USGS Studies on Contaminants in the Potomac River Basin

NAWQA Pesticides

Rock Creek Topical Study

Wastewater Compounds at Selected Effluents and Intakes

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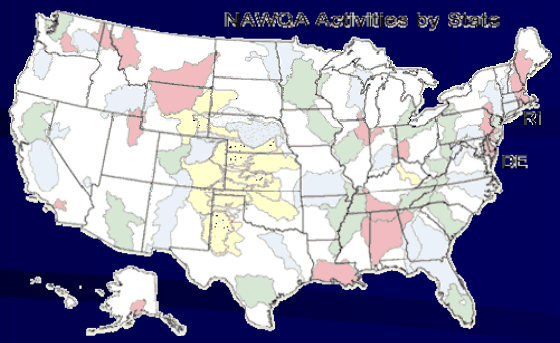
National Water Quality Assessment Program



PURPOSE

To provide water-quality information to better prioritize and manage water resources in diverse hydrologic and land-use settings in the U.S. More than 60 major river basins and aquifer systems

STATUS: Describe the quality of the Nation's water resources in a Nationally consistent manner

TRENDS: Assess long-term changes in water quality

UNDERSTANDING: Identify, describe, and explain factors that govern water quality

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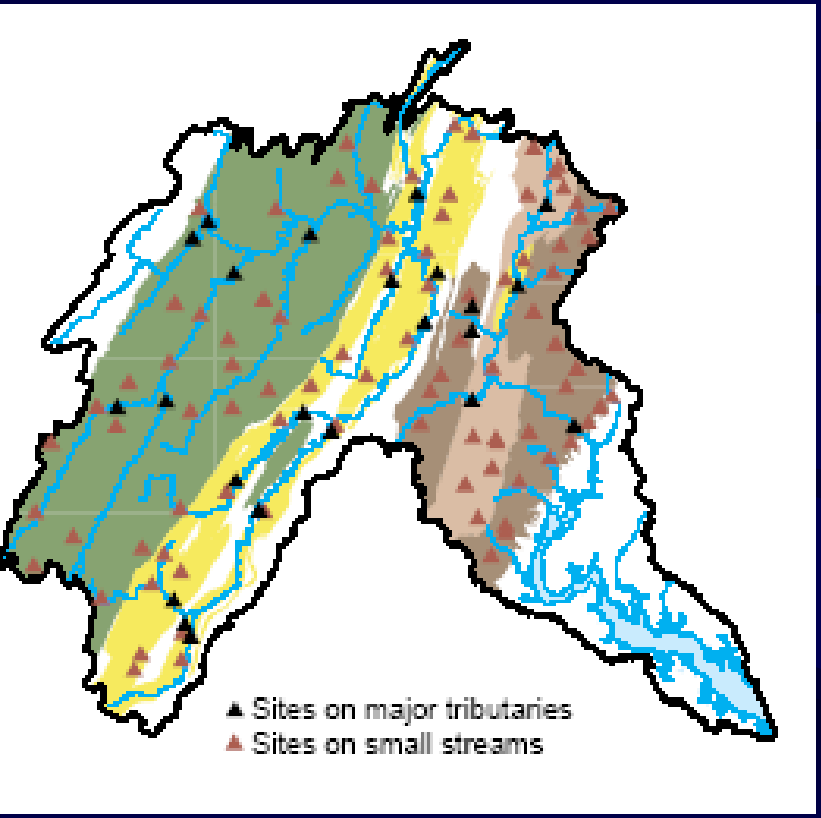
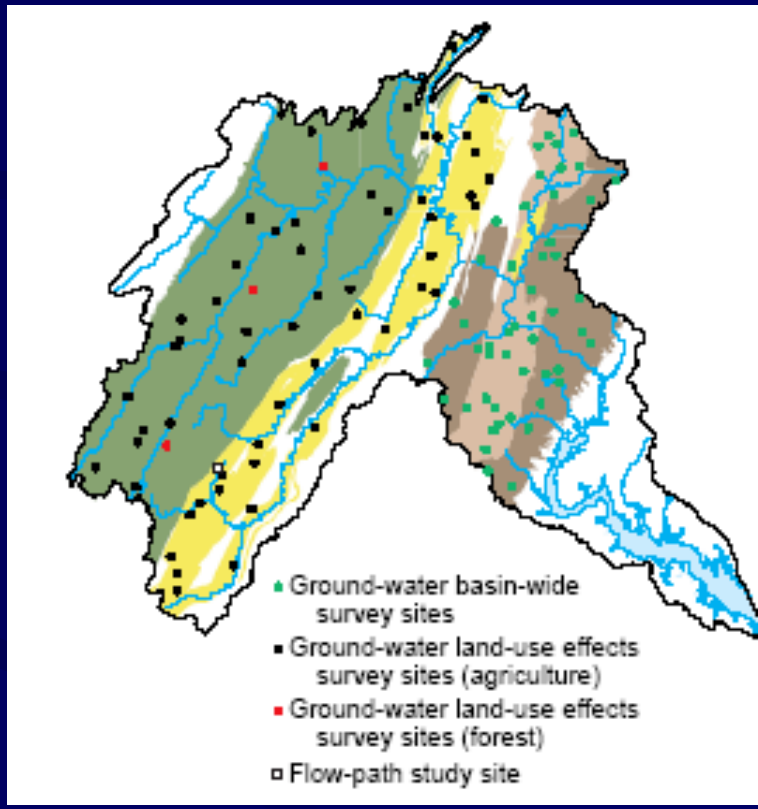
Potomac River NAWQA Pesticides

Judy Denver, Scott Ator, and Linda Debrewer



Large Spatial Coverage for Surface Water and Ground Water



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Potomac River NAWQA Pesticides
Patterns of Occurrence

Urban

- atrazine
- simazine
- prometon
- 2,4-D
- diuron
- diazinon
- carbaryl
- malathion
- chlorpyrifos

Agriculture

- atrazine
- metolachlor
- cyanazine
- alachlor

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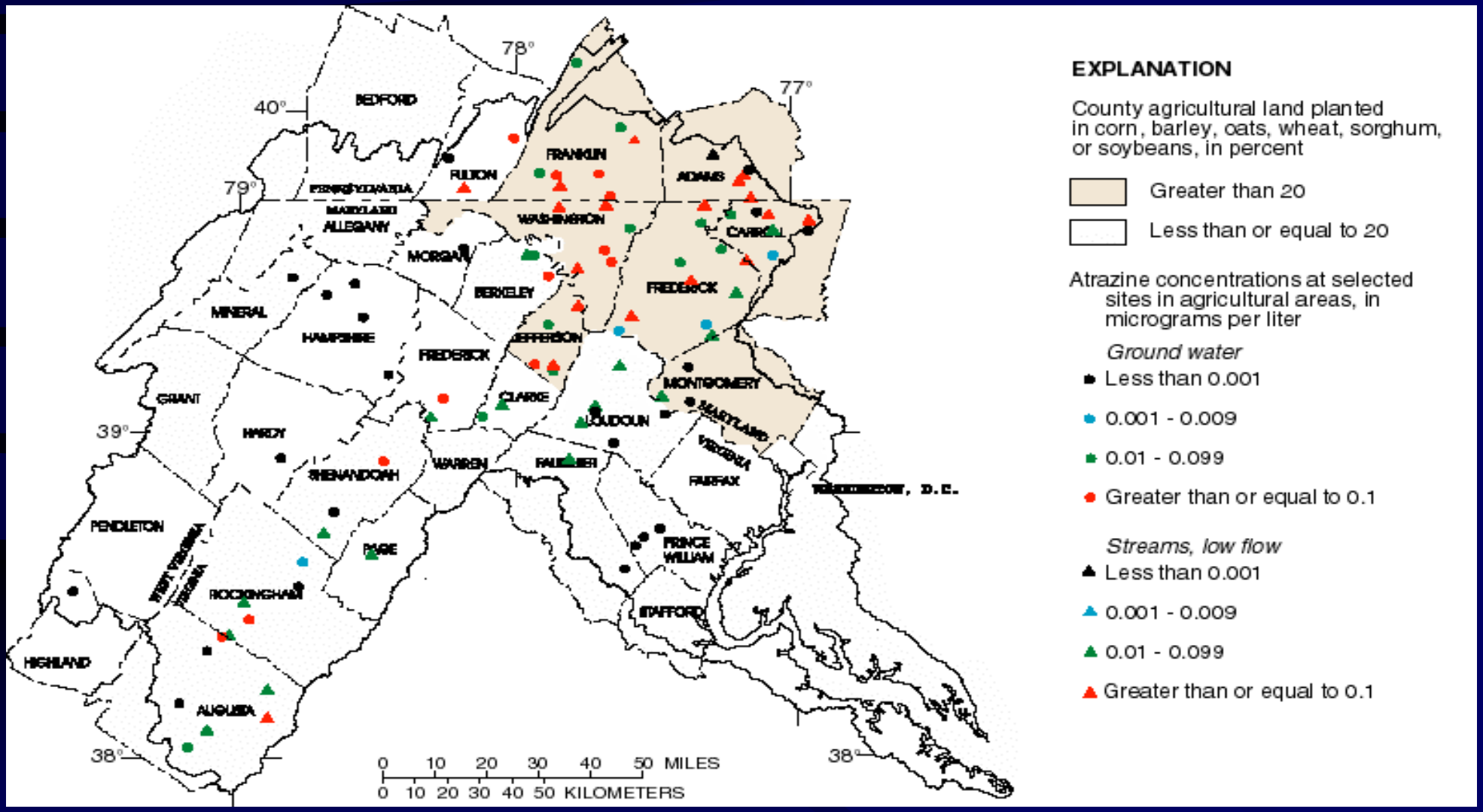
Potomac River NAWQA Pesticides

- In areas where pesticides occur, mixtures are common
- Metabolites of major-use pesticides occur with same frequency as parent compounds and in higher concentrations – sometimes by order-of-magnitude.
- Some historically used chemicals persist – DDT, Chlordane, Diazinon, PCBs
- Concentrations are usually <1 and even often <0.1 µg/L
- During periods of applications that coincide with storm events, concentrations and loads increase

Pesticide occurrence, 1993-95



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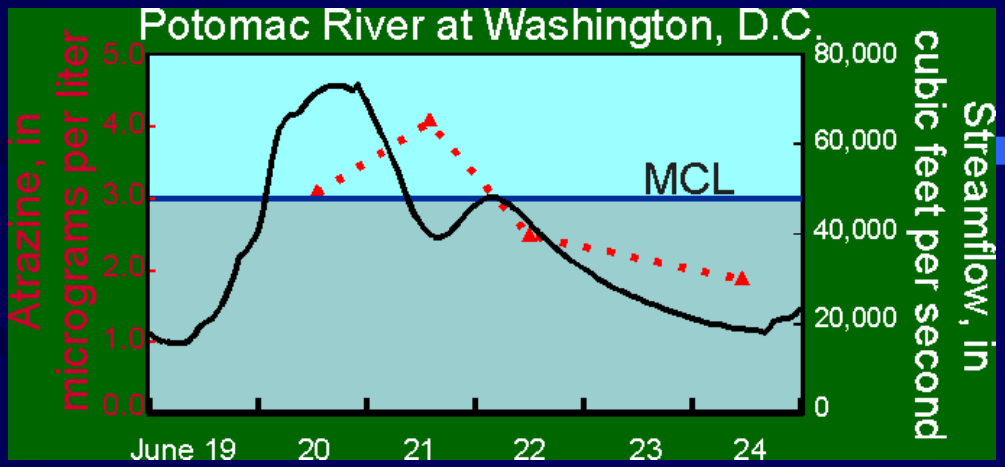
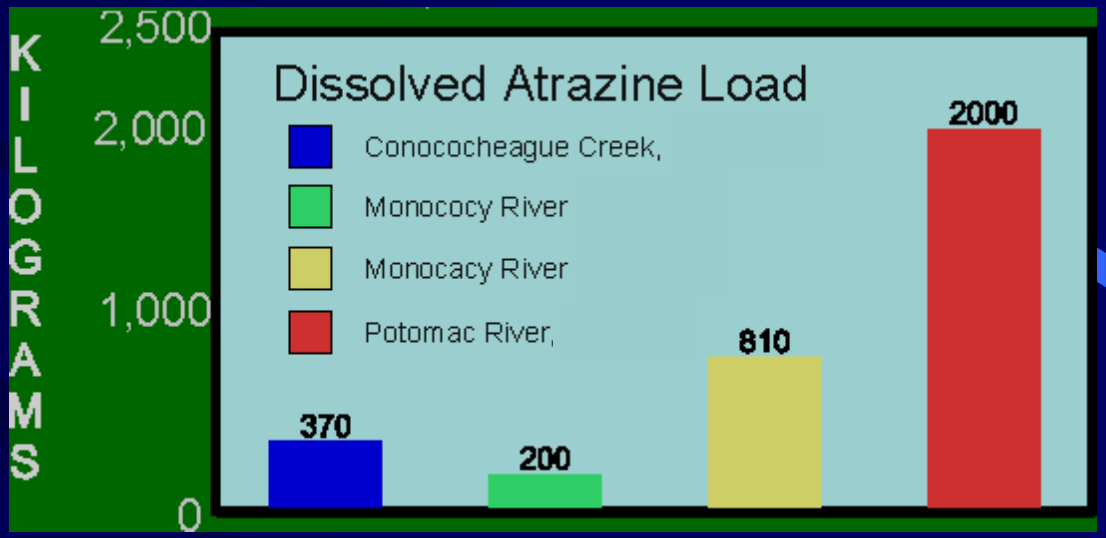
Pesticides in Storm Flow

- Highest concentrations occur during post-application runoff events
- Large runoff event in June 1996
- Monocacy River experienced a local 200-year flood event
- Storm Loads were highest we recorded at these sites.





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Pesticide Metabolites

- Transport of acetanilide and triazine herbicides often occur primarily in the form of metabolites.
- Estimates based solely on parent concentrations likely substantially under-represent total loads and ecosystem exposures.

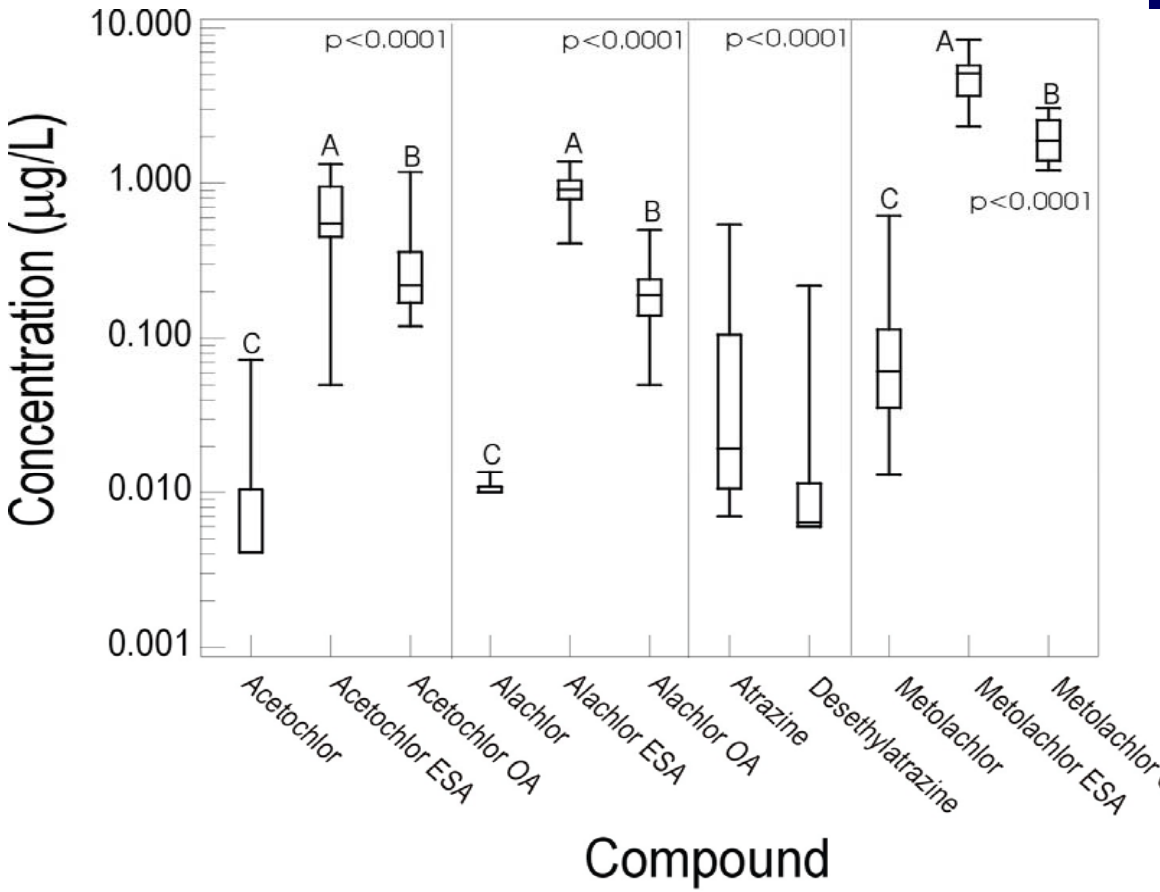
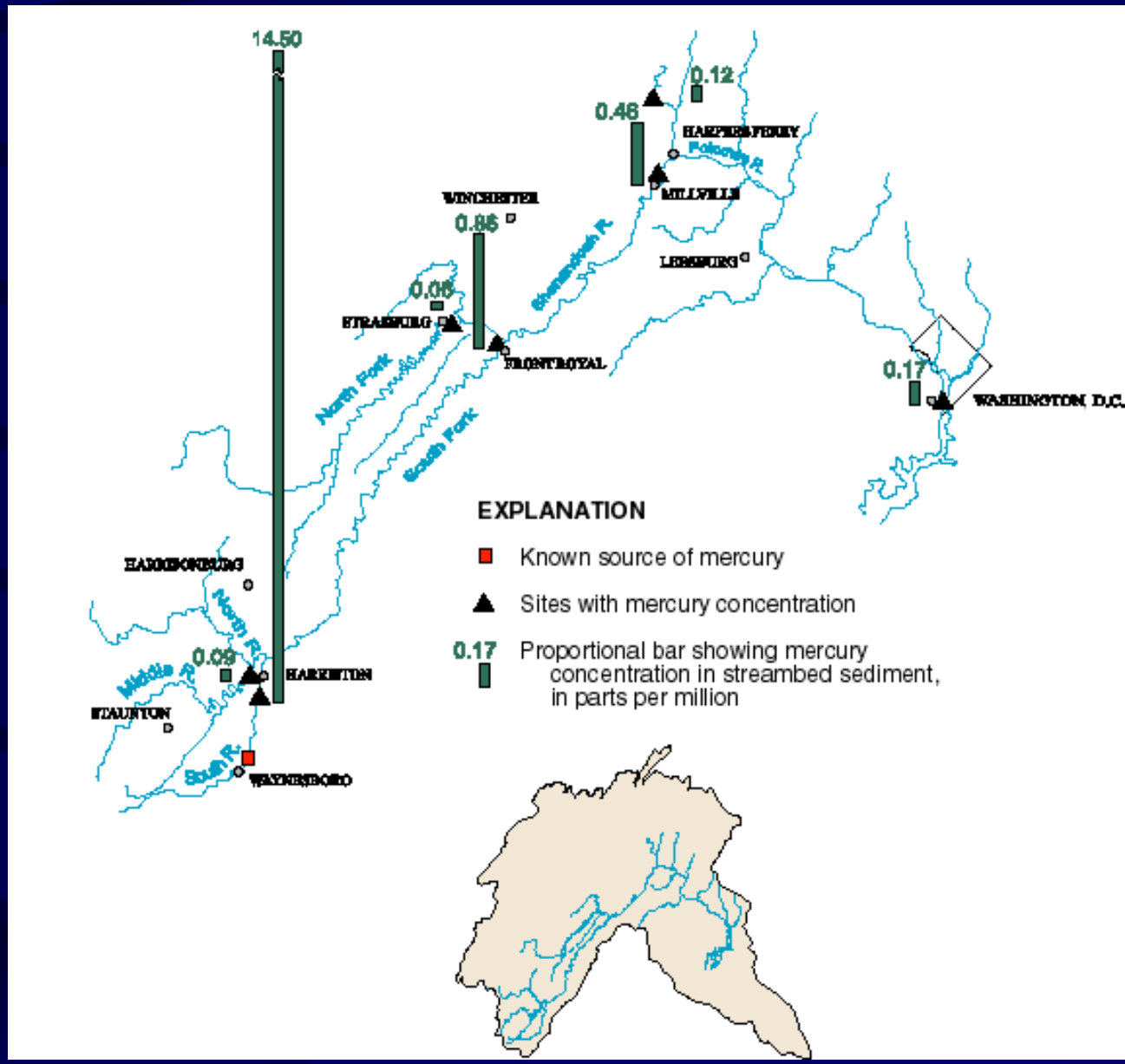


Figure 8. Concentrations of selected pesticides and metabol
in the Upper Pocomoke River.

Mercury in Streambed Sediment (1992)

- Highest concentrations found at Waynesboro, VA (14.5 mg/kg)
- Attributed to long-term industrial sources on the South Fork
- Concentrations decrease downstream



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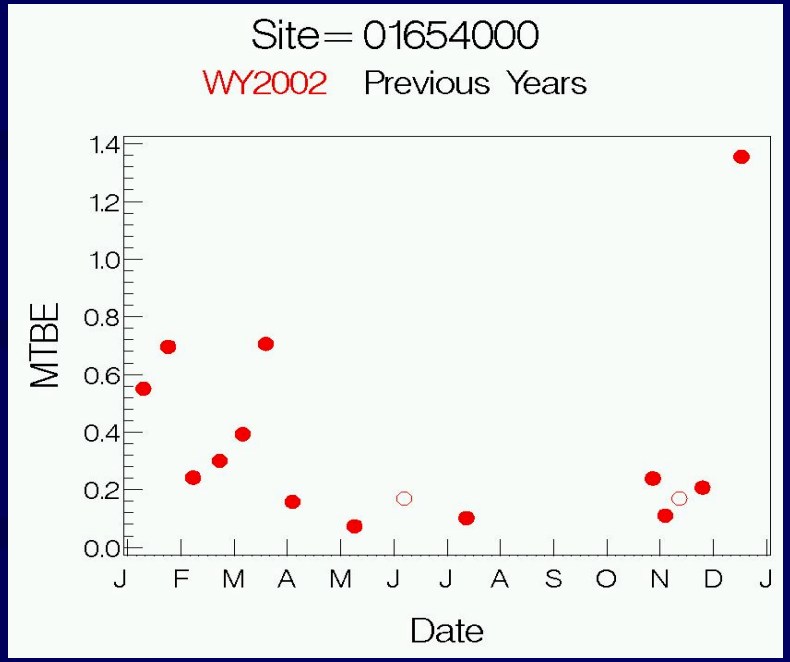
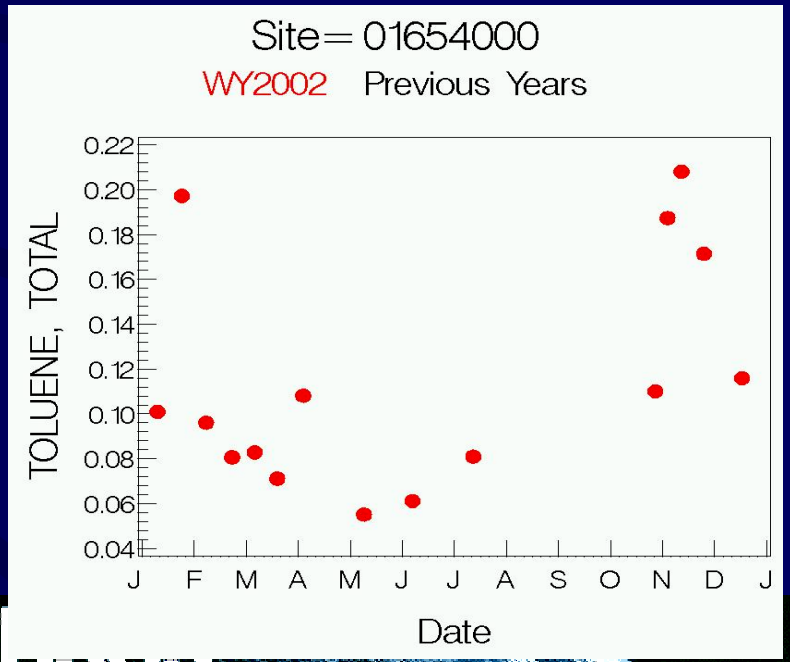
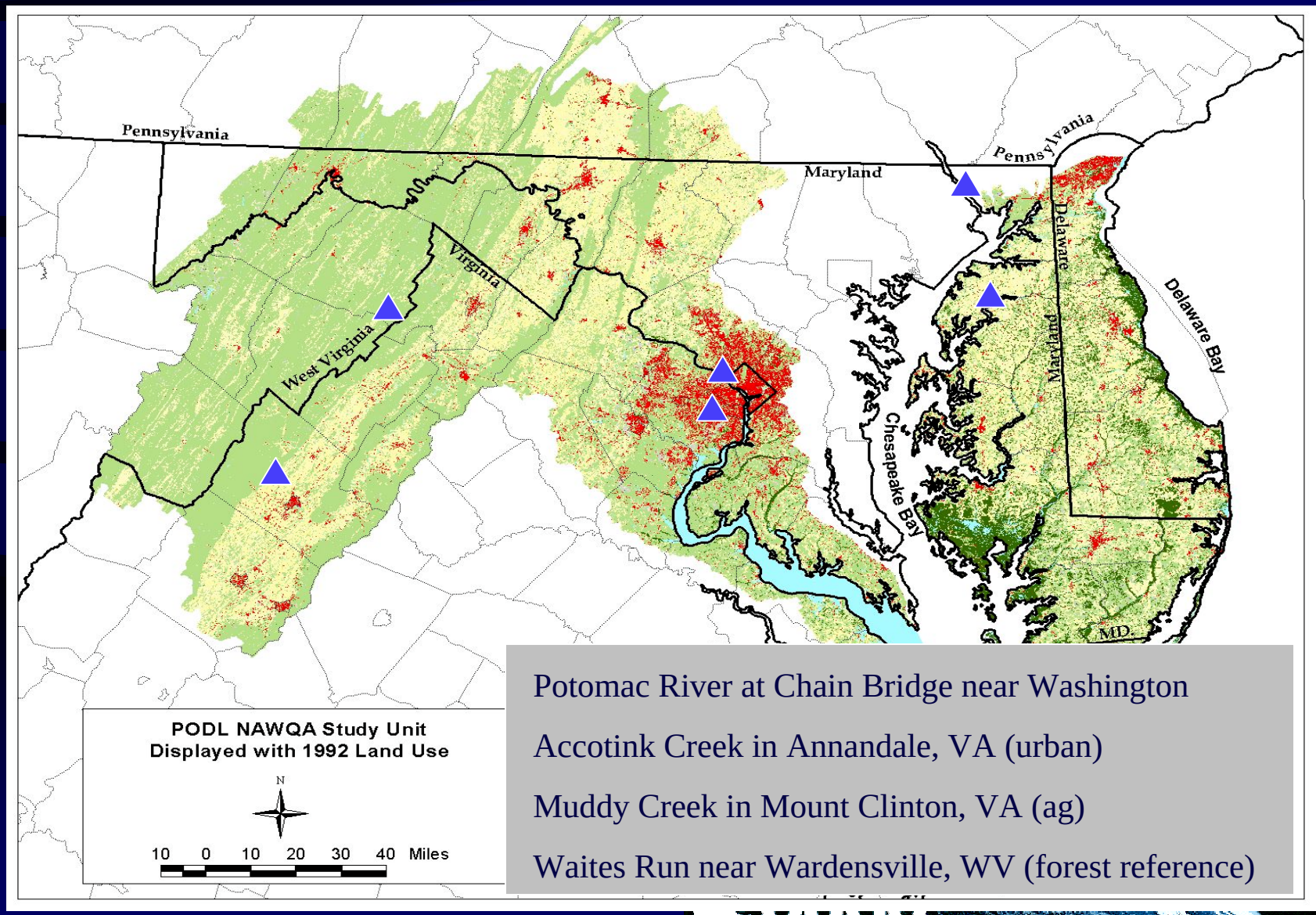
VOCs in Accotink Creek

- At least 14 different compounds were found
- Occur throughout the year in Accotink Creek
- Concentrations generally highest during periods of cooler weather





Potomac NAWQA Trends Sites - SW



Potomac River at Chain Bridge near Washington

Accotink Creek in Annandale, VA (urban)

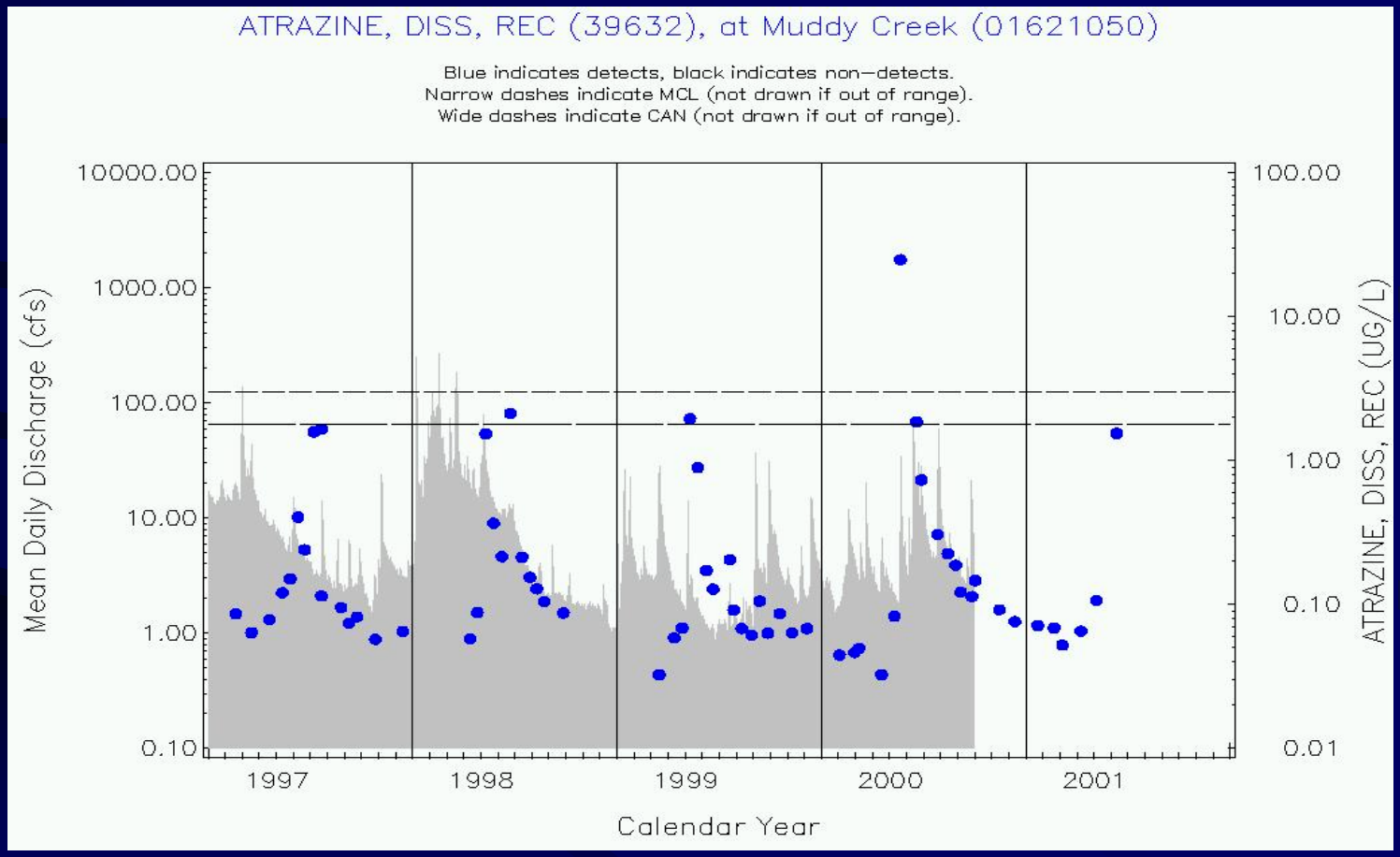
Muddy Creek in Mount Clinton, VA (ag)

Waites Run near Wardensville, WV (forest reference)

Pesticides, 1997-2001

- Seasonal trend in atrazine concentrations

Muddy Creek



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National Water Quality Assessment Program

NAWQA National Homepage

http://water.usgs.gov/nawqa/nawqa_home.html

Potomac NAWQA Homepage

http://md.water.usgs.gov/nawqa/podl/podlhome.htm

Summary Reports

Circular 1166 -- Water quality in the Potomac River Basin, Maryland, Pennsylvania, Virginia, West Virginia, and the District of Columbia, 1992-96 at http://water.usgs.gov/pubs/circ1166/

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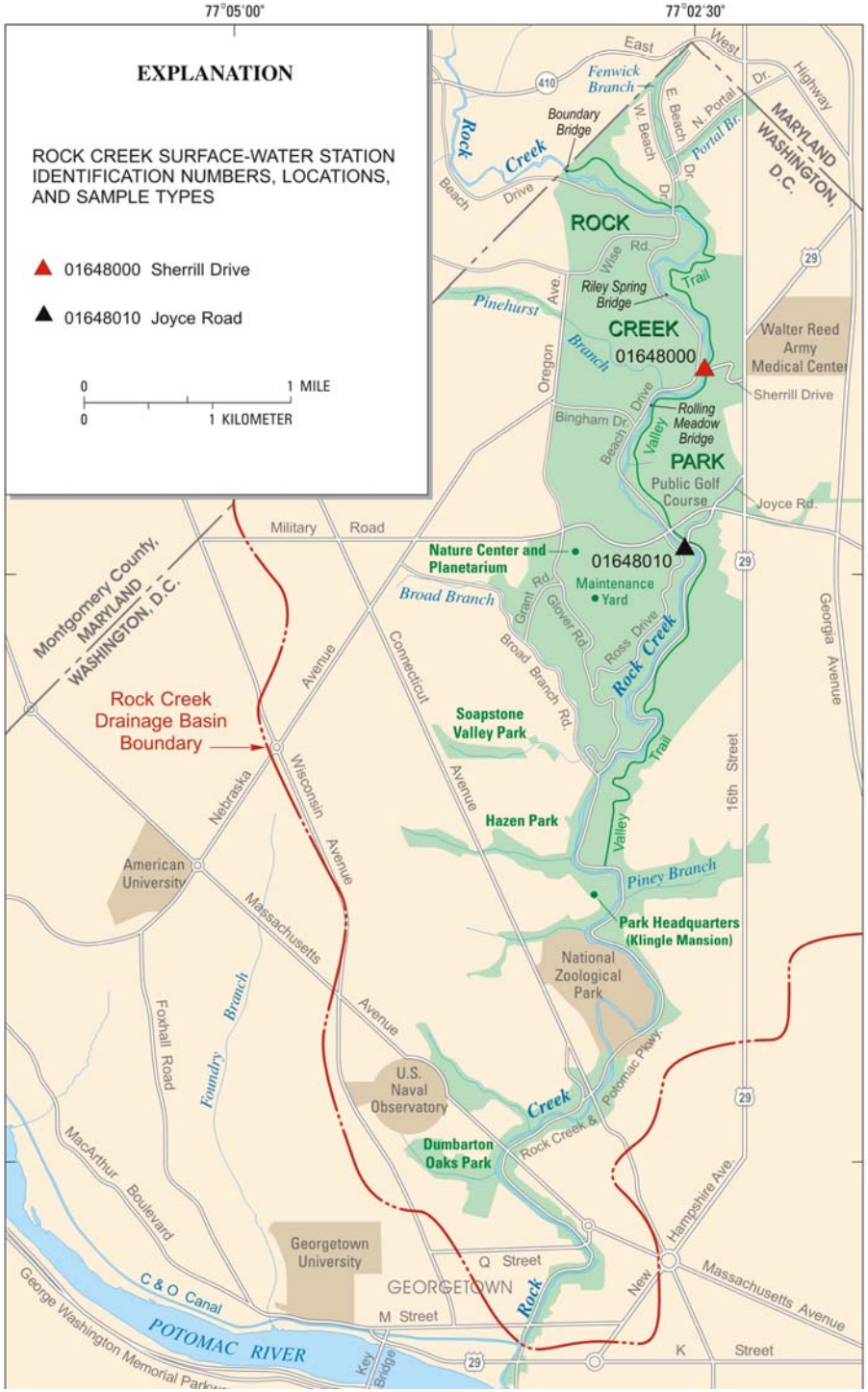

Rock Creek Park USGS and NPS

- 1999-2000 – Water and sediment quality survey
  - Spatial sampling
  - Temporal sampling

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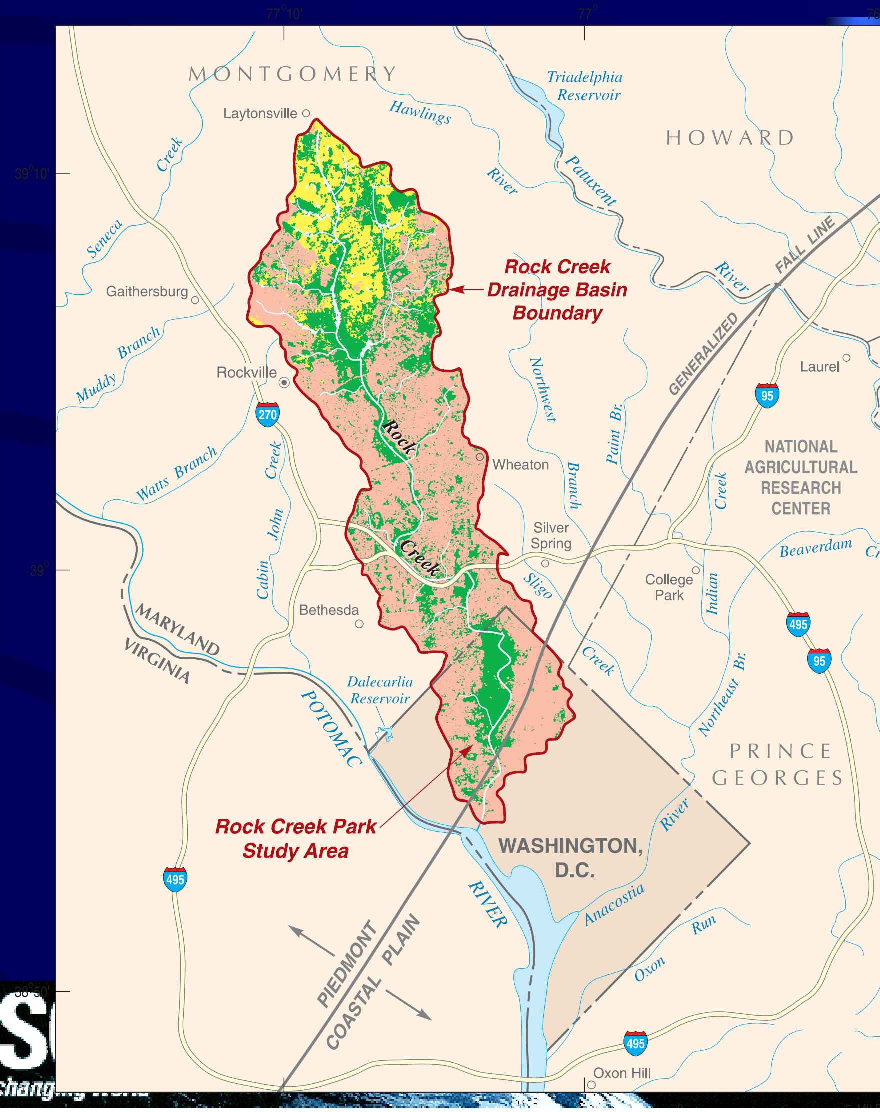
Rock Creek Park

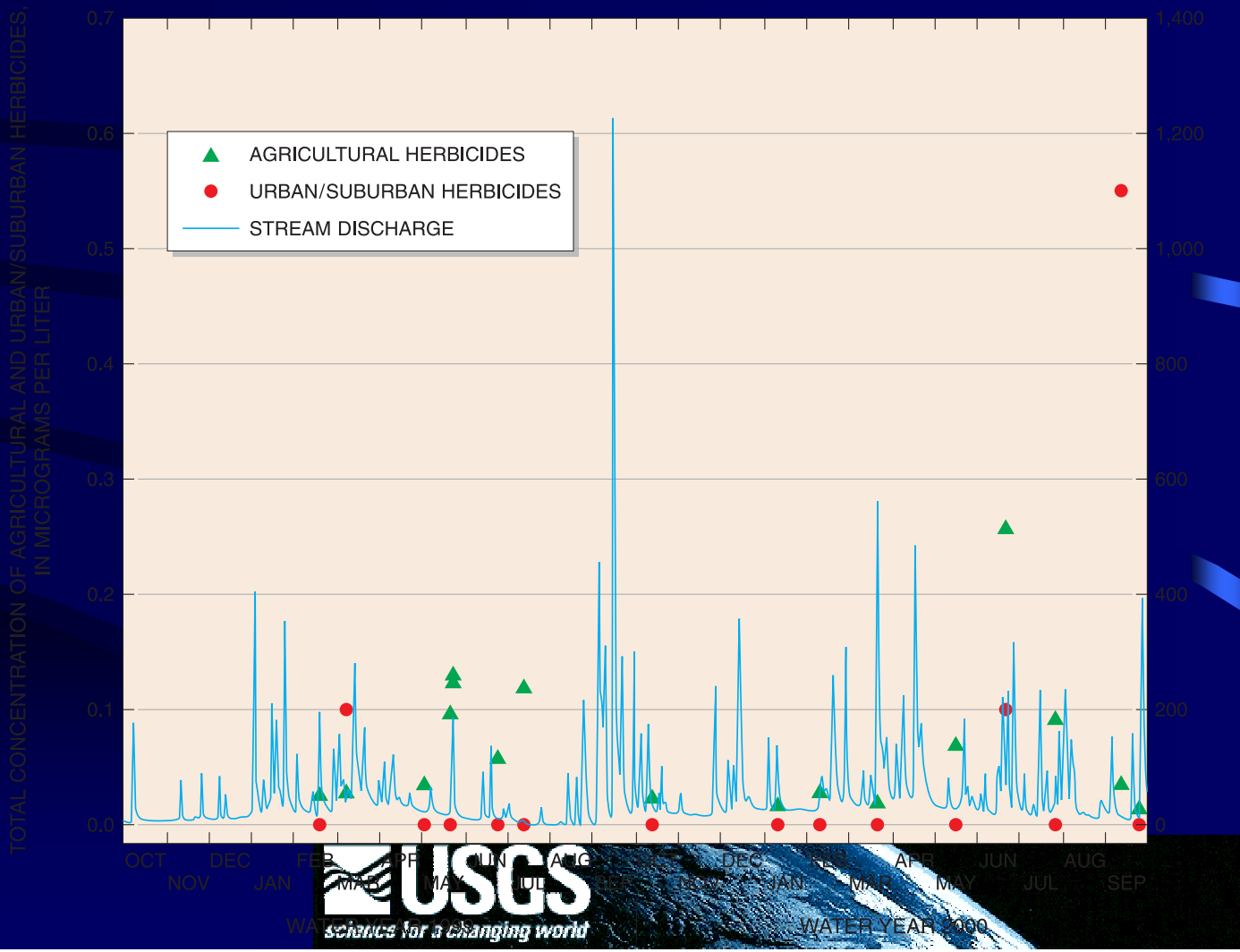
Cherie Miller, Holly Weyers, and Vicki Blazer

- Low-level concentrations of some herbicides and insecticides
- Most evidence of contamination was in the sediments
  - Hydrophobic compounds
  - PAHs, Phthalate esters, OC Pesticides, PCBs, Metals



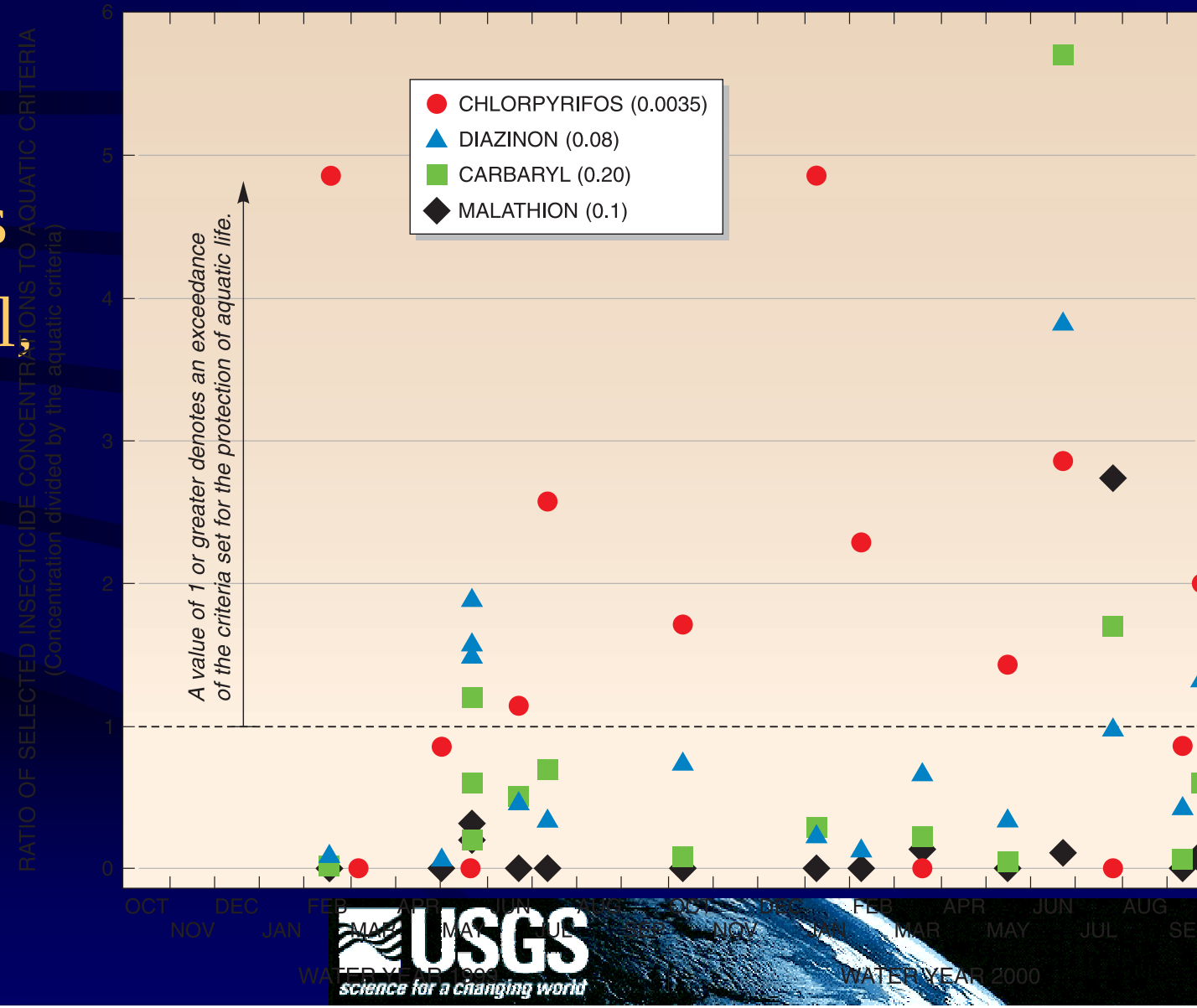
Common-Use Herbicides in Surface Water at Rock Creek

- Ag ▲
  - atrazine, cyanazine, and metolachlor
  - Seasonal usage
- Urban ●
  - 2,4-D and MCPA
  - Usage more uniform



Insecticides Exceeding Aquatic Guidelines in Rock Creek

- All are used for Ag and residences
- Diazinon, carbaryl, and malathion are somewhat seasonal
- Chlorpyrifos is more uniform



Rock Creek Park

- 2003-2004 – Fish Health Study
- White Sucker *Catostomus commersoni*
- Histopathology showed minimal tissue disorders
- Possibly stress on spawning populations
- Low-levels of contamination observed.

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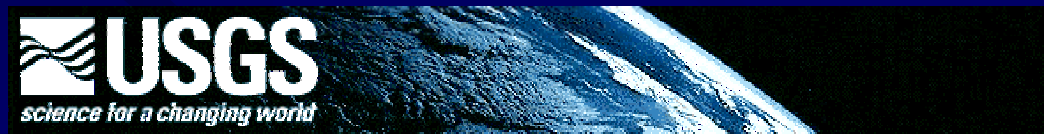
Reconnaissance for Organic Wastewater Compounds - 2002

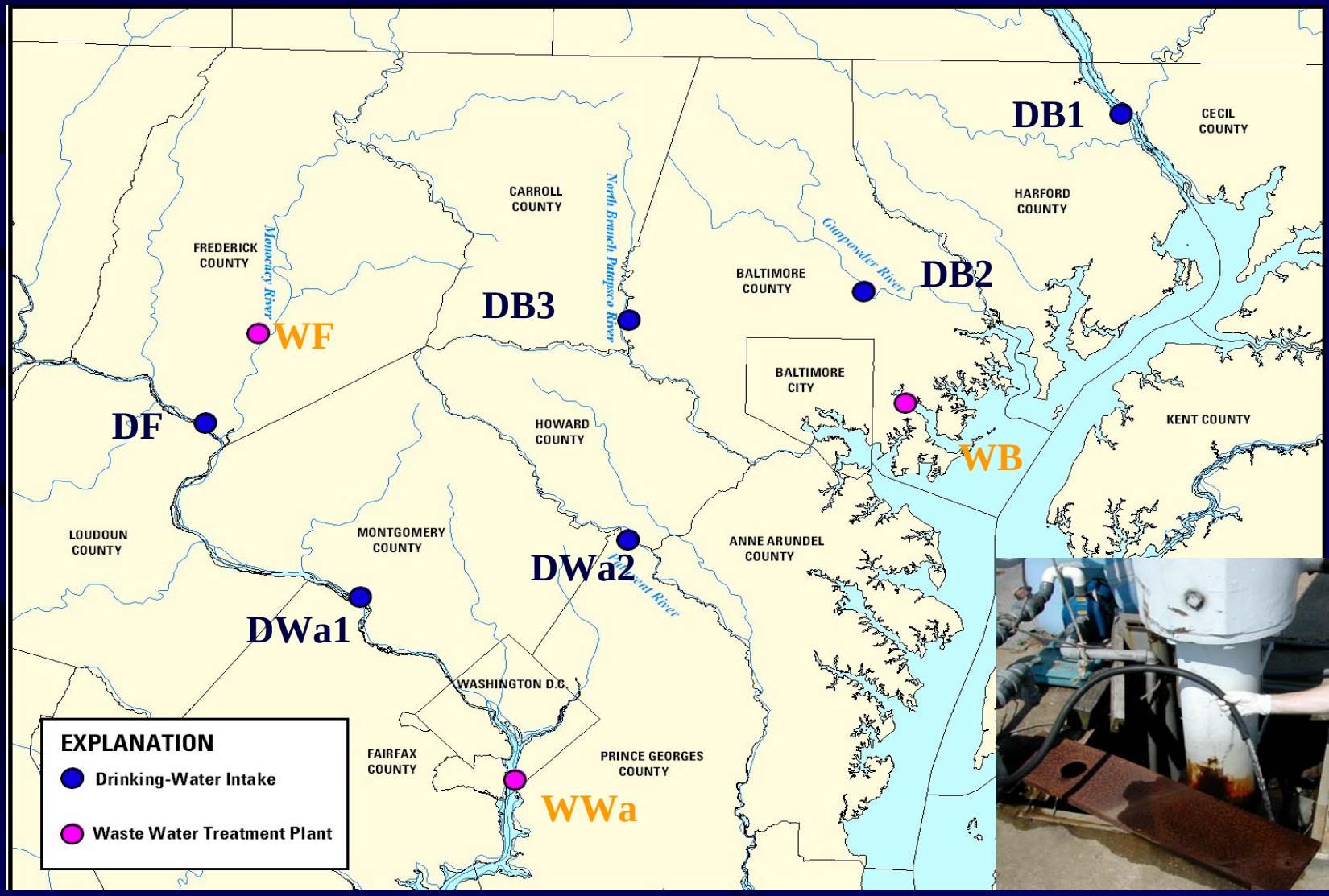
USGS and NASA

Ingrid Verstraeten and Jon Evans

- Waste-Water Treatment Plant Outfalls
  - Washington DC – Blue Plains
  - Frederick Co. – Ballenger Outfall
- Drinking-water intakes
  - Potomac, MD - Below Watts Branch
  - Tuscarora, MD



Sampling Locations



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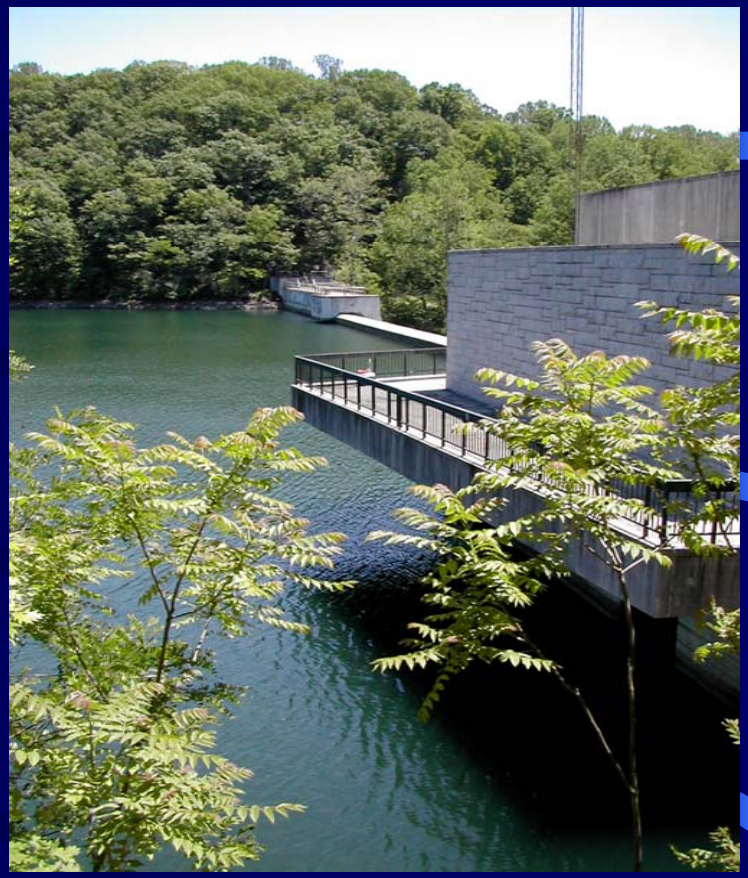
Herbicides and Metabolites

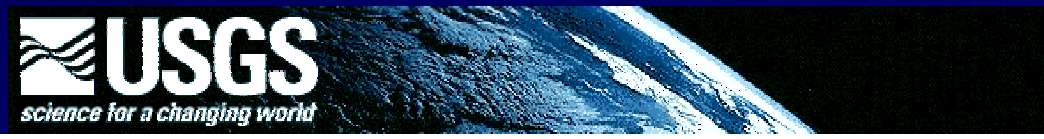
- WWTPs
  - 5 of 33 compounds found
  - .07 to .39 μg/L
  - Atrazine, deethylatrazine, simazine, alachlor ESA, metolachlor ESA
- Drinking-water intakes
  - 8 of 33 compounds found
  - Slightly higher levels .11 to 1.9 μg/L
  - Atrazine, deethylatrazine, deisopropylatrazine, simazine, alachlor ESA, metolachlor, metolachlor ESA, metolachlor OA



Loch Raven intake

Organic Waste-Water Compounds

- WWTPs
  - –Detected 34 of 69 compounds
  - –.02 to 6.5 µg/L
- Drinking-water intakes
  - –Detected 13 of 69 compounds
  - –.02 to 6.9 µg/L



OWCs Detected

- Naphtalene — PAH
- Benzo(a)pyrene — PAH
- Benzophenone — fixative for parfumes
- Bisphenol A — plasticizer
- HHCB — fragrance, musk
- Nonylphenols — surfactant
- Tri-(2-chloroethyl)phosphate — plasticizer, flame retardant
- Tri-(2-chloroisopropyl)phosphate — flame retardant additive
- Triclosan — antimicrobial disinfectant
- Tryethylcitrate — cosmetics, pharmaceuticals
- Tris2-Butoxyethylphosphate —flame retardant

OWCs Detected (cont.)

- Tetrachloroethylene — solvent, degreaser, veterinary
- Dichlorobenzene — moth repellent, fumigant, deodorant
- Diazinon — insecticide
- Cotinine — nicotine metabolite
- DEET — insect repellent
- *para*-Cresol — wood preservative
- Cholesterol — animal steroid
- Caffeine — stimulant
- *Para*-Nonylphenol — nonionic detergent metabolite

Prescription and Nonprescription Drugs

- WWTPs
  - Detected 14 of 36 compounds
  - .02 to .21 µg/L
- Drinking-water intakes
  - Detected 6 of 36 compounds
  - .001 to .006 µg/L

Back River WWTP

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Pharmaceuticals Detected

- Diphenhydramine — antihistamine
- Dehydronifedipine — cholesterol lowering drug
- Cotinine — nicotine metabolite
- Carbamazepine — antiepileptic drug
- Cimetidine — antacid
- Ranitidine — antacid
- Codeine — analgesic
- Caffeine — stimulant
- Acetominophen — antipyretic

Pharmaceuticals Detected (cont.)

- Diltiazem — antianginal, antiarrhythmic
- Ranitidine — acid reducer
- Salbutamol — bronchiodilator
- Thiabendazole — anthelmintic pesticide
- Azithormycin — antibiotic
- Trimethoprin — antibiotic
- Sulfamethoxazole — antibiotic
- Tetracycline — antibiotic
- Cyprofloxacin — antibiotic
- Erythromycin — antibiotic

Frederick County Intake

NASA

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Source Water Quality Assessment Program
List of Analytes 2004-05
Linda Debrewer

- Pesticides and metabolites
- Volatile organic compounds
- Wastewater compounds
- Gasoline oxygenates

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Source Water Quality Assessment Program

- Raw samples collected at intake on Potomac River
- Finished samples collected at Dalecarlia Drinking Water Plant
- 2-day “residence time” from raw to finished drinking water

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Source Water Quality Assessment Program

- Sampling April 2003 – June 2005
- Monthly Fixed-interval sampling
- Targeted sampling events in FY2005
- In progress

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