U.S. Department of the Interior
U.S. Geological Survey

Water Quality Assessment of the Trinity River Basin, Texas—Pesticides in a Suburban Watershed, Arlington, 1993–94

NAWQA
Fact Sheet

The Trinity River Basin was among the first 20 hydrologic systems under full inplementation of the National Water Quality Assessment (NAWQA) Program. Planning and analysis of existing information began in 1991. Intensive water-quality data collection began in 1993. As a part of the NAWQA Program, pesticide samples were taken from surface water, ground water, streambed sediment, and aquatic-organism tissue in the Rush Creek watershed in Arlington, Texas, during 1993–94.

Watershed Description

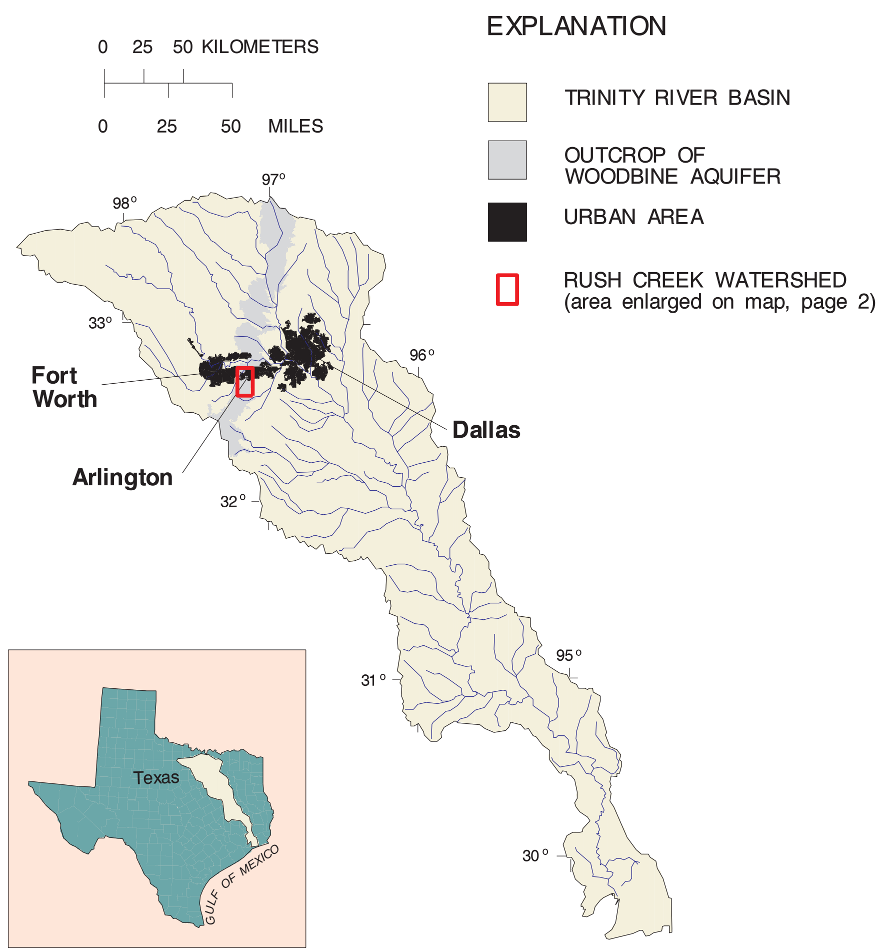
Rush Creek drains an area of approximately 91 square kilometers. Land-use information provided by the North Central Texas Council of Governments (NCTCOG) for 1990 indicates that approximately 66 percent of the watershed is urban and 34 percent is vacant (K. Kennedy, NCTOG, written commun., 1993). Older land-use data for the Trinity River Basin for the period 1973–77 (Ulery and others, 1993) indicates 37 percent of the watershed was urban, 51 percent was agriculture, and 10 percent was either range, forest, or barren. Based on the 1990 census, about 33 percent of the watershed is “new” urban (Hitt, 1994)—that is, about one-third of the watershed had a population density in 1990 indicative of urban area (residential land use) but was classified as something other than urban in the 1973–77 data. The major fraction (79 percent) of this “new” urban area had been classified as agriculture for 1973–77.

Pesticide Sampling

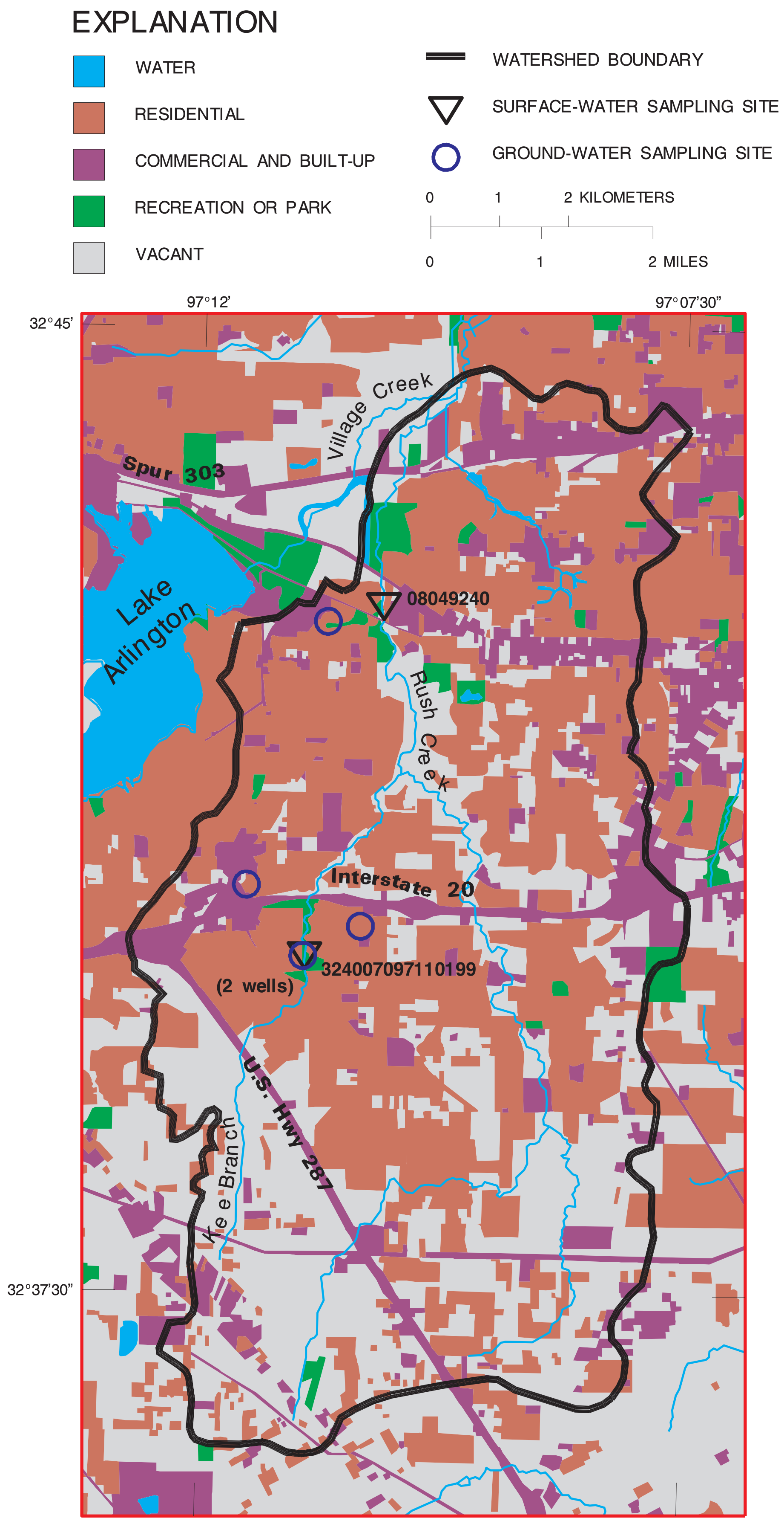
During 1993–94, pesticide samples were taken from surface water, ground water, bed sediment, and aquatic-organism tissue in the Rush Creek watershed. Twenty-three surface-water samples were collected at the streamflow-gaging station on Rush Creek at Woodland Park Boulevard (08049240). This site was sampled monthly and during several storm events from March 1993 through May 1994. One additional surface-water sample was collected at a site on Kee Branch (324007097110199), a tributary to Rush Creek, during January 1994. These samples were analyzed for more than 80 pesticides.

In August and September 1993, ground-water samples were collected at five wells in the watershed as a part of a study of the Woodbine aquifer, which outcrops in the area. Four wells are less than 12 meters deep and were constructed for the NAWQA study. Two of these monitoring wells were completed at different depths at the same site. The fifth well is a 30-meter-deep landscape-irrigation well. The ground-water samples were analyzed for the same group of pesticides as the surface-water samples.

Samples of bed sediment and aquatic-organism tissue were collected during May 1993 at the Rush Creek streamflow-gaging station. This sampling is part of a study of the occurrence and distribution of organic contaminants and trace elements in bed sediment and tissue at 16



Location of Trinity River Basin, Texas.



Land use and sampling sites in the Rush Creek watershed.
(1990 land-use information provided by North Central Texas Council of Governments.)

sites in the Trinity River Basin. Bed-sediment samples and tissue of Asian clam (*Corbicula fluminea*) were analyzed for about 25 organochlorine insecticide compounds. These insecticides have little current use, but they are persistent in the environment and tend to accumulate in sediment and in the tissues of aquatic organisms.

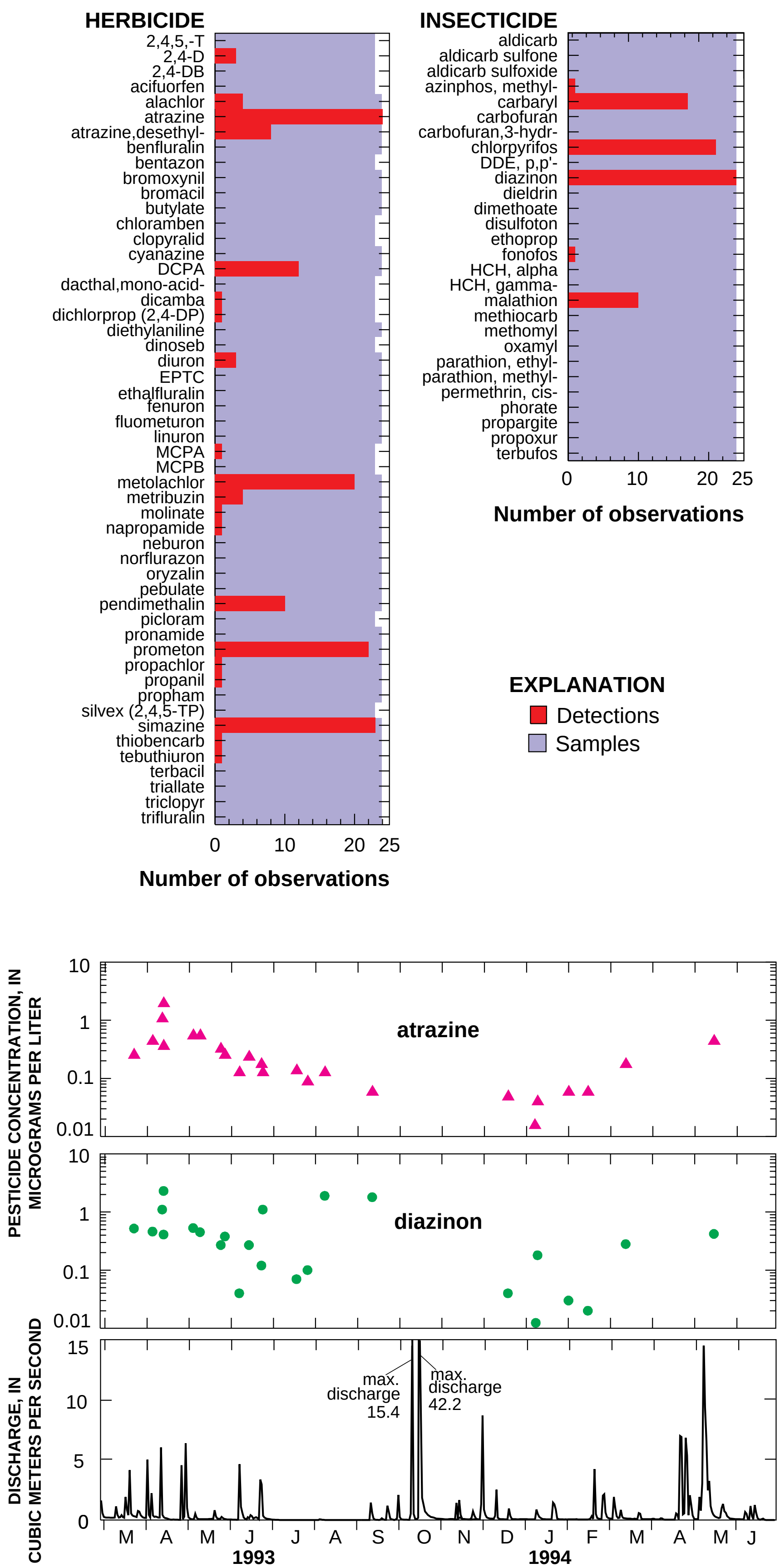
For a pesticide analysis in tissue, a sample of at least 50 individual clams and a weight of 50 grams are required. Three samples meeting these requirements were collected on May 11, 1993.

Pesticide Results

The laboratory methods for pesticides in water have minimum detection levels near 0.01 microgram per liter (µg/L). Twenty-six different pesticides were detected in one or more surface-water samples. The herbicides atrazine, metolachlor, prometon, and simazine and the insecticides carbaryl, chlorpyrifos, and diazinon were detected in more than one-half of the samples.

Atrazine and diazinon were detected in 100 percent of the 24 samples. The concentrations of these two pesticides were highest during the spring, with a maximum atrazine concentration of 2.0 µg/L and a maximum diazinon concentration of 2.3 µg/L during April 1993. Diazinon concentrations were near 2 µg/L in samples collected during August and September as well.

Median and maximum concentrations for the compounds detected in at least one-half of the samples and U.S. Environmental Protection Agency (USEPA) standards are shown on the last page. The maximum contaminant level (MCL) is the USEPA standard for the maximum permissible level of a contaminant in water that is delivered to any user of a public water system. The health advisory (HA) is a nonregulatory level of contaminants in drinking water that may be used for guidance in the



Pesticides in surface water.

absence of regulatory limits. The HA listed in the table (p. 4) is a lifetime health advisory established for the part of an individual's exposure that is attributed to drinking water and protects against noncarcinogenic adverse health effects over a lifetime (70 years). It is based on a body weight of 70 kilograms and consumption of 2 liters per day of drinking water (Nowell and Resek, 1994).

None of the pesticides were detected in ground-water samples from the five wells in the watershed.

No organochlorine insecticides were detected in two bed-sediment samples from Rush Creek. Minimum detection levels for organochlorine insecticides varied by compound from 0.01 to 1.0 microgram per kilogram (µg/kg).

Four different organochlorine-insecticide compounds were detected in one or more of three clam-tissue samples from the creek. All four of the detected compounds are components of the insecticide chlordane. Minimum detection levels for the tissue analyses were near 5 µg/kg. The maximum concentration of a single chlordane component was 14 µg/kg for *cis*-chlordane, and the maximum total chlordane concentration for one sample was 40.7 µg/kg.

The Food and Drug Administration (FDA) action level, the level at which contaminated food can be removed from the market, is 300 µg/kg for the sum of chlordane components (Nowell and Resek, 1994). The USEPA fish (or shellfish) concentration value for chlordane components is 8.3 µg/kg (Nowell and Resek, 1994). This USEPA value is designed to protect a 70-kilogram adult from exposure associated with daily ingestion of 6.5 grams of fish or shellfish for a lifetime of 70 years. The value is associated with a cancer risk of 1 in 1,000,000. In addition, the National Academy of Science level for the protection of birds and mammals feeding on fish or shellfish is 100 µg/kg for

Pesticide concentrations in surface water and standards
[µg/L, micrograms per liter; USEPA, U.S. Environmental Protection Agency; MCL, maximum contaminant level; HA, health advisory]

Chemical name	Trade name	Median concentration in water (µg/L)	Maximum concentration in water (µg/L)	USEPA MCL (µg/L)	USEPA HA (µg/L)
atrazine	AAtrex	0.26	2.0	3.0	3.0
carbaryl	Sevin	.08	.39	–	700
chlorpyrifos	Dursban	.03	.11	–	20
diazinon	Diazinon	.42	2.3	–	.6
metolachlor	Dual	.03	.18	–	100
prometon	Pramitol	.03	.09	–	100
simazine	Princep	.16	.39	4.0	4.0

chlordane components (Nowell and Resek, 1994).

Summary

- 26 pesticides were detected in 1 or more of 24 surface-water samples. Atrazine and diazinon were detected in 100 percent of these samples.
- No pesticides were detected in five ground-water samples.
- No organochlorine insecticides were detected in two bed-sediment samples.
- Four organochlorine compounds were detected in one or more of three clam samples. All of these compounds are components of chlordane.

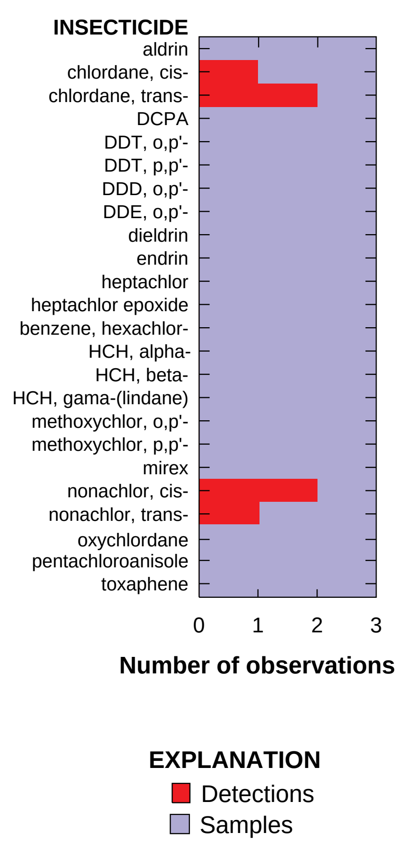
Although pesticides frequently were detected in surface water, most concentrations were below drinking-water standards set by USEPA. Chlordane concentrations in tissues of aquatic organisms were well below FDA action levels, and according to USEPA standards, might be of a cancer concern for individuals eating a steady diet of those organisms.

References

Hitt, Kerie, 1994, Refining 1970's land-use data with 1990 population data to indicate new residential development: U.S. Geological Survey Water-Resources Investigations Report 94-4250, 15 p.

Nowell, L.H. and Resek, E.A., 1994, Standards for pesticides in water, *in* Ware, G.W., ed., Reviews of environmental contamination and toxicology, v. 140: New York, Springer-Verlag, 221 p.

Ulery, R.L., Van Metre, P.C., and Crossfield, A.S., 1993, Trinity River Basin, Texas: Water Resources Bulletin, v. 29, no. 4, p. 685–711.



Pesticides in tissues.

— *Mariann F. Brown*

Any use of trade, product, or firm names is for descriptive purposes only and does not imply endorsement by the U.S. Government.

In 1991, the U.S. Geological Survey, U.S. Department of the Interior, began a National Water-Quality Assessment (NAWQA) Program. The long-term goals of the NAWQA Program are to describe the status of and trends in the quality of a large representative part of the Nation's surface- and ground-water resources and to identify the major factors that affect the quality of these resources. In addressing these goals, the NAWQA Program will produce water-quality information that is useful to policymakers and managers at Federal, State, and local levels.

Studies of 60 hydrologic systems that include parts of most major river basins and aquifer systems are the building blocks of the national assessment. The 60 study units range in size from less than 1,000 to more than 60,000 square miles and represent 60 to 70 percent of the Nation's water use and population served by public water supplies. Twenty investigations began in 1991, 15 investigations began in 1994, and 20 are scheduled to begin in 1997.

Information on technical reports and hydrologic data related to the NAWQA Program can be obtained from:

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