

APPENDIX—WATER-QUALITY DATA FROM THE KANAWHA–NEW RIVER BASIN IN A NATIONAL CONTEXT

For a complete view of Kanawha–New River Basin data and for additional information about specific benchmarks used, visit our Web site at <http://water.usgs.gov/nawqa/>. Also visit the NAWQA Data Warehouse for access to NAWQA data sets at <http://water.usgs.gov/nawqa/data>.

This appendix is a summary of chemical concentrations and biological indicators assessed in the Kanawha–New River Basin. Selected results for this basin are graphically compared to results from as many as 36 NAWQA Study Units investigated from 1991 to 1998 and to national water-quality benchmarks for human health, aquatic life, or fish-eating wildlife. The chemical and biological indicators shown were selected on the basis of frequent detection, detection at concentrations above a national benchmark, or regulatory or scientific importance. The graphs illustrate how conditions associated with each land use sampled in the Kanawha–New River Basin compare to results from across the Nation, and how conditions compare among the several land uses. Graphs for chemicals show only detected concentrations and, thus, care must be taken to evaluate detection frequencies in addition to concentrations when comparing study-unit and national results. For example, simazine concentrations in Kanawha–New River Basin agricultural streams were similar to the national distribution, but the detection frequency was much higher (94 percent compared to 61 percent).

CHEMICALS IN WATER

Concentrations and detection frequencies, Kanawha–New River Basin, 1996–98—Detection sensitivity varies among chemicals and, thus, frequencies are not directly comparable among chemicals

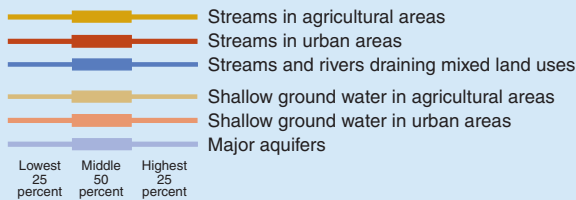
◆ Detected concentration in Study Unit

66 38 Frequencies of detection, in percent. Detection frequencies were not censored at any common reporting limit. The left-hand column is the study-unit frequency and the right-hand column is the national frequency

-- Not measured or sample size less than two

12 Study-unit sample size. For ground water, the number of samples is equal to the number of wells sampled

National ranges of detected concentrations, by land use, in 36 NAWQA Study Units, 1991–98—Ranges include only samples in which a chemical was detected



National water-quality benchmarks

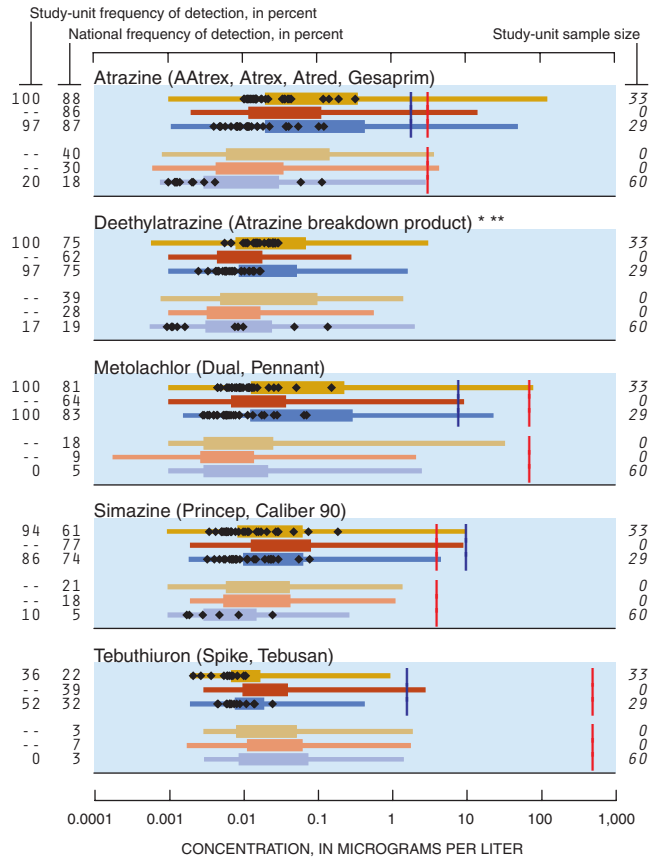
National benchmarks include standards and guidelines related to drinking-water quality, criteria for protecting the health of aquatic life, and a goal for preventing stream eutrophication due to phosphorus. Sources include the U.S. Environmental Protection Agency and the Canadian Council of Ministers of the Environment

- | Drinking-water quality (applies to ground water and surface water)
- | Protection of aquatic life (applies to surface water only)
- | Prevention of eutrophication in streams not flowing directly into lakes or impoundments

* No benchmark for drinking-water quality

** No benchmark for protection of aquatic life

Pesticides in water—Herbicides



Other herbicides detected

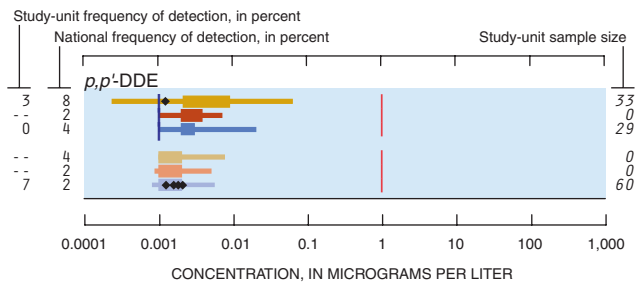
- Acetochlor (Harness Plus, Surpass) **
- Alachlor (Lasso, Bronco, Lariat, Bullet) **
- Benfluralin (Balan, Benefin, Bonalan) ***
- Cyanazine (Bladex, Fortrol)
- DCPA (Dacthal, chlorthal-dimethyl) ***
- 2,6-Diethylaniline (Alachlor breakdown product) ***
- Dinoseb (Dinosebe)
- Diuron (Crisuron, Karmex, Diurex) **
- EPTC (Eptam, Farmarox, Alirox) ***
- Fenuron (Fenulon, Fenidim) ***
- Molinate (Ordran) ***
- Napropamide (Devrinol) **
- Oryzalin (Surflan, Dirimal) **
- Prometon (Pramitol, Princep) **
- Triallate (Far-Go, Avadex BW, Tri-allate) *
- Triclopyr (Garlon, Grandstand, Redeem, Remedy) ***
- Trifluralin (Treflan, Gowan, Tri-4, Trific)

Herbicides not detected

- Acifluorfen (Blazer, Tackle 2S) **
- Bentazon (Basagran, Bentazone) **
- Bromacil (Hyvar X, Urox B, Bromax)
- Bromoxynil (Buctril, Brominal) *
- Butylate (Sutan +, Genate Plus, Butilate) **
- Chloramben (Amiben, Amilon-WP, Vegiben) **
- Clopyralid (Stinger, Lontrel, Transline) ***
- 2,4-D (Aqua-Kleen, Lawn-Keep, Weed-B-Gone)
- 2,4-DB (Butyrac, Butoxone, Embutox Plus, Embutone) ***
- Dacthal mono-acid (Dacthal breakdown product) ***
- Dicamba (Banvel, Dianat, Scotts Proturf)
- Dichlorprop (2,4-DP, Seritox 50, Lentemul) ***
- Ethalfuralin (Sonalan, Curbit) ***

Fluometuron (Flo-Met, Cotoran) **
 Linuron (Lorox, Linex, Sarclax, Linurex, Afalon) *
 MCPA (Rhomene, Rhonox, Chiptox)
 MCPB (Thistrol) * **
 Metribuzin (Lexone, Sencor)
 Neburon (Neburea, Neburyl, Noruben) * **
 Norflurazon (E vital, Predict, Solicam, Zorial) * **
 Pebulate (Tillam, PEBC) * **
 Pendimethalin (Pre-M, Prowl, Stomp) * **
 Picloram (Grazon, Tordon)
 Pronamide (Kerb, Propyzamid) **
 Propachlor (Ramrod, Satecid) **
 Propanil (Stam, Stampede, Wham) * **
 Propham (Tuberite) **
 2,4,5-T **
 2,4,5-TP (Silvex, Fenoprop) **
 Terbacil (Sinbar) **
 Thiobencarb (Bolero, Saturn, Benthicarb) * **

Pesticides in water—Insecticides



Other insecticides detected

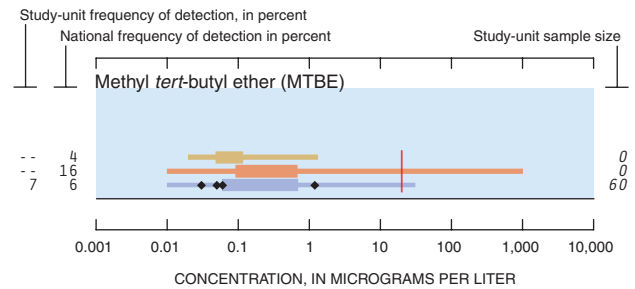
Carbaryl (Carbamine, Denapon, Sevin)
 Carbofuran (Furadan, Curater, Yaltox)
 Chlorpyrifos (Brodan, Dursban, Lorsban)
 Diazinon (Basudin, Diazatol, Neocidol, Knox Out)
 alpha-HCH (alpha-BHC, alpha-lindane) **
 gamma-HCH (Lindane, gamma-BHC)
 Malathion (Malathion)

Insecticides not detected

Aldicarb (Temik, Ambush, Pounce)
 Aldicarb sulfone (Standak, aldoxycarb)
 Aldicarb sulfoxide (Aldicarb breakdown product)
 Azinphos-methyl (Guthion, Gusathion M) *
 Dieldrin (Panoram D-31, Octalox, Compound 497)
 Disulfoton (Disyston, Di-Syston) **
 Ethoprop (Mocap, Ethoprophos) * **
 Fonofos (Dyfonate, Capfos, Cudgel, Tycap) **
 3-Hydroxycarbofuran (Carbofuran breakdown product) * **
 Methiocarb (Slug-Geta, Grandslam, Mesurol) * **
 Methomyl (Lanox, Lannate, Acinate) **
 Methyl parathion (Pennacp-M, Folidol-M) **
 Oxamyl (Vydate L, Pratt) **
 Parathion (Roethyl-P, Alkron, Panthion, Phoskil) *
cis-Permethrin (Ambush, Astro, Pounce) * **
 Phorate (Thimet, Granutox, Geomet, Rampart) * **
 Propargite (Comite, Omite, Ornamite) * **
 Propoxur (Baygon, Blattanex, Uden, Proprotox) * **
 Terbufos (Contraven, Counter, Pilarfox) **

Volatile organic compounds (VOCs) in ground water

These graphs represent data from 16 Study Units, sampled from 1996 to 1998



Other VOCs detected

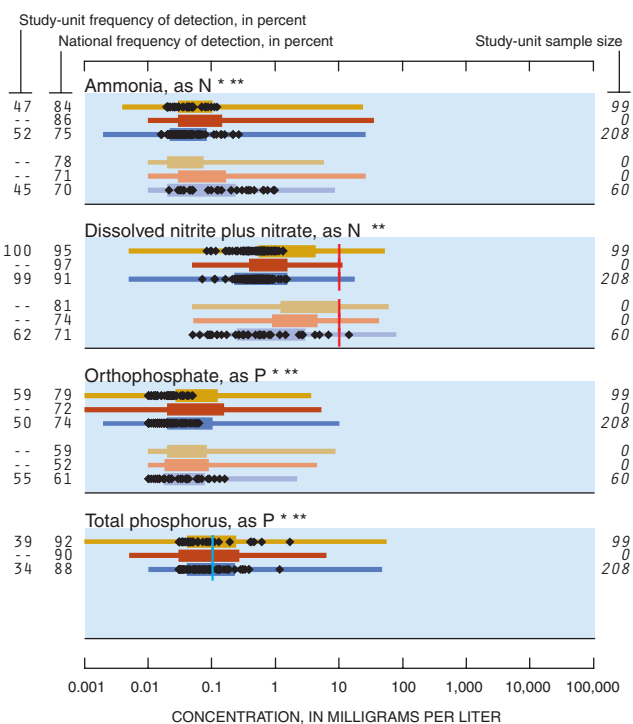
Benzene
 Bromodichloromethane (Dichlorobromomethane)
 2-Butanone (Methyl ethyl ketone (MEK)) *
 Carbon disulfide *
 Chlorodibromomethane (Dibromochloromethane)
 Chloromethane (Methyl chloride)
 1,4-Dichlorobenzene (*p*-Dichlorobenzene)
 Dichlorodifluoromethane (CFC 12, Freon 12)
 1,1-Dichloroethane (Ethylidene dichloride) *
 1,1-Dichloroethene (Vinylidene chloride)
cis-1,2-Dichloroethene (*Z*)-1,2-Dichloroethene)
 Diisopropyl ether (Diisopropylether (DIPE)) *
 1,2-Dimethylbenzene (*o*-Xylene)
 1,3 & 1,4-Dimethylbenzene (*m*-&*p*-Xylene)
 1-4-Epoxy butane (Tetrahydrofuran, Diethylene oxide) *
 Ethylbenzene (Phenylethane)
 Iodomethane (Methyl iodide) *
 Isopropylbenzene (Cumene) *
 Methylbenzene (Toluene)
 2-Propanone (Acetone) *
 Tetrachloroethene (Perchloroethene)
 Tribromomethane (Bromoform)
 1,2,4-Trichlorobenzene
 1,1,1-Trichloroethane (Methylchloroform)
 Trichloroethene (TCE)
 Trichlorofluoromethane (CFC 11, Freon 11)
 Trichloromethane (Chloroform)
 1,2,4-Trimethylbenzene (Pseudocumene) *

VOCs not detected

tert-Amylmethylether (*tert*-amyl methyl ether (TAME)) *
 Bromobenzene (Phenyl bromide) *
 Bromochloromethane (Methylene chlorobromide)
 Bromoethene (Vinyl bromide) *
 Bromomethane (Methyl bromide)
n-Butylbenzene (1-Phenylbutane) *
sec-Butylbenzene *
tert-Butylbenzene *
 3-Chloro-1-propene (3-Chloropropene) *
 1-Chloro-2-methylbenzene (*o*-Chlorotoluene)
 1-Chloro-4-methylbenzene (*p*-Chlorotoluene)
 Chlorobenzene (Monochlorobenzene)
 Chloroethane (Ethyl chloride) *
 Chloroethene (Vinyl chloride)
 1,2-Dibromo-3-chloropropane (DBCP, Nemagon)
 1,2-Dibromoethane (Ethylene dibromide, EDB)
 Dibromomethane (Methylene dibromide) *
trans-1,4-Dichloro-2-butene ((*Z*)-1,4-Dichloro-2-butene) *
 1,2-Dichlorobenzene (*o*-Dichlorobenzene)
 1,3-Dichlorobenzene (*m*-Dichlorobenzene)
 1,2-Dichloroethane (Ethylene dichloride)
trans-1,2-Dichloroethene ((*E*)-1,2-Dichloroethene)
 Dichloromethane (Methylene chloride)
 1,2-Dichloropropane (Propylene dichloride)
 2,2-Dichloropropane *
 1,3-Dichloropropane (Trimethylene dichloride) *
trans-1,3-Dichloropropene ((*E*)-1,3-Dichloropropene)
cis-1,3-Dichloropropene ((*Z*)-1,3-Dichloropropene)
 1,1-Dichloropropene *
 Diethyl ether (Ethyl ether) *
 Ethenylbenzene (Styrene)
 Ethyl methacrylate *

- Ethyl *tert*-butyl ether (Ethyl-*t*-butyl ether (ETBE)) *
- 1-Ethyl-2-methylbenzene (2-Ethyltoluene) *
- Hexachlorobutadiene
- 1,1,1,2,2,2-Hexachloroethane (Hexachloroethane)
- 2-Hexanone (Methyl butyl ketone (MBK)) *
- p*-Isopropyltoluene (*p*-Cymene) *
- Methyl acrylonitrile *
- Methyl-2-methacrylate (Methyl methacrylate) *
- 4-Methyl-2-pentanone (Methyl isobutyl ketone (MIBK)) *
- Methyl-2-propenoate (Methyl acrylate) *
- Naphthalene
- 2-Propenenitrile (Acrylonitrile)
- n*-Propylbenzene (Isocumene) *
- 1,1,2,2-Tetrachloroethane *
- 1,1,1,2-Tetrachloroethane
- Tetrachloromethane (Carbon tetrachloride)
- 1,2,3,4-Tetramethylbenzene (Prehnitene) *
- 1,2,3,5-Tetramethylbenzene (Isodurene) *
- 1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113) *
- 1,2,3-Trichlorobenzene *
- 1,1,2-Trichloroethane (Vinyl trichloride)
- 1,2,3-Trichloropropane (Allyl trichloride)
- 1,2,3-Trimethylbenzene (Hemimellitene) *
- 1,3,5-Trimethylbenzene (Mesitylene) *

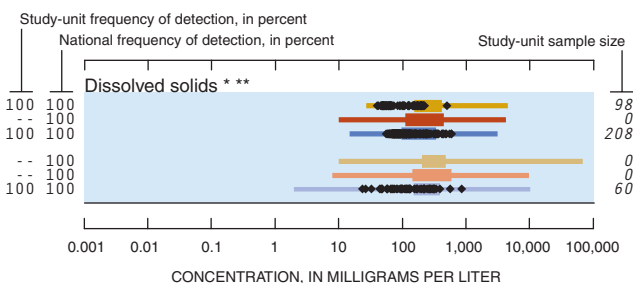
Nutrients in water



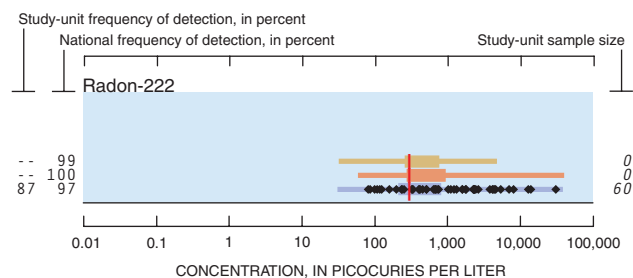
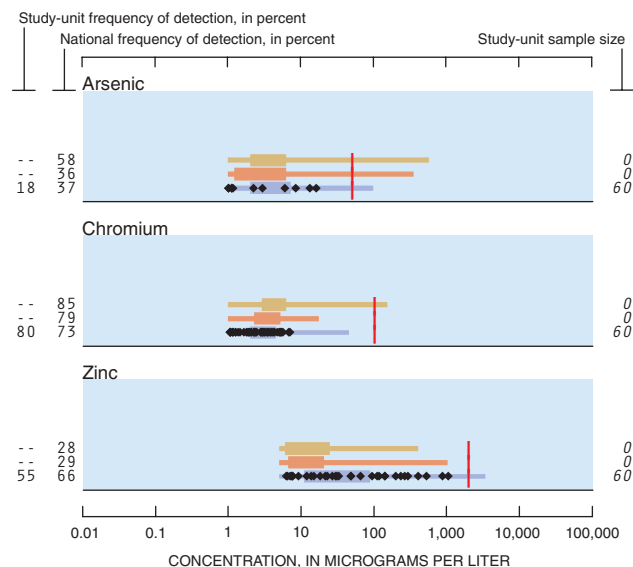
Nutrients not detected

Dissolved ammonia plus organic nitrogen as N ***

Dissolved solids in water



Trace elements in ground water



Other trace elements detected

- Lead
- Selenium
- Uranium

Trace elements not detected

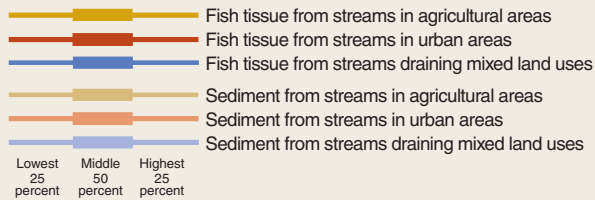
- Cadmium

CHEMICALS IN FISH TISSUE AND BED SEDIMENT

Concentrations and detection frequencies, Kanawha–New River Basin, 1996–98—Detection sensitivity varies among chemicals and, thus, frequencies are not directly comparable among chemicals. Study-unit frequencies of detection are based on small sample sizes; the applicable sample size is specified in each graph

- ◆ Detected concentration in Study Unit
- 66 38 Frequencies of detection, in percent. Detection frequencies were not censored at any common reporting limit. The left-hand column is the study-unit frequency and the right-hand column is the national frequency
- Not measured or sample size less than two
- 12 Study-unit sample size

National ranges of concentrations detected, by land use, in 36 NAWQA Study Units, 1991–98—Ranges include only samples in which a chemical was detected

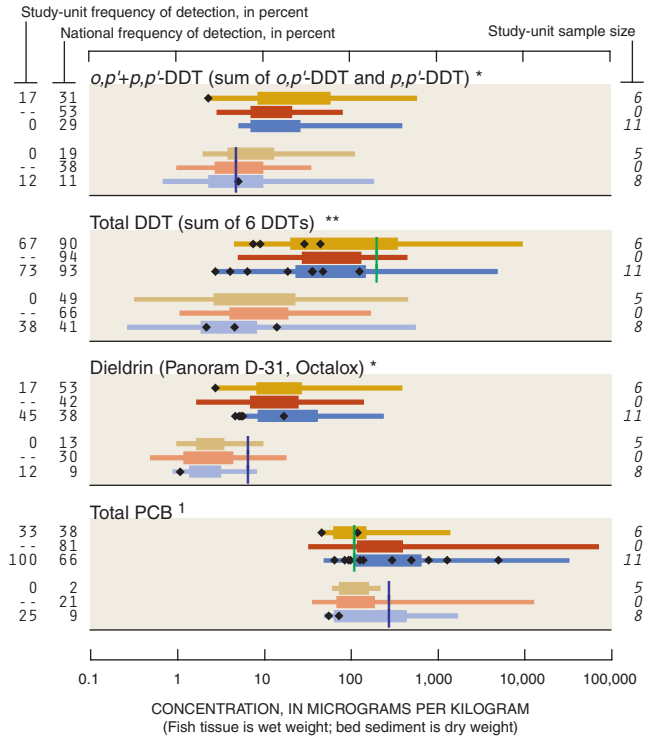
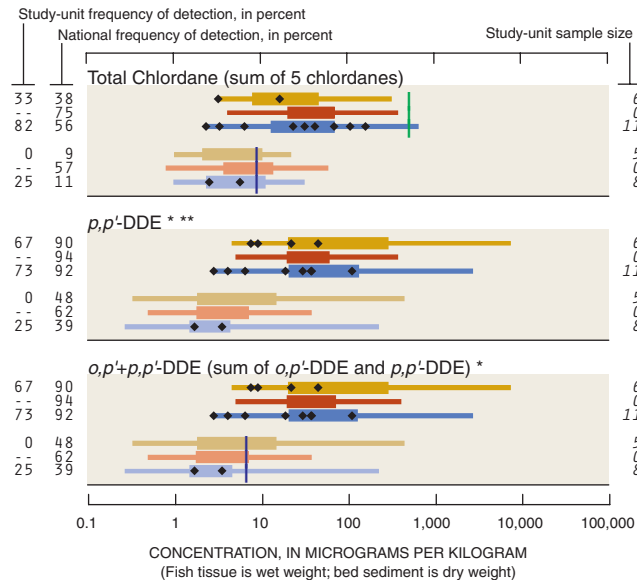


National benchmarks for fish tissue and bed sediment

National benchmarks include standards and guidelines related to criteria for protection of the health of fish-eating wildlife and aquatic organisms. Sources include the U.S. Environmental Protection Agency, other Federal and State agencies, and the Canadian Council of Ministers of the Environment

- █ Protection of fish-eating wildlife (applies to fish tissue)
- █ Protection of aquatic life (applies to bed sediment)
- * No benchmark for protection of fish-eating wildlife
- ** No benchmark for protection of aquatic life

Organochlorines in fish tissue (whole body) and bed sediment



¹ The national detection frequencies for total PCB in sediment are biased low because about 30 percent of samples nationally had elevated detection levels compared to this Study Unit. See <http://water.usgs.gov/> for additional information.

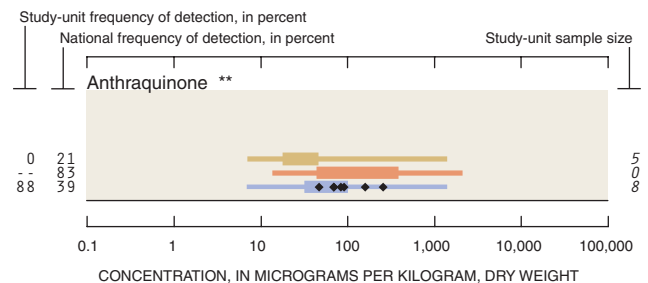
Other organochlorines detected

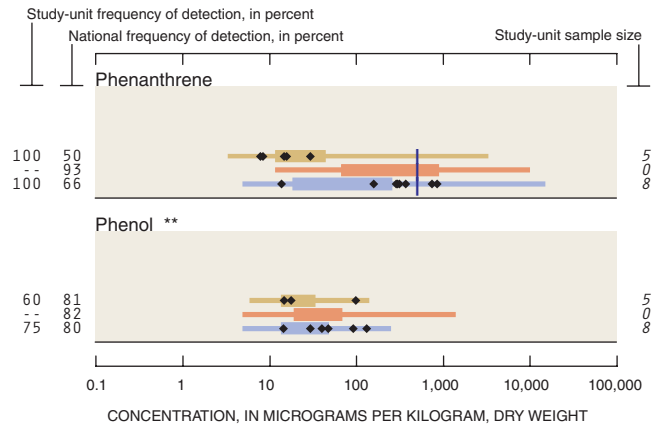
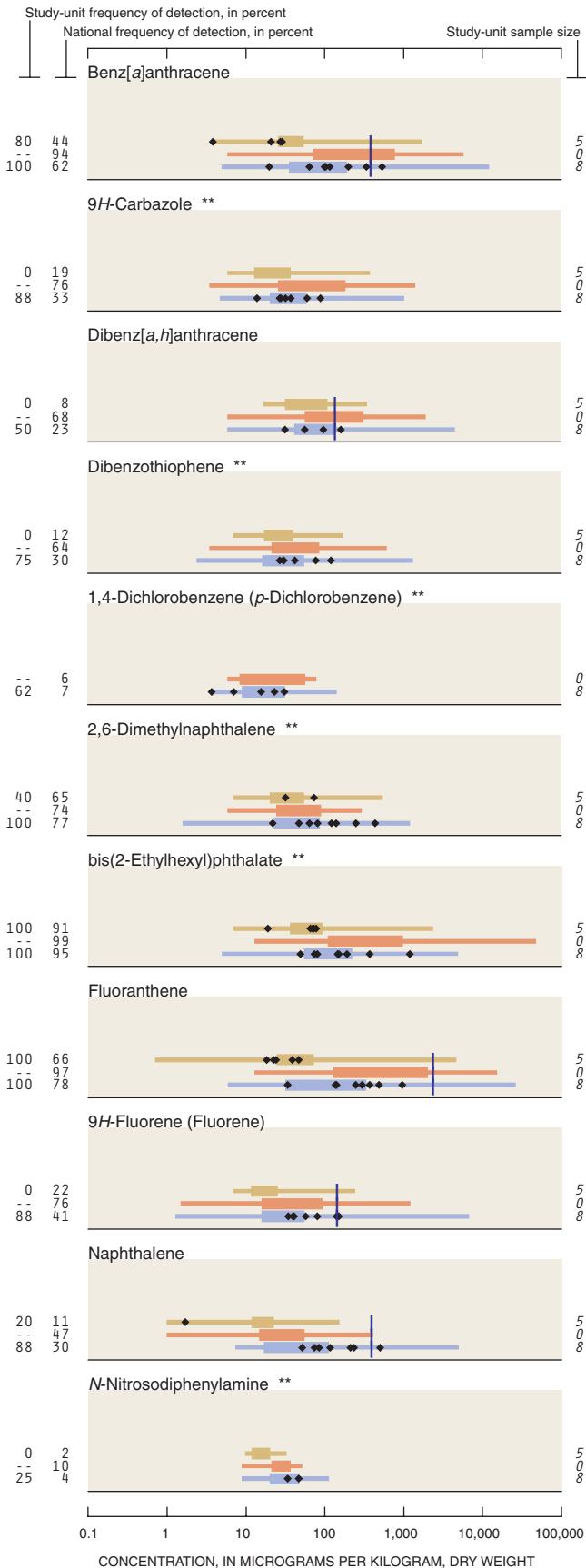
- o,p'+p,p'-DDD (sum of o,p'-DDD and p,p'-DDD) *
- Dieldrin+aldrin (sum of dieldrin and aldrin) **
- Heptachlor epoxide (Heptachlor breakdown product) *
- Heptachlor-heptachlor epoxide (sum of heptachlor and heptachlor epoxide) **

Organochlorines not detected

- Chloroneb (Chloronebe, Demosan) ***
- DCPA (Dacthal, chlorthal-dimethyl) ***
- Endosulfan I (alpha-Endosulfan, Thiodan) **
- Endrin (Endrine)
- gamma-HCH (Lindane, gamma-BHC, Gammexane) *
- Total-HCH (sum of alpha-HCH, beta-HCH, gamma-HCH, and delta-HCH) **
- Hexachlorobenzene (HCB) **
- Isodrin (Isodrine, Compound 711) **
- p,p'-Methoxychlor (Marlate, methoxychlore) **
- o,p'-Methoxychlor ***
- Mirex (Dechlorane) **
- Pentachloroanisole (PCA) ***
- cis-Permethrin (Ambush, Astro, Pounce) ***
- trans-Permethrin (Ambush, Astro, Pounce) ***
- Toxaphene (Camphechlor, Hercules 3956) ***

Semivolatile organic compounds (SVOCs) in bed sediment





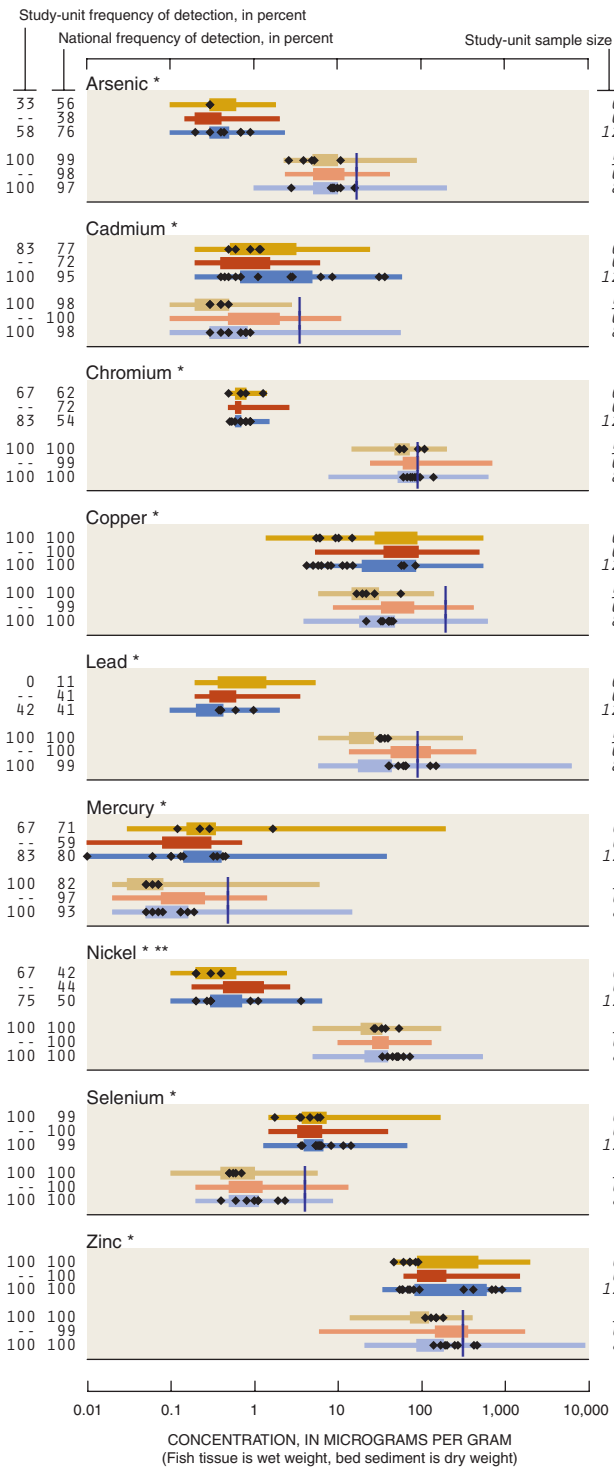
Other SVOCs detected

- Acenaphthene
- Acenaphthylene
- Acridine **
- C8-Alkylphenol **
- Anthracene
- Benzo[a]pyrene
- Benzo[b]fluoranthene **
- Benzo[ghi]perylene **
- Benzo[k]fluoranthene **
- Butylbenzylphthalate **
- Chrysene
- p-Cresol **
- Di-n-butylphthalate **
- 1,2-Dichlorobenzene (o-Dichlorobenzene) **
- Diethylphthalate **
- 1,2-Dimethylnaphthalene **
- 1,6-Dimethylnaphthalene **
- 3,5-Dimethylphenol **
- Dimethylphthalate **
- 2,4-Dinitrotoluene **
- Indeno[1,2,3-cd]pyrene **
- Isoquinoline **
- 1-Methyl-9H-fluorene **
- 2-Methylantracene **
- 4,5-Methylenephenanthrene **
- 1-Methylphenanthrene **
- 1-Methylpyrene **
- Phenanthridine **
- Pyrene
- Quinoline **
- 1,2,4-Trichlorobenzene **
- 2,3,6-Trimethylnaphthalene **

SVOCs not detected

- Azobenzene **
- Benzo[c]cinnoline **
- 2,2-Biquinoline **
- 4-Bromophenyl-phenylether **
- 4-Chloro-3-methylphenol **
- bis(2-Chloroethoxy)methane **
- 2-Chloronaphthalene **
- 2-Chlorophenol **
- 4-Chlorophenyl-phenylether **
- Di-n-octylphthalate **
- 1,3-Dichlorobenzene (m-Dichlorobenzene) **
- Isophorone **
- Nitrobenzene **
- N-Nitrosodi-n-propylamine **
- Pentachloronitrobenzene **

Trace elements in fish tissue (livers) and bed sediment



BIOLOGICAL INDICATORS

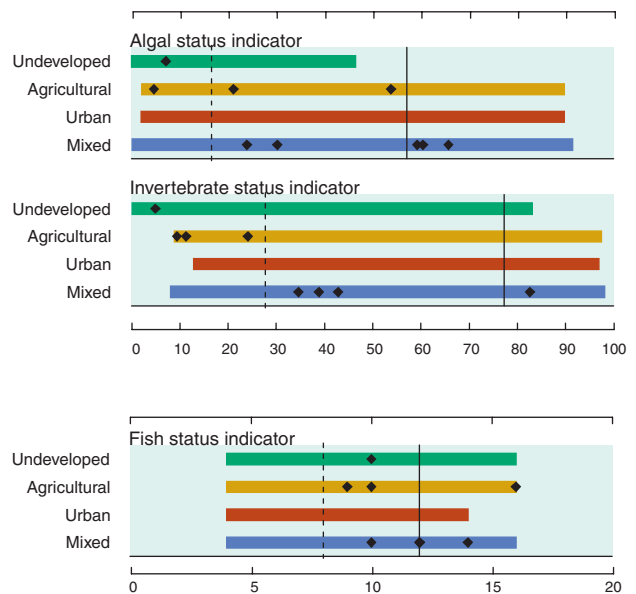
Higher national scores suggest habitat disturbance, water-quality degradation, or naturally harsh conditions. The status of algae, invertebrates (insects, worms, and clams), and fish provide a record of water-quality and stream conditions that water-chemistry indicators may not reveal. **Algal status** focuses on the changes in the percentage of certain algae in response to increasing siltation, and it often correlates with higher nutrient concentrations in some regions. **Invertebrate status** averages 11 metrics that summarize changes in richness, tolerance, trophic conditions, and dominance associated with water-quality degradation. **Fish status** sums the scores of four fish metrics (percent tolerant, omnivorous, non-native individuals, and percent individuals with external anomalies) that increase in association with water-quality degradation.

Biological indicator value, Kanawha–New River Basin, by land use, 1996–98

- ◆ Biological status assessed at a site

National ranges of biological indicators, in 16 NAWQA Study Units, 1994–98

- Streams in undeveloped areas
- Streams in agricultural areas
- Streams in urban areas
- Streams in mixed-land-use areas
- 75th percentile
- - - 25th percentile



A COORDINATED EFFORT

Coordination with agencies and organizations in the Kanawha-New River Basin was integral to the success of this water-quality assessment. We thank those who served as members of our liaison committee.

Federal Agencies

National Park Service
U.S. Army Corps of Engineers
U.S. Environmental Protection Agency
U.S. Fish and Wildlife Service
U.S. Office of Surface Mining
U.S. Department of Agriculture
 Agricultural Research Service
 Natural Resources Conservation Service
 Monongahela National Forest

State Agencies

North Carolina Division of Environmental Management
Virginia Department of Environmental Quality
Virginia Department of Game and Inland Fisheries
Virginia Department of Health
Virginia Division of Mineral Resources
Virginia Division of Soil and Water Conservation
West Virginia Bureau for Public Health
West Virginia Division of Environmental Protection
West Virginia Division of Natural Resources
West Virginia Geological and Economic Survey
West Virginia Soil Conservation Agency

Universities

Marshall University
Virginia Polytechnic Institute and State University
West Virginia University

Other public and private organizations

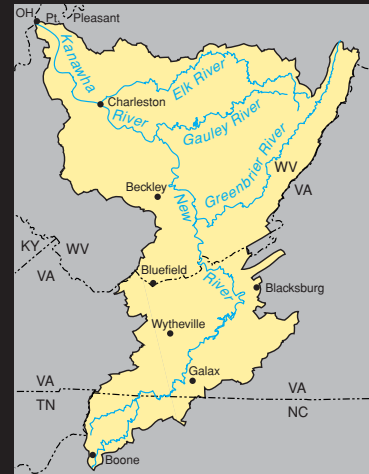
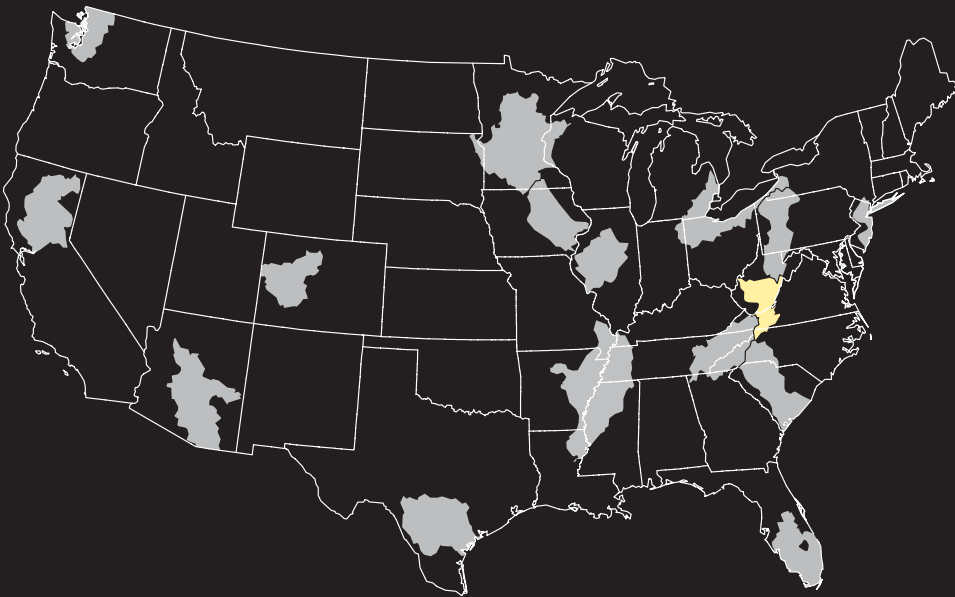
Cacapon Institute
Canaan Valley Institute
Greenbrier River Watershed Association
National Committee for the New River
New River Community Partners
Ohio River Valley Water Sanitation Commission
West Virginia American Water Company
West Virginia Citizens Action Group
West Virginia Coal Association
West Virginia Farm Bureau
West Virginia Highlands Conservancy
West Virginia Manufacturers Association
West Virginia Mining and Reclamation Association
West Virginia Rivers Coalition
West Virginia Rural Water Association

We gratefully acknowledge the cooperation of numerous property owners who provided access to sampling locations on their land. We also thank the following individuals for contributing data, knowledge, time, and expertise to this effort.

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NAWQA

National Water-Quality Assessment (NAWQA) Program Kanawha–New River Basin



Paybins and others—Water Quality in the Kanawha–New River Basin
U.S. Geological Survey Circular 1204

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