 stream
Dytiscidae
Brachycentridae
Siphlonuridae
Ptilodactylidae.

As suggested in the next section, though, comparisions among basins will be more useful following a different sampling strategy.


Habitat and Biological Summary
Percent of Streams Sampled
0
10
20
30
40
50
60
70
80
90
100
< 400
33.3 %
> 400
66.6 %
Comparable
27.7 %
Supporting
47.2 %
Partially Supporting
19.4 %
Non-Supporting
5.6 %
Non-Impaired
2.7 %
Moderately Impaired
89.0 %
Severely Impaired
8.3 %
Fecal Coliforms
Habitat Condition
Biological Condition

Implications

In the Northern Upper Ohio River watershed, 4 waterbodies were on the 1996 303(d) list: Harmon Creek, Sappingtons Run, Alexanders Run,and Deep Gut Run. What are the implications of present findings for their retention on 1998's list?

Present data indicate that Harmon Creek should remain on the list. Harmon Creek receives wastewater discharged from Weirton Steel Corporation. The EQB has granted Weirton Steel a variance (i.e., higher discharge limits) in its NPDES permit. Specifically, Harmon Creek, from its mouth to a point 2.2 miles upstream, does not have the public water supply designated use, allowing the following standards to apply: temperature shall not exceed 100°F, total iron shall not exceed 4.0 mg/l, and total fluoride shall not exceed 2.0 mg/l, each as a 30-day average to be determined from 4 weekly samples. Even with the variance, however, water quality standards continue to be violated.

Sappingtons and Alexanders runs are on the 1996 303(d) sublist for AMD. Present data, recorded at the stream mouths, do not support these listings. Further sampling along the streams' continua is recommended before these water-bodies are considered for removal from the list.

Deep Gut Run also appears on the 1996 303(d) sublist for AMD. Present data reveal it has a severely impaired benthic community. Therefore, it should remain on the list.

One stream, Allegheny Steel Run, which is not on the 1996 303(d) list, needs more attention. Present biological data for this stream, plus known characteristics of the watershed, are sufficient to recommend further study for its possible addition to the list.

In summary, with regard to the 303(d) list, the Program recommends the following actions:

- Harmon Creek - retain
- Sappingtons Run - study further for possible deletion
- Alexanders Run - study further for possible deletion
- Deep Gut Run - retain
- Allegheny Steel Run - study further for possible addition.

Unassessed Waterbodies - Although lakes were not included in this assessment, Tomlinson Run Lake, a public lake on the 303(d) list, was being monitored as part of DEP'S Clean Lakes Program. In 1994, a consultant studied the Lake and developed a management plan to reduce sediment and nutrient pollution (CES 1994). The Lake is targeted for restoration as funds become available.

The Program also did not study the mainstem of the Ohio River because the Ohio River Valley Water Sanitation Commission (ORSANCO) monitors its water quality. Based largely on ORSANCO's data, the Ohio River appears on the state's 303(d) list because of high levels of lead, PCBs, chlordane, and dioxin. In cooperation with the EPA, ORSANCO has initiated the Ohio River Watershed Pollution Reduction Program, which will document levels of the toxic chemicals listed above, plus atrazine, copper, nitrogen, and phosphorus. ORSANCO will also support the design of water quality studies and determine the feasibility of restoration.

All 303(d) listings, whether continuing or new, should trigger implementation of the TMDL option for improving water quality.

This study also concludes that 3 sites are exceptionally healthy:

White Oak Run

North Fork

Kings Creek.

The Program recommends these streams be actively protected. Like other environmental regulatory programs, the DEP's resources are primarily aimed at restoring degraded ecosystems. In the process, healthy streams, like these 3, may go under-protected. Therefore, the Program recommends that the state government develop a pro-active program of maintaining currently healthy streams. This is consistent with the DEP's mission to both "protect and enhance" the state's natural resources.

This study has implications for interagency cooperation. Currently, the following federal, multi-state, state, and non-governmental groups have an interest in a watershed approach:

US Army Corps of Engineers

US Environmental Protection Agency

US Fish and Wildlife Service

US Geological Survey

US National Park Service

US Natural Resources Conservation Service

US Office of Surface Mining

Ohio River Valley Water Sanitation Commission

WV Resource Conservation & Development Association

WV Soil Conservation District Supervisors Association

WV Division of Environmental Protection

WV Division of Forestry

WV Division of Natural Resources

WV Soil Conservation Agency

West Virginia University Extension Service

River Network

WV Watershed Network

Canaan Valley Institute

WV Rivers Coalition.

Each group has a singular history, mission, and expertise. But each watershed's problems are unique, requiring a special combination of resources. The Program recommends that these groups enter watershed-specific partnerships to protect and restore streams, preferably coordinated through the Watershed Network.

Any stream improvement plan must have local support. The Program asserts that local watershed associations, operating by the principles of inclusiveness and consensus, are crucial to the success of on-the-ground stream improvement projects. However, the Program knows of no watershed associations in this Watershed unit. Therefore, should local leadership emerge, the Program urges that the above groups, coordinated through the Watershed Network, support any embryonic associations.

Lastly, this study points to a change in the Program itself. In this assessment, streams were sampled at the most downstream road crossing. To the extent that roads form different patterns in different watersheds, each watershed would be unintentionally assessed by a unique sampling design. This would reduce the value of inter-watershed comparisons. One way to reduce this and other biases, and thereby to increase the validity of comparison among watersheds, is to randomize which and where streams are sampled. Although randomizing all sites would reduce sampling efficiency too severely, randomizing a subset of sites is feasible and would improve inter-watershed comparability.

Additional Resources

The watershed movement in West Virginia includes a wide variety of federal, state, and non-governmental organizations that are available to help improve the health of the streams in this Watershed. DEP's facilitator of watershed associations, available at (800) 556-8181, can serve as a clearinghouse to these and other resources.

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Appendices

Above: Assessment team biologist using a global postioning system

Below: Collecting benthic animals

Appendix 1. Materials and Methods

At each site, streamside and instream habitats were assessed along a 100-m long study area. The center of each study site was determined by using a global positioning system. Assessment teams completed the habitat assessment form (Table 2) on site. The terrestrial and aquatic habitats were scored with a modified habitat assessment matrix (Klemm and Lazorchak 1994).

Assessment teams also manually collected water samples at each site. Water samples were analyzed by DEP-certified laboratories (Title 47 Code of State Regulations Part 32) using EPA-approved techniques (Chp. 40 Code of Federal Regulations Part 136).

Benthic animals were collected according to EPA's Rapid Bioassessment Protocol II (Plafkin et al. 1989). In the laboratory, Program contractors sorted the samples by the RBP II 100-count subsampling method, and then Program biologists identified the specimens' families, functional feeding groups (Merritt and Cummins 1996), and tolerance values (Plafkin et al. 1989: Table C-1). Seven metrics (Plafkin et al. 1989) were calculated for each benthic sample.

Using the relational database FoxPro version 2.6 for Windows, Program biologists entered field and laboratory data, statistically analyzed the data sets, and generated tables and summary statistics.

Appendix 2. Man-made Disturbances and Other Landuses

Three sites (Brown Hollow, North Fork Tomlinson Run, Marrow Run) exhibited no soil erosion (Table 5). Erosion was slight at 1 site (Tomlinson Run), moderate at 23 sites, and heavy at the following 8 sites :

Harmon Creek
Hardin Run
Cross Creek
White Oak Run
Deep Gut Run
Turkey Foot Run
Rush Run
North Fork.

Although the potential for possible NPS pollution was noted at 20 sites (Table 5), it was obvious at 11 sites:

Alexanders Run
Mercer Run
Parmar Run
Mahan Run
Harmon Creek
Hardin Run
Marrow Run
Langfitt Run
Congo Run
Dry Run
Turkey Foot Run.

Appearing in both of the above 2 lists, 3 sites featured both heavy erosion and obvious NPS pollution:

Harmon Creek
Hardin Run
Turkey Foot Run.

Twelve sites (Alexanders Run, Ebenezer Run, Harmon Creek, Bosley Run, Cross Creek, Marks Run, Dry Run, North Fork, White Oak Run, Tomlinson Run, Deep Gut Run, and South Fork Tomlinson Run) contained no residential landuses (Table 6). Other study reaches contained residences, lawns, roads, and bridge culverts. Active construction was observed at Mechling and Rush runs. Drain pipes were obvious at 8 sites:

Mechling Run
North Potrock Run
Allegheny Steel Run
Hardin Run
Marrow Run
Congo Run
Turkey Foot Run
Rush Run.

While most sites supported no obvious recreation, assessment teams recorded the following sports-related activities at 9 sites (Table 7):

Mechling Run - public park
Sappingtons Run - parking lot
Scott Run - parking lot, fishing, foot trail
North Fork Tomlinson Run - foot trail
Hardin Run - public park, road, bridge culvert
Marrow Run - parking lot
Tomlinson Run - foot trail, ATV trail
South Fork Tomlinson Run - public park, parking lot, pipe drain, foot trail, ATV bike, road, bridge culvert
Kings Creek - fishing, foot trail.

Only 3 sites included agricultural activities (Table 8):

Mercer Run - pasture, livestock access, farm roads, bridge culverts
Langfitt Run - pasture, livestock access
South Fork Tomlinson Run - pasture.

One of the most industrialized watersheds in West Virginia, the following 7 sites contained industrial landuses (Table 9):

Alexanders Run - industrial plant, drain pipe, parking lot, road
Harmon Creek - drain pipe, road, bridge culvert
Hardin Run - parking lot, road
Holbert Run - parking lot
Marks Run - waste water, drain pipes, road, bridge culvert
Dry Run - industrial plant, parking lot, road
Deep Gut Run - industrial plant, road, bridge culvert.

The other 29 sites contained no obvious industry.

In terms of physical streambed alterations, no study reach had been altered by obvious liming or dredging, or by dams (Table 10). More than half (19) of the sites featured 1-3 other forms of alteration:

Alexanders Run - fill
Ebenezer Run - rip-rap
North Potrock Run - rip-rap, fill
Potrock Run - rip-rap, channelization, fill
Parmar Run - fill
Allegheny Steel Run - rip-rap, channalization, fill
Mahan Run - fill
Harmon Creek - rip-rap, channelization, fill
Holbert Run - fill
Marks Run - channelization
Marrow Run - rip-rap

Herron Run - channelization
Middle Run - rip-rap, channelization
Laurel Hollow- rip-rap, channelization
South Fork Tomlinson Run - rip-rap
Kings Creek - channelization
Langfitt Run - channelization
Lick Run - rip-rap
Rush Run - rip-rap.

Three of the sites listed above had been physically modified in all 3 ways:

Potrock Run
Allegheny Steel Run
Harmon Creek.

The remaining 17 sites had not been obviously physically disturbed.

Appendix 3. Habitat Conditions

At each study site, assessment teams recorded the conditions of (a) terrestrial, streamside and (b) aquatic, instream habitats.

Streamside - Because conditions of the streambank and riparian corridor help determine a stream's water quality; assessment teams evaluated their size and condition at each site. The canopy (Table 11), understory (Table 12), and groundcover (Table 13) of the left and right riparia (facing downstream) were assessed.

Assessment teams evaluated the intactness of a site's riparian canopy (leaf layer at top of forest) by estimating corridor width and the density of big and small trees (Table 11). The average widths of the left and right riparia were 6.7 and 6.6 m, respectively. Although the program did not derive a quantitative index of overall riparian canopy intactness, it is possible to place the sites into contrasting qualitative categories. Five sites with some of the most intact riparian canopies were:

Scott Run
Kings Creek
Marks Run
Dry Run
Laurel Hollow,

while the following 5 sites had some of the most degraded riparian canopies:

Allegheny Steel Run
Langfitt Run
Marrow Run
Rush Run
North Fork.

The remaining 26 sites lay somewhere between these extremes.

Assessment teams evaluated the relative intactness of the riparian understory (leaf layer 2-15 feet high) by visually estimating the densities of woody shrubs and saplings and of non-woody herbs along both left and right riparia (Table 12). Using a qualitative ranking yields 5 sites with relatively intact riparian understories:

Marks Run
Congo Run
Holbert Run
Middle Run
Sappingtons Run.

The riparian understories of the following 5 sites were among the least intact:

Allegheny Steel Run
Mahan Run
Parmar Run
Turkey Foot Run
Herron Run.

The 3rd riparian feature is the intactness of the groundcover (short plants covering the forest floor)(Table 13), determined by recording the relative densities of woody and non-woody plants up to 2 feet tall along both riparia. The following 5 sites supported some of the most intact riparian ground covers:

North Potrock Run

White Oak Run

Ebenezer Run

Alexanders Run

Lick Run,

and the following 5 sites supported some of the least intact riparian ground covers:

Allegheny Steel Run
Middle Run
Turkey Foot Run
North Fork
Tomlinson Run.

The 4th measure of riparian intactness is the relative amount of bare soil on the left and right streambanks (Table 13). The following 6 sites exhibited some of the most covered soil:

Allegheny Steel Run
Congo Run
Mahan Run
Marks Run
Cunningham Run and Dry Run (tied),

while 5 sites had some of the barest soil:

Turkey Foot Run
Hardin Run
Harmon Creek
Mercer Run
White Oak Run.

The 5th and last measure of riparian condition is stream shade (Table 13). The following 13 sites were scored as having the most stream shade:

Ebenezer Run
Kings Creek
Laurel Hollow
White Oak Run
9 sites tied for 5th,

while the following 8 sites tied with the least stream shade:

Cunningham Run
Dry Run
Langfitt Run
Mahan Run
Marrow Run
Mercer Run
Parmar Run
Rush Run
Turkey Foot Run.

Instream - Assessment teams selected stream reaches for study that were 100 m long and included a wadeable riffle. Table 4 shows that on average the sites were 4.3 m wide, with riffles, runs, and pools averaging 0.14, 0.30, and 0.72 m in depth, respectively.

The Program used EPA's Rapid Habitat Assessment (Plafkin et al. 1989) to evaluate instream habitat conditions for aquatic animals. Because all 12 habitat variables were scored on a 0-20 scale, (Table 14), their totals could be used to compare habitat quality among sites. In terms of total scores, the 5 highest ranking sites were (listed in descending order):

Tomlinson Run - most intact
North Fork Tomlinson Run
Ebenezer Run
White Oak Run
North Fork.

The following 5 sites ranked lowest in instream habitat quality (ascending order):

Allegheny Steel Run - most degraded
Harmon Creek
Lick Run
Alexanders Run
Mercer Run.

Assessment teams visually estimated the percent of streambed area covered by each of 7 particle sizes (Table 15). Of the 36 sites, Kings Creek and Rush Run featured bedrock and only North Fork Tomlinson Run contained any obvious clay. Boulders, indicating fast water, were most common (descending order) in Cunningham Run, White Oak Run, Tomlinson Run, Deep Gut Run, Herron Run, and Kings Creek.

Silt, suggesting possible excess erosion upstream of the site, was most common at:

North Fork
Mahan Run
Scott Run
Alexanders Run
8 sites tied for 5th,

whereas percent silt was lowest at:

Kings Creek
Cross Creek
Middle Run
North Potrock Run
12 sites tied for 5th.

Assessment teams also evaluated the quality of the streambed's substrate. Of the 36 sites, 2 contained sediment with an obvious odor (Table 16):

Harmon Creek - petroleum, chemical
Turkey Foot Run - sewage.

The sediment of Allegheny Steel Run and Harmon Creek displayed slight and profuse amounts of oil (Table 17), respectively. Various kinds of deposits were observed in the sediments of the following 3 streams (Table 18):

Potrock Run - slime
Harmon Creek - sludge, metal hydroxides, black mud
Turkey Foot Run - sludge.

Appendix 4. Water Quality

While on site, assessment teams recorded some visually obvious features of the water. Physical, chemical, and biological variables were measured quantitatively with instruments at the site or later in the laboratory.

Obvious Indicators - Obvious characteristics of water quality included the presence of water odors and surface oils. The water at 6 sites had obvious odors (Table 19):

Harmon Creek - petroleum, chemical

Hardin Run - sewage

Middle Run - musty

Congo Run - sewage

Turkey Foot Run - sewage

North Fork- sewage.

Only Harmon Creek contained water with surface oils (Table 20), observed as both sheen and flecks.

Physical Indicators - In terms of physical parameters, assessment teams routinely measured temperature and visually estimated a qualitative level of turbidity. Discharge was measured only at sites suspected of being impacted by AMD.

In terms of turbidity (Table 21), the following 14 sites were discharging clear water on the day(s) visited: Parmar Run, Scott Run, Brown Hollow, Ebenezer Run, Hardin Run, Holbert Run, Marrow Run, Marks Run, Cunningham Run, Laurel Hollow, Congo Run, Dry Run, Lick Run (in both Feb and May 96), and Rush Run (in both Feb and May 96). The turbidity of 6 sites (Bosley Run, Cross Creek, White Oak Run, South Fork Tomlinson Run, Kings Creek, North Fork (in both Feb and May 96) was scored as moderate. Harmon Creek was opaque.

The water temperature at the 36 sites averaged 15.0C (range=4.7-21.8, n=36) (Table 22). Five sites visited in February averaged 5.2C, while the others, studied in May, ranged between 12.6 and 21.8C.

Chemical Indicators - In the field, assessment teams routinely measured pH, dissolved oxygen, and conductivity (Table 22).

The pH at the 36 sites averaged 8.2 (range=7.8-9.0, n=36) (Table 22). Thus, all sites were discharging alkaline water. Two streams, Alexanders and Sappingtons runs, suspected of being impacted by AMD [DEP undated (b)], had pHs of 8.2 and 8.5, respectively. Thus, the assessment team's field observations are not consistent with previous indications of excess acid.

The concentration of dissolved oxygen at the 36 sites ranged from 6.8 to 12.9 mg/l (average=9.5, n=36) (Table 22), suggesting no significant oxygen depletion at the time of study.

The conductivity at the 36 sites averaged 556 μS/cm (range=212-1409, n=36) (Table 22). AMD suspects Alexanders and Sappingtons runs had conductivities of 917 and 537, respectively. Thus, on the day of the assessment team's visit, Alexanders Run's water had high conductivity.

Sappingtons and Alexanders runs were also analyzed for hot acidity, alkalinity, aluminum, iron, and manganese (Table 23). Hot acidity was not detected. Samples from both streams contained 140 mg/l total alkalinity, which indicates significant buffering capacity. This is consistent with the basic pHs reported 3 paragraphs above.

To evaluate the observed concentrations of the 3 metals (Table 23), they can be compared to water quality standards (anonymous undated). For aluminum, the comparison is 0.48 and 1.20 mg/l observed in Alexanders and Sappingtons runs, respectively, vs. 0.087 chronic and 0.75 acute mg/l standard: Alexanders Run exceeded the chronic standard and Sappingtons Run exceeded both the chronic and acute standards. For iron, the comparison is 0.46 and 0.78 mg/l observed vs. 1.5 mg/l warm water standard, suggesting no violation of the criterion. For manganese, the comparison is 0.16 and 0.12 mg/l observed vs. 1.0 mg/l, suggesting no violation.

Bottom-dwelling Animals - Table 25 lists the numbers of individual animals in each family randomly selected from each benthic sample. From those raw counts, Program biologists calculated 7 indices (Table 27) that represent the status of the benthic macroinvertebrate community:

(1) Taxa Richness averaged 13.9 (range 3-25, n=36). The 5 sites with highest taxa richnesses were (listed in descending order):

White Oak Run - most taxa
Langfitt Run
Herron Run
Alexanders Run
Kings Creek.

The 7 sites with the lowest taxa richnesses were (ascending order) :

Harmon Creek - fewest taxa
Allegheny Steel Run
Potrock Run, Marks Run, Mercer Run, Middle Run,
Turkey Foot Run (tied).

(2) The Hilsenhoff modified family biotic index averaged 5.5 (range=3.9-9.9, n=36). The 5 sites with the lowest HBI were (ascending order):

White Oak Run - lowest HBI
Rush Run
Potrock Run
Congo Run
North Potrock Run.

The following sites yielded the 5 highest HBIs (descending order):

Harmon Creek
Alexanders Run
Mercer Run
Sappingtons Run
Marks Run.

(3) The Ephemeroptera Plecoptera Trichoptera (EPT) index averaged 6.2 (range=0-14, n=36). The following 5 sites had the highest EPT (descending order):

White Oak Run - highest EPT index
Herron Run
Tomlinson Run
Langfitt Run
Kings Creek.

The following 6 sites had the lowest EPT (ascending order):

Harmon Creek
Mahan Run
Marks Run
Allegheny Steel Run
Deep Gut Run, Mercer Run (tied).

(4) The percent dominant taxa averaged 45.1 (range=19.6-95.1). The following 5 sites had the lowest % dominant taxa (ascending order):

North Fork - lowest % dom taxa
Kings Creek
Turkey Foot Run
White Oak Run
Mechling Run.

The following 5 sites had the highest % dom taxa (descending order) :

Potrock Run
Harmon Creek
South Fork Tomlinson Run
Cross Creek
Allegheny Steel Run.

(5) The Scrapers/(Scrapers + Filtering Collectors) index averaged 0.5 (range=0.0-1.0, n=36). The highest SC/(SC+FC) index occurred at the following 5 sites (descending order):

Cross Creek - highest S/(S+FC) index
North Fork Tomlinson Run
Parmar Run
Cunningham Run
Congo Run.

The following 5 sites were tied with a S/(S+FC) index of 0.00, the lowest possible value:

Allegheny Steel Run
Deep Gut Run
Harmon Creek
Scott Run
Turkey Foot Run.

(6) The Ephemeroptera Plecoptera Trichoptera/ (EPT+Chironomidae) index averaged 0.2 (range=0.0-0.6, n=36). The highest EPT/(EPT+Chi) index occurred at the following 5 sites (descending order):

Potrock Run - highest EPT/(EPT+Chi) index
Laurel Hollow
North Fork
Congo Run
Turkey Foot Run.

The lowest index occurred at the following 8 sites (ascending order) :

Harmon Creek
Alexanders Run
Allegheny Steel Run
Deep Gut Run
Langfitt Run, Mahan Run, Marks Run,
Sappingtons Run (tied).

(7) The Community Loss Index averaged 1.4 (range=0-8, n=36). The following 7 sites had the lowest CLI (ascending order):

White Oak Run - lowest CLI
Herron Run
Langfitt Run
Congo Run, Dry Run, South Fork Tomlinson Run,
Tomlinson Run (tied).

The following 5 sites had the highest CLI (descending order):

Harmon Creek
Allegheny Steel Run
Potrock Run
Mercer Run
Turkey Foot Run.

The aquatic larva of Stenonema, *a genus in the mayfly family Heptageniidae, a common taxon in the Northern Upper Ohio River watershed*

photo by Bill Mason

Table 1. **NPDES permits**

NPDES NUMBER	NAME OF FACILITY	CITY OR TOWN	COUNTY	SIC CODE	TYPE OWN.	RECEIVING WATERS
WV0056456	BOLOGNA MINING COMPANY SMA 301	BROOKE COUNTY	BROOKE	1221	PRI	MECHLING RUN HARMON CREEK
WV0039144	ISC INC	COLLIERS	BROOKE	1221	PRI	TRIB TO HARMON CREEK
WV0057223	WEST VIRGINIA ENERGY INC.	FOLLANSBEE	BROOKE	1221	PRI	OHIO RIVER
WV0091367	WEIRTON ICE AND COAL SUPPLY CO	WEIRTON	BROOKE	1221	PRI	
WV0035459	BOLOGNA COAL CO-MINE GRAF 1	BROOKE COUNTY	BROOKE	1221	PRI	PARMAR RUN
WV0035467	BOLOGNA COAL CO-ARIA MINE	BROOKE COUNTY	BROOKE	1221	PRI	UNNAMED TRIB.TO MECHLING RUN
WV0004499	WHEELING-PITTSBURGH STEEL CORP	FOLLANSBEE	BROOKE	3312	PRI	OHIO RIVER
WV0004502	WHEELING-NISSHIN INC.	FOLLANSBEE	BROOKE	3312	PRI	OHIO RIVER
WV0004588	KOPPERS INDUSTRIES, INC	FOLLANSBEE	BROOKE	2869	PRI	OHIO RIVER
WV0020273	FOLLANSBEE, CITY OF	FOLLANSBEE	BROOKE	4952	PUB	OHIO RIVER
WV0023281	WHEELING-PITTSBURGH STEEL CORP	FOLLANSBEE	BROOKE	3312	PRI	OHIO RIVER
WV0075060	HOOVERSON HEIGHTS PSD	FOLLANSBEE	BROOKE	4941	PUB	OHIO RIVER
WV0075256	CITY OF FOLLANSBEE	FOLLANSBEE	BROOKE	4941	PUB	OHIO RIVER
WV0110728	WHEELING PITTSBURGH STEEL	FOLLANSBEE	BROOKE	4953	PRI	OHIO RIVER
WV0112054	WHEELING PITTSBURGH STEEL	FOLLANSBEE	BROOKE	4953	PRI	OHIO RIVER
WV0038377	ISC INC	VIRGINVILLE	BROOKE	1221	PRI	EBENEZER & NORTH POTROCK RUNS
WV0003425	SIGNODE SUPPLY CORPORATION	WEIRTON	BROOKE	3316	PRI	OHIO RIVER
WV0023108	WEIRTON, CITY OF	WEIRTON	BROOKE	4952	PUB	OHIO RIVER
WV0070971	WEIRTON WATER TREATMENT PLANT	WEIRTON	BROOKE	4941	PUB	OHIO RIVER
WV0071129	APEX OIL COMPANY	WEIRTON	BROOKE	5171	PRI	OHIO RIVER
WV0032859	BROOKE CO. BD. OF ED.	WELLSBURG	BROOKE	8211	PRI	CROSS CREEK
WV0082724	HOOVERSON HEIGHTS PSD	FOLLANSBEE	BROOKE	4952	PUB	
WV0091049	COMBUSTION ENGINEERING, INC.	NEWELL	HANCOCK	1459	PRI	
WVG550583	MOUNTAINEER PARK, INC.	CHESTER	HANCOCK	8211	PRI	OHIO UT
WVG610052	METSCH REFRACTORIES, INC.	CHESTER	HANCOCK	3269	PRI	O
WVG610528	CONGO RIVER TERMINAL CHESTER	CHESTER	HANCOCK	4225	PRI	OHIO RIVER
WV0021768	CHESTER, CITY OF	CHESTER	HANCOCK	4952	PUB	OHIO RIVER
WV0049361	BOC GASES	CHESTER	HANCOCK	2813	PRI	DRY RUN
WVG550362	EDISON CHAFFIN, JR.	ELKHORN	HANCOCK	6515	PRI	O-102-B UT
WVG550109	TERRY L. SCOTT	HANCOCK COUNTY	HANCOCK	4952	PRI	O-100-B
WVG550377	WV DEPT. OF COMMERCE	HANCOCK COUNTY	HANCOCK	7032	STA	O-102
WVG550749	HANCOCK COUNTY COMMISSION	HANCOCK COUNTY	HANCOCK	6512	PRI	UF OF SO. FK./TOMLINSON/OHIO
WVG550224	JOHN F. PORTER	NEW CUMBERLAND	HANCOCK	6515	PRI	O-102-A UT
WVG550258	PAUL C. SETTLE	NEW CUMBERLAND	HANCOCK	6515	PRI	O-101 UT
WVG550314	RIVERVIEW ESTATES MAINTENANCE	NEW CUMBERLAND	HANCOCK	4952	PRI	O-98
WVG550684	JEFF DAVIS	NEW CUMBERLAND	HANCOCK	5812	PRI	OHIO/TOMLINSON RUN/SO FK./UT
WVG550708	DELORES PIETRANTON	NEW CUMBERLAND	HANCOCK	6515	PRI	OHIO/TOMLINSON/UT
WVG550780	KAREN WILD	NEW CUMBERLAND	HANCOCK	8062	PRI	HERRON RUN/HARDENS RUN/OHIO
WV0025119	NEW CUMBERLAND, CITY OF	NEW CUMBERLAND	HANCOCK	4952	PUB	OHIO RIVER
WV0039527	ISC INC	NEW CUMBERLAND	HANCOCK	1221	PRI	HARDIN RUN
WV0044547	CRESCENT BRICK COMPANY	NEW CUMBERLAND	HANCOCK	1459	PRI	OHIO RIVER/HARDIN'S RUN
WV0079081	SHILOH RIVER CORP.	NEW CUMBERLAND	HANCOCK	4953	PRI	UT OF OHIO RIVER
WV0079103	CM TECH, INCORPORATED	NEW CUMBERLAND	HANCOCK	2819	PRI	OHIO RIVER
WV0083577	HANCOCK COUNTY BD. OF ED.	NEW CUMBERLAND	HANCOCK	8211	PUB	
WVG610496	NORTH AMERICAN PROCESSING CO	NEWELL	HANCOCK	3295	PRI	SNOW HILL RUN/OH
WVG610531	CONGO RIVER TERMINAL	NEWELL	HANCOCK	4231	PRI	OHIO RIVER
WV0004561	NEWELL PORCELAIN COMPANY	NEWELL	HANCOCK	3261	PRI	OHIO RIVER
WV0004570	HOMER LAUGHLIN CHINA COMPANY	NEWELL	HANCOCK	3262	PRI	OHIO RIVER
WV0004626	ERGON-WEST VIRGINIA, INC.	NEWELL	HANCOCK	2911	PRI	OHIO RIVER
WV0005754	NEW CASTLE REFRACTORIES	NEWELL	HANCOCK	3255	PRI	OHIO RIVER
WV0027502	NEWELL COMPANY	NEWELL	HANCOCK	4952	PUB	OHIO RIVER
WV0076970	NEWELL SPECIALTY CHEMICALS, INC	NEWELL	HANCOCK	2869	PRI	OHIO RIVER
WV0077577	BELLOFRAM CORPORATION	NEWELL	HANCOCK	3061	PRI	DRY RUN
WV0112755	HOMER LAUGHLIN CHINA COMPANY	NEWELL	HANCOCK	4953	PRI	UT OF OHIO RIVER
WV0112941	DTC ENVIRONMENTAL SERVICES INC	NEWELL	HANCOCK	4499	PRI	OHIO RIVER
WVG550158	LLOYD HILL	WEIRTON	HANCOCK	6515	PRI	O-98
WVG550468	MR. AND MRS. DONALD BIRMINGHAM	WEIRTON	HANCOCK	6515	PRI	O-98
WV0003336	WEIRTON STEEL CORPORATION	WEIRTON	HANCOCK	3479	PRI	OHIO RIVER
WV0004391	BOC GASES	WEIRTON	HANCOCK	2813	PRI	OHIO RIVER
WV0005142	INTERNATIONAL MILL SERVICE, INC	WEIRTON	HANCOCK	3295	PRI	OHIO RIVER

SIC Code	Definition	SIC Code	Definition	SIC Code	Definition
1221	BITUMINOUS COAL & LIG, SURFACE	3262	VIT CHINA TABLE & KTCHN ARTICL	4941	WATER SUPPLY
1459	CLAY, CERAMIC & REFRAC MAT NEC	3269	POTTERY PRODUCTS, NEC	4952	SEWERAGE SYSTEMS
2813	INDUSTRIAL GASES	3295	MINE & EARTHS, GROUND OR TREAT	4953	REFUSE SYSTEMS
2819	INDUSTRIAL INORGANIC CHEMICALS	3312	BLAST FURN/STEEL WORKS/ROLLING	5171	PETROLEUM BULK STATIONS & TERM
2869	INDUST. ORGANIC CHEMICALS NEC	3316	COLD ROLLED STEEL SHEET/STRIP	5812	EATING PLACES
2911	PETROLEUM REFINING	3479	METAL COATING & ALLIED SERVIC	6512	OPER OF NONRESIDENTIAL BLDGS
3061	MECHANICAL RUBBER GOODS	4225	GENERAL WAREHOUSING & STORAGE	6515	OPER OF RES MOBILE HOME SITES
3255	CLAY REFRACTORIES	4231	TRUCKING TERMINAL FACILITIES	7032	SPORTING & RECREATIONAL CAMPS
3261	VITREOUS CHINA PLUMBING FIXTUR	4499	WATER TRANSPORTATION SERIVCES	8062	GEN. MEDICAL/SURGICAL HOSPITAL
				8211	ELEMENTARY & SECONDARY SCHOOLS

Table 2. **Stream assessment form**

WVDEP WATERSHED ASSESSMENT PROGRAM

STREAM VERIFICATION >>

STREAM NAME:				A-N CODE:	
GPS STATION #:		BASIN:		CO. & STATE:	
FIELD LAT:	° ‘ “ N		FIELD LONG:	° ‘ “ W	
CORRECTED LAT:	° ‘ “ N		CORRECTED LONG:	° ‘ “ W	
DATE:	/ /	TIME:		TEAM:	
DIRECTIONS TO STREAM SITE:					

SKETCH OF STREAM REACH AND GENERAL COMMENTS

SAMPLING DEVICE:	Surber-on-a-stick	D-net	Other (describe):	
HABITAT SAMPLED & NUMBER OF EACH	Riffle/run	Snags	Overhanging vegetation	Aquatic plants

PAGE 1 *WVDEP WAP - STREAM ASSESSMENT FORM (11 JULY 96)*

WVDEP WATERSHED ASSESSMENT PROGRAM

PHYSICAL CHARACTERIZATION >>

STREAM WIDTH (meters):		STREAM ORDER:	
STREAM DEPTH (meters):	riffle	run	pool
LOCAL WATERSHED EROSION:	☐ none ☐ slight	☐ moderate	☐ heavy
LOCAL NPS POLLUTION:	☐ no evidence	☐ some potential sources	☐ obvious source

STREAM REACH ACTIVITIES & DISTURBANCES INSERT A √ IN EACH

	RESIDENTAL		RECREATIONAL		AGRICULTURAL		INDUSTRIAL		STREAM MANAGEMENT
	Residences		Parks campgrouds		Annual rowcrops		Industrial Plants		Liming
	Lawns		Parking lots		Pasture		Surface mine		Rip rap / bank stablization
	Private boat dock		Boat access/ dock		Hay production		Deep mine		Dredging
	Construction		Swimming		Orchards		Coal prep		Channalization
	Pipes, drains		Fishing		Poultry		Quarries		Fill
	Roads		Pipes, drains		Livestock access		Oil/gas wells		Dams, impound-ments
	Bridges culverts		Foot trails		Irrigation		Power plant		
			ATV, horse, bike trails		Pipes, drains		Logging		
			Roads		Roads		Woodyards/ sawmill		
			Bridges, culverts		Bridges culverts		Sanitary landfill		
							Waste H O Plants		
							Public H O treatment		
							Pipes, drains		
							Parking lots		
							Roads		
							Bridges, culverts		

WVDEP WATERSHED ASSESSMENT PROGRAM

PHYSICAL CHARACTERIZATION >>

STREAM NAME:		A-N CODE:		STATION#:		DATE OF VISIT:	

	SEDIMENT ODORS		SEDIMENT OILS		SEDIMENT DEPOSITS
	normal		absent		sludge
	sewage		slight		sawdust
	petroleum		moderate		paperfiber
	chemical		profuse		sand
	anaerobic (septic)				relic shells
	none				marl
	other:				silt
					limestone fines
					metal hydroxides (yellow boy, white boy)
					other:

Comments:

Check each box that applies.

INORGANIC SUBSTRATE	SIZE CLASS	% COMPOSTION
bedrock	smooth surface rock/hardpan (bigger than a car)	
boulder	basketball to a car	
cobble	tennisball to a basketball	
gravel	ladybug to tennisball	
sand	gritty - up to ladybug	
silt	fine - not gritty	
clay	slick	

Enter estimated % composition for each substrate type.

Describe other substrate types (i.e., concrete slabs, chunks) if present and estimate % composition:

WVDEP WATERSHED ASSESSMENT PROGRAM

WATER QUALITY >>

PHYSICOCHEMICAL PARAMETERS		STREAM TYPE	WATER ODORS		SURFACE OILS		TURBIDITY	
	Temperature ° C	cold water		normal		slick		clear
	pH (std. units)	warm water fishable		sewage		sheen		slightly turbid
	dissolved oxygen (mg/l)	warm water non-fishable		petroleum		globs		moderately turbid
	conductivity (µmos/cm)			chemical		flecks		turbid
	flow							
				anaerobic (septic)		none		opaque
				none				water color:
				other:				

Record readings in ☐ for corresponding physicochemical parameter. Insert a ✓ in the ☐ for other categories.

WEATHER CONDITIONS			
CURRENT:		PAST 24 HOURS (IF KNOWN):	

STREAM BANK / RIPARIAN BUFFER ZONE MEASURES >>>>>>>>>>>>>>>>>>>>>>>>>>

STREAM BANK / RIPARIAN BUFFER ZONE WIDTH & VEGETATION / COVER TYPE

Vegetation types: **D**=deciduous **C**=coniferous **M**=mixed **N**=none

Score Codes: **0**=absent **1**=sparse (0-10%) **2**=moderate (10-40%) **3**=heavy (40-75%) **4**=very heavy (> 75%)

LEFT & RIGHT BANK WHILE FACING DOWN-STREAM		CANOPY (> 0.5m high)			UNDERSTORY (0.5 - 5m high)			GROUND COVER (< 0.5m high)			
	ZONE WIDTH (m)	VEG TYPE	BIG TREES (> 0,3 m DBH)	SMALL TREES (> 0,3 m DBH)	VEG TYPE	WOODY SHRUBS SAPLINGS	NON-WOODY HERBS	WOODY SHRUBS & SEED-LINGS	NON-WOODY HERBS, FERNS, MOSSES	LEAF LITTER	BARREN BARE SOIL
LEFT											
RIGHT											

STREAM SURFACE SHADING (%)	Indicate % based on cloudless day in summer at noon. Place ✓ in ☐ that applies.						
	fully exposed (0-25)		partially exposed (25-50)		partially shaded (50-75)		fully shaded (100-100)

Comments:

WVDEP WATERSHED ASSESSMENT PROGRAM

RAPID HABITAT ASSESSMENT: RIFFLE/RUN PREVALENCE >>>>>>>>>>>>>>>>>>>>>>>>

STREAM NAME:		A-N CODE:		STATION#:		DATE OF VISIT:	

HABITAT PARAMETER	CATEGORY			
	Optimal	Sub-optimal	Marginal	Poor
1. INSTREAM COVER (FISH) SCORE:	GREATER THAN 50% MIX OF BOULDER, COBBLE SUBMERGED LOGS, UNDERCUT BANKS, OR OTHER STABLE HABITATS.	30 TO 50% MIX OF BOULDER, OR OTHER STABLE HABITATS. ADEQUATE HABITAT.	10 TO 300% MIX OF BOULDER, COBBLE, OR OTHER STABLE HABITAT; HABITAT AVAILABILITY IS LESS THAN DESIRABLE.	LESS THAN 10% OF BOULDER, COBBLE, OR OTHER STABLE HABITAT; LACK OF HABITAT IS OBVIOUS
	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. EPIFAUNAL SUBSTRATE SCORE:	WELL DEVELOPED RIFFLE & RUN; RIFFLE IS AS WIDE AS STREAM AND ITS LENGTH EXTENDS TWO TIMES THE WIDTH OF THE STREAM; ABUNDANCE OF COBBLE.	RIFFLE IS AS WIDE AS STREAM, BUT IS LESS THAN TWO TIMES WIDTH; ABUNDANCE OF COBBLE; BOULDERS AND GRAVEL COMMON.	RUN AREA MAY BE LACKING; REDUCED RIFFLE AREA THAT DOES NOT EXTEND ACROSS ENTIRE CROSS SECTION AND IS LESS THAN TWO TIMES THE WIDTH; GRAVEL OR LARGE BOULDERS AND BEDROCK PREVALENT; COBBLE PRESENT.	RIFFLE OR RUN VIRTUALLY NON-EXISTENT; GRAVEL OR LARGE BOULDERS AND BEDROCK PREVALENT; COBBLE LACKING.
	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. EMBEDDEDNESS SCORE:	GRAVEL, COBBLE, AND BOULDER PARTICLES ARE BETWEEN 0 AND 25% SURROUNDED BY FINE SEDIMENT.	GRAVEL, COBBLE, AND BOULDER PARTICLES ARE BETWEEN 25 AND 50% SURROUNDED BY FINE SEDIMENT.	GRAVEL, COBBLE, AND BOULDER PARTICLES ARE BETWEEN 50 AND 75% SURROUNDED BY FINE SEDIMENT.	GRAVEL, COBBLE, AND BOULDER PARTICLES ARE OVER 75% SURROUNDED BY FINE SEDIMENT.
	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. VELOCITY/ DEPTH REGIMES SCORE:	SLOW (<.3 M/S), DEEP (>0.5 I M); SLOW, SHALLOW (<0.5 M); FAST (>0.3 M/S), DEEP; FAST, SHALLOW HABITATS ALL PRESENT.	ONLY 3 OF 4 HABITAT TYPES PRESENT (IF FAST-SHALLOW IS MISSING, SCORE LOWER THAN IF OTHER TYPES ARE MISSING.	ONLY 2 OF THE FOUR HABITAT TYPES ARE PRESENT (IF FAST-SHALLOW OR SLOW-SHALLOW ARE MISSING, SCORE LOW).	DOMINATED BY ONE VELOCITY/ DEPTH REGIME (USUALLY SLOW-DEEP).
	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. CHANNEL ALTERATION SCORE:	NO CHANNELIZATION OR DREDGING PRESENT.	SOME CHANNELIZATION PRESENT, USUALLY IN AREAS OF BRIDGE ABUTMENTS; EVIDENCE OF PAST CHANN ELIZATION, I.E., DREDGING (> THAN PAST 20 YRS.) MAY BE PRESENT, BUT NO EVIDENCE OF RECENT CHANNELIZATION.	NEW EMBANKMENTS ARE PRESENT ON BOTH BANK; AND 40 TO 80% OF THE STREAM REACH IS CHANNELIZATION AND DISRUPTED.	BANKS SHORED WITH GABION OR CEMENT; OVER 80% OF THE STREAM REACH IS CHANNELIZATION AND DISRUPTED.
	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
6. SEDIMENT DEPOSITION SCORE:	LITTLE OR NO ENLARGEMENT OF ISLANDS OR POINT BARS AND LESS THAN 5% OF THE BOTTOM IS AFFECTED BY SEDIMENT DEPOSITION.	SOME NEW INCREASE IN BAR FORMATION, MOSTLY FROM COARSE GRAVEL; 5 TO 30% OF THE BOTTOM IS AFFECTED; SLIGHT DEPOSITION IN POOLS.	MODERATE DEPOSITION OF NEW GRAVEL OR COARSE SAND ON OLD AND NEW BARS; 30 TO 50% OF BOTTOM IS AFFECTED; SEDIMENT DEPOSITS AT OBSTRUCTIONS, CONSTRICTIONS, AND BENDS; MODERATE DEPOSITION OF POOLS PREVALENT	HEAVY DEPOSITS OF FINE MATERIAL; INCREASED BAR DEVELOPMENT; MORE THAN 50% OF THE BOTTOM IS CHANGING FREQUENTLY; POOLS ALMOST ABSENT DUE TO SUBSTANTIAL SEDIMENT DEPOSITION.
	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

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WVDEP WATERSHED ASSESSMENT PROGRAM

RAPID HABITAT ASSESSMENT: GLIDE/POOL PREVALENCE >>>>>>>>>>>>>>>>>>>>>>>

STREAM NAME:		A-N CODE:		STATION#:		DATE OF VISIT:	

HABITAT PARAMETER	CATEGORY			
	Optimal	Sub-optimal	Marginal	Poor
1. INSTREAM COVER (FISH) SCORE:	GREATER THAN 50% MIX OF SNAGS, SUBMERGED LOGS, UNDERCUT BANKS, OR OTHER STABLE HABITAT; RUBBLE OR GRAVEL MAY BE PRESENT.	30 TO 50% MIX OF STABLE HABITAT; ADEQUATE HABITAT FOR MAINTENANCE OF POPULATIONS.	10 TO 30% MIX OF STABLE HABITAT; AT AVAILABILITY IS LESS THAN DESIRABLE.	LESS THAN 10% STABLE HABITAT; LACK OF HABITAT IS OBVIOUS.
	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. EPIFAUNAL SUBSTRATE SCORE:	PREFERRED BENTHIC SUBSTRATE (TO BE SAMPLED) IF IS ABUNDANT THROUGHOUT STREAM SITE AND AT A STAGE TO ALLOW FOR FULL COLONIZATION POTENTIAL (I.E., LOGS & SNAGS THAT ARE NOT NEW FALL AND NOT TRANSIENT.	SUBSTRATE IS COMMON BUT PREVALENT AND NOT WELL-SUITED FOR FULL COLONIZATION POTENTIAL.	SUBSTRATE FREQUENTLY DISTURBED OR REMOVED.	SUBSTRATE IS UNSTABLE OR LACKING.
	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. POOL SUBSTRATE CHARACTERIZATION SCORE:	MIXTURE OF SUBSTRATE MATERIALS, WITH GRAVEL AND FIRM SAND PREVALENT; ROOT MATS AND SUBMERGED VEGETATION ARE COMMON.	MIXTURE OF SOFT SAND, MUD, CLAY; MUD MAY BE DOMINANT; SOME ROOT MATS AND SUBMERGED VEGETATION ARE PRESENT.	ALL MUD OR CLAY OR SAND BOTTOM; LITTLE OR NO ROOT MAT; NO SUBMERGED VEGETATION.	HARD-PAN CLAY OR BEDROCK; NO ROOT MAT OR VEGETATION.
	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. POOL VARIABILITY **SHALLOW < 1 m **DEEP > 1 m. SCORE:	EVEN MIX OF LARGE[1]-SHALLOW, LARGE-DEEP, SMALL-SHALLOW, SMALL-DEEP POOLS PRESENT.	MAJORITY OF POOLS LARGE-DEEP; VERY FEW SHALLOW.	SHALLOW POOLS MUCH MORE PREVALENT THAN DEEP POOLS.	MAJORITY OF POOLS SMALL-SHALLOW OR POOLS ABSENT.
	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. CHANNEL ALTERATION SCORE:	NO CHANNELIZATION OR DREDGING PRESENT.	SOME CHANNELIZATION PRESENT, USUALLY IN AREAS OF BRIDGE ABUTMENTS; EVIDENCE OF PAST CHANNELIZATION, I.E., DREDGING (> THAN PAST 20 YRS.) MAY BE PRESENT, BUT NO EVIDENCE OF RECENT CHANNELIZATION.	NEW EMBANKMENTS ARE PRESENT ON BOTH BANKS; CHANNELIZATION MAY BE EXTENSIVE, USUALLY IN AREAS OR DRAINAGE AREAS OF AGRICULTURAL LANDS; AND MORE THAN 80% OF THE STREAM REACH IS CHANNELIZED OR DISRUPTED.	EXTENSIVE CHANNELIZATION; SHORED WITH GABION OR CEMENT; HEAVILY URBANIZED AREAS; INSTREAM HABITAT GREATLY ALTERED OR REMOVED ENTIRELY.
	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
6. SEDIMENT DEPOSITION SCORE:	LESS THAN 20% OF THE BOTTOM 1S AFFECTED; MINOR ACCUMULATION OF FINE AND COARSE MATERIAL AT SNAGS AND SUBMERGED VEGETATION; LITTLE OR NO ENLARGEMENT OF ISLANDS OR POINT BARS.	20 TO 50% AFFECTE D; MODERATE ACCUMULATION; SUBSTANTIAL SEDIMENT MOVEMENT ONLY DURING MA)OR STORM EVENTS; SOME NEW INCREASE IN BAR FORMATION.	50 TO 80% AFFECTE D; MAJOR DEPOSITION; POOLS SHALLOW AND HEAVILY SILTED; EMBANKMENTS MAY BE PRESENT ON BOTH BANKS; FREQUENT AND SUBSTANTIAL SEDIMENT MOVEMENT DURING STORM EVENTS.	CHANNELIZED; MUD, SILT, AND/ OR SAND IN BRAIDED OR NON-BRAIDED CHANNELS; POOLS ALMOST ABSENT DUE TO DEPOSITION.
	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

PAGE 5b *WVDEP WAP - STREAM ASSESSMENT FORM (13 FEB 96)*

[1] Large if length, width, or oblique dimension is > than 1/2 stream width.

RAPID HABITAT ASSESSMENT: RIFFLE/RUN PREVALENCE (continued)

STREAM NAME:		A-N CODE:		STATION#:		DATE OF VISIT:	

HABITAT PARAMETER	CATEGORY			
	Optimal	Sub-optimal	Marginal	Poor
7. RIFFLE FREQUENCY SCORE:	OCCURRENCE OF RIFFLES IS RELATIVELY FREQUENT; THE DISTANCE BETWEEN RIFFLES DIVIDED BY THE WIDTH OF THE STREAM EQUALS 5 TO 7; VARIETY OF HABITAT.	OCCURRENCE OF RIFFLES IS INFREQUENT; DISTANCE BETWEEN RIFFLES DIVIDED BY WIDTH OF THE STREAM EOUALS 7 TO 15.	OCCASIONAL RIFFLE OR BEND; BOTTOM CONTOURS PROVIDE SOME HABI'TAT; DISTANCE BETWEEN RIFFLES DIVIDED BY THE WIDTH OF THE STREAM IS BETWEEN 15 TO 20.	GENERALLY ALL FLAT WATER OR SHALLOW RIFFLES; POOR HABITAT; DISTANCE BETWEEN RIFFLES DIVIDED BY THE WIDTH OF THE STREAM IS GREATER THAN 25.
	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. CHANNEL FLOW STATUS SCORE:	WATER REACHES THE BASE OF BOTH BANKS AND A MINIMAL AREA OF CHANNEL SUBSTRATE IS EXPOSED.	WATER FILLS MORE THAN 75% OF THE AVAILABLE CHANNEL; OR LESS THAN 25% OF THE CHANNEL SUBSTRATE IS EXPOSED.	WATER FILLS 25 TO 75% OF THE AVAILABLE CHANNEL; AND/OR RIFFLE SUBSTRATES ARE MOSTLY EXPOSED.	VERY LITTLE WATER IN CHANNEL, AND MOSTLY RESENT AS STANDING POOLS.:
	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
9. BANK CONDITION SCORE:	UPPER BANK STABLE, 0-10% OF BANKS WITH EROSIONAL SCARS AND LITTLE POTENTIAL FOR FUTURE PROBLEMS.	MODERATELY STABLE. 10 TO 30% OF BANKS WITH EROSIONAL SCARS, MOSTLY HEALED OVER. SLIGHT POTENTIAL IN EXTREME FLOODS.	MODERATELY UNSTABLE. 30 TO 60% OF BANKS WITH EROSIONAL ARS AND HIGH EROSION POTENTIAL DURING EXTREME HIGH FLOW.	UNSTABLE. MANY ERODED AREAS. "RAW" AREAS FREQUENT ALONG STRAIGHT SECTIONS AND BENDS. SIDe SLOPES >60° COMMON.
	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
10. BANK VEGETATIVE PROTECTION	MORE THAN 90% OF THE STREAMBANK SURFACES ARE COVERED BY VEGETATION.	70 TO 90% OF THE STREAMBANK SURFACES ARE COVERED BY VEGETATION.	50 TO 70% OF THE STREAMBANK SURFACES ARE COVERED BY VEGETATION.	LESS THAN 50% OF THE STREAMBANK SURFACES ARE COVERED BY VEGETATION.
SCORE:	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
11. GRAZING OR OTHER DISRUPTIVE PRESSURE SCORE:	VEGETATIVE DISRUPTION THRU GRAZING OR MOWING IS MINIMAL OR NOT EVIDENT; ALMOST ALL PLANTS ARE ALLOWED TO GROW NATURALLY.	DISRUPTION IS EVIDENT BUT IS NOT AFFECTING FULL PLANT GROWTH POTENTIAL TO ANY GREAT EXTENT; MORE THAN ONE-HALF OF THE POTENTIAL PLANT STUBBLE HEIGHT REMAINING.	DISRUPTION IS OBVIOUS; PATCHES OF BARE SOIL OR CLOSELY CROPPED VEGETATION ARE COMMON; LESS THAN ONE-HALF OF THE POTENTIAL PLANT STUBBLE HEIGHT REMAINING.	DISRUPTION OF STREAMBANK VEGETATION IS VERY HIGH; VEGETATION HAS BEEN REMOVED TO 2 INCHES OR LESS IN AVERAGE STUBBLE HEIGHT.
	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
12. RIPARIAN VEG. ZONE WIDTH (LEAST BUFFERED SIDE) SCORE:	WIDTH OF RIPARIAN ZONE IS GREATER THAN 18 METERS; HUMAN ACTIVITIES (I.E., PARKING LOTS, ROADBEDS, CLEARCUTS, LAWNS, OR CROPS) HAVE NOT IMPACTED THIS ZONE.	ONE WIDTH IS BETWEEN 12 18 METERS; HUMAN ACTIVITIES HAVE ONLY MININIMALLY IMPACTED THIS ZONE.	ZONE WIDTH IS BETWEEN 6 AND 12 METERS; HUMAN ACTIVITIES HAVE IMPACTED THE ZONE A GREAT DEAL.	WIDTH OF ZONE IS LESS THAN 6 METERS; LITTLE OR NO RIPARIAN VEGETATION DUE TO MAN-INDUCED ACTIVITIES.
	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
TOTAL SCORE:				

PAGE 6 *WVDEP WAP - STREAM ASSESSMENT FORM (13 FEB 96)*

RAPID HABITAT ASSESSMENT: GLIDE/POOL PREVALENCE (continued)

STREAM NAME:	A-N CODE:	STATION#:	DATE OF VISIT:

HABITAT PARAMETER	CATEGORY			
	Optimal	Sub-optimal	Marginal	Poor
7. CHANNEL SINUOSITY SCORE:	THE BENDS IN THE STREAM INCREASE THE STREAM LENGTH 3 TO 4 TIMES LONGER THAN IF IT WAS IN A STRAIGHT LINE.	THE BENDS IN THE STREAM INCREASE THE STREAM LENGTH 2 TO 3 TIMES LONGER THAN IF IT WAS IN A STRAIGHT LINE.	THE BENDS IN THE STREAM INCREASE THE STREAM LENGTH 1 TO 2 TIMES LONGER THAN IF IT WAS IN A STRAIGHT LINE.	CHANNEL IS STRAIGHT; WATERWAY HAS BEEN CHANNELIZED FOR A LONG DISTANCE.
	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. CHANNEL FLOW STATUS SCORE:	WATER REACHES THE BASE OF BOTH BANKS AND A MINIMAL AREA OF CHANNEL SUBSTRATE IS EXPOSED.	WATER FILLS MORE THAN 75% OF THE AVAILABLE CHANNEL; OR LESS THAN 25% OF THE CHANNEL SUBSTRATE IS EXPOSED.	WATER FILLS 25 TO 75% OF THE AVAILABLE CHANNEL; AND/OR RIFFLE SUBSTRATES ARE MOSTLY EXPOSED.	VERY LITTLE WATER IN CHANNEL, AND MOSTLY RESENT AS STANDING POOLS.
	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
9. BANK CONDITION SCORE:	UPPER BANK STABLE, 0-10% OF BANKS WITH EROSIONAL SCARS AND LITTLE POTENTIAL FOR FUTURE PROBLEMS.	MODERATELY STABLE. 10 TO 30% OF BANKS WITH EROSIONAL SCARS, MOSTLY HEALED OVER. SLIGHT POTENTIAL IN EXTREME FLOODS.	MODERATELY UNSTABLE. 30 TO 60% OF BANKS WITH EROSIONAL ARS AND HIGH EROSION POTENTIAL DURING EXTREME HIGH FLOW.	UNSTABLE. MANY ERODED AREAS. "RAW" AREAS FREQUENT ALONG STRAIGHT SECTIONS AND BENDS. SIDE SLOPES >60° COMMON.
	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
10. BANK VEGETATIVE PROTECTION SCORE:	MORE THAN 90% OF THE STREAMBANK SURFACES ARE COVERED BY VEGETATION.	70 TO 90% OF THE STREAMBANK SURFACES ARE COVERED BY VEGETATION.	50 TO 70% OF THE STREAMBANK SURFACES ARE COVERED BY VEGETATION.	LESS THAN 50% OF THE STREAMBANK SURFACES ARE COVERED BY VEGETATION.
	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
11. GRAZING OR OTHER DISRUPTIVE PRESSURE SCORE:	VEGETATIVE DISRUPTION THRU GRAZING OR MOWING IS MINIMAL OR NOT EVIDENT; ALMOST ALL PLANTS ARE ALLOWED TO GROW NATURALLY.	DISRUPTION IS EVIDENT BUT IS NOT AFFECTING FULL PLANT GROWTH POTENTIAL TO ANY GREAT EXTENT; MORE THAN ONE-HALF OF THE POTENTIAL PLANT STUBBLE HEIGHT REMAINING.	DISRUPTION IS OBVIOUS; PATCHES OF BARE SOIL OR CLOSELY CROPPED VEGETATION ARE COMMON; LESS THAN ONE-HALF OF THE POTENTIAL PLANT STUBBLE HEIGHT REMAINING.	DISRUPTION OF STREAMBANK VEGETATION IS VERY HIGH; VEGETATION HAS BEEN REMOVED TO 2 INCHES OR LESS IN AVERAGE STUBBLE HEIGHT.
	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
12. RIPARIAN VEG. ZONE WIDTH (LEAST BUFFERED SIDE) SCORE:	WIDTH OF RIPARIAN ZONE IS GREATER THAN 18 METERS; HUMAN ACTIVITIES (I.E., PARKING LOTS, ROADBEDS, CLEARCUTS, LAWNS, OR CROPS) HAVE NOT IMPACTED THIS ZONE.	ONE WIDTH IS BETWEEN 12 18 METERS; HUMAN ACTIVITIES HAVE ONLY MININIMALLY IMPACTED THIS ZONE.	ZONE WIDTH IS BETWEEN 6 AND 12 METERS; HUMAN ACTIVITIES HAVE IMPACTED THE ZONE A GREAT DEAL.	WIDTH OF ZONE IS LESS THAN 6 METERS; LITTLE OR NO RIPARIAN VEGETATION DUE TO MAN-INDUCED ACTIVITIES.
	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
TOTAL SCORE:				

Stream Codes - symbols developed by the WV Wildlife Resources Division to identify and locate each stream.

Each code consists of up to 7 subcodes. The first subcode is the river system code (alphabetic). The other subcodes alternate numbers and letters, and indicate the position of the stream relative to the mouth of the stream. For example, KG is the stream code for the Gauley River, a tributary of the Kanawha River; KG-1 stands for the first tributary of the Gauley upriver of its mouth. KG-2-C represents the third tributary of the second tributary of the Gauley of the Kanawha.

Table 3. **Sampling stations**

name	stream code	latitude			longitude			county
		deg	min	sec	deg	min	sec	
ALEXANDERS RUN	WVO-97-B	40	22	24.94	80	33	0.66	BROOKE
ALLEGHENY STEEL RUN	WVO-95.5	40	19	52.16	80	35	41.78	BROOKE
BOSLEY RUN	WVO-95-A	40	18	37.39	80	34	16.98	BROOKE
BROWN HOLLOW	WVO-97-D	40	21	58.80	80	3 1	45.75	BROOKE
CONGO RUN	WVO-104	40	36	4.00	80	37	52.00	HANCOCK
CROSS CREEK	WVO-95	40	18	8.19	80	35	34.39	BROOKE
CUNNINGHAM RUN	WVO-106	40	36	33.42	80	34	30.60	HANCOCK
DEEP GUT RUN	WVO-101	40	30	53.45	80	36	57.65	HANCOCK
DRY RUN	WVO-103	40	34	27.19	80	39	24.97	HANCOCK
EBENEZER RUN	WVO-95-B	40	18	24.00	80	33	42.00	BROOKE
HARDIN RUN	WVO-100	40	30	2.16	80	36	32.98	HANCOCK
HARMON CREEK	WVO-97	40	23	28.69	80	35	37.96	BROOKE
HERRON RUN	WVO-IOO-A	40	30	10.40	80	35	17.60	HANCOCK
HOLBERT RUN	WVO-99	40	28	16.96	80	35	27.83	HANCOCK
KINGS CREEK	WVO-98	40	26	8.45	80	35	32.47	HANCOCK
LANGFITT RUN	WVO-IOO-B	40	30	44.98	80	33	11.96	HANCOCK
LAUREL HOLLOW	WVO-105	40	37	0.00	80	36	20.00	HANCOCK
LICK RUN	WVO-98-B	40	25	44.19	80	32	14.39	HANCOCK
MAHAN RUN	WVO-96	40	20	31.76	80	35	39.50	BROOKE
MARKS RUN	WVO-108	40	36	59.88	80	33	33.69	HANCOCK
MARROW RUN	WVO-98-A.5	40	26	16.02	80	33	47.44	HANCOCK
MECHLING RUN	WVO-97-C	40	22	2.24	80	32	26. 12	BROOKE
MERCER RUN	WVO-102-C-1	40	33	31.44	80	34	23.46	HANCOCK
MIDDLE RUN	WVO-107	40	36	41.61	80	33	44.50	HANCOCK
NORTH FORK	WVO-98-A	40	26	27.84	80	33	32.65	HANCOCK
NORTH FORK TOMLINSON RUN	WVO-102-C	40	33	1.42	80	35	5.82	HANCOCK
NORTH POTROCK RUN	WVO-95-C	40	18	11.61	80	32	49.04	BROOKE
PARMAR RUN	WVO-95-E-1	40	18	6.53	80	31	51.13	BROOKE
POTROCK RUN	WVO-95-D	40	18	4.30	80	32	48.40	BROOKE
RUSH RUN	WVO-98.7A	40	26	33.39	80	33	54.60	HANCOCK
SAPPINGTONS RUN	WVO-97-A	40	23	26.30	80	34	7.70	BROOKE
SCOTT RUN	WVO-95-E	40	17	57.42	80	32	0.76	BROOKE
SOUTH FORK TOMLINSON RUN	WVO-102-B	40	32	22.84	80	35	5.08	HANCOCK
TOMLINSON RUN	WVO-102	40	33	43.00	80	36	55.00	HANCOCK
TURKEY FOOT RUN	WVO-98.5A	40	26	28.46	80	34	9.55	HANCOCK
WHITE OAK RUN	WVO-102-A	40	33	22.64	80	36	53.09	HANCOCK

Table 4. **Sampling reach characteristics**

name	date	stream width (m)	riffle depth (m)	run depth (m)	pool depth (m)
ALEXANDERS RUN	5/22/96	2.0	0.10	0.25	0.40
ALLEGHENY STEEL RUN	5/22/96	4.0	0. 10	NA	NA
BOSLEY RUN	5/23/96	3.0	0.20	0.20	0.50
BROWN HOLLOW	5/22/96	1.0	NA	0.10	NA
CONGO RUN	5/22/96	1.5	0.20	0.30	NA
CROSS CREEK	5/23/96	10.0	0.50	1.00	1.00
CUNNINGHAM RUN	5/22/96	2.5	0.30	0.40	0.30
DEEP GUT RUN	5/22/96	2.0	0.10	0.20	0.10
DRY RUN	5/22/96	2.0	0.10	0.40	0.80
EBENEZER RUN	5/23/96	3.0	0.10	0.30	0.60
HARDIN RUN	5/22/96	7.5	0.08	0.60	1.00
HARMON CREEK	5/22/96	15.0	0.00	0.50	NA
HERRON RUN	5/22/96	1.5	0.15	0.25	1.00
HOLBERT RUN	5/22/96	3.0	0.10	0.20	0.30
KINGS CREEK	5/22/96	15.0	0.30	0.80	1.00
LANGFITT RUN	5/22/96	1.5	0.10	0.10	NA
LAUREL HOLLOW	5/22/96	3.0	0.10	0.20	0.50
LICK RUN	5/22/96	3.0	0.20	0.10	0.30
MAHAN RUN	5/22/96	2.5	0.10	0.20	0.00
MARKS RUN	5/22/96	3.0	0.20	0.20	0.60
MARROW RUN	5/22/96	2.0	0.10	0.11	0.30
MECHLING RUN	5/22/96	2.0	0. I0	0.10	0.30
MERCER RUN	5/22/96	2.5	0.15	0.30	1.00
MIDDLE RUN	5/22/96	3.0	0.20	0.20	0.60
NORTH FORK	5/22/96	10.0	0.10	0.50	0.70
NORTH FORK TOMLINSON RUN	5/22/96	6.0	0.15	0.60	1.00
NORTH POTROCK RUN	5/23/96	2.0	0.10	0.20	NA
PARMAR RUN	5/23/96	2.5	0.20	0.40	0.50
POTROCK RUN	5/23/96	2.0	0.10	0.20	NA
RUSH RUN	5/22/96	1.0	0.10	0.10	NA
SAPPINGTONS RUN	5/22/96	3.0	0.10	0.20	NA
SCOTT RUN	5/23/96	15.0	0.20	0.30	0.90
SOUTH FORK TOMLINSON RUN	5/22/96	5.0	0.30	0.30	NA
TOMLINSON RUN	5/23/96	8.0	0.00	0.50	3.20
TURKEY FOOT RUN	5/22/96	1.5	0.10	0.10	NA
WHITE OAK RUN	5/23/96	3.5	0.10	0.20	0.30
Average		4.3	0.14	0.30	0.72
Minimum		1.0	0.08	0. I0	0.I0
Maximum		15.0	0.50	1.00	3.20
n		36	35	35	25

Table 5. **Erosion and NPS pollution**

name	erosion	NPS pollution
ALEXANDERS RUN	M	OBV
ALLEGHENY STEEL RUN	M	POT
BOSLEY RUN	M	POT
BROWN HOLLOW	N	POT
CONGO RUN	M	OBV
CROSS CREEK	H	POT
CUNNINGHAM RUN	M	POT
DEEP GUT RUN	H	POT
DRY RUN	M	OBV
EBENEZER RUN	M	NOE
HARDIN RUN	H	OBV
HARMON CREEK	H	OBV
HERRON RUN	M	POT
HOLBERT RUN	M	POT
KINGS CREEK	M	POT
LANGFITT RUN	M	OBV
LAUREL HOLLOW	M	POT
LICK RUN	M	POT
MAHAN RUN	M	OBV
MARKS RUN	M	POT
MARROW RUN	N	OBV
MECHLING RUN	M	POT
MERCER RUN	ND	OBV
MIDDLE RUN	M	POT
NORTH FORK	H	NOE
NORTH FORK TOMLINSON RUN	N	NOE
NORTH POTROCK RUN	M	POT
PARMAR RUN	M	OBV
POTROCK RUN	M	POT
RUSH RUN	H	POT
SAPPINGTONS RUN	M	POT
SCOTT RUN	M	POT
SOUTH FORK TOMLINSON RUN	M	POT
TOMLINSON RUN	S	NOE
TURKEY FOOT RUN	H	OBV
WHITE OAK RUN	H	NOE

KEY: Erosion: N = none S = slight M = moderate H = heavy ND = not determined
NPS (Non-Point Source) pollution: NOE = no evidence POT = potential sources OBV = obvious sources

Table 6. **Residential landuses**

name	residences	lawns	boatdocks	construction	pipe-drain	road	bridge-culvert
ALEXANDERS RUN							
ALLEGHENY STEEL RUN	✓	✓			✓	✓	✓
BOSLEY RUN							
BROWN HOLLOW	✓	✓				✓	✓
CONGO RUN	✓	✓			✓	✓	✓
CROSS CREEK							
CUNNINGHAMRUN	✓	✓				✓	✓
DEEP GUT RUN							
DRY RUN							
EBENEZER RUN							
HARDIN RUN	✓	✓			✓		✓
HARMON CREEK							
HERRON RUN	✓	✓				✓	✓
HOLBERT RUN	✓	✓				✓	✓
KINGS CREEK	✓	✓				✓	✓
LANGFITT RUN	✓	✓				✓	✓
LAUREL HOLLOW	✓	✓				✓	✓
LICK RUN	✓	✓				✓	
MAHAN RUN	✓	✓				✓	✓
MARKS RUN							
MARROW RUN	✓	✓			✓	✓	✓
MECHLING RUN	✓	✓		✓	✓	✓	✓
MERCER RUN	✓	✓				✓	✓
MIDDLE RUN	✓	✓				✓	✓
NORTH FORK							
NORTH FORK TOMLINSON RUN	✓					✓	
NORTH POTROCK RUN	✓	✓			✓	✓	
PARMAR RUN	✓	✓					✓
POTROCK RUN	✓	✓				✓	✓
RUSH RUN	✓	✓		✓	✓	✓	✓
SAPPINGTONS RUN	✓	✓				✓	✓
SCOTT RUN						✓	
SOUTH FORK TOMLINSON RUN							
TOMLINSON RUN							
TURKEY FOOT RUN	✓	✓			✓	✓	✓
WHITE OAK RUN							

✓ = present

Table 7. **Recreational landuses**

name	parks camp	park lot	boat dock	swimming	fishing	pipe drain	foot trails	atv, horse bike trails	roads	bridge culvert
ALEXANDERS RUN										
ALLEGHENY STEEL RUN										
BOSLEY RUN										
BROWN HOLLOW										
CONGO RUN										
CROSS CREEK										
CUNNINGHAM RUN										
DEEP GUT RUN										
DRY RUN										
EBENEZER RUN										
HARDIN RUN	✓								✓	✓
HARMON CREEK										
HERRON RUN										
HOLBERT RUN										
KINGS CREEK					✓		✓			
LANGFITT RUN										
LAUREL HOLLOW										
LICK RUN										
MAHAN RUN										
MARKS RUN										
MARROW RUN		✓								
MECHLING RUN	✓									
MERCER RUN										
MIDDLE RUN										
NORTH FORK										
NORTH FORK TOMLINSON RUN							✓			
NORTH POTROCK RUN										
PARMAR RUN										
POTROCK RUN										
RUSH RUN										
SAPPINGTONS RUN		✓								
SCOTT RUN		✓			✓		✓			
SOUTH FORK TOMLINSON RUN	✓	✓				✓	✓	✓	✓	✓
TOMLINSON RUN							✓	✓		
TURKEY FOOT RUN										
WHITE OAK RUN										

✓ = present

Table 8. **Agricultural landuses**

name	row crops	pasture	hay	orchard	poultry	cattle access	irriga-tion	pipe-drain	road	bridge-culvert
ALEXANDERS RUN										
ALLEGHENY STEEL RUN										
BOSLEY RUN										
BROWN HOLLOW										
CONGO RUN										
CROSS CREEK										
CUNNINGHAM RUN										
DEEP GUT RUN										
DRY RUN										
EBENEZER RUN										
HARDIN RUN										
HARMON CREEK										
HERRON RUN										
HOLBERT RUN										
KINGS CREEK										
LANGFITT RUN		✓				✓				
LAUREL HOLLOW										
LICK RUN										
MAHAN RUN										
MARKS RUN										
MARROW RUN										
MECHLING RUN										
MERCER RUN		✓				✓			✓	✓
MIDDLE RUN										
NORTH FORK										
NORTH FORK TOMLINSON RUN										
NORTH POTROCK RUN										
PARMAR RUN										
POTROCK RUN										
RUSH RUN										
SAPPINGTONS RUN										
SCOTT RUN										
SOUTH FORK TOMLINSON RUN		✓								
TOMLINSON RUN										
TURKEY FOOT RUN										
WHITE OAK RUN										

✓ = present

Table 9. **Industrial landuses**

name	industrial plant	surface mine	deep mine	coal prep	quarries	oil-gas well	power plant	logging
ALEXANDERS RUN	✓							
ALLEGHENY STEEL RUN								
BOSLEY RUN								
BROWN HOLLOW								
CONGO RUN								
CROSS CREEK								
CUNNINGHAM RUN								
DEEP GUT RUN	✓							
DRY RUN	✓							
EBENEZER RUN								
HARDIN RUN								
HARMON CREEK								
HERRON RUN								
HOLBERT RUN								
KINGS CREEK								
LANGFITT RUN								
LAUREL HOLLOW								
LICK RUN								
MAHAN RUN								
MARKS RUN								
MARROW RUN								
MECHLING RUN								
MERCER RUN								
MIDDLE RUN								
NORTH FORK								
NORTH FORK TOMLINSON RUN								
NORTH POTROCK RUN								
PARMAR RUN								
POTROCK RUN								
RUSH RUN								
SAPPINGTONS RUN								
SCOTT RUN								
SOUTH FORK TOMLINSON RUN								
TOMLINSON RUN								
TURKEY FOOT RUN								
WHITE OAK RUN								

✓ = present

Table 9. **Industrial landuses** *continued*

name	sawmill	sanitary landfill	waste water treatment	public water treatment	pipe drain	parking lot	industrial road	bridge culvert
ALEXANDERS RUN					✓	✓	✓	
ALLEGHENY STEEL RUN								
BOSLEY RUN								
BROWN HOLLOW								
CONGO RUN								
CROSS CREEK								
CUNNINGHAM RUN								
DEEP GUT RUN							✓	✓
DRY RUN						✓	✓	
EBENEZER RUN								
HARDIN RUN						✓	✓	
HARMON CREEK					✓		✓	✓
HERRON RUN								
HOLBERT RUN						✓		
KINGS CREEK								
LANGFITT RUN								
LAUREL HOLLOW								
LICK RUN								
MAHAN RUN								
MARKS RUN			✓		✓		✓	✓
MARROW RUN								
MECHLING RUN								
MERCER RUN								
MIDDLE RUN								
NORTH FORK								
NORTH FORK TOMLINSON RUN								
NORTH POTROCK RUN								
PARMAR RUN								
POTROCK RUN								
RUSH RUN								
SAPPINGTONS RUN								
SCOTT RUN								
SOUTH FORK TOMLINSON RUN								
TOMLINSON RUN								
TURKEY FOOT RUN								
WHITE OAK RUN								

✓ = present

Table 10. **Streambed alterations**

name	liming	rip-rap stablization	dredging	channelization	fill	dams
ALEXANDERS RUN					✓	
ALLEGHENY STEEL RUN		✓		✓	✓	
BOSLEY RUN						
BROWN HOLLOW						
CONGO RUN						
CROSS CREEK						
CUNNINGHAM RUN						
DEEP GUT RUN						
DRY RUN						
EBENEZER RUN		✓				
HARDIN RUN						
HARMON CREEK		✓		✓	✓	
HERRON RUN				✓		
HOLBERT RUN					✓	
KINGS CREEK				✓		
LANGFITT RUN				✓		
LAUREL HOLLOW		✓		✓		
LICK RUN		✓				
MAHAN RUN					✓	
MARKS RUN				✓		
MARROW RUN		✓				
MECHLING RUN						
MERCER RUN						
MIDDLE RUN		✓		✓		
NORTH FORK						
NORTH FORK TOMLINSON RUN						
NORTH POTROCK RUN		✓			✓	
PARMAR RUN					✓	
POTROCK RUN		✓		✓	✓	
RUSH RUN		✓				
SAPPINGTONS RUN						
SCOTT RUN						
SOUTH FORK TOMLINSON RUN		✓				
TOMLINSON RUN						
TURKEY FOOT RUN						
WHITE OAK RUN						

✓ = present

Table 11. **Riparian canopy**

	Left				Right			
name	zone width (m)	veg type	big trees	small trees	zone width (m)	veg type	big trees	small trees
ALEXANDERS RUN	3.0	D	0	3	15.0	D	1	2
ALLEGHENY STEEL RUN	0.0	N	0	0	0.0	N	0	O
BOSLEY RUN	16.0	D	0	1	18.0	D	1	1
BROWN HOLLOW	2.0	D	1	1	2.0	D	1	1
CONGO RUN	9.0	D	1	1	9.0	D	0	3
CROSS CREEK	5.0	D	2	2	12.0	D	2	2
CUNNINGHAM RUN	9.0	D	1	2	1.0	D	0	1
DEEP GUT RUN	3.0	D	0	1	3.0	D	0	1
DRY RUN	3.5	D	0	1	31.0	D	1	2
EBENEZER RUN	3.0	D	1	2	1.5	D	1	1
HARDIN RUN	3.0	D	1	3	4.5	D	1	2
HARMON CREEK	9.0	D	0	1	12.0	D	0	1
HERRON RUN	4.5	M	1	1	7.5	D	1	2
HOLBERT RUN	3.0	D	1	2	3.0	D	0	2
KINGS CREEK	12.0	D	2	2	12.0	D	2	2
LANGFITT RUN	0.0	N	0	0	0.0	N	0	0
LAUREL HOLLOW	9.0	D	1	1	15.0	D	0	2
LICK RUN	3.0	D	1	1	1.5	D	1	1
MAHAN RUN	4.0	D	1	1	3.0	D	1	1
MARKS RUN	20.0	D	0	1	8.0	D	1	3
MARROW RUN	1.5	D	0	2	2.0	D	0	0
MECHLING RUN	2.0	D	1	1	2.0	D	1	2
MERCER RUN	3.0	D	0	1	1.0	D	0	1
MIDDLE RUN	3.5	D	2	1	5.5	D	2	1
NORTH FORK	1.0	D	1	4	1.0	D	1	4
NORTH FORK TOMLINSON RUN	20.0	D	1	0	17.0	D	1	1
NORTH POTROCK RUN	4.0	D	2	1	4.0	D	2	1
PARMAR RUN	2.5	D	1	1	3.0	M	1	1
POTROCK RUN	10.0	D	1	1	2.0	D	1	1
RUSH RUN	1.0	D	0	0	1.0	D	0	1
SAPPINGTONS RUN	8.5	D	0	2	16.0	D	0	2
SCOTT RUN	34.0	D	1	3	9.0	D	2	2
SOUTH FORK TOMLINSON RUN	7.5	D	1	1	7.5	D	1	1
TOMLINSON RUN	17.0	D	0	2	4.5	D	0	2
TURKEY FOOT RUN	2.5	D	0	1	2.0	D	0	0
WHITE OAK RUN	2.0	D	0	3	2.0	D	1	3
Average	6.7				6.6			
Minimum	0.0				0.0			
Maximum	34				31			
n	36				36			

veg type: D = deciduous C = coniferous M = mixed (at least 10 % of each type) Tree values: 0 = absent
1 = sparse (0-10%) 2 = moderate (10-40%) 3 = heavy (40-75%) 4 = very heavy (>75%)

Table 12. **Riparian understory**

	Left			Right		
name	**veg type**	**shrubs saplings**	**non-woody herbs**	**veg type**	**shrubs saplings**	**non-woody herbs**
ALEXANDERS RUN	D	1	1	D	1	1
ALLEGHENY STEEL RUN	M	0	0	M	0	0
BOSLEY RUN	D	1	1	D	3	1
BROWN HOLLOW	D	1	1	D	0	2
CONGO RUN	D	1	4	D	1	3
CROSS CREEK	D	1	1	D	1	3
CUNNINGHAM RUN	D	2	1	D	1	0
DEEP GUT RUN	D	0	3	D	1	3
DRY RUN	D	2	1	D	2	1
EBENEZER RUN	D	1	1	D	2	1
HARDIN RUN	D	1	2	D	1	2
HARMON CREEK	D	2	1	D	2	1
HERRON RUN	D	0	0	D	2	0
HOLBERT RUN	D	3	2	D	1	3
KINGS CREEK	D	2	1	D	1	1
LANGFITT RUN	D	1	0	D	1	0
LAUREL HOLLOW	D	1	1	D	1	1
LICK RUN	D	2	1	D	2	1
MAHAN RUN	D	0	0	D	0	0
MARKS RUN	D	1	4	D	1	4
MARROW RUN	D	3	1	D	1	1
MECHLING RUN	D	1	1	D	2	1
MERCER RUN	D	1	0	D	1	0
MIDDLE RUN	D	0	3	D	1	4
NORTH FORK	D	2	1	D	2	1
NORTH FORK TOMLINSON RUN	D	1	1	D	1	1
NORTH POTROCK RUN	D	1	1	D	1	1
PARMAR RUN	D	0	0	D	1	0
POTROCK RUN	D	1	0	D	1	0
RUSH RUN	D	0	0	D	3	1
SAPPINGTONS RUN	D	1	1	D	3	2
SCOTT RUN	D	1	1	D	1	1
SOUTH FORK TOMLINSON RUN	D	1	1	D	1	1
TOMLINSON RUN	D	1	1	D	1	1
TURKEY FOOT RUN	D	0	0	D	1	0
WHITE OAK RUN	D	2	1	D	2	1

Table 13. **Riparian groundcover**

name	Left			Right			stream shade
	shrubs seedlings	nonwoody grasses, etc	bare soil	shrubs seedlings	nonwoody grasses, etc	bare soil	
ALEXANDERS RUN	2	3	1	2	2	1	3
ALLEGHENY STEEL RUN	0	0	0	0	0	0	2
BOSLEY RUN	0	4	1	1	2	0	2
BROWN HOLLOW	1	3	2	0	3	2	2
CONGO RUN	1	1	0	1	1	0	3
CROSS CREEK	1	3	1	1	2	0	2
CUNNINGHAM RUN	1	2	0	0	4	1	1
DEEP GUT RUN	2	1	2	1	1	1	2
DRY RUN	1	2	0	1	3	1	1
EBENEZER RUN	1	3	0	2	4	2	4
HARDIN RUN	1	2	3	1	2	3	2
HARMON CREEK	1	1	3	1	1	3	2
HERRON RUN	0	3	1	1	3	0	3
HOLBERT RUN	1	2	3	1	2	0	3
KINGS CREEK	2	2	1	1	1	2	4
LANGFITT RUN	0	4	1	0	4	1	1
LAUREL HOLLOW	1	3	1	1	4	1	4
LICK RUN	2	3	1	1	3	1	2
MAHAN RUN	0	4	0	0	4	0	1
MARKS RUN	0	2	0	0	2	0	3
MARROW RUN	1	3	1	1	4	1	1
MECHLING RUN	1	4	2	1	3	1	2
MERCER RUN	0	3	3	0	2	3	1
MIDDLE RUN	0	2	1	0	0	0	2
NORTH FORK	1	3	2	1	3	3	3
NORTH FORK TOMLINSON RUN	0	2	3	0	2	2	2
NORTH POTROCK RUN	2	3	2	2	3	2	3
PARMAR RUN	0	3	1	0	3	1	1
POTROCK RUN	0	4	0	0	2	2	3
RUSH RUN	1	2	3	1	2	2	1
SAPPINGTONS RUN	2	3	1	1	2	0	2
SCOTT RUN	1	3	2	1	3	1	3
SOUTH FORK TOMLINSON RUN	1	2	2	1	2	2	2
TOMLINSON RUN	1	1	2	1	1	2	2
TURKEY FOOT RUN	0	3	3	0	1	4	1
WHITE OAK RUN	2	3	3	2	3	3	4

Key: Veg score codes: 0=absent, 1=sparse (0-10%), 2=moderate (10-40%), 3=heavy (40-75%), 4=very heavy (>75%);
Bare soil codes: 0=absent, 1=sparse bare soil (0-10%), 2=moderate bare soil (10-40%), 3=heavy bare soil (40-70%), 4=mostly bare soil (>75%);
Stream shade: 1=mostly exposed (0-25%), 2=partially exposed (25-50%), 3=partially shaded (50-75%), 4=mostly shaded (>75%);

Table 14. **Instream habitat assessment**

name	cover	substrate	embed	velocity	alter	sed	riffle	flow	banks	bankveg	graze	rip veg	total
ALEXANDERS RUN	3	7	14	10	16	10	11	16	4	14	10	5	120
ALLEGHENY STEEL RUN	4	8	9	3	0	5	3	17	18	1	1	0	69
BOSLEY RUN	15	16	15	16	16	17	18	19	15	16	15	12	190
BROWN HOLLOW	9	15	8	13	16	10	16	16	12	12	14	7	138
CONGO RUN	12	10	15	13	16	13	16	15	12	16	16	7	161
CROSS CREEK	18	17	7	17	18	8	17	17	12	15	14	10	170
CUNNINGHAM RUN	18	17	16	16	16	14	17	16	5	14	8	2	159
DEEP GUT RUN	16	18	11	16	16	17	18	15	8	12	16	9	172
DRY RUN	6	17	12	14	17	12	17	14	13	13	16	16	168
EBENEZER RUN	17	18	17	17	17	17	19	19	15	14	17	15	202
HARDIN RUN	14	16	11	14	12	10	15	14	10	10	8	1	136
HARMON CREEK	6	8	7	6	2	9	4	19	17	10	13	4	105
HERRON RUN	19	17	18	18	17	15	19	16	14	16	14	9	192
HOLBERT RUN	19	18	13	18	15	15	16	15	9	14	17	15	184
KINGS CREEK	18	18	16	17	13	14	19	18	11	9	10	10	173
LANGFITT RUN	5	13	8	9	12	8	17	13	13	12	11	1	122
LAUREL HOLLOW	15	16	11	16	10	10	17	11	8	12	17	10	153
LICK RUN	9	16	8	13	15	6	17	18	6	6	3	0	117
MAHAN RUN	2	7	12	10	14	11	15	16	18	18	6	2	131
MARKS RUN	12	13	16	11	8	12	17	16	14	17	17	6	158
MARROW RUN	18	17	19	16	17	17	18	17	18	19	16	3	195
MECHLING RUN	16	19	17	17	15	18	18	19	14	17	9	2	191
MERCER RUN	8	16	13	14	9	10	12	16	5	10	8	0	121
MIDDLE RUN	13	12	14	10	11	13	16	9	10	16	14	5	143
NORTH FORK	17	19	14	17	18	13	18	19	12	14	16	19	196
NORTH FORK TOMLINSON RUN	19	18	17	19	20	15	16	16	14	13	20	19	206
NORTH POTROCK RUN	10	8	18	5	14	17	9	15	13	14	5	4	132
PARMAR RUN	16	18	17	11	15	15	19	18	13	15	10	5	172
POTROCK RUN	12	11	13	8	4	15	17	16	17	16	8	2	139
RUSH RUN	11	16	14	16	12	13	16	18	15	10	11	0	152
SAPPINGTONS RUN	12	13	18	8	13	13	13	16	16	18	8	4	152
SCOTT RUN	15	12	16	19	19	13	16	13	12	13	16	7	171
SOUTH FORK TOMLINSON RUN	15	16	16	16	14	12	18	14	15	13	7	7	163
TOMLINSON RUN	18	19	19	19	20	18	19	16	14	15	20	20	217
TURKEY FOOT RUN	12	18	10	11	11	7	17	16	6	10	8	0	126
WHITE OAK RUN	19	18	14	17	19	14	19	16	10	11	20	20	197

Key: cover = instream cover
substrate = epifaunal substrate
embed = embeddedness
velocity = # of velocity/depth regimes present (ie. fast/shallow)
alter = channel alteration
sed = sediment deposition
riffles = frequency of,
flow = channel flow status
banks = erosional condition of banks (ex. 20 = no signs of erosion)
bankveg=vegetative protection
graze = cattle with free access
rip veg = intactness of riparian canopy

Categories scored 0-20, total score possible = 240

Table 15. **Substrate composition**

name	% bedrock	% boulder	% cobble	% gravel	% sand	% silt	% clay
ALEXANDERS RUN	0	0	5	50	20	25	0
ALLEGHENY STEEL RUN	0	0	15	45	30	5	0
BOSLEY RUN	0	0	50	40	5	5	0
BROWN HOLLOW	0	0	25	40	10	20	0
CONGO RUN	0	5	35	30	20	10	0
CROSS CREEK	0	5	70	20	3	2	0
CUNNINGHAM RUN	0	40	30	20	5	5	0
DEEP GUT RUN	0	20	40	15	5	20	0
DRY RUN	0	0	25	65	5	5	0
EBENEZER RUN	0	0	40	30	25	5	0
HARDIN RUN	0	1	30	30	25	14	0
HARMON CREEK	0	10	15	50	15	5	0
HERRON RUN	0	20	30	30	15	5	0
HOLBERT RUN	0	5	30	20	20	20	0
KINGS CREEK	10	20	40	10	10	0	0
LANGFITT RUN	0	5	10	20	50	20	0
LAUREL HOLLOW	0	10	35	25	20	10	0
LICK RUN	0	5	20	20	40	15	0
MAHAN RUN	0	0	5	50	19	25	0
MARKS RUN	0	5	40	35	15	5	0
MARROW RUN	0	15	30	30	10	15	0
MECHLING RUN	0	15	25	25	20	14	0
MERCER RUN	0	0	40	20	20	20	0
MIDDLE RUN	0	2	60	20	15	3	0
NORTH FORK	0	0	30	20	20	30	0
NORTH FORK TOMLINSON RUN	0	5	60	10	10	10	5
NORTH POTROCK RUN	0	1	40	40	15	4	0
PARMAR RUN	0	5	25	40	20	5	0
POTROCK RUN	0	5	35	40	10	5	0
RUSH RUN	5	0	30	25	20	20	0
SAPPINGTONS RUN	0	0	50	30	5	10	0
SCOTT RUN	0	5	20	30	20	25	0
SOUTH FORK TOMLINSON RUN	0	5	60	20	10	5	0
TOMLINSON RUN	0	20	40	20	15	5	0
TURKEY FOOT RUN	0	5	35	20	20	20	0
WHITE OAK RUN	0	20	20	25	15	20	0

Table 16. **Sediment odors**

name	normal	sewage	petroleum	chemical	anaerobic	none	other
ALEXANDERS RUN	✓						
ALLEGHENY STEEL RUN						✓	
BOSLEY RUN	✓						
BROWN HOLLOW	✓						
CONGO RUN	✓						
CROSS CREEK	✓						
CUNNINGHAM RUN	✓						
DEEP GUT RUN	✓						
DRY RUN	✓						
EBENEZER RUN	✓						
HARDIN RUN						✓	
HARMON CREEK			✓	✓			
HERRON RUN	✓						
HOLBERT RUN	✓						
KINGS CREEK						✓	
LANGFITT RUN	✓						
LAUREL HOLLOW	✓						
LICK RUN	✓						
MAHAN RUN	✓						
MARKS RUN	✓						
MARROW RUN	✓						
MECHLING RUN	✓						
MERCER RUN						✓	
MIDDLE RUN	✓						
NORTH FORK	✓						
NORTH FORK TOMLINSON RUN						✓	
NORTH POTROCK RUN						✓	
PARMAR RUN	✓						
POTROCK RUN						✓	
RUSH RUN	✓						
SAPPINGTONS RUN						✓	
SCOTT RUN	✓						
SOUTH FORK TOMLINSON RUN	✓						
TOMLINSON RUN	✓						
TURKEY FOOT RUN		✓					
WHITE OAK RUN	✓						

Table 17. **Sediment oils**

name	absent	slight	moderate	profuse
ALEXANDERS RUN	✓			
ALLEGHENY STEEL RUN		✓		
BOSLEY RUN	✓			
BROWN HOLLOW	✓			
CONGO RUN	✓			
CROSS CREEK	✓			
CUNNINGHAM RUN	✓			
DEEP GUT RUN	✓			
DRY RUN	✓			
EBENEZER RUN	✓			
HARDIN RUN	✓			
HARMON CREEK				✓
HERRON RUN	✓			
HOLBERT RUN	✓			
KINGS CREEK	✓			
LANGFITT RUN	✓			
LAUREL HOLLOW	✓			
LICK RUN	✓			
MAHAN RUN	ND			
MARKS RUN	✓			
MARROW RUN	✓			
MECHLING RUN	✓			
MERCER RUN	✓			
MIDDLE RUN	✓			
NORTH FORK	✓			
NORTH FORK TOMLINSON RUN	✓			
NORTH POTROCK RUN	✓			
PARMAR RUN	✓			
POTROCK RUN	✓			
RUSH RUN	✓			
SAPPINGTONS RUN	✓			
SCOTT RUN	✓			
SOUTH FORK TOMLINSON RUN	✓			
TOMLINSON RUN	✓			
TURKEY FOOT RUN	✓			
WHITE OAK RUN	✓			

ND = not determined

Table 18. **Sediment deposits**

name	sludge	sawdust	paper fiber	sand	relic shell	marl	silt	lime fines	metal hydroxides	other deposits
ALEXANDERS RUN				✓			✓			
ALLEGHENY STEEL RUN				✓			✓			
BOSLEY RUN				✓			✓			
BROWN HOLLOW				✓			✓			
CONGO RUN				✓			✓			
CROSS CREEK				✓			✓			
CUNNINGHAM RUN				✓			✓			
DEEP GUT RUN				✓			✓			
DRY RUN				✓			✓			
EBENEZER RUN				✓			✓			
HARDIN RUN				✓			✓			
HARMON CREEK	✓								✓	black mud
HERRON RUN				✓			✓			
HOLBERT RUN				✓			✓			
KINGS CREEK				✓						
LANGFITT RUN				✓			✓			
LAUREL HOLLOW				✓			✓			
LICK RUN				✓			✓			
MAHAN RUN				✓			✓			
MARKS RUN				✓			✓			
MARROW RUN				✓			✓			
MECHLING RUN				✓			✓			
MERCER RUN							✓			
MIDDLE RUN				✓			✓			
NORTH FORK				✓			✓			
NORTH FORK TOMLINSON RUN							✓			
NORTH POTROCK RUN										none
PARMAR RUN				✓			✓			
POTROCK RUN				✓			✓			slime
RUSH RUN				✓			✓			
SAPPINGTONS RUN										
SCOTT RUN				✓			✓			
SOUTH FORK TOMLINSON RUN				✓			✓			
TOMLINSON RUN							✓			
TURKEY FOOT RUN	✓			✓			✓			
WHITE OAK RUN				✓			✓			

Table 19. **Water odors**

name	date	normal	sewage	petroleum	chemical	anaerobic organic decay	none	other
ALEXANDERS RUN	5/22/96	✓						
ALLEGHENY STEEL RUN	5/22/96						✓	
BOSLEY RUN	5/23/96	✓						
BROWN HOLLOW	5/22/96	✓						
CONGO RUN	5/22/96		✓					
CROSS CREEK	5/23/96	✓						
CUNNINGHAM RUN	5/22/96	✓						
DEEP GUT RUN	5/22/96	✓						
DRY RUN	5/22/96	✓						
EBENEZER RUN	5/23/96	✓						
HARDIN RUN	5/22/96		✓					
HARMON CREEK	5/22/96			✓	✓			
HERRON RUN	5/22/96	✓						
HOLBERT RUN	5/22/96	✓						
KINGS CREEK	2/26/96						✓	
LAUREL HOLLOW	5/22/96	✓						
LICK RUN	2/26/96	✓						
LICK RUN	5/22/96	✓						
MAHAN RUN	5/22/96	✓						
MARKS RUN	5/22/96	✓						
MARROW RUN	5/22/96	✓						
MECHLING RUN	5/22/96	✓						
MERCER RUN	5/22/96						✓	
MIDDLE RUN	5/22/96							musty
NORTH FORK	2/26/96		✓					
NORTH POTROCK RUN	5/23/96	✓						
NORTH FORK TOMLINSON RUN	5/22/96						✓	
PARMAR RUN	5/23/96	✓						
POTROCK RUN	5/23/96	✓						
RUSH RUN	5/22/96	✓						
RUSH RUN	2/26/96	✓						
SAPPINGTONS RUN	5/22/96						✓	
SCOTT RUN	5/23/96	✓						
SOUTH FORK TOMLINSON RUN	5/22/96	✓						
TOMLINSON RUN	5/23/96	✓						
TURKEY FOOT RUN	5/22/96		✓					
TURKEY FOOT RUN	2/26/96	✓						
WHITE OAK RUN	5/23/96	✓						

Table 20. **Water surface oils**

name	date	slick	sheen	globs	flecks	none
ALEXANDERS RUN	22-May-96					✓
ALLEGHENY STEEL RUN	22-May-96					✓
BOSLEY RUN	23-May-96					✓
BROWN HOLLOW	22-May-96					✓
CONGO RUN	22-May-96					✓
CROSS CREEK	23-May-96					✓
CUNNINGHAM RUN	22-May-96					✓
DEEP GUT RUN	22-May-96					✓
DRY RUN	22-May-96					✓
EBENEZER RUN	23-May-96					✓
HARDIN RUN	22-May-96					✓
HARMON CREEK	22-May-96		✓		✓	
HERRON RUN	22-May-96					✓
HOLBERT RUN	22-May-96					✓
KINGS CREEK	22-May-96					✓
KINGS CREEK	26-Feb-96					✓
LAUREL HOLLOW	22-May-96					✓
LICK RUN	22-May-96					✓
LICK RUN	26-Feb-96					✓
MAHAN RUN	22-May-96					✓
MARKS RUN	22-May-96					✓
MARROW RUN	22-May-96					✓
MECHLING RUN	22-May-96					✓
MERCER RUN	22-May-96					✓
MIDDLE RUN	22-May-96					✓
NORTH FORK	22-May-96					✓
NORTH FORK	26-Feb-96					✓
NORTH FORK TOMLINSON RUN	22-May-96					✓
NORTH POTROCK RUN	23-May-96					✓
PARMAR RUN	23-May-96					✓
POTROCK RUN	23-May-96					✓
RUSH RUN	22-May-96					✓
RUSH RUN	26-Feb-96					✓
SAPPINGTONS RUN	22-May-96					✓
SCOTT RUN	23-May-96					✓
SOUTH FORK TOMLINSON RUN	22-May-96					✓
TOMLINSON RUN	23-May-96					✓
TURKEY FOOT RUN	22-May-96					✓
TURKEY FOOT RUN	26-Feb-96					✓
WHITE OAK RUN	23-May-96					✓

Table 21. **Water turbidity**

name	date	clear	slight	moderate	turbid	opaque	water color
ALEXANDERS RUN	5/22/96		✓				
ALLEGHENY STEEL RUN	5/22/96		✓				
BOSLEY RUN	5/23/96			✓			
BROWN HOLLOW	5/22/96	✓					
CONGO RUN	5/22/96	✓					
CROSS CREEK	5/23/96			✓			
CUNNINGHAM RUN	5/22/96	✓					
DEEP GUT RUN	5/22/96		✓				
DRY RUN	5/22/96	✓					
EBENEZER RUN	5/23/96	✓					
HARDIN RUN	5/22/96	✓					
HARMON CREEK	5/22/96					✓	gray-brown
HERRON RUN	5/22/96		✓				
HOLBERT RUN	5/22/960	✓					
KINGS CREEK	5/22/96						
KINGS CREEK	2/26/96			✓			
LAUREL HOLLOW	5/22/96	✓					
LICK RUN	5/22/96	✓					
LICK RUN	5/26/96	✓					
MAHAN RUN	5/22/96		✓				
MARKS RUN	5/22/96	✓					
MARROW RUN	5/22/96	✓					
MECHLING RUN	5/22/96		✓				
MERCER RUN	5/22/96		✓				brown
MIDDLE RUN	5/22/96		✓				
NORTH FORK	5/22/96			✓			
NORTH FORK	2/26/96			✓			
NORTH FORK TOMLINSON RUN	5/22/96		✓				
NORTH POTROCK RUN	5/23/96		✓				
PARMAR RUN	5/23/96	✓					
POTROCK RUN	5/23/96		✓				
RUSH RUN	5/22/96	✓					
RUSH RUN	2/26/96	✓					
SAPPINGTONS RUN	5/22/96		✓				
SCOTT RUN	5/23/96	✓					
SOUTH FORK TOMLINSON RUN	5/22/96			✓			
TOMLINSON RUN	5/23/96		✓				
TURKEY FOOT RUN	5/22/96		✓				
TURKEY FOOT RUN	2/26/96		✓				
WHITE OAK RUN	5/23/96			✓			

Table 22. **Physical and chemical characteristics of stream water**

name	date	temp (°C)	pH	oxygen (mg\l)	conductivity (µS/cm)	flow (cfs)
ALEXANDERS RUN	22-May-96	19.0	8.2	7.6	917	3.02
ALLEGHENY STEEL RUN	22-May-96	15.5	8.7	9.5	913	
BOSLEY RUN	23-May-96	13.3	8.2	9.9	879	
BROWN HOLLOW	22-May-96	18.2	8.4	8.2	1200	
CONGO RUN	22-May-96	17.3	8.0	8.6	246	
CROSS CREEK	23-May-96	14.6	8.4	9.9	685	
CUNNINGHAM RUN	22-May-96	13.4	8.3	10.0	302	
DEEP GUT RUN	22-May-96	15.5	7.9	9.3	406	
DRY RUN	22-May-96	21.8	8.4	8.6	321	
EBENEZER RUN	23-May-96	17.0	8.5	9.5	1094	
HARDIN RUN	22-May-96	17.8	8.2	7.5	317	
HARMON CREEK	22-May-96	21.7	8.2	7.3	654	
HERRON RUN	22-May-96	15.9	7.8	7.9	350	
HOLBERT RUN	22-May-96	17.7	7.9	8.9	321	
KINGS CREEK	26-Feb-96	4.7	8.0	12.1	326	
LANGFITT RUN	22-May-96	21.3	7.8	6.8	271	
LAUREL HOLLOW	22-May-96	14.4	8.3	9.5	288	
LICK RUN	26-Feb-96	6.0	8.1	11.5	379	
MAHAN RUN	22-May-96	16.7	8.6	10.0	1001	
MARKS RUN	22-May-96	12.6	8.3	10.0	466	
MARROW RUN	22-May-96	16.3	9.0	10.9	601	
MECHLING RUN	22-May-96	13.6	8.1	9.4	576	
MERCER RUN	22-May-96	20.2	8.2	7.3	212	
MIDDLE RUN	22-May-96	12.6	8.2	9.8	315	
NORTH FORK	26-Feb-96	5.0	7.9	12.9	251	
NORTH FORK TOMLINSON RUN	22-May-96	20.1	8.7	7.4	259	
NORTH POTROCK RUN	23-May-96	17.8	8.3	9.3	1043	
PARMAR RUN	23-May-96	16.0	8.2	9.0	1409	
POTROCK RUN	23-May-96	15.3	8.6	10.3	828	
RUSH RUN	26-Feb-96	5.1	7.9	11.7	290	
SAPPINGTONS RUN	22-May-96	18.2	8.5	9.3	537	2.96
SCOTT RUN	23-May-96	14.6	8.3	9.5	1233	
SOUTH FORK TOMLINSON RUN	22-May-96	17.1	8.4	9.8	233	
TOMLINSON RUN	23-May-96	14.9	8.2	9.5	262	
TURKEY FOOT RUN	26-Feb-96	5.3	8.1	12.3	373	
WHITE OAK RUN	23-May-96	12.8	8.0	9.9	270	
Average:		15.0	8.2	9.5	556	
Minimum:		4.7	7.8	6.8	212	
Maximum:		21.8	9.0	12.9	1409	
n		36	36	36	36	

Table 23. **Chemical characteristics of streams possibly impacted by acid mine drainage**

name	date	acid-hot	alkalinity (mg/l)	Al (mg/l)	Fe (mg/l)	Mn (mg/l)
ALEXANDERS RUN	22-May-96	ND*	140	0.48	0.46	0. 16
SAPPINGTONS RUN	22-May-96	ND*	140	1.20	0.78	0. 12

* - ND = not detected at minimum detection limit, which was 1.0 mg/l

Table 24. **Fecal coliform bacteria**

name	AN-Code	date	colonies/100 ml
ALEXANDERS RUN	WVO-97-B	5/22/96	72
ALLEGHENY STEEL RUN	WVO-95.5	5/22/96	1200
BOSLEY RUN	WVO-95 -A	5/23/96	3200
BROWN HOLLOW	WVO-97-D	5/22/96	990
CONGO RUN	WVO-104	5/22/96	1800
CROSS CREEK	WVO-95	5/23/96	2200
CUNNINGHAM RUN	WVO-106	5/22/96	1600
DEEP GUT RUN	WVO-101	5/22/96	36
DRY RUN	WVO- 103	5/22/96	1800
EBENEZER RUN	WVO-95-B	5/23/96	68
HARDIN RUN	WVO-100	5/22/96	130
HARMON CREEK	WVO-97	5/22/96	1600
HERRON RUN	WVO-100-A	5/22/96	27
HOLBERT RUN	WVO-99	5/22/96	16000
KINGS CREEK	WVO-98	5/22/96	850
KINGS CREEK	WVO-98	2/26/96	13000
LANGFITT RUN	WVO-100-B	5/22/96	12000
LAUREL HOLLOW	WVO-105	5/22/96	2700
LICK RUN	WVO-98-B	2/26/96	120
MAHAN RUN	WVO-96	5/22/96	4600
MARKS RUN	WVO-108	5/22/96	8500
MARROW RUN	WVO-98-A.5	5/22/96	830
MECHLING RUN	WVO-97-C	5/22/96	1100
MERCER RUN	WVO-102-C-1	5 /22/96	2000
MIDDLE RUN	WVO-107	5/22/96	590
NORTH FORK	WVO-98-A	2/26/96	1800
NORTH FORK TOMLINSON RUN	WVO-102-C	5/22/96	850
NORTH POTROCK RUN	WVO-95-C	5/23/96	670
PARMAR RUN	WVO-95-E-1	5/23/96	60
POTROCK RUN	WVO-95-D	5/23/96	220
RUSH RUN	WVO-98.7A	2/26/96	860
SAPPINGTONS RUN	WVO-97-A	5/22/96	150
SCOTT RUN	WVO-95-E	5/23/96	290
SOUTH FORK TOMLINSON RUN	WVO-102-B	5/22/96	860
TOMLINSON RUN	WVO-102	5/23/96	240
TURKEY FOOT RUN	WVO-98.5A	5/22/96	12000
TURKEY FOOT RUN	WVO-98.5A	2/26/96	3500
WHITE OAK RUN	WVO-102-A	5/23/96	280

Table 25. **Benthic macroinvertebrates**

name	date	taxon	count
ALEXANDERS RUN	19-May-96	Asellidae	6
ALEXANDERS RUN	19-May-96	Baetidae	1
ALEXANDERS RUN	19-May-96	Caenidae	1
ALEXANDERS RUN	19-May-96	Ceratopogonidae	2
ALEXANDERS RUN	19-May-96	Chaoboridae	1
ALEXANDERS RUN	19-May-96	Chironomidae	262
ALEXANDERS RUN	19-May-96	Corydalidae	1
ALEXANDERS RUN	19-May-96	Dytiscidae	1
ALEXANDERS RUN	19-May-96	Elmidae	72
ALEXANDERS RUN	19-May-96	Empididae	3
ALEXANDERS RUN	19-May-96	Gammaridae	46
ALEXANDERS RUN	19-May-96	Gammaridae	46
ALEXANDERS RUN	19-May-96	Hydropsychidae	15
ALEXANDERS RUN	19-May-96	Nematoda	2
ALEXANDERS RUN	19-May-96	Oligochaeta	424
ALEXANDERS RUN	19-May-96	Perlodidae	1
ALEXANDERS RUN	19-May-96	Philopotamidae	1
ALEXANDERS RUN	19-May-96	Sialidae	1
ALEXANDERS RUN	19-May-96	Simuliidae	9
ALEXANDERS RUN	19-May-96	Sphaeriidae	3
ALEXANDERS RUN	19-May-96	Tabanidae	1
ALEXANDERS RUN	19-May-96	Tipulidae	4
ALEXANDERS RUN	19-May-96	Turbellaria	6
ALLEGHENY STEEL RUN	22-May-96	Asellidae	2
ALLEGHENY STEEL RUN	22-May-96	Chironomidae	59
ALLEGHENY STEEL RUN	22-May-96	Gammaridae	21
ALLEGHENY STEEL RUN	22-May-96	Hydropsychidae	1
ALLEGHENY STEEL RUN	22-May-96	Nemertea	5
ALLEGHENY STEEL RUN	22-May-96	Oligochaeta	5
ALLEGHENY STEEL RUN	22-May-96	Physidae	1
BOSLEY RUN	23-May-96	Asellidae	13
BOSLEY RUN	23-May-96	Baetidae	7
BOSLEY RUN	23-May-96	Cambaridae	1
BOSLEY RUN	23-May-96	Capniidae/Leuctri	6
BOSLEY RUN	23-May-96	Chironomidae	97
BOSLEY RUN	23-May-96	Elmidae	2
BOSLEY RUN	23-May-96	Ephemerellidae	1
BOSLEY RUN	23-May-96	Gammaridae	226
BOSLEY RUN	23-May-96	Heptageniidae	1
BOSLEY RUN	23-May-96	Hydropsychidae	8
BOSLEY RUN	23-May-96	Hydroptilidae	28
BOSLEY RUN	23-May-96	Nemouridae	2
BOSLEY RUN	23-May-96	Oligochaeta	40
BOSLEY RUN	23-May-96	Polycentropodidae	1
BOSLEY RUN	23-May-96	Tipulidae	6
BOSLEY RUN	23-May-96	Turbellaria	1
BROWN HOLLOW	22-May-96	Cambaridae	1
BROWN HOLLOW	22-May-96	Capniidae/Leuctri	2
BROWN HOLLOW	22-May-96	Chironomidae	44
BROWN HOLLOW	22-May-96	Elmidae	3
BROWN HOLLOW	22-May-96	Gammaridae	79
BROWN HOLLOW	22-May-96	Hydropsychidae	4
BROWN HOLLOW	22-May-96	Hydroptilidae	1
BROWN HOLLOW	22-May-96	Oligochaeta	3
BROWN HOLLOW	22-May-96	Physidae	1
BROWN HOLLOW	22-May-96	Polycentropodidae	1
BROWN HOLLOW	22-May-96	Simuliidae	17
CONGO RUN	23-May-96	Asellidae	1
CONGO RUN	23-May-96	Baetidae	7
CONGO RUN	23-May-96	Chironomidae	12
CONGO RUN	23-May-96	Chloroperlidae	2
CONGO RUN	23-May-96	Elmidae	1
CONGO RUN	23-May-96	Ephemerellidae	25
CONGO RUN	23-May-96	Ephemeridae	1
CONGO RUN	23-May-96	Gammaridae	60
CONGO RUN	23-May-96	Heptageniidae	53
CONGO RUN	23-May-96	Hydropsychidae	3
CONGO RUN	23-May-96	Leptophlebiidae	1
CONGO RUN	23-May-96	Nematoda	1
CONGO RUN	23-May-96	Nemouridae	1
CONGO RUN	23-May-96	Oligochaeta	3
CONGO RUN	23-May-96	Perlodidae	3
CONGO RUN	23-May-96	Tabanidae	1
CROSS CREEK	23-May-96	Baetidae	2
CROSS CREEK	23-May-96	Cambaridae	1
CROSS CREEK	23-May-96	Capniidae/Leuctri	2
CROSS CREEK	23-May-96	Chironomidae	47
CROSS CREEK	23-May-96	Elmidae	2
CROSS CREEK	23-May-96	Gammaridae	5
CROSS CREEK	23-May-96	Nemertea	7
CROSS CREEK	23-May-96	Oligochaeta	5
CROSS CREEK	23-May-96	Perlidae	1
CROSS CREEK	23-May-96	Psephenidae	1
CROSS CREEK	23-May-96	Tipulidae	1
CUNNINGHAM RUN	22-May-96	Cambaridae	1
CUNNINGHAM RUN	22-May-96	Capniidae/Leuctri	6
CUNNINGHAM RUN	22-May-96	Chironomidae	24
CUNNINGHAM RUN	22-May-96	Gammaridae	37
CUNNINGHAM RUN	22-May-96	Heptageniidae	48
CUNNINGHAM RUN	22-May-96	Hydropsychidae	2
CUNNINGHAM RUN	22-May-96	Nemertea	5
CUNNINGHAM RUN	22-May-96	Nemouridae	1
CUNNINGHAM RUN	22-May-96	Oligochaeta	6
CUNNINGHAM RUN	22-May-96	Polycentropodidae	1
CUNNINGHAM RUN	22-May-96	Tipulidae	3
CUNNINGHAM RUN	22-May-96	Tricorythidae	7
DEEP GUT RUN	22-May-96	Asellidae	5
DEEP GUT RUN	22-May-96	Baetidae	1
DEEP GUT RUN	22-May-96	Chironomidae	99
DEEP GUT RUN	22-May-96	Gammaridae	44
DEEP GUT RUN	22-May-96	Hydroptilidae	1
DEEP GUT RUN	22-May-96	Oligochaeta	7
DEEP GUT RUN	22-May-96	Simuliidae	1
DEEP GUT RUN	22-May-96	Stratiomyidae	1
DEEP GUT RUN	22-May-96	Tipulidae	2
DEEP GUT RUN	22-May-96	Turbellaria	2
DRY RUN	20-May-96	Asellidae	2
DRY RUN	20-May-96	Cambaridae	1
DRY RUN	20-May-96	Capniidae/Leuctri	2
DRY RUN	20-May-96	Chironomidae	12
DRY RUN	20-May-96	Corbiculidae	1
DRY RUN	20-May-96	Elmidae	2
DRY RUN	20-May-96	Gammaridae	11
DRY RUN	20-May-96	Heptageniidae	57
DRY RUN	20-May-96	Hydropsychidae	3

name	date	taxon	count
DRY RUN	20-May-96	Hydroptilidae	1
DRY RUN	20-May-96	Isonychiidae	19
DRY RUN	20-May-96	Nematoda	4
DRY RUN	20-May-96	Nemertea	35
DRY RUN	20-May-96	Nemouridae	14
DRY RUN	20-May-96	Oligochaeta	1
DRY RUN	20-May-96	Perlidae	3
DRY RUN	20-May-96	Simuliidae	1
DRY RUN	20-May-96	Tipulidae	1
DRY RUN	20-May-96	Tricorythidae	7
EBENEZER RUN	22-May-96	Capniidae/Leuctri	61
EBENEZER RUN	22-May-96	Chironomidae	77
EBENEZER RUN	22-May-96	Elmidae	1
EBENEZER RUN	22-May-96	Empididae	2
EBENEZER RUN	22-May-96	Gammaridae	49
EBENEZER RUN	22-May-96	Hirudinidae	1
EBENEZER RUN	22-May-96	Hydropsychidae	3
EBENEZER RUN	22-May-96	Hydroptilidae	4
EBENEZER RUN	22-May-96	Nemouridae	20
EBENEZER RUN	22-May-96	Oligochaeta	3
EBENEZER RUN	22-May-96	Perlidae	3
EBENEZER RUN	22-May-96	Philopotamidae	11
EBENEZER RUN	22-May-96	Tipulidae	12
HARDIN RUN	22-May-96	Baetidae	1
HARDIN RUN	22-May-96	Chironomidae	14
HARDIN RUN	22-May-96	Elmidae	3
HARDIN RUN	22-May-96	Ephemerellidae	20
HARDIN RUN	22-May-96	Ephemeridae	1
HARDIN RUN	22-May-96	Heptageniidae	2
HARDIN RUN	22-May-96	Hydropsychidae	6
HARDIN RUN	22-May-96	Leptophlebiidae	1
HARDIN RUN	22-May-96	Oligochaeta	3
HARDIN RUN	22-May-96	Perlidae	1
HARDIN RUN	22-May-96	Psephenidae	1
HARDIN RUN	22-May-96	Tipulidae	2
HARMON CREEK	19-May-96	Chironomidae	1
HARMON CREEK	19-May-96	Oligochaeta	87
HARMON CREEK	19-May-96	Physidae	8
HERRON RUN	22-May-96	Asellidae	1
HERRON RUN	22-May-96	Baetidae	234
HERRON RUN	22-May-96	Brachycentridae	1
HERRON RUN	22-May-96	Capniidae/Leuctri	12
HERRON RUN	22-May-96	Chironomidae	108
HERRON RUN	22-May-96	Corydalidae	3
HERRON RUN	22-May-96	Elmidae	4
HERRON RUN	22-May-96	Empididae	1
HERRON RUN	22-May-96	Ephemerellidae	22
HERRON RUN	22-May-96	Gammaridae	149
HERRON RUN	22-May-96	Heptageniidae	10
HERRON RUN	22-May-96	Hirudinidae	1
HERRON RUN	22-May-96	Hydropsychidae	29
HERRON RUN	22-May-96	Hydroptilidae	16
HERRON RUN	22-May-96	Limnephilidae	1
HERRON RUN	22-May-96	Nemouridae	74
HERRON RUN	22-May-96	Oligochaeta	8
HERRON RUN	22-May-96	Perlodidae	2
HERRON RUN	22-May-96	Philopotamidae	72
HERRON RUN	22-May-96	Polycentropodidae	1

name	date	taxon	count
HERRON RUN	22-May-96	Pyralidae	1
HERRON RUN	22-May-96	Rhyacophilidae	1
HERRON RUN	22-May-96	Tipulidae	4
HOLBERT RUN	22-May-96	Baetidae	1
HOLBERT RUN	22-May-96	Capniidae/Leuctri	1
HOLBERT RUN	22-May-96	Chironomidae	13
HOLBERT RUN	22-May-96	Corydalidae	1
HOLBERT RUN	22-May-96	Ephemerellidae	1
HOLBERT RUN	22-May-96	Ephemeridae	2
HOLBERT RUN	22-May-96	Heptageniidae	1
HOLBERT RUN	22-May-96	Leptophlebiidae	2
HOLBERT RUN	22-May-96	Oligochaeta	6
HOLBERT RUN	22-May-96	Philopotamidae	1
HOLBERT RUN	22-May-96	Sialidae	1
HOLBERT RUN	22-May-96	Tabanidae	1
KINGS CREEK	22-May-96	Baetidae	1
KINGS CREEK	22-May-96	Caenidae	1
KINGS CREEK	22-May-96	Chironomidae	17
KINGS CREEK	22-May-96	Dolichopodidae	1
KINGS CREEK	22-May-96	Elmidae	11
KINGS CREEK	22-May-96	Empididae	1
KINGS CREEK	22-May-96	Ephemerellidae	1
KINGS CREEK	22-May-96	Ephemeridae	1
KINGS CREEK	22-May-96	Heptageniidae	2
KINGS CREEK	22-May-96	Hydropsychidae	8
KINGS CREEK	22-May-96	Nematoda	1
KINGS CREEK	22-May-96	Nemouridae	3
KINGS CREEK	22-May-96	Oligochaeta	8
KINGS CREEK	22-May-96	Oligoneuriidae	1
KINGS CREEK	22-May-96	Polycentropodidae	1
KINGS CREEK	22-May-96	Psephenidae	1
KINGS CREEK	22-May-96	Ptilodactylidae	2
KINGS CREEK	22-May-96	Simuliidae	18
KINGS CREEK	22-May-96	Taeniopterygidae	2
KINGS CREEK	22-May-96	Tipulidae	4
LANGFITT RUN	22-May-96	Asellidae	13
LANGFITT RUN	22-May-96	Baetidae	152
LANGFITT RUN	22-May-96	Caenidae	8
LANGFITT RUN	22-May-96	Cambaridae	2
LANGFITT RUN	22-May-96	Ceratopogonidae	2
LANGFITT RUN	22-May-96	Chironomidae	308
LANGFITT RUN	22-May-96	Corydalidae	6
LANGFITT RUN	22-May-96	Ephemerellidae	1
LANGFITT RUN	22-May-96	Gomphidae	2
LANGFITT RUN	22-May-96	Heptageniidae	13
LANGFITT RUN	22-May-96	Hirudinidae	1
LANGFITT RUN	22-May-96	Hydropsychidae	7
LANGFITT RUN	22-May-96	Hydroptilidae	2
LANGFITT RUN	22-May-96	Leptophlebiidae	46
LANGFITT RUN	22-May-96	Nematoda	1
LANGFITT RUN	22-May-96	Nemouridae	17
LANGFITT RUN	22-May-96	Oligochaeta	45
LANGFITT RUN	22-May-96	Perlodidae	29
LANGFITT RUN	22-May-96	Philopotamidae	2
LANGFITT RUN	22-May-96	Polycentropodidae	2
LANGFITT RUN	22-May-96	Psephenidae	2
LANGFITT RUN	22-May-96	Simuliidae	5
LANGFITT RUN	22-May-96	Tipulidae	25

name	date	taxon	count
LANGFITT RUN	22-May-96	Turbellaria	4
LAUREL HOLLOW	22-May-96	Asellidae	2
LAUREL HOLLOW	22-May-96	Chironomidae	4
LAUREL HOLLOW	22-May-96	Corbiculidae	2
LAUREL HOLLOW	22-May-96	Gammaridae	18
LAUREL HOLLOW	22-May-96	Heptageniidae	2
LAUREL HOLLOW	22-May-96	Hydropsychidae	2
LAUREL HOLLOW	22-May-96	Hydroptilidae	1
LAUREL HOLLOW	22-May-96	Nemertea	28
LAUREL HOLLOW	22-May-96	Nemouridae	1
LAUREL HOLLOW	22-May-96	Oligochaeta	6
LAUREL HOLLOW	22-May-96	Polycentropodidae	2
LAUREL HOLLOW	22-May-96	Sialidae	1
LICK RUN	26-Feb-96	Asellidae	2
LICK RUN	26-Feb-96	Baetidae	2
LICK RUN	26-Feb-96	Capniidae/Leuctri	11
LICK RUN	26-Feb-96	Chironomidae	33
LICK RUN	26-Feb-96	Chloroperlidae	2
LICK RUN	26-Feb-96	Elmidae	9
LICK RUN	26-Feb-96	Ephemerellidae	25
LICK RUN	26-Feb-96	Ephemeridae	1
LICK RUN	26-Feb-96	Gammaridae	1
LICK RUN	26-Feb-96	Heptageniidae	2
LICK RUN	26-Feb-96	Hydropsychidae	25
LICK RUN	26-Feb-96	Limnephilidae	1
LICK RUN	26-Feb-96	Oligochaeta	3
LICK RUN	26-Feb-96	Polycentropodidae	1
LICK RUN	26-Feb-96	Simuliidae	2
MAHAN RUN	22-May-96	Asellidae	2
MAHAN RUN	22-May-96	Cambaridae	1
MAHAN RUN	22-May-96	Chironomidae	33
MAHAN RUN	22-May-96	Elmidae	7
MAHAN RUN	22-May-96	Gammaridae	201
MAHAN RUN	22-May-96	Hydropsychidae	1
MAHAN RUN	22-May-96	Nemertea	167
MAHAN RUN	22-May-96	Oligochaeta	18
MAHAN RUN	22-May-96	Physidae	1
MAHAN RUN	22-May-96	Tipulidae	3
MARKS RUN	22-May-96	Asellidae	2
MARKS RUN	22-May-96	Cambaridae	1
MARKS RUN	22-May-96	Chironomidae	29
MARKS RUN	22-May-96	Elmidae	1
MARKS RUN	22-May-96	Gammaridae	24
MARKS RUN	22-May-96	Hydropsychidae	1
MARKS RUN	22-May-96	Nematoda	3
MARKS RUN	22-May-96	Oligochaeta	15
MARKS RUN	22-May-96	Physidae	1
MARROW RUN	22-May-96	Asellidae	1
MARROW RUN	22-May-96	Baetidae	37
MARROW RUN	22-May-96	Chironomidae	103
MARROW RUN	22-May-96	Chloroperlidae	1
MARROW RUN	22-May-96	Elmidae	1
MARROW RUN	22-May-96	Empididae	1
MARROW RUN	22-May-96	Ephemerellidae	3
MARROW RUN	22-May-96	Gammaridae	26
MARROW RUN	22-May-96	Heptageniidae	2
MARROW RUN	22-May-96	Hydropsychidae	2
MARROW RUN	22-May-96	Nematoda	1

name	date	taxon	count
MARROW RUN	22-May-96	Nemouridae	3
MARROW RUN	22-May-96	Oligochaeta	8
MARROW RUN	22-May-96	Tipulidae	1
MARROW RUN	22-May-96	Turbellaria	2
MECHLING RUN	22-May-96	Asellidae	3
MECHLING RUN	22-May-96	Baetidae	44
MECHLING RUN	22-May-96	Capniidae/Leuctri	7
MECHLING RUN	22-May-96	Chironomidae	49
MECHLING RUN	22-May-96	Gammaridae	66
MECHLING RUN	22-May-96	Hydropsychidae	1
MECHLING RUN	22-May-96	Leptophlebiidae	3
MECHLING RUN	22-May-96	Nematoda	2
MECHLING RUN	22-May-96	Nemertea	5
MECHLING RUN	22-May-96	Nemouridae	72
MECHLING RUN	22-May-96	Oligochaeta	1
MECHLING RUN	22-May-96	Polycentropodidae	12
MECHLING RUN	22-May-96	Psephenidae	1
MECHLING RUN	22-May-96	Simuliidae	7
MECHLING RUN	22-May-96	Tipulidae	5
MERCER RUN	22-May-96	Asellidae	4
MERCER RUN	22-May-96	Chironomidae	30
MERCER RUN	22-May-96	Elmidae	6
MERCER RUN	22-May-96	Ephemeridae	1
MERCER RUN	22-May-96	Heptageniidae	3
MERCER RUN	22-May-96	Oligochaeta	30
MERCER RUN	22-May-96	Sphaeriidae	1
MERCER RUN	22-May-96	Tabanidae	1
MERCER RUN	22-May-96	Turbellaria	2
MIDDLE RUN	22-May-96	Baetidae	1
MIDDLE RUN	22-May-96	Chironomidae	48
MIDDLE RUN	22-May-96	Chloroperlidae	1
MIDDLE RUN	22-May-96	Gammaridae	15
MIDDLE RUN	22-May-96	Heptageniidae	6
MIDDLE RUN	22-May-96	Hydropsychidae	2
MIDDLE RUN	22-May-96	Nemouridae	3
MIDDLE RUN	22-May-96	Oligochaeta	6
MIDDLE RUN	22-May-96	Tipulidae	1
NORTH FORK	26-Feb-96	Baetidae	1
NORTH FORK	26-Feb-96	Caenidae	1
NORTH FORK	26-Feb-96	Capniidae/Leuctri	5
NORTH FORK	26-Feb-96	Chironomidae	10
NORTH FORK	26-Feb-96	Elmidae	7
NORTH FORK	26-Feb-96	Ephemerellidae	5
NORTH FORK	26-Feb-96	Ephemeridae	4
NORTH FORK	26-Feb-96	Gammaridae	1
NORTH FORK	26-Feb-96	Heptageniidae	1
NORTH FORK	26-Feb-96	Hydropsychidae	4
NORTH FORK	26-Feb-96	Limnephilidae	5
NORTH FORK	26-Feb-96	Oligochaeta	1
NORTH FORK	26-Feb-96	Oligoneuriidae	2
NORTH FORK	26-Feb-96	Taeniopterygidae	1
NORTH FORK	26-Feb-96	Tipulidae	2
N.FORK TOMLINSON RUN	22-May-96	Asellidae	2
N.FORK TOMLINSON RUN	22-May-96	Caenidae	5
N.FORK TOMLINSON RUN	22-May-96	Chironomidae	50
N.FORK TOMLINSON RUN	22-May-96	Corydalidae	2
N.FORK TOMLINSON RUN	22-May-96	Elmidae	5
N.FORK TOMLINSON RUN	22-May-96	Empididae	3

name	date	taxon	count
N.FORK TOMLINSON RUN	22-May-96	Gammaridae	1
N.FORK TOMLINSON RUN	22-May-96	Heptageniidae	3
N.FORK TOMLINSON RUN	22-May-96	Leptophlebiidae	2
N.FORK TOMLINSON RUN	22-May-96	Nemouridae	1
N.FORK TOMLINSON RUN	22-May-96	Oligochaeta	6
N.FORK TOMLINSON RUN	22-May-96	Perlodidae	2
N.FORK TOMLINSON RUN	22-May-96	Psephenidae	5
N.FORK TOMLINSON RUN	22-May-96	Tabanidae	1
NORTH POTROCK RUN	23-May-96	Asellidae	4
NORTH POTROCK RUN	23-May-96	Cambaridae	1
NORTH POTROCK RUN	23-May-96	Capniidae/Leuctri	7
NORTH POTROCK RUN	23-May-96	Chironomidae	37
NORTH POTROCK RUN	23-May-96	Elmidae	2
NORTH POTROCK RUN	23-May-96	Gammaridae	243
NORTH POTROCK RUN	23-May-96	Hydropsychidae	8
NORTH POTROCK RUN	23-May-96	Hydroptilidae	35
NORTH POTROCK RUN	23-May-96	Nemouridae	43
NORTH POTROCK RUN	23-May-96	Oligochaeta	2
NORTH POTROCK RUN	23-May-96	Perlidae	1
NORTH POTROCK RUN	23-May-96	Philopotamidae	5
NORTH POTROCK RUN	23-May-96	Simuliidae	2
NORTH POTROCK RUN	23-May-96	Turbellaria	2
PARMAR RUN	23-May-96	Capniidae/Leuctri	97
PARMAR RUN	23-May-96	Chironomidae	115
PARMAR RUN	23-May-96	Elmidae	1
PARMAR RUN	23-May-96	Gammaridae	1
PARMAR RUN	23-May-96	Hydroptilidae	28
PARMAR RUN	23-May-96	Nemertea	23
PARMAR RUN	23-May-96	Nemouridae	38
PARMAR RUN	23-May-96	Peltoperlidae	7
PARMAR RUN	23-May-96	Perlidae	2
PARMAR RUN	23-May-96	Polycentropodidae	3
PARMAR RUN	23-May-96	Tabanidae	1
PARMAR RUN	23-May-96	Tipulidae	9
POTROCK RUN	23-May-96	Asellidae	2
POTROCK RUN	23-May-96	Chironomidae	2
POTROCK RUN	23-May-96	Elmidae	3
POTROCK RUN	23-May-96	Gammaridae	449
POTROCK RUN	23-May-96	Heptageniidae	11
POTROCK RUN	23-May-96	Hydropsychidae	4
POTROCK RUN	23-May-96	Perlidae	1
RUSH RUN	26-Feb-96	Asellidae	5
RUSH RUN	26-Feb-96	Baetidae	1
RUSH RUN	26-Feb-96	Chironomidae	15
RUSH RUN	26-Feb-96	Ephemerellidae	40
RUSH RUN	26-Feb-96	Gammaridae	57
RUSH RUN	26-Feb-96	Gomphidae	1
RUSH RUN	26-Feb-96	Heptageniidae	6
RUSH RUN	26-Feb-96	Hydropsychidae	19
RUSH RUN	26-Feb-96	Leptophlebiidae	2
RUSH RUN	26-Feb-96	Limnephilidae	14
RUSH RUN	26-Feb-96	Oligochaeta	2
RUSH RUN	26-Feb-96	Perlidae	1
RUSH RUN	26-Feb-96	Perlodidae	3
RUSH RUN	26-Feb-96	Siphlonuridae	1
RUSH RUN	26-Feb-96	Tipulidae	2
SAPPINGTONS RUN	22-May-96	Asellidae	10
SAPPINGTONS RUN	22-May-96	Capniidae/Leuctri	3
SAPPINGTONS RUN	22-May-96	Chironomidae	126
SAPPINGTONS RUN	22-May-96	Elmidae	28
SAPPINGTONS RUN	22-May-96	Gammaridae	31
SAPPINGTONS RUN	22-May-96	Heptageniidae	1
SAPPINGTONS RUN	22-May-96	Hydroptilidae	5
SAPPINGTONS RUN	22-May-96	Nematoda	1
SAPPINGTONS RUN	22-May-96	Nemouridae	20
SAPPINGTONS RUN	22-May-96	Oligochaeta	60
SAPPINGTONS RUN	22-May-96	Psephenidae	1
SAPPINGTONS RUN	22-May-96	Simuliidae	4
SAPPINGTONS RUN	22-May-96	Sphaeriidae	1
SAPPINGTONS RUN	22-May-96	Tabanidae	1
SCOTT RUN	23-May-96	Caenidae	1
SCOTT RUN	23-May-96	Cambaridae	1
SCOTT RUN	23-May-96	Capniidae/Leuctri	13
SCOTT RUN	23-May-96	Chironomidae	48
SCOTT RUN	23-May-96	Corydalidae	1
SCOTT RUN	23-May-96	Empididae	3
SCOTT RUN	23-May-96	Ephemerellidae	1
SCOTT RUN	23-May-96	Hydropsychidae	6
SCOTT RUN	23-May-96	Hydroptilidae	9
SCOTT RUN	23-May-96	Nemouridae	4
SCOTT RUN	23-May-96	Oligochaeta	3
SCOTT RUN	23-May-96	Polycentropodidae	1
SCOTT RUN	23-May-96	Simuliidae	1
SCOTT RUN	23-May-96	Tipulidae	3
S. FORK TOMLINSON RUN	21-May-96	Asellidae	2
S. FORK TOMLINSON RUN	21-May-96	Baetidae	3
S. FORK TOMLINSON RUN	21-May-96	Caenidae	2
S. FORK TOMLINSON RUN	21-May-96	Cambaridae	1
S. FORK TOMLINSON RUN	21-May-96	Chironomidae	147
S. FORK TOMLINSON RUN	21-May-96	Corydalidae	6
S. FORK TOMLINSON RUN	21-May-96	Elmidae	3
S. FORK TOMLINSON RUN	21-May-96	Empididae	10
S. FORK TOMLINSON RUN	21-May-96	Ephemerellidae	1
S. FORK TOMLINSON RUN	21-May-96	Ephemeridae	4
S. FORK TOMLINSON RUN	21-May-96	Gammaridae	7
S. FORK TOMLINSON RUN	21-May-96	Heptageniidae	4
S. FORK TOMLINSON RUN	21-May-96	Leptophlebiidae	1
S. FORK TOMLINSON RUN	21-May-96	Nematoda	1
S. FORK TOMLINSON RUN	21-May-96	Nemouridae	3
S. FORK TOMLINSON RUN	21-May-96	Oligochaeta	18
S. FORK TOMLINSON RUN	21-May-96	Perlodidae	1
S. FORK TOMLINSON RUN	21-May-96	Simuliidae	5
S. FORK TOMLINSON RUN	21-May-96	Tipulidae	9
TOMLINSON RUN	23-May-96	Asellidae	1
TOMLINSON RUN	23-May-96	Baetidae	12
TOMLINSON RUN	23-May-96	Caenidae	5
TOMLINSON RUN	23-May-96	Capniidae/Leuctri	5
TOMLINSON RUN	23-May-96	Chironomidae	61
TOMLINSON RUN	23-May-96	Elmidae	1
TOMLINSON RUN	23-May-96	Empididae	2
TOMLINSON RUN	23-May-96	Ephemerellidae	1
TOMLINSON RUN	23-May-96	Heptageniidae	2
TOMLINSON RUN	23-May-96	Hydropsychidae	4
TOMLINSON RUN	23-May-96	Hydroptilidae	3
TOMLINSON RUN	23-May-96	Leptophlebiidae	6
TOMLINSON RUN	23-May-96	Nemouridae	3

name	date	taxon	count
TOMLINSON RUN	23-May-96	Oligochaeta	7
TOMLINSON RUN	23-May-96	Perlidae	1
TOMLINSON RUN	23-May-96	Perlodidae	2
TOMLINSON RUN	23-May-96	Polycentropodidae	2
TOMLINSON RUN	23-May-96	Tipulidae	1
TURKEY FOOT RUN	22-May-96	Baetidae	4
TURKEY FOOT RUN	22-May-96	Chironomidae	7
TURKEY FOOT RUN	22-May-96	Ephemerellidae	2
TURKEY FOOT RUN	22-May-96	Gammaridae	4
TURKEY FOOT RUN	22-May-96	Hydropsychidae	3
TURKEY FOOT RUN	22-May-96	Leptophlebiidae	4
TURKEY FOOT RUN	22-May-96	Oligochaeta	2
TURKEY FOOT RUN	22-May-96	Perlodidae	1
TURKEY FOOT RUN	22-May-96	Simuliidae	1
WHITE OAK RUN	23-May-96	Asellidae	1
WHITE OAK RUN	23-May-96	Baetidae	101
WHITE OAK RUN	23-May-96	Cambaridae	1
WHITE OAK RUN	23-May-96	Capniidae/Leuctri	107
WHITE OAK RUN	23-May-96	Chironomidae	73

name	date	taxon	count
WHITE OAK RUN	23-May-96	Chloroperlidae	7
WHITE OAK RUN	23-May-96	Elmidae	5
WHITE OAK RUN	23-May-96	Empididae	1
WHITE OAK RUN	23-May-96	Ephemerellidae	33
WHITE OAK RUN	23-May-96	Ephemeridae	3
WHITE OAK RUN	23-May-96	Gammaridae	5
WHITE OAK RUN	23-May-96	Heptageniidae	5
WHITE OAK RUN	23-May-96	Hydropsychidae	7
WHITE OAK RUN	23-May-96	Hydroptilidae	4
WHITE OAK RUN	23-May-96	Leptophlebiidae	11
WHITE OAK RUN	23-May-96	Nematoda	2
WHITE OAK RUN	23-May-96	Nemertea	2
WHITE OAK RUN	23-May-96	Nemouridae	37
WHITE OAK RUN	23-May-96	Oligochaeta	4
WHITE OAK RUN	23-May-96	Perlidae	3
WHITE OAK RUN	23-May-96	Philopotamidae	1
WHITE OAK RUN	23-May-96	Polycentropodidae	1
WHITE OAK RUN	23-May-96	Rhyacophilidae	5
WHITE OAK RUN	23-May-96	Tabanidae	1
WHITE OAK RUN	23-May-96	Tipulidae	3

Table 26. **Rank of frequency of occurence**

rank[1]	taxon	number of streams	total organisms
1	Chironomidae	36	2214
2	Oligochaeta	34	846
3	Gammaridae	26	1877
4	Hydropsychidae	27	178
5	Elmidae	24	180
6	Asellidae	23	86
7	Heptageniidae	22	235
	Tipulidae	22	103
9	Baetidae	20	613
	Nemouridae	20	360
11	Capniidae/Leuctridae	17	347
12	Ephemerellidae	16	182
13	Hydroptilidae	14	136
14	Simuliidae	13	73
	Polycentropodidae	13	29
16	Cambaridae	12	13
17	Leptophlebiidae	11	79
	Nematoda	11	19
19	Empididae	10	27
	Perlidae	10	17
21	Nemertea	9	277
	Perlodidae	9	44
	Ephemeridae	9	18
24	Cacnidae	8	24
	Tabanida	8	8

rank	taxon	number of streams	total organisms
26	Philopotamidae	7	93
	Corydalidae	7	20
	Turbellaria	7	19
	Psephenidae	7	12
30	Chloroperlidae	5	13
	Physidae	5	12
32	Limnephilidae	4	21
33	Sphaeriidae	3	5
	Hirudinidae	3	3
	Sialidae	3	3
36	Tricorythidae	2	14
	Rhyacophilidae	2	6
	Ceratopogonidae	2	4
	Corbiculidae	2	3
	Oligoneuriidae	2	3
	Taeniopterygidae	2	3
	Gomphidae	2	3
43	Isoychiidae	4	19
	Peltoperlidae	1	7
	Ptilodactylidae	1	2
	Siphlonuridae	1	1
	Brachycentrida	1	1
	Dytiscidae	1	1
	Pyralidae	1	1

1= no entry means a tie

Table 27. **Metric scores for benthic macroinvertebrate communities**

name	taxa richness	HBI	EPT index	% dom. family	scrapers/ filterers	EPT/Chir.	CLI
ALEXANDERS RUN	22	8.04	5	49. 1	0.72	0.02	0.7
ALLEGHENY STEEL RUN	7	6.46	1	62.8	0.00	0.02	2.9
BOSLEY RUN	16	5.32	8	51.4	0.27	0.08	0.7
BROWN HOLLOW	11	5.26	4	50.6	0.13	0.08	1.5
CONGO RUN	17	4.06	9	34.1	0.93	0.43	0.6
CROSS CREEK	11	6.49	3	63.5	1.00	0.06	1.5
CUNNINGHAM RUN	12	4.62	6	34.0	0.96	0.20	1.3
DEEP GUT RUN	10	6.22	2	60.7	0.00	0.02	1.9
DRY RUN	19	4.20	8	29.8	0.91	0.40	0.6
EBENEZER RUN	13	4.28	6	31.2	0.07	0.07	1.1
HARDIN RUN	12	4.45	7	36.4	0.50	0.33	1.3
HARMON CREEK	3	9.89	0	90.6	0.00	0.00	8.0
HERRON RUN	23	4.46	13	31.0	0.12	0.11	0.4
HOLBERT RUN	12	6.26	7	41.9	0.50	0.35	1.3
KINGS CREEK	20	5.74	10	21.2	0.35	0.37	0.7
LANGFITT RUN	24	5.87	11	44.3	0.60	0.03	0.4
LAUREL HOLLOW	12	5.71	5	40.6	0.33	0.56	1.3
LICK RUN	15	4.73	9	27.5	0.29	0.21	0.9
MAHAN RUN	10	5.29	1	46.3	0.88	0.03	1.7
MARKS RUN	9	6.56	1	37.7	0.50	0.03	2.0
MARROW RUN	15	6.02	6	53.6	0.60	0.06	0.8
MECHLING RUN	15	4.38	6	25.9	0. 11	0.11	0.9
MERCER RUN	9	7.81	2	38.5	0.90	0.06	2.1
MIDDLE RUN	9	6.07	5	57.8	0.75	0.09	1.9
NORTH FORK	16	4.45	10	19.6	0.67	0.50	0.9
NORTH FORK TOMLINSON RUN	14	6.40	5	56.8	1.00	0.09	1.1
NORTH POTROCK RUN	14	4. 12	6	62.0	0.12	0.14	1.0
PARMAR RUN	11	4.20	6	38.1	1.00	0.05	1.5
POTROCK RUN	7	4.04	3	95.1	0.78	0.60	2.7
RUSH RUN	14	4.02	9	33.9	0.24	0.38	1.1
SAPPINGTONS RUN	14	6.66	4	43.2	0.86	0.03	1.1
SCOTT RUN	14	5.51	7	50.5	0.00	0.13	1.1
SOUTH FORK TOMLINSON RUN	19	6.50	8	64.5	0.58	0.05	0.6
TOMLINSON RUN	18	6.02	12	51.3	0.43	0.16	0.6
TURKEY FOOT RUN	9	5.31	5	24.1	0.00	0.42	2.1
WHITE OAK RUN	25	3.89	14	25.3	0.56	0.16	
Average	13.92	5.54	6.22	45.14	0.49	0.18	1.4
Minimum	3	3.89	0	19.6	0.00	0.00	0
Maximum	25	9.89	14	95.1	1.00	0.60	8
n	36	36	36	36	36	36	36

Key: HBI = Hilsenhoff Biotic Index EPT = Ephemeroptera, Plecoptera, Trichoptera CLI = Community Loss Index

Appendix 6. Glossary

`303(d) list` - a list of stream names required by the EPA that are water quality limited and not expected to meet water quality criteria even after applying best available technology; named for a section in the Clean Water Act

`acidity` - the capacity of water to donate protons. The abbreviation pH refers to degree of acidity.

`acid mine drainage (AMD)` - acidic water discharged from an active or abandoned mine

`alkalinity` - measures water's buffering capacity, or resistance to acidification; often expressed as amount of carbonate and bicarbonate

`aluminum` - a potentially toxic metallic element often found in mine drainage; when oxidized forms a white precipitate called "white boy"

`benthic macroinvertebrates` - small animals without backbones that live on the bottom of a water body (e.g., insect, worms, snails); see benthos, macroinvertebrate

`benthos` - organisms that live on the bottom of a water body, e.g., algae, mayflies, darters

`buffer` - a dissolved substance that maintains a solution's original pH by neutralizing added acid

`canopy` - the nearly continuous layer of leaves along the top of a forest

`citizen monitoring team` - a group of people that periodically checks the ecological health of its local streams conductivity (specific conductance) - the capacity of water to conduct an electrical current, reciprocal of resistance; indicates the general mineral content of water; short cut in analyzing for total dissolved solids

designated uses - the uses specified in the water quality standards [see anonymous undated (Title 46, Legislative Rule) in references] for each water body or segment

discharge - liquid flowing from a man-made container; or the volume of water flowing down a stream

discharge permit - a legal document issued by a government regulatory agency specifying the kinds and amounts of pollutants a person or group may discharge into a water body; often called NPDES permit

dissolved oxygen - describes the amount of molecular oxygen dissolved in water, and therefore available for aquatic organisms.

Division of Environmental Protection (DEP) - a unit in the executive branch of West Virginia's state government charged with enforcing environmental laws

effluent - liquid flowing from a man-made container

Environmental Quality Board (EQB) - a standing group, whose members are appointed by the governor, that promulgates water quality criteria and judges appeals for relief from water quality regulations

EPA - U.S. Environmental Protection Agency

ephemeral - a stream that carries surface water during only part of the year; a stream that occasionally dries up fecal coliform bacteria - a group of single-celled organisms common in the digestive tracts of some birds and all mammals, including man; indicates fecal pollution and the potential presence of human pathogens

groundcover - short plants (up to 2 feet tall) that form a layer on the ground

I/I - infiltration and inflow; water leaking into sewer collection lines that may cause problems at the sewage treatment plant

impaired - (1) according to the water quality standards, a stream that does not fully support 1 or more of its designated uses; (2) as used in this assessment report, a benthic community that is depauperate compared to the reference site

iron - a potentially toxic metallic element often found in mine drainage; when oxidized forms an orange precipitate called "yellow boy" that can clog fish gills

macroinvertebrate - a small animal that is large enough to be seen by the naked eye and does not have a backbone, e.g., mussel, stonefly, crayfish

MACS - mid-Atlantic Coastal Streams

manganese - a potentially toxic metallic element often found in mine drainage

National Pollutant Discharge Elimination System (NPDES) - a government permit program created by section 402 of the federal Clean Water Act of 1972 to control all discharges of pollutants from point sources `nonimpaired` - (1) according to the water quality standards, a stream that fully supports 1 or more of its designated uses; (2) as used in this assessment report, a benthic community that is not depauperate compared to the reference site

`nonpoint source (NPS) pollution` - contaminants that run off a broad landscape area (e.g., plowed field, parking lot, dirt road) and enter a receiving water body

`Office of Water Resources (OWR)` - a unit within the DEP that manages a variety of regulatory and voluntary programs to enhance and protect West Virginia's surface and ground waters.

`Ohio River Valley Water Sanitation Commission (ORSANCO)` - a multi-state, quasi-governmental agency that works to improve the Ohio River's water quality

`pH` - indicates the concentration of hydrogen ions; a measure of the intensity of acidity of a liquid. Represented on a scale of 0-14, a pH of 1 describes the strongest acid, 14 represents the strongest base, and 7 is neutral.

`point source` - a specific, discernible site (e.g., pipe, ditch, container) locatable on a map as a point, from which pollution discharges into a water body

`reference stream` - a stream reach that represents a watershed's least impacted condition; used to compare against other sites

`riparium` (pl. riparia) - short for "riparian corridor"; the terrestrial ecosystem along a water body

`stakeholder` - a person or group with a vested interest in a watershed, e.g., landowner, businessperson, angler

STORET - developed by EPA and used by OWR, software used to store and analyze water quality data

STP - sewage treatment plant

supporting, fully - (1) a stream whose water qualities meet or exceed the criteria compatible with its highest designated use, a stream that does not violate water quality criteria more than 10% of the time; (2) in terms of habitat, 74-90% of the reference condition

total maximum daily load (TMDL) - the total mass of a particular pollutant allowed to enter a water body; for example, no more than 100 tons of sediment per day is allowed to pass through the mouth of the XYZ River

turbidity - the extent to which light passes through water, indicating its clarity; indirect measure of suspended sediment

understory - the set of shrubs and trees at 5-15 feet high that forms a forest's middle layer

water-contact recreation - the type of designated use in which a person (e.g., angler, swimmer, boater) comes in contact with the stream's water

watershed - a geographic area from which water drains to a particular point

Watershed Management Approach Steering Committee - a taskforce of federal (e.g., U.S. EPA, USGS) and state (e.g., DEP, SCA) officers that recommends streams for intense, detailed study

`Watershed Assessment Program (the Program)` - a group of scientists within the OWR charged with evaluating the ecological health of West Virginia's watersheds

`watershed association` - a group of diverse stakeholders working via a consensus process to improve water quality in their local streams

`Watershed Network` - an informal coalition of federal, state, multi-state, and non-governmental groups cooperating to support local watershed associations