SURFACE-WATER-QUALITY ASSESSMENT OF THE YAKIMA RIVER BASIN IN WASHINGTON: MAJOR- AND MINOR-ELEMENT DATA FOR SEDIMENT, WATER, AND AQUATIC BIOTA, 1987-91

U.S. GEOLOGICAL SURVEY
Open-File Report 94-308

NATIONAL WATER - QUALITY ASSESSMENT PROGRAM

Surface-Water-Quality Assessment of the Yakima River Basin in Washington: Major- and Minor-Element Data for Sediment, Water, and Aquatic Biota, 1987-91

By Gregory J. Fuhrer, Shelley L. Fluter, Stuart W. McKenzie, Joseph F. Rinella, J. Kent Crawford, Daniel J. Cain, Michelle I. Hornberger, Jennifer L. Bridges, *and* Kenneth A. Skach

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CONVERSION FACTORS

[SI = International System of units, a modernized metric system of measurement]

Factors for converting SI metric units to inch/pound units

Multiply	By	To obtain
	LENGTH	
micrometer (µm)	0.00003937	inch (in)
millimeter (mm)	0.03937	inch
centimeter (cm)	0.3937	inch
meter (m)	3.281	foot (ft)
	VOLUME	
microliter (µL)	0.000001057	quart (qt)
milliliter (mL)	0.001057	quart
liter (L)	1.057	quart
liter	0.2642	gallon (gal)
	MASS	
microgram (µg)	0.00000003527	ounce (oz avoirdupois)
milligram (mg)	0.00003527	ounce
gram (g)	0.03527	ounce
	DENSITY	
grams per cubic centimeter (g/cm^3)	0.5780	ounces per cubic inch (oz/in^3)
	TEMPERATURE	
degree Celsius ($^{\circ}C$)	1/	degree Fahrenheit ($^{\circ}F$)
	CONCENTRATION, IN WATER	
micrograms per liter (µg/L)	1	parts per billion (ppb)
milligrams per liter (mg/L)	1	parts per million (ppm)
	CONCENTRATION, IN SEDIMENT AND TISSUE	
micrograms per gram (µg/g)	1	parts per million

1/ Temperature $^{\circ}F = 1.8$ (Temperature $^{\circ}C$) + 32

Surface-Water-Quality Assessment of the Yakima River Basin in Washington: Major- and Minor-Element Data for Sediment, Water, and Aquatic Biota, 1987–91

By Gregory J. Fuhrer, Shelley L. Fluter, Stuart W. McKenzie, Joseph F. Rinella, J. Kent Crawford, Daniel J. Cain, Michelle I. Hornberger, Jennifer L. Bridges, *and* Kenneth A. Skach

Abstract

Major- and minor-element concentrations are presented for streambed and suspended sediment, filtered- and unfiltered-water, and aquatic-biota samples collected during 1987-91 from the Yakima River Basin in south-central Washington. The samples were collected as part of the U.S. Geological Survey's National Water-quality Assessment (NAWQA) program which is designed to provide results that are useful in understanding and managing the Nation's water resources. This report includes the sampling approach, field collection and processing techniques, and methods of chemical analysis, as well as a compilation of chemical data, statistical summaries, and quality-control data. These data may be used by scientists and resource managers to describe (1) spatial distribution of selected major and minor elements in sediment, water, and aquatic biota of the Yakima River Basin; (2) temporal variation for element concentrations in filtered water and in suspended sediment at selected sites; (3) suitability of surface water for preservation of aquatic life and protection of human health; and, (4) major natural and anthropogenic sources of major and minor elements in the Yakima River Basin that affect observed water-quality conditions.

Streambed-sediment samples were collected once from 27 sites in the basin during 1987-91. Suspended-sediment and filtered-water samples were collected monthly and during hydrologic events (including snowmelt and winter rainstorms) at seven sites, and filtered-water samples were collected at least once at an additional 37 sites during synoptic samplings. Unfiltered-water samples were collected at seven sites on a quarterly basis during 1987 only. Samples of aquatic plants were collected once in 1989, and aquatic insects, fish, and clams were collected from 34 sites three times during 1989-90.

INTRODUCTION

One of the most difficult issues facing water managers today is protecting the Nation's water resources while maintaining viable industrial and agricultural activities. Over the last several decades, concern about the water quality of our Nation's waterways has intensified. Federal, State, and local governments, as well as the general public, recognize the detrimental effects of major, and especially minor, elements that enter waterways from point and non-point sources. When present in excessive concentrations, these elements may accumulate to toxic amounts in the tissues of aquatic organisms and pass up the food chain. Thus, contaminants can disrupt the structure of the aquatic-biological community and can pose a risk to consumers near the top of the food chain, including humans.

Background

In 1986, Congress appropriated funds for the U.S. Geological Survey (USGS) to implement a pilot program to test and refine concepts for a

National Water-Quality Assessment (NAWQA) program (Hirsch and others, 1988). The Yakima River Basin, one of the most intensively irrigated areas in the United States, was one of four surface-water pilot studies selected to refine NAWQA concepts (McKenzie and Rinella, 1987). The Yakima study began with a planning phase in 1986; a data-collection phase from 1987 to 1990; and a report phase in 1991. This report, one of several topical reports for the Yakima NAWQA study, presents data which describes the spatial and temporal distribution of major and minor elements in water, sediment, and aquatic biota.

The full-scale NAWQA program entails the operation of 60 combined surface-water and ground-water study units, covers about 60-70 percent of the Nation's water use, and began operation in 1991 (Leahy and others, 1990). The NAWQA program will provide results that are useful in understanding and managing water resources, as well as addressing national water-quality issues. Specifically, the goals of the NAWQA program are to:

1. Provide a nationally consistent description of current water-quality conditions for a large part of the Nation's water resources;

2. Define long-term trends (or lack of trends) in water quality; and,

3. Identify, describe, and explain, as possible, the major factors affecting observed water-quality conditions and trends.

The program is perennial and involves a cyclic pattern of 3 years of active sampling followed by a period of low-level sampling. This cyclic pattern of sampling is sufficient to define long-term trends in water quality. The water-quality issues addressed in the program are broad, covering topics such as eutrophication, pesticides, major and minor elements, sanitary quality in surface water, suspended sediment, temperature, and aquatic biota.

Purpose and Scope

The purpose of this report is to document the sampling approach, field techniques, and laboratory methods; and to provide a compilation of major- and minor-element data collected during the Yakima NAWQA study. The scope of this report consists of a presentation of the sampling approach, field collection and processing techniques, methods of chemical analysis, and a compilation of sediment, water, and aquatic-biota data—including quality-control data. The data presented may be used by scientists and resource managers to describe the: (1) spatial distribution of selected-major and minor elements in sediment, water, and aquatic biota of the Yakima River Basin; (2) temporal variation of element concentrations in filtered water and in suspended sediment at selected sites; (3) suitability of surface water for preservation of aquatic life and protection of human health; and, (4) major-natural and anthropogenic sources in the Yakima River Basin that affect observed water-quality conditions.

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David W. Zimmer	U.S. Bureau of Reclamation
Don Schram	U.S. Bureau of Reclamation
Richard Albright	U.S. Environmental Protection Agency
Bill Garrigues	U.S. Forest Service
Terry W. Berkompas	U.S. Bureau of Indian Affairs
Kate Benkert	U.S. Fish and Wildlife Service
Wendell Hanigan	Yakima Indian Nation
Jannine Jennings	Yakima Indian Nation
Bob Barwin	Washington State Department of Ecology
Perry Harvester	Washington State Department of Fisheries
Brent Renfrow	Washington State Department of Wildlife
Glen Patrick	Washington State Department of Health
Dr. L. Clint Duncan	Washington Water Research Center, Central Washington State University
Skip Steinmetz	Yakima County Health Department

Ronald L. Van Gundy	Yakima River Basin Association of Irrigation Districts
Ray L. Wondercheck	U.S. Soil Conservation Service
Elaine Taylor	Yakima Valley Conference of Governments
Don Chaplin	County Extension Service
Mike Tobin	North Yakima Conservation District
Richard C. Bain, Jr.	Kittitas County Conservation District

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APPROACH AND METHODS

Major- and minor-element concentrations were determined from several media in the Yakima River Basin (fig. 1). These media include streambed sediment and suspended sediment, filtered and unfiltered water[1], and aquatic biota. Major- and minor-element concentrations in one or more of these media were measured in samples from 57 sites in the Yakima River Basin during 1987-91 (table1) for selected elements (table 2).

Sampling Approach

The most extensively sampled medium was streambed sediment. In 1987, as part of the Yakima NAWQA occurrence and distribution survey, streambed sediment was collected from 448 locations in the basin. These locations represented a variety of sampling sites that covered large and small streams, and included limited samplings of urban-storm drains and agricultural soils. A data report (Ryder and others, 1992) and an interpretative report (Fuhrer and others, 1993) were published from these streambed-sediment data. Many of the sites that had elements measured in suspended sediment, water, and aquatic biota, corresponded to streambed-sediment sites sampled as part of the occurrence and distribution survey in 1987. Additionally, some new streambed-sediment sites were sampled in 1989-91 to complement sites where minor elements were measured in aquatic biota. This report includes streambed-sediment data for 32 sites; 22 of the 32 sites were previously published in Ryder and others (1992) as part of the Yakima NAWQA streambed-sediment occurrence and distribution survey. All of the streambed-sediment sites included in this report correspond to aquatic-biota sites.

The sampling frequency for major and minor elements in filtered water varied for some sites (table 3). Forty-four sites were sampled at least once for filtered- major and minor elements; a majority of these sites were sampled during synoptic surveys in July and (or) November, 1987. Synoptic surveys were made over a short period of time (during steady-state conditions) and provide a broad spatial coverage for occurrence and distribution of element concentrations in filtered water. Seven of the 44 sites also were sampled monthly and during hydrologic events (including snowmelt and winter rainstorms) for the period April 1987 to April 1990. This monthly and event-sampling frequency provided the temporal

[1]The term “filtered water” is an operational definition referring to the chemical analysis of that portion of a water-suspended-sediment sample that passes through a nominal 0.45-µm (micrometer) filter. Conversely, the term “unfiltered water” refers to the chemical analysis of a water sample that has not been filtered or centrifuged, nor in any way altered from the original matrix.

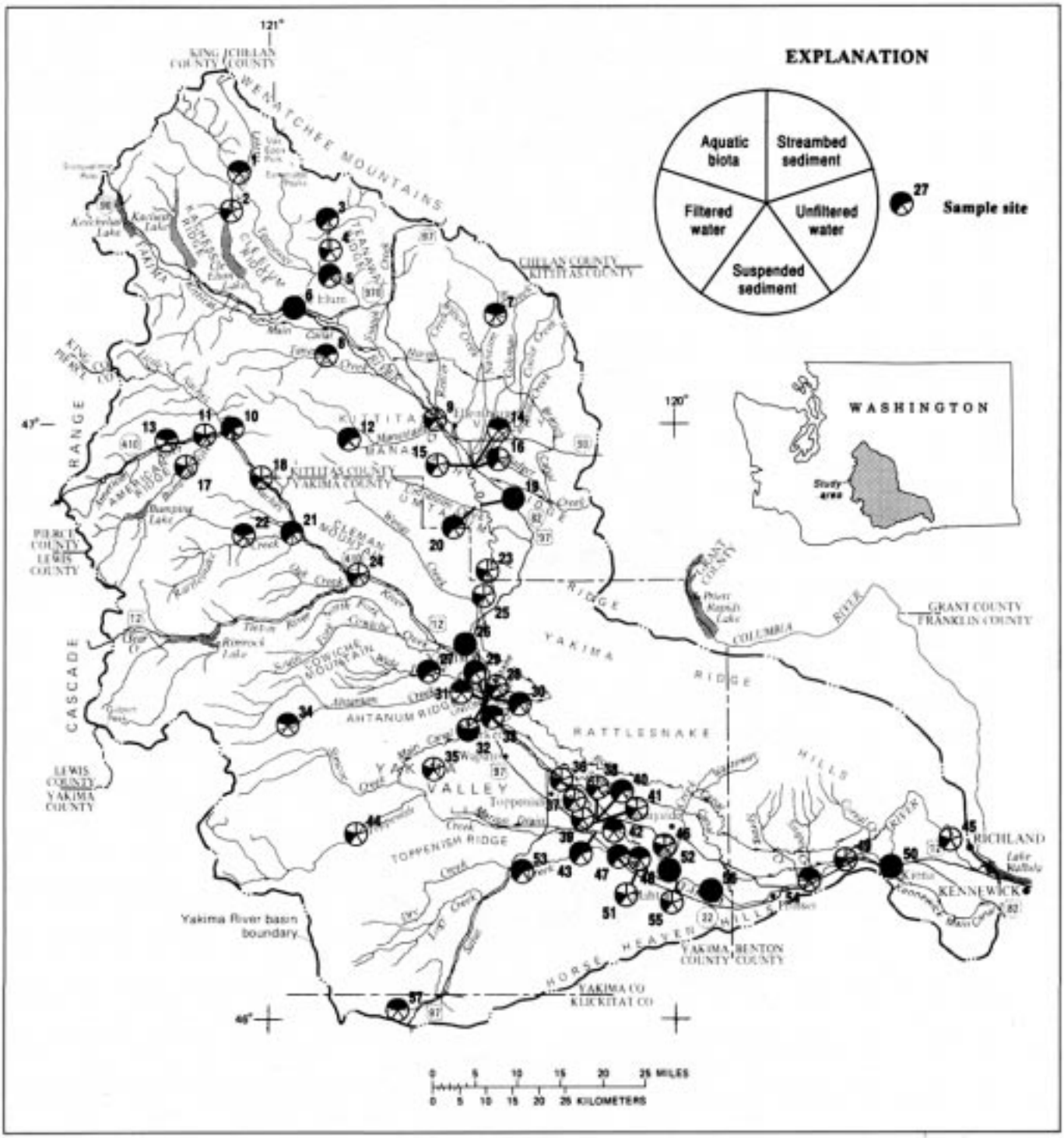

Figure 1. Sampling-site locations for major and minor elements in sediment, water, and aquatic biota, Yakima River Basin, Washington, 1987-91. (Site reference numbers are shown on map and are listed in table 1; shaded areas of individual pie charts correspond to media that were sampled at the site)

Table 1. Sampling-site locations for major and minor elements, Yakima River Basin, Washington, 1987-91

[S = streambed sediment; SS = suspended sediment; T = aquatic-biota tissue; F = filtered water; U = unfiltered water; RM = river mile; STP = sewage treatment plant; and DID = drainage irrigation district; the term "filtered water" is an operational definition referring to the chemical analysis of that portion of a water-suspended-sediment sample that passes through a nominal 0.45-micrometer filter; the term "unfiltered water" refers to the chemical analysis of a water sample that has not been filtered or centrifuged, nor in any way altered from the original matrix]

Site reference number	Site name	Station number [1]	Latitude	Longitude	Media				
					Sediment			Water	
					S	SS	T	F	U
1	Waptus River at mouth near Roslyn	12478100	472513	1210515	x		x		
2	Cle Elum River above Cle Elum Lake near Roslyn	12478300	472119	1210622				x	
6	Yakima River at Cle Elum	12479500	471135	1205655	x	x	x	x	x
3	Jungle Creek near mouth near Cle Elum	12479720	472030	1205159	x		x	x	
4	North Fork Teanaway River below bridge at Dickey Creek Campground	12479750	471721	1205130			x		
5	Teanaway River below Forks near Cle Elum	12480000	471448	1205136	x		x	x	
8	Taneum Creek at Taneum Meadow near Thorp	12481900	470647	1205201	x		x		
9	Yakima River at Thorp Highway bridge at Ellensburg	12482800	470020	1203543				x	
12	South Fork Manastash Creek near Ellensburg	12483190	465818	1204832	x		x	x	
7	Naneum Creek below High Creek near Ellensburg	12483750	471055	1202644	x		x		
15	Wilson Creek above Cherry Creek at Thrall	12484100	465535	1203001				x	
14	Cherry Creek above Wipple Wasteway at Thrall	12484440	465544	1202948	x		x		
16	Cherry Creek at Thrall	12484480	465534	1202951			x	x	
19	Yakima River at Umtanum	12484500	465146	1202844	x	x	x	x	x
20	Umtanum Creek near mouth at Umtanum	12484550	465127	1202946	x		x	x	
23	Yakima River above canal diversion at RM 128 at Roza Dam	12484950	464503	1202752				x	
25	Yakima River above Selah Creek at Pomona	12485550	464232	1202825				x	
10	Little Naches River at mouth near Cliffdell	12487200	465920	1210555	x		x	x	
17	Bumping River at Soda Springs Walkway near Nile	12488050	465527	1211250				x	
13	American River at Hells Crossing near Nile	12488250	465804	1211545	x		x		
11	American River near Nile	12488500	465839	1211005				x	
18	Naches River at Cottonwood Campground near Cliffdell	12489050	465424	1210133				x	
22	Rattlesnake Creek above North Fork Rattlesnake Creek near Nile	12489100	464834	1210408	x		x		
21	Rattlesnake Creek above Little Rattlesnake near Nile	12489150	464850	1205658	x		x	x	
24	Tieton River at mouth near Naches	12493100	464439	1204706				x	
26	Naches River near North Yakima	12499000	463742	1203110	x	x	x	x	x
28	Tributary to Moxee Drain at Bell Road near Union Gap	12500415	463326	1202632				x	
30	Moxee Drain at Thorp Road near Union Gap	12500430	463218	1202719	x		x	x	
27	Wide Hollow Creek at West Valley Middle School near Ahtanum	12500437	463456	1203634	x		x	x	
29	Wide Hollow Creek at old STP at Union Gap	12500442	463235	1202826	x		x	x	

Table 1. Sampling-site locations for major and minor elements, Yakima River Basin, Washington, 1987-91—Continued

Site reference number	Site name	Station number [1]	Latitude	Longitude	Media				
					Sediment			Water	
					S	SS	T	F	U
32	Yakima River above Ahtanum Creek at Union Gap	12500450	463204	1202758		x		x	x
34	South Fork Ahtanum Creek above Conrad Ranch near Tampico	12500900	462932	1205723	x		x		
31	Ahtanum Creek at Union Gap	12502500	463210	1202820	x		x		
33	Yakima River at Parker	12503950	463022	1202707	x		x	x	
36	Yakima River at RM 91 at Zillah	12505320	462407	1201654				x	
37	East Toppenish Drain at Wilson Road near Toppenish	12505350	462204	1201500				x	
39	Sub 35 Drain at Parton Road near Granger	12505410	462011	1201348				x	
38	Yakima River at Bridge Avenue at Granger	12505440	462016	1201148				x	
40	Granger Drain at mouth near Granger	12505460	462010	1201138	x		x	x	
41	Marion Drain at Indian Church Road at Granger	12505510	461952	1201154				x	
44	Toppenish Creek near Fort Simcoe	12506000	461840	1204713				x	
35	Unnamed drain at Progressive Road near Harrah	12507050	462509	1203545				x	
43	Toppenish Creek at Indian Church Road near Granger	12507508	461852	1201153	x		x	x	
42	Yakima River below Toppenish Creek at RM 79.6 near Granger	12507525	461858	1200913	x		x		
48	Yakima River at RM 72 above Satus Creek near Sunnyside	12507585	461611	1200530	x		x		
57	Satus Creek above Wilson-Charley Canyon near Toppenish	12507594	460100	1204054	x		x		
53	Satus Creek below Dry Creek near Toppenish	12508500	461500	1202240	x		x	x	
47	Satus Creek at Gage at Satus	12508620	461626	1200832	x		x	x	
51	Yakima River below Satus Creek at RM 68 near Satus	12508625	461506	1200545				x	
46	DID 3 Drain below STP at Midvale Road at Sunnyside	12508838	461728	1200148				x	
52	Sulphur Creek Wasteway near Sunnyside	12508850	461503	1200107	x	x	x	x	x
55	Yakima River at Mabton	12508990	461353	1195954				x	
56	Yakima River at Euclid Bridge at RM 55 near Grandview	12509050	461301	1195500	x	x	x	x	x
54	Spring Creek at mouth at Whitstran	12509710	461400	1194038	x		x		
49	Yakima River above Chandler Pump at RM 35.9 near Whitstran	12509900	461558	1193518				x	
50	Yakima River at Kiona	12510500	461513	1192837	x	x	x	x	x
45	Yakima River at Van Geison Bridge near Richland	12511800	461750	1191956				x	

[1] This number can be used for computer retrieval of suspended-sediment, filtered-water, and unfiltered-water chemical data from either the U.S. Geological Survey's WATer data STOrage and REtrieval system (WATSTORE) or the U.S. Environmental Protection Agency's STOrage and RETrieval system (STORET).
[2] For filtered-water data retrieval, use station number 12483200.
[3] For filtered-water data retrieval, use station number 12489300.
[4] For filtered-water data retrieval, use station number 12500445.
[5] For filtered-water data retrieval, use station number 12505000.

Table 2. Elements analyzed in aquatic biota, water, and sediment, Yakima River Basin, Washington, 1987-91

[The term "filtered water" is an operational definition referring to the chemical analysis of that portion of a water-suspended-sediment sample that passes through a nominal 0.45-micrometer filter; the term "unfiltered water" refers to the chemical analysis of a water sample that has not been filtered or centrifuged, nor in any way altered from the original matrix]

Element analyzed	Aquatic biota				Water		Sediment	
	Insects	Fish	Clams	Plants	Filtered	Unfiltered	Streambed	Suspended
Aluminum	X	X	X	X	X	X	X	X
Antimony					X		X	X
Arsenic	X	X	X	X	X		X	X
Barium	X	X	X	X	X	X	X	
Beryllium	X	X	X	X	X	X	X	X
Bismuth							X	
Boron	X	X	X	X	X	X	X	
Bromide					X			
Cadmium	X	X	X	X	X	X	X	X
Calcium		X	X				X	X
Carbon, inorganic							X	
Carbon, organic					X			X
Carbon, total							X	
Cerium							X	
Chromium	X	X	X	X	X	X	X	X
Cobalt	X	X	X		X		X	X
Copper	X	X	X	X	X	X	X	X
Cyanide					X			
Europium							X	
Gallium							X	
Gold							X	
Iron	X	X	X	X	X	X	X	X
Lanthanum							X	
Lead	X	X	X	X	X	X	X	X
Lithium					X		X	
Magnesium	X	X	X	X			X	X
Manganese	X	X	X	X	X	X	X	X
Mercury	X	X	X	X	X	X	X	
Molybdenum	X	X	X	X	X	X	X	X
Neodymium							X	
Nickel	X	X	X	X	X	X	X	X
Niobium							X	
Phosphorus							X	X
Potassium			X				X	X
Scandium							X	
Selenium	X	X	X	X	X		X	
Silver	X	X	X	X	X	X	X	X
Sodium			X				X	X
Strontium	X	X	X	X	X		X	
Sulfur							X	
Thallium	X	X	X	X				X
Thorium							X	
Tin							X	
Titanium	X	X	X				X	X
Uranium							X	
Vanadium	X	X	X	X	X		X	X
Ytterbium							X	
Yttrium							X	
Zinc	X	X	X	X	X	X	X	X

Table 3. Types of samples analyzed for major and minor elements in the Yakima River Basin, Washington, 1987-91

[OT = sample was collected at the site at least one time; M = sample was collected at a fixed site once a month from March 1987 to April 1990; RT = rainbow trout (*Oncorhynchus mykiss*); MW = mountain whitefish (*Prosopium williamsoni*); BT = brook trout (*Salvelinus fontinalis*); BS = bridgelip sucker (*Catostomus columbianus*); LS = largescale sucker (*Catostomus macrocheilus*); CM = chiselmouth *(Acrocheilus alutaceus)* CT = cutthroat trout (*Oncorhynchus clarki*); CP = carp (*Cyprinus carpio*); SN = sculpin (*Cottus* spp.); CF = caddisfly (Trichoptera:Hydropsychidae); SF = stonefly (Plecoptera:Perlidae, Perlodidae, Pteronarcidae); MF = mayfly (Ephemeroptera); WP = western pearlshell clam (Unionaia:Unionidae *Margaritifera falcata*); AC = Asiatic clam (Veneroida:Corbiculidae *Corbicula fluminea*); AG = algae (unidentified); CL = curlyleaf pondweed (*Potamogeton crispus*); WW = waterweed (*Elodea* sp.); CO = coontail (*Ceratophyllum demersum*); Q = sample was collected at the site approximately four times in a year and (or) during storm events; "--" = not determined; N.F. = North Fork; R = River; RM = river mile; MS = Middle School; STP = sewage treatment plant; DID = drainage irrigation district; the term "filtered water" is an operational definition referring to the chemical analysis of that portion of a water-suspended-sediment sample that passes through a nominal 0.45-micrometer filter; the term "unfiltered water" refers to the chemical analysis of a water sample that has not been filtered or centrifuged, nor in any way altered from the original matrix]

Site reference number	Site name	Sediment		Aquatic-biota tissue[1]							
				Fish			Insects	Clams	Plants	Water	
		Streambed	Suspended	Liver	Whole fish	Muscle	Whole organism	Soft tissue	Stem and leaves	Filtered[2]	Unfiltered
1	Waptus River at mouth near Roslyn	OT	--	RT	--	--	CF	--	--	--	--
2	Cle Elum River above Cle Elum Lake near Roslyn	--	--	--	--	--	--	--	--	OT	--
6	Yakima River at Cle Elum	OT	M	MW	SN	--	CF,SF	--	--	M	Q
3	Jungle Creek near mouth near Cle Elum	OT	--	RT	--	--	MF	--	AG	OT	--
4	N.F. Teanaway R below bridge at Dickey Creek Campground	--	--	--	--	--	CF,SF	--	--	--	--
5	Teanaway River below Forks near Cle Elum	OT	--	RT	--	--	--	--	--	OT	--
8	Taneum Creek at Taneum Meadow near Thorp	OT	--	RT	SN	RT	CF,SF	--	--	--	--
9	Yakima River at Thorp Highway bridge at Ellensburg	--	--	--	--	--	--	--	--	OT	--
12	South Fork Manastash Creek near Ellensburg	OT	--	RT	SN	--	CF,SF	--	--	OT	--
7	Naneum Creek below High Creek near Ellensburg	OT	--	BT	SN	--	CF,SF	--	--	--	--
15	Wilson Creek above Cherry Creek at Thrall	--	--	--	--	--	--	--	--	OT	--
14	Cherry Creek above Wipple Wasteway at Thrall	OT	--	MW	--	--	CF	--	--	--	--
16	Cherry Creek at Thrall	--	--	BS	--	--	CF	--	CL	OT	--
19	Yakima River at Umtanum	OT	M	MW,RT	--	RT	CF,SF	WP	CL	M	Q
20	Umtanum Creek near mouth at Umtanum	OT	--	RT	SN	--	CF,SF	--	--	OT	--
23	Yakima River above canal diversion at RM 128 at Roza Dam	--	--	--	--	--	--	--	--	OT	--
25	Yakima River above Selah Creek at Pomona	--	--	--	--	--	--	--	--	OT	--
10	Little Naches River at mouth near Cliffdell	OT	--	--	--	--	CF,SF	--	--	OT	--
17	Bumping River at Soda Springs Walkway near Nile	--	--	--	--	--	--	--	--	OT	--
13	American River at Hells Crossing near Nile	OT	--	--	RT,SN	--	CF,SF	--	--	--	--
11	American River near Nile	--	--	--	--	--	--	--	--	OT	--
18	Naches River at Cottonwood Campground near Cliffdell	--	--	--	--	--	--	--	--	OT	--
22	Rattlesnake Creek above N.F. Rattlesnake Creek near Nile	OT	--	RT	SN	RT	CF,SF	--	--	--	--
21	Rattlesnake Creek above Little Rattlesnake near Nile	OT	--	--	--	--	CF,SF	--	--	OT	--
24	Tieton River at mouth near Naches	--	--	--	--	--	--	--	--	OT	--
26	Naches River near North Yakima	OT	M	LS,MW	--	--	CF,SF	--	--	M	Q
28	Tributary to Moxee Drain at Bell Road near Union Gap	--	--	--	--	--	--	--	--	OT	--
30	Moxee Drain at Thorp Road near Union Gap	OT	--	CM	--	--	--	--	--	OT	--
27	Wide Hollow Creek at West Valley MS near Ahtanum	OT	--	BS	--	--	CF	--	--	OT	--
29	Wide Hollow Creek at old STP at Union Gap	OT	--	CM,RT	--	--	CF	--	CL,WW	OT	--

Table 3. Types of samples analyzed for major and minor elements in the Yakima River Basin, Washington, 1987-91—Continued

Site reference number	Site name	Sediment		Aquatic-biota tissue[1]							
				Fish			Insects	Clams	Plants	Water	
		Streambed	Suspended	Liver	Whole fish	Muscle	Whole organism	Soft tissue	Stem and leaves	Filtered[2]	Unfiltered
32	Yakima River above Ahtanum Creek at Union Gap	--	M	--	--	--	--	--	--	M	Q
34	South Fork Ahtanum Creek above Conrad Ranch near Tampico	OT	--	CT	SN	--	CF,SF	--	--	--	--
31	Ahtanum Creek at Union Gap	OT	--	--	SN	--	CF	--	--	--	--
33	Yakima River at Parker	OT	--	LS,CP,MW	--	--	CF	--	CL	OT	--
36	Yakima River at RM 91 at Zillah	--	--	--	--	--	--	--	--	OT	--
37	East Toppenish Drain at Wilson Road near Toppenish	--	--	--	--	--	--	--	--	OT	--
39	Sub 35 Drain at Parton Road near Granger	--	--	--	--	--	--	--	--	OT	--
38	Yakima River at Bridge Avenue at Granger	--	--	--	--	--	--	--	--	OT	--
40	Granger Drain at mouth near Granger	OT	--	BS	--	--	CF	--	--	OT	--
41	Marion Drain at Indian Church Road at Granger	--	--	--	--	--	--	--	--	OT	--
44	Toppenish Creek near Fort Simcoe	--	--	--	--	--	--	--	--	OT	--
35	Unnamed drain at Progressive Road near Harrah	--	--	--	--	--	--	--	--	OT	--
43	Toppenish Creek at Indian Church Road near Granger	OT	--	LS	--	--	CF	--	WW	OT	--
42	Yakima R below Toppenish Creek at RM 79.6 near Granger	OT	--	LS,MW	--	--	CF	AC	--	--	--
48	Yakima River at RM 72 above Satus Creek near Sunnyside	OT	--	LS,CP	--	--	--	AC	CL	--	--
57	Satus Creek above Wilson-Charley Canyon near Toppenish	OT	--	RT	SN	--	CF,SF	--	--	--	--
53	Satus Creek below Dry Creek near Toppenish	OT	--	--	SN	--	CF,SF	--	--	OT	--
47	Satus Creek at Gage at Satus	OT	--	LS	SN	--	CF	--	WW,CL	OT	--
51	Yakima River below Satus Creek at RM 68 near Satus	--	--	--	--	--	--	--	--	OT	--
46	DID 3 Drain below STP at Midvale Road at Sunnyside	--	--	--	--	--	--	--	--	OT	--
52	Sulphur Creek Wasteway near Sunnyside	OT	M	LS	--	--	CF	--	--	M	Q
55	Yakima River at Mabton	--	--	--	--	--	--	--	--	OT	--
56	Yakima River at Euclid Bridge at RM 55 near Grandview	OT	M	LS	--	--	CF	AC	CL	M	Q
54	Spring Creek at mouth at Whitstran	OT	--	LS	--	--	CF	AC	WW	--	--
49	Yakima R above Chandler Pump at RM 35.9 near Whitstran	--	--	--	--	--	--	--	--	OT	--
50	Yakima River at Kiona	OT	M	MW,LS,CP	--	LS,MW	CF	AC	CL,CO	M	Q
45	Yakima River at Van Geison Bridge near Richland	--	--	--	--	--	--	--	--	OT	--

[1] Tissue samples were collected during one or more of the following time periods: May and October-November of 1989, October-November of 1990, and October of 1991.

[2] Elements analyzed varied with frequency of sampling. For example, only cadmium, copper, mercury, and lead were analyzed monthly. All other elements were analyzed once or twice in a given year.

coverage necessary to describe seasonal variations for element concentrations in filtered water. These seven sites, referred to in this report as *fixed sites*, are Yakima River at Cle Elum (site 6), Yakima River at Umtanum (site 19), Naches River near North Yakima (site 26), Yakima River above Ahtanum Creek at Union Gap (site 32), Yakima River at Kiona (site 50), Sulphur Creek Wasteway near Sunnyside (site 52), and Yakima River at Euclid Bridge at river mile 55 near Grandview (site 56) [fig.1].

Fixed sites were sampled with the greatest frequency, and elements in all media were measured at these sites. Five of the seven fixed sites were on the main stem of the Yakima River; one, at the mouth of the Naches River—a major tributary—and, the other, at the mouth of Sulphur Creek Wasteway—a major drain carrying irrigation-return flow and urban runoff (fig. 1). Fixed sites were sampled in a systematic-downstream order to simulate the movement of surface water passing through the basin.

Sampling frequency for major and minor elements in suspended sediment was identical to that for filtered water for the period April 1987 to April 1990. The seven fixed sites were sampled monthly and during several hydrologic events (including snowmelt and winter rainstorms) for major and minor elements associated with suspended sediment. Water and suspended sediment were sampled simultaneously. The sampling frequency for the unfiltered-water samples, however, varied from that of filtered water, and likewise, from that of suspended sediment. Generally, unfiltered samples were collected quarterly during 1987, and not at all during 1988-90.

The frequency that sites were sampled for major and minor elements in aquatic biota varied with each synoptic sampling (table 4). A preliminary sampling was made in May 1989 at four sites to test and refine collection and processing methods. Aquatic biota were sampled at 20 and 30 sites in 1989 and 1990, respectively. The aquatic biota sampled were aquatic insects, aquatic plants, fish, and clams (table 3). The aquatic insects sampled were caddisflies (Trichoptera), stoneflies (Plecoptera), and mayflies (Ephemeroptera). The aquatic plants sampled were algae (unidentified species), coontail (*Ceratophyllum demersum*), curlyleaf pondweed (*Potamogeton crispus*), and waterweed (*Elodea* sp.). The fish sampled were bridgelip sucker (*Catostomus columbianus*), brook trout (*Salvelinus fontinalis*), carp (*Cyprinus carpio*), chiselmouth (*Acrocheilus alutaceus*), cutthroat trout (*Oncorhynchus clarki*), largescale sucker (*Catostomus macrocheilus*), mountain whitefish (*Prosopium williamsoni*), rainbow trout (*Oncorhynchus mykiss*), and sculpin (*Cottus* spp.). The clams sampled were Asiatic clam (Veneroida: Corbiculidae *Corbicula fluminea*) and western pearlshell (Unionoida: Unionidae *Margaritifera falcata*). In addition, a special sampling to assess mercury concentrations in fish muscle was done in 1991, with samples collected at four sites: Taneum Creek at Taneum Meadow near Thorp (site 8), Yakima River at Umtanum (site 19), Rattlesnake Creek above North Fork Rattlesnake Creek near Nile (site 22), and Yakima River at Kiona (site 50) [table 4].

Streamflow was generally measured during each site visit, except for sites equipped with continuous stage recorders. Suspension- and (or) wading-streamflow measurements were made according to methods described by Rantz and others (1982). Fixed sites were equipped with stage recorders, and stage was recorded every 30 minutes. Streamflow-rating tables were developed and updated for fixed sites based on methods described by Rantz and others (1982).

Sample Collection and Processing

Streambed Sediment

Ideally, streambed sediment was collected from five to seven points in each cross section of the stream channel; often, however, sediment was collected near stream banks and behind large rocks, or wherever fine sediment had been deposited. Sampling was confined to surficial-oxic sediment, usually present in the upper one-half inch of the streambed. Samples were collected by dipping a polyethylene or glass 100-mL (milliliter) beaker or a polyethylene scoop into the streambed. In deeper water, samples were collected by coring the streambed with a butyrate-acetate cylinder.

Table 4. Sampling frequency for major and minor elements in aquatic biota, Yakima River Basin, Washington, 1989-91
[Nov. = November; Oct. = October]

Site reference number	Site name	May 1989	Nov. 1989	Nov. 1990	Oct. 1991
1	Waptus River at mouth near Roslyn		X		
6	Yakima River at Cle Elum		X	X	
3	Jungle Creek near mouth near Cle Elum	X		X	
4	North Fork Teanaway River below bridge at Dickey Creek Campground			X	
5	Teanaway River below Forks near Cle Elum		X		
8	Taneum Creek at Taneum Meadow near Thorp			X	X
12	South Fork Manastash Creek near Ellensburg			X	
7	Naneum Creek below High Creek near Ellensburg			X	
14	Cherry Creek above Wipple Wasteway at Thrall			X	
16	Cherry Creek at Thrall		X	X	
19	Yakima River at Umtanum	X	X	X	X
20	Umtanum Creek near mouth at Umtanum	X	X	X	
10	Little Naches River at mouth near Cliffdell			X	
13	American River at Hells Crossing near Nile		X	X	
22	Rattlesnake Creek above North Fork Rattlesnake Creek near Nile		X	X	X
21	Rattlesnake Creek above Little Rattlesnake near Nile			X	
26	Naches River near North Yakima			X	
30	Moxee Drain at Thorp Road near Union Gap			X	
27	Wide Hollow Creek at West Valley Middle School near Ahtanum	X		X	
29	Wide Hollow Creek at old sewage treatment plant at Union Gap		X	X	
34	South Fork Ahtanum Creek above Conrad Ranch near Tampico			X	
31	Ahtanum Creek at Union Gap			X	
33	Yakima River at Parker		X	X	
40	Granger Drain at mouth near Granger		X	X	
43	Toppenish Creek at Indian Church Road near Granger		X		
42	Yakima River below Toppenish Creek at river mile 79.6 near Granger			X	
48	Yakima River at river mile 72 above Satus Creek near Sunnyside		X		
57	Satus Creek above Wilson-Charley Canyon near Toppenish		X	X	
53	Satus Creek below Dry Creek near Toppenish			X	
47	Satus Creek at gage at Satus		X	X	
52	Sulphur Creek Wasteway near Sunnyside		X	X	
56	Yakima River at Euclid Bridge at river mile 55 near Grandview		X	X	
54	Spring Creek at mouth at Whitstran		X	X	
50	Yakima River at Kiona		X	X	X

All streambed-sediment samples were wet-sieved through a 0.062-mm (millimeter) mesh-polyethylene sieve, using a minimum amount of ambient stream water to facilitate the settling process. The supernatant was decanted (after overnight-settling in 2-L [liter] glass bottles), and the sediment was dried at room temperature and placed in plastic containers. Samples were submitted to the USGS's Geologic Division (GD) Branch of Geochemistry Laboratory in Denver, Colorado, for further preparation and analysis.

Equipment used for major- and minor-element sampling was washed in Liquinox and rinsed in deionized water. Sample containers and equipment were additionally rinsed in 10 percent (by volume) hydrochloric acid. The acid rinse was followed by several rinses with deionized water. All equipment was rinsed in ambient stream water prior to sample collection.

Suspended Sediment and Water

Water samples were collected using an equal-width-increment method which requires a sample volume proportional to the amount of flow at each of several equally spaced verticals in the stream cross section (Edwards and Glysson, 1988). A minimum of 10 verticals was sampled in the stream cross section. Samples were collected using USGS depth-integrating samplers fitted with 3-L polyethylene bottles. The D-77 (depth-integrating sampler), an epoxy-coated brass sampler that is operated by a cable and reel assembly, was used a majority of the time. The DH-81 (depth-integrating, hand-held sampler) was an optional sampler used when flow conditions permitted crossing the stream by wading.

Equipment used for major- and minor-element sampling of suspended sediment and water was cleaned and rinsed with the same procedure as described for streambed-sediment equipment, with the exception of depth-integrating samplers. The depth-integrating samplers were not rinsed because the water sample does not come into contact with the sampler body.

Processing of suspended-sediment samples

Depending on the suspended-sediment concentration at the time of sampling, 10 to 30 L of water were collected to acquire the 50 mg (milligrams) of sediment necessary for suspended major- and minor-element determinations. The water samples were transferred from the 3-L polyethylene-sample bottles (fitted to D-77 or DH-81 samplers) into 10-L polycarbonate containers. The 10-L containers were immediately placed in Gott coolers, iced, and shipped to the USGS Water Resources Division (WRD) laboratory in Portland, Oregon, for dewatering.

The suspended major- and minor-element samples were refrigerated at 4°C (degrees Celsius) on arrival at the Portland laboratory. Within 1 week of collection, the samples were brought to room temperature and centrifuged to concentrate the suspended sediment. Centrifuge speed and spin times were adequate to remove 0.45-µm or larger particles—assuming a particle density of 2.5 g/cm^3 (grams per cubic centimeter). Each sample was rinsed in approximately 250-mL of deionized water during the final centrifugation steps. Final sample-concentrate volumes, ranging from 30 to 50 mL, were placed in pre-tared 125-mL-sample containers and shipped on dry ice to the USGS WRD Laboratory in Atlanta, Georgia, for initial laboratory processing.

Processing of unfiltered- and filtered-water samples

Water samples were transferred from the 3-L polyethylene-sample bottle (fitted to a D-77 or DH-81 sampler) to a churn splitter. The churn splitter was used to process unfiltered-water samples by resuspending sediment particles to concentrations present in the stream cross section at the time of sampling. Once resuspended, some of the water-suspended sediment mixture was dispensed from the churn into 200-mL glass bottles for the analysis of mercury, and into 250-mL polyethylene, acid-rinsed bottles for the analysis of other major and minor elements. For filtered-water samples, part of the water remaining in the churn was filtered through a 142-mm diameter, 0.45-µm pore-size filter. These samples were dispensed into sample bottles as described above for unfiltered-water samples. For low-level analyses of cadmium, copper, and lead, however, samples were filtered into acid-washed, 200-mL Teflon-sample bottles. Unfiltered- and filtered-water samples were preserved according to methods described by Fishman and Friedman

(1989), and shipped from the field on ice to the USGS WRD National Water-quality Laboratory in Arvada, Colorado, for analysis.

Monthly samples of suspended organic carbon in unfiltered water and organic carbon in filtered water were collected at the same time as samples for major and minor elements in unfiltered and filtered water. Some of the water-suspended sediment mixture (used for filtered- and unfiltered-water sample processing) was withdrawn from the churn splitter into a graduated cylinder. The mixture was then filtered through a 47-mm diameter, 0.45-µm pore-size silver filter. The filtrate was collected in 125-mL glass bottles with Teflon lid liners for the analysis of organic carbon in filtered water. The silver filter was removed from the filter assembly, and then placed in a petri dish for the analysis of suspended organic carbon in unfiltered water. The organic carbon in filtered water and the suspended organic carbon samples were shipped on ice to the USGS WRD National Water-quality Laboratory in Arvada, Colorado, for analysis.

Aquatic Biota

Aquatic-insect samples

Insects were collected from shallow (typically less than 0.5 meter, deep) riffle areas in two ways: with kick nets and by picking insects directly from rocks using hand tweezers. Insects from the two orders Trichoptera and Plecoptera (caddisflies and stoneflies, respectively) were targeted for collection because species in these two orders are generally wide spread in cobble-bottom river systems, and because the size of individuals in these groups is relatively large (Crawford and Luoma, 1992). Trichoptera of the family Hydropsychidae and the genus Hydropsyche were collected preferentially, although other genera were collected inadvertently. For tissue analysis, insect taxa were separated to order or family in the field, and placed in separate polyethylene zipper-seal bags. The bags were filled partially with ambient stream water and then placed in an ice chest for 6 to 8 hours for gut purging. After this period of gut purging, the water in the bags was decanted, a subsample for taxonomic identification was taken from each bag, and then the samples were frozen on dry ice. Subsamples were preserved initially in 10 percent formalin, but were later transferred to ethanol for storage. In 1989, the frozen samples were submitted to a U.S. Fish and Wildlife Service (USFWS) contract laboratory, whereas in 1990, samples were submitted to the USGS WRD Laboratory in Menlo Park, California, for further preparation and analysis.

Aquatic-plant samples

Plant material was collected and composited from several individual beds of submersed aquatic plants according to methods described by Crawford and Luoma (1992). Plants were thoroughly rinsed in ambient stream water to minimize attached sediment and debris. The apical 5 cm (centimeters) of the plant stems with leaves were removed using unpowdered polyethylene gloves. Tissue samples were then placed in precleaned polyethylene containers with deionized water. To minimize attached sediment, debris, and algae, samples were given three deionized-water soaks lasting approximately 1 hour each. After the final soak, the tissue samples were drained, transferred to a precleaned I-Chem glass jar and weighed. I-Chem's cleaning protocol, although proprietary, met U.S. Environmental Protection Agency (USEPA) criteria (Sharon Sutton, I-Chem, written commun., 1993). A minimum of 5 g (grams) of plant tissue [wet weight] was collected for each sample. Samples were then frozen on dry ice for shipment to a contract laboratory for analysis of major and minor elements. Voucher specimens were collected at a number of sites, and then pressed and dried for later identification.

Clam samples

Asiatic clams were collected from five sampling sites where they were relatively common. They were collected by hand or by using a clam rake. In addition, the western pearlshell clam was collected at one site in the same manner. Where possible, three composite samples were collected from each site, with each composite containing approximately 20 clams. The actual number of clams in the composites ranged from 10 to 34. Once collected, individual clams were

scrubbed with a soft nylon-bristle brush, rinsed with ambient stream water, and placed in precleaned polyethylene pans filled with deionized water. All instruments were cleaned at each site with Liquinox and tap water, rinsed with tap water, rinsed with deionized water, rinsed with a 1:10 nitric acid mixture, and, finally, rinsed with deionized water. Clams were gut purged for a period of 48 hours at 10°C, with water in the pans being replaced after 24 hours. Clam-shell lengths were measured to the nearest tenth of a millimeter (greatest anterior-posterior dimension) and soft tissues were removed by cutting the adductor muscles with a precleaned, stainless-steel scalpel using procedures described by Crawford and Luoma (1992). A composite sample of soft tissue was placed in a labeled, acid-washed, glass jar with a Teflon lid liner, which was then placed inside a labeled, zipper-seal plastic bag. The sample was frozen using dry ice, and shipped to a USFWS contract laboratory in 1989, and to the USGS WRD Laboratory in Menlo Park, California, in 1990, for further preparation and analysis. Clam shells from about 50 percent of the sites were cleaned, dried, and saved as voucher specimens.

Fish samples

Fish were collected by electrofishing using backpack and boat-mounted electrofishing equipment. Electrofishing involved netting immobilized fish after they were stunned by an electrical current. Each sample consisted of a composite of several fish of the same species. The species and size of fish collected were contingent on site location. Rainbow trout, brook trout, and sculpin—a nontarget taxon—were collected from lower-order streams or higher-elevation tributaries to the main stem. Trout also were collected from the main stem upstream from the city of Yakima. Cutthroat trout, mountain whitefish, largescale sucker, bridgelip sucker, chiselmouth, and carp were collected in the main stem and in lower-elevation reaches of tributaries—primarily downstream from the city of Yakima.

Three different sample-preparation techniques were used for fish analysis. Fish livers of the target taxa were collected when possible in order to determine the concentrations of major and minor elements. These elements are known to concentrate preferentially in the livers of fish (Crawford and Luoma, 1992). Sculpins were collected at sites where target taxa were not available. Due to the small size of sculpin, liver analysis was not feasible. Alternately, whole-fish analysis was used. Finally, a special study to assess concentrations of mercury in fish muscle was done in 1991. Sample preparation usually was within 2 hours of fish collection, and always within 8 hours of collection. Preparation included determining the length, weight, and sex of each individual fish in the composite sample. Additionally, fish were examined for external abnormalities and scale samples were collected for determining the age of each fish. Each sample was a composite of approximately 10 fish, with three being the minimum number of fish in any composite.

For samples of fish liver, the body cavity of individual fish in the composite sample was opened using precleaned (as described for instruments used for clam samples) surgical instruments. The liver, or part of the liver (for large fish), was removed using a different set of precleaned surgical instruments and placed in a precleaned and tared glass jar. Once all 10 livers for the composite sample were collected, the glass jar was weighed to determine the sample weight. Ideally, at least 10 g of sample material (wet weight) were collected for each composite sample. In most cases this was accomplished, and in no case was less than 1 g collected.

Samples of whole fish were processed similar to fish-liver samples, except that no dissections were performed and whole fish were composited into a plastic zipper-seal bag. All samples were double-bagged to guard against container failure.

For samples of fish muscle, ancillary data were collected as described for the fish-liver samples. Three individual fish were used for each composite sample for mercury analysis. A strip of muscle tissue, approximately 2 cm wide and 8 cm long, was then extracted from above the lateral line and below the dorsal fin on the left side of each individual fish and composited into a

precleaned, tared, labeled glass jar. The jar was placed in a labeled, plastic, zipper-seal bag and frozen using dry ice. The frozen samples were then shipped to the USGS WRD Laboratory in Menlo Park, California, for further preparation. Duplicate samples for some fish were collected from the right side of the same fish.

Methods of Determination

Streambed Sediment

At the USGS's GD Branch of Geochemistry Laboratory in Denver, Colorado, sediment samples were processed through a jaw crusher to break up large aggregates that formed during the drying period. While about 25 percent of the sediment sample was archived, the remainder of the sample was processed using a ceramic-plate pulverizer to disaggregate and homogenize the sample.

The sediment samples were analyzed for 46 constituents—see table 5 for methods of determination, lower limits of determination[2] (LLD), and decomposition methods. The majority of elements were determined by inductively coupled plasma-atomic emission spectroscopy (ICP-AES). Decompositions methods used for the sediment samples for elements measured by atomic absorption spectroscopy (AAS) and ICP-AES were total digestions—greater than 95 percent of the element of interest was recovered during analysis. The decomposition methods used for boron and inorganic carbon were partial techniques. Total carbon was determined by combustion techniques. Protocols used for sample-handling procedures, sample preparation, methods of determination, use of instrumentation, laboratory procedures, and laboratory quality control are described by Arbogast (1990).

Suspended Sediment

At the USGS WRD Laboratory in Atlanta, Georgia, each suspended-sediment sample was freeze-dried and subsequently weighed to determine the mass of suspended sediment. A surface-area measurement of each sample was made using a single point Brunauer, Emmett, and Teller (BET) gas-adsorption theory procedure. Freeze-dried suspended-sediment samples were outgassed initially for 24 hours at 105°C, then further outgassed for 1 hour at 150°C, under helium or a helium-nitrogen mixture. A 30 percent/70 percent helium/nitrogen mixture of liquid nitrogen was equilibrated with each freeze-dried sample at liquid-nitrogen temperature—nitrogen is selectively adsorbed by solids during this process (Kremen and others, 1966). Desorption was at room temperature and surface area was calculated by determining the difference between the total nitrogen introduced to each sample and the amount of nitrogen unadsorbed (Horowitz and Elrick, 1987). This procedure measures "external surface area," not the total surface area of the suspended-sediment sample.

When the surface-area measurements were completed, the freeze-dried suspended-sediment samples were shipped to the USGS GD Branch of Geochemistry Laboratory in Menlo Park, California, for acid digestion. A 50-mg aliquot of the dried sample was placed into a 30-mL screw-cap, Teflon vial. A 25-µg (microgram) aliquot (50-µL [microliters]) of a 500-mg/L ([milligram per liter] solution) of lutetium was pipetted to each vial for use as an internal standard. Suspended sediment was rinsed from the side walls of each vial with a minimum amount of deionized water. To each vial, 1.5 mL of 12-molar hydrochloric acid were dispensed along with 1 mL of 16-molar nitric acid. The vials were placed in a heating block where 0.5 mL of 12-molar perchloric acid and 2.0 mL of 29-molar hydrofluoric acid were pipetted. The heating block was then heated at 110°C for at least 2 hours. The temperature of the heating block was raised to 160°C and the samples were brought to incipient dryness. When the samples were nearly dry, 0.5 mL of 12-molar perchloric acid were added to the vials and the temperature of the heating block was raised to 190°C. The samples were brought to dryness at this temperature over a period of approximately 12 hours. When dry, the vials were cooled and secured for shipment to the USGS GD Branch of

[2]The lower limit of determination (LLD) is three times the standard deviation of the blank added to the average of the blank.

Table 5. Methods and lower limits of determination for major and minor elements in streambed sediment, Yakima River Basin, Washington, 1987-91

[All concentrations are reported in micrograms per gram (µg/g), unless otherwise noted; for some elements, the lower limit of determination was raised, thus, two values are reported; ICP-AES = inductively coupled plasma-atomic emission spectroscopy; AAS = atomic absorption spectroscopy; % = percent; HCl = hydrochloric acid; HNO3 = nitric acid; HClO4 = perchloric acid; HF = hydrofluoric acid; NaCr2O7 = sodium dichromate]

Element	Method of determination	Lower limit of determination	Decomposition method[1]
Aluminum	ICP-AES	0.005%	HCl/HNO3/HClO4/HF
Antimony	AAS, hydride	.1 and .7	HCl/HNO3/HClO4
Arsenic	AAS, hydride	.1	HCl/HNO3/HClO4
Barium	ICP-AES	1	HCl/HNO3/HClO4/HF
Beryllium	ICP-AES	1	HCl/HNO3/HClO4/HF
Bismuth	ICP-AES	10	HCl/HNO3/HClO4/HF
Boron	ICP-AES	.4	Hot water soluble
Cadmium	ICP-AES	[2]2 and .05	HCl/HNO3/HClO4/HF
Calcium	ICP-AES	.005%	HCl/HNO3 /HClO4 /HF
Carbon, inorganic	Titration	.01%	HClO4
Carbon, total	Infrared	.01%	Combustion
Cerium	ICP-AES	4	HCl/HNO3/HClO4/HF
Chromium	ICP-AES	1	HCl/HNO3/HClO4/HF
Cobalt	ICP-AES	1	HCl/HNO3/HClO4/HF
Copper	ICP-AES	1	HCl/HNO3/HClO4/HF
Europium	ICP-AES	2	HCl/HNO3/HClO4/HF
Gallium	ICP-AES	4	HCl/HNO3/HClO4/HF
Gold	ICP-AES	8	HCl/HNO3/HClO4/HF
Iron	ICP-AES	.005%	HCl/HNO3/HClO4/HF
Lanthanum	ICP-AES	2	HCl/HNO3/HClO4/HF
Lead	ICP-AES	4	HCl/HNO3/HClO4/HF
Lithium	ICP-AES	2	HCl/HNO3/HClO4/HF
Magnesium	ICP-AES	.005%	HCl/HNO3/HClO4/HF
Manganese	ICP-AES	4	HCl/HNO3/HClO4/HF
Mercury	Cold vapor-AAS	.02	HNO3/NaCr2O7
Molybdenum	ICP-AES	2	HCl/HNO3/HClO4/HF
Neodymium	ICP-AES	4	HCl/HNO3/HClO4/HF
Nickel	ICP-AES	2	HCl/HNO3/HClO4/HF
Niobium	ICP-AES	4	HCl/HNO3/HClO4/HF
Phosphorus	ICP-AES	.005%	HCl/HNO3/HClO4/HF
Potassium	ICP-AES	.01%	HCl/HNO3/HClO4/HF
Scandium	ICP-AES	2	HCl/HNO3/HClO4/HF
Selenium	AAS, hydride	.1 and .4	HCl/HNO3/HClO4

Table 5. Methods and lower limits of determination for major and minor elements in streambed sediment, Yakima River Basin, Washington, 1987-91—Continued

Element	Method of determination	Lower limit of determination	Decomposition method[1]
Silver	ICP-AES	2	HCl/HNO3/HClO4/HF
Sodium	ICP-AES	.005%	HCl/HNO3/HClO4/HF
Strontium	ICP-AES	2	HCl/HNO3/HClO4/HF
Sulfur	Titration	.01% and .05%	Combustion
Thorium	ICP-AES	4	HCl/HNO3/HClO4/HF
Tin	ICP-AES	5 and 10	HCl/HNO3/HClO4/HF
Titanium	ICP-AES	.005%	HCl/HNO3/HClO4/HF
Uranium	Fluorimetry	.05	Partial HNO3
Uranium	ICP-AES	100	HCl/HNO3/HClO4/HF
Vanadium	ICP-AES	2	HCl/HNO3/HClO4/HF
Ytterbium	ICP-AES	1	HCl/HNO3/HClO4/HF
Yttrium	ICP-AES	2	HCl/HNO3/HClO4/HF
Zinc	ICP-AES	2	HCl/HNO3/HClO4/HF

[1]For a complete description of the method of determination used, see Arbogast,1990.

[2]Prior to analysis by ICP-AES, an organo-metallic halide extraction that had a lower limit of determination of 0.5 µg/g was used on samples collected in 1991.

Geochemistry Laboratory in Denver, Colorado, for chemical analysis.

The digested residues were dissolved in dilute nitric acid using the following procedure. To each vial, 0.5 mL of 16-molar nitric acid and 0.05 mL of hydrogen peroxide were added, and the solution was warmed to 100°C for 5 minutes. The samples were removed from the heat and 4.5 mL of 1-percent nitric acid were added to each vial before allowing the sample to cool.

Chemical analysis of the various samples were performed using inductively coupled plasma-optical emission spectroscopy (ICP-OES), and inductively coupled plasma-mass spectroscopy (ICP-MS) according to methods described by Arbogast (1990). The major and minor elements determined for suspended sediment along with the method of determination (ICP-OES or ICP-MS) and lower limits of determination are listed in table 6 of this report.

At the USGS WRD National Water-Quality Laboratory in Arvada, Colorado, suspended organic-carbon samples were processed and analyzed according to wet- oxidation method number 0-7100-83, described by Wershaw and others (1987). In general, samples were acidified, purged to remove inorganic carbon, and then oxidized with persulfate. The carbon dioxide that resulted from the oxidation was then measured by nondispersive infrared spectrometry.

Filtered and Unfiltered Water

At the USGS WRD National Water-quality Laboratory in Arvada, Colorado, filtered- and unfiltered-water samples were analyzed for major and minor elements according to methods of Fishman and Friedman (1989). A small suite of elements (cadmium, chromium, copper, and lead) for filtered water was determined by atomic absorption spectroscopy in conjunction with a graphite furnace (AAGF) containing a graphite platform. For unfiltered water, AAGF was used for cadmium, lead, nickel, and silver. This method of analysis routinely was used for fixed sites because the lower limits of determination fall within a concentration range to which aquatic biota are sensitive. With AAGF, lower limits of determination for filtered water ranged from 0.1 to 0.5 µg/L (micrograms per liter). For unfiltered water, the lower limits of determination for AAGF ranged from 1 to 5 µg/L. A larger suite of major

Table 6. Methods and lower limits of determination for major and minor elements in suspended sediment, Yakima River Basin, Washington, 1987-90

[All concentrations are reported in micrograms per gram (µg/g), unless otherwise noted; ICP-OES = inductively coupled plasma-optical emission spectroscopy; ICP-MS = inductively coupled plasma-mass spectroscopy; mg/L = milligrams per liter]

Element	Method of determination[1]	Lower limit of determination
Aluminum	ICP-OES	0.01 percent
Antimony	ICP-MS	.1
Arsenic	ICP-MS	.1
Beryllium	ICP-OES	2
Cadmium	ICP-MS	.1
Calcium	ICP-OES	.01 percent
Carbon, organic	Infrared	.1 mg/L
Chromium	ICP-OES	2
Cobalt	ICP-OES	2
Copper	ICP-OES	2
Iron	ICP-OES	.01 percent
Lead	ICP-MS	.1
Magnesium	ICP-OES	.01 percent
Manganese	ICP-OES	8
Molybdenum	ICP-MS	.1
Nickel	ICP-OES	4
Phosphorus	ICP-OES	.01 percent
Potassium	ICP-OES	.10 percent
Silver	ICP-MS	.1
Sodium	ICP-OES	.01 percent
Thallium	ICP-MS	.1
Titanium	ICP-OES	.01 percent
Vanadium	ICP-OES	4
Zinc	ICP-OES	4

[1]For a complete description of the method of determination used, see Wershaw and others, 1987, for organic carbon; or Fishman and Friedman, 1989, for all other elements.

Table 7. Methods and lower limits of determination for major and minor elements in filtered water, Yakima River Basin, Washington, 1987-90

[The term "filtered water" is an operational definition referring to the chemical analysis of that portion of a water-suspended sediment sample that passes through a nominal 0.45-micrometer filter; all concentrations are reported in micrograms per liter (µg/L), unless otherwise noted; for some elements, the lower limit of determination was raised, thus, two values are reported; AES = atomic emission spectroscopy; d-c = direct current; AAS = atomic absorption spectroscopy; ICP = inductively coupled plasma; AAGF = atomic absorption spectroscopy with graphite furnace; mg/L = milligrams per liter]

Element	Method of determination	Lower limit of determination	Method number[1]
Aluminum	AES, d-c plasma	10	I-1054-86
Antimony	AAS, hydride	1	I-1055-85
Arsenic	AAS, hydride, automated	1	I-2062-85
Barium	AES, ICP	2	I-1472-85
Beryllium	AES, ICP	.5	I-1472-85
Boron	AES, d-c plasma	10	I-1114-86
Bromide	Colorimetric, fluorescein, automated-segmented flow	.01 mg/L	I-2129-85
Cadmium	AAGF	.1 and .2	I-1137-85
Cadmium	AES, ICP	1	I-1472-85
Carbon, organic	Infrared	.1 mg/L	0-1100-83
Chromium	AAGF	.5	I-1235-85
Chromium	AES, ICP	5 and 10	I-1472-87
Cobalt	AES, ICP	3	I-1472-85
Copper	AAGF	.5	I-1272-85
Copper	AES, ICP	10	I-1472-85
Cyanide	Colorimetry, barbituric acid, auto	.01 mg/L	I-2302-85
Iron	AES, ICP	3	I-1472-85
Lead	AAGF	.5	I-1401-85
Lead	AES, ICP	10	I-1472-85
Lithium	AES, ICP	4	I-1472-85
Manganese	AES, ICP	1	I-1472-85
Mercury	AAS, flameless automated-sequential	.1	I-2462-85
Molybdenum	AES, ICP	10	I-1472-85
Nickel	AES, ICP	10	I-1472-88
Selenium	AAS, hydride, automated	1	I-2667-85
Silver	AES, ICP	1	I-1472-85
Strontium	AES, ICP	.5	I-1472-85
Vanadium	AES, ICP	6	I-1472-85
Zinc	AES, ICP	3	I-1472-85

[1]For a more complete description of the method of determination used, see Wershaw and others, 1987, for organic carbon; or Fishman and Friedman, 1989, for all other elements.

Table 8. Methods and lower limits of determination for major and minor elements in unfiltered water, Yakima River Basin, Washington, 1987-90

[The term "unfiltered water" refers to the chemical analysis of a water sample that has not been filtered or centrifuged, nor in any way altered from the original matrix; all concentrations are reported in micrograms per liter (µg/L); for some elements, the lower limit of determination was raised, thus, two values are reported; AES = atomic emision spectroscopy; d-c = direct current; AAS = atomic- bsorption spectroscopy; AAGF = atomic absorption spectroscopy with graphite furnace]

Element	Method of determination	Lower limit of determination	Method number[1]
Aluminum	AES, d-c plasma	10	I-3054-86
Barium	AAS, direct	100	I-3084-85
Beryllium	AAS, direct	10	I-3095-85
Boron	AAS, d-c plasma, direct	10	I-3114-86
Cadmium	AAGF	1	I-3138-89
Chromium	d-c plasma, direct	1	I-3229-87
Copper	AAS, direct	10	I-3270-85
Iron	AAS, direct	10	I-3381-85
Lead	AAGF	1 and 5	I-3403-89
Manganese	AAS, direct	10	I-3454-85
Mercury	AAS, flameless	.1	I-3462-85
Molybdenum	AAS, chelation-extraction	1	I-3490-85
Nickel	AAGF	1	I-3503-89
Silver	AAGF	1	I-3724-85
Zinc	AAS, direct	10	I-3900-85

[1]For a complete description of the method of determination used, see Fishman and Friedman, 1989.

and minor elements in filtered water, which include aluminum, antimony, barium, beryllium, nickel, selenium, silver, and zinc, was determined simultaneously on a single sample by inductively coupled plasma (ICP). This method of analysis also was used periodically for fixed sites during 1987 at the frequency described earlier for unfiltered-water sample collection, and during the synoptic surveys in July and November 1987. With ICP, lower limits of determination for the element suite typically range from 1 to 10 µg/L. A complete list of lower limits of determination, method numbers, and element suites are shown in table 7 for filtered water and table 8 for unfiltered water.

Organic carbon in filtered-water samples was processed and analyzed at the USGS WRD National Water-quality Laboratory in Arvada, Colorado, according to wet-oxidation method number 0-1100-83, described by Wershaw and others (1987). In general, samples were acidified, purged to remove inorganic forms of carbon, and then oxidized with persulfate. The carbon dioxide that resulted from the oxidation was then measured by nondispersive infrared spectrometry.

Aquatic Biota

Samples collected in 1989

Samples collected for tissue analysis in 1989 were analyzed for major and minor elements by the Environmental Trace Substances Research Center in Columbia, Missouri, which is a contract lab for the USFWS. All tissue samples were homogenized. Percent moisture was determined from the difference between wet weight (determined in the field) and dry weight. For

animal samples of sufficient size, an aliquot of the sample was weighed and then dried in an oven at 103-105°C. For smaller samples, percent moisture was determined from weight loss after freeze-drying. For chemical analyses, the homogenized sample was frozen, and later an aliqout of the sample was freeze-dried, weighed, and further homogenized in a blender or mixer mill with a tungston-carbide vial and balls. Tissue samples to be analyzed for all elements except mercury were digested in a hot nitric-perchloric acid reflux. Samples for mercury analysis were digested in a hot nitric acid reflux, and diluted to 50 mL with 1-percent hydrochloric acid. Mercury was determined by cold-vapor AAS, and arsenic and selenium were determined by hydride-generation AAS. All other elements were determined by ICP (see Appendix for a more complete description of methods of determination used).

Samples collected in 1990 and 1991

Tissue samples collected in 1990 were submitted to the USGS WRD Laboratory in Menlo Park, California, for analysis. There, samples were further prepared and analyzed for all elements except arsenic, mercury, and selenium. Samples for arsenic, mercury, and selenium were homogenized and dried in the Menlo Park Laboratory and then shipped to the USGS WRD Laboratory in Atlanta, Georgia, for analysis.

Prior to chemical analysis, aquatic-insect samples were thawed, rinsed free of debris with deionized water, and sorted to genus or species—based on descriptions in Merrit and Cummings (1984), Schefter and Wiggins (1986), and Alstad (1980). This level of taxonomic separation was not performed on samples collected in 1989. Samples were only differentiated as “caddisfly”, “stonefly”, or “mayfly”. All identifications were based on characteristics of the nymph and larva. Species identifications were difficult without additional information from the pupa or adult. In this report, species identifications (for example, *Hydropsyche* spp.) should, therefore, be considered “tentative.” At most sites, enough specimens were collected for replicate samples. Individuals of the same taxon were composited to obtain a sample with a total dry weight of at least 100 mg. This sample was analyzed by ICP.

The livers of fish and soft tissues of clams were freeze-dried and then homogenized on a Spex 8000 mixer/mill in polystyrene vials and methacrylate balls. Subsamples of the homogenate were analyzed by ICP or by hydride-generation AAS (arsenic, mercury, and selenium only). Subsamples destined to be analyzed by hydride-generation AAS were packaged and shipped to the USGS WRD Laboratory in Atlanta, Georgia.

Whole fish (sculpins) were partially thawed and then homogenized in a Warring blender equipped with a 1-quart glass container and stainless-steel blades. A small volume (50-100 mL) of deionized water was added to the sample to form a slurry during homogenization. The sample slurry was poured into pre-cleaned, acid-washed, polypropylene, Nalgene jars and immediately frozen at -10°C. Subsequently, the samples were freeze-dried, packaged, and shipped to the USGS WRD Laboratory in Atlanta, Georgia, for determination of arsenic, mercury, and selenium. The glass container, stainless-steel blades, and lid of the blender used for homogenization were thoroughly rinsed between samples with deionized water. Overnight, the container, blades, and lid were soaked in RBS 35 cleaning agent and then rinsed with deionized water.

All 1990 samples that were analyzed by ICP at the USGS WRD Laboratory in Menlo Park, California, were put into either 20-mL vials or 125-mL Erlenmeyer flasks, and then digested on a hot plate using reflux in subboiling, 16-normal (N) nitric acid. The digestion was considered complete when the acid solution turned clear. Following digestion, the acid was evaporated. The residue was allowed to cool, and was reconstituted in 4-10 mL of 0.6-N hydrochloric acid. The sample solution was filtered (0.45 µm) and then analyzed using a Thermo-Jarrell-Ash ICP-61.

At the USGS WRD Laboratory in Atlanta, Georgia, samples to be analyzed for selenium were digested using a mixed acid attack. Concentrated nitric, hydrochloric, hydrofluoric, and perchloric acids were heated on a hot plate in open Teflon beakers at a temperature of 200°C to near dryness,

and then diluted to 50 mL in 5-percent nitric acid. Analysis for selenium was performed by hydride-generation AAS. Samples to be analyzed for mercury were digested using LeForte aqua regia (3:1 concentrated nitric to hydrochloric acids) and heated in 125-mL Erlenmeyer flasks at approximately 125°C for about 90 minutes; 5 mL of 5-percent potassium chromate was added, and the resulting solution was diluted to 50 mL with deionized water. Cold-vapor AAS was used to determine mercury. Samples to be analyzed for arsenic were digested with a 4:1:1 mixture of concentrated nitric, perchloric, and sulfuric acids and heated to near dryness at 270°C in open glass beakers. Then the samples were diluted to 50 mL in 5-percent nitric acid. Arsenic concentrations were determined by hydride-generation AAS. In all cases, 0.5000 grams of sample was used making the final dilution factor 100:1.

In 1991, fish-muscle samples were submitted to the USGS WRD Laboratory in Atlanta, Georgia, where tissue samples were analyzed for mercury by the same procedure as outlined above.

Quality-Control Samples

Quality-control data for replicates, spikes, standard reference materials, and blanks are included in this report for suspended sediment, water, and aquatic biota. Most streambed-sediment quality-control data are listed in Sanzolone and Ryder (1989) and Fuhrer and others (1993), but replicate-sample results are listed along with streambed-sediment data in this report. The accuracy of filtered-water or aquatic-biota analyses may be assessed by analyzing standard reference samples (samples having known chemical concentrations) that are listed in tables 9-12. Spikes (samples which had a known concentration—a spike—added to the original concentration) can be used to measure the analyzing laboratory's ability to recover element concentrations. Results of spiked samples of filtered water or aquatic biota are listed in tables 13 and 14.

Precision can be assessed for suspended-sediment or filtered-water samples by analyzing the replicate samples (samples thought to be essentially identical in composition) listed in tables 15-16. The precision of aquatic-biota analyses can be assessed by analyzing results of replicate, duplicate, and split-tissue samples included along with the biological data (tables 30-35, at back of report). For aquatic biota, replicate samples were collected from the same species and tissue medium (for example, liver or whole fish) on the same day at a given site. Duplicate samples of fish muscle were collected in the field from the same fish—one sample was a composite of muscle from the right side of the fish, and the duplicate sample was a composite of muscle from the left side. Split samples of aquatic biota consisted of a single sample that was split into two in the laboratory, and then analyzed separately.

Procedural blanks were analyzed to determine the level of contamination from sampling equipment, sample processing, and laboratory analysis. Results of laboratory blanks for aquatic biota and water are listed in tables 17 and 18. For aquatic biota, blanks were digested, diluted, and analyzed like tissue samples were, but no tissue was actually present in the solution that was analyzed (table 17). While analyzing the blank, if the concentration reported for the blank sample was greater than the detection limit of the analyzing instrument, tissue-sample results were adjusted by the concentration of the blank. This adjustment was made prior to the conversion of sample concentrations to micrograms per gram. The laboratory-blank solutions for water samples consisted of deionized water that presumably was free of target elements. These solutions were not exposed to sample collection and processing equipment, but were analyzed in the same manner that filtered-water samples were normally analyzed (see "Methods of Determination" section of this report).

For 1990 aquatic-biota samples analyzed by ICP at the USGS WRD Laboratory in Menlo Park, California, a quality-control standard made up of a similar sample matrix was analyzed to check for internal drift within the machine. If the concentration of elements failed to fall within 5 percent of the actual concentration of the standard, the machine was re-standardized and re-profiled. Limits of determination and limits of quantification were

Table 9. Standard reference samples used for evaluating the accuracy of laboratory analyses of major and minor elements in filtered water, Yakima River Basin, Washington, 1987-89

[The term “filtered water” is an operational definition referring to the chemical analysis of that portion of a water-suspended sediment sample that passes through a nominal 0.45-micrometer filter; all element concentrations are reported in micrograms per liter (µg/L); "--" = not determined; "<" = less than]

Element	Laboratory results	Standard reference sample	
		Expected results	Standard deviation
	November 6, 1987[1]		
Aluminum	130	126	42
Barium	97	98	12
Boron	410	367	101
Cadmium	17	16.3	2.3
Chromium	24	26	4.3
Cobalt	4	6.3	2.6
Copper	20	16.3	1.5
Iron	110	100	9
Lead	20	15	3.7
Lithium	47	47.7	7.7
Manganese	31	35.7	3.6
Molybdenum	30	35.7	3.6
Nickel	20	15.2	5.8
Silver	6	7	1.8
Strontium	520	514	19
Vanadium	6	7.2	1.3
	March 9, 1988[2]		
Cadmium	.3	.24	--
Copper	1.6	1.0	--
Lead	1.0	1.0	--
Mercury	.6	.67	--
	May 11, 1988[2]		
Cadmium	<.1	.24	--
Copper	1.3	1.0	--
Lead	<.5	1.0	--
Mercury	.9	.49	--

Table 9. Standard reference samples used for evaluating the accuracy of laboratory analyses of major and minor elements in filtered water, Yakima River Basin, Washington, 1987-89—Continued

Element	Laboratory results	Standard reference sample	
		Expected results	Standard deviation
October 14, 1988[1]			
Cadmium	32	16.3	2.3
Copper	15	16.8	2.5
Lead	14	15.	3.7
Mercury	.7	.9	.2
March 11, 1989[1]			
Cadmium	17	16.3	.06
Copper	14	16.8	.08
Lead	15	15	1.2
Mercury	1.7	.9	.1
May 4, 1989[3]			
Arsenic	2	1.6	--
Chromium	1.5	2.8	--
Copper	2.7	2.2	--
Lead	1.7	2.0	--
Mercury	<.1	.14	--
Zinc	20	19.8	--
August 10, 1989[3]			
Cadmium	<.1	.163	--
Copper	<.5	.168	--
Lead	<.5	.150	--
Mercury	.01	.01	--

[1]U.S. Geological Survey (USGS) standard reference water sample T97 was used for analysis.
[2]U.S. Environmental Protection Agency reference sample TM1 was diluted with distilled-deionized water from the USGS laboratory in Portland, Oregon, and then used for analysis.
[3]U.S. Geological Survey standard reference water sample T97 was diluted with distilled-deionized water from the USGS laboratory in Portland, Oregon, and then used for analysis.

Table 10. Standard reference tissue samples used for evaluating the accuracy of laboratory analyses of major and minor elements in aquatic biota, Yakima River Basin, Washington, 1989

[All concentrations are reported in micrograms per gram (µg/g), dry weight; 1989 standard reference sample codes are in parentheses; "--" = not determined; N/A = not available; "<" = less than]

Element	Laboratory results — Sampling			Standard reference tissue sample	
	May 1989	October 1989	November 1989	Expected results	Standard deviation
Dogfish muscle (DORM-1)[1]					
Arsenic	15	14	14	17.7	2.1
Cadmium	.2	<.2	<.3	.086	.012
Chromium	3.2	3.6	3.2	3.60	.40
Copper	5.0	4.1	4.3	5.22	.33
Iron	75	60	62	63.6	5.3
Lead	< 4	< 4	< 4	.4	.12
Magnesium	1,190	1,190	1,200	1,210	130
Manganese	1.4	1.6	1.2	1.32	.26
Mercury	.835	.839	.891	.798	.074
Nickel	2	< 2	< 2	1.20	.30
Selenium	1.3	1.6	1.6	1.62	.12
Zinc	21	17	18	21.3	1.0
Orchard leaves (NBS 1571)[2]					
Arsenic	10	9.3	--	10	2
Barium	41.3	42.2	--	44	N/A
Beryllium	<.1	<.1	--	.027	.01
Boron	25	24	--	33	3
Cadmium	<.2	< 0.3	--	0.11	.01
Chromium	2	2	--	2.6	.3
Copper	10	10	--	12	1
Iron	226	209	--	270	20
Lead	39	34	--	45	3
Magnesium	5,160	5,400	--	6,200	200
Manganese	77.7	75.7	--	91	4
Mercury	.15	.13	--	.155	.015
Moybdenum	<1	<1	--	.3	.1
Nickel	1	<2	--	1.3	.2
Selenium	<.1	<.1	--	.08	.01
Strontium	32	33	--	37	1
Zinc	23	20	--	25	3

[1]Standard reference sample source: National Research Council of Canada, Institute for Environmental Chemistry, Ottawa, Ontario.

[2]Standard reference sample source: National Bureau of Standards (NBS), Georgia.

Table 11. Standard reference tissue samples used for evaluating the accuracy of laboratory analyses of major and minor elements in aquatic biota, Yakima River Basin, Washington, 1990

[All concentrations are reported in micrograms per gram (µg/g), dry weight]

	Laboratory results [1]		Standard reference tissue sample [2]		
Element	Mean	Standard deviation	Expected value	Standard deviation	Percent recovery
Cadmium	4.15	0.38	3.74	0.21	111
Chromium	1.43	.46	1.11	.22	129
Copper	66.3	4.3	60.6	4	109
Iron	539	15	451	23	120
Lead	.371	.014	.394	.04	94
Manganese	12.3	1.5	10.53	.63	117
Nickel	.25	.44	1.89	.33	119
Silver	.32	.16	1.68	.15	79
Vanadium	.68	.15	3.98	.28	118
Zinc	830	57	700	40	119

[1]Means and standard deviations reported are based on eight replicate samples.
[2]Oyster tissue (reference sample code NIST 1566a) was obtained from the National Institute of Standards and Technology, Georgia.

Table 12. Standard reference tissue samples used for evaluating the accuracy of laboratory analyses of mercury in fish muscle, Yakima River Basin, Washington, 1991

[All concentrations are reported in micrograms per gram (µg/g), dry weight; "--" = not determined]

Reference-sample code	Reference-sample name	Laboratory results	Standard reference tissue sample		
			Expected value	Standard deviation	Range
DOLT-1[1]	Dogfish liver	0.36	0.23	0.04	--
DORM-1[1]	Dogfish muscle	.67	.80	.07	--
TORT-1[1]	Lobster hepatopancreas	.24	.33	.06	--
MA-A-1-TM[2]	Copepod homogenate	.22	.27	--	0.24 - 0.32
MA-A-2-TM[2]	Fish flesh homogenate	.50	.47	--	.45 - .49
MA-B-3-TM[2]	Lyophilised fish tissue	.48	.51	--	.47 - .61

[1]Standard reference sample source: National Research Council of Canada, Institute for Environmental Chemistry, Ottawa, Ontario.
[2]Standard reference sample source: International Atomic Energy Agency, Analytical Quality Control Service, Vienna, Austria.

Table 13. Spiked water sample used for evaluating the laboratory's ability to recover minor-element concentrations in filtered water collected from the Yakima River at Kiona, Yakima River Basin, Washington, September 28, 1989

[The term “filtered water” is an operational definition referring to the chemical analysis of that portion of a water-suspended-sediment sample that passes through a nominal 0.45-micrometer filter; all concentrations are reported in micrograms per liter (µg/L); water was spiked from two to three times the concentrations normally measured at the site; for calculation of the spiked cadmium concentration, <0.1 µg/L was assumed to be 0.05 µg/L]

Element	Non-spiked sample concentration	Spiked-sample concentration	Percent recovery
Cadmium	<0.1	6.7	120
Copper	.8	7.7	122
Lead	.7	5.8	104

Table 14. Spiked tissue samples used for evaluating the laboratory's ability to recover major- and minor-element concentrations in aquatic biota collected from the Yakima River Basin, Washington, 1989

[All concentrations are reported in micrograms per gram (µg/g), dry weight; sampling sites are listed in brackets; "**" = spike concentration added was less than 50 percent of the non-spiked sample concentration, and, therefore, too low for a valid percent recovery; RM = river mile;"---" = order not reported; "--" = not determined; "<" = less than; organism taxa are listed in the table as follows: Order (common name)

Family

Genus species]

Element	Non-spiked sample concentration	Spiked-sample concentration	Percent recovery	Non-spiked sample concentration	Spiked-sample concentration	Percent recovery
			May 1989			
	Plecoptera (stoneflies) [Umtanum Creek near mouth at Umtanum]			Attached algae (unidentified [Jungle Creek near mouth near Cle Elum]		
Aluminum	538	645	**	2,920	3,060	**
Arsenic	.4	99	100	--	--	--
Barium	9.3	29.5	101	33.1	80.0	97
Beryllium	<.1	10.5	105	<.2	24	99
Boron	< 2	180	90	<5	380	79
Cadmium	<.2	19	95	<.5	45	93
Chromium	<1	95	95	5	230	93
Copper	19	218	100	18	482	96
Iron	842	2,720	94	5,000	9,520	94
Lead	<4	100	100	<10	240	99
Magnesium	2,070	3,020	**	2,470	4,730	94
Manganese	74.7	167	92	99.3	332	96
Mercury	.094	2.27	109	--	--	--
Moybdenum	<1	100	100	<3	240	99
Nickel	<1	100	100	4	240	98
Selenium	2.4	99	97	<.2	230	95
Silver	<2	38	95	<5	92	95
Strontium	24	44	100	25	71	95
Thallium	<6	99	99	<10	240	99
Vanadium	2.6	22	97	8.7	53	92
Zinc	143	515	93	29	941	94

Table 14. Spiked tissue samples used for evaluating the laboratory's ability to recover major- and minor-element concentrations in aquatic biota collected from the Yakima River Basin, Washington, 1989—Continued

Element	Non-spiked sample concentration	Spiked-sample concentration	Percent recovery	Non-spiked sample concentration	Spiked-sample concentration	Percent recovery
			October-November 1989			
	Cypriniformes (largescale sucker) Catostomidae *Catostomus macrochelius* [Toppenish Creek at Indian Church Road near Granger]			Cypriniformes (carp) Cyprinidae *Cyprinus carpio* [Yakima River at RM 72 above Satus Creek near Sunnyside]		
Aluminum	<3	200	104	16	220	104
Arsenic	<.2	100	102	<.2	95	97
Barium	<.1	19.5	101	.2	20.3	102
Beryllium	<.1	10.4	108	<.1	10.4	106
Boron	<2	170	88	<2	160	81
Cadmium	<.2	19	99	.79	20.6	101
Chromium	<1	93	97	<1	94	96
Copper	19	208	98	103	296	98
Iron	429	2,260	95	548	2,390	94
Lead	<4	91	95	<4	95	97
Magnesium	608	1,560	99	552	1,490	95
Manganese	6.8	98.9	96	5.1	100	96
Mercury	.33	2.35	101	.38	2.37	100
Moybdenum	<1	96	100	<1	98	100
Nickel	<2	96	100	<2	98	100
Selenium	2.9	98	97	4.2	99	98
Silver	<2	39	101	3	43	102
Strontium	.2	19.1	98	.49	19.4	96
Thallium	<6	98	102	<6	100	102
Vanadium	.6	20	101	1.3	20	95
Zinc	87.9	452	95	890	1,270	**

Table 14. Spiked tissue samples used for evaluating the laboratory's ability to recover major- and minor-element concentrations in aquatic biota collected from the Yakima River Basin, Washington, 1989—Continued

Element	Non-spiked sample concentration	Spiked-sample concentration	Percent recovery	Non-spiked sample concentration	Spiked-sample concentration	Percent recovery
			October-November 1989			
	Veneroida (Asiatic clam) Corbiculidae *Corbicula fluminea* [Yakima River at Euclid Bridge at RM 55 near Grandview]			Trichoptera (caddisflies) [Sulphur Creek Wasteway near Sunnyside]		
Aluminum	17	220	105	4,750	4,940	**
Arsenic	5.8	100	97	--	--	--
Barium	5.2	24.9	102	132	155	**
Beryllium	<.1	10.7	111	.3	12	101
Boron	<2	170	88	<2	210	90
Cadmium	.3	20.2	103	<.2	22	95
Chromium	2	97	98	8.8	120	96
Copper	33.2	228	101	19	245	97
Iron	191	2,020	95	9,060	11,100	**
Lead	<4	96	99	5	110	90
Magnesium	660	1,620	99	2,500	3,560	**
Manganese	14	110	99	2,790	2,850	**
Mercury	.15	2.12	99	--	--	--
Moybdenum	<1	96	99	<2	110	95
Nickel	<2	99	103	6.7	120	97
Selenium	2.3	95	96	--	--	--
Silver	<2	39	101	<2	36	77
Strontium	8.3	26.9	96	18.5	40.6	95
Thallium	<6	97	100	<8	100	86
Vanadium	.5	19	96	36	58.3	96
Zinc	93.4	466	97	111	530	90

Table 14. Spiked tissue samples used for evaluating the laboratory's ability to recover major- and minor-element concentrations in aquatic biota collected from the Yakima River Basin, Washington, 1989—Continued

Element	Non-spiked sample concentration	Spiked-sample concentration	Percent recovery	Non-spiked sample concentration	Spiked-sample concentration	Percent recovery
			October-November 1989			
	Trichoptera (caddisflies)			--- (waterweed) Hydrocharitaceae *Elodea* sp.		
	[Satus Creek at gage at Satus]			[Satus Creek at gage at Satus]		
Aluminum	4,140	4,340	**	2,070	2,250	**
Barium	146	168	**	72.9	91.2	**
Beryllium	.3	11	104	<.1	10.0	105
Boron	<2	180	87	5	180	92
Cadmium	<.2	20	97	<.3	19.0	100
Chromium	10	110	97	3.8	94	95
Copper	16	216	97	18	201	96
Iron	10,100	12,000	**	3,190	4,890	89
Lead	<4	99	96	<4	91	96
Magnesium	2,230	3,200	**	2,910	3,780	**
Manganese	4,120	4,180	**	2,840	2,870	**
Moybdenum	<2	100	97	<1	93	98
Nickel	13	110	94	17	110	98
Silver	<2	32	78	<2	27	71
Strontium	15.5	35.3	96	45.6	63.5	**
Thallium	<7	94	91	<9	95	100
Vanadium	32	51.8	96	15	34	100
Zinc	95.5	466	90	60.5	404	90

Table 15. Replicate analyses of organic carbon in filtered water and in suspended sediment, Yakima River Basin, Washington, 1988-90

[The term “filtered water” is an operational definition referring to the chemical analysis of that portion of a water-suspended-sediment sample that passes through a nominal 0.45-micrometer filter; all concentrations are reported in milligrams per liter (mg/L); each sample replicate was made from a single water sample; "--" = not determined; "<" = less than]

Station number	Site name	Date	Laboratory results	
	Organic carbon in filtered water			
12479500	Yakima River at Cle Elum	08-09-89	3.2	1.1
12500450	Yakima River above Ahtanum Creek at Union Gap	01-14-88	1.6	1.6
12500450	Yakima River above Ahtanum Creek at Union Gap	01-19-90	2.2	2.1
12508850	Sulphur Creek Wasteway near Sunnyside	09-18-89	2.3	2.1
12510500	Yakima River at Kiona	07-21-88	2.2	2.2
12510500	Yakima River at Kiona	07-20-89	2.3	2.4
12510500	Yakima River at Kiona	03-15-90	2.0	2.1
	Organic carbon in suspended sediment			
12479500	Yakima River at Cle Elum	08-09-89	.1	.1
12500450	Yakima River above Ahtanum Creek at Union Gap	01-14-88	.3	--
12500450	Yakima River above Ahtanum Creek at Union Gap	01-19-90	.1	.1
12508850	Sulphur Creek Wasteway near Sunnyside	09-18-89	.7	.9
12510500	Yakima River at Kiona	07-21-88	.7	.8
12510500	Yakima River at Kiona	07-20-89	.2	.7
12510500	Yakima River at Kiona	03-15-90	<.1	.2

Table 16. Replicate filtered-water samples analyzed for major and minor elements, Yakima River Basin, Washington, 1987-90

[All element concentrations are reported in micrograms per liter (µg/L); each sample replicate was made from a single water sample; "--" = not determined; "<" = less than]

	Laboratory results for replicate samples collected on the following dates													
	07/16/87		08/20/87		11/05/87		03/16/88		07/21/88		08/15/89		03/16/90	
	Sample number													
Element	1	2	1	2	1	2	1	2	1	2	1	2	1	2
Aluminum	--		--		<10	<10	--		--		--		--	
Arsenic	--		--		<10	<10	--		--		--		--	
Barium	--		29	29	79	77	--		--		--		--	
Beryllium	--		<.5	<.5	<.5	<.5	--		--		--		--	
Boron	--		--		40	40	--		--		--		--	
Cadmium	<0.1	<.1	<.1	<.1	<1.0	<1.0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Chromium	--		<.5	<.5	<5.0	<5.0	--		--		--		--	
Cobalt	--		<3	<3	<3	<3	--		--		--		--	
Copper	.6	.8	1.2	1.1	<10	<10	1.1	.7	1.2	2.3	1.1	1.0	<1	1
Iron	--		15	15	20	18	--		--		--		--	
Lead	< .5	<.5	<.5	<.5	<10	<10	<.5	<.5	<.5	<.5	<.5	<.5	<1	<1
Lithium	--		<4	<4	9	7	--		--		--		--	
Manganese	--		3	3	110	110	--		--		--		--	
Mercury	--		<.1	<.1		--	<.1	<.1	<.1	<.1	--		--	
Molybdenum	--		<10	<10	<10	<10	--		--		--		--	
Nickel	--		<10	<10	<10	<10	--		--		--		--	
Silver	--		<1	2	1	<1	--		--		--		--	
Strontium	--		150	150	330	330	--		--		--		--	
Vanadium	--		8	8	21	21	--		--		--		--	
Zinc	--		7	<3	5	<3	--		--		--		--	

Table 17. Blanks used to measure major and minor elements that are associated with the chemical-extraction procedure of tissue in aquatic biota, Yakima River Basin, Washington, 1989

[All concentrations are reported in micrograms (µg); blanks represent major- and minor-element concentrations that are detected in the chemical reagents, dilution water, and general tissue-extraction procedure; blanks were digested, diluted, and analyzed like tissue samples were, but no tissue was actually present in the solution that was analyzed; 1989 aquatic-biota data was blank adjusted (by the mass of elements listed below) prior to the conversion of concentrations to micrograms per gram (µg/g, dry weight); "<" = less than]

	May 1989 sampling		October-November 1989 sampling				
Element	Blank 1	Blank 2	Blank 1	Blank 2	Blank 3	Blank 4	Blank 5
Aluminum	<2	2	<2	<2	<2	<2	<2
Arsenic	<.1	<.05	<.1	<.1	<.08	<.08	<.08
Barium	<.05	<.05	<.05	<.05	<.05	<.05	<.05
Beryllium	<.05	<.05	<.05	<.05	<.05	<.05	<.05
Boron	<1	<1	<1	<1	<1	<1	<1
Cadmium	<.1	<.1	<.1	<.1	<.1	<.1	<.1
Chromium	<.5	<.5	<.5	<.5	<.5	<.5	<.5
Copper	<.1	<.1	<.1	<.1	<.1	<.1	<.1
Iron	<.5	<.5	<.5	<.5	<.5	1	.6
Lead	<2	<2	<2	<2	<2	<2	<2
Magnesium	<.05	.24	<.05	<.05	<.05	<.05	<.05
Manganese	<.1	<.1	<.1	<.1	<.1	<.1	<.1
Mercury	<.003	<.003	<.004	<.004	<.003	<.003	<.003
Molybdenum	<.5	<.5	<.5	<.5	<.5	<.5	<.5
Nickel	<.6	<.6	<.8	<.8	<.8	<.8	<.8
Selenium	<.07	<.05	<.06	<.06	<.06	<.06	<.06
Silver	<1	<1	<1	<1	<1	<1	<1
Strontium	<.5	<.5	<.05	<.05	<.05	<.05	<.05
Thallium	<3	<3	<3	<3	<3	<3	<3
Vanadium	<.2	<.2	<.2	<.2	<.2	<.2	<.2
Zinc	.65	.67	.3	.34	.34	.3	.44

Table 18. Blank water determination for cadmium, copper, and lead, Yakima River Basin, Washington, July 13, 1989

[Blank water sample consisted of distilled-deionized water that was transferred from a polycarbonate carboy into a teflon-sample bottle, and preserved with ultra-pure nitric acid; all concentrations are reported in micrograms per liter (µg/L); "<" = less than]

Element	Laboratory results
Cadmium	<0.1
Copper	<.5
Lead	<.5

Table 19. Field blanks for minor elements associated with water-sampling equipment and field-processing techniques, Yakima River Basin, Washington, March 1989

[All element concentrations are reported in micrograms per liter (µg/L); rerun values are in parentheses; "filtered acidified blank" refers to a blank sample consisting of deionized water that was run through a sampler, transferred to a churn splitter, filtered into a linear polyethylene (LPE) bottle, and then preserved with nitric acid (blanks were replicated a few times at the Yakima River at Kiona sampling site); "deionized water unused" refers to the water left over in the original container of deionized water which was not used as rinse water; "deionized water rinse" refers to deionized water that was run through the sampler, transferred to the churn splitter, and then was used to rinse the filter and LPE-sample bottles prior to the collection of the filtered, acidified, blank samples; "<" = less than]

Sample description	Date	Cadmium	Copper	Lead	Nickel
Yakima River at Kiona					
Filtered acidified blank	03-23-89	<0.1 (0.1)	0.3 (0.3)	<0.3 (<.3)	0.2 (0.6)
Filtered acidified blank	03-23-89	<.1 (<.1)	.1 (<.1)	<.3 (<.3)	.1 (.5)
Filtered acidified blank	03-23-89	<.1 (<.1)	.1 (<.1)	<.3 (<.3)	.1 (<.1)
Filtered acidified blank	03-23-89	<.1 (<.1)	.1 (<.1)	<.3 (<.3)	.2 (<.1)
Deionized water unused	03-23-89	.1 (<.1)	.3 (.3)	<.3 (<.3)	.3 (<.1)
Deionized water rinse	03-23-89	.2 (.2)	1.6 (2.9)	2.5 (2.8)	.3 (.6)
Yakima River at Euclid Bridge at river mile 55 near Grandview					
Filtered acidified blank	03-22-89	<.1 (.1)	.9 (.8)	<.3 (<.3)	.4 (.4)
Deionized water unused	03-22-89	<.1 (<.1)	.9 (.2)	.3 (.4)	1.3 (<.1)

calculated by running a 0.6-N hydrochloric-acid blank 10 times consecutively. The absolute values for each element were averaged. The limit of determination is three times the standard deviation of the blank added to the average of the blank. The limit of quantitation, a value that has a high probability of being the actual concentration, was calculated by adding 10 times the standard deviation to the average. The linear working range was considered to be between the limit of detection and the limit of quantitation.

Methods used for analyzing filtered water have become more sensitive to contamination because of decreases in lower limits of determination. Because of this, field-processing methods and sampling equipment were evaluated by the USGS's Office of Water Quality (OWQ) to determine if they were a source of contamination to water samples analyzed at concentrations of parts per billion. Personnel from the Yakima NAWQA study participated in the preparation of two field-processing and equipment blanks for cadmium, copper, lead, and nickel in filtered-water samples (table 19). These elements were among a listing of elements derived by the USGS's OWQ that pose a risk of contamination to water samples processed using certain water-quality samplers and processing techniques (Dave Rickert, U.S. Geological Survey, written commun., 1991). Blanks (assayed deionized water) were run on the type of sampler and processing equipment used to collect water samples at fixed sites.

A second study was done by the USGS's OWQ (Dave Rickert, U.S. Geological Survey, written commun., 1992) to determine the potential for trace-element contamination from a variety of surface-water-quality samplers including the D-77 sampler. The USGS's OWQ concluded that the D-77 sampler with polyethylene-sample bottle may be suitable for trace-element sampling at the parts per billion level. Furthermore, specific cleaning techniques were recommended for sampling and processing equipment which included a detergent wash, tap-water rinse, acid soak/rinse, and several deionized-water rinses (Dave Rickert, U.S. Geological Survey, written commun., 1992). Cleaning procedures similar to these were used for sampling equipment used for the collection of samples at fixed sites (see "Sample Collection and Processing" section of this report).

Chemical determinations of major and minor elements in suspended-sediment samples can be used to determine the short-term variability (variation of element concentrations within a given day) of suspended-trace-element concentrations (table 20). Samples were collected in August 1987 and September 1988 (during the irrigation season) at five of the seven fixed sites. Four sites (Yakima River at Umtanum, Yakima River above Ahtanum Creek at Union Gap, Sulphur Creek Wasteway near Sunnyside, and Yakima River at Kiona) were sampled three times in a 24-hour period at 8-hour intervals. The fifth site, Yakima River at Euclid Bridge at river mile 55 near Grandview, also was sampled three times in a 24-hour period, but at 4-hour rather than 8-hour intervals.

STATISTICAL SUMMARIES

Statistical-summary tables list the percentiles and minimum and maximum values for major- and minor-element concentrations at fixed sites in the Yakima River Basin. Fixed sites include the Yakima River at Cle Elum (site 6), Yakima River at Umtanum (site 19), Naches River near North Yakima (site 26), Yakima River above Ahtanum Creek at Union Gap (site 32), Yakima River at Kiona (site 50), Sulphur Creek Wasteway near Sunnyside (site 52), and Yakima River at Euclid Bridge at river mile 55 near Grandview (site 56) [see fig. 1 for site locations].

In order to construct a statistical-summary table for element concentrations for aquatic biota, the tissue data base was modified so that the mean element concentration was used for sites where duplicate and triplicate measurements of a single species were taken. *Hydropsyche* species were treated slightly different. Multiple species were combined and reported under the single name of *Hydropsyche* spp. The *Hydropsyche* spp. and Asiatic clam tissue concentrations were normalized by calculating the logarithm of the element concentrations, taking the mean of these values, and then calculating the antilogarithm of the aggregated data. Thus, each site is represented by a single element concentration for each species analyzed. Due to the small number of stations summarized, only minimum, median, and maximum values are reported. Although aquatic biota were collected over the period 1989-91, the 1990 data are more comprehensive in the number of sites sampled and in utilizing methods of determination with low or sensitive limits of determination. As a result, the 1990 data are used primarily to describe the spatial distribution of trace elements, and data from other years are used to compliment the 1990 data.

Statistical-summary tables have been organized by sampling medium. Streambed-sediment data are listed in table 21; suspended-sediment data are in table 22; filtered-water data are in table 23; unfiltered-water data are in table 24; aquatic-biota data are in table 25.

ANALYTICAL DATA FOR MAJOR AND MINOR ELEMENTS IN SEDIMENT AND WATER, AND AQUATIC BIOTA

Analytical data has been organized by sampling medium. Streambed-sediment data are listed in table 26; suspended-sediment data are in table 27; filtered-water data are in table 28; unfiltered-water data are in table 29; and aquatic-biota data are in tables 30-36.

Table 20. Concentrations of major and minor elements in suspended sediment, showing short-term variability of element concentrations in samples collected from the Yakima River Basin, Washington, 1987-88

[All results are reported in micrograms per gram (µg/g), unless otherwise noted; RM = river mile; "--" = not determined; "<" = less than]

Station number	Site name	Date	Time	Laboratory results
	Discharge, in cubic feet per second			
12484500	Yakima River at Umtanum	09-21-88	1610	1,230
		09-22-88	0015	1,130
		09-22-88	0815	1,060
12500450	Yakima River above Ahtanum Creek at Union Gap	08-11-87	0800	2,790
		08-11-87	2246	3,510
		08-12-87	0630	3,440
12508850	Sulphur Creek Wasteway near Sunnyside	08-03-87	1220	224
		08-03-87	2010	197
		08-04-87	0430	203
12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	08-04-87	0820	1,178
		08-04-87	1235	1,168
		08-05-87	0433	1,236
12510500	Yakima River at Kiona	08-06-87	0010	1,145
		08-06-87	0750	1,154
		08-06-87	1608	1,154
	Surface area, in square meters per gram			
12484500	Yakima River at Umtanum	09-21-88	1610	30.0
		09-22-88	0015	35.1
		09-22-88	0815	29.1
12500450	Yakima River above Ahtanum Creek at Union Gap	08-11-87	0800	18.0
		08-11-87	2246	16.1
		08-12-87	0630	12.1
12508850	Sulphur Creek Wasteway near Sunnyside	08-03-87	1220	19.9
		08-03-87	2010	18.2
		08-04-87	0430	23.4
12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	08-04-87	0820	28.4
		08-04-87	1235	28.6
		08-05-87	0433	29.0
12510500	Yakima River at Kiona	08-06-87	0010	26.5
		08-06-87	0750	26.4
		08-06-87	1608	20.2
	Sediment, suspended, in milligrams per liter			
12484500	Yakima River at Umtanum	09-21-88	1610	22
		09-22-88	0015	42
		09-22-88	0815	--
12500450	Yakima River above Ahtanum Creek at Union Gap	08-11-87	0800	16
		08-11-87	2246	15
		08-12-87	0630	16
12508850	Sulphur Creek Wasteway near Sunnyside	08-03-87	1220	124
		08-03-87	2010	91
		08-04-87	0430	119
12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	08-04-87	0820	25
		08-04-87	1235	21
		08-05-87	0433	29
12510500	Yakima River at Kiona	08-06-87	0010	26
		08-06-87	0750	28
		08-06-87	1608	21

Table 20. Concentrations of major and minor elements in suspended sediment, showing short-term variability of element concentrations in samples collected from the Yakima River Basin, Washington, 1987-88—Continued

Station number	Site name	Date	Time	Laboratory results
	Percentage of sediment finer than 0.062 millimeters			
12484500	Yakima River at Umtanum	09-21-88	1610	86
		09-22-88	0015	84
		09-22-88	0815	--
12500450	Yakima River above Ahtanum Creek at Union Gap	08-11-87	0800	86
		08-11-87	2246	84
		08-12-87	0630	83
12508850	Sulphur Creek Wasteway near Sunnyside	08-03-87	1220	70
		08-03-87	2010	75
		08-04-87	0430	80
12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	08-04-87	0820	95
		08-04-87	1235	93
		08-05-87	0433	--
12510500	Yakima River at Kiona	08-06-87	0010	95
		08-06-87	0750	94
		08-06-87	1608	94
	Total suspended organic carbon, in milligrams per liter			
12484500	Yakima River at Umtanum	09-21-88	1610	0.7
		09-22-88	0015	.4
		09-22-88	0815	.6
12500450	Yakima River above Ahtanum Creek at Union Gap	08-11-87	0800	.1
		08-11-87	2246	.4
		08-12-87	0630	.5
12508850	Sulphur Creek Wasteway near Sunnyside	08-03-87	1220	--
		08-03-87	2010	--
		08-04-87	0430	--
12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	08-04-87	0820	.8
		08-04-87	1235	--
		08-05-87	0433	--
12510500	Yakima River at Kiona	08-06-87	0010	1.0
		08-06-87	0750	.5
		08-06-87	1608	.5
	Aluminum, in percent			
12484500	Yakima River at Umtanum	09-21-88	1610	6.4
		09-22-88	0015	6.4
		09-22-88	0815	6.4
12500450	Yakima River above Ahtanum Creek at Union Gap	08-11-87	0800	6.5
		08-11-87	2246	6.6
		08-12-87	0630	6.5
12508850	Sulphur Creek Wasteway near Sunnyside	08-03-87	1220	6.9
		08-03-87	2010	6.9
		08-04-87	0430	6.8
12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	08-04-87	0820	6.8
		08-04-87	1235	6.7
		08-05-87	0433	6.8
12510500	Yakima River at Kiona	08-06-87	0010	6.3
		08-06-87	0750	6.6
		08-06-87	1608	6.3

Table 20. Concentrations of major and minor elements in suspended sediment, showing short-term variability of element concentrations in samples collected from the Yakima River Basin, Washington, 1987-88—Continued

Station number	Site name	Date	Time	Laboratory results
		Antimony		
12484500	Yakima River at Umtanum	09-21-88	1610	.5
		09-22-88	0015	.5
		09-22-88	0815	.6
12500450	Yakima River above Ahtanum Creek at Union Gap	08-11-87	0800	.5
		08-11-87	2246	.6
		08-12-87	0630	.5
12508850	Sulphur Creek Wasteway near Sunnyside	08-03-87	1220	.6
		08-03-87	2010	.6
		08-04-87	0430	.8
12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	08-04-87	0820	0.8
		08-04-87	1235	.7
		08-05-87	0433	1.2
12510500	Yakima River at Kiona	08-06-87	0010	.9
		08-06-87	0750	.6
		08-06-87	1608	.7
		Arsenic		
12484500	Yakima River at Umtanum	09-21-88	1610	4.6
		09-22-88	0015	4.4
		09-22-88	0815	5.0
12500450	Yakima River above Ahtanum Creek at Union Gap	08-11-87	0800	5.0
		08-11-87	2246	4.2
		08-12-87	0630	4.6
12508850	Sulphur Creek Wasteway near Sunnyside	08-03-87	1220	6.8
		08-03-87	2010	6.5
		08-04-87	0430	8.0
12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	08-04-87	0820	8.6
		08-04-87	1235	8.7
		08-05-87	0433	7.6
12510500	Yakima River at Kiona	08-06-87	0010	6.6
		08-06-87	0750	6.4
		08-06-87	1608	6.4
		Beryllium		
12484500	Yakima River at Umtanum	09-21-88	1610	<2
		09-22-88	0015	<2
		09-22-88	0815	<2
12500450	Yakima River above Ahtanum Creek at Union Gap	08-11-87	0800	<2
		08-11-87	2246	<2
		08-12-87	0630	<2
12508850	Sulphur Creek Wasteway near Sunnyside	08-03-87	1220	<2
		08-03-87	2010	<2
		08-04-87	0430	2
12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	08-04-87	0820	<2
		08-04-87	1235	<2
		08-05-87	0433	<2
12510500	Yakima River at Kiona	08-06-87	0010	<2
		08-06-87	0750	<2
		08-06-87	1608	<2

Table 20. Concentrations of major and minor elements in suspended sediment, showing short-term variability of element concentrations in samples collected from the Yakima River Basin, Washington, 1987-88—Continued

Station number	Site name	Date	Time	Laboratory results
		Cadmium		
12484500	Yakima River at Umtanum	09-21-88	1610	< 0.1
		09-22-88	0015	< .1
		09-22-88	0815	< .1
12500450	Yakima River above Ahtanum Creek at Union Gap	08-11-87	0800	.2
		08-11-87	2246	.2
		08-12-87	0630	.3
12508850	Sulphur Creek Wasteway near Sunnyside	08-03-87	1220	.2
		08-03-87	2010	.2
		08-04-87	0430	.2
12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	08-04-87	0820	.4
		08-04-87	1235	.3
		08-05-87	0433	.2
12510500	Yakima River at Kiona	08-06-87	0010	.2
		08-06-87	0750	.2
		08-06-87	1608	.2
		Calcium, in percent		
12484500	Yakima River at Umtanum	09-21-88	1610	1.8
		09-22-88	0015	1.8
		09-22-88	0815	1.8
12500450	Yakima River above Ahtanum Creek at Union Gap	08-11-87	0800	1.9
		08-11-87	2246	2.0
		08-12-87	0630	2.0
12508850	Sulphur Creek Wasteway near Sunnyside	08-03-87	1220	2.7
		08-03-87	2010	2.7
		08-04-87	0430	2.7
12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	08-04-87	0820	2.2
		08-04-87	1235	2.2
		08-05-87	0433	2.4
12510500	Yakima River at Kiona	08-06-87	0010	2.2
		08-06-87	0750	2.3
		08-06-87	1608	2.2
		Chromium		
12484500	Yakima River at Umtanum	09-21-88	1610	74
		09-22-88	0015	59
		09-22-88	0815	68
12500450	Yakima River above Ahtanum Creek at Union Gap	08-11-87	0800	73
		08-11-87	2246	83
		08-12-87	0630	73
12508850	Sulphur Creek Wasteway near Sunnyside	08-03-87	1220	50
		08-03-87	2010	52
		08-04-87	0430	54
12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	08-04-87	0820	60
		08-04-87	1235	59
		08-05-87	0433	64
12510500	Yakima River at Kiona	08-06-87	0010	58
		08-06-87	0750	61
		08-06-87	1608	57

Table 20. Concentrations of major and minor elements in suspended sediment, showing short-term variability of element concentrations in samples collected from the Yakima River Basin, Washington, 1987-88—Continued

Station number	Site name	Date	Time	Laboratory results
		Cobalt		
12484500	Yakima River at Umtanum	09-21-88	1610	22
		09-22-88	0015	22
		09-22-88	0815	21
12500450	Yakima River above Ahtanum Creek at Union Gap	08-11-87	0800	18
		08-11-87	2246	19
		08-12-87	0630	18
12508850	Sulphur Creek Wasteway near Sunnyside	08-03-87	1220	18
		08-03-87	2010	18
		08-04-87	0430	20
12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	08-04-87	0820	21
		08-04-87	1235	22
		08-05-87	0433	21
12510500	Yakima River at Kiona	08-06-87	0010	19
		08-06-87	0750	21
		08-06-87	1608	19
		Copper		
12484500	Yakima River at Umtanum	09-21-88	1610	40
		09-22-88	0015	51
		09-22-88	0815	41
12500450	Yakima River above Ahtanum Creek at Union Gap	08-11-87	0800	116
		08-11-87	2246	46
		08-12-87	0630	49
12508850	Sulphur Creek Wasteway near Sunnyside	08-03-87	1220	35
		08-03-87	2010	28
		08-04-87	0430	35
12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	08-04-87	0820	43
		08-04-87	1235	48
		08-05-87	0433	39
12510500	Yakima River at Kiona	08-06-87	0010	38
		08-06-87	0750	39
		08-06-87	1608	43
		Iron, in percent		
12484500	Yakima River at Umtanum	09-21-88	1610	4.8
		09-22-88	0015	4.9
		09-22-88	0815	4.9
12500450	Yakima River above Ahtanum Creek at Union Gap	08-11-87	0800	4.6
		08-11-87	2246	4.6
		08-12-87	0630	4.5
12508850	Sulphur Creek Wasteway near Sunnyside	08-03-87	1220	4.7
		08-03-87	2010	4.8
		08-04-87	0430	5.0
12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	08-04-87	0820	5.6
		08-04-87	1235	5.6
		08-05-87	0433	5.6
12510500	Yakima River at Kiona	08-06-87	0010	5.1
		08-06-87	0750	5.3
		08-06-87	1608	5.1

Table 20. Concentrations of major and minor elements in suspended sediment, showing short-term variability of element concentrations in samples collected from the Yakima River Basin, Washington, 1987-88—Continued

Station number	Site name	Date	Time	Laboratory results
		Lead		
12484500	Yakima River at Umtanum	09-21-88	1610	18
		09-22-88	0015	27
		09-22-88	0815	17
12500450	Yakima River above Ahtanum Creek at Union Gap	08-11-87	0800	33
		08-11-87	2246	21
		08-12-87	0630	20
12508850	Sulphur Creek Wasteway near Sunnyside	08-03-87	1220	25
		08-03-87	2010	25
		08-04-87	0430	26
12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	08-04-87	0820	29
		08-04-87	1235	28
		08-05-87	0433	25
12510500	Yakima River at Kiona	08-06-87	0010	24
		08-06-87	0750	27
		08-06-87	1608	23
		Magnesium, in percent		
12484500	Yakima River at Umtanum	09-21-88	1610	1.4
		09-22-88	0015	1.3
		09-22-88	0815	1.3
12500450	Yakima River above Ahtanum Creek at Union Gap	08-11-87	0800	1.2
		08-11-87	2246	1.3
		08-12-87	0630	1.3
12508850	Sulphur Creek Wasteway near Sunnyside	08-03-87	1220	1.4
		08-03-87	2010	1.4
		08-04-87	0430	1.4
12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	08-04-87	0820	1.5
		08-04-87	1235	1.4
		08-05-87	0433	1.4
12510500	Yakima River at Kiona	08-06-87	0010	1.3
		08-06-87	0750	1.4
		08-06-87	1608	1.3
		Manganese		
12484500	Yakima River at Umtanum	09-21-88	1610	2,310
		09-22-88	0015	2,230
		09-22-88	0815	2,080
2500450	Yakima River above Ahtanum Creek at Union Gap	08-11-87	0800	1,400
		08-11-87	2246	1,380
		08-12-87	0630	1,320
12508850	Sulphur Creek Wasteway near Sunnyside	08-03-87	1220	954
		08-03-87	2010	1,000
		08-04-87	0430	1,110
12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	08-04-87	0820	3,190
		08-04-87	1235	3,780
		08-05-87	0433	2,950
12510500	Yakima River at Kiona	08-06-87	0010	3,160
		08-06-87	0750	3,060
		08-06-87	1608	3,060

Table 20. Concentrations of major and minor elements in suspended sediment, showing short-term variability of element concentrations in samples collected from the Yakima River Basin, Washington, 1987-88—Continued

Station number	Site name	Date	Time	Laboratory results
		Molybdenum		
12484500	Yakima River at Umtanum	09-21-88	1610	.5
		09-22-88	0015	.6
		09-22-88	0815	.7
12500450	Yakima River above Ahtanum Creek at Union Gap	08-11-87	0800	.9
		08-11-87	2246	.7
		08-12-87	0630	.5
12508850	Sulphur Creek Wasteway near Sunnyside	08-03-87	1220	.8
		08-03-87	2010	.8
		08-04-87	0430	.7
12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	08-04-87	0820	.7
		08-04-87	1235	.8
		08-05-87	0433	.6
12510500	Yakima River at Kiona	08-06-87	0010	.7
		08-06-87	0750	.8
		08-06-87	1608	.5
		Nickel		
12484500	Yakima River at Umtanum	09-21-88	1610	61
		09-22-88	0015	43
		09-22-88	0815	49
12500450	Yakima River above Ahtanum Creek at Union Gap	08-11-87	0800	53
		08-11-87	2246	57
		08-12-87	0630	56
12508850	Sulphur Creek Wasteway near Sunnyside	08-03-87	1220	24
		08-03-87	2010	25
		08-04-87	0430	27
12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	08-04-87	0820	35
		08-04-87	1235	34
		08-05-87	0433	34
12510500	Yakima River at Kiona	08-06-87	0010	32
		08-06-87	0750	32
		08-06-87	1608	31
		Phosphorus, in percent		
12484500	Yakima River at Umtanum	09-21-88	1610	.18
		09-22-88	0015	.16
		09-22-88	0815	.18
12500450	Yakima River above Ahtanum Creek at Union Gap	08-11-87	0800	.15
		08-11-87	2246	.13
		08-12-87	0630	.14
12508850	Sulphur Creek Wasteway near Sunnyside	08-03-87	1220	.13
		08-03-87	2010	.13
		08-04-87	0430	.14
12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	08-04-87	0820	.17
		08-04-87	1235	.18
		08-05-87	0433	.17
12510500	Yakima River at Kiona	08-06-87	0010	.17
		08-06-87	0750	.17
		08-06-87	1608	.18

Table 20. Concentrations of major and minor elements in suspended sediment, showing short-term variability of element concentrations in samples collected from the Yakima River Basin, Washington, 1987-88—Continued

Station number	Site name	Date	Time	Laboratory results
		Potassium, in percent		
12484500	Yakima River at Umtanum	09-21-88	1610	.98
		09-22-88	0015	1.0
		09-22-88	0815	1.0
12500450	Yakima River above Ahtanum Creek at Union Gap	08-11-87	0800	1.1
		08-11-87	2246	1.0
		08-12-87	0630	1.0
12508850	Sulphur Creek Wasteway near Sunnyside	08-03-87	1220	1.5
		08-03-87	2010	1.6
		08-04-87	0430	1.6
12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	08-04-87	0820	1.4
		08-04-87	1235	1.4
		08-05-87	0433	1.4
12510500	Yakima River at Kiona	08-06-87	0010	1.3
		08-06-87	0750	1.3
		08-06-87	1608	1.3
		Silver		
12484500	Yakima River at Umtanum	09-21-88	1610	.2
		09-22-88	0015	.2
		09-22-88	0815	.2
12500450	Yakima River above Ahtanum Creek at Union Gap	08-11-87	0800	.4
		08-11-87	2246	.5
		08-12-87	0630	.3
12508850	Sulphur Creek Wasteway near Sunnyside	08-03-87	1220	.3
		08-03-87	2010	.3
		08-04-87	0430	.3
12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	08-04-87	0820	.6
		08-04-87	1235	.4
		08-05-87	0433	.4
12510500	Yakima River at Kiona	08-06-87	0010	.2
		08-06-87	0750	.3
		08-06-87	1608	.3
		Sodium, in percent		
12484500	Yakima River at Umtanum	09-21-88	1610	1.2
		09-22-88	0015	1.2
		09-22-88	0815	1.2
12500450	Yakima River above Ahtanum Creek at Union Gap	08-11-87	0800	1.3
		08-11-87	2246	1.4
		08-12-87	0630	1.4
12508850	Sulphur Creek Wasteway near Sunnyside	08-03-87	1220	1.6
		08-03-87	2010	1.5
		08-04-87	0430	1.4
12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	08-04-87	0820	1.1
		08-04-87	1235	1.0
		08-05-87	0433	1.1
12510500	Yakima River at Kiona	08-06-87	0010	1.1
		08-06-87	0750	1.2
		08-06-87	1608	1.2

Table 20. Concentrations of major and minor elements in suspended sediment, showing short-term variability of element concentrations in samples collected from the Yakima River Basin, Washington, 1987-88—Continued

Station number	Site name	Date	Time	Laboratory results
		Thallium		
12484500	Yakima River at Umtanum	09-21-88	1610	0.3
		09-22-88	0015	.3
		09-22-88	0815	.3
12500450	Yakima River above Ahtanum Creek at Union Gap	08-11-87	0800	.4
		08-11-87	2246	.4
		08-12-87	0630	.3
12508850	Sulphur Creek Wasteway near Sunnyside	08-03-87	1220	--
		08-03-87	2010	--
		08-04-87	0430	--
12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	08-04-87	0820	.5
		08-04-87	1235	.5
		08-05-87	0433	.5
12510500	Yakima River at Kiona	08-06-87	0010	.5
		08-06-87	0750	.5
		08-06-87	1608	.4
		Titanium, in percent		
12484500	Yakima River at Umtanum	09-21-88	1610	.52
		09-22-88	0015	.51
		09-22-88	0815	.52
12500450	Yakima River above Ahtanum Creek at Union Gap	08-11-87	0800	.51
		08-11-87	2246	.52
		08-12-87	0630	.52
12508850	Sulphur Creek Wasteway near Sunnyside	08-03-87	1220	.60
		08-03-87	2010	.61
		08-04-87	0430	.62
12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	08-04-87	0820	.63
		08-04-87	1235	.60
		08-05-87	0433	.63
12510500	Yakima River at Kiona	08-06-87	0010	.58
		08-06-87	0750	.62
		08-06-87	1608	.59
		Vanadium		
12484500	Yakima River at Umtanum	09-21-88	1610	120
		09-22-88	0015	124
		09-22-88	0815	126
12500450	Yakima River above Ahtanum Creek at Union Gap	08-11-87	0800	118
		08-11-87	2246	120
		08-12-87	0630	119
12508850	Sulphur Creek Wasteway near Sunnyside	08-03-87	1220	137
		08-03-87	2010	140
		08-04-87	0430	142
12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	08-04-87	0820	146
		08-04-87	1235	144
		08-05-87	0433	146
12510500	Yakima River at Kiona	08-06-87	0010	134
		08-06-87	0750	140
		08-06-87	1608	132

Table 20. Concentrations of major and minor elements in suspended sediment, showing short-term variability of element concentrations in samples collected from the Yakima River Basin, Washington, 1987-88—Continued

Station number	Site name	Date	Time	Laboratory results
		Zinc		
12484500	Yakima River at Umtanum	09-21-88	1610	141
		09-22-88	0015	128
		09-22-88	0815	120
12500450	Yakima River above Ahtanum Creek at Union Gap	08-11-87	0800	148
		08-11-87	2246	132
		08-12-87	0630	121
12508850	Sulphur Creek Wasteway near Sunnyside	08-03-87	1220	97
		08-03-87	2010	101
		08-04-87	0430	108
12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	08-04-87	0820	122
		08-04-87	1235	117
		08-05-87	0433	114
12510500	Yakima River at Kiona	08-06-87	0010	113
		08-06-87	0750	117
		08-06-87	1608	110

Table 21. Summary of major- and minor-element concentrations in streambed sediment, Yakima River Basin, Washington, 1987-91

[To avoid statistical bias that may be associated with constituents analyzed in duplicate or triplicate at a site, only one element concentration per site was statistically summarized; all concentrations are reported in units of micrograms per gram (µg/g), except aluminum, calcuim, inorganic carbon, total carbon, iron, magnesium, phosphorus, potassium, sodium, sulfur, and titanium, which are in percent; "<" = less than]

Element	Number of sites	Minimum value	Value at indicated percentile						Maximum value
			10	25	50	75	90	95	
Aluminum	32	5.8	6.3	6.8	7.1	7.6	8.0	8.2	8.2
Antimony[1]	17	.2	.3	.3	.4	.6	.9	1.4	1.4
Arsenic	32	1.1	1.5	2.4	3.7	5.7	12	35	45
Barium	32	380	393	447	480	530	563	584	590
Beryllium	32	1	1	1	1	2	2	2	3
Bismuth	32	<10	<10	<10	<10	<10	<10	<10	<10
Boron	16	.4	.4	.5	.8	1.4	3.6	4.0	4.0
Cadmium	27	<2	<2	<2	<2	<2	<2	<2	<2
Cadmium	5	.2	.2	.2	.2	.2	.5	.6	.8
Calcium	32	.8	1.8	2.1	2.5	2.9	3.0	3.1	3.2
Carbon, inorganic	32	<.01	<.01	<.01	<.01	<.01	.1	.1	.1
Carbon, total	32	.4	.7	1.5	2.3	4.0	5.7	7.5	9.2
Cerium	32	35	37	39	45	56	74	91	94
Chromium	32	21	44	53	62	79	170	210	210
Cobalt	32	14	16	19	20	23	30	32	33
Copper	32	17	21	25	30	42	70	94	96
Europium	32	<2	<2	<2	<2	<2	<2	<2	2
Gallium	32	15	15	17	18	19	20	20	21
Gold	32	<8	<8	<8	<8	<8	<8	<8	<8
Iron	32	3.9	4.3	4.9	5.1	5.7	6.6	7.1	7.3
Lanthanum	32	18	20	22	24	29	38	48	51
Lead	32	9	11	12	14	17	32	49	63
Lithium	32	17	19	21	24	28	35	45	45
Magnesium	32	.7	.9	1.2	1.3	1.4	1.8	2.3	2.6
Manganese	32	550	760	860	1,000	1,200	1,500	1,600	1,700
Mercury	32	<.02	<.02	<.02	.1	.2	.3	.5	.6
Molybdenum	32	<2	<2	<2	<2	<2	<2	<2	2.0
Neodymium	32	19	21	23	26	30	35	45	45
Nickel	32	9	17	20	27	37	82	190	260
Niobium	32	<4	<4	5	8	9	10	13	15
Phosphorus	32	.1	.1	.1	.1	.1	.1	.2	.2
Potassium	32	.7	.8	.9	1.0	1.3	1.4	1.4	1.5
Scandium	32	13	15	18	20	21	25	27	29
Selenium	23	<.4	<.4	<.4	.4	.7	.9	1.0	1.0
Silver	32	<2	<2	<2	<2	<2	<2	<2	3
Sodium	32	1.1	1.2	1.4	1.6	1.7	1.9	2.0	2.0
Strontium	32	140	210	230	260	290	310	340	350
Sulfur	32	<.05	<.05	<.05	<.05	.1	1.2	3.3	5.3
Thorium	32	<4	4	5	6	7	10	12	15
Tin	32	<10	<10	<10	<10	<10	<10	<10	<10
Titanium	32	.3	.6	.6	.7	.8	1.0	1.0	1.1
Uranium[2]	24	<.05	.1	.7	1.1	1.4	1.9	3.0	3.3
Vanadium	32	84	113	130	140	180	220	230	240
Ytterbium	32	2	2	2	3	3	3	4	4
Yttrium	32	19	19	21	23	26	29	35	38
Zinc	32	77	84	95	100	110	170	200	210

[1]For antimony, two lower limits of determination (LLD) exist (0.01 µg/g and 0.07 µg/g). Less-than values for the higher LLD of 0.07 µg/g were not statistically summarized.

[2]For uranium, two different methods of determination were used with different LLDs (0.05 µg/g and 100 µg/g). Less-than values for the higher LLD of 100 µg/g were not statistically summarized.

Table 22. Summary of major- and minor-element concentrations in suspended sediment at fixed sites, Yakima River Basin, Washington, 1987-90

[To avoid statistical bias that may be associated with constituents analyzed in duplicate or triplicate at a site, only one element concentration per visit was statistically summarized; only data from fixed sites (sites 6, 19, 26, 32, 52, 56, and 50; see table 1) were summarized; all concentrations are reported in micrograms per gram (µg/g), except suspended organic carbon, which is in milligrams per liter (mg/L), and aluminum, calcium, iron, magnesium, phosphorus, potassium, sodium, and titanium, which are in percent; "<" = less than]

Element	Number of samples	Minimum value	Value at indicated percentile						Maximum value
			10	25	50	75	90	95	
Aluminum	211	4.6	6.3	6.6	6.9	7.3	7.7	8.3	9.7
Antimony	211	.3	.5	.5	.6	.7	.8	.9	3.1
Arsenic	211	2.8	4.7	5.4	6.6	8.2	11	14	20
Beryllium	211	<2	<2	<2	<2	<2	2	2	3
Cadmium	211	<.1	.2	.3	.5	.7	1.4	1.7	33
Calcium	211	1.2	1.8	2.0	2.2	2.5	2.9	3.0	3.5
Carbon, suspended organic	203	<.1	.2	.4	.6	1.3	2.5	2.9	4.9
Chromium	184	28	46	55	60	83	110	120	160
Cobalt	211	13	18	19	21	22	24	25	31
Copper	211	21	33	39	44	55	74	96	680
Iron	211	3.8	4.7	4.9	5.2	5.5	5.7	5.9	8.1
Lead	211	6	12	15	19	24	27	30	410
Magnesium	210	.8	1.1	1.2	1.4	1.4	1.6	1.7	2.4
Manganese	211	910	1,200	1,400	1,900	2,900	3,500	4,000	6,300
Molybdenum	211	<.1	<.1	.6	.6	.8	1.1	1.4	3.0
Nickel	184	12	22	29	37	55	82	105	170
Phosphorus	211	.10	13	14	16	18	21	24	1.2
Potassium	211	.70	90	1.0	1.2	1.4	1.6	1.6	2.4
Silver	211	<.1	.2	.2	.4	.5	.9	1.3	7.7
Sodium	211	.8	1.0	1.2	1.3	1.4	1.6	1.7	2.4
Thallium	211	.1	.2	.3	.4	.4	.5	.5	.6
Titanium	211	.4	.5	.5	.6	.6	.7	.7	.8
Vanadium	211	101	121	131	142	149	160	166	193
Zinc	184	88	112	123	142	172	202	231	521

Table 23. Summary of major- and minor-element concentrations in filtered-water samples at fixed sites, Yakima River Basin, Washington, 1987-90

[The term "filtered water" is an operational definition referring to the chemical analysis of that portion of a water-suspended sediment sample that passes through a nominal 0.45-micrometer filter; to avoid statistical bias that may be associated with constituents analyzed made in duplicate or triplicate at a site, only one element concentration per visit was statistically summarized; only data from fixed sites (sites 6, 19, 26, 32, 52, 56, and 50; see table 1) were summarized; all concentrations are reported in micrograms per liter (µg/L), except bromide, cyanide, and organic carbon, which are reported in milligrams per liter (mg/L); for cadmium, chromium, copper, and lead, only samples analyzed by atomic absorption spectroscopy with graphite furnace were statistically summarized; "<" = less than**]**

Element	Number of samples	Minimum value	Value at indicated percentile						Maximum value
			10	25	50	75	90	95	
Aluminum	27	<10	<10	<10	10	20	50	150	210
Antimony	18	<1	<1	<1	<1	<1	<1	1	1
Arsenic	106	<1	<1	<1	<1	2	3	7	9
Barium	36	<2	3	6	10	26	40	74	79
Beryllium	36	<.5	<.5	<.5	<.5	<.5	<.5	<.5	<.5
Boron	23	<10	<10	10	20	20	40	40	40
Bromide	19	<.01	<.01	<.01	<.01	<.01	.02	.08	.08
Cadmium	279	<.2	<.2	<.2	<.2	<.2	.3	.5	2.2
Carbon, Organic	275	.4	1.2	1.5	2.0	2.6	3.5	4.4	8.0
Chromium	26	<.5	<.5	<.5	<.5	.6	1.0	1.1	1.1
Cobalt	36	<3	<3	<3	<3	<3	<3	<3	<3
Copper	280	<.5	<.5	.6	.9	1.3	1.9	3.0	20
Cyanide	21	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01
Iron	36	8	13	18	28	39	57	101	250
Lead	279	<.5	<.5	<.5	<.5	<.5	<.5	.6	1.9
Lithium	36	<4	<4	<4	<4	<4	5	8	16
Manganese	36	<1	2	3	7	16	40	87	110
Mercury	283	<.1	<.1	<.1	<.1	<.1	<.1	.1	.6
Molybdenum	36	<10	<10	<10	<10	<10	<10	<10	<10
Nickel	36	<10	<10	<10	<10	<10	<10	<10	<10
Selenium	22	<1	<1	<1	<1	<1	<1	2	2
Silver	36	<1	<1	<1	<1	<1	1	2	2
Strontium	36	21	30	46	68	130	160	330	330
Vanadium	36	<6	<6	<6	<6	8	10	21	22
Zinc	36	<3	<3	<3	5	12	18	29	30

Table 24. Summary of major- and minor-element concentrations in unfiltered-water samples at fixed sites, Yakima River Basin, Washington, 1987-90

[The term “unfiltered water” refers to the chemical analysis of a water sample that has not been filtered or centrifuged, nor in any way altered from the original matrix; only data from fixed sites (sites 6, 19, 26, 32, 52, 56, and 50; see table 1) were summarized; all concentrations are reported in micrograms per liter (µg/L); "<" = less than]

Element	Number of samples	Minimum value	Value at indicated percentile						Maximum value
			10	25	50	75	90	95	
Aluminum	18	130	328	768	1,650	3,320	3,520	3,700	3,700
Barium	18	<100	<100	<100	<100	<100	100	100	100
Beryllium	18	<10	<10	<10	<10	<10	<10	<10	<10
Boron	18	<10	<10	10	25	40	41	50	50
Cadmium	18	<1	<1	<1	<1	<1	1	1	1
Chromium	18	<1	<1	3	4	14	25	29	29
Copper	18	<10	<10	<10	<10	10	22	40	40
Iron	18	210	354	710	2,000	3,650	5,140	5,300	5,300
Lead	18	<5	<5	<5	<5	<5	<5	6	6
Manganese	18	<10	18	20	100	133	155	200	200
Mercury	18	<.1	<.1	<.1	<.1	.2	.2	1.0	1.0
Molybdenum	17	<1	<1	<1	1	2	4	4	4
Nickel	18	<1	<1	2	4	6	10	20	20
Silver	18	<1	<1	<1	<1	<1	10	12	12
Zinc	17	<10	<10	<10	<10	20	32	40	40

Table 25. Summary of selected element concentrations in aquatic biota, Yakima River Basin, Washington, 1989-91

[To avoid statistical bias that may be associated with constituents analyzed in duplicate or triplicate at a site, the mean element concentration of each site was statistically summarized; concentrations are reported in units of micrograms per gram (µg/g), dry weight; livers from bridgelip sucker, carp, largescale sucker, mountain whitefish, and rainbow trout were analyzed from composites of usually 10 or more samples; whole bodies of sculpin, caddisfly, and stonefly, respectively, were analyzed from composites of usually 10 or more fish and 50 or more insects; soft parts of the Asiatic clam were analyzed from composites of usually 20 samples; curlyleaf-pondweed and waterweed samples consisted of a minimum of 5 grams of mass; only 1990 data are summarized for largescale suckers, *Arctopsyche* sp., *Hydropsyche* spp., and lead in Asiatic clams; Asiatic clams are of the order Veneroida and family corbiculidae; organism taxa are listed as follows:

common name
(*Genus species*)]

Arsenic

Sample	Number of sites	Minimum	Median	Maximum
Bridgelip sucker (*Catostomus columbianus*)	3	0.20	0.85	1.2
Largescale sucker (*Catostomus macrocheilus*)	6	.10	.30	.50
Mountain whitefish (*Prosopium williamsoni*)	7	<.30	<.30	.40
Sculpin (*Cottus* spp.)	12	<.10	.15	.37
Asiatic clam (*Corbicula fluminea*)	5	3.6	4.1	5.2
Curlyleaf pondweed (*Potamogeton crispus*)	8	.48	.79	1.5
Waterweed (*Elodea* sp.)	4	1.0	1.6	2.6

Cadmium

Carp (*Cyprinus carpio*)	3	.46	.79	2.5
Largescale sucker (*Catostomus macrocheilus*)	6	.03	.35	.43
Mountain whitefish (*Prosopium williamsoni*)	7	<.20	<.20	1.2
Rainbow trout (*Oncorhynchus mykiss*)	10	<.40	<.40	1.0
Asiatic clam (*Corbicula fluminea*)	5	<.20	.24	.38
Caddisfly (*Arctopsyche* sp.)	12	<.41	<.41	.43
Caddisfly (*Cheumatopsyche* spp.)	4	<.19	<.19	.19
Caddisfly (*Hydropsyche* spp.)	24	<.18	<.18	.25
Stonefly (*Calineuria* sp.)	6	<.14	<.14	.45
Stonefly (*Claassenia* sp.)	7	<.15	.16	.40
Stonefly (*Doroneuria* sp.)	5	<.15	<.15	.50
Stonefly (*Hesperoperla* sp.)	10	<.12	<.12	.33
Stonefly (*Megarcys* sp.)	3	.18	.24	.36
Stonefly (*Perlinodes* sp.)	3	.12	.17	.25
Stonefly (*Pteronarcys* sp.)	8	<.41	<.41	<.41
Stonefly (*Skwala* sp.)	9	<.23	<.23	.23
Curlyleaf pondweed (*Potamogeton crispus*)	8	<.80	<.80	.91

Table 25. Summary of selected element concentrations in aquatic biota, Yakima River Basin, Washington, 1989-91—Continued

Chromium

Sample	Number of sites	Minimum	Median	Maximum
Largescale sucker (*Catostomus macrocheilus*)	6	0.50	0.59	0.78
Mountain whitefish (*Prosopium williamsoni*)	7	<1.0	<1.0	1.0
Rainbow trout (*Oncorhynchus mykiss*)	10	<4.0	<4.0	<4.0
Asiatic clam (*Corbicula fluminea*)	5	1.0	1.4	2.0
Caddisfly (*Arctopsyche* sp.)	12	.71	1.6	10
Caddisfly (*Cheumatopsyche* spp.)	4	2.3	4.3	5.9
Caddisfly (*Hydropsyche* spp.)	24	.66	2.4	3.8
Stonefly (*Calineuria* sp.)	6	<.11	1.1	3.9
Stonefly (*Claassenia* sp.)	7	.49	1.4	2.2
Stonefly (*Doroneuria* sp.)	5	.95	1.3	2.6
Stonefly (*Hesperoperla* sp.)	10	.61	1.3	2.4
Stonefly (*Megarcys* sp.)	3	.44	2.2	5.2
Stonefly (*Perlinodes* sp.)	3	2.2	3.0	34
Stonefly (*Pteronarcys* sp.)	8	.58	1.2	3.3
Stonefly (*Skwala* sp.)	9	.31	1.8	16
Curlyleaf pondweed (*Potamogeton crispus*)	8	2.0	3.0	4.0
Waterweed (*Elodea* sp.)	4	3.8	6.4	8.3

Cobalt

Largescale sucker (*Catostomus macrocheilus*)	6	.12	.31	.50
Mountain whitefish (*Prosopium williamsoni*)	6	.38	.46	.84
Rainbow trout (*Oncorhynchus mykiss*)	5	.18	.32	.46
Asiatic clam (*Corbicula fluminea*)	4	.50	.58	1.1
Caddisfly (*Arctopsyche* sp.)	12	.71	1.1	5.0
Caddisfly (*Cheumatopsyche* spp.)	4	1.8	2.5	5.7
Caddisfly (*Hydropsyche* spp.)	24	.75	2.7	9.1
Stonefly (*Calineuria* sp.)	6	.37	.68	.86
Stonefly (*Claassenia* sp.)	7	.39	.57	1.0
Stonefly (*Doroneuria* sp.)	5	.20	.49	1.7
Stonefly (*Hesperoperla* sp.)	10	.25	.43	1.8
Stonefly (*Megarcys* sp.)	3	.58	.88	.97
Stonefly (*Perlinodes* sp.)	3	1.8	2.2	5.7
Stonefly (*Pteronarcys* sp.)	8	.74	.82	4.3
Stonefly (*Skwala* sp.)	9	.89	1.6	3.0

Table 25. Summary of selected element concentrations in aquatic biota, Yakima River Basin, Washington, 1989-91—Continued

Copper

Sample	Number of sites	Minimum	Median	Maximum
Bridgelip sucker (*Catostomus columbianus*)	3	7.7	14	19
Carp (*Cyprinus carpio*)	3	28	55	100
Largescale sucker (*Catostomus macrocheilus*)	6	23	26	32
Mountain whitefish (*Prosopium williamsoni*)	7	5.6	6.4	11
Rainbow trout (*Oncorhynchus mykiss*)	10	18	91	480
Asiatic clam (*Corbicula fluminea*)	5	25	28	34
Caddisfly (*Arctopsyche* sp.)	12	5.9	9.8	15
Caddisfly (*Cheumatopsyche* spp.)	4	6.5	12	19
Caddisfly (*Hydropsyche* spp.)	24	9.2	13	21
Stonefly (*Calineuria* sp.)	6	18	22	24
Stonefly (*Claassenia* sp.)	7	27	32	38
Stonefly (*Doroneuria* sp.)	5	25	30	38
Stonefly (*Hesperoperla* sp.)	10	18	24	28
Stonefly (*Megarcys* sp.)	3	11	26	36
Stonefly (*Perlinodes* sp.)	3	14	15	22
Stonefly (*Pteronarcys* sp.)	8	8.0	21	32
Stonefly (*Skwala* sp.)	9	14	19	26
Curlyleaf pondweed (*Potamogeton crispus*)	8	9.2	11	22
Waterweed (*Elodea* sp.)	4	13	19	65

Lead

Largescale sucker (*Catostomus macrocheilus*)	6	<.12	.18	.29
Mountain whitefish (*Prosopium williamsoni*)	7	<4.0	<4.0	<4.0
Asiatic clam (*Corbicula fluminea*)	4	.18	.31	.40
Caddisfly (*Arctopsyche* sp.)	12	<2.1	<2.1	24
Caddisfly (*Cheumatopsyche* spp.)	4	1.3	2.1	3.2
Caddisfly (*Hydropsyche* spp.)	24	<.96	1.1	5.6
Stonefly (*Claassenia* sp.)	7	<.68	<.68	1.8
Stonefly (*Doroneuria* sp.)	5	<.59	<.59	.65
Stonefly (*Hesperoperla* sp.)	10	<.65	<.65	.92
Stonefly (*Perlinodes* sp.)	3	1.8	2.8	3.3
Stonefly (*Pteronarcys* sp.)	8	<2.1	<2.1	<2.1
Stonefly (*Skwala* sp.)	9	<.80	<.80	2.8

Table 25. Summary of selected element concentrations in aquatic biota, Yakima River Basin, Washington, 1989-91—Continued

Mercury

Sample	Number of sites	Minimum	Median	Maximum
Bridgelip sucker (*Catostomus columbianus*)	3	0.05	0.06	0.06
Carp (*Cyprinus carpio*)	3	.30	.38	.42
Largescale sucker (*Catostomus macrocheilus*)	6	.05	.32	.47
Mountain whitefish (*Prosopium williamsoni*)	7	.40	.81	1.3
Rainbow trout (*Oncorhynchus mykiss*)	10	.12	.26	.35
Sculpin (*Cottus* spp.)	12	.09	.19	.31
Asiatic clam (*Corbicula fluminea*)	5	.10	.16	.17
Curlyleaf pondweed (*Potamogeton crispus*)	8	.03	.05	.06
Waterweed (*Elodea* sp.)	4	.06	.07	.09

Nickel

Asiatic clam (*Corbicula fluminea*)	5	<2.0	<2.0	<2.0
Caddisfly (*Arctopsyche* sp.)	12	<1.0	<1.0	42
Caddisfly (*Cheumatopsyche* spp.)	4	1.5	5.1	7.3
Caddisfly (*Hydropsyche* spp.)	24	.58	2.4	5.5
Stonefly (*Calineuria* sp.)	6	.28	.48	6.9
Stonefly (*Claassenia* sp.)	7	<.38	<.38	6.4
Stonefly (*Doroneuria* sp.)	5	<.15	1.4	1.6
Stonefly (*Hesperoperla* sp.)	10	<.26	.43	7.1
Stonefly (*Megarcys* sp.)	3	.26	2.0	2.4
Stonefly (*Perlinodes* sp.)	3	2.2	2.3	76
Stonefly (*Pteronarcys* sp.)	8	.74	1.2	7.5
Stonefly (*Skwala* sp.)	9	.38	.86	34
Curlyleaf pondweed (*Potamogeton crispus*)	8	3.0	5.8	20
Waterweed (*Elodea* sp.)	4	8.5	14	23

Table 25. Summary of selected element concentrations in aquatic biota, Yakima River Basin, Washington, 1989-91—Continued

Selenium

Sample	Number of sites	Minimum	Median	Maximum
Bridgelip sucker (*Catostomus columbianus*)	3	1.9	2.0	5.2
Carp (*Cyprinus carpio*)	3	2.2	3.8	4.2
Largescale sucker (*Catostomus macrocheilus*)	6	1.9	3.5	4.8
Mountain whitefish (*Prosopium williamsoni*)	7	4.2	5.0	13
Rainbow trout (*Oncorhynchus mykiss*)	10	2.2	7.0	31
Sculpin (*Cottus* spp.)	12	.20	1.6	5.4
Asiatic clam (*Corbicula fluminea*)	5	2.1	2.4	3.0
Curlyleaf pondweed (*Potamogeton crispus*)	8	.20	.36	.70
Waterweed (*Elodea* sp.)	4	.30	.59	1.2

Silver

Carp (*Cyprinus carpio*)	3	.24	.45	3.0
Largescale sucker (*Catostomus macrocheilus*)	6	.06	.10	.14
Mountain whitefish (*Prosopium williamsoni*)	7	<2.0	<2.0	<2.0
Rainbow trout (*Oncorhynchus mykiss*)	10	<7.0	<7.0	20
Stonefly (*Calineuria* sp.)	6	<.09	.13	.21
Stonefly (*Claassenia* sp.)	7	.13	.15	.30
Stonefly (*Doroneuria* sp.)	5	<.07	.12	.30
Stonefly (*Hesperoperla* sp.)	10	<.08	.08	.22

Zinc

Bridgelip sucker (*Catostomus columbianus*)	3	55	56	94
Carp (*Cyprinus carpio*)	3	160	634	890
Largescale sucker (*Catostomus macrocheilus*)	6	60	81	102
Mountain whitefish (*Prosopium williamsoni*)	7	57	72	79
Rainbow trout (*Oncorhynchus mykiss*)	10	75	99	226
Asiatic clam (*Corbicula fluminea*)	5	96	108	452

Table 25. Summary of selected element concentrations in aquatic biota, Yakima River Basin, Washington, 1989-91—Continued

Zinc

Sample	Number of sites	Minimum	Median	Maximum
Caddisfly (*Arctopsyche* sp.)	12	96	141	192
Caddisfly (*Cheumatopsyche* spp.)	4	81	96	102
Caddisfly (*Hydropsyche* spp.)	24	67	105	152
Stonefly (*Calineuria* sp.)	6	142	196	251
Stonefly (*Claassenia* sp.)	7	174	218	352
Stonefly (*Doroneuria* sp.)	5	216	231	254
Stonefly (*Hesperoperla* sp.)	10	276	372	450
Stonefly (*Megarcys* sp.)	3	127	256	271
Stonefly (*Perlinodes* sp.)	3	84	106	141
Stonefly (*Pteronarcys* sp.)	8	114	128	150
Stonefly (*Skwala* sp.)	9	102	138	314
Curlyleaf pondweed (*Potamogeton crispus*)	8	50	76	187
Waterweed (*Elodea* sp.)	4	44	130	239

Table 26. Concentrations of major and minor elements in streambed sediment, Yakima River Basin, Washington, 1987-91

[All concentrations are reported in micrograms per gram (µg/g), unless otherwise noted; only streambed-sediment data corresponding to aquatic-biota sampling sites are listed--for a complete listing of streambed-sediment samples, see Ryder and others, 1992; for some elements, lower limits of determination may differ due to the use of different methods of determination; (r) = replicate or triplicate sample collected to measure variability in element concentrations in the stream cross section; N.F. = North Fork; MS = Middle School; STP = sewage treatment plant; RM = river mile; nr = near; "--" = not determined; "<" = less than]

Site reference number	Station number	Site name	Date	Aluminum (percent)	Antimony	Arsenic	Barium
1	12478100	Waptus River at mouth near Roslyn	10-19-89	6.9	--	45	447
6	12479500	Yakima River at Cle Elum	11-03-87	7.5	0.5	7.9	480
3	12479720	Jungle Creek near mouth near Cle Elum	05-02-89	8.2	--	29	564
5	12480000	Teanaway River below Forks near Cle Elum	10-19-89	7.7	--	4.4	506
8	12481900	Taneum Creek at Taneum Meadow near Thorp	11-03-90	8.0	--	2.3	450
12	12483190	South Fork Manastash Creek near Ellensburg	10-16-89	8.0	--	1.6	480
7	12483750	Naneum Creek below High Creek near Ellensburg	10-29-91	6.7	< .7	1.4	460
14	12484440	Cherry Creek above Wipple Wasteway at Thrall	09-15-87(r)	7.0	.3	3.1	510
14	12484440	Cherry Creek above Wipple Wasteway at Thrall	09-15-87(r)	7.0	.3	2.6	500
19	12484500	Yakima River at Umtanum	11-05-87	5.9	.4	2.8	470
20	12484550	Umtanum Creek near mouth at Umtanum	05-03-89	7.4	--	1.6	478
10	12487200	Little Naches River at mouth near Cliffdell	10-30-91	7.7	< .7	3.5	410
13	12488250	American River at Hells Crossing near Nile	10-30-91	8.2	.9	13	390
22	12489100	Rattlesnake Creek above N.F. Rattlesnake Creek near Nile	10-21-89	7.8	--	9.5	433
21	12489150	Rattlesnake Creek above Little Rattlesnake near Nile	08-12-87	7.6	.7	7.8	420
26	12499000	Naches River near North Yakima	08-10-87(r)	6.6	.7	4.9	390
26	12499000	Naches River near North Yakima	08-10-87(r)	6.8	.4	4.3	410
26	12499000	Naches River near North Yakima	08-10-87(r)	6.7	1.4	3.3	400
30	12500430	Moxee Drain at Thorp Road near Union Gap	08-12-87	7.5	.4	3.6	560
27	12500437	Wide Hollow Creek at West Valley MS near Ahtanum	05-01-89	5.8	--	4.6	383
29	12500442	Wide Hollow Creek at old STP at Union Gap	08-10-87(r)	6.6	.6	5.4	430
29	12500442	Wide Hollow Creek at old STP at Union Gap	08-10-87(r)	6.9	.6	3.6	450
29	12500442	Wide Hollow Creek at old STP at Union Gap	08-10-87(r)	7.1	.5	2.3	450
34	12500900	South Fork Ahtanum Creek above Conrad Ranch near Tampico	11-06-90	7.5	--	1.1	500
31	12502500	Ahtanum Creek at Union Gap	09-14-87	7.1	.3	2.3	490
33	12503950	Yakima River at Parker	08-13-87(r)	7.1	.4	3.9	500
33	12503950	Yakima River at Parker	08-13-87(r)	6.8	.6	4.4	480
40	12505460	Granger Drain at mouth near Granger	08-14-87	6.6	.4	5.4	540
43	12507508	Toppenish Creek at Indian Church Road near Granger	08-13-87	7.0	.4	3.7	460
42	12507525	Yakima River below Toppenish Creek at RM 79.6 nr Granger	10-31-91	7.3	< .7	3.5	540
48	12507585	Yakima River at RM 72 above Satus Creek near Sunnyside	11-01-89	6.8	--	3.7	504
57	12507594	Satus Creek above Wilson-Charley Canyon near Toppenish	09-20-90	6.7	--	1.3	380
53	12508500	Satus Creek below Dry Creek near Toppenish	08-24-87	7.6	.2	2.8	580
47	12508620	Satus Creek at gage at Satus	09-14-87	6.9	.7	5.8	530
52	12508850	Sulphur Creek Wasteway near Sunnyside	04-21-91	7.1	< .7	5.4	590
56	12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	08-27-87(r)	6.9	.2	6.8	550
56	12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	08-27-87(r)	6.8	.5	6.3	540
54	12509710	Spring Creek at mouth at Whitstran	08-25-87	6.2	.6	5.1	510
50	12510500	Yakima River at Kiona	08-25-87	6.8	.6	5.4	530

Table 26. Concentrations of major and minor elements in streambed sediment, Yakima River Basin, Washington, 1987-91—Continued

Station number	Date	Beryllium	Bismuth	Boron	Cadmium	Calcium (percent)	Carbon, inorganic (percent)	Carbon, total (percent)	Cerium
12478100	10-19-89	1	< 10	--	< 2	1.1	< 0.01	6.6	38
12479500	11-03-87	1	< 10	0.6	< 2	1.9	.02	3.7	40
12479720	05-02-89	1	< 10	--	< 2	.85	.04	1.6	43
12480000	10-19-89	1	< 10	--	< 2	2.0	< .01	2.6	36
12481900	11-03-90	1	< 10	--	< 2	2.5	.01	4.7	39
12483190	10-16-89	1	< 10	--	< 2	2.2	.02	3.0	46
12483750	10-29-91	1	< 10	--	.2	2.1	.04	9.2	51
12484440	09-15-87(r)	1	< 10	1.6	< 2	2.7	.13	1.4	44
12484440	09-15-87(r)	1	< 10	.8	< 2	2.8	.11	1.5	42
12484500	11-05-87	1	< 10	1.1	< 2	1.7	.02	4.1	36
12484550	05-03-89	1	< 10	--	< 2	3.0	< .01	2.2	44
12487200	10-30-91	1	< 10	--	.2	2.5	.04	4.2	52
12488250	10-30-91	1	< 10	--	.8	2.1	.01	3.8	55
12489100	10-21-89	1	< 10	--	< 2	1.9	< .01	3.3	45
12489150	08-12-87	1	< 10	.9	< 2	2.6	.02	2.9	42
12499000	08-10-87(r)	1	< 10	--	< 2	2.6	.05	3.4	34
12499000	08-10-87(r)	1	< 10	--	< 2	2.8	.03	2.9	35
12499000	08-10-87(r)	1	< 10	3.4	< 2	2.7	.02	3.2	35
12500430	08-12-87	2	< 10	.4	< 2	2.7	.02	.5	60
12500437	05-01-89	1	< 10	--	< 2	2.0	.01	5.2	38
12500442	08-10-87(r)	1	< 10	--	< 2	2.5	.02	3.0	37
12500442	08-10-87(r)	1	< 10	2.5	< 2	2.9	.03	2.0	41
12500442	08-10-87(r)	1	< 10	4.0	< 2	3.1	.02	1.9	39
12500900	11-06-90	1	< 10	--	< 2	2.9	.03	5.2	43
12502500	09-14-87	1	< 10	.5	< 2	2.9	< .01	2.1	38
12503950	08-13-87(r)	1	< 10	1.0	< 2	2.3	.02	1.9	45
12503950	08-13-87(r)	1	< 10	1.5	< 2	2.3	.02	2.0	44
12505460	08-14-87	2	< 10	.4	< 2	3.2	.12	.4	94
12507508	08-13-87	1	< 10	.8	< 2	2.5	< .01	2.0	45
12507525	10-31-91	1	< 10	--	.2	2.6	.02	1.3	65
12507585	11-01-89	2	< 10	--	< 2	2.4	.01	2.4	48
12507594	09-20-90	3	< 10	--	< 2	2.5	< .01	5.9	59
12508500	08-24-87	2	< 10	.4	< 2	2.5	< .01	1.2	56
12508620	09-14-87	2	< 10	.8	< 2	2.9	.02	1.7	48
12508850	04-21-91	1	< 10	--	.2	3.0	.12	1.1	78
12509050	08-27-87(r)	2	< 10	.9	< 2	2.6	.06	1.3	59
12509050	08-27-87(r)	2	< 10	1.2	< 2	2.7	.05	1.3	56
12509710	08-25-87	2	< 10	.9	< 2	2.9	.04	.6	90
12510500	08-25-87	2	< 10	2.3	< 2	2.6	.07	2.1	53

Table 26. Concentrations of major and minor elements in streambed sediment, Yakima River Basin, Washington, 1987-91—Continued

Station number	Date	Chromium	Cobalt	Copper	Europium	Gallium	Gold	Iron (percent)	Lanthanum
12478100	10-19-89	61	14	20	< 2	16	< 8	3.9	23
12479500	11-03-87	210	28	43	< 2	18	< 8	5.1	22
12479720	05-02-89	93	23	36	< 2	21	< 8	6.0	22
12480000	10-19-89	210	32	32	< 2	20	< 8	5.6	20
12481900	11-03-90	170	26	47	< 2	16	< 8	5.0	21
12483190	10-16-89	130	27	44	< 2	19	< 8	6.3	27
12483750	10-29-91	58	21	24	< 2	17	< 8	4.9	26
12484440	09-15-87(r)	50	17	23	< 2	18	< 8	4.1	24
12484440	09-15-87(r)	54	17	22	< 2	18	< 8	4.2	23
12484500	11-05-87	64	18	28	< 2	15	< 8	4.3	20
12484550	05-03-89	50	29	30	< 2	20	< 8	6.7	24
12487200	10-30-91	50	20	48	< 2	19	< 8	6.0	25
12488250	10-30-91	21	16	79	< 2	20	< 8	4.9	27
12489100	10-21-89	62	19	43	< 2	19	< 8	5.2	24
12489150	08-12-87	49	20	39	< 2	18	< 8	5.6	22
12499000	08-10-87(r)	51	18	41	< 2	17	< 8	4.7	19
12499000	08-10-87(r)	59	19	46	< 2	18	< 8	5.0	19
12499000	08-10-87(r)	160	20	96	< 2	17	< 8	5.0	19
12500430	08-12-87	64	16	25	< 2	18	< 8	4.3	32
12500437	05-01-89	42	18	93	< 2	15	< 8	4.6	18
12500442	08-10-87(r)	55	18	42	< 2	17	< 8	4.8	20
12500442	08-10-87(r)	66	20	43	< 2	18	< 8	5.3	21
12500442	08-10-87(r)	80	21	41	< 2	18	< 8	5.4	21
12500900	11-06-90	33	33	29	< 2	19	< 8	6.9	24
12502500	09-14-87	56	23	25	< 2	19	< 8	5.7	23
12503950	08-13-87(r)	66	17	29	< 2	18	< 8	4.6	24
12503950	08-13-87(r)	63	17	29	< 2	17	< 8	4.5	23
12505460	08-14-87	60	21	21	2	18	< 8	5.5	51
12507508	08-13-87	75	19	32	< 2	18	< 8	5.1	23
12507525	10-31-91	73	20	31	< 2	18	< 8	5.1	35
12507585	11-01-89	64	19	31	< 2	17	< 8	4.9	27
12507594	09-20-90	53	31	25	< 2	20	< 8	7.3	33
12508500	08-24-87	53	21	32	< 2	20	< 8	5.3	31
12508620	09-14-87	54	22	29	< 2	17	< 8	5.9	27
12508850	04-21-91	80	21	26	< 2	18	< 8	5.1	40
12509050	08-27-87(r)	55	19	29	< 2	18	< 8	5.0	32
12509050	08-27-87(r)	57	20	25	< 2	18	< 8	5.1	29
12509710	08-25-87	62	21	17	< 2	15	< 8	5.5	46
12510500	08-25-87	61	20	29	< 2	19	< 8	5.1	28

Table 26. Concentrations of major and minor elements in streambed sediment, Yakima River Basin, Washington, 1987-91—Continued

Station number	Date	Lead	Lithium	Magnesium (percent)	Manganese	Mercury	Molybdenum	Neodymium	Nickel
12478100	10-19-89	13	51	0.72	1,400	0.08	< 2	25	29
12479500	11-03-87	16	26	2.1	1,100	.12	< 2	23	150
12479720	05-02-89	22	34	.82	910	.56	< 2	25	43
12480000	10-19-89	12	32	2.6	1,100	.20	< 2	20	260
12481900	11-03-90	16	34	1.9	820	.40	< 2	24	78
12483190	10-16-89	15	28	1.4	1,100	.04	< 2	29	61
12483750	10-29-91	12	27	.95	1,000	.05	< 2	25	22
12484440	09-15-87(r)	10	22	1.2	830	.04	< 2	24	21
12484440	09-15-87(r)	11	22	1.2	830	.04	< 2	23	21
12484500	11-05-87	13	20	1.2	1,700	.06	< 2	20	48
12484550	05-03-89	10	20	1.2	1,100	.02	< 2	25	19
12487200	10-30-91	11	27	1.2	1,400	.08	< 2	28	20
12488250	10-30-91	14	36	.88	1,100	.13	< 2	29	9
12489100	10-21-89	13	36	1.0	1,200	.14	< 2	27	27
12489150	08-12-87	12	29	1.2	1,000	.24	< 2	25	16
12499000	08-10-87(r)	22	20	1.2	960	.18	< 2	20	21
12499000	08-10-87(r)	18	21	1.3	990	.24	< 2	20	25
12499000	08-10-87(r)	36	21	1.2	1,300	.30	2	22	83
12500430	08-12-87	14	23	1.2	740	.02	< 2	30	22
12500437	05-01-89	63	17	.92	550	.12	< 2	19	19
12500442	08-10-87(r)	56	21	1.2	760	.20	< 2	21	25
12500442	08-10-87(r)	47	20	1.4	750	.30	< 2	22	27
12500442	08-10-87(r)	42	20	1.5	790	.28	< 2	22	33
12500900	11-06-90	12	24	1.2	1,500	.04	< 2	26	15
12502500	09-14-87	18	19	1.3	960	.04	< 2	23	19
12503950	08-13-87(r)	16	25	1.3	780	.16	< 2	24	37
12503950	08-13-87(r)	17	24	1.2	780	.26	< 2	24	36
12505460	08-14-87	16	19	1.6	1,000	< .02	< 2	45	20
12507508	08-13-87	13	22	1.4	960	.04	< 2	24	31
12507525	10-31-91	16	25	1.5	750	.06	< 2	31	35
12507585	11-01-89	16	25	1.4	1,000	.04	< 2	27	36
12507594	09-20-90	9	26	1.0	1,400	.06	< 2	34	23
12508500	08-24-87	13	23	1.3	850	.02	< 2	29	25
12508620	09-14-87	12	21	1.4	1,100	.16	< 2	28	25
12508850	04-21-91	15	25	1.5	990	< .02	< 2	35	37
12509050	08-27-87(r)	24	26	1.4	1,000	.08	< 2	33	27
12509050	08-27-87(r)	20	24	1.4	1,100	.14	< 2	30	27
12509710	08-25-87	15	20	1.4	930	< .02	< 2	45	22
12510500	08-25-87	20	26	1.4	1,500	.10	< 2	30	30

Table 26. Concentrations of major and minor elements in streambed sediment, Yakima River Basin, Washington, 1987-91—Continued

Station number	Date	Niobium	Phosphorus (percent)	Potassium (percent)	Scandium	Selenium	Silver	Sodium (percent)	Strontium
12478100	10-19-89	5	0.09	1.0	13	0.8	< 2	1.8	220
12479500	11-03-87	9	.12	.91	19	--	< 2	1.6	220
12479720	05-02-89	9	.11	1.0	23	< .4	< 2	1.1	140
12480000	10-19-89	6	.09	1.0	22	.4	< 2	1.4	250
12481900	11-03-90	6	.12	.97	21	.9	< 2	1.4	220
12483190	10-16-89	8	.10	.84	29	.3	< 2	1.2	200
12483750	10-29-91	7	.13	.75	20	.9	< 2	1.1	230
12484440	09-15-87(r)	< 4	.07	1.2	16	--	< 2	2.0	320
12484440	09-15-87(r)	< 4	.06	1.2	16	--	< 2	2.0	330
12484500	11-05-87	6	.16	1.1	14	.5	< 2	1.2	210
12484550	05-03-89	9	.11	.84	24	< .4	< 2	1.7	290
12487200	10-30-91	10	.15	.78	26	.4	< 2	1.2	240
12488250	10-30-91	10	.15	.96	20	.7	< 2	1.8	250
12489100	10-21-89	8	.10	1.1	20	1.0	< 2	1.2	210
12489150	08-12-87	8	.12	1.0	19	.9	< 2	1.5	250
12499000	08-10-87(r)	< 4	.10	.90	19	--	< 2	1.5	240
12499000	08-10-87(r)	< 4	.09	.93	20	--	< 2	1.6	250
12499000	08-10-87	< 4	.10	.92	20	--	< 2	1.6	250
12500430	08-12-87	9	.11	1.4	14	.2	< 2	2.0	350
12500437	05-01-89	6	.16	.79	16	.6	3	1.2	210
12500442	08-10-87(r)	< 4	.10	.97	19	--	< 2	1.6	260
12500442	08-10-87(r)	< 4	.09	.99	21	--	< 2	1.8	290
12500442	08-10-87(r)	< 4	.07	.99	21	--	< 2	1.9	300
12500900	11-06-90	7	.14	.70	25	.3	< 2	1.6	290
12502500	09-14-87	8	.10	.94	21	.3	< 2	1.7	290
12503950	08-13-87(r)	< 4	.09	1.2	17	--	< 2	1.8	280
12503950	08-13-87(r)	< 4	.10	1.2	18	--	< 2	1.6	260
12505460	08-14-87	12	.14	1.4	20	< .1	< 2	1.7	310
12507508	08-13-87	8	.12	1.1	18	.5	< 2	1.6	270
12507525	10-31-91	9	.12	1.3	20	.2	< 2	1.7	290
12507585	11-01-89	10	.15	1.4	18	.4	< 2	1.4	250
12507594	09-20-90	15	.13	.93	21	.2	< 2	1.5	240
12508500	08-24-87	9	.11	1.3	17	< .1	< 2	1.7	270
12508620	09-14-87	< 4	.11	1.0	22	--	< 2	1.7	270
12508850	04-21-91	10	.13	1.5	18	.3	< 2	1.7	310
12509050	08-27-87(r)	< 4	.10	1.4	18	--	< 2	1.6	270
12509050	08-27-87(r)	< 4	.10	1.4	19	--	< 2	1.7	280
12509710	08-25-87	5	.09	1.3	19	--	< 2	1.7	290
12510500	08-25-87	< 4	.10	1.4	19	--	< 2	1.6	260

Table 26. Concentrations of major and minor elements in streambed sediment, Yakima River Basin, Washington, 1987-91—Continued

Station number	Date	Sulfur (percent)	Thorium	Tin	Titanium (percent)	Uranium	Vanadium	Ytterbium	Yttrium	Zinc
12478100	10-19-89	0.09	4	< 10	0.28	3.3	84	2	20	77
12479500	11-03-87	.02	< 4	< 10	.64	.65	140	3	23	89
12479720	05-02-89	1.6	6	< 10	.85	< .05	140	3	23	150
12480000	10-19-89	< .05	6	< 10	.64	1.1	130	2	22	99
12481900	11-03-90	.07	5	< 5	.54	< 100	160	2	20	110
12483190	10-16-89	< .05	7	< 5	.83	< 100	200	3	27	110
12483750	10-29-91	.12	6	< 5	.61	< 100	170	3	27	100
12484440	09-15-87(r)	.04	5	< 10	.55	.60	120	2	19	76
12484440	09-15-87(r)	.03	5	< 10	.63	.75	130	3	19	77
12484500	11-05-87	.03	< 4	< 10	.50	.80	110	2	19	93
12484550	05-03-89	2.2	5	< 10	1.0	< .05	230	3	26	100
12487200	10-30-91	.06	5	< 5	.63	< 100	130	4	38	100
12488250	10-30-91	.07	5	< 5	.60	< 100	100	3	28	210
12489100	10-21-89	.06	6	< 10	.58	.90	130	3	29	110
12489150	08-12-87	< .01	7	< 10	.73	.70	170	3	24	110
12499000	08-10-87(r)	.08	< 4	< 10	.57	2.1	140	3	23	100
12499000	08-10-87(r)	.06	4	< 10	.62	1.9	150	3	23	110
12499000	08-10-87	.06	4	< 10	.58	2.0	140	3	24	120
12500430	08-12-87	< .01	10	< 10	.68	.60	130	2	19	94
12500437	05-01-89	5.3	4	< 10	.61	.15	140	2	19	170
12500442	08-10-87(r)	.14	4	< 10	.59	1.3	140	3	22	240
12500442	08-10-87(r)	.08	4	< 10	.72	1.0	160	3	22	200
12500442	08-10-87(r)	.09	5	< 10	.75	1.1	180	3	21	200
12500900	11-06-90	.06	6	< 5	.97	< 100	240	3	27	120
12502500	09-14-87	.06	5	< 10	.84	1.3	210	3	22	98
12503950	08-13-87(r)	.03	6	< 10	.57	1.3	120	3	21	100
12503950	08-13-87(r)	.04	5	< 10	.58	.90	120	3	21	100
12505460	08-14-87	< .01	11	< 10	1.0	1.2	200	3	25	87
12507508	08-13-87	.04	7	< 10	.67	1.1	140	3	22	100
12507525	10-31-91	.05	7	< 5	.73	< 100	160	2	23	100
12507585	11-01-89	.06	7	< 10	.66	1.5	140	3	22	110
12507594	09-20-90	.06	6	< 10	1.1	1.8	220	4	34	160
12508500	08-24-87	.02	6	< 10	.65	.90	130	3	23	82
12508620	09-14-87	.04	6	< 10	.80	1.4	180	3	25	97
12508850	04-21-91	< .05	9	< 5	.76	< 100	170	2	23	98
12509050	08-27-87(r)	.02	9	< 10	.64	1.4	150	3	22	99
12509050	08-27-87(r)	.03	8	< 10	.66	1.1	150	3	23	97
12509710	08-25-87	< .01	15	< 10	.93	1.5	200	3	24	88
12510500	08-25-87	.04	8	< 10	.62	1.1	140	3	23	100

Table 27. Concentrations of major and minor elements in suspended sediment, Yakima River Basin, Washington, 1987-90

[All concentrations are reported in micrograms per gram (µg/g), unless otherwise noted; m^2/g = square meters per gram; mg/L = milligrams per liter; mm = millimeters; C = carbon; "--" = not determined; "<" = less than; ">" = greater than; E = estimated value; M = presence of material verified but not quantified; RM = river mile]

Site reference number	Station number	Site name	Date	Time	Discharge, instantaneous (cubic feet per second)	Surface area (m^2/g)
6	12479500	Yakima River at Cle Elum	08-10-87	1200	3,610	7.3
6	12479500	Yakima River at Cle Elum	04-16-88	1215	1,430	14.7
6	12479500	Yakima River at Cle Elum	05-10-88	0930	672	9.6
6	12479500	Yakima River at Cle Elum	06-14-88	1000	1,500	8.6
6	12479500	Yakima River at Cle Elum	07-12-88	1130	2,950	17.0
6	12479500	Yakima River at Cle Elum	08-09-88	1100	3,610	6.4
6	12479500	Yakima River at Cle Elum	12-13-88	1210	1,170	12.3
6	12479500	Yakima River at Cle Elum	01-31-89	1857	1,410	11.8
6	12479500	Yakima River at Cle Elum	02-14-89	1200	442	9.1
6	12479500	Yakima River at Cle Elum	04-06-89	1943	2,150	12.2
6	12479500	Yakima River at Cle Elum	04-11-89	1110	1,200	--
6	12479500	Yakima River at Cle Elum	05-09-89	1127	1,440	9.3
6	12479500	Yakima River at Cle Elum	11-14-89	0605	1,020	26.5
6	12479500	Yakima River at Cle Elum	12-12-89	1201	837	13.2
6	12479500	Yakima River at Cle Elum	01-09-90	1052	1,450	10.4
6	12479500	Yakima River at Cle Elum	01-10-90	1130	3,130	13.0
6	12479500	Yakima River at Cle Elum	02-13-90	0815	1,670	8.4
19	12484500	Yakima River at Umtanum	07-15-87	0800	3,230	18.7
19	12484500	Yakima River at Umtanum	08-18-87	0900	3,350	15.6
19	12484500	Yakima River at Umtanum	09-09-87	0845	1,820	4.3
19	12484500	Yakima River at Umtanum	10-14-87	0750	559	33.7
19	12484500	Yakima River at Umtanum	01-13-88	1200	454	16.1
19	12484500	Yakima River at Umtanum	02-10-88	1000	1,060	19.3
19	12484500	Yakima River at Umtanum	04-13-88	1050	1,910	21.7
19	12484500	Yakima River at Umtanum	04-15-88	1520	3,850	20.1
19	12484500	Yakima River at Umtanum	05-11-88	1130	1,550	33.1
19	12484500	Yakima River at Umtanum	06-15-88	1245	2,280	11.7
19	12484500	Yakima River at Umtanum	07-13-88	1100	3,450	17.9
19	12484500	Yakima River at Umtanum	08-10-88	1045	3,800	13.8
19	12484500	Yakima River at Umtanum	09-14-88	1110	1,210	32.4
19	12484500	Yakima River at Umtanum	09-21-88	1610	1,230	30.0
19	12484500	Yakima River at Umtanum	09-22-88	0015	1,130	35.1
19	12484500	Yakima River at Umtanum	09-22-88	0815	1,060	29.1
19	12484500	Yakima River at Umtanum	10-12-88	1300	753	28.5
19	12484500	Yakima River at Umtanum	11-09-88	1100	1,300	--

Table 27. Concentrations of major and minor elements in suspended sediment, Yakima River Basin, Washington, 1987-90—Continued

Station number	Date	Sediment, suspended (mg/L)	Percentage of sediment finer than 0.062 mm	Carbon, organic suspended total (mg/L as C)	Aluminum (percent)	Antimony	Arsenic	Beryllium	Cadmium	Calcium (percent)
12479500	08-10-87	3	67	--	--	--	--	--	--	--
12479500	04-16-88	16	95	0.4	8.3	0.8	8.8	<2	0.7	1.9
12479500	05-10-88	2	89	.2	--	--	--	--	--	--
12479500	06-14-88	2	79	--	--	--	--	--	--	--
12479500	07-12-88	7	45	.1	--	--	--	--	--	--
12479500	08-09-88	3	52	.2	--	--	--	--	--	--
12479500	12-13-88	25	98	.3	8.1	.9	7.1	<2	9.3	1.8
12479500	01-31-89	25	95	.5	9.0	1.2	6.6	<2	.6	1.5
12479500	02-14-89	2	93	.1	--	--	--	--	--	--
12479500	04-06-89	85	91	.6	8.4	.6	7.0	<2	.7	1.9
12479500	04-11-89	5	95	.4	8.5	.7	6.9	2	2.6	1.8
12479500	05-09-89	6	95	.3	7.5	2.6	8.4	<2	3.0	1.8
12479500	11-14-89	6	E99	<.1	8.6	.7	7.9	<2	1.3	1.7
12479500	12-12-89	3	E100	.1	9.2	.7	6.7	<2	.5	1.6
12479500	01-09-90	12	E88	.6	9.0	3.1	7.6	<2	1.0	1.2
12479500	01-10-90	130	47	1.9	8.8	.6	6.3	<2	.3	2.0
12479500	02-13-90	8	E75	.1	8.4	2.3	6.3	<2	.8	1.8
12484500	07-15-87	--	--	.4	6.8	.7	4.8	<2	.3	2.0
12484500	08-18-87	10	81	.3	6.9	.6	3.8	<2	.5	2.0
12484500	09-09-87	18	88	.4	5.8	.5	6.0	<2	.4	1.6
12484500	10-14-87	6	96	--	5.8	.4	4.7	<2	.4	1.5
12484500	01-13-88	3	87	.3	--	--	--	--	--	--
12484500	02-10-88	25	88	.7	5.8	.4	6.0	<2	.3	1.8
12484500	04-13-88	22	84	.7	6.5	.7	5.7	<2	.5	1.7
12484500	04-15-88	78	90	>1.7	7.5	.6	6.3	<2	.2	2.0
12484500	05-11-88	14	92	.6	6.1	.3	2.8	<2	.5	1.8
12484500	06-15-88	12	79	.3	6.6	.5	4.8	<2	1.2	1.9
12484500	07-13-88	24	63	.4	7.0	.5	5.4	<2	.8	1.8
12484500	08-10-88	10	64	.3	6.8	.7	6.9	<2	1.7	1.9
12484500	09-14-88	12	71	.4	6.9	.7	6.0	2	1.5	1.9
12484500	09-21-88	22	86	.7	6.4	.5	4.6	<2	<.1	1.8
12484500	09-22-88	42	84	.4	6.4	.5	4.4	<2	<.1	1.8
12484500	09-22-88	--	--	.6	6.4	.6	5.0	<2	<.1	1.8
12484500	10-12-88	3	91	.6	--	--	--	--	--	--
12484500	11-09-88	6	95	.3	6.8	.7	6.3	<2	.6	1.8

Table 27. Concentrations of major and minor elements in suspended sediment, Yakima River Basin, Washington, 1987-90—Continued

Station number	Date	Chro-mium	Cobalt	Copper	Iron (percent)	Lead	Magne-sium (percent)	Man-ganese	Molyb-denum
12479500	08-10-87	--	--	--	--	--	--	--	--
12479500	04-16-88	--	27	70	5.9	12	1.9	1,500	<0.1
12479500	05-10-88	--	--	--	--	--	--	--	--
12479500	06-14-88	--	--	--	--	--	--	--	--
12479500	07-12-88	--	--	--	--	--	--	--	--
12479500	08-09-88	--	--	--	--	--	--	--	--
12479500	12-13-88	110	25	61	5.4	17	1.7	2,000	.6
12479500	01-31-89	110	23	55	4.9	24	1.5	1,600	.7
12479500	02-14-89	--	--	--	--	--	--	--	--
12479500	04-06-89	110	23	49	5.3	12	1.8	1,700	.7
12479500	04-11-89	110	26	60	5.8	16	1.9	2,200	.8
12479500	05-09-89	140	23	68	5.1	120	1.7	1,400	.9
12479500	11-14-89	110	26	62	5.8	19	1.8	2,000	.7
12479500	12-12-89	120	28	60	5.9	15	1.9	2,600	.8
12479500	01-09-90	110	20	67	4.0	60	1.1	1,400	1.3
12479500	01-10-90	120	25	47	5.8	12	1.8	1,500	.7
12479500	02-13-90	110	22	54	5.5	21	1.7	1,600	.9
12484500	07-15-87	110	21	33	4.6	18	1.8	1,200	.6
12484500	08-18-87	120	20	57	4.5	16	1.5	1,300	.7
12484500	09-09-87	80	19	54	4.3	12	1.2	1,900	.6
12484500	10-14-87	66	21	73	4.9	18	1.3	3,000	.6
12484500	01-13-88	--	--	--	--	--	--	--	--
12484500	02-10-88	--	20	42	4.6	9	1.2	2,200	<.1
12484500	04-13-88	--	22	48	4.8	13	1.4	1,700	<.1
12484500	04-15-88	--	28	39	5.7	10	2.0	1,400	<.1
12484500	05-11-88	120	18	45	4.5	6	1.2	1,600	.4
12484500	06-15-88	120	21	56	4.8	14	1.4	1,600	.6
12484500	07-13-88	160	22	39	4.9	13	1.6	1,500	.6
12484500	08-10-88	150	24	41	5.0	16	1.7	1,700	.6
12484500	09-14-88	78	22	49	5.2	26	1.4	2,000	.7
12484500	09-21-88	74	22	40	4.8	18	1.4	2,300	.5
12484500	09-22-88	59	22	51	4.9	27	1.3	2,200	.6
12484500	09-22-88	68	21	41	4.9	17	1.3	2,100	.7
12484500	10-12-88	--	--	--	--	--	--	--	--
12484500	11-09-88	84	25	60	5.4	18	1.6	2,600	.6

Table 27. Concentrations of major and minor elements in suspended sediment, Yakima River Basin, Washington, 1987-90—Continued

Station number	Date	Nickel	Phos-phorus (percent)	Potas-sium (percent)	Silver	Sodium (percent)	Thal-lium	Tita-nium (percent)	Vana-dium	Zinc
12479500	08-10-87	--	--	--	--	--	--	--	--	--
12479500	04-16-88	--	0.15	1.1	0.4	1.3	0.3	0.71	170	--
12479500	05-10-88	--	--	--	--	--	--	--	--	--
12479500	06-14-88	--	--	--	--	--	--	--	--	--
12479500	07-12-88	--	--	--	--	--	--	--	--	--
12479500	08-09-88	--	--	--	--	--	--	--	--	--
12479500	12-13-88	65	.15	1.2	.2	1.2	.3	.60	160	230
12479500	01-31-89	66	.15	1.1	.2	1.3	.4	.58	140	150
12479500	02-14-89	--	--	--	--	--	--	--	--	--
12479500	04-06-89	62	.14	1.1	.3	1.6	.3	.74	160	160
12479500	04-11-89	73	.15	1.1	.3	1.4	.3	.76	170	200
12479500	05-09-89	130	.14	1.1	.5	1.2	.5	.64	140	520
12479500	11-14-89	74	.15	1.1	.4	1.2	.3	.66	160	170
12479500	12-12-89	80	.15	1.2	.5	1.2	.3	.66	160	200
12479500	01-09-90	72	.16	.90	.4	1.0	.4	.50	120	230
12479500	01-10-90	66	.14	1.1	.3	1.5	.4	.71	170	140
12479500	02-13-90	75	.14	1.0	.9	1.3	.4	.65	160	160
12484500	07-15-87	110	.11	.95	.2	1.6	.3	.52	120	100
12484500	08-18-87	93	.11	1.0	.2	1.6	.3	.52	120	100
12484500	09-09-87	66	.21	.93	7.7	1.1	.2	.47	110	100
12484500	10-14-87	49	.17	1.0	.2	1.0	.3	.51	130	130
12484500	01-13-88	--	--	--	--	--	--	--	--	--
12484500	02-10-88	--	.19	.89	.2	1.2	.2	.49	120	--
12484500	04-13-88	--	.15	.90	.2	1.1	.2	.52	120	--
12484500	04-15-88	--	.13	.96	.2	1.4	.3	.61	140	--
12484500	05-11-88	61	.15	1.4	.2	1.1	.2	.49	110	220
12484500	06-15-88	88	.15	1.0	.2	1.3	.3	.54	120	170
12484500	07-13-88	100	.13	1.1	.2	1.4	.3	.55	120	120
12484500	08-10-88	130	.14	.97	.2	1.4	.2	.57	130	140
12484500	09-14-88	67	.16	1.1	.2	1.3	.4	.55	130	130
12484500	09-21-88	61	.18	.98	.2	1.2	.3	.52	120	140
12484500	09-22-88	43	.16	1.0	.2	1.2	.3	.51	120	130
12484500	09-22-88	49	.18	1.0	.2	1.2	.3	.52	130	120
12484500	10-12-88	--	--	--	--	--	--	--	--	--
12484500	11-09-88	71	.16	1.1	.3	1.2	.3	.56	140	150

Table 27. Concentrations of major and minor elements in suspended sediment, Yakima River Basin, Washington, 1987-90—Continued

Site reference number	Station number	Site name	Date	Time	Discharge, instantaneous (cubic feet per second)	Surface area (m^2/g)
19	12484500	Yakima River at Umtanum	12-14-88	1205	2,230	14.8
19	12484500	Yakima River at Umtanum	01-11-89	1130	1,010	14.7
19	12484500	Yakima River at Umtanum	01-31-89	2100	2,940	21.9
19	12484500	Yakima River at Umtanum	03-15-89	1158	1,570	20.9
19	12484500	Yakima River at Umtanum	04-06-89	2145	3,770	20.9
19	12484500	Yakima River at Umtanum	04-12-89	1300	3,370	15.3
19	12484500	Yakima River at Umtanum	05-10-89	1125	5,600	10.6
19	12484500	Yakima River at Umtanum	06-14-89	1110	3,470	12.3
19	12484500	Yakima River at Umtanum	07-12-89	0845	3,850	12.5
19	12484500	Yakima River at Umtanum	08-10-89	1130	3,780	9.4
19	12484500	Yakima River at Umtanum	09-13-89	1915	1,130	19.5
19	12484500	Yakima River at Umtanum	10-12-89	0900	1,340	17.2
19	12484500	Yakima River at Umtanum	11-15-89	0635	1,480	14.9
19	12484500	Yakima River at Umtanum	12-05-89	1523	2,720	18.6
19	12484500	Yakima River at Umtanum	12-13-89	1057	1,240	19.7
19	12484500	Yakima River at Umtanum	01-10-90	0737	3,960	14.0
19	12484500	Yakima River at Umtanum	02-14-90	0845	2,230	13.7
19	12484500	Yakima River at Umtanum	03-14-90	0945	1,340	10.2
26	12499000	Naches River near North Yakima	07-15-87	1450	656	21.4
26	12499000	Naches River near North Yakima	08-10-87	1458	285	12.4
26	12499000	Naches River near North Yakima	09-09-87	0955	1,350	30.4
26	12499000	Naches River near North Yakima	10-14-87	1347	1,310	32.4
26	12499000	Naches River near North Yakima	04-13-88	1330	1,810	23.0
26	12499000	Naches River near North Yakima	05-11-88	1400	2,200	25.7
26	12499000	Naches River near North Yakima	05-13-88	1945	3,940	23.1
26	12499000	Naches River near North Yakima	06-14-88	1520	1,480	10.2
26	12499000	Naches River near North Yakima	07-16-88	1415	608	18.7
26	12499000	Naches River near North Yakima	08-10-88	1544	674	12.1
26	12499000	Naches River near North Yakima	09-14-88	1217	2,110	24.3
26	12499000	Naches River near North Yakima	10-11-88	0808	1,470	31.8
26	12499000	Naches River near North Yakima	12-14-88	1430	1,130	10.1
26	12499000	Naches River near North Yakima	02-15-89	1414	350	10.1
26	12499000	Naches River near North Yakima	03-15-89	1336	1,010	27.3
26	12499000	Naches River near North Yakima	04-07-89	1715	2,500	23.0
26	12499000	Naches River near North Yakima	04-14-89	1508	2,990	15.4

Table 27. Concentrations of major and minor elements in suspended sediment, Yakima River Basin, Washington, 1987-90—Continued

Station number	Date	Sediment, suspended (mg/L)	Percentage of sediment finer than 0.062 mm	Carbon, organic suspended total (mg/L as C)	Aluminum (percent)	Antimony	Arsenic	Beryllium	Cadmium	Calcium (percent)
12484500	12-14-88	17	88	0.6	7.4	0.5	5.5	<2	0.4	1.9
12484500	01-11-89	2	96	.2	--	--	--	--	--	--
12484500	01-31-89	70	90	.5	8.1	.8	7.4	2	.5	1.8
12484500	03-15-89	22	95	.2	7.8	.5	5.0	2	1.7	1.7
12484500	04-06-89	109	82	.7	7.6	.6	4.8	<2	.6	2.0
12484500	04-12-89	34	79	1.3	7.6	.6	4.6	<2	1.3	2.0
12484500	05-10-89	97	61	--	9.7	.5	5.2	<2	.4	2.9
12484500	06-14-89	17	65	.5	6.9	.5	3.8	<2	.8	2.0
12484500	07-12-89	26	39	.1	7.1	.5	5.9	<2	.5	2.1
12484500	08-10-89	9	83	.2	7.1	.6	5.5	<2	.7	2.2
12484500	09-13-89	11	89	.6	6.4	.5	4.3	<2	.7	1.9
12484500	10-12-89	6	E86	.3	6.0	.9	4.4	<2	.6	1.7
12484500	11-15-89	25	34	--	6.9	.7	4.1	<2	.3	2.0
12484500	12-05-89	48	70	1.9	7.3	.7	5.6	<2	.3	1.8
12484500	12-13-89	4	E80	.2	6.6	.7	5.5	<2	1.8	1.6
12484500	01-10-90	108	78	--	7.1	.5	4.4	<2	.2	1.9
12484500	02-14-90	6	E83	.1	7.9	.8	6.2	<2	33	1.6
12484500	03-14-90	3	E82	.2	5.8	.8	4.1	<2	.5	1.5
12499000	07-15-87	3	88	.4	--	--	--	--	--	--
12499000	08-10-87	6	83	--	5.2	.5	4.7	<2	.1	2.0
12499000	09-09-87	14	91	.4	7.5	.6	10	<2	1.6	2.0
12499000	10-14-87	24	98	.2	8.7	.6	13	<2	.6	1.4
12499000	04-13-88	30	87	1.2	6.3	.5	6.9	<2	.7	1.9
12499000	05-11-88	10	84	.5	6.6	.6	7.7	<2	1.2	2.2
12499000	05-13-88	73	83	2.9	7.5	.7	8.8	<2	.4	2.4
12499000	06-14-88	5	87	.2	--	--	--	--	--	--
12499000	07-16-88	3	92	.4	--	--	--	--	--	--
12499000	08-10-88	5	87	2.1	7.4	.5	4.4	<2	.3	2.8
12499000	09-14-88	20	90	.4	8.0	.6	8.9	<2	1.3	2.5
12499000	10-11-88	7	93	.3	7.6	.6	13	<2	.1	1.9
12499000	12-14-88	6	96	.3	5.3	.5	5.9	<2	4.5	2.0
12499000	02-15-89	4	96	.3	5.5	.8	6.5	<2	2.8	2.0
12499000	03-15-89	21	93	.7	7.8	.5	5.5	<2	.7	1.8
12499000	04-07-89	78	81	1.9	7.5	.5	5.4	<2	.6	2.3
12499000	04-14-89	77	63	1.4	7.6	1.2	6.0	<2	.8	2.5

Table 27. Concentrations of major and minor elements in suspended sediment, Yakima River Basin, Washington, 1987-90—Continued

Station number	Date	Chro-mium	Cobalt	Copper	Iron (percent)	Lead	Magne-sium (percent)	Man-ganese	Molyb-denum
12484500	12-14-88	110	25	48	5.4	13	1.7	1,900	0.6
12484500	01-11-89	--	--	--	--	--	--	--	--
12484500	01-31-89	130	25	43	5.6	14	1.7	1,400	.5
12484500	03-15-89	98	20	46	5.3	20	1.2	1,300	.5
12484500	04-06-89	110	20	35	4.8	12	1.5	1,200	.5
12484500	04-12-89	100	23	39	5.4	23	1.6	1,400	.7
12484500	05-10-89	160	27	41	6.3	10	2.4	1,400	.6
12484500	06-14-89	97	19	32	4.4	13	1.5	1,100	.5
12484500	07-12-89	100	23	39	4.9	13	1.6	1,400	.5
12484500	08-10-89	130	19	31	4.7	13	1.6	1,400	.4
12484500	09-13-89	82	23	42	5.0	15	1.2	2,600	.6
12484500	10-12-89	73	22	52	5.0	410	1.1	2,600	.6
12484500	11-15-89	94	20	60	4.8	22	1.3	2,000	.6
12484500	12-05-89	150	28	43	5.6	12	2.0	1,800	.6
12484500	12-13-89	93	25	61	5.6	20	1.4	3,700	.7
12484500	01-10-90	120	21	38	4.8	12	1.5	1,500	.5
12484500	02-14-90	120	25	64	5.7	25	1.5	2,400	.9
12484500	03-14-90	80	16	37	4.5	15	1.1	1,600	.4
12499000	07-15-87	--	--	--	--	--	--	--	--
12499000	08-10-87	42	13	40	3.8	24	.9	1,400	.6
12499000	09-09-87	54	20	78	5.0	19	1.2	3,600	1.0
12499000	10-14-87	83	22	77	5.8	17	1.5	3,200	1.1
12499000	04-13-88	--	17	54	5.0	13	.9	1,400	<.1
12499000	05-11-88	65	18	42	4.9	15	1.0	1,500	1.0
12499000	05-13-88	46	18	44	5.4	10	1.1	1,500	1.0
12499000	06-14-88	--	--	--	--	--	--	--	--
12499000	07-16-88	--	--	--	--	--	--	--	--
12499000	08-10-88	48	15	28	4.4	13	1.2	1,400	.6
12499000	09-14-88	45	21	53	5.4	18	1.3	2,600	1.1
12499000	10-11-88	60	23	59	5.6	26	1.3	3,300	1.2
12499000	12-14-88	38	15	26	4.2	24	.9	1,500	.8
12499000	02-15-89	35	16	48	4.4	46	.9	1,600	.8
12499000	03-15-89	44	20	50	5.5	20	.8	1,300	.8
12499000	04-07-89	31	18	42	5.3	15	1.0	1,300	.7
12499000	04-14-89	33	18	40	5.0	14	1.0	1,300	.7

Table 27. Concentrations of major and minor elements in suspended sediment, Yakima River Basin, Washington, 1987-90—Continued

Station number	Date	Nickel	Phos-phorus (percent)	Potas-sium (percent)	Silver	Sodium (percent)	Thal-lium	Tita-nium (percent)	Vana-dium	Zinc
12484500	12-14-88	100	0.14	1.0	0.3	1.3	0.3	0.54	150	120
12484500	01-11-89	--	--	--	--	--	--	--	--	--
12484500	01-31-89	120	.12	1.0	.2	1.3	.3	.58	150	110
12484500	03-15-89	72	.14	1.1	.2	1.1	.3	.58	140	160
12484500	04-06-89	85	.12	1.0	.2	1.5	.3	.56	130	98
12484500	04-12-89	94	.13	.99	.2	1.4	.3	.65	140	180
12484500	05-10-89	140	.15	1.3	.2	2.4	.2	.83	170	170
12484500	06-14-89	91	.12	.95	.2	1.6	.2	.58	120	130
12484500	07-12-89	100	.13	1.0	.3	1.6	.3	.60	130	150
12484500	08-10-89	100	.11	1.0	.2	1.7	.3	.59	120	150
12484500	09-13-89	77	.15	.90	.8	1.2	.2	.51	130	180
12484500	10-12-89	64	.19	.80	.3	1.0	.3	.48	130	380
12484500	11-15-89	75	.15	.90	.3	1.4	.3	.54	130	380
12484500	12-05-89	170	.14	.90	.3	1.2	.3	.56	140	160
12484500	12-13-89	89	.18	.90	1.7	.9	.3	.52	150	220
12484500	01-10-90	92	.13	.90	.2	1.3	.3	.54	130	130
12484500	02-14-90	140	.16	.90	.4	1.0	.3	.59	150	250
12484500	03-14-90	71	.19	.70	.5	.8	.3	.45	120	140
12499000	07-15-87	--	--	--	--	--	--	--	--	--
12499000	08-10-87	19	.14	.76	.3	1.0	.3	.41	110	120
12499000	09-09-87	29	.12	1.2	.2	1.3	.4	.49	150	120
12499000	10-14-87	41	.13	1.6	.3	1.3	.4	.47	170	120
12499000	04-13-88	--	.13	.77	.3	.9	.2	.56	120	--
12499000	05-11-88	16	.14	.88	.3	1.2	.3	.53	120	120
12499000	05-13-88	14	.13	.96	.1	1.4	.3	.60	130	110
12499000	06-14-88	--	--	--	--	--	--	--	--	--
12499000	07-16-88	--	--	--	--	--	--	--	--	--
12499000	08-10-88	17	.11	1.1	<.1	1.8	.2	.54	120	91
12499000	09-14-88	22	.13	1.3	.2	1.6	.4	.57	150	110
12499000	10-11-88	30	.15	1.2	.2	1.2	.4	.49	160	120
12499000	12-14-88	16	.22	.80	.3	.9	.2	.47	110	130
12499000	02-15-89	16	.20	.73	.4	1.0	.2	.46	110	140
12499000	03-15-89	21	.13	.96	.1	1.1	.5	.56	120	110
12499000	04-07-89	16	.13	.96	.2	1.3	.3	.65	130	140
12499000	04-14-89	16	.13	.98	.2	1.5	.3	.61	130	130

Table 27. Concentrations of major and minor elements in suspended sediment, Yakima River Basin, Washington, 1987-90—Continued

Site reference number	Station number	Site name	Date	Time	Discharge, instantaneous (cubic feet per second)	Surface area (m^2/g)
26	12499000	Naches River near North Yakima	05-10-89	1510	3,660	11.8
26	12499000	Naches River near North Yakima	06-14-89	1602	2,760	17.6
26	12499000	Naches River near North Yakima	09-15-89	1423	2,200	19.1
26	12499000	Naches River near North Yakima	12-13-89	1513	680	5.8
26	12499000	Naches River near North Yakima	01-10-90	1332	4,910	14.6
26	12499000	Naches River near North Yakima	02-14-90	1503	1,090	18.9
32	12500450	Yakima River above Ahtanum Creek at Union Gap	07-16-87	1225	3,340	17.2
32	12500450	Yakima River above Ahtanum Creek at Union Gap	08-11-87	0800	2,790	18.0
32	12500450	Yakima River above Ahtanum Creek at Union Gap	08-11-87	2246	3,510	16.1
32	12500450	Yakima River above Ahtanum Creek at Union Gap	08-12-87	0630	3,440	12.1
32	12500450	Yakima River above Ahtanum Creek at Union Gap	09-10-87	1030	2,320	23.8
32	12500450	Yakima River above Ahtanum Creek at Union Gap	10-15-87	1046	1,530	22.8
32	12500450	Yakima River above Ahtanum Creek at Union Gap	11-12-87	1135	678	--
32	12500450	Yakima River above Ahtanum Creek at Union Gap	12-10-87	1352	3,600	20.5
32	12500450	Yakima River above Ahtanum Creek at Union Gap	01-14-88	1045	863	8.1
32	12500450	Yakima River above Ahtanum Creek at Union Gap	02-11-88	1633	1,980	15.9
32	12500450	Yakima River above Ahtanum Creek at Union Gap	02-11-88	1638	--	13.9
32	12500450	Yakima River above Ahtanum Creek at Union Gap	03-10-88	1035	1,720	17.7
32	12500450	Yakima River above Ahtanum Creek at Union Gap	04-14-88	1202	4,720	28.5
32	12500450	Yakima River above Ahtanum Creek at Union Gap	05-12-88	1130	3,540	23.4
32	12500450	Yakima River above Ahtanum Creek at Union Gap	05-15-88	1520	4,380	27.7
32	12500450	Yakima River above Ahtanum Creek at Union Gap	06-15-88	1652	3,350	27.4
32	12500450	Yakima River above Ahtanum Creek at Union Gap	07-14-88	0800	3,170	13.7
32	12500450	Yakima River above Ahtanum Creek at Union Gap	08-11-88	1718	3,440	17.8
32	12500450	Yakima River above Ahtanum Creek at Union Gap	09-15-88	1030	2,390	22.1
32	12500450	Yakima River above Ahtanum Creek at Union Gap	10-13-88	0858	1,820	26.6
32	12500450	Yakima River above Ahtanum Creek at Union Gap	11-10-88	1050	2,100	25.4
32	12500450	Yakima River above Ahtanum Creek at Union Gap	12-16-88	1356	2,450	17.5
32	12500450	Yakima River above Ahtanum Creek at Union Gap	02-24-89	1340	1,490	16.4
32	12500450	Yakima River above Ahtanum Creek at Union Gap	03-10-89	1056	2,960	48.5
32	12500450	Yakima River above Ahtanum Creek at Union Gap	03-17-89	1355	2,460	20.0
32	12500450	Yakima River above Ahtanum Creek at Union Gap	04-15-89	1514	8,460	19.9
32	12500450	Yakima River above Ahtanum Creek at Union Gap	05-11-89	1115	8,920	12.9
32	12500450	Yakima River above Ahtanum Creek at Union Gap	06-15-89	1549	5,080	15.3
32	12500450	Yakima River above Ahtanum Creek at Union Gap	07-13-89	1055	3,300	13.1

Table 27. Concentrations of major and minor elements in suspended sediment, Yakima River Basin, Washington, 1987-90—Continued

Station number	Date	Sediment, suspended (mg/L)	Percentage of sediment finer than 0.062 mm	Carbon, organic suspended total (mg/L as C)	Aluminum (percent)	Antimony	Arsenic	Beryllium	Cadmium	Calcium (percent)
12499000	05-10-89	24	64	0.6	8.0	0.6	6.8	<2	1.3	2.7
12499000	06-14-89	11	56	.3	7.4	.6	6.8	<2	1.4	2.5
12499000	09-15-89	27	74	.7	7.6	.6	5.3	<2	.4	2.3
12499000	12-13-89	13	E66	1.0	6.8	.5	4.9	<2	.7	2.7
12499000	01-10-90	129	66	4.3	8.0	.5	5.8	<2	.2	2.9
12499000	02-14-90	2	E88	.3	6.2	1.0	6.1	<2	1.7	1.8
12500450	07-16-87	26	90	.8	6.9	.5	5.3	<2	.6	2.1
12500450	08-11-87	16	86	.1	6.5	.5	5.0	<2	.2	1.9
12500450	08-11-87	15	84	.4	6.6	.6	4.2	<2	.2	2.0
12500450	08-12-87	16	83	.5	6.5	.5	4.6	<2	.3	2.0
12500450	09-10-87	12	90	<.1	7.0	.6	6.9	<2	.6	1.9
12500450	10-15-87	15	94	--	7.0	1.1	11	<2	.6	1.3
12500450	11-12-87	137	27	.5	4.6	.5	5.1	<2	.7	1.4
12500450	12-10-87	162	88	>2.9	7.4	.5	5.1	<2	.3	2.5
12500450	01-14-88	4	84	.3	--	--	--	--	--	--
12500450	02-11-88	13	87	1.0	5.7	.5	7.2	<2	.5	1.8
12500450	02-11-88	--	--	--	5.8	.4	7.1	<2	.8	1.9
12500450	03-10-88	11	91	--	5.4	.5	5.4	<2	.3	1.6
12500450	04-14-88	76	81	3.1	6.6	.5	6.9	<2	.4	2.0
12500450	05-12-88	26	--	--	6.5	.4	4.2	<2	.2	2.0
12500450	05-15-88	28	92	1.0	7.3	.5	6.9	<2	.6	2.3
12500450	06-15-88	13	92	.5	6.9	.5	4.6	<2	.8	2.1
12500450	07-14-88	28	92	--	7.0	.5	5.2	<2	.4	1.9
12500450	08-11-88	16	92	.7	6.7	.5	5.6	<2	.4	1.9
12500450	09-15-88	18	85	.6	7.6	.7	9.0	<2	.2	2.3
12500450	10-13-88	12	93	.4	7.3	.7	10	<2	1.2	1.9
12500450	11-10-88	12	--	.2	6.5	.6	6.4	<2	.1	1.9
12500450	12-16-88	7	96	.3	6.3	.8	6.2	<2	1.2	1.8
12500450	02-24-89	20	96	.7	6.8	.6	5.4	<2	.7	2.0
12500450	03-10-89	1,110	98	>4.9	7.6	.5	5.0	2	.4	2.1
12500450	03-17-89	23	88	.2	7.2	.5	4.2	<2	.5	2.0
12500450	04-15-89	133	68	3.0	7.7	.5	4.6	<2	.4	2.5
12500450	05-11-89	50	79	.5	7.6	.6	5.1	<2	.4	2.6
12500450	06-15-89	19	87	.9	7.3	.6	6.7	<2	.5	2.2
12500450	07-13-89	28	72	.1	7.2	.5	5.8	<2	.7	2.1

Table 27. Concentrations of major and minor elements in suspended sediment, Yakima River Basin, Washington, 1987-90—Continued

Station number	Date	Chro-mium	Cobalt	Copper	Iron (percent)	Lead	Magne-sium (percent)	Man-ganese	Molyb-denum
12499000	05-10-89	28	17	46	5.2	25	1.1	1,300	0.7
12499000	06-14-89	36	18	46	4.9	18	1.1	1,600	.7
12499000	09-15-89	41	18	54	5.0	14	1.1	2,300	.6
12499000	12-13-89	46	18	39	4.8	20	1.2	1,600	.8
12499000	01-10-90	30	19	33	5.2	11	1.3	1,200	.8
12499000	02-14-90	35	17	51	4.8	21	.9	1,600	1.0
12500450	07-16-87	73	19	41	4.6	22	1.3	1,100	.7
12500450	08-11-87	73	18	120	4.6	33	1.2	1,400	.9
12500450	08-11-87	83	19	46	4.6	21	1.3	1,400	.7
12500450	08-12-87	73	18	49	4.5	20	1.3	1,300	.5
12500450	09-10-87	63	20	150	4.9	23	M1.2	2,600	.7
12500450	10-15-87	78	19	93	5.0	30	1.3	3,100	3.0
12500450	11-12-87	59	16	53	3.9	16	1.0	2,900	1.3
12500450	12-10-87	53	19	42	4.9	27	1.2	1,200	1.1
12500450	01-14-88	--	--	--	--	--	--	--	--
12500450	02-11-88	--	19	78	4.6	13	1.1	2,100	<.1
12500450	02-11-88	--	18	89	4.5	14	1.1	2,000	<.1
12500450	03-10-88	--	17	88	4.5	11	1.0	2,300	<.1
12500450	04-14-88	--	18	41	4.9	12	1.1	1,500	<.1
12500450	05-12-88	80	18	42	4.8	12	1.1	1,600	.6
12500450	05-15-88	69	19	46	5.4	13	1.2	1,600	.8
12500450	06-15-88	87	19	50	5.0	18	1.2	1,800	.6
12500450	07-14-88	89	17	43	4.6	18	1.2	1,200	.6
12500450	08-11-88	90	19	44	4.8	19	1.3	1,400	.6
12500450	09-15-88	53	22	61	5.3	26	1.3	2,500	1.3
12500450	10-13-88	62	21	89	5.4	30	1.3	2,800	1.1
12500450	11-10-88	80	21	65	5.1	18	1.4	2,400	.8
12500450	12-16-88	70	20	94	5.1	29	1.2	2,100	.8
12500450	02-24-89	87	21	42	5.1	17	1.4	1,500	.6
12500450	03-10-89	43	25	43	6.4	17	1.2	1,300	.7
12500450	03-17-89	62	21	45	5.5	19	1.1	1,600	.7
12500450	04-15-89	63	20	36	5.2	14	1.4	1,200	.6
12500450	05-11-89	79	20	58	5.0	25	1.4	1,300	.6
12500450	06-15-89	58	21	46	5.2	18	1.2	1,500	.7
12500450	07-13-89	62	19	46	4.8	21	1.2	1,200	.6

Table 27. Concentrations of major and minor elements in suspended sediment, Yakima River Basin, Washington, 1987-90—Continued

Station number	Date	Nickel	Phos-phorus (percent)	Potas-sium (percent)	Silver	Sodium (percent)	Thal-lium	Tita-nium (percent)	Vana-dium	Zinc
12499000	05-10-89	12	0.12	1.0	0.2	1.7	0.3	0.64	130	160
12499000	06-14-89	19	.13	1.0	.3	1.5	.3	.58	130	170
12499000	09-15-89	21	.12	1.1	.4	1.4	.3	.50	130	130
12499000	12-13-89	21	.18	.90	.6	1.5	.2	.60	140	180
12499000	01-10-90	17	.10	1.0	.2	1.7	.3	.61	140	120
12499000	02-14-90	17	.17	.70	.4	.9	.3	.47	120	170
12500450	07-16-87	52	.13	1.2	.3	1.5	.4	.54	120	120
12500450	08-11-87	53	.15	1.1	.4	1.3	.4	.51	120	150
12500450	08-11-87	57	.13	1.0	.5	1.4	.4	.52	120	130
12500450	08-12-87	56	.14	1.0	.3	1.4	.3	.52	120	120
12500450	09-10-87	41	.15	1.1	.5	1.3	.3	.52	140	150
12500450	10-15-87	39	.34	1.3	1.1	1.0	.3	.39	150	140
12500450	11-12-87	43	.32	.73	2.0	.8	.2	.37	100	150
12500450	12-10-87	31	.14	1.0	.2	1.7	.3	.59	140	120
12500450	01-14-88	--	--	--	--	--	--	--	--	--
12500450	02-11-88	--	.22	.82	.5	1.1	.2	.48	120	--
12500450	02-11-88	--	.21	.82	1.2	1.2	.2	.47	120	--
12500450	03-10-88	--	.21	.74	1.1	.9	.1	.48	110	--
12500450	04-14-88	--	.16	.88	.2	1.2	.2	.54	120	--
12500450	05-12-88	33	.17	1.2	.3	1.2	.2	.52	120	140
12500450	05-15-88	31	.15	1.1	.4	1.4	.3	.59	130	120
12500450	06-15-88	44	.13	1.2	1.2	1.4	.3	.56	120	140
12500450	07-14-88	47	.14	1.4	.6	1.6	.4	.52	120	120
12500450	08-11-88	62	.14	1.1	.8	1.3	.3	.52	110	150
12500450	09-15-88	28	.17	1.3	1.4	1.5	.4	.56	140	150
12500450	10-13-88	34	.19	1.2	1.2	1.3	.4	.50	140	180
12500450	11-10-88	61	.20	.93	.8	1.1	.3	.52	130	160
12500450	12-16-88	52	.19	1.0	1.5	1.1	.3	.51	120	230
12500450	02-24-89	71	.16	.97	.7	1.3	.2	.54	130	140
12500450	03-10-89	26	.16	1.3	.2	1.4	.4	.65	150	110
12500450	03-17-89	43	.15	1.0	.5	1.2	.4	.58	140	130
12500450	04-15-89	50	.12	1.0	.3	1.7	.3	.67	140	140
12500450	05-11-89	58	.13	1.0	.3	1.8	.3	.67	140	220
12500450	06-15-89	46	.14	1.1	.4	1.4	.4	.60	130	170
12500450	07-13-89	52	.14	1.2	.4	1.5	.4	.58	120	200

Table 27. Concentrations of major and minor elements in suspended sediment, Yakima River Basin, Washington, 1987-90—Continued

Site reference number	Station number	Site name	Date	Time	Discharge, instantaneous (cubic feet per second)	Surface area (m^2/g)
32	12500450	Yakima River above Ahtanum Creek at Union Gap	08-10-89	1542	3,070	17.6
32	12500450	Yakima River above Ahtanum Creek at Union Gap	09-14-89	1050	2,370	16.0
32	12500450	Yakima River above Ahtanum Creek at Union Gap	10-19-89	1709	937	17.8
32	12500450	Yakima River above Ahtanum Creek at Union Gap	11-16-89	1120	1,810	16.0
32	12500450	Yakima River above Ahtanum Creek at Union Gap	12-05-89	1756	4,840	15.7
32	12500450	Yakima River above Ahtanum Creek at Union Gap	12-14-89	1544	1,830	14.0
32	12500450	Yakima River above Ahtanum Creek at Union Gap	01-10-90	1724	8,940	15.5
32	12500450	Yakima River above Ahtanum Creek at Union Gap	01-11-90	1125	6,770	14.0
32	12500450	Yakima River above Ahtanum Creek at Union Gap	02-15-90	1603	3,010	14.2
52	12508850	Sulphur Creek Wasteway near Sunnyside	07-17-87	1230	232	22.4
52	12508850	Sulphur Creek Wasteway near Sunnyside	08-03-87	1220	225	19.9
52	12508850	Sulphur Creek Wasteway near Sunnyside	08-03-87	2010	197	18.2
52	12508850	Sulphur Creek Wasteway near Sunnyside	08-04-87	0430	203	23.4
52	12508850	Sulphur Creek Wasteway near Sunnyside	08-18-87	1213	210	16.8
52	12508850	Sulphur Creek Wasteway near Sunnyside	09-15-87	0925	181	10.7
52	12508850	Sulphur Creek Wasteway near Sunnyside	10-20-87	1005	87	13.4
52	12508850	Sulphur Creek Wasteway near Sunnyside	11-17-87	1610	67	5.1
52	12508850	Sulphur Creek Wasteway near Sunnyside	12-15-87	1035	70	9.8
52	12508850	Sulphur Creek Wasteway near Sunnyside	01-14-88	1545	79	5.9
52	12508850	Sulphur Creek Wasteway near Sunnyside	01-19-88	1020	72	6.2
52	12508850	Sulphur Creek Wasteway near Sunnyside	02-16-88	1105	72	9.0
52	12508850	Sulphur Creek Wasteway near Sunnyside	03-15-88	1042	63	15.0
52	12508850	Sulphur Creek Wasteway near Sunnyside	03-23-88	1309	349	14.9
52	12508850	Sulphur Creek Wasteway near Sunnyside	04-19-88	1426	282	23.2
52	12508850	Sulphur Creek Wasteway near Sunnyside	04-22-88	1150	338	19.5
52	12508850	Sulphur Creek Wasteway near Sunnyside	05-17-88	1655	246	32.1
52	12508850	Sulphur Creek Wasteway near Sunnyside	06-21-88	0915	243	22.3
52	12508850	Sulphur Creek Wasteway near Sunnyside	07-19-88	1230	231	21.6
52	12508850	Sulphur Creek Wasteway near Sunnyside	08-16-88	1318	256	18.6
52	12508850	Sulphur Creek Wasteway near Sunnyside	09-18-88	1225	223	24.5
52	12508850	Sulphur Creek Wasteway near Sunnyside	10-18-88	0957	207	25.4
52	12508850	Sulphur Creek Wasteway near Sunnyside	11-14-88	1413	76	18.3
52	12508850	Sulphur Creek Wasteway near Sunnyside	12-19-88	1156	69	14.3
52	12508850	Sulphur Creek Wasteway near Sunnyside	12-30-88	0951	79	16.5
52	12508850	Sulphur Creek Wasteway near Sunnyside	01-17-89	1346	64	7.6

Table 27. Concentrations of major and minor elements in suspended sediment, Yakima River Basin, Washington, 1987-90—Continued

Station number	Date	Sediment, suspended (mg/L)	Percentage of sediment finer than 0.062 mm	Carbon, organic suspended total (mg/L as C)	Aluminum (percent)	Antimony	Arsenic	Beryllium	Cadmium	Calcium (percent)
12500450	08-10-89	17	89	0.4	7.1	0.6	4.5	<2	0.4	2.2
12500450	09-14-89	24	90	.5	7.2	.6	5.0	<2	.4	2.1
12500450	10-19-89	15	95	.3	7.1	.6	5.8	<2	.6	2.0
12500450	11-16-89	10	E95	.3	6.4	.5	5.2	<2	.4	1.8
12500450	12-05-89	48	79	2.6	7.4	.6	4.3	<2	.3	2.5
12500450	12-14-89	4	E93	.9	6.4	.7	5.7	<2	1.5	1.9
12500450	01-10-90	139	60	>4.7	7.6	.8	4.8	<2	.3	2.5
12500450	01-11-90	52	61	1.3	8.0	.6	5.4	<2	.3	2.3
12500450	02-15-90	6	E93	.8	6.9	.5	5.1	<2	.6	2.0
12508850	07-17-87	212	76	1.6	7.1	.6	5.9	2	.2	2.8
12508850	08-03-87	124	70	--	6.9	.6	6.8	<2	.2	2.7
12508850	08-03-87	91	75	--	6.9	.6	6.5	<2	.2	2.7
12508850	08-04-87	119	80	--	6.8	.8	8.0	2	.2	2.7
12508850	08-18-87	77	83	.8	6.9	.6	6.0	2	.2	2.9
12508850	09-15-87	39	65	.5	7.2	.6	6.8	<2	.3	2.9
12508850	10-20-87	7	83	.2	6.7	.9	12	<2	1.7	2.5
12508850	11-17-87	13	91	.6	6.0	.7	16	<2	1.5	2.7
12508850	12-15-87	28	94	1.3	6.6	.8	16	2	.8	2.8
12508850	01-14-88	99	94	--	6.5	.7	17	<2	.4	3.1
12508850	01-19-88	32	91	1.5	6.3	.7	17	2	.5	3.1
12508850	02-16-88	34	83	--	6.5	.6	13	<2	.4	3.0
12508850	03-15-88	35	91	1.2	6.8	.8	19	2	.4	3.5
12508850	03-23-88	225	49	1.9	7.1	.6	6.2	2	.3	3.0
12508850	04-19-88	86	71	1.9	7.1	.7	12	2	.6	2.5
12508850	04-22-88	99	78	1.3	7.6	.6	7.0	<2	.6	2.5
12508850	05-17-88	186	73	2.7	7.2	.7	8.2	<2	.3	2.7
12508850	06-21-88	299	69	2.8	7.1	.6	7.0	<2	.4	2.6
12508850	07-19-88	135	83	1.6	7.3	.5	4.9	2	.2	2.8
12508850	08-16-88	89	81	1.3	7.2	.7	8.1	<2	.4	2.8
12508850	09-18-88	40	69	.6	7.5	.8	11	2	<.1	2.9
12508850	10-18-88	31	70	.5	7.4	.8	12	2	<.1	3.1
12508850	11-14-88	14	95	.6	5.6	.9	20	<2	.3	2.7
12508850	12-19-88	42	96	1.0	6.9	.7	15	2	.5	3.0
12508850	12-30-88	83	94	1.7	7.0	.7	13	2	.5	3.0
12508850	01-17-89	44	93	2.9	6.5	.7	12	2	.5	3.0

Table 27. Concentrations of major and minor elements in suspended sediment, Yakima River Basin, Washington, 1987-90—Continued

Station number	Date	Chro-mium	Cobalt	Copper	Iron (percent)	Lead	Magne-sium (percent)	Man-ganese	Molyb-denum
12500450	08-10-89	67	19	59	4.8	17	1.2	1,300	0.6
12500450	09-14-89	49	18	49	4.8	15	1.1	2,200	.5
12500450	10-19-89	57	18	50	5.0	27	1.1	1,800	.7
12500450	11-16-89	70	22	58	5.2	16	1.2	2,900	.7
12500450	12-05-89	56	18	38	4.7	13	1.2	1,300	.7
12500450	12-14-89	90	21	84	5.2	26	1.2	2,900	1.0
12500450	01-10-90	56	19	33	5.0	15	1.2	1,400	.9
12500450	01-11-90	77	22	42	5.3	13	1.4	1,600	.8
12500450	02-15-90	76	20	46	5.1	16	1.2	2,000	.8
12508850	07-17-87	54	18	29	4.8	23	1.4	920	.7
12508850	08-03-87	50	18	35	4.7	25	1.4	950	.8
12508850	08-03-87	52	18	28	4.8	25	1.4	1,000	.8
12508850	08-04-87	54	20	35	5.0	27	1.4	1,100	.7
12508850	08-18-87	50	18	27	4.7	20	1.4	970	.6
12508850	09-15-87	51	19	31	4.9	20	1.4	1,300	.8
12508850	10-20-87	59	21	100	5.3	43	1.4	3,100	1.7
12508850	11-17-87	58	22	110	5.1	33	1.4	5,200	2.0
12508850	12-15-87	60	22	65	5.7	27	1.5	2,400	1.4
12508850	01-14-88	--	21	56	5.3	25	1.4	1,900	<.1
12508850	01-19-88	--	22	69	5.4	23	1.4	2,200	<.1
12508850	02-16-88	--	21	64	5.1	21	1.4	2,900	<.1
12508850	03-15-88	--	23	61	5.6	26	1.5	2,300	<.1
12508850	03-23-88	--	19	30	4.8	18	1.4	960	<.1
12508850	04-19-88	--	22	42	5.5	24	1.5	1,400	<.1
12508850	04-22-88	--	22	41	5.9	17	1.5	1,500	<.1
12508850	05-17-88	89	22	35	5.4	18	1.5	1,100	.9
12508850	06-21-88	65	19	190	5.0	41	1.4	980	.6
12508850	07-19-88	62	21	31	5.4	13	1.5	1,100	.4
12508850	08-16-88	59	20	30	5.2	20	1.5	1,100	.6
12508850	09-18-88	52	22	33	5.5	26	1.5	1,600	1.2
12508850	10-18-88	52	23	52	5.6	26	1.6	1,800	1.0
12508850	11-14-88	47	21	58	4.8	28	1.3	3,500	1.7
12508850	12-19-88	56	21	58	5.6	25	1.5	2,300	1.2
12508850	12-30-88	53	20	43	5.4	26	1.5	2,000	.9
12508850	01-17-89	51	20	52	5.1	24	1.4	2,200	1.1

Table 27. Concentrations of major and minor elements in suspended sediment, Yakima River Basin, Washington, 1987-90—Continued

Station number	Date	Nickel	Phos-phorus (percent)	Potas-sium (percent)	Silver	Sodium (percent)	Thal-lium	Tita-nium (percent)	Vana-dium	Zinc
12500450	08-10-89	55	0.13	1.1	0.5	1.5	0.3	0.54	120	160
12500450	09-14-89	34	.14	1.0	.6	1.3	.3	.49	130	150
12500450	10-19-89	38	.16	1.2	1.0	1.3	.4	.51	120	220
12500450	11-16-89	62	.19	.90	.9	1.0	.3	.51	130	170
12500450	12-05-89	45	.14	.90	.4	1.7	.3	.58	130	140
12500450	12-14-89	63	.22	.90	1.6	1.0	.3	.51	130	300
12500450	01-10-90	42	.12	.90	.3	1.6	.4	.61	140	140
12500450	01-11-90	54	.14	1.0	.4	1.5	.3	.62	150	140
12500450	02-15-90	62	.16	.80	.7	1.1	.3	.54	130	180
12508850	07-17-87	24	.12	1.6	.2	1.6	.6	.62	140	96
12508850	08-03-87	24	.13	1.5	.3	1.6	.6	.60	140	97
12508850	08-03-87	25	.13	1.6	.3	1.5	.5	.61	140	100
12508850	08-04-87	27	.14	1.6	.3	1.4	.6	.62	140	110
12508850	08-18-87	24	.13	1.6	.3	1.7	.4	.63	140	97
12508850	09-15-87	23	.13	1.6	.3	1.7	.4	.66	150	100
12508850	10-20-87	27	.19	1.5	1.0	1.3	.4	.66	160	180
12508850	11-17-87	28	.33	1.4	2.5	1.0	.4	.61	170	180
12508850	12-15-87	27	.27	1.6	1.7	1.0	.4	.63	160	150
12508850	01-14-88	--	.24	1.5	1.1	1.2	.3	.64	160	--
12508850	01-19-88	--	.29	1.5	1.0	1.1	.4	.62	160	--
12508850	02-16-88	--	.22	1.5	.6	1.4	.4	.63	160	--
12508850	03-15-88	--	.20	1.6	1.3	1.1	.4	.62	150	--
12508850	03-23-88	--	.13	1.6	.2	1.8	.4	.65	140	--
12508850	04-19-88	--	.16	1.5	.6	1.3	.4	.64	150	--
12508850	04-22-88	--	.17	1.3	.2	1.5	.3	.71	160	--
12508850	05-17-88	33	.15	1.6	.2	1.4	.5	.64	140	110
12508850	06-21-88	28	.13	1.6	.2	1.6	.4	.65	140	110
12508850	07-19-88	31	.15	2.4	.2	1.5	.4	.65	140	120
12508850	08-16-88	30	.14	1.7	.2	1.5	.4	.65	140	110
12508850	09-18-88	23	.16	1.7	.4	1.5	.5	.67	160	120
12508850	10-18-88	24	.17	1.7	.3	1.4	.5	.67	160	130
12508850	11-14-88	18	.19	1.3	.4	.9	.5	.54	150	140
12508850	12-19-88	28	.18	1.6	.3	1.2	.5	.64	170	140
12508850	12-30-88	24	.17	1.6	.4	1.3	.5	.63	160	140
12508850	01-17-89	23	.26	1.5	.4	1.3	.4	.62	160	160

Table 27. Concentrations of major and minor elements in suspended sediment, Yakima River Basin, Washington, 1987-90—Continued

Site reference number	Station number	Site name	Date	Time	Discharge, instantaneous (cubic feet per second)	Surface area (m^2/g)
52	12508850	Sulphur Creek Wasteway near Sunnyside	02-21-89	1125	66	10.9
52	12508850	Sulphur Creek Wasteway near Sunnyside	02-24-89	2000	83	9.0
52	12508850	Sulphur Creek Wasteway near Sunnyside	03-21-89	1423	251	19.5
52	12508850	Sulphur Creek Wasteway near Sunnyside	04-18-89	1225	303	14.3
52	12508850	Sulphur Creek Wasteway near Sunnyside	05-16-89	1330	422	14.1
52	12508850	Sulphur Creek Wasteway near Sunnyside	06-20-89	1059	335	12.8
52	12508850	Sulphur Creek Wasteway near Sunnyside	07-12-89	1220	232	20.5
52	12508850	Sulphur Creek Wasteway near Sunnyside	08-15-89	1507	340	17.1
52	12508850	Sulphur Creek Wasteway near Sunnyside	08-15-89	1512	340	17.3
52	12508850	Sulphur Creek Wasteway near Sunnyside	09-18-89	1636	385	10.9
52	12508850	Sulphur Creek Wasteway near Sunnyside	10-24-89	1501	92	9.1
52	12508850	Sulphur Creek Wasteway near Sunnyside	11-20-89	1621	80	9.5
52	12508850	Sulphur Creek Wasteway near Sunnyside	12-19-89	1538	72	8.4
52	12508850	Sulphur Creek Wasteway near Sunnyside	01-16-90	1600	79	12.5
52	12508850	Sulphur Creek Wasteway near Sunnyside	02-20-90	1204	57	6.8
52	12508850	Sulphur Creek Wasteway near Sunnyside	03-20-90	1454	375	11.2
56	12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	07-18-87	1325	1,380	26.2
56	12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	08-04-87	0820	1,180	28.4
56	12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	08-04-87	1235	1,170	28.6
56	12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	08-05-87	0433	1,240	29.0
56	12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	08-19-87	1447	1,190	26.6
56	12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	09-16-87	1015	1,530	33.6
56	12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	10-21-87	1055	1,910	26.0
56	12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	11-18-87	1533	1,270	23.5
56	12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	12-11-87	1008	4,940	37.3
56	12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	01-15-88	1555	3,370	57.0
56	12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	01-20-88	1154	2,180	22.0
56	12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	02-17-88	1101	2,750	20.6
56	12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	03-16-88	1159	1,860	25.8
56	12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	04-16-88	1624	4,660	29.0
56	12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	04-20-88	1336	4,310	27.4
56	12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	05-18-88	1236	2,550	36.4
56	12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	06-22-88	1519	1,480	28.6
56	12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	07-20-88	1343	1,100	19.1
56	12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	08-17-88	1150	1,410	22.3

Table 27. Concentrations of major and minor elements in suspended sediment, Yakima River Basin, Washington, 1987-90—Continued

Station number	Date	Sediment, suspended (mg/L)	Percentage of sediment finer than 0.062 mm	Carbon, organic suspended total (mg/L as C)	Aluminum (percent)	Antimony	Arsenic	Beryllium	Cadmium	Calcium (percent)
12508850	02-21-89	13	96	0.7	6.5	0.7	13	2	1.0	3.1
12508850	02-24-89	50	93	1.7	6.7	.7	11	2	.5	3.2
12508850	03-21-89	620	61	>3.5	7.2	.6	6.7	2	.2	2.7
12508850	04-18-89	59	75	1.0	7.3	.6	8.2	<2	.4	2.3
12508850	05-16-89	144	70	1.2	7.3	.8	6.9	<2	.5	2.6
12508850	06-20-89	199	69	1.6	7.4	.6	6.5	<2	.2	2.8
12508850	07-12-89	191	83	2.8	7.6	.8	8.7	2	.4	2.8
12508850	08-15-89	154	60	1.1	7.2	.6	5.8	2	.2	2.8
12508850	08-15-89	--	--	--	7.2	.6	5.9	2	.3	2.8
12508850	09-18-89	103	54	.9	7.2	.6	5.9	3	.3	3.5
12508850	10-24-89	20	85	.6	6.8	.8	13	2	.5	3.0
12508850	11-20-89	17	91	.7	6.4	.7	14	2	.6	3.1
12508850	12-19-89	92	83	1.9	6.6	.7	10	2	.4	3.0
12508850	01-16-90	34	92	1.9	6.8	.8	15	2	.4	3.1
12508850	02-20-90	13	E93	>3.9	6.1	.7	15	2	.5	3.0
12508850	03-20-90	377	39	3.2	7.1	.6	5.3	<2	.1	2.9
12509050	07-18-87	22	95	.8	6.8	.8	9.0	<2	.6	2.2
12509050	08-04-87	25	--	--	6.8	.8	8.6	<2	.4	2.2
12509050	08-04-87	21	95	--	6.7	.7	8.7	<2	.3	2.2
12509050	08-05-87	29	93	.8	6.8	1.2	7.6	<2	.2	2.4
12509050	08-19-87	31	93	.9	6.7	.7	8.4	<2	.5	2.2
12509050	09-16-87	21	94	.9	7.0	.6	8.8	<2	1.6	2.2
12509050	10-21-87	13	94	.4	6.7	.6	8.4	<2	2.6	2.2
12509050	11-18-87	10	95	--	6.3	.6	8.2	<2	.7	2.2
12509050	12-11-87	205	97	2.1	7.2	.4	5.0	<2	.2	2.4
12509050	01-15-88	354	96	>3.6	7.2	.3	6.7	2	.1	2.3
12509050	01-20-88	20	67	.5	6.9	.4	8.0	<2	.6	2.5
12509050	02-17-88	17	95	.6	6.8	.4	8.3	<2	.4	2.4
12509050	03-16-88	13	95	.5	6.5	.5	9.0	<2	1.1	2.3
12509050	04-16-88	121	96	2.9	7.0	.5	6.9	<2	.4	2.3
12509050	04-20-88	67	91	1.4	6.4	.6	8.8	2	.3	2.4
12509050	05-18-88	39	97	.6	6.9	.6	7.1	<2	.8	2.1
12509050	06-22-88	44	68	1.1	6.9	.6	6.7	<2	1.5	2.3
12509050	07-20-88	23	99	.7	6.6	.7	11	<2	1.0	2.2
12509050	08-17-88	38	96	1.4	6.5	.5	6.7	<2	.6	2.2

Table 27. Concentrations of major and minor elements in suspended sediment, Yakima River Basin, Washington, 1987-90—Continued

Station number	Date	Chro-mium	Cobalt	Copper	Iron (percent)	Lead	Magne-sium (percent)	Man-ganese	Molyb-denum
12508850	02-21-89	55	21	120	5.4	28	1.5	3,700	1.6
12508850	02-24-89	52	22	65	5.2	24	1.5	3,100	1.3
12508850	03-21-89	41	17	24	4.6	17	1.3	910	.6
12508850	04-18-89	55	20	54	5.3	21	1.4	1,300	.6
12508850	05-16-89	50	19	31	5.0	23	1.4	980	.6
12508850	06-20-89	46	18	29	4.8	20	1.4	910	.6
12508850	07-12-89	52	21	36	5.4	22	1.5	1,100	.7
12508850	08-15-89	48	18	33	4.7	18	1.3	960	.6
12508850	08-15-89	47	18	26	4.7	18	1.3	960	.6
12508850	09-18-89	47	18	26	4.7	16	1.3	1,100	.6
12508850	10-24-89	56	24	61	5.6	27	1.4	4,100	1.1
12508850	11-20-89	54	25	56	5.4	26	1.4	5,000	1.5
12508850	12-19-89	53	20	210	5.1	20	1.4	1,900	1.5
12508850	01-16-90	56	22	44	5.5	27	1.5	3,000	1.4
12508850	02-20-90	52	22	64	5.2	24	1.4	5,400	1.7
12508850	03-20-90	45	17	21	4.7	14	1.3	960	.6
12509050	07-18-87	59	21	44	5.6	31	1.5	3,000	.8
12509050	08-04-87	60	21	43	5.6	29	1.5	3,200	.7
12509050	08-04-87	59	22	48	5.6	28	1.4	3,800	.8
12509050	08-05-87	64	21	39	5.6	25	1.4	3,000	.6
12509050	08-19-87	60	22	44	5.6	25	1.5	3,100	.8
12509050	09-16-87	62	22	54	5.7	25	1.4	3,600	.8
12509050	10-21-87	67	21	74	5.4	26	1.4	4,300	.8
12509050	11-18-87	57	21	46	5.2	22	1.3	6,300	.9
12509050	12-11-87	61	24	39	6.3	15	1.3	1,600	.7
12509050	01-15-88	--	28	53	7.5	11	1.2	1,500	<.1
12509050	01-20-88	--	24	50	6.0	16	1.4	3,900	<.1
12509050	02-17-88	--	23	45	5.7	12	1.3	2,500	<.1
12509050	03-16-88	--	23	52	5.4	22	1.3	4,300	<.1
12509050	04-16-88	--	20	42	5.4	13	1.3	1,500	<.1
12509050	04-20-88	--	20	41	4.9	20	1.3	1,300	<.1
12509050	05-18-88	95	21	42	5.6	16	1.4	2,000	.7
12509050	06-22-88	90	21	31	5.6	19	1.5	3,000	.5
12509050	07-20-88	79	22	38	5.7	23	1.4	3,600	.7
12509050	08-17-88	67	19	32	5.2	16	1.4	2,600	.5

Table 27. Concentrations of major and minor elements in suspended sediment, Yakima River Basin, Washington, 1987-90—Continued

Station number	Date	Nickel	Phos-phorus (percent)	Potas-sium (percent)	Silver	Sodium (percent)	Thal-lium	Tita-nium (percent)	Vana-dium	Zinc
12508850	02-21-89	28	0.22	1.6	0.6	1.1	0.5	0.61	160	180
12508850	02-24-89	24	.24	1.6	.5	1.3	.4	.62	160	160
12508850	03-21-89	19	.11	1.6	.2	1.7	.4	.61	140	88
12508850	04-18-89	34	.15	1.5	.4	1.4	.4	.68	150	160
12508850	05-16-89	32	.14	1.6	.3	1.6	.4	.70	140	180
12508850	06-20-89	24	.13	1.6	.3	1.7	.4	.67	140	140
12508850	07-12-89	24	.14	1.7	.3	1.5	.5	.71	150	160
12508850	08-15-89	26	.12	1.5	.3	1.6	.4	.61	140	120
12508850	08-15-89	27	.12	1.4	.4	1.6	.4	.60	140	120
12508850	09-18-89	23	.12	1.4	.4	1.7	.4	.63	140	120
12508850	10-24-89	33	.21	1.5	.8	1.2	.4	.65	170	200
12508850	11-20-89	30	.22	1.4	.7	1.1	.4	.62	170	180
12508850	12-19-89	29	.26	1.4	1.0	1.3	.4	.61	160	210
12508850	01-16-90	30	.19	1.5	1.4	1.1	.5	.64	170	180
12508850	02-20-90	27	.29	1.3	2.4	1.0	.4	.59	160	220
12508850	03-20-90	23	.11	1.4	.4	1.8	.4	.64	150	120
12509050	07-18-87	33	.17	1.4	.5	1.1	.6	.63	140	130
12509050	08-04-87	35	.17	1.4	.6	1.1	.5	.63	150	120
12509050	08-04-87	34	.18	1.4	.4	1.0	.5	.60	140	120
12509050	08-05-87	34	.17	1.4	.4	1.1	.5	.63	150	110
12509050	08-19-87	35	.18	1.4	.4	1.1	.4	.61	140	120
12509050	09-16-87	35	.17	1.3	.4	1.2	.4	.66	150	130
12509050	10-21-87	34	.18	1.3	.4	1.3	.3	.64	150	160
12509050	11-18-87	29	.20	1.2	.5	1.2	.4	.64	160	120
12509050	12-11-87	30	.18	1.2	.2	1.4	.3	.75	180	110
12509050	01-15-88	--	.20	1.1	.8	1.3	.3	.76	190	--
12509050	01-20-88	--	.19	1.3	.6	1.5	.3	.79	180	--
12509050	02-17-88	--	.19	1.2	.2	1.4	.3	.68	160	--
12509050	03-16-88	--	.19	1.2	.5	1.3	.3	.65	150	--
12509050	04-16-88	--	.16	1.2	.2	1.4	.3	.66	150	--
12509050	04-20-88	--	.15	1.4	.4	1.2	.4	.58	130	--
12509050	05-18-88	37	.17	1.3	.4	1.2	.5	.63	140	120
12509050	06-22-88	35	.15	1.4	.2	1.4	.4	.69	150	120
12509050	07-20-88	40	.18	1.4	.2	1.0	.4	.60	140	130
12509050	08-17-88	36	.17	1.4	.2	1.2	.4	.61	130	110

Table 27. Concentrations of major and minor elements in suspended sediment, Yakima River Basin, Washington, 1987-90—Continued

Site reference number	Station number	Site name	Date	Time	Discharge, instantaneous (cubic feet per second)	Surface area (m^2/g)
56	12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	09-19-88	1350	1,520	29.0
56	12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	10-19-88	1145	2,640	28.8
56	12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	11-18-88	1059	2,250	32.5
56	12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	12-20-88	1235	2,690	13.7
56	12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	01-18-89	1339	2,350	13.9
56	12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	02-22-89	1350	2,270	17.5
56	12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	03-22-89	1010	3,320	26.2
56	12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	05-18-89	1510	2,760	17.6
56	12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	06-21-89	1138	1,700	26.2
56	12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	07-19-89	1827	1,640	18.1
56	12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	08-16-89	1732	1,290	17.3
56	12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	09-20-89	1205	1,520	19.7
56	12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	10-25-89	1306	2,440	13.0
56	12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	11-21-89	1757	2,650	16.1
56	12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	12-06-89	1117	4,790	22.1
56	12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	12-20-89	1443	2,390	1.1
56	12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	01-17-90	1401	3,780	15.8
56	12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	02-21-90	1323	3,120	15.0
56	12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	03-21-90	1447	3,910	13.8
50	12510500	Yakima River at Kiona	07-19-87	1155	1,350	21.2
50	12510500	Yakima River at Kiona	08-06-87	0010	1,140	26.5
50	12510500	Yakima River at Kiona	08-06-87	0750	1,150	26.4
50	12510500	Yakima River at Kiona	08-06-87	1608	1,150	20.2
50	12510500	Yakima River at Kiona	08-20-87	0935	1,200	26.6
50	12510500	Yakima River at Kiona	09-15-87	0900	1,110	34.3
50	12510500	Yakima River at Kiona	10-22-87	1130	1,780	22.9
50	12510500	Yakima River at Kiona	12-12-87	1020	4,460	41.7
50	12510500	Yakima River at Kiona	01-16-88	1342	2,990	63.7
50	12510500	Yakima River at Kiona	01-21-88	0950	2,170	28.0
50	12510500	Yakima River at Kiona	02-18-88	1030	2,770	27.1
50	12510500	Yakima River at Kiona	03-17-88	0945	1,730	26.5
50	12510500	Yakima River at Kiona	04-17-88	1341	5,880	25.3
50	12510500	Yakima River at Kiona	04-21-88	1408	4,290	30.6
50	12510500	Yakima River at Kiona	05-19-88	0955	2,600	34.9
50	12510500	Yakima River at Kiona	06-23-88	1726	1,270	25.3

Table 27. Concentrations of major and minor elements in suspended sediment, Yakima River Basin, Washington, 1987-90—Continued

Station number	Date	Sediment, suspended (mg/L)	Percentage of sediment finer than 0.062 mm	Carbon, organic suspended total (mg/L as C)	Aluminum (percent)	Antimony	Arsenic	Beryllium	Cadmium	Calcium (percent)
12509050	09-19-88	38	68	0.6	7.1	0.6	9.2	<2	0.1	2.5
12509050	10-19-88	18	95	.5	6.9	.6	9.8	<2	<.1	2.2
12509050	11-18-88	14	98	.4	6.8	.6	7.9	<2	.2	2.2
12509050	12-20-88	10	94	.5	6.7	.5	6.0	<2	.8	2.2
12509050	01-18-89	131	19	.6	6.6	.5	5.8	<2	.6	2.4
12509050	02-22-89	14	96	.7	6.6	.4	6.1	<2	1.1	2.3
12509050	03-22-89	74	90	--	7.4	.5	5.0	<2	.6	2.4
12509050	05-18-89	31	94	.8	7.3	.6	7.4	<2	.9	2.2
12509050	06-21-89	36	95	.7	7.3	.7	8.8	2	.7	2.3
12509050	07-19-89	24	92	1.6	7.1	.7	9.7	<2	.5	2.3
12509050	08-16-89	40	80	.7	6.9	.7	6.7	2	.3	2.2
12509050	09-20-89	29	52	.6	6.6	.6	5.8	<2	1.2	2.2
12509050	10-25-89	13	E90	.4	6.5	.6	6.9	<2	.6	2.1
12509050	11-21-89	24	96	.7	6.9	.6	5.9	<2	.4	2.2
12509050	12-06-89	135	94	>2.1	7.0	.5	5.2	<2	.2	2.2
12509050	12-20-89	8	E91	.8	7.0	.6	6.5	<2	.7	2.3
12509050	01-17-90	25	90	.6	7.2	.6	5.8	<2	.4	2.2
12509050	02-21-90	7	E85	.4	6.9	.5	5.7	<2	.7	2.2
12509050	03-21-90	37	92	1.0	7.0	.6	5.1	<2	.4	2.3
12510500	07-19-87	28	92	1.1	6.5	.5	6.2	<2	.2	2.3
12510500	08-06-87	26	95	1.0	6.3	.9	6.6	<2	.2	2.2
12510500	08-06-87	28	94	.5	6.6	.6	6.4	<2	.2	2.3
12510500	08-06-87	21	94	.5	6.3	.7	6.4	<2	.2	2.2
12510500	08-20-87	28	94	.1	6.5	.6	7.6	<2	.2	2.2
12510500	09-15-87	18	97	.2	6.8	.6	7.8	<2	.3	2.1
12510500	10-22-87	14	92	.6	6.5	.6	8.1	<2	.6	2.2
12510500	12-12-87	117	97	2.4	7.0	.6	5.9	<2	.2	2.1
12510500	01-16-88	131	99	2.6	7.3	.4	6.9	2	.2	2.2
12510500	01-21-88	9	95	--	6.6	.6	11	<2	.5	1.9
12510500	02-18-88	15	93	.5	6.6	.5	9.1	<2	.6	2.0
12510500	03-17-88	14	93	.3	6.3	.7	10	<2	1.1	2.0
12510500	04-17-88	150	88	2.7	6.6	.6	6.7	<2	.5	2.2
12510500	04-21-88	57	91	1.2	6.9	.5	6.6	<2	.4	2.2
12510500	05-19-88	36	--	.2	6.8	.5	6.0	<2	.2	2.1
12510500	06-23-88	18	96	.9	6.8	.6	6.5	<2	1.6	2.1

Table 27. Concentrations of major and minor elements in suspended sediment, Yakima River Basin, Washington, 1987-90—Continued

Station number	Date	Chro-mium	Cobalt	Copper	Iron (percent)	Lead	Magne-sium (percent)	Man-ganese	Molyb-denum
12509050	09-19-88	57	21	36	5.6	20	1.5	2,800	0.8
12509050	10-19-88	55	21	42	5.7	23	1.4	2,900	.8
12509050	11-18-88	61	21	39	5.5	26	1.4	3,200	.9
12509050	12-20-88	60	21	47	5.3	18	1.4	2,900	.7
12509050	01-18-89	110	21	29	5.3	22	1.4	3,000	.5
12509050	02-22-89	66	22	40	5.3	18	1.4	3,800	.6
12509050	03-22-89	100	20	36	5.4	15	1.4	1,200	.6
12509050	05-18-89	58	21	40	5.7	21	1.5	1,900	.7
12509050	06-21-89	64	22	44	5.9	24	1.5	2,400	1.8
12509050	07-19-89	64	22	39	5.8	24	1.5	2,500	.6
12509050	08-16-89	57	21	37	5.5	20	1.4	2,700	.5
12509050	09-20-89	54	20	37	5.4	17	1.3	2,900	.3
12509050	10-25-89	59	21	43	5.2	19	1.3	3,400	.6
12509050	11-21-89	58	20	39	5.2	18	1.3	2,900	.7
12509050	12-06-89	56	19	35	5.0	15	1.3	1,400	.6
12509050	12-20-89	64	22	41	5.5	17	1.4	3,500	.7
12509050	01-17-90	60	19	37	5.1	18	1.3	1,500	.6
12509050	02-21-90	61	21	34	5.2	18	1.3	2,300	.6
12509050	03-21-90	58	19	31	5.1	16	1.3	1,400	.6
12510500	07-19-87	74	20	41	5.1	25	1.3	2,400	.8
12510500	08-06-87	58	19	38	5.1	25	1.3	3,200	.7
12510500	08-06-87	61	21	39	5.3	27	1.4	3,100	.8
12510500	08-06-87	57	19	43	5.1	23	1.3	3,100	.5
12510500	08-20-87	60	19	38	5.2	22	1.4	2,700	.5
12510500	09-15-87	61	20	54	5.4	21	1.4	3,300	.6
12510500	10-22-87	57	20	120	5.1	28	1.3	2,900	.7
12510500	12-12-87	54	23	290	6.2	20	1.2	1,700	.8
12510500	01-16-88	--	31	53	8.1	10	1.2	1,600	<.1
12510500	01-21-88	--	25	90	6.2	22	1.2	4,100	<.1
12510500	02-18-88	--	23	94	5.7	12	1.2	3,300	<.1
12510500	03-17-88	--	25	54	5.6	20	1.2	4,600	<.1
12510500	04-17-88	--	20	43	5.3	17	1.3	1,600	<.1
12510500	04-21-88	--	21	48	5.5	14	1.3	1,700	<.1
12510500	05-19-88	92	20	43	5.5	12	1.3	2,300	.6
12510500	06-23-88	91	22	38	5.7	20	1.4	4,100	.6

Table 27. Concentrations of major and minor elements in suspended sediment, Yakima River Basin, Washington, 1987-90—Continued

Station number	Date	Nickel	Phos-phorus (percent)	Potas-sium (percent)	Silver	Sodium (percent)	Thal-lium	Tita-nium (percent)	Vana-dium	Zinc
12509050	09-19-88	28	0.17	1.4	0.4	1.4	0.4	0.69	150	120
12509050	10-19-88	29	.21	1.4	.4	1.2	.5	.64	150	120
12509050	11-18-88	31	.19	1.3	.3	1.3	.4	.62	140	120
12509050	12-20-88	37	.17	1.3	.4	1.3	.4	.64	150	120
12509050	01-18-89	38	.15	1.2	.4	1.6	.3	.65	160	110
12509050	02-22-89	40	.17	1.2	.4	1.4	.3	.62	150	120
12509050	03-22-89	38	.14	1.3	.3	1.6	.3	.73	150	150
12509050	05-18-89	38	.16	1.4	.4	1.4	.4	.71	150	170
12509050	06-21-89	43	.16	1.5	.4	1.2	.5	.69	150	190
12509050	07-19-89	38	.17	1.5	.4	1.2	.4	.68	150	180
12509050	08-16-89	38	.16	1.3	.5	1.2	.4	.61	140	150
12509050	09-20-89	34	.17	1.2	.4	1.1	.4	.59	140	150
12509050	10-25-89	37	.20	1.2	.5	1.2	.4	.58	140	170
12509050	11-21-89	39	.17	1.2	.4	1.2	.4	.60	140	170
12509050	12-06-89	32	.16	1.2	.4	1.4	.4	.60	140	130
12509050	12-20-89	42	.18	1.2	.6	1.3	.4	.60	150	200
12509050	01-17-90	38	.14	1.2	.4	1.4	.4	.61	140	140
12509050	02-21-90	41	.15	1.1	.6	1.3	.4	.63	150	150
12509050	03-21-90	37	.14	1.2	.4	1.4	.3	.62	140	140
12510500	07-19-87	38	.15	1.3	.3	1.2	.5	.61	140	120
12510500	08-06-87	32	.17	1.3	.2	1.1	.5	.58	130	110
12510500	08-06-87	32	.17	1.3	.3	1.2	.5	.62	140	120
12510500	08-06-87	31	.18	1.3	.3	1.2	.4	.59	130	110
12510500	08-20-87	32	.18	1.3	.3	1.2	.4	.60	140	120
12510500	09-15-87	32	.18	1.3	.4	1.2	.4	.62	140	120
12510500	10-22-87	30	.21	1.3	.6	1.2	.3	.59	140	200
12510500	12-12-87	30	.18	1.2	.2	1.2	.4	.67	160	170
12510500	01-16-88	--	.22	1.1	.8	1.1	.3	.74	190	--
12510500	01-21-88	--	.23	1.1	.4	1.0	.2	.64	160	--
12510500	02-18-88	--	.21	1.2	.7	1.2	.2	.63	150	--
12510500	03-17-88	--	.21	1.1	.4	1.1	.3	.60	150	--
12510500	04-17-88	--	.17	1.2	.4	1.3	.3	.63	140	--
12510500	04-21-88	--	.17	1.2	.5	1.3	.3	.64	140	--
12510500	05-19-88	36	.18	1.5	.8	1.2	.4	.62	140	130
12510500	06-23-88	42	.16	1.4	.3	1.2	.4	.64	140	130

Table 27. Concentrations of major and minor elements in suspended sediment, Yakima River Basin, Washington, 1987-90—Continued

Site reference number	Station number	Site name	Date	Time	Discharge, instantaneous (cubic feet per second)	Surface area (m^2/g)
50	12510500	Yakima River at Kiona	07-21-88	0900	1,040	20.3
50	12510500	Yakima River at Kiona	08-18-88	1518	1,460	23.0
50	12510500	Yakima River at Kiona	09-22-88	0900	1,890	36.2
50	12510500	Yakima River at Kiona	10-20-88	1114	2,290	37.6
50	12510500	Yakima River at Kiona	11-17-88	1020	2,300	35.8
50	12510500	Yakima River at Kiona	12-21-88	0939	2,580	22.0
50	12510500	Yakima River at Kiona	02-23-89	1512	2,170	14.5
50	12510500	Yakima River at Kiona	03-23-89	0855	3,330	22.1
50	12510500	Yakima River at Kiona	04-09-89	1639	7,170	27.6
50	12510500	Yakima River at Kiona	04-20-89	1108	6,520	20.6
50	12510500	Yakima River at Kiona	06-22-89	1530	1,480	20.8
50	12510500	Yakima River at Kiona	07-20-89	0925	1,410	16.1
50	12510500	Yakima River at Kiona	08-17-89	1700	1,260	22.2
50	12510500	Yakima River at Kiona	09-21-89	0946	1,480	25.4
50	12510500	Yakima River at Kiona	10-26-89	1530	2,350	16.1
50	12510500	Yakima River at Kiona	11-21-89	0940	2,460	20.8
50	12510500	Yakima River at Kiona	12-06-89	1615	5,200	20.3
50	12510500	Yakima River at Kiona	12-06-89	2357	5,210	24.4
50	12510500	Yakima River at Kiona	12-07-89	1852	4,780	21.1
50	12510500	Yakima River at Kiona	12-21-89	1512	2,500	13.6
50	12510500	Yakima River at Kiona	01-18-90	1100	3,420	17.9
50	12510500	Yakima River at Kiona	02-22-90	1050	2,900	16.3
50	12510500	Yakima River at Kiona	03-22-90	1045	4,070	15.4
50	12510500	Yakima River at Kiona	04-22-90	1701	4,990	17.8
50	12510500	Yakima River at Kiona	05-10-90	1000	2,920	17.7
50	12510500	Yakima River at Kiona	06-30-90	1700	2,120	19.4
50	12510500	Yakima River at Kiona	07-18-90	1040	1,200	15.2
50	12510500	Yakima River at Kiona	08-27-90	1446	2,940	17.0
50	12510500	Yakima River at Kiona	09-06-90	1105	1,780	17.8
50	12510500	Yakima River at Kiona	10-19-90	1212	2,230	16.7
50	12510500	Yakima River at Kiona	11-21-90	0955	3,210	15.1

Table 27. Concentrations of major and minor elements in suspended sediment, Yakima River Basin, Washington, 1987-90—Continued

Station number	Date	Sediment, suspended (mg/L)	Percentage of sediment finer than 0.062 mm	Carbon, organic suspended total (mg/L as C)	Aluminum (percent)	Antimony	Arsenic	Beryllium	Cadmium	Calcium (percent)
12510500	07-21-88	19	92	0.6	6.4	0.6	7.2	<2	0.5	2.2
12510500	08-18-88	38	96	1.8	6.3	.6	7.5	<2	.3	2.1
12510500	09-22-88	26	90	.5	7.0	.7	10	<2	.4	2.2
12510500	10-20-88	24	96	.6	6.9	.6	10	<2	.1	2.3
12510500	11-17-88	8	--	.1	6.6	1.2	8.5	<3	<.1	2.2
12510500	12-21-88	6	97	--	6.4	.5	7.0	<2	1.2	2.1
12510500	02-23-89	9	95	.4	6.4	.6	8.8	<2	.6	2.2
12510500	03-23-89	76	95	.4	7.1	.5	5.9	<2	.5	2.1
12510500	04-09-89	193	92	2.8	7.4	.5	5.3	<2	.5	2.3
12510500	04-20-89	122	88	2.2	7.4	.5	5.1	<2	.3	2.4
12510500	06-22-89	21	94	.9	7.0	.6	7.3	<2	.7	2.3
12510500	07-20-89	31	86	.2	6.9	.9	7.7	<2	.4	2.2
12510500	08-17-89	27	93	1.3	6.5	.5	5.6	<2	.3	2.2
12510500	09-21-89	--	--	--	6.7	.6	6.8	<2	.9	2.1
12510500	10-26-89	16	91	.4	6.5	.6	6.5	<2	.3	2.1
12510500	11-21-89	20	93	.5	6.8	.6	6.5	<2	.4	2.1
12510500	12-06-89	71	83	1.8	6.9	.8	5.4	<2	.4	2.3
12510500	12-06-89	71	89	2.3	7.0	.6	5.5	<2	.3	2.2
12510500	12-07-89	57	93	2.0	7.1	.6	5.7	<2	.5	2.1
12510500	12-21-89	4	E94	.4	6.8	.7	7.9	<2	1.7	2.2
12510500	01-18-90	40	85	.1	7.4	.6	6.0	<2	.3	2.2
12510500	02-22-90	8	E92	.5	6.9	.6	6.4	<2	.7	2.1
12510500	03-22-90	70	90	1.2	6.8	.5	5.3	<2	.2	2.2
12510500	04-22-90	23	60	1.8	7.2	.6	5.1	<2	.4	2.3
12510500	05-10-90	36	--	.6	7.2	.6	6.5	<2	.3	2.2
12510500	06-30-90	--	--	.8	7.2	.7	8.7	<2	2.5	2.1
12510500	07-18-90	23	96	.8	6.6	.5	7.3	<2	.3	2.2
12510500	08-27-90	44	92	--	7.1	.5	7.1	<2	5.0	2.2
12510500	09-06-90	16	95	.3	6.6	.5	7.6	<2	15	2.1
12510500	10-19-90	15	90	.5	6.6	.6	8.5	<2	3.2	2.0
12510500	11-21-90	11	E88	.4	6.8	.6	7.5	<2	1.4	2.0

Table 27. Concentrations of major and minor elements in suspended sediment, Yakima River Basin, Washington, 1987-90—Continued

Station number	Date	Chro-mium	Cobalt	Copper	Iron (percent)	Lead	Magne-sium (percent)	Man-ganese	Molyb-denum
12510500	07-21-88	110	21	43	5.3	23	1.3	3,500	0.7
12510500	08-18-88	84	18	39	5.0	19	1.3	2,600	.5
12510500	09-22-88	56	21	41	5.6	23	1.4	2,800	1.0
12510500	10-20-88	55	21	39	5.6	23	1.4	2,600	.8
12510500	11-17-88	57	23	48	5.7	20	1.4	3,800	.8
12510500	12-21-88	57	20	47	5.2	20	1.3	3,300	.5
12510500	02-23-89	55	20	37	5.1	22	1.3	3,500	.6
12510500	03-23-89	56	20	40	5.7	18	1.3	1,800	.6
12510500	04-09-89	60	20	38	5.4	17	1.4	1,300	.7
12510500	04-20-89	59	20	39	5.4	17	1.4	1,200	.6
12510500	06-22-89	55	21	45	5.6	21	1.4	2,800	.6
12510500	07-20-89	54	20	490	5.5	24	1.4	2,500	.6
12510500	08-17-89	55	18	39	5.2	18	1.3	2,600	.5
12510500	09-21-89	55	20	48	5.4	21	1.3	3,000	.6
12510500	10-26-89	53	19	36	5.1	18	1.3	2,500	.6
12510500	11-21-89	58	20	40	5.5	20	1.3	3,000	.6
12510500	12-06-89	56	18	48	4.9	18	1.3	1,800	.6
12510500	12-06-89	59	20	41	5.2	16	1.3	1,800	.6
12510500	12-07-89	61	20	42	5.3	17	1.4	1,800	.7
12510500	12-21-89	63	23	52	5.7	22	1.4	4,000	.8
12510500	01-18-90	70	19	48	5.1	18	1.3	1,600	.6
12510500	02-22-90	61	21	41	5.4	17	1.3	2,500	.6
12510500	03-22-90	57	18	32	5.0	15	1.3	1,600	.6
12510500	04-22-90	62	20	38	5.2	15	1.3	1,200	.6
12510500	05-10-90	62	21	39	5.6	18	1.4	1,700	.7
12510500	06-30-90	64	23	47	6.0	23	1.4	1,900	.6
12510500	07-18-90	58	22	46	5.3	18	1.3	2,500	.6
12510500	08-27-90	60	21	37	5.6	18	1.4	1,700	.6
12510500	09-06-90	58	22	93	5.4	19	1.4	2,400	.6
12510500	10-19-90	56	21	680	5.6	25	1.3	2,600	.7
12510500	11-21-90	66	23	110	5.7	21	1.4	2,700	.7

Table 27. Concentrations of major and minor elements in suspended sediment, Yakima River Basin, Washington, 1987-90—Continued

Station number	Date	Nickel	Phos-phorus (percent)	Potas-sium (percent)	Silver	Sodium (percent)	Thal-lium	Tita-nium (percent)	Vana-dium	Zinc
12510500	07-21-88	39	0.19	1.2	0.3	1.2	0.3	0.59	140	180
12510500	08-18-88	32	1.2	1.2	.2	1.2	.3	.59	130	100
12510500	09-22-88	29	.18	1.4	.3	1.2	.4	.63	140	140
12510500	10-20-88	28	.19	1.4	.4	1.3	.4	.63	140	120
12510500	11-17-88	34	.21	1.3	.4	1.1	.4	.60	140	140
12510500	12-21-88	34	.20	1.2	.4	1.2	.3	.59	140	140
12510500	02-23-89	33	.22	1.4	.4	1.2	.4	.57	140	130
12510500	03-23-89	35	.17	1.3	.4	1.3	.4	.69	150	170
12510500	04-09-89	40	.15	1.3	.3	1.5	.4	.71	150	150
12510500	04-20-89	38	.14	1.3	.4	1.6	.4	.70	150	150
12510500	06-22-89	37	.16	1.4	.4	1.3	.4	.68	150	180
12510500	07-20-89	39	.17	1.4	.5	1.3	.4	.67	140	350
12510500	08-17-89	34	.17	1.2	E.5	1.1	.3	.58	130	140
12510500	09-21-89	36	.17	1.2	.5	1.1	.4	.58	130	160
12510500	10-26-89	34	.20	1.2	.5	1.2	.4	.57	130	150
12510500	11-21-89	37	.18	1.2	.5	1.1	.4	.58	140	180
12510500	12-06-89	31	.16	1.2	.4	1.4	.4	.61	140	150
12510500	12-06-89	36	.16	1.2	.5	1.3	.3	.60	140	150
12510500	12-07-89	45	.17	1.2	.6	1.3	.4	.60	140	160
12510500	12-21-89	43	.21	1.2	.7	1.1	.3	.58	140	260
12510500	01-18-90	42	.14	1.2	.4	1.4	.4	.58	140	180
12510500	02-22-90	42	.18	1.1	.6	1.2	.4	.59	140	180
12510500	03-22-90	36	.15	1.2	.4	1.4	.3	.61	140	130
12510500	04-22-90	38	.14	1.2	.4	1.4	.3	.61	140	140
12510500	05-10-90	39	.16	1.3	.4	1.2	.4	.61	140	160
12510500	06-30-90	39	.16	1.4	.4	1.2	.4	.62	140	130
12510500	07-18-90	52	.17	1.3	.5	1.2	.4	.59	140	110
12510500	08-27-90	37	.16	1.4	.3	1.3	.4	.62	140	120
12510500	09-06-90	35	.17	1.3	.4	1.2	.3	.58	140	170
12510500	10-19-90	49	.19	1.4	.4	1.1	.4	.58	140	180
12510500	11-21-90	44	.18	1.3	.5	1.2	.4	.60	150	170

Table 28. Concentrations of major and minor elements in filtered water, Yakima River Basin, Washington, 1987-90

[The term "filtered water" is an operational definition referring to the chemical analysis of that portion of a water-suspended sediment sample that passes through a nominal 0.45-micrometer filter; for some elements, lower limits of determination may differ due to the use of different methods of determination; in cases where both inductively coupled plasma (ICP) and graphite furnace methods of determination were used, the ICP value is shown in parentheses; inst. = instantaneous; µs/cm = microsiemens per centimeter; mg/L = milligrams per liter; dis it = dissolved incremental alkalinity titration; CaCO3 = calcium carbonate; µg/L = micrograms per liter; RM = river mile; MS = Middle School; DID = drainage irrigation district; STP = sewage treatment plant; "--" = not determined; "<" = less than]

Site reference number	Station number	Site name	Date	Time	Discharge, inst. (cubic feet per second)	Specific conductance (µs/cm)	pH (standard units)
2	12478300	Cle Elum River above Cle Elum Lake near Roslyn	07-14-87	1100	366	37	7.9
2	12478300	Cle Elum River above Cle Elum Lake near Roslyn	11-03-87	0945	51	65	7.9
6	12479500	Yakima River at Cle Elum	04-14-87	1225	805	66	7.8
6	12479500	Yakima River at Cle Elum	04-30-87	1030	993	59	7.7
6	12479500	Yakima River at Cle Elum	05-12-87	1115	759	57	6.8
6	12479500	Yakima River at Cle Elum	06-11-87	1030	2,410	49	7.1
6	12479500	Yakima River at Cle Elum	07-14-87	1000	3,320	40	7.5
6	12479500	Yakima River at Cle Elum	08-10-87	1200	3,610	46	7.8
6	12479500	Yakima River at Cle Elum	09-08-87	1000	1,120	52	7.8
6	12479500	Yakima River at Cle Elum	11-10-87	1000	195	84	7.8
6	12479500	Yakima River at Cle Elum	12-07-87	0930	308	70	7.8
6	12479500	Yakima River at Cle Elum	01-12-88	1000	236	71	7.7
6	12479500	Yakima River at Cle Elum	02-09-88	1000	478	67	7.8
6	12479500	Yakima River at Cle Elum	03-08-88	0900	507	74	7.7
6	12479500	Yakima River at Cle Elum	04-12-88	0900	796	72	7.8
6	12479500	Yakima River at Cle Elum	04-16-88	1215	1,430	56	7.1
6	12479500	Yakima River at Cle Elum	05-10-88	0930	672	62	7.8
6	12479500	Yakima River at Cle Elum	06-14-88	1000	1,500	55	7.8
6	12479500	Yakima River at Cle Elum	07-12-88	1130	2,950	47	7.7
6	12479500	Yakima River at Cle Elum	08-09-88	1100	3,610	48	7.7
6	12479500	Yakima River at Cle Elum	09-13-88	0900	430	58	7.6
6	12479500	Yakima River at Cle Elum	09-20-88	1244	450	--	--
6	12479500	Yakima River at Cle Elum	09-20-88	2100	430	--	--
6	12479500	Yakima River at Cle Elum	09-21-88	0511	417	--	--
6	12479500	Yakima River at Cle Elum	10-11-88	1100	471	60	7.8
6	12479500	Yakima River at Cle Elum	11-08-88	1320	853	62	7.6
6	12479500	Yakima River at Cle Elum	12-13-88	1210	1,170	62	7.3
6	12479500	Yakima River at Cle Elum	01-12-89	1125	541	70	7.1

Table 28. Concentrations of major and minor elements in filtered water, Yakima River Basin, Washington, 1987-90—Continued

Station number	Date	Alkalinity water dis it field (mg/L as CaCO3)	Hardness, total (mg/L as CaCO3)	Carbon, organic fil-tered (mg/L)	Bromide, fil-tered (mg/L)	Cyanide, fil-tered (mg/L)	Aluminum, fil-tered (µg/L)	Antimony, fil-tered (µg/L)	Arsenic fil-tered (µg/L)	Barium, fil-tered (µg/L)
12478300	07-14-87	19	17	--	--	--	160	--	--	<2
12478300	11-03-87	33	32	--	--	--	90	--	--	4
12479500	04-14-87	30	26	2.5	--	--	--	--	--	--
12479500	04-30-87	27	24	1.5	<0.01	<0.01	10	<1	<1	3
12479500	05-12-87	28	24	--	--	--	--	--	--	--
12479500	06-11-87	25	22	1.7	--	--	--	--	--	--
12479500	07-14-87	22	21	1.5	--	--	--	--	--	--
12479500	08-10-87	21	21	--	<.01	--	--	<1	<1	3
12479500	09-08-87	22	22	1.7	--	--	--	--	--	--
12479500	11-10-87	36	35	1.1	<.01	<.01	--	<1	<1	4
12479500	12-07-87	35	32	1.3	--	--	--	--	--	--
12479500	01-12-88	34	30	1.0	--	--	--	--	--	--
12479500	02-09-88	29	28	1.2	--	--	--	--	--	--
12479500	03-08-88	32	30	--	--	--	--	--	--	--
12479500	04-12-88	33	28	2.1	--	--	--	--	--	--
12479500	04-16-88	25	23	1.6	--	--	--	--	--	--
12479500	05-10-88	29	25	1.3	--	--	--	--	--	--
12479500	06-14-88	26	24	1.2	--	--	--	--	--	--
12479500	07-12-88	19	21	1.4	--	--	--	--	--	--
12479500	08-09-88	21	22	1.9	--	--	--	--	--	--
12479500	09-13-88	19	25	.9	--	--	--	--	--	--
12479500	09-20-88	--	27	.9	--	--	--	--	--	3
12479500	09-20-88	--	27	1.0	--	--	--	--	--	4
12479500	09-21-88	--	--	--	--	--	--	--	--	--
12479500	10-11-88	30	27	1.0	--	--	--	--	--	--
12479500	11-08-88	29	26	1.3	--	--	--	--	--	--
12479500	12-13-88	26	24	2.0	--	--	--	--	--	--
12479500	01-12-89	33	28	1.2	--	--	--	--	--	--

Table 28. Concentrations of major and minor elements in filtered water, Yakima River Basin, Washington, 1987-90—Continued

Station number	Date	Beryllium, filtered (µg/L)	Boron, filtered (µg/L)	Cadmium, filtered (µg/L)	Chromium, filtered (µg/L)	Cobalt, filtered (µg/L)	Copper, filtered (µg/L)	Iron, filtered (µg/L)	Lead, filtered (µg/L)	Lithium filtered (µg/L)
12478300	07-14-87	<0.5	<10	<1	<10	<3	<10	12	<10	<4
12478300	11-03-87	<.5	<10	<1	<5	<3	<10	7	<10	<4
12479500	04-14-87	--	--	.4	--	--	<.5	--	<.5	--
12479500	04-30-87	<.5	<10	<.1 (<1)	<.5	<3	<.5 (<10)	13	<.5 (<10)	<4
12479500	05-12-87	--	--	<.1	--	--	<.5	--	<.5	--
12479500	06-11-87	--	--	.4	--	--	.7	--	<.5	--
12479500	07-14-87	--	--	.3	--	--	<.5	--	<.5	--
12479500	08-10-87	<.5	--	.2 (<1)	<2.2	<3	<.5 (<10)	10	<.5 (<10)	<4
12479500	09-08-87	--	--	<.1	--	--	1.5	--	<.5	--
12479500	11-10-87	<.5	--	<.1 (<1)	<.5 (<5)	<3	<.5 (<10)	28	<.5 (<10)	5
12479500	12-07-87	--	--	<.1	--	--	<.5	--	<.5	--
12479500	01-12-88	--	--	1.5	--	--	<.5	--	<.5	--
12479500	02-09-88	--	--	<.1	--	--	.5	--	<.5	--
12479500	03-08-88	--	--	.1	--	--	<.5	--	<.5	--
12479500	04-12-88	--	--	.1	--	--	<.5	--	<.5	--
12479500	04-16-88	--	--	.2	--	--	<.5	--	<.5	--
12479500	05-10-88	--	--	.2	--	--	.8	--	<.5	--
12479500	06-14-88	--	--	.4	--	--	1.4	--	<.5	--
12479500	07-12-88	--	--	.1	--	--	.8	--	<.5	--
12479500	08-09-88	--	--	.1	--	--	<.5	--	<.5	--
12479500	09-13-88	--	--	.2	--	--	.6	--	<.5	--
12479500	09-20-88	<.5	--	.2 (<1)	<5	<3	<.8 (<10)	8	<.5 (<10)	<4
12479500	09-20-88	<.5	--	<1	<5	<3	<10	11	<10	<4
12479500	09-21-88	--	--	.2	--	--	.6	--	<.5	--
12479500	10-11-88	--	--	.2	--	--	.8	--	<.5	--
12479500	11-08-88	--	--	.2	--	--	1.2	--	<.5	--
12479500	12-13-88	--	--	.2	--	--	.9	--	<.5	--
12479500	01-12-89	--	--	.2	--	--	<.5	--	<.5	--

Table 28. Concentrations of major and minor elements in filtered water, Yakima River Basin, Washington, 1987-90—Continued

Station number	Date	Manganese, filtered (µg/L)	Mercury, filtered (µg/L)	Molybdenum, filtered (µg/L)	Nickel, filtered (µg/L)	Selenium, filtered (µg/L)	Silver, filtered (µg/L)	Strontium, filtered (µg/L)	Vanadium, filtered (µg/L)	Zinc, filtered (µg/L)
12478300	07-14-87	<1	--	<10	<10	--	<1	16	<6	<3
12478300	11-03-87	2	--	<10	<10	--	<1	27	<6	22
12479500	04-14-87	--	<0.1	--	--	--	--	--	--	--
12479500	04-30-87	2	<.1	<10	<10	<1	<1	31	<6	10
12479500	05-12-87	--	<.1	--	--	--	--	--	--	--
12479500	06-11-87	--	<.1	--	--	--	--	--	--	--
12479500	07-14-87	--	.6	--	--	--	--	--	--	--
12479500	08-10-87	2	<.1	<10	<10	<1	<1	23	<6	19
12479500	09-08-87	--	<.1	--	--	--	--	--	--	--
12479500	11-10-87	3	<.1	<10	<10	<1	<1	41	<6	16
12479500	12-07-87	--	<.1	--	--	--	--	--	--	--
12479500	01-12-88	--	<.1	--	--	--	--	--	--	--
12479500	02-09-88	--	<.1	--	--	--	--	--	--	--
12479500	03-08-88	--	<.1	--	--	--	--	--	--	--
12479500	04-12-88	--	<.1	--	--	--	--	--	--	--
12479500	04-16-88	--	<.1	--	--	--	--	--	--	--
12479500	05-10-88	--	<.1	--	--	--	--	--	--	--
12479500	06-14-88	--	<.1	--	--	--	--	--	--	--
12479500	07-12-88	--	<.1	--	--	--	--	--	--	--
12479500	08-09-88	--	<.1	--	--	--	--	--	--	--
12479500	09-13-88	--	<.1	--	--	--	--	--	--	--
12479500	09-20-88	2	<.1	<10	<10	--	<1	30	<6	4
12479500	09-20-88	2	<.1	<10	<10	--	1	30	<6	7
12479500	09-21-88	--	--	--	--	--	--	--	--	--
12479500	10-11-88	--	<.1	--	--	--	--	--	--	--
12479500	11-08-88	--	<.1	--	--	--	--	--	--	--
12479500	12-13-88	--	.2	--	--	--	--	--	--	--
12479500	01-12-89	--	<.1	--	--	--	--	--	--	--

Table 28. Concentrations of major and minor elements in filtered water, Yakima River Basin, Washington, 1987-90—Continued

Site reference number	Station number	Site name	Date	Time	Discharge, inst. (cubic feet per second)	Specific conductance (µs/cm)	pH (standard units)
6	12479500	Yakima River at Cle Elum	01-31-89	1857	1,410	126	7.8
6	12479500	Yakima River at Cle Elum	02-14-89	1200	442	81	7.6
6	12479500	Yakima River at Cle Elum	03-14-89	1315	504	90	7.2
6	12479500	Yakima River at Cle Elum	04-06-89	1943	2,150	70	7.7
6	12479500	Yakima River at Cle Elum	04-11-89	1110	1,200	70	7.9
6	12479500	Yakima River at Cle Elum	05-09-89	1127	1,440	51	7.6
6	12479500	Yakima River at Cle Elum	06-13-89	1150	2,920	54	7.8
6	12479500	Yakima River at Cle Elum	07-11-89	1130	3,720	46	7.8
6	12479500	Yakima River at Cle Elum	08-09-89	1345	3,610	47	7.3
6	12479500	Yakima River at Cle Elum	09-12-89	1837	456	61	8.1
6	12479500	Yakima River at Cle Elum	10-11-89	1345	476	61	--
6	12479500	Yakima River at Cle Elum	11-14-89	0605	1,020	58	6.8
6	12479500	Yakima River at Cle Elum	12-12-89	1201	837	63	6.3
6	12479500	Yakima River at Cle Elum	01-09-90	1052	1,450	59	7.1
6	12479500	Yakima River at Cle Elum	01-10-90	1130	3,130	49	7.2
6	12479500	Yakima River at Cle Elum	02-13-90	0815	1,670	72	6.6
6	12479500	Yakima River at Cle Elum	03-13-90	1045	659	75	7.8
3	12479720	Jungle Creek near mouth near Cle Elum	05-02-89	1230	15	114	8.1
5	12480000	Teanaway River below Forks near Cle Elum	07-14-87	0750	36	125	8.1
9	12482800	Yakima River at Thorp Highway bridge at Ellensburg	07-16-87	1216	3,600	--	--
9	12482800	Yakima River at Thorp Highway bridge at Ellensburg	11-07-87	1200	--	88	--
9	12482800	Yakima River at Thorp Highway bridge at Ellensburg	07-26-88	0915	3,594	48	7.0
12	12483200	South Fork Manastash Creek near Ellensburg	11-07-87	1245	6	100	7.9
15	12484100	Wilson Creek above Cherry Creek at Thrall	07-15-87	0940	110	259	7.9

Table 28. Concentrations of major and minor elements in filtered water, Yakima River Basin, Washington, 1987-90—Continued

Station number	Date	Alkalinity water dis it field (mg/L as CaCO3)	Hardness, total (mg/L as CaCO3)	Carbon, organic fil-tered (mg/L)	Bromide, fil-tered (mg/L)	Cyanide, fil-tered (mg/L)	Aluminum, fil-tered (µg/L)	Antimony, fil-tered (µg/L)	Arsenic fil-tered (µg/L)	Barium, fil-tered (µg/L)
12479500	01-31-89	55	36	2.6	--	--	--	--	--	--
12479500	02-14-89	39	32	1.0	--	--	--	--	--	--
12479500	03-14-89	43	34	1.3	--	--	--	--	--	--
12479500	04-06-89	28	24	1.9	--	--	--	--	<1	--
12479500	04-11-89	32	26	1.2	--	--	--	--	<1	--
12479500	05-09-89	24	20	1.2	--	--	--	--	<1	--
12479500	06-13-89	26	24	1.3	--	--	--	--	<1	--
12479500	07-11-89	22	22	1.2	--	--	--	--	<1	--
12479500	08-09-89	22	22	1.1	--	--	--	--	<1	--
12479500	09-12-89	27	26	.8	--	--	--	--	<1	--
12479500	10-11-89	--	27	.8	--	--	--	--	--	--
12479500	11-14-89	26	24	1.7	--	--	--	--	<1	--
12479500	12-12-89	28	27	1.2	--	--	--	--	<1	--
12479500	01-09-90	28	26	2.2	--	--	--	--	<1	--
12479500	01-10-90	23	21	2.8	--	<0.01	--	<1	<1	2
12479500	02-13-90	32	27	1.7	--	--	--	--	<1	--
12479500	03-13-90	38	32	1.2	--	--	--	--	<1	--
12479720	05-02-89	--	--	1.8	--	--	--	--	2	--
12480000	07-14-87	64	63	--	--	--	20	--	--	9
12482800	07-16-87	33	25	--	--	--	<10	--	--	4
12482800	11-07-87	--	42	--	--	--	<10	--	--	5
12482800	07-26-88	--	26	--	--	--	--	--	--	--
12483200	11-07-87	48	43	--	--	--	<10	--	--	6
12484100	07-15-87	121	100	--	--	--	<10	--	--	18

Table 28. Concentrations of major and minor elements in filtered water, Yakima River Basin, Washington, 1987-90—Continued

Station number	Date	Beryllium, filtered (µg/L)	Boron, filtered (µg/L)	Cadmium, filtered (µg/L)	Chromium, filtered (µg/L)	Cobalt, filtered (µg/L)	Copper, filtered (µg/L)	Iron, filtered (µg/L)	Lead, filtered (µg/L)	Lithium filtered (µg/L)
12479500	01-31-89	--	--	0.1	--	--	1.5	--	<0.5	--
12479500	02-14-89	--	--	<.1	--	--	.6	--	<.5	--
12479500	03-14-89	--	--	.4	--	--	1.6	--	<.5	--
12479500	04-06-89	--	--	<.2	--	--	.9	--	<.5	--
12479500	04-11-89	--	--	<.2	--	--	1.0	--	<.5	--
12479500	05-09-89	--	--	.3	--	--	2.0	--	<.5	--
12479500	06-13-89	--	--	<.1	--	--	1.2	--	<.5	--
12479500	07-11-89	--	--	<.1	--	--	1.1	--	<.5	--
12479500	08-09-89	--	--	<.1	--	--	.5	--	<.5	--
12479500	09-12-89	--	--	<.1	--	--	<.5	--	<.5	--
12479500	10-11-89	--	--	<.1	--	--	.6	--	<.5	--
12479500	11-14-89	--	--	.7	--	--	14	--	<.5	--
12479500	12-12-89	--	--	<.1	--	--	7.4	--	<.5	--
12479500	01-09-90	--	--	.1	--	--	5.3	--	<.5	--
12479500	01-10-90	<0.5	--	.1	<5	<3	3.0	44	<.5	<4
12479500	02-13-90	--	--	<.1	--	--	6.3	--	<.5	--
12479500	03-13-90	--	--	<.1	--	--	2.8	--	<.5	--
12479720	05-02-89	--	--	<.1	<.5	--	1.1	--	<.5	--
12480000	07-14-87	<.5	20	<1	<10	<3	<10	9	<10	<4
12482800	07-16-87	<.5	<10	<1	<10	<3	<10	11	<10	<4
12482800	11-07-87	<.5	<10	<1	<5	<3	<10	23	<10	<4
12482800	07-26-88	--	--	.4	<.5	--	.6	--	<.5	--
12483200	11-07-87	<.5	<10	<1	<5	<3	<10	100	<10	<4
12484100	07-15-87	<.5	20	<1	<10	<3	<10	92	<10	4

Table 28. Concentrations of major and minor elements in filtered water, Yakima River Basin, Washington, 1987-90—Continued

Station number	Date	Manganese, filtered (µg/L)	Mercury, filtered (µg/L)	Molybdenum, filtered (µg/L)	Nickel, filtered (µg/L)	Selenium, filtered (µg/L)	Silver, filtered (µg/L)	Strontium, filtered (µg/L)	Vanadium, filtered (µg/L)	Zinc, filtered (µg/L)
12479500	01-31-89	--	<0.1	--	--	--	--	--	--	--
12479500	02-14-89	--	<.1	--	--	--	--	--	--	--
12479500	03-14-89	--	<.1	--	--	--	--	--	--	--
12479500	04-06-89	--	<.1	--	--	--	--	--	--	--
12479500	04-11-89	--	<.1	--	--	--	--	--	--	--
12479500	05-09-89	--	<.1	--	--	--	--	--	--	--
12479500	06-13-89	--	<.1	--	--	--	--	--	--	--
12479500	07-11-89	--	<.1	--	--	--	--	--	--	--
12479500	08-09-89	--	<.1	--	--	--	--	--	--	--
12479500	09-12-89	--	<.1	--	--	--	--	--	--	--
12479500	10-11-89	--	<.1	--	--	--	--	--	--	--
12479500	11-14-89	--	<.1	--	--	--	--	--	--	--
12479500	12-12-89	--	<.1	--	--	--	--	--	--	--
12479500	01-09-90	--	<.1	--	--	--	--	--	--	--
12479500	01-10-90	7	<.1	<10	<10	<1	<1	28	<6	8
12479500	02-13-90	--	<.1	--	--	--	--	--	--	--
12479500	03-13-90	--	<.1	--	--	--	--	--	--	--
12479720	05-02-89	--	<.1	--	--	--	--	--	--	10
12480000	07-14-87	2	--	<10	<10	--	<1	57	<6	<3
12482800	07-16-87	3	--	<10	<10	--	<1	28	<6	10
12482800	11-07-87	7	--	<10	<10	--	2	47	<6	10
12482800	07-26-88	--	--	--	--	--	--	--	--	--
12483200	11-07-87	6	--	<10	<10	--	1	42	<6	6
12484100	07-15-87	23	--	<10	<10	--	<1	110	<6	18

Table 28. Concentrations of major and minor elements in filtered water, Yakima River Basin, Washington, 1987-90—Continued

Site reference number	Station number	Site name	Date	Time	Discharge, inst. (cubic feet per second)	Specific conductance (µs/cm)	pH (standard units)
16	12484480	Cherry Creek at Thrall	07-15-87	1050	102	436	8.3
16	12484480	Cherry Creek at Thrall	11-03-87	1430	68	491	8.4
19	12484500	Yakima River at Umtanum	04-15-87	1345	1,990	106	8.2
19	12484500	Yakima River at Umtanum	05-01-87	1505	3,450	111	7.9
19	12484500	Yakima River at Umtanum	06-10-87	1300	3,000	98	7.6
19	12484500	Yakima River at Umtanum	07-15-87	0800	3,230	74	7.5
19	12484500	Yakima River at Umtanum	08-18-87	0900	3,350	86	7.0
19	12484500	Yakima River at Umtanum	09-09-87	0845	1,820	111	6.9
19	12484500	Yakima River at Umtanum	12-09-87	1230	591	159	8.2
19	12484500	Yakima River at Umtanum	01-13-88	1200	454	164	8.0
19	12484500	Yakima River at Umtanum	02-10-88	1000	1,060	130	7.6
19	12484500	Yakima River at Umtanum	03-08-88	1630	1,050	131	9.0
19	12484500	Yakima River at Umtanum	03-09-88	1000	1,040	128	7.7
19	12484500	Yakima River at Umtanum	04-13-88	1050	1,910	117	7.3
19	12484500	Yakima River at Umtanum	04-15-88	1520	3,850	93	7.1
19	12484500	Yakima River at Umtanum	05-11-88	1130	1,550	133	8.1
19	12484500	Yakima River at Umtanum	06-15-88	1245	2,280	112	8.1
19	12484500	Yakima River at Umtanum	07-13-88	1100	3,450	84	7.9
19	12484500	Yakima River at Umtanum	08-10-88	1045	3,800	80	7.4
19	12484500	Yakima River at Umtanum	09-14-88	1110	1,210	145	7.9
19	12484500	Yakima River at Umtanum	09-21-88	1610	1,230	142	8.9
19	12484500	Yakima River at Umtanum	09-22-88	0015	1,130	149	8.1
19	12484500	Yakima River at Umtanum	09-22-88	0815	1,060	149	8.2
19	12484500	Yakima River at Umtanum	10-12-88	1300	753	166	8.4
19	12484500	Yakima River at Umtanum	11-09-88	1100	1,300	121	7.4
19	12484500	Yakima River at Umtanum	12-14-88	1205	2,230	99	8.2
19	12484500	Yakima River at Umtanum	01-11-89	1130	1,010	123	8.2

Table 28. Concentrations of major and minor elements in filtered water, Yakima River Basin, Washington, 1987-90—Continued

Station number	Date	Alkalinity water dis it field (mg/L as CaCO3)	Hardness, total (mg/L as CaCO3)	Carbon, organic fil-tered (mg/L)	Bromide, fil-tered (mg/L)	Cyanide, fil-tered (mg/L)	Aluminum, fil-tered (µg/L)	Antimony, fil-tered (µg/L)	Arsenic fil-tered (µg/L)	Barium, fil-tered (µg/L)
12484480	07-15-87	107	180	--	--	--	30	--	--	52
12484480	11-03-87	225	200	--	--	--	<10	--	--	57
12484500	04-15-87	57	43	3.7	--	--	--	--	--	--
12484500	05-01-87	51	46	3.2	<0.01	<0.01	210	<1	<1	9
12484500	06-10-87	44	41	3.2	--	--	--	--	--	--
12484500	07-15-87	36	33	2.2	--	--	--	--	--	--
12484500	08-18-87	41	35	3.3	<.01	<.01	--	1	<1	8
12484500	09-09-87	51	44	2.2	--	--	--	--	--	--
12484500	12-09-87	77	68	2.0	--	--	--	--	--	--
12484500	01-13-88	79	70	1.2	--	--	--	--	--	--
12484500	02-10-88	61	54	2.2	--	--	--	--	--	--
12484500	03-08-88	61	58	--	--	--	--	--	--	10
12484500	03-09-88	61	54	2.1	--	--	--	--	--	--
12484500	04-13-88	54	49	1.9	--	--	--	--	--	--
12484500	04-15-88	39	39	2.3	--	--	--	--	--	--
12484500	05-11-88	--	54	0.4	--	--	--	--	--	--
12484500	06-15-88	49	45	2.0	--	--	--	--	--	--
12484500	07-13-88	45	--	2.2	--	--	--	--	--	--
12484500	08-10-88	36	34	2.1	--	--	--	--	--	--
12484500	09-14-88	65	61	2.1	--	--	--	--	--	--
12484500	09-21-88	67	61	2.0	--	--	--	--	--	13
12484500	09-22-88	71	66	2.0	--	--	--	--	--	16
12484500	09-22-88	74	66	2.4	--	--	--	--	--	17
12484500	10-12-88	77	68	4.5	--	--	--	--	--	--
12484500	11-09-88	57	51	1.2	--	--	--	--	--	--
12484500	12-14-88	47	41	2.0	--	--	--	--	--	--
12484500	01-11-89	58	50	1.2	--	--	--	--	--	--

Table 28. Concentrations of major and minor elements in filtered water, Yakima River Basin, Washington, 1987-90—Continued

Station number	Date	Beryllium, filtered (µg/L)	Boron, filtered (µg/L)	Cadmium, filtered (µg/L)	Chromium, filtered (µg/L)	Cobalt, filtered (µg/L)	Copper, filtered (µg/L)	Iron, filtered (µg/L)	Lead, filtered (µg/L)	Lithium filtered (µg/L)
12484480	07-15-87	<0.5	30	<1	<10	<3	<10	38	<10	6
12484480	11-03-87	<.5	20	<1	<5	<3	<10	9	<10	<4
12484500	04-15-87	--	--	.5	--	--	1.0	--	<.5	--
12484500	05-01-87	<.5	20	1.2 (<1)	<.5	<3	2.1 (<10)	250	.9 (<10)	<4
12484500	06-10-87	--	--	.2	--	--	1.7	--	<.5	--
12484500	07-15-87	--	--	< .1	--	--	1.8	--	.6	--
12484500	08-18-87	<.5	--	<.1 (<1)	<.5	<3	1.0 (<10)	19	<.5 (<10)	<4
12484500	09-09-87	--	--	1.2	--	--	2.7	--	<.5	--
12484500	12-09-87	--	--	<.1	--	--	1.0	--	<.5	--
12484500	01-13-88	--	--	<.1	--	--	.6	--	.6	--
12484500	02-10-88	--	--	<.1	--	--	1.1	--	<.5	--
12484500	03-08-88	<.5	--	1.0	<5	<3	<10	21	<10	16
12484500	03-09-88	--	--	.2	--	--	.8	--	<.5	--
12484500	04-13-88	--	--	.2	--	--	.6	--	<.5	--
12484500	04-15-88	--	--	.1	--	--	.7	--	<.5	--
12484500	05-11-88	--	--	<.1	--	--	1.0	--	<.5	--
12484500	06-15-88	--	--	.2	--	--	1.2	--	<.5	--
12484500	07-13-88	--	--	.1	<.5	--	1.2	--	<.5	--
12484500	08-10-88	--	--	.3	--	--	<.5	--	<.5	--
12484500	09-14-88	--	--	.3	--	--	1.4	--	<.5	--
12484500	09-21-88	<.5	--	<.1 (<1)	<5	<3	1.4 (<10)	21	<.5 (<10)	<4
12484500	09-22-88	<.5	--	<.1 (<1)	<5	<3	.7 (<10)	25	<10	<4
12484500	09-22-88	<.5	--	<.1 (<1)	<5	<3	.9 (<10)	26	<.5 (<10)	<4
12484500	10-12-88	--	--	.2	--	--	1.3	--	<.5	--
12484500	11-09-88	--	--	.3	--	--	.5	--	<.5	--
12484500	12-14-88	--	--	.3	--	--	1.0	--	<.5	--
12484500	01-11-89	--	--	.1	--	--	1.4	--	<.5	--

Table 28. Concentrations of major and minor elements in filtered water, Yakima River Basin, Washington, 1987-90—Continued

Station number	Date	Manganese, filtered (µg/L)	Mercury, filtered (µg/L)	Molybdenum, filtered (µg/L)	Nickel, filtered (µg/L)	Selenium, filtered (µg/L)	Silver, filtered (µg/L)	Strontium, filtered (µg/L)	Vanadium, filtered (µg/L)	Zinc, filtered (µg/L)
12484480	07-15-87	13	--	<10	<10	--	<1	210	25	57
12484480	11-03-87	11	--	<10	<10	--	<1	220	34	3
12484500	04-15-87	--	<0.1	--	--	--	--	--	--	--
12484500	05-01-87	21	<.1	<10	<10	<1	<1	51	<6	6
12484500	06-10-87	--	<.1	--	--	--	--	--	--	--
12484500	07-15-87	--	.2	--	--	--	--	--	--	--
12484500	08-18-87	4	<.1	<10	<10	<1	1	42	<6	3
12484500	09-09-87	--	<.1	--	--	--	--	--	--	--
12484500	12-09-87	--	<.1	--	--	--	--	--	--	--
12484500	01-13-88	--	<.1	--	--	--	--	--	--	--
12484500	02-10-88	--	<.1	--	--	--	--	--	--	--
12484500	03-08-88	16	--	<10	<10	--	1	68	<6	12
12484500	03-09-88	--	<.1	--	--	--	--	--	--	--
12484500	04-13-88	--	<.1	--	--	--	--	--	--	--
12484500	04-15-88	--	<.1	--	--	--	--	--	--	--
12484500	05-11-88	--	<.1	--	--	--	--	--	--	--
12484500	06-15-88	--	<.1	--	--	--	--	--	--	--
12484500	07-13-88	--	<.1	--	--	--	--	--	--	--
12484500	08-10-88	--	<.1	--	--	--	--	--	--	--
12484500	09-14-88	--	<.1	--	--	--	--	--	--	--
12484500	09-21-88	4	<.1	<10	<10	--	<1	69	<6	<3
12484500	09-22-88	5	<.1	<10	<10	--	<1	74	<6	8
12484500	09-22-88	5	<.1	<10	<10	--	<1	76	<6	6
12484500	10-12-88	--	<.1	--	--	--	--	--	--	--
12484500	11-09-88	--	<.1	--	--	--	--	--	--	--
12484500	12-14-88	--	<.1	--	--	--	--	--	--	--
12484500	01-11-89	--	.2	--	--	--	--	--	--	--

Table 28. Concentrations of major and minor elements in filtered water, Yakima River Basin, Washington, 1987-90—Continued

Site reference number	Station number	Site name	Date	Time	Discharge, inst. (cubic feet per second)	Specific conductance (µs/cm)	pH (standard units)
19	12484500	Yakima River at Umtanum	01-31-89	2100	2,940	101	7.9
19	12484500	Yakima River at Umtanum	02-15-89	1212	826	142	7.5
19	12484500	Yakima River at Umtanum	03-15-89	1158	1,570	130	8.3
19	12484500	Yakima River at Umtanum	04-06-89	2145	3,770	98	7.7
19	12484500	Yakima River at Umtanum	04-12-89	1300	3,370	104	8.0
19	12484500	Yakima River at Umtanum	05-10-89	1125	5,600	82	7.6
19	12484500	Yakima River at Umtanum	06-14-89	1110	3,470	98	7.9
19	12484500	Yakima River at Umtanum	07-12-89	0845	3,850	79	7.8
19	12484500	Yakima River at Umtanum	08-10-89	1130	3,780	88	7.4
19	12484500	Yakima River at Umtanum	09-13-89	1915	1,130	144	8.9
19	12484500	Yakima River at Umtanum	10-12-89	0900	1,340	156	7.9
19	12484500	Yakima River at Umtanum	11-15-89	0635	1,480	109	7.4
19	12484500	Yakima River at Umtanum	12-05-89	1523	2,720	92	6.8
19	12484500	Yakima River at Umtanum	12-13-89	1057	1,240	118	7.7
19	12484500	Yakima River at Umtanum	01-10-90	0737	3,960	102	7.3
19	12484500	Yakima River at Umtanum	02-14-90	0845	2,230	104	7.1
19	12484500	Yakima River at Umtanum	03-14-90	0945	1,340	128	7.6
20	12484550	Umtanum Creek near mouth at Umtanum	05-03-89	0945	4	181	8.0
23	12484950	Yakima River above canal diversion at RM 128 at Roza Dam	07-15-87	0710	--	77	7.6
25	12485550	Yakima River above Selah Creek at Pomona	11-04-87	1300	443	186	9.1
10	12487200	Little Naches River at mouth near Cliffdell	07-15-87	1200	58	75	8.0
17	12488050	Bumping River at Soda Springs Walkway near Nile	07-14-87	1200	106	41	7.4
17	12488050	Bumping River at Soda Springs Walkway near Nile	07-27-88	1250	171	39	--

Table 28. Concentrations of major and minor elements in filtered water, Yakima River Basin, Washington, 1987-90—Continued

Station number	Date	Alkalinity water dis it field (mg/L as CaCO3)	Hardness, total (mg/L as CaCO3)	Carbon, organic fil-tered (mg/L)	Bromide, fil-tered (mg/L)	Cyanide, fil-tered (mg/L)	Aluminum, fil-tered (µg/L)	Antimony, fil-tered (µg/L)	Arsenic fil-tered (µg/L)	Barium, fil-tered (µg/L)
12484500	01-31-89	46	42	2.8	--	--	--	--	--	--
12484500	02-15-89	67	56	1.6	--	--	--	--	--	--
12484500	03-15-89	68	60	2.6	--	--	--	--	--	--
12484500	04-06-89	46	42	2.6	--	--	--	--	<1	--
12484500	04-12-89	49	45	2.2	--	--	--	--	<1	--
12484500	05-10-89	39	35	1.7	--	--	--	--	<1	--
12484500	06-14-89	54	42	1.8	--	--	--	--	--	--
12484500	07-12-89	44	34	.4	--	--	--	--	<1	--
12484500	08-10-89	38	37	1.6	--	--	--	--	<1	--
12484500	09-13-89	66	59	1.9	--	--	--	--	<1	--
12484500	10-12-89	76	59	1.6	--	--	--	--	--	--
12484500	11-15-89	51	46	1.6	--	--	--	--	<1	--
12484500	12-05-89	44	41	2.5	<0.01	<0.01	20	<1	<1	7
12484500	12-13-89	56	50	1.2	--	--	--	--	--	--
12484500	01-10-90	44	42	3.3	--	--	--	--	--	--
12484500	02-14-90	50	43	2.1	--	--	--	--	<1	--
12484500	03-14-90	63	54	1.7	--	--	--	--	--	--
12484550	05-03-89	--	--	2.5	--	--	--	--	<1	--
12484950	07-15-87	38	34	--	--	--	20	--	--	7
12485550	11-04-87	84	80	--	--	--	10	--	--	14
12487200	07-15-87	34	27	--	--	--	<10	--	--	2
12488050	07-14-87	16	16	--	--	--	<10	--	--	2
12488050	07-27-88	--	--	--	--	--	--	--	--	--

Table 28. Concentrations of major and minor elements in filtered water, Yakima River Basin, Washington, 1987-90—Continued

Station number	Date	Beryl-lium, fil-tered (µg/L)	Boron, fil-tered (µg/L)	Cadmium, fil-tered (µg/L)	Chro-mium, fil-tered (µg/L)	Cobalt, fil-tered (µg/L)	Copper, fil-tered (µg/L)	Iron, fil-tered (µg/L)	Lead, fil-tered (µg/L)	Lithium fil-tered (µg/L)
12484500	01-31-89	--	--	2.1	--	--	1.6	--	<0.5	--
12484500	02-15-89	--	--	<.1	--	--	<.5	--	<.5	--
12484500	03-15-89	--	--	.5	--	--	1.9	--	<.5	--
12484500	04-06-89	--	--	<.2	--	--	1.3	--	<.5	--
12484500	04-12-89	--	--	<.2	--	--	1.6	--	<.5	--
12484500	05-10-89	--	--	.1	--	--	1.4	--	<.5	--
12484500	06-14-89	--	--	<.1	--	--	.7	--	<.5	--
12484500	07-12-89	--	--	<.1	--	--	<.5	--	<.5	--
12484500	08-10-89	--	--	.1	--	--	2.2	--	<.5	--
12484500	09-13-89	--	--	<.1	--	--	.8	--	1.8	--
12484500	10-12-89	--	--	.2	--	--	20	--	<.5	--
12484500	11-15-89	--	--	.2	--	--	7.0	--	<.5	--
12484500	12-05-89	<0.5	<10	.2 (<1)	0.6 (<5)	<3	4.6 (<10)	53	<.5 (<10)	<4
12484500	12-13-89	--	--	<.1	--	--	4.1	--	<.5	--
12484500	01-10-90	--	--	<.1	--	--	2.5	--	<.5	--
12484500	02-14-90	--	--	.1	--	--	3.7	--	<.5	--
12484500	03-14-90	--	--	<.1	--	--	.7	--	<.5	--
12484550	05-03-89	--	--	<.1	<.5	--	1.4	--	<.5	--
12484950	07-15-87	<.5	<10	2.0	<10	<3	<10	24	<10	<4
12485550	11-04-87	<.5	10	<1	<5	<3	<10	30	<10	<4
12487200	07-15-87	<.5	10	<1	<10	<3	<10	10	<10	<4
12488050	07-14-87	<.5	<10	<1	<10	<3	<10	7	<10	<4
12488050	07-27-88	--	--	<.1	--	--	<.5	--	--	--

Table 28. Concentrations of major and minor elements in filtered water, Yakima River Basin, Washington, 1987-90—Continued

Station number	Date	Manganese, filtered (µg/L)	Mercury, filtered (µg/L)	Molybdenum, filtered (µg/L)	Nickel, filtered (µg/L)	Selenium, filtered (µg/L)	Silver, filtered (µg/L)	Strontium, filtered (µg/L)	Vanadium, filtered (µg/L)	Zinc, filtered (µg/L)
12484500	01-31-89	--	<0.1	--	--	--	--	--	--	--
12484500	02-15-89	--	<.1	--	--	--	--	--	--	--
12484500	03-15-89	--	<.1	--	--	--	--	--	--	--
12484500	04-06-89	--	.6	--	--	--	--	--	--	--
12484500	04-12-89	--	<.1	--	--	--	--	--	--	--
12484500	05-10-89	--	<.1	--	--	--	--	--	--	--
12484500	06-14-89	--	<.1	--	--	--	--	--	--	--
12484500	07-12-89	--	<.1	--	--	--	--	--	--	--
12484500	08-10-89	--	<.1	--	--	--	--	--	--	--
12484500	09-13-89	--	<.1	--	--	--	--	--	--	--
12484500	10-12-89	--	<.1	--	--	--	--	--	--	--
12484500	11-15-89	--	<.1	--	--	--	--	--	--	--
12484500	12-05-89	6	<.1	<10	<10	<1	<1	46	<6	<3
12484500	12-13-89	--	<.1	--	--	--	--	--	--	--
12484500	01-10-90	--	<.1	--	--	--	--	--	--	--
12484500	02-14-90	--	<.1	--	--	--	--	--	--	--
12484500	03-14-90	--	<.1	--	--	--	--	--	--	--
12484550	05-03-89	--	<.1	--	--	--	--	--	--	<10
12484950	07-15-87	12	--	<10	<10	--	<1	37	<6	210
12485550	11-04-87	10	--	<10	<10	--	<1	88	8	6
12487200	07-15-87	1	--	<10	<10	--	<1	22	<6	23
12488050	07-14-87	1	--	<10	<10	--	<1	26	<6	160
12488050	07-27-88	--	--	--	--	--	--	--	--	10

Table 28. Concentrations of major and minor elements in filtered water, Yakima River Basin, Washington, 1987-90—Continued

Site reference number	Station number	Site name	Date	Time	Discharge, inst. (cubic feet per second)	Specific conductance (µs/cm)	pH (standard units)
11	12488500	American River near Nile	07-14-87	1425	76	57	7.8
11	12488500	American River near Nile	11-04-87	0900	--	74	7.8
18	12489050	Naches River at Cottonwood Campground near Cliffdell	11-05-87	1500	116	64	7.6
21	12489300	Rattlesnake Creek at mouth near Nile	07-15-87	1620	48	86	8.1
24	12493100	Tieton River at mouth near Naches	11-05-87	1200	16	111	7.9
26	12499000	Naches River near North Yakima	04-15-87	1420	1,415	79	8.8
26	12499000	Naches River near North Yakima	04-30-87	1230	5,250	57	7.0
26	12499000	Naches River near North Yakima	05-13-87	1105	6,450	54	7.6
26	12499000	Naches River near North Yakima	06-10-87	1200	1,170	62	7.8
26	12499000	Naches River near North Yakima	07-15-87	1450	656	86	8.8
26	12499000	Naches River near North Yakima	08-10-87	1911	278	108	8.9
26	12499000	Naches River near North Yakima	09-09-87	0955	1,350	83	8.0
26	12499000	Naches River near North Yakima	10-14-87	1347	1,310	94	7.9
26	12499000	Naches River near North Yakima	11-04-87	1615	289	138	9.1
26	12499000	Naches River near North Yakima	12-09-87	1255	391	120	8.3
26	12499000	Naches River near North Yakima	01-13-88	1225	292	127	8.1
26	12499000	Naches River near North Yakima	02-10-88	1249	513	110	8.0
26	12499000	Naches River near North Yakima	03-09-88	1145	813	99	8.1
26	12499000	Naches River near North Yakima	04-13-88	1330	1,810	76	8.1
26	12499000	Naches River near North Yakima	05-11-88	1400	2,200	63	8.3
26	12499000	Naches River near North Yakima	05-13-88	1945	3,940	50	7.6
26	12499000	Naches River near North Yakima	06-14-88	1520	1,480	62	8.1
26	12499000	Naches River near North Yakima	07-16-88	1415	608	81	8.7
26	12499000	Naches River near North Yakima	08-10-88	1544	674	88	9.0
26	12499000	Naches River near North Yakima	09-14-88	1217	2,110	78	8.2
26	12499000	Naches River near North Yakima	10-11-88	0808	1,470	81	7.8
26	12499000	Naches River near North Yakima	11-09-88	1201	706	91	8.2
26	12499000	Naches River near North Yakima	12-14-88	1430	1,130	80	8.5

Table 28. Concentrations of major and minor elements in filtered water, Yakima River Basin, Washington, 1987-90—Continued

Station number	Date	Alkalinity water dis it field (mg/L as CaCO3)	Hardness, total (mg/L as CaCO3)	Carbon, organic fil-tered (mg/L)	Bromide, fil-tered (mg/L)	Cyanide, fil-tered (mg/L)	Aluminum, fil-tered (µg/L)	Antimony, fil-tered (µg/L)	Arsenic fil-tered (µg/L)	Barium, fil-tered (µg/L)
12488500	07-14-87	25	24	--	--	--	90	--	--	2
12488500	11-04-87	34	30	--	--	--	<10	--	--	<2
12489050	11-05-87	27	25	--	--	--	<10	--	--	2
12489300	07-15-87	34	32	--	--	--	20	--	--	3
12493100	11-05-87	49	46	--	--	--	<10	--	--	8
12499000	04-15-87	33	29	3.1	--	--	--	--	--	--
12499000	04-30-87	13	19	2.6	<0.01	<0.01	20	<1	<1	<2
12499000	05-13-87	20	20	1.6	--	--	--	--	--	--
12499000	06-10-87	33	23	2.2	--	--	--	--	--	--
12499000	07-15-87	36	32	2.2	--	--	--	--	--	--
12499000	08-10-87	47	38	2.0	<.01	<.01	20	<1	<1	4
12499000	09-09-87	32	31	2.0	--	--	--	--	--	--
12499000	10-14-87	40	36	2.1	--	--	--	--	--	--
12499000	11-04-87	62	57	--	--	--	20	--	--	6
12499000	12-09-87	46	46	1.9	--	--	--	--	--	--
12499000	01-13-88	47	48	1.1	--	--	--	--	--	--
12499000	02-10-88	46	42	1.5	--	--	--	--	--	--
12499000	03-09-88	38	38	2.2	--	--	--	--	--	--
12499000	04-13-88	29	28	2.1	--	--	--	--	--	--
12499000	05-11-88	26	23	1.5	--	--	--	--	--	--
12499000	05-13-88	20	18	2.2	--	--	--	--	--	--
12499000	06-14-88	26	22	1.3	--	--	--	--	--	--
12499000	07-16-88	35	30	1.3	--	--	--	--	--	--
12499000	08-10-88	34	33	1.4	--	--	--	--	--	--
12499000	09-14-88	30	30	1.2	--	--	--	--	--	--
12499000	10-11-88	33	31	1.0	--	--	--	--	--	--
12499000	11-09-88	39	34	1.0	--	--	--	--	--	--
12499000	12-14-88	34	31	1.4	--	--	--	--	--	--

Table 28. Concentrations of major and minor elements in filtered water, Yakima River Basin, Washington, 1987-90—Continued

Station number	Date	Beryl-lium, fil-tered (µg/L)	Boron, fil-tered (µg/L)	Cadmium, fil-tered (µg/L)	Chro-mium, fil-tered (µg/L)	Cobalt, fil-tered (µg/L)	Copper, fil-tered (µg/L)	Iron, fil-tered (µg/L)	Lead, fil-tered (µg/L)	Lithium fil-tered (µg/L)
12488500	07-14-87	<0.5	<10	<1	<10	<3	<10	5	<10	<4
12488500	11-04-87	<.5	<10	<1	<5	<3	<10	<3	<10	<4
12489050	11-05-87	<.5	<10	<1	<5	<3	<10	9	<10	<4
12489300	07-15-87	<.5	<10	<1	<10	<3	<10	4	<10	<4
12493100	11-05-87	<.5	<10	<1	<5	<3	<10	12	<10	4
12499000	04-15-87	--	--	.3	--	--	<.5	--	<.5	--
12499000	04-30-87	<.5	20	<.2 (<1)	.7 (<5)	<3	<1.3 (<10)	35	<.5 (<10)	<4
12499000	05-13-87	--	--	<.1	--	--	.9	--	<.5	--
12499000	06-10-87	--	--	.2	--	--	.7	--	<.5	--
12499000	07-15-87	--	--	.1	--	--	.8	--	<.5	--
12499000	08-10-87	<.5	10	<.1 (<1)	<5	<3	<.5 (<10)	18	<10	<4
12499000	09-09-87	--	--	<.1	--	--	<.5	--	<.5	--
12499000	10-14-87	--	--	<.1	--	--	.7	--	<.5	--
12499000	11-04-87	<.5	10	<1	<5	<3	<10	13	<10	<4
12499000	12-09-87	--	--	.3	--	--	.6	--	<.5	--
12499000	01-13-88	--	--	<.1	--	--	<.5	--	<.5	--
12499000	02-10-88	--	--	<.1	--	--	.7	--	<.5	--
12499000	03-09-88	--	--	<.1	--	--	.7	--	.7	--
12499000	04-13-88	--	--	.2	--	--	1.0	--	<.5	--
12499000	05-11-88	--	--	<.1	--	--	.5	--	<.5	--
12499000	05-13-88	--	--	.1	--	--	1.0	--	<.5	--
12499000	06-14-88	--	--	.1	--	--	.6	--	<.5	--
12499000	07-16-88	--	--	<.1	<.5	--	.5	--	<.5	--
12499000	08-10-88	--	--	.3	--	--	.8	--	<.5	--
12499000	09-14-88	--	--	<.1	--	--	.9	--	<.5	--
12499000	10-11-88	--	--	<.1	--	--	.5	--	<.5	--
12499000	11-09-88	--	--	2.2	--	--	<.5	--	<.5	--
12499000	12-14-88	--	--	.1	--	--	.7	--	<.5	--

Table 28. Concentrations of major and minor elements in filtered water, Yakima River Basin, Washington, 1987-90—Continued

Station number	Date	Manganese, filtered (µg/L)	Mercury, filtered (µg/L)	Molybdenum, filtered (µg/L)	Nickel, filtered (µg/L)	Selenium, filtered (µg/L)	Silver, filtered (µg/L)	Strontium, filtered (µg/L)	Vanadium, filtered (µg/L)	Zinc, filtered (µg/L)
12488500	07-14-87	2	--	<10	<10	--	<1	23	<6	120
12488500	11-04-87	<1	--	<10	<10	--	<1	24	<6	<3
12489050	11-05-87	<1	--	<10	<10	--	<1	28	<6	4
12489300	07-15-87	<1	--	<10	<10	--	1	42	<6	8
12493100	11-05-87	3	--	<10	<10	--	<1	65	<6	10
12499000	04-15-87	--	<0.1	--	--	--	--	--	--	--
12499000	04-30-87	2	<.1	<10	<10	<1	<1	21	<6	<3
12499000	05-13-87	--	<.1	--	--	--	--	--	--	--
12499000	06-10-87	--	<.1	--	--	--	--	--	--	--
12499000	07-15-87	--	.2	--	--	--	--	--	--	--
12499000	08-10-87	4	<.1	<10	<10	<1	2	53	<6	18
12499000	09-09-87	--	<.1	--	--	--	--	--	--	--
12499000	10-14-87	--	<.1	--	--	--	--	--	--	--
12499000	11-04-87	3	--	<10	<10	--	2	65	<6	<3
12499000	12-09-87	--	<.1	--	--	--	--	--	--	--
12499000	01-13-88	--	<.1	--	--	--	--	--	--	--
12499000	02-10-88	--	<.1	--	--	--	--	--	--	--
12499000	03-09-88	--	<.1	--	--	--	--	--	--	--
12499000	04-13-88	--	<.1	--	--	--	--	--	--	--
12499000	05-11-88	--	<.1	--	--	--	--	--	--	--
12499000	05-13-88	--	<.1	--	--	--	--	--	--	--
12499000	06-14-88	--	<.1	--	--	--	--	--	--	--
12499000	07-16-88	--	<.1	--	--	--	--	--	--	--
12499000	08-10-88	--	<.1	--	--	--	--	--	--	--
12499000	09-14-88	--	<.1	--	--	--	--	--	--	--
12499000	10-11-88	--	<.1	--	--	--	--	--	--	--
12499000	11-09-88	--	<.1	--	--	--	--	--	--	--
12499000	12-14-88	--	<.1	--	--	--	--	--	--	--

Table 28. Concentrations of major and minor elements in filtered water, Yakima River Basin, Washington, 1987-90—Continued

Site reference number	Station number	Site name	Date	Time	Discharge, inst. (cubic feet per second)	Specific conductance (µs/cm)	pH (standard units)
26	12499000	Naches River near North Yakima	01-11-89	1451	608	83	8.4
26	12499000	Naches River near North Yakima	02-15-89	1414	350	96	8.5
26	12499000	Naches River near North Yakima	03-15-89	1336	1,010	100	8.2
26	12499000	Naches River near North Yakima	04-07-89	1715	2,500	83	7.9
26	12499000	Naches River near North Yakima	04-14-89	1508	2,990	74	8.0
26	12499000	Naches River near North Yakima	05-10-89	1510	3,660	55	8.0
26	12499000	Naches River near North Yakima	06-14-89	1602	2,760	59	8.1
26	12499000	Naches River near North Yakima	07-18-89	1648	650	83	8.8
26	12499000	Naches River near North Yakima	08-08-89	1628	557	90	8.6
26	12499000	Naches River near North Yakima	09-15-89	1423	2,200	74	8.2
26	12499000	Naches River near North Yakima	10-18-89	1714	278	125	8.9
26	12499000	Naches River near North Yakima	11-15-89	1211	482	95	8.6
26	12499000	Naches River near North Yakima	12-13-89	1513	680	82	8.2
26	12499000	Naches River near North Yakima	01-10-90	1332	4,910	60	7.6
26	12499000	Naches River near North Yakima	02-14-90	1503	1,090	84	7.8
26	12499000	Naches River near North Yakima	03-14-90	1518	998	91	8.2
28	12500415	Tributary to Moxee Drain at Bell Road near Union Gap	11-04-87	1020	6	526	7.8
30	12500430	Moxee Drain at Thorp Road near Union Gap	07-16-87	0930	79	299	8.1
30	12500430	Moxee Drain at Thorp Road near Union Gap	11-04-87	1240	23	632	8.4
27	12500437	Wide Hollow Creek at West Valley MS near Ahtanum	05-01-89	1430	10	181	9.4
29	12500445	Wide Hollow Creek near mouth at Union Gap	11-04-87	0905	10	400	7.6
29	12500445	Wide Hollow Creek near mouth at Union Gap	07-27-88	1025	26	322	7.8
32	12500450	Yakima River above Ahtanum Creek at Union Gap	04-16-87	1053	3,871	100	8.3
32	12500450	Yakima River above Ahtanum Creek at Union Gap	05-01-87	0900	8,201	73	6.7
32	12500450	Yakima River above Ahtanum Creek at Union Gap	05-14-87	1000	6,020	75	7.8
32	12500450	Yakima River above Ahtanum Creek at Union Gap	06-11-87	1207	3,060	100	8.2
32	12500450	Yakima River above Ahtanum Creek at Union Gap	07-16-87	1225	3,340	96	8.3
32	12500450	Yakima River above Ahtanum Creek at Union Gap	08-11-87	0800	2,790	105	7.9
32	12500450	Yakima River above Ahtanum Creek at Union Gap	08-11-87	2246	3,510	103	8.2

Table 28. Concentrations of major and minor elements in filtered water, Yakima River Basin, Washington, 1987-90—Continued

Station number	Date	Alkalinity water dis it field (mg/L as CaCO3)	Hardness, total (mg/L as CaCO3)	Carbon, organic fil-tered (mg/L)	Bromide, fil-tered (mg/L)	Cyanide, fil-tered (mg/L)	Aluminum, fil-tered (µg/L)	Antimony, fil-tered (µg/L)	Arsenic fil-tered (µg/L)	Barium, fil-tered (µg/L)
12499000	01-11-89	34	32	1.3	--	--	--	--	--	--
12499000	02-15-89	39	38	1.2	--	--	--	--	--	--
12499000	03-15-89	41	39	2.5	--	--	--	--	--	--
12499000	04-07-89	33	37	3.3	--	--	--	--	<1	--
12499000	04-14-89	32	29	3.1	--	--	--	--	<1	--
12499000	05-10-89	23	21	1.3	--	--	--	--	<1	--
12499000	06-14-89	25	22	1.0	--	--	--	--	<1	--
12499000	07-18-89	34	30	.6	--	--	--	--	<1	--
12499000	08-08-89	37	34	1.2	--	--	--	--	<1	--
12499000	09-15-89	30	28	1.0	--	--	--	--	<1	--
12499000	10-18-89	53	48	1.1	--	--	--	--	<1	--
12499000	11-15-89	40	37	1.4	--	--	--	--	<1	--
12499000	12-13-89	35	32	1.2	--	--	--	--	1	--
12499000	01-10-90	22	22	4.3	--	--	--	--	<1	--
12499000	02-14-90	33	32	1.8	--	--	--	--	<1	--
12499000	03-14-90	36	34	1.4	--	--	--	--	<1	--
12500415	11-04-87	229	220	--	--	--	<10	--	--	25
12500430	07-16-87	137	90	--	--	--	30	--	--	32
12500430	11-04-87	278	200	--	--	--	<10	--	--	47
12500437	05-01-89	--	--	2.5	--	--	--	--	1	--
12500445	11-04-87	165	160	--	--	--	<10	--	--	22
12500445	07-27-88	--	120	2.6	--	--	--	--	--	--
12500450	04-16-87	45	38	2.6	--	--	--	--	--	--
12500450	05-01-87	31	28	--	<0.01	<0.01	60	<1	<1	5
12500450	05-14-87	28	28	1.8	--	--	--	--	--	--
12500450	06-11-87	42	37	3.2	--	--	--	--	--	--
12500450	07-16-87	47	36	2.6	--	--	--	--	--	--
12500450	08-11-87	47	42	2.7	<.01	<.01	<10	--	--	8
12500450	08-11-87	44	40	--	--	--	<10	--	--	6

Table 28. Concentrations of major and minor elements in filtered water, Yakima River Basin, Washington, 1987-90—Continued

Station number	Date	Beryl-lium, fil-tered (µg/L)	Boron, fil-tered (µg/L)	Cadmium, fil-tered (µg/L)	Chro-mium, fil-tered (µg/L)	Cobalt, fil-tered (µg/L)	Copper, fil-tered (µg/L)	Iron, fil-tered (µg/L)	Lead, fil-tered (µg/L)	Lithium fil-tered (µg/L)
12499000	01-11-89	--	--	<0.1	--	--	1.1	--	<0.5	--
12499000	02-15-89	--	--	<.1	--	--	.5	--	<.5	--
12499000	03-15-89	--	--	<.1	--	--	.7	--	<.5	--
12499000	04-07-89	--	--	<.2	--	--	1.5	--	.6	--
12499000	04-14-89	--	--	<.2	--	--	<.5	--	<.5	--
12499000	05-10-89	--	--	<.1	--	--	.4	--	<.5	--
12499000	06-14-89	--	--	<.1	--	--	<.5	--	<.5	--
12499000	07-18-89	--	--	<.1	--	--	<.5	--	.6	--
12499000	08-08-89	--	--	<.1	--	--	.8	--	<.5	--
12499000	09-15-89	--	--	<.1	--	--	.6	--	<.5	--
12499000	10-18-89	--	--	<.1	--	--	<.5	--	.7	--
12499000	11-15-89	--	--	<.1	--	--	<.5	--	<.5	--
12499000	12-13-89	--	--	<.1	--	--	.6	--	<.5	--
12499000	01-10-90	--	--	<.1	--	--	1.4	--	<.5	--
12499000	02-14-90	--	--	<.1	--	--	.6	--	<.5	--
12499000	03-14-90	--	--	<.1	--	--	.6	--	<.5	--
12500415	11-04-87	<0.5	40	<1	<5	<3	<10	7	<10	<4
12500430	07-16-87	<.5	40	<1	<10	<3	<10	31	<10	9
12500430	11-04-87	<.5	70	<1	<5	<3	<10	19	<10	14
12500437	05-01-89	--	--	<.1	<.5	--	5.0	--	.7	--
12500445	11-04-87	<.5	40	1.0	<5	<3	<10	23	<10	5
12500445	07-27-88	--	--	<.1	--	--	1.4	--	<.5	--
12500450	04-16-87	--	--	.5	--	--	1.2	--	<.5	--
12500450	05-01-87	<.5	10	.2 (<1)	<.5 (<5)	<3	1.2	67	<.5	<4
12500450	05-14-87	--	--	<.1	--	--	.8	--	<.5	--
12500450	06-11-87	--	--	.2	--	--	1.7	--	<.5	--
12500450	07-16-87	--	--	<.1	--	--	.8	--	<.5	--
12500450	08-11-87	<.5	--	<.1	<.5	<3	.6	31	<.5	<4
12500450	08-11-87	<.5	<10	<1	<5	<3	<10	29	<10	<4

Table 28. Concentrations of major and minor elements in filtered water, Yakima River Basin, Washington, 1987-90—Continued

Station number	Date	Manganese, filtered (µg/L)	Mercury, filtered (µg/L)	Molybdenum, filtered (µg/L)	Nickel, filtered (µg/L)	Selenium, filtered (µg/L)	Silver, filtered (µg/L)	Strontium, filtered (µg/L)	Vanadium, filtered (µg/L)	Zinc, filtered (µg/L)
12499000	01-11-89	--	<0.1	--	--	--	--	--	--	--
12499000	02-15-89	--	<.1	--	--	--	--	--	--	--
12499000	03-15-89	--	<.1	--	--	--	--	--	--	--
12499000	04-07-89	--	<.1	--	--	--	--	--	--	--
12499000	04-14-89	--	<.1	--	--	--	--	--	--	--
12499000	05-10-89	--	<.1	--	--	--	--	--	--	--
12499000	06-14-89	--	<.1	--	--	--	--	--	--	--
12499000	07-18-89	--	<.1	--	--	--	--	--	--	--
12499000	08-08-89	--	<.1	--	--	--	--	--	--	--
12499000	09-15-89	--	<.1	--	--	--	--	--	--	--
12499000	10-18-89	--	<.1	--	--	--	--	--	--	--
12499000	11-15-89	--	<.1	--	--	--	--	--	--	--
12499000	12-13-89	--	<.1	--	--	--	--	--	--	--
12499000	01-10-90	--	<.1	--	--	--	--	--	--	--
12499000	02-14-90	--	<.1	--	--	--	--	--	--	--
12499000	03-14-90	--	<.1	--	--	--	--	--	--	--
12500415	11-04-87	80	--	<10	<10	--	<1	230	22	4
12500430	07-16-87	8	--	<10	<10	--	<1	100	14	120
12500430	11-04-87	49	--	<10	<10	--	<1	220	41	<3
12500437	05-01-89	--	<.1	--	--	--	--	--	--	<10
12500445	11-04-87	18	--	<10	<10	--	<1	170	14	8
12500445	07-27-88	--	--	--	--	--	--	--	--	17
12500450	04-16-87	--	<.1	--	--	--	--	--	--	--
12500450	05-01-87	7	<.1	<10	<10	<1	<1	31	<6	7
12500450	05-14-87	--	<.1	--	--	--	--	--	--	--
12500450	06-11-87	--	<.1	--	--	--	--	--	--	--
12500450	07-16-87	--	.2	--	--	--	--	--	--	--
12500450	08-11-87	9	<.1	<10	--	--	<1	50	<6	6
12500450	08-11-87	6	--	<10	<10	--	<1	46	<6	12

Table 28. Concentrations of major and minor elements in filtered water, Yakima River Basin, Washington, 1987-90—Continued

Site reference number	Station number	Site name	Date	Time	Discharge, inst. (cubic feet per second)	Specific conductance (µs/cm)	pH (standard units)
32	12500450	Yakima River above Ahtanum Creek at Union Gap	08-12-87	0630	3,440	104	7.8
32	12500450	Yakima River above Ahtanum Creek at Union Gap	09-10-87	1030	2,320	122	8.1
32	12500450	Yakima River above Ahtanum Creek at Union Gap	10-15-87	1046	1,530	155	8.0
32	12500450	Yakima River above Ahtanum Creek at Union Gap	11-04-87	1540	778	213	8.8
32	12500450	Yakima River above Ahtanum Creek at Union Gap	11-12-87	1135	678	214	8.2
32	12500450	Yakima River above Ahtanum Creek at Union Gap	12-10-87	1352	3,600	142	8.0
32	12500450	Yakima River above Ahtanum Creek at Union Gap	01-14-88	1045	863	202	8.0
32	12500450	Yakima River above Ahtanum Creek at Union Gap	02-11-88	1633	1,980	156	8.3
32	12500450	Yakima River above Ahtanum Creek at Union Gap	03-10-88	1035	1,720	136	7.5
32	12500450	Yakima River above Ahtanum Creek at Union Gap	04-14-88	1202	4,720	103	8.0
32	12500450	Yakima River above Ahtanum Creek at Union Gap	05-12-88	1130	3,540	93	8.3
32	12500450	Yakima River above Ahtanum Creek at Union Gap	05-15-88	1520	4,380	86	8.1
32	12500450	Yakima River above Ahtanum Creek at Union Gap	06-15-88	1652	3,350	96	8.4
32	12500450	Yakima River above Ahtanum Creek at Union Gap	07-14-88	0800	3,170	99	7.8
32	12500450	Yakima River above Ahtanum Creek at Union Gap	08-11-88	1718	3,440	97	8.7
32	12500450	Yakima River above Ahtanum Creek at Union Gap	09-15-88	1030	2,390	111	7.9
32	12500450	Yakima River above Ahtanum Creek at Union Gap	10-13-88	0858	1,820	125	8.1
32	12500450	Yakima River above Ahtanum Creek at Union Gap	11-10-88	1050	2,100	139	7.9
32	12500450	Yakima River above Ahtanum Creek at Union Gap	12-16-88	1356	2,450	120	8.2
32	12500450	Yakima River above Ahtanum Creek at Union Gap	01-12-89	1020	1,740	131	7.8
32	12500450	Yakima River above Ahtanum Creek at Union Gap	02-24-89	1340	1,490	158	8.3
32	12500450	Yakima River above Ahtanum Creek at Union Gap	03-10-89	1056	2,960	162	8.1
32	12500450	Yakima River above Ahtanum Creek at Union Gap	03-17-89	1355	2,460	149	8.2
32	12500450	Yakima River above Ahtanum Creek at Union Gap	04-15-89	1514	8,460	91	7.9
32	12500450	Yakima River above Ahtanum Creek at Union Gap	05-11-89	1115	8,920	75	7.8
32	12500450	Yakima River above Ahtanum Creek at Union Gap	06-15-89	1549	5,080	87	7.9
32	12500450	Yakima River above Ahtanum Creek at Union Gap	07-13-89	1055	3,300	93	8.1
32	12500450	Yakima River above Ahtanum Creek at Union Gap	08-10-89	1542	3,070	104	8.8
32	12500450	Yakima River above Ahtanum Creek at Union Gap	09-14-89	1051	2,370	108	7.9
32	12500450	Yakima River above Ahtanum Creek at Union Gap	10-19-89	1709	937	192	8.9
32	12500450	Yakima River above Ahtanum Creek at Union Gap	11-16-89	1120	1,810	144	8.0
32	12500450	Yakima River above Ahtanum Creek at Union Gap	12-05-89	1756	4,840	100	8.0
32	12500450	Yakima River above Ahtanum Creek at Union Gap	12-14-89	1544	1,830	132	8.1
32	12500450	Yakima River above Ahtanum Creek at Union Gap	01-10-90	1724	8,940	90	7.8
32	12500450	Yakima River above Ahtanum Creek at Union Gap	01-11-90	1125	6,770	85	7.7
32	12500450	Yakima River above Ahtanum Creek at Union Gap	02-15-90	1603	3,010	117	7.9
32	12500450	Yakima River above Ahtanum Creek at Union Gap	03-15-90	1105	2,250	131	8.1
33	12505000	Yakima River near Parker	07-16-87	1000	430	102	8.0

Table 28. Concentrations of major and minor elements in filtered water, Yakima River Basin, Washington, 1987-90—Continued

Station number	Date	Alkalinity water dis it field (mg/L as CaCO3)	Hardness, total (mg/L as CaCO3)	Carbon, organic fil-tered (mg/L)	Bromide, fil-tered (mg/L)	Cyanide, fil-tered (mg/L)	Aluminum, fil-tered (µg/L)	Antimony, fil-tered (µg/L)	Arsenic fil-tered (µg/L)	Barium, fil-tered (µg/L)
12500450	08-12-87	46	40	--	--	--	20	--	--	7
12500450	09-10-87	67	44	3.6	--	--	--	--	--	--
12500450	10-15-87	67	57	2.4	--	--	--	--	--	--
12500450	11-04-87	87	80	--	--	--	<10	--	--	13
12500450	11-12-87	98	87	2.3	--	<0.01	--	--	--	--
12500450	12-10-87	53	53	--	--	--	--	--	--	--
12500450	01-14-88	85	77	1.6	--	--	--	--	--	--
12500450	02-11-88	62	57	2.0	--	--	--	--	--	--
12500450	03-10-88	63	55	2.8	--	--	--	--	--	--
12500450	04-14-88	42	39	2.6	--	--	--	--	--	--
12500450	05-12-88	40	38	2.6	--	--	--	--	--	--
12500450	05-15-88	33	32	1.8	--	--	--	--	--	--
12500450	06-15-88	42	36	1.8	--	--	--	--	--	--
12500450	07-14-88	43	41	2.8	--	--	--	--	--	--
12500450	08-11-88	38	39	1.6	--	--	--	--	--	--
12500450	09-15-88	45	44	2.9	--	--	--	--	--	--
12500450	10-13-88	50	44	1.2	--	--	--	--	--	--
12500450	11-10-88	58	56	1.7	--	--	--	--	--	--
12500450	12-16-88	51	45	1.3	--	--	--	--	--	--
12500450	01-12-89	56	52	1.6	--	--	--	--	--	--
12500450	02-24-89	66	58	1.3	--	--	--	--	--	--
12500450	03-10-89	64	60	5.8	--	--	--	--	--	--
12500450	03-17-89	63	61	2.7	--	--	--	--	<1	--
12500450	04-15-89	39	37	2.7	--	--	--	--	<1	--
12500450	05-11-89	29	33	2.0	--	--	--	--	<1	--
12500450	06-15-89	37	33	.8	--	--	--	--	<1	--
12500450	07-13-89	44	38	1.8	--	--	--	--	<1	--
12500450	08-10-89	46	40	1.8	--	--	--	--	1	--
12500450	09-14-89	--	--	--	--	--	--	--	--	--
12500450	10-19-89	81	70	1.6	--	--	--	--	<1	--
12500450	11-16-89	62	54	1.9	--	--	--	--	<1	--
12500450	12-05-89	--	40	2.1	<0.01	<0.01	20	<1	<1	6
12500450	12-14-89	57	50	1.2	--	--	--	--	<1	--
12500450	01-10-90	35	34	2.2	--	--	--	--	<1	--
12500450	01-11-90	35	34	4.0	--	--	--	--	<1	--
12500450	02-15-90	48	45	1.3	--	--	--	--	<1	--
12500450	03-15-90	57	49	2.1	--	--	--	--	<1	--
12505000	07-16-87	44	39	--	--	--	<10	--	--	7

Table 28. Concentrations of major and minor elements in filtered water, Yakima River Basin, Washington, 1987-90—Continued

Station number	Date	Beryl-lium, fil-tered (µg/L)	Boron, fil-tered (µg/L)	Cadmium, fil-tered (µg/L)	Chro-mium, fil-tered (µg/L)	Cobalt, fil-tered (µg/L)	Copper, fil-tered (µg/L)	Iron, fil-tered (µg/L)	Lead, fil-tered (µg/L)	Lithium fil-tered (µg/L)
12500450	08-12-87	<.5	<10	<1	<5	<3	<10	28	<10	<4
12500450	09-10-87	--	--	<.1	--	--	1.7	--	<.5	--
12500450	10-15-87	--	--	<.1	--	--	.6	--	<.5	--
12500450	11-04-87	<.5	20	<1	<5	<3	<10	40	<10	<4
12500450	11-12-87	--	--	<.1	<.5	--	<.5	--	<.5	--
12500450	12-10-87	--	--	<.1	--	--	1.5	--	<.5	--
12500450	01-14-88	--	--	<.1	--	--	3.6	--	<.5	--
12500450	02-11-88	--	--	.1	--	--	1.9	--	<.5	--
12500450	03-10-88	--	--	<.1	--	--	.5	--	<.5	--
12500450	04-14-88	--	--	.2	--	--	.9	--	<.5	--
12500450	05-12-88	--	--	<.1	--	--	.7	--	<.5	--
12500450	05-15-88	--	--	<.1	--	--	.9	--	<.5	--
12500450	06-15-88	--	--	.1	--	--	.9	--	<.5	--
12500450	07-14-88	--	--	<.3	--	--	.9	--	<.5	--
12500450	08-11-88	--	--	.1	--	--	1.2	--	<.5	--
12500450	09-15-88	--	--	<.1	--	--	1.0	--	<.5	--
12500450	10-13-88	--	--	<.1	--	--	.9	--	<.5	--
12500450	11-10-88	--	--	.2	<1	--	<.5	--	<.5	--
12500450	12-16-88	--	--	<.1	--	--	<.5	--	<.5	--
12500450	01-12-89	--	--	<.1	--	--	1.1	--	<.5	--
12500450	02-24-89	--	--	<.1	--	--	<.5	--	<.5	--
12500450	03-10-89	--	--	<0.1	--	--	3.2	--	<0.5	--
12500450	03-17-89	--	--	<.1	--	--	1.0	--	--	--
12500450	04-15-89	--	--	<.2	--	--	<.5	--	<.5	--
12500450	05-11-89	--	--	<.1	--	--	.7	--	<.5	--
12500450	06-15-89	--	--	<.1	--	--	.8	--	<.5	--
12500450	07-13-89	--	--	<.1	--	--	1.0	--	<.5	--
12500450	08-10-89	--	--	<.1	--	--	.8	--	<.5	--
12500450	09-14-89	--	--	<.1	--	--	.7	--	<.5	--
12500450	10-19-89	--	--	<.1	--	--	.8	--	.8	--
12500450	11-16-89	--	--	<.1	--	--	<.5	--	<.5	--
12500450	12-05-89	--	<10	<.1 (<1)	0.6 (<5)	--	1.0 (<10)	--	<.5 (<10)	<4
12500450	12-14-89	--	--	<.1	--	--	1.0	--	<.5	--
12500450	01-10-90	--	--	<.1	--	--	1.0	--	<.5	--
12500450	01-11-90	--	--	.2	--	--	.7	--	<.5	--
12500450	02-15-90	--	--	<.1	--	--	.6	--	<.5	--
12500450	03-15-90	--	--	--	--	--	--	--	--	--
12505000	07-16-87	<.5	10	<1	<10	<3	<10	30	<10	5

Table 28. Concentrations of major and minor elements in filtered water, Yakima River Basin, Washington, 1987-90—Continued

Station number	Date	Manganese, filtered (µg/L)	Mercury, filtered (µg/L)	Molybdenum, filtered (µg/L)	Nickel, filtered (µg/L)	Selenium, filtered (µg/L)	Silver, filtered (µg/L)	Strontium, filtered (µg/L)	Vanadium, filtered (µg/L)	Zinc, filtered (µg/L)
12500450	08-12-87	7	--	<10	<10	--	<1	46	<6	30
12500450	09-10-87	--	<.1	--	--	--	--	--	--	--
12500450	10-15-87	--	<.1	--	--	--	--	--	--	--
12500450	11-04-87	14	--	<10	<10	--	<1	91	<6	11
12500450	11-12-87	--	<.1	--	--	--	--	--	--	--
12500450	12-10-87	--	<.1	--	--	--	--	--	--	--
12500450	01-14-88	--	<.1	--	--	--	--	--	--	--
12500450	02-11-88	--	<.1	--	--	--	--	--	--	--
12500450	03-10-88	--	<.1	--	--	--	--	--	--	--
12500450	04-14-88	--	<.1	--	--	--	--	--	--	--
12500450	05-12-88	--	<.1	--	--	--	--	--	--	--
12500450	05-15-88	--	<.1	--	--	--	--	--	--	--
12500450	06-15-88	--	<.1	--	--	--	--	--	--	--
12500450	07-14-88	--	<.1	--	--	--	--	--	--	--
12500450	08-11-88	--	<.1	--	--	--	--	--	--	--
12500450	09-15-88	--	<.1	--	--	--	--	--	--	--
12500450	10-13-88	--	<.1	--	--	--	--	--	--	--
12500450	11-10-88	--	<.1	--	--	--	--	--	--	--
12500450	12-16-88	--	<.1	--	--	--	--	--	--	--
12500450	01-12-89	--	<.1	--	--	--	--	--	--	--
12500450	02-24-89	--	<.1	--	--	--	--	--	--	--
12500450	03-10-89	--	<0.1	--	--	--	--	--	--	--
12500450	03-17-89	--	<.1	--	--	--	--	--	--	--
12500450	04-15-89	--	<.1	--	--	--	--	--	--	--
12500450	05-11-89	--	<.1	--	--	--	--	--	--	--
12500450	06-15-89	--	<.1	--	--	--	--	--	--	--
12500450	07-13-89	--	<.1	--	--	--	--	--	--	--
12500450	08-10-89	--	<.1	--	--	--	--	--	--	--
12500450	09-14-89	--	--	--	--	--	--	--	--	--
12500450	10-19-89	--	<.1	--	--	--	--	--	--	--
12500450	11-16-89	--	<.1	--	--	--	--	--	--	--
12500450	12-05-89	6	<.1	<10	<10	<1	<1	46	<6	<3
12500450	12-14-89	--	<.1	--	--	--	--	--	--	--
12500450	01-10-90	--	<.1	--	--	--	--	--	--	--
12500450	01-11-90	--	<.1	--	--	--	--	--	--	--
12500450	02-15-90	--	<.1	--	--	--	--	--	--	--
12500450	03-15-90	--	<.1	--	--	--	--	--	--	--
12505000	07-16-87	13	--	<10	<10	--	<1	45	<6	<3

Table 28. Concentrations of major and minor elements in filtered water, Yakima River Basin, Washington, 1987-90—Continued

Site reference number	Station number	Site name	Date	Time	Discharge, inst. (cubic feet per second)	Specific conductance (µs/cm)	pH (standard units)
36	12505320	Yakima River at RM 91 at Zillah	07-17-87	0700	403	122	7.6
36	12505320	Yakima River at RM 91 at Zillah	11-05-87	1005	--	210	7.7
37	12505350	East Toppenish Drain at Wilson Road near Toppenish	07-17-87	1045	16	219	7.7
37	12505350	East Toppenish Drain at Wilson Road near Toppenish	11-03-87	1420	12	320	7.3
39	12505410	Sub 35 Drain at Parton Road near Granger	07-17-87	1355	33	230	8.0
38	12505440	Yakima River at Bridge Avenue at Granger	07-17-87	0900	578	187	7.7
38	12505440	Yakima River at Bridge Avenue at Granger	07-17-87	0901	--	--	--
40	12505460	Granger Drain at mouth near Granger	07-17-87	1045	51	326	7.6
41	12505510	Marion Drain at Indian Church Road at Granger	07-17-87	1425	19	271	8.2
44	12506000	Toppenish Creek near Fort Simcoe	07-15-87	0730	12	125	8.1
33	12507050	Unnamed drain at Progressive Road near Harrah	11-07-87	0900	1	600	8.9
43	12507508	Toppenish Creek at Indian Church Road near Granger	07-17-87	0700	55	291	7.8
43	12507508	Toppenish Creek at Indian Church Road near Granger	11-04-87	1710	19	400	8.6
53	12508500	Satus Creek below Dry Creek near Toppenish	07-17-87	0715	16	122	7.9
47	12508620	Satus Creek at gage at Satus	11-04-87	1315	36	300	8.2
51	12508625	Yakima River below Satus Creek at RM 68 near Satus	07-17-87	0730	--	277	8.2

Table 28. Concentrations of major and minor elements in filtered water, Yakima River Basin, Washington, 1987-90—Continued

Station number	Date	Alkalinity water dis it field (mg/L as CaCO3)	Hardness, total (mg/L as CaCO3)	Carbon, organic filtered (mg/L)	Bromide, filtered (mg/L)	Cyanide, filtered (mg/L)	Aluminum, filtered (µg/L)	Antimony, filtered (µg/L)	Arsenic filtered (µg/L)	Barium, filtered (µg/L)
12505320	07-17-87	53	48	--	--	--	<10	--	--	8
12505320	11-05-87	89	83	--	--	--	<10	--	--	14
12505350	07-17-87	96	93	--	--	--	<10	--	--	10
12505350	11-03-87	129	130	--	--	--	<10	--	--	14
12505410	07-17-87	3,110	100	--	--	--	20	--	--	11
12505440	07-17-87	--	70	--	--	--	<10	--	--	17
12505440	07-17-87	77	70	--	--	--	<10	--	--	17
12505460	07-17-87	127	120	--	--	--	<10	--	--	48
12505510	07-17-87	103	110	--	--	--	10	--	--	15
12506000	07-15-87	66	53	--	--	--	<10	--	--	6
12507050	11-07-87	275	250	--	--	--	<10	--	--	80
12507508	07-17-87	129	120	--	--	--	20	--	--	26
12507508	11-04-87	186	180	--	--	--	20	--	--	26
12508500	07-17-87	64	48	--	--	--	10	--	--	7
12508620	11-04-87	143	120	--	--	--	<10	--	--	15
12508625	07-17-87	124	110	--	--	--	20	--	--	19

Table 28. Concentrations of major and minor elements in filtered water, Yakima River Basin, Washington, 1987-90—Continued

Station number	Date	Beryllium, filtered (µg/L)	Boron, filtered (µg/L)	Cadmium, filtered (µg/L)	Chromium, filtered (µg/L)	Cobalt, filtered (µg/L)	Copper, filtered (µg/L)	Iron, filtered (µg/L)	Lead, filtered (µg/L)	Lithium filtered (µg/L)
12505320	07-17-87	<0.5	10	<1	10	3	<10	32	30	8
12505320	11-05-87	<.5	20	<1	<5	<3	<10	30	<10	<4
12505350	07-17-87	<.5	30	1.0	<10	<3	<10	15	<10	7
12505350	11-03-87	<.5	40	<1	<5	<3	<10	22	<10	<4
12505410	07-17-87	<.5	20	<1	<10	<3	<10	26	<10	7
12505440	07-17-87	<.5	20	<1	<10	<3	<10	27	<10	4
12505440	07-17-87	<.5	20	<1	<10	<3	<10	26	<10	8
12505460	07-17-87	<.5	30	<1	<10	<3	<10	39	<10	10
12505510	07-17-87	<.5	30	<1	<10	<3	<10	13	<10	9
12506000	07-15-87	<.5	10	<1	<10	<3	<10	130	<10	<4
12507050	11-07-87	<.5	20	<1	<5	<3	<10	18	<10	4
12507508	07-17-87	<.5	50	<1	<10	<3	<10	17	<10	7
12507508	11-04-87	<.5	20	2.0	<5	<3	<10	59	<10	<4
12508500	07-17-87	<.5	10	<1	<10	<3	<10	72	<10	7
12508620	11-04-87	<.5	20	<1	<5	<3	<10	64	<10	<4
12508625	07-17-87	<.5	20	<1	<10	<3	<10	22	<10	5

Table 28. Concentrations of major and minor elements in filtered water, Yakima River Basin, Washington, 1987-90—Continued

Station number	Date	Manganese, filtered (µg/L)	Mercury, filtered (µg/L)	Molybdenum, filtered (µg/L)	Nickel, filtered (µg/L)	Selenium, filtered (µg/L)	Silver, filtered (µg/L)	Strontium, filtered (µg/L)	Vanadium, filtered (µg/L)	Zinc, filtered (µg/L)
12505320	07-17-87	5	--	<10	<10	--	10	55	8	32
12505320	11-05-87	5	--	<10	<10	--	<1	93	6	3
12505350	07-17-87	5	--	<10	<10	--	<1	92	<6	280
	11-03-87	27	--	<10	<10	--	<1	120	<6	<3
12505410	07-17-87	16	--	<10	<10	--	<1	100	<6	5
12505440	07-17-87	11	--	<10	<10	--	<1	83	<6	12
12505440	07-17-87	10	--	<10	<10	--	<1	84	<6	270
12505460	07-17-87	41	--	<10	<10	--	<1	150	10	19
12505510	07-17-87	14	--	<10	<10	--	<1	120	<6	29
12506000	07-15-87	5	--	<10	<10	--	<1	63	<6	14
12507050	11-07-87	300	--	<10	<10	--	<1	300	31	3
12507508	07-17-87	27	--	<10	<10	--	<1	120	8	8
12507508	11-04-87	62	--	<10	<10	--	1	180	8	<3
12508500	07-17-87	9	--	<10	<10	--	<1	60	<6	7
12508620	11-04-87	32	--	<10	<10	--	<1	120	7	<3
12508625	07-17-87	24	--	<10	<10	--	<1	120	<6	57

Table 28. Concentrations of major and minor elements in filtered water, Yakima River Basin, Washington, 1987-90—Continued

Site reference number	Station number	Site name	Date	Time	Discharge, inst. (cubic feet per second)	Specific conductance (µs/cm)	pH (standard units)
46	12508838	DID 3 Drain below STP at Midvale Road at Sunnyside	11-06-87	1300	15	780	8.0
52	12508850	Sulphur Creek Wasteway near Sunnyside	04-20-87	1355	327	233	8.6
52	12508850	Sulphur Creek Wasteway near Sunnyside	05-01-87	1105	253	247	8.1
52	12508850	Sulphur Creek Wasteway near Sunnyside	05-19-87	1355	291	254	8.1
52	12508850	Sulphur Creek Wasteway near Sunnyside	06-16-87	1115	248	295	8.0
52	12508850	Sulphur Creek Wasteway near Sunnyside	07-17-87	1230	232	312	8.1
52	12508850	Sulphur Creek Wasteway near Sunnyside	08-03-87	1220	225	321	8.1
52	12508850	Sulphur Creek Wasteway near Sunnyside	08-03-87	2010	197	325	8.2
52	12508850	Sulphur Creek Wasteway near Sunnyside	08-04-87	0430	203	334	8.0
52	12508850	Sulphur Creek Wasteway near Sunnyside	08-18-87	1213	210	355	8.1
52	12508850	Sulphur Creek Wasteway near Sunnyside	09-15-87	0925	181	378	8.2
52	12508850	Sulphur Creek Wasteway near Sunnyside	10-20-87	1005	87	616	8.2
52	12508850	Sulphur Creek Wasteway near Sunnyside	11-05-87	0910	65	671	8.3
52	12508850	Sulphur Creek Wasteway near Sunnyside	11-17-87	1610	67	682	8.6
52	12508850	Sulphur Creek Wasteway near Sunnyside	12-15-87	1035	70	723	8.4
52	12508850	Sulphur Creek Wasteway near Sunnyside	01-14-88	1545	79	748	8.4
52	12508850	Sulphur Creek Wasteway near Sunnyside	01-19-88	1020	72	736	8.3
52	12508850	Sulphur Creek Wasteway near Sunnyside	02-16-88	1105	72	710	8.3
52	12508850	Sulphur Creek Wasteway near Sunnyside	03-15-88	1042	63	638	9.3
52	12508850	Sulphur Creek Wasteway near Sunnyside	03-23-88	1309	349	243	8.3
52	12508850	Sulphur Creek Wasteway near Sunnyside	04-19-88	1426	282	261	8.3
52	12508850	Sulphur Creek Wasteway near Sunnyside	04-22-88	1150	338	258	8.2
52	12508850	Sulphur Creek Wasteway near Sunnyside	05-17-88	1655	246	290	8.2
52	12508850	Sulphur Creek Wasteway near Sunnyside	06-21-88	0915	243	270	8.0
52	12508850	Sulphur Creek Wasteway near Sunnyside	07-19-88	1230	231	293	8.1
52	12508850	Sulphur Creek Wasteway near Sunnyside	07-28-88	1200	151	333	8.1

Table 28. Concentrations of major and minor elements in filtered water, Yakima River Basin, Washington, 1987-90—Continued

Station number	Date	Alkalinity water dis it field (mg/L as CaCO3)	Hardness, total (mg/L as CaCO3)	Carbon, organic fil-tered (mg/L)	Bromide, fil-tered (mg/L)	Cyanide, fil-tered (mg/L)	Aluminum, fil-tered (µg/L)	Antimony, fil-tered (µg/L)	Arsenic fil-tered (µg/L)	Barium, fil-tered (µg/L)
12508838	11-06-87	248	280	--	--	--	<10	--	--	70
12508850	04-20-87	83	83	2.9	--	--	--	--	--	--
12508850	05-01-87	93	90	2.8	<0.01	<0.01	20	<1	3	29
12508850	05-19-87	97	92	2.6	--	--	--	--	--	--
12508850	06-16-87	121	110	5.4	--	--	--	--	--	--
12508850	07-17-87	122	100	3.8	--	--	--	--	--	--
12508850	08-03-87	123	120	--	--	--	<10	--	--	37
12508850	08-03-87	129	130	--	--	--	20	--	--	39
12508850	08-04-87	127	130	--	--	--	<10	--	--	39
12508850	08-18-87	155	130	3.6	.02	<.01	--	<1	4	42
12508850	09-15-87	144	140	2.7	--	--	--	--	--	--
12508850	10-20-87	228	240	3.0	--	--	--	--	--	--
12508850	11-05-87	266	270	--	--	--	<10	--	--	79
12508850	11-17-87	253	260	4.0	.08	<.01	<10	<1	9	73
12508850	12-15-87	260	270	4.6	--	--	--	--	--	--
12508850	01-14-88	250	250	5.5	--	--	--	--	--	--
12508850	01-19-88	250	260	4.7	--	--	--	--	--	--
12508850	02-16-88	250	270	3.1	--	--	--	--	--	--
12508850	03-15-88	231	240	3.1	--	--	--	--	--	--
12508850	03-23-88	93	88	2.5	--	--	--	--	--	--
12508850	04-19-88	96	95	2.6	--	--	--	--	--	--
12508850	04-22-88	95	90	2.9	--	--	--	--	--	--
12508850	05-17-88	105	100	2.3	--	--	--	--	--	--
12508850	06-21-88	101	100	2.2	--	--	--	--	--	--
12508850	07-19-88	110	100	2.7	--	--	--	--	--	--
12508850	07-28-88	--	120	3.0	--	--	--	--	--	--

Table 28. Concentrations of major and minor elements in filtered water, Yakima River Basin, Washington, 1987-90—Continued

Station number	Date	Beryl-lium, fil-tered (µg/L)	Boron, fil-tered (µg/L)	Cadmium, fil-tered (µg/L)	Chro-mium, fil-tered (µg/L)	Cobalt, fil-tered (µg/L)	Copper, fil-tered (µg/L)	Iron, fil-tered (µg/L)	Lead, fil-tered (µg/L)	Lithium fil-tered (µg/L)
12508838	11-06-87	<0.5	60	1.0	<5	<3	<10	44	<10	11
12508850	04-20-87	--	--	.2	--	--	.9	--	<.5	--
12508850	05-01-87	<.5	20	<.1 (<1)	<.5 (<5)	<3	<1 (<10)	27	<.5 (<10)	<4
12508850	05-19-87	--	--	<.1	--	--	1.1	--	<.5	--
12508850	06-16-87	--	--	.3	--	--	2.5	--	<.5	--
12508850	07-17-87	<.5	20	<.1	<10	<3	1.4	22	<.5	8
12508850	08-03-87	<.5	20	<1	<5	<3	<10	33	<10	<4
12508850	08-03-87	<.5	20	<1	<5	<3	<10	46	<10	<4
12508850	08-04-87	<.5	20	<1	<5	<3	<10	30	<10	<4
12508850	08-18-87	<.5	--	<.1 (<1)	<.5	<3	<5 (<10)	18	<.5 (<10)	<4
12508850	09-15-87	--	--	<.1	--	--	1.1	--	<.5	--
12508850	10-20-87	--	--	<.1	--	--	.9	--	<.5	--
12508850	11-05-87	<.5	40	<1	<5	<3	<10	20	<10	9
12508850	11-17-87	<.5	40	.1 (<1)	.8 (<5)	<3	.9 (<10)	16	<.5 (<10)	6
12508850	12-15-87	--	--	<.1	--	--	1.5	--	1.2	--
12508850	01-14-88	--	--	.2	--	--	1.2	--	<.5	--
12508850	01-19-88	--	--	.6	--	--	1.7	--	<.5	--
12508850	02-16-88	--	--	<.1	--	--	.9	--	<.5	--
12508850	03-15-88	--	--	<.1	--	--	1.0	--	<.5	--
12508850	03-23-88	--	--	<.2	--	--	.9	--	<.5	--
12508850	04-19-88	--	--	.1	--	--	.9	--	<.5	--
12508850	04-22-88	--	--	<.1	--	--	1.3	--	<.5	--
12508850	05-17-88	--	--	<.1	--	--	1.3	--	<.5	--
12508850	06-21-88	--	--	.4	--	--	.9	--	<.5	--
12508850	07-19-88	--	--	.6	<.5	--	1.1	--	<.5	--
12508850	07-28-88	--	--	<.1	--	--	1.0	--	<.5	--

Table 28. Concentrations of major and minor elements in filtered water, Yakima River Basin, Washington, 1987-90—Continued

Station number	Date	Manganese, filtered (µg/L)	Mercury, filtered (µg/L)	Molybdenum, filtered (µg/L)	Nickel, filtered (µg/L)	Selenium, filtered (µg/L)	Silver, filtered (µg/L)	Strontium, filtered (µg/L)	Vanadium, filtered (µg/L)	Zinc, filtered (µg/L)
12508838	11-06-87	120	--	<10	<10	--	2	350	19	6
12508850	04-20-87	--	<0.1	--	--	--	--	--	--	--
12508850	05-01-87	16	<.1	<10	<10	<1	1	110	8	<3
12508850	05-19-87	--	<.1	--	--	--	--	--	--	--
12508850	06-16-87	--	<.1	--	--	--	--	--	--	--
12508850	07-17-87	13	.1	<10	<10	--	<1	140	8	<3
12508850	08-03-87	18	--	<10	<10	--	<1	150	10	<3
12508850	08-03-87	20	--	<10	<10	--	<1	150	10	37
12508850	08-04-87	18	--	<10	<10	--	<1	150	10	4
12508850	08-18-87	13	.3	<10	<10	2	<1	170	11	9
12508850	09-15-87	--	<.1	--	--	--	--	--	--	--
12508850	10-20-87	--	<.1	--	--	--	--	--	--	--
12508850	11-05-87	110	--	<10	<10	--	1	330	21	5
12508850	11-17-87	86	<.1	<10	<10	1	<1	330	22	5
12508850	12-15-87	--	<.1	--	--	--	--	--	--	--
12508850	01-14-88	--	<.1	--	--	--	--	--	--	--
12508850	01-19-88	--	--	--	--	--	--	--	--	--
12508850	02-16-88	--	<.1	--	--	--	--	--	--	--
12508850	03-15-88	--	<.1	--	--	--	--	--	--	--
12508850	03-23-88	--	<.1	--	--	--	--	--	--	--
12508850	04-19-88	--	<.1	--	--	--	--	--	--	--
12508850	04-22-88	--	<.1	--	--	--	--	--	--	--
12508850	05-17-88	--	<.1	--	--	--	--	--	--	--
12508850	06-21-88	--	<.1	--	--	--	--	--	--	--
12508850	07-19-88	--	<.1	--	--	--	--	--	--	--
12508850	07-28-88	--	--	--	--	--	--	--	--	--

Table 28. Concentrations of major and minor elements in filtered water, Yakima River Basin, Washington, 1987-90—Continued

Site reference number	Station number	Site name	Date	Time	Discharge, inst. (cubic feet per second)	Specific conductance (µs/cm)	pH (standard units)
52	12508850	Sulphur Creek Wasteway near Sunnyside	08-16-88	1318	256	287	8.2
52	12508850	Sulphur Creek Wasteway near Sunnyside	09-18-88	1225	223	334	8.3
52	12508850	Sulphur Creek Wasteway near Sunnyside	10-18-88	0957	207	388	8.4
52	12508850	Sulphur Creek Wasteway near Sunnyside	11-14-88	1413	76	676	8.5
52	12508850	Sulphur Creek Wasteway near Sunnyside	12-19-88	1156	69	681	8.6
52	12508850	Sulphur Creek Wasteway near Sunnyside	12-30-88	0951	79	724	8.4
52	12508850	Sulphur Creek Wasteway near Sunnyside	01-17-89	1346	64	714	8.5
52	12508850	Sulphur Creek Wasteway near Sunnyside	02-21-89	1125	66	697	8.5
52	12508850	Sulphur Creek Wasteway near Sunnyside	02-24-89	2000	83	800	8.6
52	12508850	Sulphur Creek Wasteway near Sunnyside	03-21-89	1423	251	300	8.4
52	12508850	Sulphur Creek Wasteway near Sunnyside	04-18-89	1225	303	211	8.3
52	12508850	Sulphur Creek Wasteway near Sunnyside	05-16-89	1330	422	185	8.3
52	12508850	Sulphur Creek Wasteway near Sunnyside	06-20-89	1059	335	252	8.2
52	12508850	Sulphur Creek Wasteway near Sunnyside	07-12-89	1220	232	315	8.5
52	12508850	Sulphur Creek Wasteway near Sunnyside	08-15-89	1507	340	270	8.3
52	12508850	Sulphur Creek Wasteway near Sunnyside	09-18-89	1636	385	262	8.4
52	12508850	Sulphur Creek Wasteway near Sunnyside	10-24-89	1501	92	649	8.5
52	12508850	Sulphur Creek Wasteway near Sunnyside	11-20-89	1621	80	681	8.5
52	12508850	Sulphur Creek Wasteway near Sunnyside	12-19-89	1538	72	677	8.4
52	12508850	Sulphur Creek Wasteway near Sunnyside	01-16-90	1600	79	706	8.1
52	12508850	Sulphur Creek Wasteway near Sunnyside	02-20-90	1204	57	695	8.3
52	12508850	Sulphur Creek Wasteway near Sunnyside	03-20-90	1454	375	224	8.2
55	12508990	Yakima River at Mabton	07-17-87	0940	960	291	8.2
56	12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	04-21-87	1715	2,460	184	8.1
56	12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	05-20-87	1325	1,630	235	8.3
56	12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	06-17-87	1440	1,410	256	8.4
56	12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	07-18-87	1325	1,390	300	8.3
56	12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	08-04-87	1235	1,170	278	8.4
56	12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	08-04-87	2200	1,230	273	8.4
56	12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	08-05-87	0433	1,240	280	8.3
56	12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	08-19-87	1447	1,190	304	8.5
56	12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	09-16-87	1015	1,530	303	8.2

Table 28. Concentrations of major and minor elements in filtered water, Yakima River Basin, Washington, 1987-90—Continued

Station number	Date	Alkalinity water dis it field (mg/L as CaCO3)	Hardness, total (mg/L as CaCO3)	Carbon, organic fil-tered (mg/L)	Bromide, fil-tered (mg/L)	Cyanide, fil-tered (mg/L)	Aluminum, fil-tered (µg/L)	Antimony, fil-tered (µg/L)	Arsenic fil-tered (µg/L)	Barium, fil-tered (µg/L)
12508850	08-16-88	99	110	2.2	--	--	--	--	--	--
12508850	09-18-88	130	120	2.4	--	--	--	--	--	--
12508850	10-18-88	155	140	1.9	--	--	--	--	--	--
12508850	11-14-88	250	250	2.0	--	--	--	--	--	--
12508850	12-19-88	250	260	2.0	--	--	--	--	--	--
12508850	12-30-88	260	240	4.3	--	--	--	--	--	--
12508850	01-17-89	255	260	4.4	--	--	--	--	--	--
12508850	02-21-89	251	260	3.3	--	--	--	--	--	--
12508850	02-24-89	261	260	8.0	--	--	--	--	--	--
12508850	03-21-89	106	110	2.9	--	--	--	--	--	--
12508850	04-18-89	81	79	2.7	--	--	--	--	2	--
12508850	05-16-89	72	70	1.7	--	--	--	--	2	--
12508850	06-20-89	96	93	1.5	--	--	--	--	2	--
12508850	07-12-89	117	120	1.6	--	--	--	--	3	--
12508850	08-15-89	104	98	2.1	--	--	--	--	2	--
12508850	09-18-89	102	97	2.1	--	--	--	--	2	--
12508850	10-24-89	239	240	3.8	--	--	--	--	7	--
12508850	11-20-89	253	260	2.9	--	--	--	--	7	--
12508850	12-19-89	248	260	2.0	--	--	--	--	7	--
12508850	01-16-90	252	260	2.4	--	--	--	--	8	--
12508850	02-20-90	253	260	2.2	--	--	--	--	8	--
12508850	03-20-90	81	82	1.5	--	--	--	--	2	--
12508990	07-17-87	128	120	--	--	--	10	--	--	25
12509050	04-21-87	75	67	3.4	--	--	--	--	--	--
12509050	05-20-87	98	86	2.6	--	--	--	--	--	--
12509050	06-17-87	108	96	5.6	--	--	--	--	--	--
12509050	07-18-87	127	110	3.7	--	--	--	--	--	--
12509050	08-04-87	119	110	--	--	--	10	--	--	24
12509050	08-04-87	121	110	--	--	--	<10	--	--	23
12509050	08-05-87	121	110	--	--	--	<10	--	--	23
12509050	08-19-87	127	110	3.1	0.02	<0.01	20	<1	3	27
12509050	09-16-87	123	120	2.5	--	--	--	--	--	--

Table 28. Concentrations of major and minor elements in filtered water, Yakima River Basin, Washington, 1987-90—Continued

Station number	Date	Beryllium, filtered (µg/L)	Boron, filtered (µg/L)	Cadmium, filtered (µg/L)	Chromium, filtered (µg/L)	Cobalt, filtered (µg/L)	Copper, filtered (µg/L)	Iron, filtered (µg/L)	Lead, filtered (µg/L)	Lithium filtered (µg/L)
12508850	08-16-88	--	--	<0.2	--	--	1.0	--	<0.5	--
12508850	09-18-88	--	--	<.1	--	--	1.2	--	<.5	--
12508850	10-18-88	--	--	<.1	--	--	1.9	--	<.5	--
12508850	11-14-88	--	--	<.1	--	--	1.5	--	<.5	--
12508850	12-19-88	--	--	<.1	--	--	.7	--	<.5	--
12508850	12-30-88	--	--	<.1	--	--	1.3	--	<.5	--
12508850	01-17-89	--	--	<.1	--	--	1.4	--	<.5	--
12508850	02-21-89	--	--	<.1	--	--	1.2	--	<.5	--
12508850	02-24-89	--	--	<.1	--	--	1.5	--	<.5	--
12508850	03-21-89	--	--	.3	--	--	1.6	--	1.0	--
12508850	04-18-89	--	--	<.2	--	--	<.5	--	<.5	--
12508850	05-16-89	--	--	<.1	--	--	.6	--	<.5	--
12508850	06-20-89	--	--	<.1	--	--	1.1	--	<.5	--
12508850	07-12-89	--	--	<.1	--	--	1.1	--	<.5	--
12508850	08-15-89	--	--	<.1	--	--	1.0	--	<.5	--
12508850	09-18-89	--	--	<.1	--	--	1.3	--	<.5	--
12508850	10-24-89	--	--	<.1	--	--	.8	--	.9	--
12508850	11-20-89	--	--	<.1	--	--	.8	--	<.5	--
12508850	12-19-89	--	--	<.1	--	--	.9	--	<.5	--
12508850	01-16-90	--	--	<.1	--	--	.7	--	<.5	--
12508850	02-20-90	--	--	<.1	--	--	.7	--	<.5	--
12508850	03-20-90	--	--	<.1	--	--	.7	--	<.5	--
12508990	07-17-87	<0.5	20	<1	<10	<3	<10	19	<10	8
12509050	04-21-87	--	--	<.1	--	--	.5	--	<.5	--
12509050	05-20-87	--	--	.2	--	--	1.3	--	<.5	--
12509050	06-17-87	--	--	1.0	--	--	1.7	--	<.5	--
12509050	07-18-87	--	--	<.1	--	--	1.5	--	<.5	--
12509050	08-04-87	<.5	20	<1	<5	<3	<10	30	<10	<4
12509050	08-04-87	<.5	20	<1	<5	<3	<10	28	<10	<4
12509050	08-05-87	<.5	20	<1	<5	<3	<10	24	<10	<4
12509050	08-19-87	<.5	--	<.1 (<1)	<.5 (<5)	<3	1.5 (<10)	20	<.5 (<10)	<4
12509050	09-16-87	--	--	.2	--	--	1.2	--	<.5	--

Table 28. Concentrations of major and minor elements in filtered water, Yakima River Basin, Washington, 1987-90—Continued

Station number	Date	Manganese, filtered (µg/L)	Mercury, filtered (µg/L)	Molybdenum, filtered (µg/L)	Nickel, filtered (µg/L)	Selenium, filtered (µg/L)	Silver, filtered (µg/L)	Strontium, filtered (µg/L)	Vanadium, filtered (µg/L)	Zinc, filtered (µg/L)
12508850	08-16-88	--	<0.1	--	--	--	--	--	--	--
12508850	09-18-88	--	<.1	--	--	--	--	--	--	--
12508850	10-18-88	--	<.1	--	--	--	--	--	--	--
12508850	11-14-88	--	<.1	--	--	--	--	--	--	--
12508850	12-19-88	--	<.1	--	--	--	--	--	--	--
12508850	12-30-88	--	<.1	--	--	--	--	--	--	--
12508850	01-17-89	--	<.1	--	--	--	--	--	--	--
12508850	02-21-89	--	<.1	--	--	--	--	--	--	--
12508850	02-24-89	--	<.1	--	--	--	--	--	--	--
12508850	03-21-89	--	<.1	--	--	--	--	--	--	--
12508850	04-18-89	--	<.1	--	--	--	--	--	--	--
12508850	05-16-89	--	<.1	--	--	--	--	--	--	--
12508850	06-20-89	--	<.1	--	--	--	--	--	--	--
12508850	07-12-89	--	<.1	--	--	--	--	--	--	--
12508850	08-15-89	--	<.1	--	--	--	--	--	--	--
12508850	09-18-89	--	<.1	--	--	--	--	--	--	--
12508850	10-24-89	--	<.1	--	--	--	--	--	--	--
12508850	11-20-89	--	<.1	--	--	--	--	--	--	--
12508850	12-19-89	--	<.1	--	--	--	--	--	--	--
12508850	01-16-90	--	<.1	--	--	--	--	--	--	--
12508850	02-20-90	--	<.1	--	--	--	--	--	--	--
12508850	03-20-90	--	<.1	--	--	--	--	--	--	--
12508990	07-17-87	60	--	<10	<10	--	<1	130	7	120
12509050	04-21-87	--	<.1	--	--	--	--	--	--	--
12509050	05-20-87	--	.1	--	--	--	--	--	--	--
12509050	06-17-87	--	<.1	--	--	--	--	--	--	--
12509050	07-18-87	--	<.1	--	--	--	--	--	--	--
12509050	08-04-87	53	--	<10	<10	--	<1	130	8	29
12509050	08-04-87	44	--	<10	<10	--	<1	120	8	28
12509050	08-05-87	33	--	<10	<10	--	<1	130	6	<3
12509050	08-19-87	38	<.1	<10	<10	<1	2	140	8	18
12509050	09-16-87	--	<.1	--	--	--	--	--	--	--

Table 28. Concentrations of major and minor elements in filtered water, Yakima River Basin, Washington, 1987-90—Continued

Site reference number	Station number	Site name	Date	Time	Discharge, inst. (cubic feet per second)	Specific conductance (µs/cm)	pH (standard units)
56	12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	10-21-87	1055	1,910	302	8.1
56	12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	12-11-87	1008	4,940	216	8.0
56	12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	01-15-88	1555	3,370	195	8.2
56	12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	01-20-88	1154	2,180	262	--
56	12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	02-17-88	1101	2,750	207	8.2
56	12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	03-16-88	1159	1,860	238	8.2
56	12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	04-16-88	1624	4,660	134	8.0
56	12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	04-20-88	1336	4,310	143	8.0
56	12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	05-18-88	1236	2,550	184	8.1
56	12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	06-22-88	1519	1,480	251	8.5
56	12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	07-20-88	1343	1,100	277	8.5
56	12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	08-17-88	1150	1,410	269	8.4
56	12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	09-19-88	1350	1,520	288	--
56	12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	10-19-88	1145	2,640	246	8.3
56	12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	11-18-88	1059	2,250	247	8.4
56	12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	12-20-88	1235	2,690	210	8.4
56	12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	01-18-89	1339	2,350	220	8.5
56	12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	02-22-89	1350	2,270	235	8.4
56	12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	03-22-89	1010	3,320	200	8.2
56	12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	04-19-89	1259	6,250	124	8.0
56	12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	05-18-89	1510	2,760	179	8.3
56	12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	06-21-89	1138	1,700	258	8.6
56	12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	07-19-89	1827	1,640	244	8.5
56	12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	08-16-89	1732	1,290	271	8.7
56	12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	09-20-89	1205	1,520	280	8.6
56	12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	10-25-89	1306	2,440	282	8.3
56	12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	11-21-89	1757	2,650	244	8.2
56	12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	12-06-89	1117	4,790	156	7.8
56	12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	12-20-89	1443	2,390	217	8.1
56	12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	01-17-90	1401	3,780	177	7.9
56	12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	02-21-90	1323	3,120	184	8.0
56	12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	03-21-90	1447	3,910	170	8.3
49	12509900	Yakima River above Chandler Pump at RM 35.9 near Whitstran	07-18-87	1115	323	338	8.5
50	12510500	Yakima River at Kiona	04-22-87	1450	2,060	192	8.6
50	12510500	Yakima River at Kiona	05-02-87	1150	6,840	113	7.9
50	12510500	Yakima River at Kiona	05-21-87	0930	1,590	238	8.4
50	12510500	Yakima River at Kiona	06-18-87	1512	1,240	281	8.4
50	12510500	Yakima River at Kiona	07-19-87	1155	1,350	320	8.4

Table 28. Concentrations of major and minor elements in filtered water, Yakima River Basin, Washington, 1987-90—Continued

Station number	Date	Alkalinity water dis it field (mg/L as CaCO3)	Hardness, total (mg/L as CaCO3)	Carbon, organic fil-tered (mg/L)	Bromide, fil-tered (mg/L)	Cyanide, fil-tered (mg/L)	Aluminum, fil-tered (µg/L)	Antimony, fil-tered (µg/L)	Arsenic fil-tered (µg/L)	Barium, fil-tered (µg/L)
12509050	10-21-87	127	110	4.6	--	--	--	--	--	--
12509050	12-11-87	84	75	6.4	--	--	--	--	--	--
12509050	01-15-88	77	68	4.4	--	--	--	--	--	--
12509050	01-20-88	106	96	2.2	--	--	--	--	--	--
12509050	02-17-88	87	79	1.7	--	--	--	--	--	--
12509050	03-16-88	99	88	1.8	--	--	--	--	--	--
12509050	04-16-88	54	50	2.5	--	--	--	--	--	--
12509050	04-20-88	58	54	2.2	--	--	--	--	--	--
12509050	05-18-88	77	68	2.2	--	--	--	--	--	--
12509050	06-22-88	103	92	2.8	--	--	--	--	--	--
12509050	07-20-88	116	100	2.2	--	--	--	--	--	--
12509050	08-17-88	111	100	2.2	--	--	--	--	--	--
12509050	09-19-88	120	110	2.0	--	--	--	--	--	--
12509050	10-19-88	100	90	1.6	--	--	--	--	--	--
12509050	11-18-88	103	91	1.0	--	--	--	--	--	--
12509050	12-20-88	87	79	1.0	--	--	--	--	--	--
12509050	01-18-89	91	82	1.6	--	--	--	--	--	--
12509050	02-22-89	100	85	1.6	--	--	--	--	--	--
12509050	03-22-89	84	78	--	--	--	--	--	--	--
12509050	04-19-89	55	49	2.5	--	--	--	--	<1	--
12509050	05-18-89	77	69	1.6	--	--	--	--	1	--
12509050	06-21-89	108	98	1.5	--	--	--	--	2	--
12509050	07-19-89	102	89	1.2	--	--	--	--	2	--
12509050	08-16-89	114	100	2.0	--	--	--	--	2	--
12509050	09-20-89	116	100	1.9	--	--	--	--	2	--
12509050	10-25-89	118	100	1.9	--	--	--	--	2	--
12509050	11-21-89	102	92	1.5	--	--	--	--	1	--
12509050	12-06-89	65	60	2.3	<0.01	<0.01	<10	<1	<1	11
12509050	12-20-89	89	84	1.2	--	--	--	--	1	--
12509050	01-17-90	73	67	1.7	--	--	--	--	<1	--
12509050	02-21-90	75	70	1.3	--	--	--	--	1	--
12509050	03-21-90	69	65	1.7	--	--	--	--	1	--
12509900	07-18-87	146	140	--	--	--	<10	--	--	28
12510500	04-22-87	79	71	2.3	--	--	--	--	--	--
12510500	05-02-87	47	43	2.5	<0.01	<0.01	30	<1	<1	7
12510500	05-21-87	100	96	2.1	--	--	--	--	--	--
12510500	06-18-87	118	110	7.5	--	--	--	--	--	--
12510500	07-19-87	139	120	3.1	--	--	--	--	--	--

Table 28. Concentrations of major and minor elements in filtered water, Yakima River Basin, Washington, 1987-90—Continued

Station number	Date	Beryl-lium, fil-tered (µg/L)	Boron, fil-tered (µg/L)	Cadmium, fil-tered (µg/L)	Chro-mium, fil-tered (µg/L)	Cobalt, fil-tered (µg/L)	Copper, fil-tered (µg/L)	Iron, fil-tered (µg/L)	Lead, fil-tered (µg/L)	Lithium fil-tered (µg/L)
12509050	10-21-87	--	--	<0.1	--	--	2.9	--	<0.5	--
12509050	12-11-87	--	--	.2	--	--	1.5	--	<.5	--
12509050	01-15-88	--	--	.4	--	--	1.7	--	<.5	--
12509050	01-20-88	--	--	.1	--	--	.8	--	<.5	--
12509050	02-17-88	--	--	<.1	--	--	.7	--	<.5	--
12509050	03-16-88	--	--	<.1	--	--	.7	--	<.5	--
12509050	04-16-88	--	--	<.1	--	--	.7	--	<.5	--
12509050	04-20-88	--	--	<.1	--	--	.7	--	1.9	--
12509050	05-18-88	--	--	<.1	--	--	1.0	--	<.5	--
12509050	06-22-88	--	--	<.1	--	--	.7	--	<.5	--
12509050	07-20-88	--	--	<.1	<0.5	--	1.2	--	<.5	--
12509050	08-17-88	--	--	<.2	--	--	.9	--	<.5	--
12509050	09-19-88	--	--	<.1	--	--	.8	--	<.5	--
12509050	10-19-88	--	--	<.1	--	--	1.2	--	<.5	--
12509050	11-18-88	--	--	<.1	--	--	1.3	--	<.5	--
12509050	12-20-88	--	--	<.1	--	--	<.5	--	<.5	--
12509050	01-18-89	--	--	<.1	--	--	.8	--	<.5	--
12509050	02-22-89	--	--	.1	--	--	<.5	--	<.5	--
12509050	03-22-89	--	--	<.2	--	--	1.0	--	<.5	--
12509050	04-19-89	--	--	<.1	--	--	1.3	--	1.1	--
12509050	05-18-89	--	--	<.1	--	--	.9	--	<.5	--
12509050	06-21-89	--	--	<.1	--	--	1.2	--	<.5	--
12509050	07-19-89	--	--	<.1	--	--	.8	--	<.5	--
12509050	08-16-89	--	--	<.1	--	--	1.3	--	<.5	--
12509050	09-20-89	--	--	<.1	--	--	1.0	--	<.5	--
12509050	10-25-89	--	--	<.1	--	--	.5	--	<2.0	--
12509050	11-21-89	--	--	<.1	--	--	<.5	--	<1.0	--
12509050	12-06-89	<0.5	10	<.1 (<1)	.6 (<5)	<3	1.1 (<10)	75	<.5 (<10)	<4
12509050	12-20-89	--	--	<.1	--	--	.8	--	<.5	--
12509050	01-17-90	--	--	<.1	--	--	.6	--	<.5	--
12509050	02-21-90	--	--	<.1	--	--	<.5	--	<.5	--
12509050	03-21-90	--	--	<.1	--	--	.7	--	<.5	--
12509900	07-18-87	<0.5	20	<1	<10	<3	<10	9	<10	9
12510500	04-22-87	--	--	<.1	--	--	.8	--	.8	--
12510500	05-02-87	<.5	30	<.1 (<1)	<.5 (<5)	<3	.7 (<10)	42	<.5 (<10)	<4
12510500	05-21-87	--	--	--	--	--	--	--	--	--
12510500	06-18-87	--	--	.2	--	--	1.7	--	<.5	--
12510500	07-19-87	--	--	<.1	--	--	1.3	--	<.5	--

Table 28. Concentrations of major and minor elements in filtered water, Yakima River Basin, Washington, 1987-90—Continued

Station number	Date	Manganese, filtered (µg/L)	Mercury, filtered (µg/L)	Molybdenum, filtered (µg/L)	Nickel, filtered (µg/L)	Selenium, filtered (µg/L)	Silver, filtered (µg/L)	Strontium, filtered (µg/L)	Vanadium, filtered (µg/L)	Zinc, filtered (µg/L)
12509050	10-21-87	--	<0.1	--	--	--	--	--	--	--
12509050	12-11-87	--	<.1	--	--	--	--	--	--	--
12509050	01-15-88	--	<.1	--	--	--	--	--	--	--
12509050	01-20-88	--	<.1	--	--	--	--	--	--	--
12509050	02-17-88	--	<.1	--	--	--	--	--	--	--
12509050	03-16-88	--	<.1	--	--	--	--	--	--	--
12509050	04-16-88	--	--	--	--	--	--	--	--	--
12509050	04-20-88	--	<.1	--	--	--	--	--	--	--
12509050	05-18-88	--	<.1	--	--	--	--	--	--	--
12509050	06-22-88	--	<.1	--	--	--	--	--	--	--
12509050	07-20-88	--	<.1	--	--	--	--	--	--	--
12509050	08-17-88	--	<.1	--	--	--	--	--	--	--
12509050	09-19-88	--	<.1	--	--	--	--	--	--	--
12509050	10-19-88	--	<.1	--	--	--	--	--	--	--
12509050	11-18-88	--	<.1	--	--	--	--	--	--	--
12509050	12-20-88	--	<.1	--	--	--	--	--	--	--
12509050	01-18-89	--	<.1	--	--	--	--	--	--	--
12509050	02-22-89	--	<.1	--	--	--	--	--	--	--
12509050	03-22-89	--	<.1	--	--	--	--	--	--	--
12509050	04-19-89	--	<.1	--	--	--	--	--	--	--
12509050	05-18-89	--	<.1	--	--	--	--	--	--	--
12509050	06-21-89	--	<.1	--	--	--	--	--	--	--
12509050	07-19-89	--	<.1	--	--	--	--	--	--	--
12509050	08-16-89	--	<.1	--	--	--	--	--	--	--
12509050	09-20-89	--	<.1	--	--	--	--	--	--	--
12509050	10-25-89	--	<.1	--	--	--	--	--	--	--
12509050	11-21-89	--	<.1	--	--	--	--	--	--	--
12509050	12-06-89	10	<.1	<10	<10	<1	<1	71	<6	<3
12509050	12-20-89	--	<.1	--	--	--	--	--	--	--
12509050	01-17-90	--	<.1	--	--	--	--	--	--	--
12509050	02-21-90	--	<.1	--	--	--	--	--	--	--
12509050	03-21-90	--	<.1	--	--	--	--	--	--	--
12509900	07-18-87	12	--	<10	<10	--	<1	160	7	6
12510500	04-22-87	--	<0.1	--	--	--	--	--	--	--
12510500	05-02-87	<1	<.1	<10	<10	<1	<1	49	<6	<3
12510500	05-21-87	--	<.1	--	--	--	--	--	--	--
12510500	06-18-87	--	<.1	--	--	--	--	--	--	--
12510500	07-19-87	--	.1	--	--	--	--	--	--	--

Table 28. Concentrations of major and minor elements in filtered water, Yakima River Basin, Washington, 1987-90—Continued

Site reference number	Station number	Site name	Date	Time	Discharge, inst. (cubic feet per second)	Specific conductance (µs/cm)	pH (standard units)
50	12510500	Yakima River at Kiona	08-06-87	0010	1,150	307	8.5
50	12510500	Yakima River at Kiona	08-06-87	0750	1,150	306	8.3
50	12510500	Yakima River at Kiona	08-06-87	1608	1,150	310	8.6
50	12510500	Yakima River at Kiona	08-20-87	0936	1,200	318	8.4
50	12510500	Yakima River at Kiona	09-15-87	0900	1,110	342	8.4
50	12510500	Yakima River at Kiona	10-22-87	1130	1,790	324	8.1
50	12510500	Yakima River at Kiona	11-19-87	0940	1,470	333	8.4
50	12510500	Yakima River at Kiona	12-12-87	1020	4,460	157	8.1
50	12510500	Yakima River at Kiona	01-16-88	1342	2,990	217	8.2
50	12510500	Yakima River at Kiona	01-21-88	0950	2,170	224	8.1
50	12510500	Yakima River at Kiona	02-18-88	1030	2,770	221	8.3
50	12510500	Yakima River at Kiona	03-17-88	0945	1,730	247	8.3
50	12510500	Yakima River at Kiona	04-17-88	1341	5,880	136	8.0
50	12510500	Yakima River at Kiona	04-21-88	1408	4,290	156	8.1
50	12510500	Yakima River at Kiona	05-19-88	0955	2,600	204	8.1
50	12510500	Yakima River at Kiona	06-23-88	1726	1,270	278	8.8
50	12510500	Yakima River at Kiona	07-21-88	0900	1,040	302	8.3
50	12510500	Yakima River at Kiona	08-18-88	1518	1,460	288	8.7
50	12510500	Yakima River at Kiona	09-22-88	0900	1,890	285	8.2
50	12510500	Yakima River at Kiona	10-20-88	1114	2,290	272	8.3
50	12510500	Yakima River at Kiona	11-17-88	1020	2,300	245	8.2
50	12510500	Yakima River at Kiona	12-21-88	0939	2,580	222	8.2
50	12510500	Yakima River at Kiona	01-19-89	1110	2,530	229	8.2
50	12510500	Yakima River at Kiona	02-23-89	1512	2,170	249	8.7
50	12510500	Yakima River at Kiona	03-23-89	0855	3,330	208	8.2
50	12510500	Yakima River at Kiona	04-09-89	1639	7,170	129	8.1
50	12510500	Yakima River at Kiona	04-20-89	1108	6,520	132	8.2
50	12510500	Yakima River at Kiona	05-18-89	1010	2,900	149	8.2
50	12510500	Yakima River at Kiona	06-22-89	1530	1,480	270	8.7
50	12510500	Yakima River at Kiona	07-20-89	0925	1,410	272	8.2
50	12510500	Yakima River at Kiona	08-17-89	1700	1,260	290	8.9
50	12510500	Yakima River at Kiona	09-21-89	0946	1,480	291	8.2
50	12510500	Yakima River at Kiona	10-26-89	1530	2,350	300	8.4
50	12510500	Yakima River at Kiona	11-21-89	0940	2,460	252	8.1
50	12510500	Yakima River at Kiona	12-06-89	1615	5,200	251	8.0
50	12510500	Yakima River at Kiona	12-06-89	2357	5,210	185	8.0
50	12510500	Yakima River at Kiona	12-07-89	1852	4,780	152	7.9
50	12510500	Yakima River at Kiona	12-21-89	1512	2,500	234	8.4
50	12510500	Yakima River at Kiona	01-18-90	1100	3,420	180	8.0
50	12510500	Yakima River at Kiona	02-22-90	1050	2,900	193	8.1
50	12510500	Yakima River at Kiona	03-22-90	1045	4,070	171	8.1
45	12511800	Yakima River at Van Geisan Bridge near Richland	07-19-87	0815	1,030	336	8.4
45	12511800	Yakima River at Van Geisan Bridge near Richland	11-06-87	1330	1,600	338	8.6

Table 28. Concentrations of major and minor elements in filtered water, Yakima River Basin, Washington, 1987-90—Continued

Station number	Date	Alkalinity water dis it field (mg/L as CaCO3)	Hardness, total (mg/L as CaCO3)	Carbon, organic fil-tered (mg/L)	Bromide, fil-tered (mg/L)	Cyanide, fil-tered (mg/L)	Aluminum, fil-tered (µg/L)	Antimony, fil-tered (µg/L)	Arsenic fil-tered (µg/L)	Barium, fil-tered (µg/L)
12510500	08-06-87	133	120	--	--	--	<10	--	--	26
12510500	08-06-87	129	120	--	--	--	20	--	--	27
12510500	08-06-87	133	120	--	--	--	<10	--	--	26
12510500	08-20-87	137	120	3.4	<0.01	<0.01	--	--	--	--
12510500	09-15-87	159	130	3.5	--	--	--	--	--	--
12510500	10-22-87	136	130	2.4	--	--	--	--	--	--
12510500	11-19-87	147	140	2.9	--	<.01	--	--	--	--
12510500	12-12-87	77	70	6.6	--	--	--	--	--	--
12510500	01-16-88	82	77	3.5	--	--	--	--	--	--
12510500	01-21-88	120	100	5.6	--	--	--	--	--	--
12510500	02-18-88	91	82	1.9	--	--	--	--	--	--
12510500	03-17-88	110	98	2.5	--	--	--	--	--	--
12510500	04-17-88	56	50	2.4	--	--	--	--	--	--
12510500	04-21-88	64	59	2.1	--	--	--	--	--	--
12510500	05-19-88	84	79	2.6	--	--	--	--	--	--
12510500	06-23-88	116	110	2.6	--	--	--	--	--	--
12510500	07-21-88	126	120	3.6	--	--	--	--	--	--
12510500	08-18-88	119	110	2.1	--	--	--	--	--	--
12510500	09-22-88	118	120	2.4	--	--	--	--	--	--
12510500	10-20-88	113	100	1.8	--	--	--	--	--	--
12510500	11-17-88	102	98	1.3	--	--	--	--	--	--
12510500	12-21-88	92	84	1.4	--	--	--	--	--	--
12510500	01-19-89	98	89	1.8	--	--	--	--	--	--
12510500	02-23-89	102	91	1.3	--	--	--	--	--	--
12510500	03-23-89	90	83	2.2	--	--	--	--	1	--
12510500	04-09-89	53	51	2.8	--	--	--	--	1	--
12510500	04-20-89	57	52	2.4	--	--	--	--	1	--
12510500	05-18-89	70	72	1.9	--	--	--	--	2	--
12510500	06-22-89	114	110	1.4	--	--	--	--	1	--
12510500	07-20-89	115	110	2.3	--	--	--	--	2	--
12510500	08-17-89	124	110	2.1	--	--	--	--	2	--
12510500	09-21-89	--	--	--	--	--	--	--	2	--
12510500	10-26-89	125	110	2.0	--	--	--	--	2	--
12510500	11-21-89	111	100	1.9	--	--	--	--	1	--
12510500	12-06-89	104	97	1.6	.02	<.01	<10	<1	1	17
12510500	12-06-89	76	69	1.8	--	--	--	--	<1	--
12510500	12-07-89	62	54	2.7	--	--	--	--	<1	--
12510500	12-21-89	94	87	1.3	--	--	--	--	2	--
12510500	01-18-90	74	71	2.2	--	--	--	--	<1	--
12510500	02-22-90	79	75	1.1	--	--	--	--	1	--
12510500	03-22-90	76	63	2.4	--	--	--	--	<1	--
12511800	07-19-87	145	130	--	--	--	10	--	--	28
12511800	11-06-87	145	140	--	--	--	<10	--	--	28

Table 28. Concentrations of major and minor elements in filtered water, Yakima River Basin, Washington, 1987-90—Continued

Station number	Date	Beryllium, filtered (µg/L)	Boron, filtered (µg/L)	Cadmium, filtered (µg/L)	Chromium, filtered (µg/L)	Cobalt, filtered (µg/L)	Copper, filtered (µg/L)	Iron, filtered (µg/L)	Lead, filtered (µg/L)	Lithium filtered (µg/L)
12510500	05-19-88	--	--	<0.1	--	--	1.0	--	<0.5	--
12510500	06-23-88	--	--	<.1	--	--	1.3	--	<.5	--
12510500	07-21-88	--	--	<.1	--	--	1.0	--	<.5	--
12510500	08-18-88	--	--	<.2	--	--	1.2	--	<.5	--
12510500	09-22-88	--	--	<.1	--	--	5.2	--	<.5	--
12510500	10-20-88	--	--	<.1	--	--	1.2	--	<.5	--
12510500	11-17-88	--	--	.6	--	--	1.0	--	.6	--
12510500	12-21-88	--	--	.2	--	--	1.5	--	<.5	--
12510500	01-19-89	--	--	<.1	--	--	5.5	--	.6	--
12510500	02-23-89	--	--	<.1	--	--	.6	--	.5	--
12510500	03-23-89	--	--	<.1	--	--	<.5	--	<.5	--
12510500	04-09-89	--	--	<.2	--	--	1.1	--	<.5	--
12510500	04-20-89	--	--	<.1	--	--	2.9	--	<.5	--
12510500	05-18-89	--	--	<.1	--	--	.6	--	<.5	--
12510500	06-22-89	--	--	<.1	--	--	1.0	--	<.5	--
12510500	07-20-89	--	--	<.1	--	--	--	--	<.5	--
12510500	08-17-89	--	--	<.1	--	--	1.1	--	<.5	--
12510500	09-21-89	--	--	<.1	--	--	.8	--	.7	--
12510500	10-26-89	--	--	<.1	--	--	<.5	--	<.5	--
12510500	11-21-89	--	--	<.1	--	--	<.9	--	<.5	--
12510500	12-06-89	<.5	20	<.1 (<1)	0.5 (<5)	<3	.9 (<10)	13	<.5 (<10)	<4
12510500	12-06-89	--	--	<.1	--	--	.9	--	<.5	--
12510500	12-07-89	--	--	<.1	--	--	1.1	--	<.5	--
12510500	12-21-89	--	--	<.1	--	--	.9	--	<.5	--
12510500	01-18-90	--	--	<.1	--	--	<.5	--	<.5	--
12510500	02-22-90	--	--	<.1	--	--	.6	--	<.5	--
12510500	03-22-90	--	--	<1	--	--	<10	--	<10	--
12511800	07-19-87	<.5	30	<1	<10	<3	<10	11	<10	8
12511800	11-06-87	<.5	20	1.0	<5	<3	<10	22	<10	6
12510500	08-06-87	<.5	20	<1	<5	<3	<10	17	<10	<4
12510500	08-06-87	<.5	20	<1	<5	<3	<10	15	<10	<4
12510500	08-06-87	<.5	40	<1	<5	<3	<10	16	<10	<4
12510500	08-20-87	--	--	<.1 (<1)	.5 (<5)	--	1.2 (<10)	--	<.5 (<10)	--
12510500	09-15-87	--	--	<.1	--	--	1.9	--	<.5	--
12510500	10-22-87	--	--	<.1	--	--	.7	--	<.5	--
12510500	11-19-87	--	--	<.1	<.5	--	<.5	--	<.5	--
12510500	12-12-87	--	--	<.1	--	--	2.6	--	9.2	--
12510500	01-16-88	--	--	.2	--	--	1.2	--	<.5	--
12510500	01-21-88	--	--	<.1	--	--	.7	--	<.5	--
12510500	02-18-88	--	--	<.1	--	--	.8	--	<.5	--
12510500	03-17-88	--	--	--	--	--	--	--	<.5	--
12510500	04-17-88	--	--	<.1	--	--	1.3	--	<.5	--
12510500	04-21-88	--	--	<.1	--	--	.7	--	<.5	--

Table 28. Concentrations of major and minor elements in filtered water, Yakima River Basin, Washington, 1987-90—Continued

Station number	Date	Manganese, filtered (µg/L)	Mercury, filtered (µg/L)	Molybdenum, filtered (µg/L)	Nickel, filtered (µg/L)	Selenium, filtered (µg/L)	Silver, filtered (µg/L)	Strontium, filtered (µg/L)	Vanadium, filtered (µg/L)	Zinc, filtered (µg/L)
12510500	05-19-88	--	<0.1	--	--	--	--	--	--	--
12510500	06-23-88	--	<.1	--	--	--	--	--	--	--
12510500	07-21-88	--	<.1	--	--	--	--	--	--	--
12510500	08-18-88	--	<.1	--	--	--	--	--	--	--
12510500	09-22-88	--	<.1	--	--	--	--	--	--	--
12510500	10-20-88	--	<.1	--	--	--	--	--	--	--
12510500	11-17-88	--	<.1	--	--	--	--	--	--	--
12510500	12-21-88	--	<.1	--	--	--	--	--	--	--
12510500	01-19-89	--	<.1	--	--	--	--	--	--	--
12510500	02-23-89	--	<.1	--	--	--	--	--	--	--
12510500	03-23-89	--	<.1	--	--	--	--	--	--	--
12510500	04-09-89	--	<.1	--	--	--	--	--	--	--
12510500	04-20-89	--	<.1	--	--	--	--	--	--	--
12510500	05-18-89	--	<.1	--	--	--	--	--	--	--
12510500	06-22-89	--	<.1	--	--	--	--	--	--	--
12510500	07-20-89	--	<.1	--	--	--	--	--	--	--
12510500	08-17-89	--	<.1	--	--	--	--	--	--	--
12510500	09-21-89	--	<.1	--	--	--	--	--	--	--
12510500	10-26-89	--	<.1	--	--	--	--	--	--	--
12510500	11-21-89	--	<.1	--	--	--	--	--	--	--
12510500	12-06-89	2	<.1	<10	<10	<1	<1	110	<6	<3
12510500	12-06-89	--	<.1	--	--	--	--	--	--	--
12510500	12-07-89	--	<.1	--	--	--	--	--	--	--
12510500	12-21-89	--	<.1	--	--	--	--	--	--	--
12510500	01-18-90	--	<.1	--	--	--	--	--	--	--
12510500	02-22-90	--	<.1	--	--	--	--	--	--	--
12510500	03-22-90	--	.2	--	--	--	--	--	--	--
12511800	07-19-87	5	--	<10	<10	--	<1	150	8	24
12511800	11-06-87	12	--	<10	<10	--	<1	160	7	5
12510500	08-06-87	2	--	<10	<10	--	<1	140	8	12
12510500	08-06-87	2	--	<10	<10	--	<1	140	8	7
12510500	08-06-87	5	--	<10	<10	--	<1	140	<6	<3
12510500	08-20-87	--	<.1	--	--	--	--	--	--	--
12510500	09-15-87	--	<.1	--	--	--	--	--	--	--
12510500	10-22-87	--	<.1	--	--	--	--	--	--	--
12510500	11-19-87	--	<.1	--	--	--	--	--	--	--
12510500	12-12-87	--	<.1	--	--	--	--	--	--	--
12510500	01-16-88	--	<.1	--	--	--	--	--	--	--
12510500	01-21-88	--	<.1	--	--	--	--	--	--	--
12510500	02-18-88	--	<.1	--	--	--	--	--	--	--
12510500	03-17-88	--	<.1	--	--	--	--	--	--	--
12510500	04-17-88	--	<.1	--	--	--	--	--	--	--
12510500	04-21-88	--	<.1	--	--	--	--	--	--	--

Table 29. Concentrations of major and minor elements in unfiltered water, Yakima River Basin, Washington, 1987-90

[The term "unfiltered water" refers to the chemical analysis of a water sample that has not been filtered or centrifuged, nor in any way altered from the original matrix; all concentrations are reported in micrograms per liter (µg/L), unless otherwise noted; ft^3/s = cubic feet per second; µs/cm = microsiemens per centimeter; dis it = dissolved incremental alkalinity titration; mg/L = milligrams per liter; CaCO3 = calcium carbonate; RM = river mile; "--" = not determined; "<" = less than]

Site reference number	Station number	Site name	Date	Discharge instantaneous, (ft^3/s)	Specific conductance (µs/cm)	pH (standard units)	Alkalinity water dis it field (mg/L as CaCO3)	Hardness (mg/L as CaCO3)
6	12479500	Yakima River at Cle Elum	04-30-87	993	59	7.7	27	24
6	12479500	Yakima River at Cle Elum	08-10-87	3,610	46	7.8	21	21
6	12479500	Yakima River at Cle Elum	01-10-90	3,130	49	7.2	23	21
19	12484500	Yakima River at Umtanum	05-01-87	3,450	111	7.9	51	46
19	12484500	Yakima River at Umtanum	08-18-87	3,350	86	7.0	41	35
19	12484500	Yakima River at Umtanum	12-05-89	2,720	92	6.8	44	41
26	12499000	Naches River near North Yakima	04-30-87	5,250	57	7.0	13	19
32	12500450	Yakima River above Ahtanum Creek at Union Gap	05-01-87	8,201	73	6.7	31	28
32	12500450	Yakima River above Ahtanum Creek at Union Gap	08-11-87	2,790	105	7.9	47	42
32	12500450	Yakima River above Ahtanum Creek at Union Gap	02-11-88	1,980	155	8.3	62	57
32	12500450	Yakima River above Ahtanum Creek at Union Gap	12-05-89	4,840	100	8.0	--	41
52	12508850	Sulphur Creek Wasteway near Sunnyside	05-01-87	253	247	8.1	93	90
52	12508850	Sulphur Creek Wasteway near Sunnyside	08-18-87	210	355	8.1	155	130
56	12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	08-19-87	1,188	304	8.5	127	110
56	12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	12-06-89	4,790	156	7.8	65	60
50	12510500	Yakima River at Kiona	05-02-87	6,840	113	7.9	47	43
50	12510500	Yakima River at Kiona	08-20-87	1,200	318	8.4	137	120
50	12510500	Yakima River at Kiona	12-06-89	5,200	251	8.0	104	97

Table 29. Concentrations of major and minor elements in unfiltered water, Yakima River Basin, Washington, 1987-90—Continued

Station number	Date	Aluminum	Barium	Beryllium	Boron	Cadmium	Chromium	Copper	Iron	Lead
12479500	04-30-87	840	< 100	< 10	10	< 1	15	< 10	960	< 5
12479500	08-10-87	130	< 100	< 10	< 10	1	4	20	210	< 5
12479500	01-10-90	3,300	< 100	< 10	40	< 1	5	< 10	4,000	2
12484500	05-01-87	2,000	< 100	< 10	30	< 1	29	< 10	3,100	6
12484500	08-18-87	350	< 100	< 10	20	< 1	3	10	500	< 5
12484500	12-05-89	1,300	< 100	< 10	30	< 1	5	< 10	2,000	2
12499000	04-30-87	3,700	< 100	< 10	20	< 1	9	< 10	390	< 5
12500450	05-01-87	3,400	100	< 10	< 10	< 1	< 1	10	3,800	< 5
12500450	08-11-87	400	< 100	< 10	40	< 1	8	20	600	< 5
12500450	02-11-88	640	< 100	< 10	40	1	2	< 10	820	< 5
12500450	12-05-89	1,700	< 100	< 10	10	< 1	3	< 10	2,800	2
12508850	05-01-87	3,500	100	< 10	50	< 1	25	< 10	5,300	< 5
12508850	08-18-87	2,300	< 100	< 10	30	< 1	14	40	--	< 5
12509050	08-19-87	810	< 100	< 10	20	< 1	< 1	10	1,200	< 5
12509050	12-06-89	3,400	< 100	< 10	30	< 1	3	< 10	5,100	3
12510500	05-02-87	2,600	< 100	< 10	10	< 1	19	< 10	3,500	< 5
12510500	08-20-87	980	< 100	< 10	40	< 1	2	10	1,300	< 5
12510500	12-06-89	1,600	< 100	< 10	< 10	< 1	3	< 10	3,100	2

Table 29. Concentrations of major and minor elements in unfiltered water, Yakima River Basin, Washington, 1987-90—Continued

Station number	Date	Manganese	Mercury	Molybdenum	Nickel	Silver	Zinc
12479500	04-30-87	20	< 0.1	1	3	< 1	< 10
12479500	08-10-87	20	< .1	< 1	4	< 1	< 10
12479500	01-10-90	140	.1	< 1	6	< 1	20
12484500	05-01-87	90	.2	2	20	< 1	< 10
12484500	08-18-87	20	.2	< 1	6	1	< 10
12484500	12-05-89	70	< .1	< 1	9	< 1	< 10
12499000	04-30-87	110	1.0	< 1	2	< 1	20
12500450	05-01-87	110	.1	1	3	< 1	< 10
12500450	08-11-87	20	< .1	< 1	< 1	< 1	< 10
12500450	02-11-88	40	< .1	4	4	12	< 10
12500450	12-05-89	90	< .1	< 1	5	< 1	30
12508850	05-01-87	140	.1	2	6	< 1	10
12508850	08-18-87	< 10	< .1	--	2	10	--
12509050	08-19-87	110	.2	3	1	< 1	20
12509050	12-06-89	200	< .1	< 1	5	< 1	20
12510500	05-02-87	130	< .1	1	4	< 1	< 10
12510500	08-20-87	110	.2	4	< 1	< 1	40
12510500	12-06-89	150	< .1	1	4	< 1	10

Table 30. Concentrations of major and minor elements in aquatic insects, Yakima River Basin, Washington, 1989-90

[All concentrations are reported in micrograms per gram (µg/g), dry weight, unless otherwise noted; lower limits of determination may differ for some elements because they are dependent on the mass of the sample analyzed; rows of data with identical taxa, station numbers, and dates represent samples that were split into two or more samples in the lab; not all samples were identified to the genus species level of classification; sp. = sample contains one species with the given genus, but the species is unidentified; spp. = sample contains more than one species within the given genus; "<" = less than; "--" = not determined; organism taxa are listed in the table as follows:

Order (common name)
Family
Genus species]

Site reference number	Station number	Site name	Date	Percent moisture
		Ephemeroptera (mayflies)		
3	12479720	Jungle Creek at mouth near Cle Elum	5- 2-89	81.5
		Plecoptera (stoneflies) Perlidae *Calineuria* sp.		
4	12479750	North Fork Teanaway River below bridge at Dickey Creek Campground	11- 3-90	--
			11- 3-90	--
8	12481900	Taneum Creek at Taneum Meadow near Thorp	11- 3-90	--
			11- 3-90	--
7	12483750	Naneum Creek below High Creek near Ellensburg	11- 2-90	--
			11- 2-90	--
			11- 2-90	--
20	12484550	Umtanum Creek near mouth at Umtanum	11- 5-90	--
			11- 5-90	--
10	12487200	Little Naches River at mouth near Cliffdell	10-30-90	--
			10-30-90	--
			10-30-90	--
22	12489100	Rattlesnake Creek above North Fork Rattlesnake Creek near Nile	11- 1-90	--
			11- 1-90	--
		Plecoptera (stoneflies) Perlidae *Claassenia* sp.		
6	12479500	Yakima River at Cle Elum	11- 4-90	--
4	12479750	North Fork Teanaway River below bridge at Dickey Creek Campground	11- 3-90	--
7	12483750	Naneum Creek below High Creek near Ellensburg	11- 2-90	--
19	12484500	Yakima River at Umtanum	11- 5-90	--
			11- 5-90	--
10	12487200	Litlle Naches River at mouth near Cliffdell	10-30-90	--
22	12489100	Rattlesnake Creek above North Fork Rattlesnake Creek near Nile	11- 1-90	--
21	12489150	Rattlesnake Creek above Little Rattlesnake near Nile	11- 8-90	--
			11- 8-90	--
		Plecoptera (stoneflies) Perlidae *Doroneuria* sp.		
6	12479500	Yakima River at Cle Elum	11- 4-90	--
8	12481900	Taneum Creek at Taneum Meadow near Thorp	11- 3-90	--
			11- 3-90	--
12	12483190	South Fork Manastash Creek near Ellensburg	11- 2-90	--
			11- 2-90	--
13	12488250	American River at Hells Crossing near Nile	11- 1-90	--

Table 30. Concentrations of major and minor elements in aquatic insects, Yakima River Basin, Washington, 1989-90—Continued

Site reference number	Station number	Site name	Date	Percent moisture
		Plecoptera (stoneflies) Perlidae *Doroneuria* sp.		
34	12500900	South Fork Ahtanum Creek above Conrad Ranch near Tampico	11- 6-90	--
			11- 6-90	--
			11- 6-90	--
			11- 6-90	--
		Plecoptera (stoneflies) Perlidae *Hesperoperla* sp.		
6	12479500	Yakima River at Cle Elum	11- 4-90	--
4	12479750	North Fork Teanaway River below bridge at Dickey Creek Campground	11- 3-90	--
8	12481900	Taneum Creek at Taneum Meadow near Thorp	11- 3-90	--
12	12483190	South Fork Manastash Creek near Ellensburg	11- 2-90	--
7	12483750	Naneum Creek below High Creek near Ellensburg	11- 2-90	--
			11- 2-90	--
			11- 2-90	--
19	12484500	Yakima River at Umtanum	11- 5-90	--
22	12489100	Rattlesnake Creek above North Fork Rattlesnake Creek near Nile	11- 1-90	--
21	12489150	Rattlesnake Creek above Little Rattlesnake near Nile	11- 8-90	--
			11- 8-90	--
			11- 8-90	--
34	12500900	South Fork Ahtanum Creek above Conrad Ranch near Tampico	11- 6-90	--
57	12507594	Satus Creek above Wilson-Charley Canyon near Toppenish	11- 7-90	--
			11- 7-90	--
			11- 7-90	--
			11- 7-90	--
		Plecoptera (stoneflies) Perlodidae *Isoperla* sp.		
7	12483750	Naneum Creek below High Creek near Ellensburg	11- 2-90	--
		Plecoptera (stoneflies) Perlodidae *Megarcys* sp.		
8	12481900	Taneum Creek at Taneum Meadow near Thorp	11- 3-90	--
12	12483190	South Fork Manastash Creek near Ellensburg	11- 2-90	--
			11- 2-90	--
13	12488250	American River at Hells Crossing near Nile	11- 1-90	--
		Plecoptera (stoneflies) Perlodidae *Perlinodes* sp.		
4	12479750	North Fork Teanaway River below bridge at Dickey Creek Campground	11- 3-90	--
			11- 3-90	--
10	12487200	Little Naches River at mouth near Cliffdell	10-30-90	--
21	12489150	Rattlesnake Creek above Little Rattlesnake Creek	11- 8-90	--
			11- 8-90	--

Table 30. Concentrations of major and minor elements in aquatic insects, Yakima River Basin, Washington, 1989-90—Continued

Site reference number	Station number	Site name	Date	Percent moisture
		Plecoptera (stoneflies) Perlodidae *Skwala* sp.		
4	12479750	North Fork Teanaway River below bridge at Dickey Creek Campground	11- 3-90	--
12	12483190	South Fork Manastash Creek near Ellensburg	11- 2-90	--
			11- 2-90	--
7	12483750	Naneum Creek below High Creek near Ellensburg	11- 2-90	--
19	12484500	Yakima River at Umtanum	11- 5-90	--
			11- 5-90	--
			11- 5-90	--
			11- 5-90	--
			11- 5-90	--
20	12484550	Umtanum Creek near mouth at Umtanum	11- 5-90	--
			11- 5-90	--
10	12487200	Little Naches River at mouth near Cliffdell	10-30-90	--
21	12489150	Rattlesnake Creek above Little Rattlesnake near Nile	11- 8-90	--
			11- 8-90	--
26	12499000	Naches River near North Yakima	11- 4-90	--
53	12508500	Satus Creek below Dry Creek near Toppenish	11- 7-90	--
			11- 7-90	--
		Plecoptera (stoneflies) Pteronarcidae *Pteronarcys* sp.		
6	12479500	Yakima River at Cle Elum	11- 4-90	--
			11- 4-90	--
			11- 4-90	--
			11- 4-90	--
8	12481900	Taneum Creek at Taneum Meadow near Thorp	11- 3-90	--
12	12483190	South Fork Manastash Creek near Ellensburg	11- 2-90	--
			11- 2-90	--
			11- 2-90	--
10	12487200	Little Naches River at mouth near Cliffdell	10-30-90	--
			10-30-90	--
13	12488250	American River at Hells Crossing near Nile	11- 1-90	--
22	12489100	Rattlesnake Creek above North Fork Rattlesnake Creek near Nile	11- 1-90	--
21	12489150	Rattlesnake Creek above Little Rattlesnake near Nile	11- 8-90	--
			11- 8-90	--
			11- 8-90	--
			11- 8-90	--
34	12500900	South Fork Ahtanum Creek above Conrad Ranch near Tampico	11- 6-90	--
			11- 6-90	--
		Plecoptera (stoneflies)		
20	12484550	Umtanum Creek near mouth at Umtanum	5- 3-89	77.0
13	12488250	American River at Hells Crossing near Nile	11- 7-89	99.5
57	12507594	Satus Creek above Wilson-Charley Canyon near Toppenish	11- 9-89	97.6

Table 30. Concentrations of major and minor elements in aquatic insects, Yakima River Basin, Washington, 1989-90—Continued

Site reference number	Station number	Site name	Date	Percent moisture
		Trichoptera (caddisflies) Hydropsychidae *Arctopsyche* sp.		
6	12479500	Yakima River at Cle Elum	11- 4-90	--
4	12479750	North Fork Teanaway River below bridge at Dickey Creek Campground	11- 3-90	--
8	12481900	Taneum Creek at Taneum Meadow near Thorp	11- 3-90	--
			11- 3-90	--
			11- 3-90	--
			11- 3-90	--
			11- 3-90	--
12	12483190	South Fork Manastash Creek near Ellensburg	11- 2-90	--
			11- 2-90	--
7	12483750	Naneum Creek below High Creek near Ellensburg	11- 2-90	--
			11- 2-90	--
			11- 2-90	--
10	12487200	Little Naches River at mouth near Cliffdell	10-30-90	--
13	12488250	American River at Hells Crossing near Nile	11- 1-90	--
22	12489100	Rattlesnake Creek above North Fork Rattlesnake Creek near Nile	11- 1-90	--
			11- 1-90	--
			11- 1-90	--
21	12489150	Rattlesnake Creek above Little Rattlesnake Creek near Nile	11- 8-90	--
26	12499000	Naches River near North Yakima	11- 4-90	--
34	12500900	South Fork Ahtanum Creek above Conrad Ranch near Tampico	11- 6-90	--
			11- 6-90	--
			11- 6-90	--
			11- 6-90	--
33	12503950	Yakima River at Parker	11- 6-90	--
		Trichoptera (caddisflies) Hydropsychidae *Cheumatopsyche* spp.		
19	12484500	Yakima River at Umtanum	11- 5-90	--
			11- 5-90	--
26	12499000	Naches River near North Yakima	11- 4-90	--
			11- 4-90	--
			11- 4-90	--
33	12503950	Yakima River at Parker	11- 6-90	--
47	12508620	Satus Creek at gage at Satus	11- 7-90	--
		Trichoptera (caddisflies) Hydropsychidae *Hydropsyche amblis*		
6	12479500	Yakima River at Cle Elum	11- 4-90	--
7	12483750	Naneum Creek below High Creek near Ellensberg	11- 2-90	--
			11- 2-90	--
20	12484550	Umtanum Creek near mouth at Umtanum	11- 5-90	--
			11- 5-90	--
			11- 5-90	--
			11- 5-90	--
10	12487200	Little Naches River at mouth near Cliffdell	10-30-90	--
22	12489100	Rattlesnake Creek above North Fork Rattlesnake Creek near Nile	11- 1-90	--
			11- 1-90	--

Table 30. Concentrations of major and minor elements in aquatic insects, Yakima River Basin, Washington, 1989-90—Continued

Site reference number	Station number	Site name	Date	Percent moisture
		Trichoptera (caddisflies) Hydropsychidae *Hydropsyche amblis*		
21	12489150	Rattlesnake Creek above Little Rattlesnake near Nile	11- 8-90	--
			11- 8-90	--
			11- 8-90	--
			11- 8-90	--
34	12500900	South Fork Ahtanum Creek above Conrad Ranch near Tampico	11- 6-90	--
57	12507594	Satus Creek above Wilson-Charley Canyon near Toppenish	11- 7-90	--
			11- 7-90	--
			11- 7-90	--
			11- 7-90	--
			11- 7-90	--
		Trichoptera (caddisflies) Hydropsychidae *Hydropsyche californica*		
14	12484440	Cherry Creek above Wipple Wasteway at Thrall	10-31-90	--
			10-31-90	--
16	12484480	Cherry Creek at Thrall	10-31-90	--
26	12499000	Naches River near North Yakima	11- 4-90	--
			11- 4-90	--
			11- 4-90	--
			11- 4-90	--
27	12500437	Wide Hollow Creek at West Valley High School near Ahtanum	11- 9-90	--
			11- 9-90	--
			11- 9-90	--
29	12500442	Wide Hollow Creek at old sewage treatment plant at Union Gap	11- 5-90	--
			11- 5-90	--
			11- 5-90	--
			11- 5-90	--
			11- 5-90	--
			11- 5-90	--
31	12502500	Ahtanum Creek at Union Gap	11- 6-90	--
			11- 6-90	--
			11- 6-90	--
			11- 6-90	--
			11- 6-90	--
			11- 6-90	--
33	12503950	Yakima River at Parker	11- 6-90	--
			11- 6-90	--
40	12505460	Granger Drain at mouth near Granger	11- 8-90	--
			11- 8-90	--
			11- 8-90	--
42	12507525	Yakima River below Toppenish Creek at river mile 79.6 near Granger	11- 4-90	--
			11- 4-90	--
			11- 4-90	--
53	12508500	Satus Creek below Dry Creek near Toppenish	11- 7-90	--
			11- 7-90	--
			11- 7-90	--
			11- 7-90	--
			11- 7-90	--

Table 30. Concentrations of major and minor elements in aquatic insects, Yakima River Basin, Washington, 1989-90—Continued

Site reference number	Station number	Site name	Date	Percent moisture
		Trichoptera (caddisflies) Hydropsychidae *Hydropsyche californica*		
47	12508620	Satus Creek at gage at Satus	11- 7-90	--
			11- 7-90	--
			11- 7-90	--
			11- 7-90	--
			11- 7-90	--
			11- 7-90	--
52	12508850	Sulphur Creek Wasteway near Sunnyside	11- 4-90	--
			11- 4-90	--
			11- 4-90	--
56	12509050	Yakima River at Euclid Bridge at river mile 55 near Grandview	11- 4-90	--
50	12510500	Yakima River at Kiona	11- 4-90	--
			11- 4-90	--
			11- 4-90	--
			11- 4-90	--
		Trichoptera (caddisflies) Hydropsychida *Hydropsyche cockerelli*		
6	12479500	Yakima River at Cle Elum	11- 4-90	--
			11- 4-90	--
			11- 4-90	--
14	12484440	Cherry Creek above Wipple Wasteway at Thrall	10-31-90	--
			10-31-90	--
			10-31-90	--
16	12484480	Cherry Creek at Thrall	10-31-90	--
			10-31-90	--
			10-31-90	--
19	12484500	Yakima River at Umtanum	11- 5-90	--
			11- 5-90	--
10	12487200	Little Naches River at mouth near Cliffdell	10-30-90	--
			10-30-90	--
26	12499000	Naches River near North Yakima	11- 4-90	--
33	12503950	Yakima River at Parker	11- 6-90	--
			11- 6-90	--
52	12508850	Suplhur Creek Wasteway near Sunnyside	11- 4-90	--
54	12509710	Spring Creek at mouth at Whitstran	11- 8-90	--
			11- 8-90	--
			11- 8-90	--
			11- 8-90	--
		Trichoptera (caddisflies) Hydropsychidae *Hydropsyche occidentalis*		
6	12479500	Yakima River at Cle Elum	11- 4-90	--
			11- 4-90	--
			11- 4-90	--
19	12484500	Yakima River at Umtanum	11- 5-90	--
			11- 5-90	--
			11- 5-90	--
26	12499000	Naches River near North Yakima	11- 4-90	--

Table 30. Concentrations of major and minor elements in aquatic insects, Yakima River Basin, Washington, 1989-90—Continued

Site reference number	Station number	Site name	Date	Percent moisture
		Trichoptera (caddisflies) Hydropsychidae *Hydropsyche* sp.		
6	12479500	Yakima River at Cle Elum	11- 4-90	--
		Trichoptera (caddisflies) Hydropsychidae *Parapsyche* sp.		
13	12488250	American River at Hells Crossing near Nile	11- 1-90	--
		Trichoptera (caddisflies)		
1	12478100	Waptus River at mouth near Roslyn	11- 2-89	99.6
6	12479500	Yakima River at Cle Elum	11- 2-89	98.8
			11- 6-89	98.4
16	12484480	Cherry Creek at Thrall	11- 6-89	95.3
			11- 6-89	96.2
19	12484500	Yakima River at Umtanum	5- 3-89	82.4
			11- 1-89	97.7
			11- 5-89	97.6
20	12484550	Umtanum Creek near mouth at Umtanum	11- 8-89	96.4
			11- 8-89	96.4
22	12489100	Rattlesnake Creek above North Fork Rattlesnake Creek near Nile	11- 7-89	99.8
27	12500437	Wide Hollow Creek at West Valley High School near Ahtanum	5- 1-89	80.5
29	12500442	Wide Hollow Creek at old sewage treatment plant at Union Gap	11- 4-89	97.1
			11- 4-89	97.1
33	12503950	Yakima River at Parker	11- 4-89	97.4
			11- 4-89	97.4
40	12505460	Granger Drain at mouth near Granger	11- 3-89	96.3
43	12507508	Toppenish Creek at Indian Church Road near Granger	11- 3-89	96.5
			11- 3-89	96.5
47	12508620	Satus Creek at gage at Satus	11- 3-89	85.4
			11- 3-89	86.7
52	12508850	Sulphur Creek Wasteway near Sunnyside	11- 1-89	97.4
			11- 1-89	96.8
56	12509050	Yakima River at Euclid Bridge at river mile 55 near Grandview	10-31-89	96.7
			10-31-89	96.7
			10-31-89	97.9
54	12509710	Spring Creek at mouth at Whitstran	10-30-89	98.0
			10-30-89	97.8
50	12510500	Yakima River at Kiona	10-30-89	96.4
			10-30-89	96.9

Table 30. Concentrations of major and minor elements in aquatic insects, Yakima River Basin, Washington, 1989-90—Continued

Station number	Date	Aluminum	Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium	Cobalt
Ephemeroptera (mayflies)									
12479720	5- 2-89	2,020	4.3	24	<0.10	2.0	5.0	2.0	--
Plecoptera (stoneflies) Perlidae *Calineuria* sp.									
12479750	11- 3-90	--	--	--	--	--	.10	3.7	0.86
	11- 3-90	--	--	--	--	--	.19	4.1	.87
12481900	11- 3-90	--	--	--	--	--	.10	1.5	.42
	11- 3-90	--	--	--	--	--	.11	1.6	.39
12483750	11- 2-90	--	--	--	--	--	.08	.89	.50
	11- 2-90	--	--	--	--	--	< .06	.80	.64
	11- 2-90	--	--	--	--	--	.12	1.2	.55
12484550	11- 5-90	--	--	--	--	--	<.14	<.11	1.1
	11- 5-90	--	--	--	--	--	<.07	<.06	.49
12487200	10-30-90	--	--	--	--	--	< .05	1.3	.35
	10-30-90	--	--	--	--	--	.06	1.2	.37
	10-30-90	--	--	--	--	--	.08	1.2	.39
12489100	11- 1-90	--	--	--	--	--	.45	.91	.73
	11- 1-90	--	--	--	--	--	.45	.80	.86
Plecoptera (stoneflies) Perlidae *Claassenia* sp.									
12479500	11- 4-90	--	--	--	--	--	.22	1.6	.87
12479750	11- 3-90	--	--	--	--	--	.16	2.2	1.0
12483750	11- 2-90	--	--	--	--	--	< .15	1.1	.41
12484500	11- 5-90	--	--	--	--	--	.10	1.6	1.1
	11- 5-90	--	--	--	--	--	.06	1.8	.73
12487200	10-30-90	--	--	--	--	--	.06	1.4	.39
12489100	11- 1-90	--	--	--	--	--	.40	.82	.51
12489150	11- 8-90	--	--	--	--	--	.24	.49	.67
	11- 8-90	--	--	--	--	--	.20	.50	.47
Plecoptera (stoneflies) Perlidae *Doroneuria* sp.									
12479500	11- 4-90	--	--	--	--	--	.19	1.4	.60
12481900	11- 3-90	--	--	--	--	--	.06	.68	.29
	11- 3-90	--	--	--	--	--	.21	1.9	.47
12483190	11- 2-90	--	--	--	--	--	.06	1.3	.38
	11- 2-90	--	--	--	--	--	< .15	3.8	.60
12488250	11- 1-90	--	--	--	--	--	.50	.95	.20

Table 30. Concentrations of major and minor elements in aquatic insects, Yakima River Basin, Washington, 1989-90—Continued

Station number	Date	Aluminum	Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium	Cobalt
				Plecoptera (stoneflies) Perlidae *Doroneuria* sp.					
12500900	11- 6-90	--	--	--	--	--	0.04	0.99	1.4
	11- 6-90	--	--	--	--	--	<.04	1.1	1.7
	11- 6-90	--	--	--	--	--	<.11	1.5	2.4
	11- 6-90	--	--	--	--	--	.04	.96	1.4
				Plecoptera (stoneflies) Perlidae *Hesperoperla* sp.					
12479500	11- 4-90	--	--	--	--	--	.12	1.3	0.43
12479750	11- 3-90	--	--	--	--	--	.08	2.4	1.0
12481900	11- 3-90	--	--	--	--	--	<.08	1.3	.25
12483190	11- 2-90	--	--	--	--	--	<.12	1.5	.40
12483750	11- 2-90	--	--	--	--	--	.05	.91	.31
	11- 2-90	--	--	--	--	--	.05	.86	.40
	11- 2-90	--	--	--	--	--	<.09	.99	.58
12484500	11- 5-90	--	--	--	--	--	<.07	2.2	.36
12489100	11- 1-90	--	--	--	--	--	.33	.62	.34
12489150	11- 8-90	--	--	--	--	--	.22	.52	.51
	11- 8-90	--	--	--	--	--	.20	.66	.54
	11- 8-90	--	--	--	--	--	.14	.64	.31
12500900	11- 6-90	--	--	--	--	--	<.10	1.3	1.8
12507594	11- 7-90	--	--	--	--	--	<.04	1.1	1.0
	11- 7-90	--	--	--	--	--	<.04	1.3	1.0
	11- 7-90	--	--	--	--	--	<.04	1.2	.81
	11- 7-90	--	--	--	--	--	<.08	1.6	.65
				Plecoptera (stoneflies) Perlodidae *Isoperla* sp.					
12483750	11- 2-90	--	--	--	--	--	<.87	2.8	< .57
				Plecoptera (stoneflies) Perlodidae *Megarcys* sp.					
12481900	11- 3-90	--	--	--	--	--	.36	5.2	.88
12483190	11- 2-90	--	--	--	--	--	.20	1.6	.85
	11- 2-90	--	--	--	--	--	.16	2.8	1.1
12488250	11- 1-90	--	--	--	--	--	.24	.44	.58
				Plecoptera (stoneflies) Perlodidae *Perlinodes* sp.					
12479750	11- 3-90	--	--	--	--	--	.17	41	6.4
	11- 3-90	--	--	--	--	--	.18	26	5.0
12487200	10-30-90	--	--	--	--	--	.12	3.0	2.2
12489150	11- 8-90	--	--	--	--	--	.26	2.2	1.8
	11- 8-90	--	--	--	--	--	.25	2.1	1.9

Table 30. Concentrations of major and minor elements in aquatic insects, Yakima River Basin, Washington, 1989-90—Continued

Station number	Date	Aluminum	Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium	Cobalt
				Plecoptera (stoneflies) Perlodidae *Skwala* sp.					
12479750	11- 3-90	--	--	--	--	--	0.22	16	3.0
12483190	11- 2-90	--	--	--	--	--	.11	3.4	1.0
	11- 2-90	--	--	--	--	--	.23	2.5	.92
12483750	11- 2-90	--	--	--	--	--	.16	1.3	.96
12484500	11- 5-90	--	--	--	--	--	.08	3.8	2.0
	11- 5-90	--	--	--	--	--	.10	3.5	1.6
	11- 5-90	--	--	--	--	--	.09	3.3	1.8
	11- 5-90	--	--	--	--	--	.11	3.6	1.8
	11- 5-90	--	--	--	--	--	.06	3.1	1.8
12484550	11- 5-90	--	--	--	--	--	<.10	0.12	1.8
	11- 5-90	--	--	--	--	--	.09	.51	1.7
12487200	10-30-90	--	--	--	--	--	<.23	4.7	1.6
12489150	11- 8-90	--	--	--	--	--	.24	1.4	1.2
	11- 8-90	--	--	--	--	--	.22	1.2	1.0
12499000	11- 4-90	--	--	--	--	--	<.10	.45	.89
12508500	11- 7-90	--	--	--	--	--	.09	1.7	2.7
	11- 7-90	--	--	--	--	--	<.06	1.8	2.6
				Plecoptera (stoneflies) Pteronarcidae *Pteronarcys* sp.					
12479500	11- 4-90	--	--	--	--	--	.07	3.3	1.0
	11- 4-90	--	--	--	--	--	.09	3.4	1.2
	11- 4-90	--	--	--	--	--	<.05	3.9	1.2
	11- 4-90	--	--	--	--	--	.13	2.6	1.1
12481900	11- 3-90	--	--	--	--	--	.14	2.9	.80
12483190	11- 2-90	--	--	--	--	--	<.03	2.0	1.2
	11- 2-90	--	--	--	--	--	.03	2.0	1.3
	11- 2-90	--	--	--	--	--	<.41	3.7	1.6
12487200	10-30-90	--	--	--	--	--	.06	1.0	.56
	10-30-90	--	--	--	--	--	.06	1.6	.97
12488250	11- 1-90	--	--	--	--	--	.11	.75	.85
12489100	11- 1-90	--	--	--	--	--	.23	.58	.74
12489150	11- 8-90	--	--	--	--	--	.10	1.0	1.0
	11- 8-90	--	--	--	--	--	.08	.72	.70
	11- 8-90	--	--	--	--	--	.08	.75	.53
	11- 8-90	--	--	--	--	--	<.14	.97	.90
12500900	11- 6-90	--	--	--	--	--	<.04	1.2	4.8
	11- 6-90	--	--	--	--	--	<.05	1.1	3.8
				Plecoptera (stoneflies)					
12484550	5- 3-89	540	0.40	9.3	<0.10	2.0	<.20	< 1.0	--
12488250	11- 7-89	760	.08	24	< 1.0	20	<3.0	< 10	--
12507594	11- 9-89	210	.30	7.3	< .10	3.0	<.40	< 1.0	--

Table 30. Concentrations of major and minor elements in aquatic insects, Yakima River Basin, Washington, 1989-90—Continued

Station number	Date	Aluminum	Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium	Cobalt
					Trichoptera (caddisflies) Hydropsychidae *Arctopsyche* sp.				
12479500	11- 4-90	--	--	--	--	--	0.02	2.2	0.82
12479750	11- 3-90	--	--	--	--	--	.22	10	3.6
12481900	11- 3-90	--	--	--	--	--	.30	1.6	.84
	11- 3-90	--	--	--	--	--	.24	1.9	.95
	11- 3-90	--	--	--	--	--	.30	1.8	.93
	11- 3-90	--	--	--	--	--	.27	1.8	1.0
	11- 3-90	--	--	--	--	--	.25	2.1	1.0
12483190	11- 2-90	--	--	--	--	--	.12	1.6	1.1
	11- 2-90	--	--	--	--	--	.09	1.7	1.0
12483750	11- 2-90	--	--	--	--	--	.16	1.2	1.3
	11- 2-90	--	--	--	--	--	.09	1.4	1.4
	11- 2-90	--	--	--	--	--	.09	1.0	1.2
12487200	10-30-90	--	--	--	--	--	0.14	1.8	.71
12488250	11- 1-90	--	--	--	--	--	< .41	3.8	1.0
12489100	11- 1-90	--	--	--	--	--	.43	.97	1.2
	11- 1-90	--	--	--	--	--	.43	.94	1.2
	11- 1-90	--	--	--	--	--	.44	1.0	1.1
12489150	11- 8-90	--	--	--	--	--	.24	.71	.80
12499000	11- 4-90	--	--	--	--	--	<.10	1.5	1.5
12500900	11- 6-90	--	--	--	--	--	<.08	1.5	3.6
	11- 6-90	--	--	--	--	--	<.10	1.6	4.6
	11- 6-90	--	--	--	--	--	<.04	.68	5.7
	11- 6-90	--	--	--	--	--	.04	.74	5.9
12503950	11- 6-90	--	--	--	--	--	.25	1.6	3.2
					Trichoptera (caddisflies) Hydropsychidae *Cheumatopsyche* spp.				
12484500	11- 5-90	--	--	--	--	--	.11	5.0	2.2
	11- 5-90	--	--	--	--	--	.09	5.7	2.5
12499000	11- 4-90	--	--	--	--	--	.23	2.3	2.0
	11- 4-90	--	--	--	--	--	.16	2.1	1.8
	11- 4-90	--	--	--	--	--	.17	2.6	1.7
12503950	11- 6-90	--	--	--	--	--	.18	3.2	2.7
12508620	11- 7-90	--	--	--	--	--	<.19	5.9	5.7
					Trichoptera (caddisflies) Hydropsychidae *Hydropsyche amblis*				
12479500	11- 4-90	--	--	--	--	--	.23	2.7	1.8
12483750	11- 2-90	--	--	--	--	--	.10	2.1	2.0
	11- 2-90	--	--	--	--	--	.10	1.9	1.6
12484550	11- 5-90	--	--	--	--	--	.06	.63	3.3
	11- 5-90	--	--	--	--	--	.06	.66	3.0
	11- 5-90	--	--	--	--	--	.12	.61	3.4
	11- 5-90	--	--	--	--	--	.15	.74	3.2
12487200	10-30-90	--	--	--	--	--	.14	1.5	.85
12489100	11- 1-90	--	--	--	--	--	.24	.79	.76
	11- 1-90	--	--	--	--	--	.26	1.0	.74

Table 30. Concentrations of major and minor elements in aquatic insects, Yakima River Basin, Washington, 1989-90—Continued

Station number	Date	Aluminum	Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium	Cobalt
				Trichoptera (caddisflies) Hydropsychidae *Hydropsyche amblis*					
12489150	11- 8-90	--	--	--	--	--	0.20	1.2	0.96
	11- 8-90	--	--	--	--	--	.23	1.2	1.1
	11- 8-90	--	--	--	--	--	.25	1.1	1.0
	11- 8-90	--	--	--	--	--	.22	1.5	1.2
12500900	11- 6-90	--	--	--	--	--	< .18	2.4	9.1
12507594	11- 7-90	--	--	--	--	--	.14	2.6	1.4
	11- 7-90	--	--	--	--	--	.06	1.6	1.1
	11- 7-90	--	--	--	--	--	.08	2.0	1.3
	11- 7-90	--	--	--	--	--	<.13	3.1	2.8
	11- 7-90	--	--	--	--	--	<.05	2.2	1.3
				Trichoptera (caddisflies) Hydropsychidae *Hydropsyche californica*					
12484440	10-31-90	--	--	--	--	--	<.09	4.1	2.3
	10-31-90	--	--	--	--	--	< .05	2.5	3.5
12484480	10-31-90	--	--	--	--	--	.07	3.4	3.3
12499000	11- 4-90	--	--	--	--	--	.10	1.4	1.6
	11- 4-90	--	--	--	--	--	.12	1.4	1.7
	11- 4-90	--	--	--	--	--	.08	1.2	1.6
	11- 4-90	--	--	--	--	--	.15	1.4	1.6
12500437	11- 9-90	--	--	--	--	--	.08	1.4	1.6
	11- 9-90	--	--	--	--	--	.07	1.2	1.5
	11- 9-90	--	--	--	--	--	.06	1.4	1.6
12500442	11- 5-90	--	--	--	--	--	.22	2.7	3.4
	11- 5-90	--	--	--	--	--	.20	3.4	3.2
	11- 5-90	--	--	--	--	--	.22	2.7	3.0
	11- 5-90	--	--	--	--	--	.22	2.8	3.4
	11- 5-90	--	--	--	--	--	.21	2.7	3.3
	11- 5-90	--	--	--	--	--	.20	2.4	3.6
12502500	11- 6-90	--	--	--	--	--	<.05	4.3	8.6
	11- 6-90	--	--	--	--	--	.05	3.4	7.3
	11- 6-90	--	--	--	--	--	.07	3.3	6.7
	11- 6-90	--	--	--	--	--	.07	3.0	5.7
	11- 6-90	--	--	--	--	--	<.05	2.5	5.2
	11- 6-90	--	--	--	--	--	<.05	1.8	3.7
12503950	11- 6-90	--	--	--	--	--	.09	1.7	2.2
	11- 6-90	--	--	--	--	--	.18	2.3	2.6
12505460	11- 8-90	--	--	--	--	--	.13	3.5	8.5
	11- 8-90	--	--	--	--	--	.09	3.6	8.4
	11- 8-90	--	--	--	--	--	.04	3.8	9.5
12507525	11- 4-90	--	--	--	--	--	.06	2.1	1.9
	11- 4-90	--	--	--	--	--	.05	1.6	1.8
	11- 4-90	--	--	--	--	--	.05	1.6	2.0
12508500	11- 7-90	--	--	--	--	--	.07	1.2	6.3
	11- 7-90	--	--	--	--	--	.08	2.7	3.9
	11- 7-90	--	--	--	--	--	.09	1.3	6.1
	11- 7-90	--	--	--	--	--	.09	1.4	5.8
	11- 7-90	--	--	--	--	--	<.10	1.4	6.2

Table 30. Concentrations of major and minor elements in aquatic insects, Yakima River Basin, Washington, 1989-90—Continued

Station number	Date	Aluminum	Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium	Cobalt
Trichoptera (caddisflies) Hydropsychidae *Hydropsyche californica*									
12508620	11- 7-90	--	--	--	--	--	0.08	2.7	3.9
	11- 7-90	--	--	--	--	--	.19	4.5	4.0
	11- 7-90	--	--	--	--	--	.08	2.9	3.2
	11- 7-90	--	--	--	--	--	.14	4.5	4.1
	11- 7-90	--	--	--	--	--	.07	3.5	3.9
	11- 7-90	--	--	--	--	--	.13	4.6	3.9
12508850	11- 4-90	--	--	--	--	--	.13	3.1	4.9
	11- 4-90	--	--	--	--	--	.14	3.5	4.7
	11- 4-90	--	--	--	--	--	.12	2.6	3.7
12509050	11- 4-90	--	--	--	--	--	.10	2.9	3.7
12510500	11- 4-90	--	--	--	--	--	.08	2.9	2.8
	11- 4-90	--	--	--	--	--	.07	2.9	2.7
	11- 4-90	--	--	--	--	--	.06	2.2	2.6
	11- 4-90	--	--	--	--	--	.06	1.9	2.5
Trichoptera (caddisflies) Hydropsychidae *Hydropsyche cockerelli*									
12479500	11- 4-90	--	--	--	--	--	<.06	2.0	.95
	11- 4-90	--	--	--	--	--	.12	2.2	1.0
	11- 4-90	--	--	--	--	--	<.05	2.0	.88
12484440	10-31-90	--	--	--	--	--	.06	4.0	3.0
	10-31-90	--	--	--	--	--	.09	3.5	2.3
	10-31-90	--	--	--	--	--	.08	3.6	2.6
12484480	10-31-90	--	--	--	--	--	.09	4.2	3.7
	10-31-90	--	--	--	--	--	.10	4.3	4.0
	10-31-90	--	--	--	--	--	<.05	4.3	3.3
12484500	11- 5-90	--	--	--	--	--	.04	3.6	1.7
	11- 5-90	--	--	--	--	--	.07	3.1	1.6
12487200	10-30-90	--	--	--	--	--	.08	1.4	.98
	10-30-90	--	--	--	--	--	.13	1.5	1.1
12499000	11- 4-90	--	--	--	--	--	.09	1.5	1.6
12503950	11- 6-90	--	--	--	--	--	.06	1.5	1.9
	11- 6-90	--	--	--	--	--	.19	2.5	2.5
12508850	11- 4-90	--	--	--	--	--	.17	4.3	4.0
12509710	11- 8-90	--	--	--	--	--	.08	2.3	2.4
	11- 8-90	--	--	--	--	--	.11	3.2	2.6
	11- 8-90	--	--	--	--	--	.16	4.6	3.4
	11- 8-90	--	--	--	--	--	.20	4.8	4.0
Trichoptera (caddisflies) Hydropsychidae *Hydropsyche occidentalis*									
12479500	11- 4-90	--	--	--	--	--	.33	2.4	1.0
	11- 4-90	--	--	--	--	--	<.08	2.6	.86
	11- 4-90	--	--	--	--	--	.13	2.4	1.1
12484500	11- 5-90	--	--	--	--	--	<.06	4.0	2.1
	11- 5-90	--	--	--	--	--	.07	4.1	1.9
	11- 5-90	--	--	--	--	--	<.05	4.0	1.7
12499000	11- 4-90	--	--	--	--	--	0.11	1.3	1.5

Table 30. Concentrations of major and minor elements in aquatic insects, Yakima River Basin, Washington, 1989-90—Continued

Station number	Date	Aluminum	Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium	Cobalt
				Trichoptera (caddisflies) Hydropsychidae *Hydropsyche* sp.					
12484550	11- 4-90	--	--	--	--	--	.22	2.3	1.2
				Trichoptera (caddisflies) Hydropsychidae *Parapsyche* sp.					
12488250	11- 1-90	--	--	--	--	--	.11	.84	.96
				Trichoptera (caddisflies)					
12478100	11- 2-89	570	4.0	440	<1.0	<20	<3.0	<10	--
12479500	11- 2-89	1,230	2.1	250	.10	<3.0	.40	5.5	--
	11- 6-89	2,780	2.5	270	.30	<6.0	<.80	11	--
12484480	11- 6-89	6,260	.96	140	.38	<2.0	< .20	11	--
	11- 6-89	5,960	1.1	120	.38	<2.0	<.30	9.0	--
12484500	5- 3-89	2,520	1.0	48	<.10	3.0	<.20	5.2	--
	11- 1-89	3,120	.91	51	.20	< 2.0	<.20	7.2	--
	11- 5-89	1,450	.82	39	.10	<2.0	<.20	3.3	--
12484550	11- 8-89	1,160	.30	60	.10	<2.0	<.30	2.0	--
	11- 8-89	1,160	--	59	<.10	<2.0	<.30	2.0	--
12489100	11- 7-89	2,200	3.0	64	<2.0	<30	<5.0	<20	--
12500437	5- 1-89	1,550	1.9	63	<.20	<3.0	<.30	3.0	--
12500442	11- 4-89	2,400	1.6	80	.20	<2.0	<.20	5.0	--
	11- 4-89	2,470	1.7	82	.20	<2.0	<.20	5.9	--
12503950	11- 4-89	2,240	1.1	48	.20	<2.0	<.20	3.7	--
	11- 4-89	4,220	1.4	54	.20	<2.0	<.20	7.2	--
12505460	11- 3-89	5,860	5.4	220	.42	<2.0	<.20	11	--
12507508	11- 3-89	1,780	.98	57	.10	<2.0	<.20	3.0	--
	11- 3-89	1,760	--	57	.10	<2.0	<.20	3.0	--
12508620	11- 3-89	4,050	1.4	120	.20	<2.0	<.20	6.4	--
	11- 3-89	4,140	1.8	150	.30	<2.0	<.20	10	--
12508850	11- 1-89	4,750	4.2	130	.30	<2.0	<.20	8.8	--
	11- 1-89	4,200	4.0	120	.30	<2.0	<.20	7.2	--
12509050	10-31-89	1,500	1.4	120	.20	<2.0	<.20	3.0	--
	10-31-89	1,500	--	120	.20	<2.0	<.20	3.2	--
	10-31-89	1,700	1.2	130	.20	<2.0	<.20	3.0	--
12509710	10-30-89	5,340	2.9	150	.40	<3.0	<.30	8.4	--
	10-30-89	3,800	1.4	83	.30	2.0	<.20	4.7	--
12510500	10-30-89	3,950	2.3	120	.30	4.0	<.30	7.4	--
	10-30-89	3,810	2.3	120	.30	3.0	<.30	8.1	--

Table 30. Concentrations of major and minor elements in aquatic insects, Yakima River Basin, Washington, 1989-90—Continued

Station number	Date	Copper	Iron	Lead	Magnesium	Manganese	Mercury	Molybdenum	Nickel
Ephemeroptera (mayflies)									
12479720	5- 2-89	40	1,900	<4.0	1,330	110	0.08	<1.0	3.0
Plecoptera (stoneflies) Perlidae *Calineuria* sp.									
12479750	11- 3-90	24	235	<.25	--	37	--	<.05	6.6
	11- 3-90	20	204	.46	--	40	--	<.09	7.2
12481900	11- 3-90	24	195	<.21	--	16	--	<.04	1.1
	11- 3-90	24	131	.55	--	14	--	<.08	1.3
12483750	11- 2-90	24	160	<.27	--	27	--	.10	.32
	11- 2-90	24	206	.34	--	27	--	.10	.37
	11- 2-90	19	194	.80	--	23	--	<.13	.52
12484550	11- 5-90	18	722	<.74	--	69	--	.22	.68
	11- 5-90	23	471	<.36	--	59	--	.17	.43
12487200	10-30-90	22	405	.47	--	36	--	.06	.30
	10-30-90	15	289	<.24	--	30	--	.06	.29
	10-30-90	17	231	.50	--	26	--	.11	.50
12489100	11- 1-90	23	90	<.42	--	20	--	<.09	.35
	11- 1-90	19	130	<.32	--	23	--	.07	.21
Plecoptera (stoneflies) Perlidae *Claassenia* sp.									
12479500	11- 4-90	27	144	1.8	--	40	--	.32	1.4
12479750	11- 3-90	37	156	<.56	--	43	--	<.11	6.4
12483750	11- 2-90	30	133	1.1	--	22	--	<.16	<.38
12484500	11- 5-90	33	316	<.23	--	100	--	.09	1.2
	11- 5-90	30	369	.25	--	100	--	.10	1.3
12487200	10-30-90	27	126	.40	--	24	--	.10	.16
12489100	11- 1-90	38	62	<.68	--	17	--	<.14	<.32
12489150	11- 8-90	33	198	<.35	--	15	--	.13	.30
	11- 8-90	36	124	.35	--	18	--	.09	.23
Plecoptera (stoneflies) Perlidae *Doroneuria* sp.									
12479500	11- 4-90	38	322	.65	--	46	--	<.13	1.4
12481900	11- 3-90	32	185	.39	--	68	--	<.05	1.2
	11- 3-90	28	323	.46	--	40	--	.10	2.1
12483190	11- 2-90	27	367	.25	--	65	--	.06	1.1
	11- 2-90	30	792	.82	--	48	--	<.16	2.0
12488250	11- 1-90	38	141	<.31	--	67	--	<.06	<.15

Table 30. Concentrations of major and minor elements in aquatic insects, Yakima River Basin, Washington, 1989-90—Continued

Station number	Date	Copper	Iron	Lead	Magnesium	Manganese	Mercury	Molybdenum	Nickel
				Plecoptera (stoneflies) Perlidae *Doroneuria* sp.					
12500900	11- 6-90	31	784	0.22	--	120	--	0.13	0.45
	11- 6-90	27	1,110	.50	--	140	--	.16	.54
	11- 6-90	20	1,290	<.59	--	130	--	.13	.83
	11- 6-90	21	761	.29	--	120	--	.09	.40
				Plecoptera (stoneflies) Perlidae *Hesperoperla* sp.					
12479500	11- 4-90	26	106	.92	--	38	--	.12	.92
12479750	11- 3-90	28	152	<.31	--	55	--	<.06	7.1
12481900	11- 3-90	24	108	.57	--	40	--	<.09	.56
12483190	11- 2-90	24	541	<.65	--	40	--	<.13	.83
12483750	11- 2-90	25	186	.44	--	39	--	.05	.12
	11- 2-90	26	249	.38	--	37	--	.15	.27
	11- 2-90	26	320	.93	--	35	--	.13	.41
12484500	11- 5-90	25	204	.44	--	63	--	.10	.84
12489100	11- 1-90	21	137	<.23	--	45	--	<.05	.12
12489150	11- 8-90	27	356	.48	--	35	--	.09	.30
	11- 8-90	22	308	.38	--	41	--	.13	.23
	11- 8-90	16	208	<.14	--	31	--	.08	.13
12500900	11- 6-90	19	376	<.55	--	110	--	<.11	<.26
12507594	11- 7-90	17	511	<.20	--	26	--	.15	.22
	11- 7-90	18	566	<.21	--	27	--	.14	.49
	11- 7-90	17	537	<.23	--	22	--	.16	.17
	11- 7-90	19	644	.40	--	18	--	.15	.33
				Plecoptera (stoneflies) Perlodidae *Isoperla* sp.					
12483750	11- 2-90	24	264	<4.5	--	48	--	<.92	<2.2
				Plecoptera (stoneflies) Perlodidae *Megarcys* sp.					
12481900	11- 3-90	36	824	<1.7	--	32	--	<.35	2.4
12483190	11- 2-90	30	851	< .64	--	37	--	.20	1.6
	11- 2-90	23	1,620	1.0	--	50	--	.23	2.4
12488250	11- 1-90	11	952	<.47	--	45	--	.15	.26
				Plecoptera (stoneflies) Perlodidae *Perlinodes* sp.					
12479750	11- 3-90	15	6,310	3.9	--	260	--	.11	87
	11- 3-90	14	4,340	2.7	--	190	--	<.08	64
12487200	10-30-90	15	3,540	2.8	--	170	--	.42	2.2
12489150	11- 8-90	21	3,420	1.8	--	130	--	.40	2.3
	11- 8-90	22	3,130	1.7	--	130	--	.43	2.3

Table 30. Concentrations of major and minor elements in aquatic insects, Yakima River Basin, Washington, 1989-90—Continued

Station number	Date	Copper	Iron	Lead	Magnesium	Manganese	Mercury	Molybdenum	Nickel
				Plecoptera (stoneflies) Perlodidae *Skwala* sp.					
12479750	11- 3-90	18	2,420	1.1	--	96	--	<0.09	34
12483190	11- 2-90	18	1,890	.97	--	58	--	.16	2.3
	11- 2-90	22	1,280	<.80	--	40	--	.22	1.8
12483750	11- 2-90	24	980	1.1	--	51	--	.26	.76
12484500	11- 5-90	9.8	1,560	.77	--	110	--	.13	4.9
	11- 5-90	11	852	.46	--	73	--	.16	3.2
	11- 5-90	16	1,070	.57	--	86	--	.17	4.0
	11- 5-90	20	1,420	.56	--	96	--	.13	4.2
	11- 5-90	20	1,190	.48	--	88	--	.17	4.4
12484550	11- 5-90	27	2,430	.73	--	190	--	.51	.81
	11- 5-90	25	2,330	<.42	--	180	--	.36	.79
12487200	10-30-90	14	2,270	2.8	--	85	--	<.24	1.4
12489150	11- 8-90	23	1,920	.99	--	58	--	.30	1.1
	11- 8-90	21	1,340	.94	--	44	--	.21	.63
12499000	11- 4-90	19	341	<.53	--	32	--	.20	.38
12508500	11- 7-90	18	1,120	.28	--	200	--	.44	.66
	11- 7-90	12	1,270	<.29	--	200	--	.39	.72
				Plecoptera (stoneflies) Pteronarcidae *Pteronarcys* sp.					
12479500	11- 4-90	29	900	.89	--	130	--	.19	6.9
	11- 4-90	36	1,520	.44	--	150	--	.15	8.5
	11- 4-90	38	1,480	1.0	--	150	--	.23	7.6
	11- 4-90	23	1,280	.79	--	140	--	.23	6.9
12481900	11- 3-90	8.0	790	.65	--	66	--	.10	4.5
12483190	11- 2-90	17	896	.40	--	120	--	.06	4.5
	11- 2-90	20	932	.48	--	150	--	.10	4.2
	11- 2-90	19	1,930	<2.1	--	150	--	<.44	4.1
12487200	10-30-90	21	992	.55	--	78	--	.30	.56
	10-30-90	22	1,410	.56	--	120	--	.40	.93
12488250	11- 1-90	21	1,400	<.21	--	140	--	.41	.95
12489100	11- 1-90	25	740	<.32	--	62	--	<.06	1.3
12489150	11- 8-90	22	1,340	.74	--	68	--	.26	1.2
	11- 8-90	25	818	.52	--	51	--	.21	1.0
	11- 8-90	22	457	.39	--	42	--	.15	.87
	11- 8-90	18	1,660	.77	--	91	--	.52	1.2
12500900	11- 6-90	19	2,620	.51	--	460	--	.12	.89
	11- 6-90	13	2,010	.27	--	340	--	.18	.66
				Plecoptera (stoneflies)					
12484550	5- 3-89	19	842	<4.0	2,070	75	.09	<1.0	<1.0
12488250	11- 7-89	52	890	<40	2,200	120	.13	<10	<20
12507594	11- 9-89	44	450	<6.0	3,430	61	.08	<1.0	<2.0

Table 30. Concentrations of major and minor elements in aquatic insects, Yakima River Basin, Washington, 1989-90—Continued

Station number	Date	Copper	Iron	Lead	Magnesium	Manganese	Mercury	Molybdenum	Nickel
				Trichoptera (caddisflies) Hydropsychidae *Arctopsyche* sp.					
12479500	11- 4-90	8.0	562	1.4	--	200	--	0.29	2.1
12479750	11- 3-90	12	1,500	<1.0	--	260	--	<.21	42
12481900	11- 3-90	8.9	492	.57	--	170	--	.12	2.4
	11- 3-90	10	546	.46	--	180	--	.15	2.5
	11- 3-90	11	538	.56	--	170	--	.15	2.6
	11- 3-90	9.5	586	.37	--	180	--	.14	2.7
	11- 3-90	11	657	1.2	--	190	--	<.14	2.7
12483190	11- 2-90	10	885	.34	--	150	--	.18	2.2
	11- 2-90	9.3	781	.48	--	140	--	.19	1.9
12483750	11- 2-90	7.8	1,030	27	--	300	--	.21	.72
	11- 2-90	10	862	27	--	260	--	.29	.68
	11- 2-90	9.2	750	17	--	220	--	.22	.46
12487200	10-30-90	6.7	810	.85	--	260	--	.29	.51
12488250	11- 1-90	12	911	<2.1	--	250	--	<.43	<1.0
12489100	11- 1-90	8.5	1,170	<.37	--	440	--	<.08	.83
	11- 1-90	10	925	.41	--	340	--	.16	.96
	11- 1-90	9.3	1,090	<.56	--	440	--	<.11	.74
12489150	11- 8-90	5.9	617	<.44	--	170	--	.27	.41
12499000	11- 4-90	10	1,040	.73	--	480	--	.39	.93
12500900	11- 6-90	26	2,400	.49	--	420	--	.30	.54
	11- 6-90	14	3,340	<.53	--	510	--	.30	.55
	11- 6-90	9.5	1,060	<.20	--	850	--	.23	.32
	11- 6-90	9.7	1,570	<.19	--	800	--	.31	.41
12503950	11- 6-90	12	1,630	1.3	--	1,320	--	.46	3.9
				Trichoptera (caddisflies) Hydropsychidae *Cheumatopsyche* spp.					
12484500	11- 5-90	9.9	3,690	1.4	--	770	--	.65	7.2
	11- 5-90	14	3,740	1.2	--	740	--	.77	7.4
12499000	11- 4-90	4.4	3,180	2.1	--	870	--	.51	1.7
	11- 4-90	4.1	3,490	1.7	--	840	--	.65	1.3
	11- 4-90	11	3,430	1.8	--	810	--	.89	1.6
12503950	11- 6-90	12	3,540	2.4	--	1,460	--	.99	5.5
12508620	11- 7-90	19	6,000	3.2	--	4,480	--	1.5	4.7
				Trichoptera (caddisflies) Hydropsychidae *Hydropsyche amblis*					
12479500	11- 4-90	12	1,280	2.1	--	250	--	.56	3.4
12483750	11- 2-90	14	2,240	.97	--	390	--	.40	1.0
	11- 2-90	14	1,790	.75	--	350	--	.47	.83
12484550	11- 5-90	17	2,680	.48	--	590	--	.81	.87
	11- 5-90	15	1,930	.28	--	660	--	.70	.78
	11- 5-90	17	2,660	<.43	--	710	--	.67	.97
	11- 5-90	14	2,720	.55	--	710	--	.68	1.0
12487200	10-30-90	12	1,050	.72	--	250	--	.98	.67
12489100	11- 1-90	13	935	.45	--	120	--	.26	.56
	11- 1-90	13	1,100	.30	--	120	--	.20	.60

Table 30. Concentrations of major and minor elements in aquatic insects, Yakima River Basin, Washington, 1989-90—Continued

Station number	Date	Copper	Iron	Lead	Magnesium	Manganese	Mercury	Molybdenum	Nickel
				Trichoptera (caddisflies) Hydropsychidae *Hydropsyche amblis*					
12489150	11- 8-90	9.3	1,520	0.87	--	180	--	0.52	0.73
	11- 8-90	12	1,480	.96	--	180	--	.67	.76
	11- 8-90	12	1,660	.61	--	180	--	.58	.96
	11- 8-90	14	1,780	.95	--	190	--	.57	.94
12500900	11- 6-90	13	5,050	<.96	--	1,030	--	.56	.73
12507594	11- 7-90	8.4	3,680	<.50	--	100	--	.34	.75
	11- 7-90	6.4	2,470	.52	--	82	--	.37	.44
	11- 7-90	12	3,460	.44	--	92	--	.69	.59
	11- 7-90	10	3,800	.86	--	120	--	.49	.77
	11- 7-90	10	3,140	.72	--	100	--	.53	.66
				Trichoptera (caddisflies) Hydropsychidae *Hydropsyche californica*					
12484440	10-31-90	8.7	3,360	1.9	--	500	--	.96	1.9
	10-31-90	16	3,370	.98	--	590	--	1.0	2.1
12484480	10-31-90	10	3,800	1.2	--	610	--	.94	2.3
12499000	11- 4-90	6.3	1,770	.80	--	570	--	.56	.94
	11- 4-90	12	1,750	.91	--	580	--	.90	1.0
	11- 4-90	11	1,660	.78	--	560	--	.89	1.0
	11- 4-90	10	1,540	.66	--	590	--	.81	1.0
12500437	11- 9-90	23	1,770	2.4	--	180	--	1.2	.94
	11- 9-90	17	1,660	2.3	--	180	--	1.2	.92
	11- 9-90	24	1,780	2.4	--	180	--	1.2	.92
12500442	11- 5-90	14	1,730	5.2	--	1,590	--	.81	2.3
	11- 5-90	18	3,200	6.6	--	1,300	--	1.0	2.6
	11- 5-90	18	3,180	5.2	--	1,300	--	1.1	2.3
	11- 5-90	17	3,470	6.5	--	1,330	--	1.1	2.6
	11- 5-90	14	2,860	4.9	--	1,680	--	.99	2.4
	11- 5-90	17	2,850	4.9	--	1,500	--	1.1	2.3
12502500	11- 6-90	14	4,870	4.4	--	3,600	--	.95	4.9
	11- 6-90	9.9	3,720	3.3	--	3,140	--	.84	4.2
	11- 6-90	10	3,870	3.6	--	2,600	--	.75	4.3
	11- 6-90	8.2	3,350	3.5	--	2,130	--	.55	3.7
	11- 6-90	7.2	2,900	3.0	--	1,810	--	.59	3.1
	11- 6-90	5.6	2,130	2.3	--	1,280	--	.46	2.3
12503950	11- 6-90	8.5	1,350	.30	--	960	--	.48	3.4
	11- 6-90	14	1,940	3.0	--	770	--	1.1	3.6
12505460	11- 8-90	16	4,590	3.0	--	6,020	--	2.8	4.3
	11- 8-90	17	5,020	1.4	--	4,770	--	2.5	4.0
	11- 8-90	16	2,960	1.5	--	5,180	--	1.9	3.9
12507525	11- 4-90	13	1,830	.52	--	580	--	.99	2.5
	11- 4-90	11	1,350	.43	--	680	--	.89	2.2
	11- 4-90	13	1,650	.56	--	730	--	1.1	2.3
12508500	11- 7-90	14	3,110	.55	--	2,970	--	1.5	1.7
	11- 7-90	13	3,330	.56	--	3,050	--	1.4	1.7
	11- 7-90	13	3,030	.48	--	2,700	--	1.4	1.6
	11- 7-90	12	3,450	.64	--	2,960	--	1.3	1.7
	11- 7-90	12	3,380	.65	--	2,190	--	1.4	1.8

Table 30. Concentrations of major and minor elements in aquatic insects, Yakima River Basin, Washington, 1989-90—Continued

Station number	Date	Copper	Iron	Lead	Magnesium	Manganese	Mercury	Molybdenum	Nickel
				Trichoptera (caddisflies) Hydropsychidae *Hydropsyche californica*					
12508620	11- 7-90	12	3,900	1.2	--	3,990	--	1.6	3.8
	11- 7-90	14	5,240	2.2	--	3,030	--	1.7	4.0
	11- 7-90	12	2,330	1.2	--	3,820	--	.88	3.9
	11- 7-90	15	5,500	1.8	--	2,740	--	1.6	4.4
	11- 7-90	16	4,580	1.2	--	3,430	--	1.3	3.8
	11- 7-90	15	4,850	1.9	--	2,910	--	1.6	3.9
12508850	11- 4-90	16	3,810	2.5	--	2,830	--	1.9	3.3
	11- 4-90	17	3,680	2.4	--	2,840	--	1.8	3.4
	11- 4-90	11	2,710	2.2	--	2,960	--	1.4	3.2
12509050	11- 4-90	13	2,380	1.0	--	2,540	--	.66	3.1
12510500	11- 4-90	16	2,750	1.7	--	1,130	--	1.1	3.4
	11- 4-90	11	2,600	1.3	--	1,240	--	1.1	3.2
	11- 4-90	15	2,350	.96	--	1,260	--	1.2	2.6
	11- 4-90	14	2,210	1.2	--	1,340	--	1.2	2.8
				Trichoptera (caddisflies) Hydropsychidae *Hydropsyche cockerelli*					
12479500	11- 4-90	11	1,050	.88	--	240	--	.56	2.6
	11- 4-90	11	1,090	1.5	--	250	--	.63	2.9
	11- 4-90	11	955	.64	--	220	--	.62	2.5
12484440	10-31-90	13	3,060	1.2	--	490	--	.58	2.4
	10-31-90	8.7	4,080	1.2	--	440	--	.62	2.2
	10-31-90	8.2	3,140	1.6	--	500	--	.54	2.1
12484480	10-31-90	14	5,080	1.9	--	470	--	.62	3.0
	10-31-90	16	3,060	1.3	--	560	--	.58	2.8
	10-31-90	12	4,600	1.6	--	560	--	.60	2.8
12484500	11- 5-90	11	2,100	.66	--	510	--	.65	5.2
	11- 5-90	6.0	1,820	.63	--	460	--	.72	4.8
12487200	10-30-90	10	1,250	1.1	--	260	--	.85	.63
	10-30-90	8.6	1,340	1.1	--	290	--	.76	.77
12499000	11- 4-90	10	2,020	.96	--	770	--	.85	1.4
12503950	11- 6-90	6.8	948	.51	--	990	--	.42	2.5
	11- 6-90	14	2,280	2.0	--	830	--	.78	4.1
12508850	11- 4-90	13	5,720	3.3	--	2,670	--	1.7	4.0
12509710	11- 8-90	12	3,870	1.5	--	600	--	1.1	2.7
	11- 8-90	13	3,100	2.2	--	610	--	.65	3.2
	11- 8-90	15	6,030	3.0	--	630	--	.73	4.0
	11- 8-90	14	7,120	3.7	--	640	--	.70	4.8
				Trichoptera (caddisflies) Hydropsychidae *Hydropsyche occidentalis*					
12479500	11- 4-90	8.1	1,440	1.1	--	320	--	.46	3.3
	11- 4-90	10	1,240	.93	--	290	--	.66	3.4
	11- 4-90	12	1,350	.81	--	310	--	.74	3.6
12484500	11- 5-90	12	2,660	1.0	--	570	--	.78	6.5
	11- 5-90	11	2,680	.75	--	590	--	.68	6.6
	11- 5-90	9.2	2,120	1.0	--	410	--	.57	5.2
12499000	11- 4-90	8.3	1,850	1.2	--	560	--	0.78	1.1

Table 30. Concentrations of major and minor elements in aquatic insects, Yakima River Basin, Washington, 1989-90—Continued

Station number	Date	Copper	Iron	Lead	Magnesium	Manganese	Mercury	Molybdenum	Nickel
				Trichoptera (caddisflies) Hydropsychidae *Hydropsyche* sp.					
12479500	11- 4-90	11	1,130	2.2	--	270	--	.77	3.4
				Trichoptera (caddisflies) Hydropsychidae *Parapsyche* sp.					
12488250	11- 1-90	15	976	<.39	--	310	--	.41	.31
				Trichoptera (caddisflies)					
12478100	11- 2-89	17	1,560	<50	1,700	700	0.14	10	<20
12479500	11- 2-89	21	1,800	<5.0	1,760	700	.09	<1.0	21
	11- 6-89	21	3,630	<10	2,840	720	.09	<3.0	27
12484480	11- 6-89	15	14,900	<4.0	2,070	1,050	.07	<2.0	6.4
	11- 6-89	15	11,900	<4.0	1,930	870	.07	<2.0	7.4
12484500	5- 3-89	18	2,970	10	1,210	660	.15	<1.0	10
	11- 1-89	15	6,250	<4.0	1,310	870	.05	<1.0	9.6
	11- 5-89	15	3,180	<4.0	1,030	880	.04	<1.0	7.5
12484550	11- 8-89	14	3,040	<4.0	795	462	.05	<1.0	<2.0
	11- 8-89	14	3,010	<4.0	798	459	--	<1.0	<2.0
12489100	11- 7-89	25	2,060	<70	1,650	310	.16	<20	<30
12500437	5- 1-89	48	6,040	<7.0	895	260	.07	<2.0	2.0
12500442	11- 4-89	20	4,720	8.0	1,600	1,450	.09	<1.0	4.0
	11- 4-89	21	4,600	9.0	1,440	1,480	.08	<1.0	4.0
12503950	11- 4-89	16	3,300	<4.0	1,170	1,540	.09	<1.0	5.1
	11- 4-89	17	7,400	<4.0	1,890	1,500	.05	<1.0	11
12505460	11- 3-89	20	13,200	5.0	2,850	4,610	.07	<2.0	7.5
12507508	11- 3-89	16	2,480	<4.0	1,040	2,180	.10	<1.0	3.0
	11- 3-89	16	2,440	<4.0	1,030	2,140	--	<1.0	2.0
12508620	11- 3-89	18	8,790	<4.0	1,840	3,670	.07	<2.0	8.3
	11- 3-89	16	10,100	<4.0	2,230	4,120	.09	<2.0	13
12508850	11- 1-89	19	9,060	5.0	2,500	2,790	.06	<2.0	6.7
	11- 1-89	20	7,090	5.0	2,220	2,970	.06	<1.0	5.1
12509050	10-31-89	14	3,730	<4.0	1,090	2,210	.06	<1.0	3.0
	10-31-89	14	3,720	<4.0	1,090	2,190	--	<1.0	3.0
	10-31-89	14	2,030	<4.0	977	2,170	.07	<1.0	2.0
12509710	10-30-89	32	10,300	<6.0	3,380	1,490	.09	<2.0	6.0
	10-30-89	17	6,020	<4.0	2,220	800	.09	<1.0	4.0
12510500	10-30-89	29	7,210	<5.0	2,620	2,150	.07	<2.0	9.3
	10-30-89	29	6,850	<5.0	2,530	2,310	.06	<2.0	8.3

Table 30. Concentrations of major and minor elements in aquatic insects, Yakima River Basin, Washington, 1989-90—Continued

Station number	Date	Selenium	Silver	Strontium	Thallium	Titanium	Vanadium	Zinc
Ephemeroptera (mayflies)								
12479720	5- 2-89	2.0	<2.0	7.0	<6.0	--	3.5	533
Plecoptera (stoneflies) Perlidae *Calineuria* sp.								
12479750	11- 3-90	--	.14	--	--	5.1	.50	136
	11- 3-90	--	.14	--	--	7.0	.47	149
12481900	11- 3-90	--	.13	--	--	4.9	.55	161
	11- 3-90	--	.15	--	--	6.5	.42	200
12483750	11- 2-90	--	.17	--	--	5.7	.50	248
	11- 2-90	--	.20	--	--	12	.59	244
	11- 2-90	--	.25	--	--	13	.59	262
12484550	11- 5-90	--	.09	--	--	36	2.0	224
	11- 5-90	--	<.04	--	--	12	1.4	210
12487200	10-30-90	--	.08	--	--	3.7	.97	164
	10-30-90	--	.11	--	--	12	.67	181
	10-30-90	--	.15	--	--	9.2	.50	261
12489100	11- 1-90	--	.07	--	--	3.8	.23	187
	11- 1-90	--	.09	--	--	4.8	.23	195
Plecoptera (stoneflies) Perlidae *Claassenia* sp.								
12479500	11- 4-90	--	.30	--	--	7.8	.40	174
12479750	11- 3-90	--	.20	--	--	5.8	.31	187
12483750	11- 2-90	--	.21	--	--	8.2	.38	347
12484500	11- 5-90	--	.14	--	--	13	1.0	212
	11- 5-90	--	.13	--	--	16	1.1	205
12487200	10-30-90	--	.15	--	--	5.6	.28	352
12489100	11- 1-90	--	.13	--	--	3.4	.07	284
12489150	11- 8-90	--	.14	--	--	10	.48	208
	11- 8-90	--	.13	--	--	5.1	.31	229
Plecoptera (stoneflies) Perlidae *Doroneuria* sp.								
12479500	11- 4-90	--	.30	--	--	6.6	.67	216
12481900	11- 3-90	--	.11	--	--	5.2	.60	215
	11- 3-90	--	.13	--	--	8.3	.96	247
12483190	11- 2-90	--	.10	--	--	5.4	1.0	194
	11- 2-90	--	.14	--	--	21	2.0	241
12488250	11- 1-90	--	.06	--	--	4.3	.26	254

Table 30. Concentrations of major and minor elements in aquatic insects, Yakima River Basin, Washington, 1989-90—Continued

Station number	Date	Selenium	Silver	Strontium	Thallium	Titanium	Vanadium	Zinc
				Plecoptera (stoneflies) Perlidae *Doroneuria* sp.				
12500900	11- 6-90	--	<0.02	--	--	5.3	2.2	242
	11- 6-90	--	.04	--	--	6.2	2.7	258
	11- 6-90	--	<.07	--	--	10	3.1	217
	11- 6-90	--	.03	--	--	4.1	2.1	216
				Plecoptera (stoneflies) Perlidae *Hesperoperla* sp.				
12479500	11- 4-90	--	.22	--	--	6.2	0.34	372
12479750	11- 3-90	--	.10	--	--	4.4	.28	276
12481900	11- 3-90	--	<.06	--	--	4.6	.34	314
12483190	11- 2-90	--	<.08	--	--	18	1.6	384
12483750	11- 2-90	--	.10	--	--	5.1	.54	415
	11- 2-90	--	.14	--	--	11	.73	462
	11- 2-90	--	.18	--	--	14	.88	473
12484500	11- 5-90	--	.08	--	--	14	.71	351
12489100	11- 1-90	--	.08	--	--	3.0	.27	372
12489150	11- 8-90	--	.07	--	--	9.3	.92	432
	11- 8-90	--	.06	--	--	6.2	.76	372
	11- 8-90	--	.04	--	--	4.7	.57	336
12500900	11- 6-90	--	<.07	--	--	13	1.1	376
12507594	11- 7-90	--	.06	--	--	6.5	.70	338
	11- 7-90	--	.05	--	--	3.4	1.1	328
	11- 7-90	--	.08	--	--	4.0	.96	354
	11- 7-90	--	.10	--	--	9.7	1.0	354
				Plecoptera (stoneflies) Perlodidae *Isoperla* sp.				
12483750	11- 2-90	--	<.57	--	--	24	.72	387
				Plecoptera (stoneflies) Perlodidae *Megarcys* sp.				
12481900	11- 3-90	--	<.21	--	--	40	2.4	271
12483190	11- 2-90	--	.10	--	--	26	2.1	271
	11- 2-90	--	<.08	--	--	46	4.3	241
12488250	11- 1-90	--	<.06	--	--	16	1.7	127
				Plecoptera (stoneflies) Perlodidae *Perlinodes* sp.				
12479750	11- 3-90	--	<.04	--	--	28	13	86
	11- 3-90	--	<.05	--	--	57	7.4	83
12487200	10-30-90	--	<.04	--	--	53	7.7	141
12489150	11- 8-90	--	<.04	--	--	13	9.3	104
	11- 8-90	--	.22	--	--	5.7	9.3	109

Table 30. Concentrations of major and minor elements in aquatic insects, Yakima River Basin, Washington, 1989-90—Continued

Station number	Date	Selenium	Silver	Strontium	Thallium	Titanium	Vanadium	Zinc
				Plecoptera (stoneflies) Perlodidae *Skwala* sp.				
12479750	11- 3-90	--	<0.06	--	--	26	4.7	102
12483190	11- 2-90	--	<.05	--	--	21	5.5	164
	11- 2-90	--	<.10	--	--	54	3.6	154
12483750	11- 2-90	--	.12	--	--	46	3.0	314
12484500	11- 5-90	--	<.03	--	--	9.0	5.2	132
	11- 5-90	--	.03	--	--	9.2	2.8	120
	11- 5-90	--	.03	--	--	6.5	3.3	137
	11- 5-90	--	<.04	--	--	6.4	4.3	122
	11- 5-90	--	.03	--	--	9.7	3.7	140
12484550	11- 5-90	--	<.06	--	--	77	6.7	119
	11- 5-90	--	<.05	--	--	7.0	6.6	111
12487200	10-30-90	--	<.15	--	--	112	5.3	203
12489150	11- 8-90	--	<.06	--	--	27	5.4	121
	11- 8-90	--	<.06	--	--	45	3.4	132
12499000	11- 4-90	--	<.06	--	--	11	.80	227
12508500	11- 7-90	--	<.04	--	--	12	3.4	133
	11- 7-90	--	<.04	--	--	28	3.6	142
				Plecoptera (stoneflies) Pteronarcidae *Pteronarcys* sp.				
12479500	11- 4-90	--	<.02	--	--	6.0	2.4	115
	11- 4-90	--	.05	--	--	7.1	3.9	116
	11- 4-90	--	<.03	--	--	9.0	3.8	117
	11- 4-90	--	<.03	--	--	9.9	3.3	157
12481900	11- 3-90	--	<.03	--	--	3.5	3.7	124
12483190	11- 2-90	--	<.02	--	--	2.2	4.2	100
	11- 2-90	--	<.02	--	--	3.5	4.6	122
	11- 2-90	--	<.27	--	--	74	6.6	172
12487200	10-30-90	--	.03	--	--	9.5	2.7	141
	10-30-90	--	.04	--	--	6.2	4.3	118
12488250	11- 1-90	--	<.02	--	--	2.7	2.8	114
12489100	11- 1-90	--	.06	--	--	2.9	1.9	136
12489150	11- 8-90	--	<.04	--	--	8.4	4.2	163
	11- 8-90	--	<.02	--	--	3.6	2.9	154
	11- 8-90	--	<.02	--	--	6.1	1.6	113
	11- 8-90	--	<.09	--	--	5.7	4.8	172
12500900	11- 6-90	--	<.02	--	--	11	8.6	113
	11- 6-90	--	<.03	--	--	3.2	6.5	138
				Plecoptera (stoneflies)				
12484550	5- 3-89	2.4	<2.0	24	<6.0	--	2.6	143
12488250	11- 7-89	4.5	<20	8.6	<90	--	<4.0	529
12507594	11- 9-89	.59	<3.0	31	<10	--	1.0	722

Table 30. Concentrations of major and minor elements in aquatic insects, Yakima River Basin, Washington, 1989-90—Continued

Station number	Date	Selenium	Silver	Strontium	Thallium	Titanium	Vanadium	Zinc
				Trichoptera (caddisflies) Hydropsychidae *Arctopsyche* sp.				
12479500	11- 4-90	--	<0.07	--	--	16	1.1	114
12479750	11- 3-90	--	<.13	--	--	37	2.8	143
12481900	11- 3-90	--	<.03	--	--	8.3	1.7	132
	11- 3-90	--	<.02	--	--	5.5	2.0	127
	11- 3-90	--	<.04	--	--	12	1.9	136
	11- 3-90	--	<.04	--	--	11	2.2	148
	11- 3-90	--	<.09	--	--	17	2.4	156
12483190	11- 2-90	--	<.03	--	--	6.4	2.8	139
	11- 2-90	--	<.03	--	--	8.2	2.5	126
12483750	11- 2-90	--	<.08	--	--	32	4.1	202
	11- 2-90	--	<.04	--	--	7.6	3.5	187
	11- 2-90	--	<.02	--	--	8.9	2.8	147
12487200	10-30-90	--	<.04	--	--	11	1.6	192
12488250	11- 1-90	--	<.26	--	--	35	1.3	137
12489100	11- 1-90	--	<.04	--	--	18	2.1	139
	11- 1-90	--	<.04	--	--	14	2.0	139
	11- 1-90	--	<.07	--	--	22	2.0	151
12489150	11- 8-90	--	<.06	--	--	13	1.5	145
12499000	11- 4-90	--	<.06	--	--	13	2.6	109
12500900	11- 6-90	--	<.05	--	--	6.6	6.6	188
	11- 6-90	--	<.07	--	--	10	8.5	188
	11- 6-90	--	<.02	--	--	2.3	4.9	133
	11- 6-90	--	<.02	--	--	3.3	4.8	132
12503950	11- 6-90	--	<.04	--	--	41	5.2	96
				Trichoptera (caddisflies) Hydropsychidae *Cheumatopsyche* spp.				
12484500	11- 5-90	--	<.04	--	--	7.2	9.9	83
	11- 5-90	--	<.04	--	--	2.2	11	79
12499000	11- 4-90	--	<.04	--	--	3.0	8.8	98
	11- 4-90	--	<.03	--	--	3.1	8.6	92
	11- 4-90	--	<.04	--	--	2.9	9.2	90
12503950	11- 6-90	--	<.09	--	--	121	9.5	98
12508620	11- 7-90	--	<.12	--	--	140	22	102
				Trichoptera (caddisflies) Hydropsychidae *Hydropsyche amblis*				
12479500	11- 4-90	--	<.08	--	--	51	2.6	85
12483750	11- 2-90	--	<.04	--	--	11	7.8	133
	11- 2-90	--	<.03	--	--	7.1	6.3	128
12484550	11- 5-90	--	<.04	--	--	5.7	8.4	101
	11- 5-90	--	<.03	--	--	<.03	7.8	91
	11- 5-90	--	<.05	--	--	.20	9.5	117
	11- 5-90	--	<.04	--	--	<.04	9.5	118
12487200	10-30-90	--	<.04	--	--	19	2.1	122
12489100	11- 1-90	--	<.02	--	--	18	1.6	78
	11- 1-90	--	<.02	--	--	12	2.4	86

Table 30. Concentrations of major and minor elements in aquatic insects, Yakima River Basin, Washington, 1989-90—Continued

Station number	Date	Selenium	Silver	Strontium	Thallium	Titanium	Vanadium	Zinc
				Trichoptera (caddisflies) Hydropsychidae *Hydropsyche amblis*				
12489150	11- 8-90	--	<0.05	--	--	4.4	4.0	111
	11- 8-90	--	<.05	--	--	1.8	3.8	106
	11- 8-90	--	<.06	--	--	9.2	4.2	111
	11- 8-90	--	<.06	--	--	6.4	5.1	114
12500900	11- 6-90	--	<.12	--	--	100	12	152
12507594	11- 7-90	--	<.06	--	--	7.7	5.0	130
	11- 7-90	--	<.03	--	--	.47	3.9	105
	11- 7-90	--	<.04	--	--	58	4.2	102
	11- 7-90	--	<.08	--	--	18	5.3	137
	11- 7-90	--	<.04	--	--	.34	4.8	120
				Trichoptera (caddisflies) Hydropsychidae *Hydropsyche californica*				
12484440	10-31-90	--	<.06	--	--	3.8	12	129
	10-31-90	--	<.03	--	--	17	13	97
12484480	10-31-90	--	<.03	--	--	4.0	15	114
12499000	11- 4-90	--	<.03	--	--	3.4	4.7	116
	11- 4-90	--	<.03	--	--	1.3	4.7	106
	11- 4-90	--	<.03	--	--	2.1	4.6	108
	11- 4-90	--	<.04	--	--	3.1	4.4	104
12500437	11- 9-90	--	<.02	--	--	7.2	5.7	116
	11- 9-90	--	<.02	--	--	8.5	5.6	105
	11- 9-90	--	<.02	--	--	5.8	5.8	101
12500442	11- 5-90	--	<.02	--	--	.98	16	134
	11- 5-90	--	<.03	--	--	2.2	18	159
	11- 5-90	--	<.03	--	--	40	17	150
	11- 5-90	--	<.03	--	--	36	18	160
	11- 5-90	--	<.02	--	--	2.4	18	144
	11- 5-90	--	<.03	--	--	49	16	141
12502500	11- 6-90	--	<.04	--	--	8.3	30	132
	11- 6-90	--	<.03	--	--	51	23	116
	11- 6-90	--	<.03	--	--	6.6	23	104
	11- 6-90	--	<.03	--	--	10	20	92
	11- 6-90	--	<.03	--	--	6.2	17	81
	11- 6-90	--	<.03	--	--	6.6	12	64
12503950	11- 6-90	--	<.02	--	--	3.0	5.8	81
	11- 6-90	--	<.09	--	--	--	5.9	120
12505460	11- 8-90	--	<.04	--	--	62	22	119
	11- 8-90	--	<.02	--	--	12	24	92
	11- 8-90	--	<.02	--	--	3.0	26	98
12507525	11- 4-90	--	<.02	--	--	3.5	5.7	82
	11- 4-90	--	<.02	--	--	3.4	5.1	67
	11- 4-90	--	<.02	--	--	10	5.1	71
12508500	11- 7-90	--	<.03	--	--	27	7.8	109
	11- 7-90	--	<.03	--	--	38	8.0	116
	11- 7-90	--	<.03	--	--	22	7.4	107
	11- 7-90	--	<.03	--	--	34	8.5	124
	11- 7-90	--	<.06	--	--	60	7.6	135

Table 30. Concentrations of major and minor elements in aquatic insects, Yakima River Basin, Washington, 1989-90—Continued

Station number	Date	Selenium	Silver	Strontium	Thallium	Titanium	Vanadium	Zinc
Trichoptera (caddisflies) Hydropsychidae *Hydropsyche californica*								
12508620	11- 7-90	--	<0.02	--	--	83	16	88
	11- 7-90	--	<.07	--	--	112	19	109
	11- 7-90	--	<.02	--	--	6.2	16	88
	11- 7-90	--	<.05	--	--	84	19	101
	11- 7-90	--	<.03	--	--	15	18	86
	11- 7-90	--	<.07	--	--	143	17	104
12508850	11- 4-90	--	<.03	--	--	8.4	18	88
	11- 4-90	--	<.02	--	--	6.2	18	88
	11- 4-90	--	<.02	--	--	12	15	85
12509050	11- 4-90	--	<.02	--	--	2.5	12	67
12510500	11- 4-90	--	<.04	--	--	2.2	8.7	98
	11- 4-90	--	<.02	--	--	4.0	8.4	100
	11- 4-90	--	<.02	--	--	7.0	7.4	80
	11- 4-90	--	<.02	--	--	9.3	6.5	82
Trichoptera (caddisflies) Hydropsychidae *Hydropsyche cockerelli*								
12479500	11- 4-90	--	<.04	--	--	37	2.0	76
	11- 4-90	--	<.04	--	--	21	2.2	89
	11- 4-90	--	<.03	--	--	16	1.8	80
12484440	10-31-90	--	<.03	--	--	2.9	14	93
	10-31-90	--	<.02	--	--	4.7	15	93
	10-31-90	--	<.03	--	--	2.4	15	98
12484480	10-31-90	--	<.04	--	--	32	16	116
	10-31-90	--	<.03	--	--	7.3	16	105
	10-31-90	--	<.03	--	--	3.8	18	105
12484500	11- 5-90	--	<.03	--	--	2.1	6.5	78
	11- 5-90	--	<.03	--	--	1.4	6.4	80
12487200	10-30-90	--	<.04	--	--	--	2.5	--
	10-30-90	--	<.03	--	--	--	2.8	--
12499000	11- 4-90	--	<.03	--	--	3.7	5.2	102
12503950	11- 6-90	--	<.02	--	--	1.7	4.9	71
	11- 6-90	--	<.08	--	--	64	6.5	106
12508850	11- 4-90	--	<.03	--	--	13	20	116
12509710	11- 8-90	--	<.02	--	--	23	9.8	91
	11- 8-90	--	<.02	--	--	12	13	103
	11- 8-90	--	<.03	--	--	12	17	119
	11- 8-90	--	<.05	--	--	33	18	134
Trichoptera (caddisflies) Hydropsychidae Hydropsyche occidentalis								
12479500	11- 4-90	--	<.06	--	--	40	2.7	108
	11- 4-90	--	<.05	--	--	12	2.8	97
	11- 4-90	--	<.04	--	--	34	2.6	96
12484500	11- 5-90	--	<.04	--	--	2.0	8.1	104
	11- 5-90	--	<.03	--	--	6.2	7.9	105
	11- 5-90	--	<.03	--	--	2.3	6.8	91
12499000	11- 4-90	--	<.04	--	--	4.3	5.3	128

Table 30. Concentrations of major and minor elements in aquatic insects, Yakima River Basin, Washington, 1989-90—Continued

Station number	Date	Selenium	Silver	Strontium	Thallium	Titanium	Vanadium	Zinc
				Trichoptera (caddisflies) Hydropsychidae *Hydropsyche* sp.				
12479500	11- 4-90	--	<0.09	--	--	37	2.2	96
				Trichoptera (caddisflies) Hydropsychidae *Parapsyche* sp.				
12488250	11- 1-90	--	<.05	--	--	7.8	1.6	147
				Trichoptera (caddisflies)				
12478100	11- 2-89	4.0	<20	14	<100	--	<5.0	278
12479500	11- 2-89	1.7	<3.0	7.2	<8.0	--	3.8	200
	11- 6-89	1.6	<6.0	10	<30	--	8.0	203
12484480	11- 6-89	.81	<2.0	16	<8.0	--	53	80
	11- 6-89	.89	<2.0	15	<10	--	39	86
12484500	5- 3-89	.80	<2.0	7.6	<8.0	--	7.6	216
	11- 1-89	.65	<2.0	9.6	<6.0	--	12	87
	11- 5-89	.78	<2.0	7.1	<6.0	--	8.5	88
12484550	11- 8-89	1.0	<2.0	5.2	<9.0	--	12	97
	11- 8-89	--	<2.0	5.2	<9.0	--	12	96
12489100	11- 7-89	3.0	<30	13	<100	--	<6.0	260
12500437	5- 1-89	.73	<3.0	6.9	<10	--	16	107
12500442	11- 4-89	1.9	<2.0	11	<6.0	--	25	156
	11- 4-89	1.9	<2.0	9.6	<6.0	--	25	156
12503950	11- 4-89	.91	<2.0	6.3	<6.0	--	11	101
	11- 4-89	.78	<2.0	13	<6.0	--	18	99
12505460	11- 3-89	3.1	<2.0	23	<6.0	--	53	123
12507508	11- 3-89	.84	<2.0	12	<6.0	--	11	86
	11- 3-89	--	<2.0	12	<6.0	--	11	84
12508620	11- 3-89	1.2	<2.0	12	<7.0	--	24	105
	11- 3-89	1.1	<2.0	16	<7.0	--	32	96
12508850	11- 1-89	3.3	<2.0	18	<8.0	--	36	111
	11- 1-89	3.7	<2.0	19	<7.0	--	29	113
12509050	10-31-89	.72	<2.0	7.7	<6.0	--	13	93
	10-31-89	--	<2.0	7.8	<6.0	--	13	91
	10-31-89	.82	<2.0	6.4	<6.0	--	8.7	95
12509710	10-30-89	3.2	<3.0	21	<9.0	--	23	219
	10-30-89	1.7	<2.0	14	<7.0	--	20	109
12510500	10-30-89	2.2	<3.0	15	<9.0	--	20	208
	10-30-89	2.2	<3.0	15	<8.0	--	19	202

Table 31. Concentrations of major and minor elements in aquatic plants, Yakima River Basin, Washington, 1989

[All concentrations are reported in micrograms per gram (µg/g), dry weight, unless otherwise noted; rows of data with identical taxa, station numbers, and dates represent samples that were split into two or more samples in the lab; STP = sewage treatment plant; RM = river mile; "--" = not determined; "<" = less than; organism taxa are listed in the table as follows:

Family (Common name)
Genus species]

Site reference number	Station number	site name	Date	Percent moisture	Aluminum	Arsenic	Barium	Beryllium
		Ceratophyllaceae (coontail) *Ceratophyllum demersum*						
50	12510500	Yakima River at Kiona	10-30-89	94.7	1,210	1.6	50	<0.1
50	12510500	Yakima River at Kiona	10-30-89	94.7	1,210	--	50	< .1
		Potamogetonaceae (curlyleaf pondweed) *Potamogeton crispus*						
16	12484480	Cherry Creek at Thrall	11-06-89	93.8	1,720	.48	61	< .1
19	12484500	Yakima River at Umtanum	11-05-89	93.4	1,300	.54	55	< .1
29	12500442	Wide Hollow Creek at old STP at Union Gap	11-04-89	92.6	1,210	.98	35	< .1
33	12503950	Yakima River at Parker	11-04-89	93.0	1,470	.83	52	< .1
48	12507585	Yakima River at RM 72 above Satus Creek near Sunnyside	11-01-89	94.3	550	.72	28	< .1
47	12508620	Satus Creek at gage at Satus	11-03-89	92.3	1,370	.84	43	< .1
56	12509050	Yakima River at Euclid Bridge at RM 55 near Grandview	10-31-89	92.2	1,460	1.5	41	< .1
50	12510500	Yakima River at Kiona	10-30-89	95.7	1,260	.75	66	< .3
		Hydrocharitaceae (waterweed) *Elodea* sp.						
29	12500442	Wide Hollow Creek at old STP at Union Gap	11-04-89	93.6	3,590	1.6	63	< .1
43	12507508	Toppenish Creek at Indian Church Road near Granger	11-03-89	94.0	3,320	1.5	79	< .1
47	12508620	Satus Creek at gage at Satus	11-03-89	94.2	2,070	1.0	73	< .1
54	12509710	Spring Creek at mouth at Whitstran	10-30-89	94.8	4,280	2.6	146	< .3
		Unidentified attached algae						
3	12479720	Jungle Creek at mouth near Cle Elum	05-02-89	94.7	7,790	11	1,640	< .3
3	12479720	Jungle Creek at mouth near Cle Elum	05-02-89	94.7	--	11	--	--
3	12479720	Jungle Creek at mouth near Cle Elum	05-02-89	96.5	2,920	3.7	33	< .2

Table 31. Concentrations of major and minor elements in aquatic plants, Yakima River Basin, Washington, 1989—Continued

Station number	Date	Boron	Cadmium	Chromium	Copper	Iron	Lead	Magnesium	Manganese
				Ceratophyllaceae (coontail) *Ceratophyllum demersum*					
12510500	10-30-89	7.3	0.50	2.0	13	1,540	< 4	5,730	3,190
12510500	10-30-89	7.0	.60	2.0	12	1,540	< 4	5,720	3,180
				Potamogetonaceae (curlyleaf pondweed) *Potamogeton crispus*					
12484480	11-06-89	7.7	.9	4.0	22	2,410	< 4	2,860	221
12484500	11-05-89	4.0	.4	3.9	9.5	1,700	< 4	2,440	610
12500442	11-04-89	6.0	.4	3.1	21	2,330	< 4	2,260	216
12503950	11-04-89	6.3	< .3	3.2	9.2	2,320	< 4	2,450	647
12507585	11-01-89	6.0	.5	2.0	10	1,020	< 4	2,310	131
12508620	11-03-89	6.0	.4	2.0	11	2,110	< 4	2,450	807
12509050	10-31-89	4.0	< .3	3.0	11	2,350	< 4	2,260	521
12510500	10-30-89	9.0	< .8	3.0	21	1,960	< 10	3,630	603
				Hydrocharitaceae (waterweed) *Elodea* sp.					
12500442	11-04-89	6.7	.9	8.3	20	6,250	7	3,790	593
12507508	11-03-89	5.0	< .3	5.8	13	4,800	< 4	3,070	2,740
12508620	11-03-89	5.0	< .3	3.8	18	3,190	< 4	2,910	2,840
12509710	10-30-89	20	3.3	7.0	65	6,150	< 10	6,760	1,120
				Unidentified attached algae					
12479720	05-02-89	< 4.0	< .4	14	14	19,200	< 10	3,730	342
12479720	05-02-89	--	--	--	--	--	--	--	--
12479720	05-02-89	< 5.0	< .5	5.0	18	5,000	< 10	2,470	99

Table 31. Concentrations of major and minor elements in aquatic plants, Yakima River Basin, Washington, 1989—Continued

Station number	Date	Mercury	Molybdenum	Nickel	Selenium	Silver	Strontium	Thallium	Vanadium	Zinc
				Ceratophyllaceae (coontail) *Ceratophyllum demersum*						
12510500	10-30-89	0.04	< 1	26	0.76	< 2	45	< 9	7.0	51
12510500	10-30-89	--	< 1	26	--	< 2	44	< 9	7.0	51
				Potamogetonaceae (curlyleaf pondweed) *Potamogeton crispus*						
12484480	11-06-89	.05	< 1	5.8	.30	< 2	60	< 9	14	91
12484500	11-05-89	.03	< 1	20	.30	< 2	62	< 9	7.0	61
12500442	11-04-89	.06	< 1	3.0	.40	< 2	48	< 9	13	187
12503950	11-04-89	.05	< 1	6.7	.35	< 2	61	< 9	8.3	84
12507585	11-01-89	.06	< 1	5.7	.20	< 2	54	< 10	4.4	67
12508620	11-03-89	.03	< 1	5.0	.39	< 2	52	< 9	8.1	50
12509050	10-31-89	.03	< 1	5.3	.38	< 2	44	< 9	7.8	61
12510500	10-30-89	.05	< 3	1.0	.70	< 5	88	< 20	8.4	104
				Hydrocharitaceae (waterweed) *Elodea* sp.						
12500442	11-04-89	.08	< 1	8.5	.70	< 2	56	< 9	37	239
12507508	11-03-89	.06	< 1	12	.30	< 2	53	< 9	18	44
12508620	11-03-89	.06	< 1	17	.48	< 2	46	< 9	15	60
12509710	10-30-89	.09	< 3	23	1.2	< 6	140	< 20	51	201
				Unidentified attached algae						
12479720	05-02-89	.08	< 3	11	< .20	< 4	40	< 10	27	81
12479720	05-02-89	--	--	--	< .20	--	--	--	--	--
12479720	05-02-89	.12	< 3	4.0	< .20	< 5	25	< 10	8.7	29

Table 32. Concentrations of major and minor elements in clams, Yakima River Basin, Washington, 1989-90

[All concentrations are reported in micrograms per gram (µg/g), unless otherwise noted; rows of data with identical taxa, station numbers, and dates represent samples that were split into two or more samples in the lab; blw = below; Cr = Creek; RM = river mile; nr = near; "--" = not determined; "<" = less than; organism taxa are listed in the table as follows:
Order (common name)
Family
Genus species]

Site reference number	Station number	Site name	Date	Field number	Percent moisture	Aluminum	Arsenic	Barium	Beryllium
		Veneroida (Asiatic clam)							
		Corbiculidae							
		Corbicula fluminea							
42	12507525	Yakima River blw Toppenish Cr at RM 79.6 nr Granger	11-04-90	YK0374TC	--	--	4.1	--	--
48	12507585	Yakima River at RM 72 above Satus Cr near Sunnyside	11-01-89	YK0104TC	77.1	6	4.8	3.1	0.10
48	12507585	Yakima River at RM 72 above Satus Cr near Sunnyside	11-01-89	YK0105TC	76.0	5	5.3	2.9	< .09
56	12509050	Yakima River at Euclid Bridge at RM 55 nr Grandview	10-31-89	YK0083TC	78.9	17	5.8	5.2	< .10
56	12509050	Yakima River at Euclid Bridge at RM 55 nr Grandview	11-04-90	YK0362TC	--	--	4.8	--	--
56	12509050	Yakima River at Euclid Bridge at RM 55 nr Grandview	11-04-90	YK0363TC	--	--	4.5	--	--
56	12509050	Yakima River at Euclid Bridge at RM 55 nr Grandview	11-04-90	YK0364TC	--	--	4.5	--	--
54	12509710	Spring Creek at mouth at Whitstran	11-08-90	YK0409TC	--	--	3.6	--	--
50	12510500	Yakima River at Kiona	10-30-89	YK0113TC	81.0	14	4.0	3.5	< .10
50	12510500	Yakima River at Kiona	10-30-89	YK0114TC	81.9	7	3.8	3.3	< .10
50	12510500	Yakima River at Kiona	11-04-90	YK0365TC	--	--	4.0	--	--
50	12510500	Yakima River at Kiona	11-04-90	YK0366TC	--	--	4.3	--	--
		Unionoida (western pearlshell)							
		Unionoidae							
		Margaritifera falcata							
19	12484500	Yakima River at Umtanum	11-04-89	YK0112TM	86.2	220	6.1	350	.20

Table 32. Concentrations of major and minor elements in clams, Yakima River Basin, Washington, 1989-90—Continued

Station	Date	Boron	Cadmium	Calcium	Chromium	Cobalt	Copper	Iron	Lead	Magnesium	Manganese	Mercury
					Veneroida (Asiatic clam)							
					Corbiculidae							
					Corbicula fluminea							
12507525	11-04-90	--	0.23	1,350	1.4	1.1	30	178	0.41	643	7.3	0.17
12507585	11-01-89	< 2	< .20	--	1.0	--	30	163	< 4.0	641	13	.14
12507585	11-01-89	< 2	.20	--	1.0	--	27	142	< 4.0	585	9.9	.14
12509050	10-31-89	< 2	.30	--	2.0	--	33	191	< 4.0	660	14	.15
12509050	11-04-90	--	.34	1,630	2.1	.65	35	331	.39	673	22	.17
12509050	11-04-90	--	.34	2,130	1.9	.64	34	236	.36	699	16	.14
12509050	11-04-90	--	.34	1,930	2.1	.63	36	255	.25	653	19	.18
12509710	11-08-90	--	.39	1,600	1.2	.50	25	288	.29	653	7.0	.16
12510500	10-30-89	< 2	.20	--	2.0	--	23	165	< 4.0	628	7.4	.10
12510500	10-30-89	< 2	.20	--	3.0	--	23	177	< 4.0	642	6.8	.10
12510500	11-04-90	--	.28	1,450	1.1	.52	28	195	.16	604	7.3	.11
12510500	11-04-90	--	.27	1,800	1.3	.52	26	207	.21	702	8.0	.10
					Unionoida (western pearlshell)							
					Unionoidae							
					Margaritifera falcata							
12484500	11-04-89	< 2	.50	--	11	--	14	1,480	< 4.0	1,390	3,220	.20

Table 32. Concentrations of major and minor elements in clams, Yakima River Basin, Washington, 1989-90—Continued

Station	Date	Molybdenum	Nickel	Potassium	Selenium	Silver	Sodium	Strontium	Thallium	Titanium	Vanadium	Zinc
					Veneroida (Asiatic clam)							
					Corbiculidae							
					Corbicula fluminea							
12507525	11-04-90	0.37	1.3	1,670	3.0	0.07	859	--	--	0.64	0.21	116
12507585	11-01-89	< 1.0	< 2.0	--	2.5	< 2.0	--	2.8	< 6	--	.40	109
12507585	11-01-89	< 1.0	< 2.0	--	2.2	< 2.0	--	2.2	< 6	--	.30	107
12509050	10-31-89	< 1.0	< 2.0	--	2.3	< 2.0	--	8.3	< 6	--	.50	93
12509050	11-04-90	.48	1.0	2,000	1.9	.07	1,660	--	--	7.5	.62	96
12509050	11-04-90	.50	1.0	2,020	1.8	.07	1,550	--	--	2.4	.47	109
12509050	11-04-90	.55	.79	2,060	2.3	.07	1,630	--	--	1.9	.49	91
12509710	11-08-90	.75	.88	1,790	2.6	.05	1,250	--	--	3.8	.62	452
12510500	10-30-89	< 1.0	2.0	--	1.4	< 2.0	--	3.0	< 6	--	.30	105
12510500	10-30-89	< 1.0	2.0	--	2.2	< 2.0	--	2.9	< 6	--	.40	108
12510500	11-04-90	.44	1.2	1,940	2.3	.04	1,030	--	--	.79	.35	91
12510500	11-04-90	.45	1.2	2,120	2.8	.04	1,070	--	--	.76	.38	105
					Unionoida (western pearlshell)							
					Unionoidae							
					Margaritifera falcata							
12484500	11-04-89	< 1.0	3.0	--	2.3	< 2.0	--	117	< 6	--	1.4	113

Table 33. Concentrations of major and minor elements in fish livers, Yakima River Basin, Washington, 1989-90

[All concentrations are reported in micrograms per gram (µg/g), dry weight, unless otherwise noted; lower limits of determination may differ for some elements due to the use of different methods of determination; rows of data with identical field numbers represent samples that were split into two or more samples in the lab; Cr = Creek; RM = river mile; "--" = not determined; "<" = less than; organism taxa are listed in the table as follows:

Order (common name)
Family
Genus species]

Site reference number	Station number	Site name	Date	Field number	Percent moisture	Alu-minum	Arsenic
		Cypriniformes (bridgelip sucker)					
		Catostomidae					
		Catostomus columbianus					
16	12484480	Cherry Creek at Thrall	11- 6-89	YK0123TF	76.4	<3.0	0.20
27	12500437	Wide Hollow Cr at West Valley Middle School near Ahtanum	5- 1-89	YK0002TF	80.4	19	1.2
40	12505460	Granger Drain at mouth near Granger	11- 3-89	YK0072TF	79.0	8.0	.90
			11- 8-90	YK0387TF	--	--	.80
		Salmoniformes (brook trout)					
		Salmonidae					
		Salvelinus fontinalis					
7	12483750	Naneum Creek below High Creek near Ellensburg	11- 2-90	YK0246TF	--	--	<.50
		Cypriniformes (carp)					
		Cyprinidae					
		Cyprinus carpio					
33	12503950	Yakima River at Parker	11- 6-90	YK0328TF	--	--	.40
48	12507585	Yakima River at RM 72 above Satus Creek near Sunnyside	11- 1-89	YK0057TF	72.6	16	<.20
50	12510500	Yakima River at Kiona	11-10-90	YK0405TF	--	--	.70
		Cypriniformes (chiselmouth)					
		Cyprinidae					
		Acrocheilus alutaceus					
30	12500430	Moxee Drain at Thorp Road near Union Gap	10-31-90	YK0219TF	--	--	.50
29	12500442	Wide Hollow Cr at old sewage treatment plant at Union Gap	11- 8-89	YK0156TF	74.1	100	.60
		Salmoniformes (cutthroat trout)					
		Salmonidae					
		Oncorhynchus clarki					
34	12500900	South Fork Ahtanum Cr above Conrad Ranch near Tampico	11- 6-90	YK0336TF	--	--	.30

Table 33. Concentrations of major and minor elements in fish livers, Yakima River Basin, Washington, 1989-90—Continued

Site reference number	Station number	Site name	Date	Field number	Percent moisture	Alu-minum	Arsenic
		Cypriniformes (largescale sucker) Catostomidae *Catostomus macrocheilus*					
26	12499000	Naches River near North Yakima	11- 6-90	YK0330TF	--	--	0.40
33	12503950	Yakima River at Parker	11- 7-89	YK0142TF	78.2	<3.0	<.20
			11- 6-90	YK0325TF	--	--	.20
			11- 6-90	YK0326TF	--	--	.20
			11- 6-90	YK0327TF	--	--	.20
43	12507508	Toppenish Creek at Indian Church Road near Granger	11- 3-89	YK0074TF	75.0	<3.0	<.20
			11- 3-89	YK0075TF	73.4	3.0	<.20
42	12507525	Yakima River below Toppenish Cr at RM 79.6 near Granger	11- 7-90	YK0373TF	--	--	--
			11- 7-90	YK0376TF	--	--	<.50
48	12507585	Yakima River at river mile 72 above Satus Cr near Sunnyside	11- 1-89	YK0054TF	76.1	<3.0	<.20
47	12508620	Satus Creek at gage at Satus	11- 3-89	YK0077TF	77.3	<3.0	<.20
			11- 7-90	YK0362TF	--	--	.30
52	12508850	Sulphur Creek Wasteway near Sunnyside	11- 1-89	YK0053TF	74.1	<3.0	.20
56	12509050	Yakima River at Euclid Bridge at river mile 55 near Grandview	11- 9-90	YK0399TF	--	--	.10
54	12509710	Spring Creek at mouth at Whitstran	10-30-89	YK0021TF	72.1	80	<2.0
50	12510500	Yakima River at Kiona	10-31-89	YK0043TF	77.7	<3.0	.30
			10-31-89	YK0043TF	77.7	<3.0	.20
			10-31-89	YK0046TF	74.1	<3.0	.30
			11-10-90	YK0406TF	--	--	.30
		Salmoniformes (mountain whitefish) Salmonidae *Prosopium williamsoni*					
6	12479500	Yakima River at Cle Elum	11- 2-89	YK0068TF	78.2	<3.0	<.20
			11- 5-90	YK0306TF	--	--	.10
			11- 5-90	YK0307TF	--	--	.10
			11- 5-90	YK0308TF	--	--	<.30
14	12484440	Cherry Creek above Wipple Wasteway at Thrall	10-31-90	YK0210TF	--	--	.20
19	12484500	Yakima River at Umtanum	11- 7-89	YK0144TF	79.0	<3.0	<.20
26	12499000	Naches River near North Yakima	11- 6-90	YK0333TF	--	--	0.30
			11- 6-90	YK0334TF	--	--	.30
			11- 6-90	YK0335TF	--	--	.20

Table 33. Concentrations of major and minor elements in fish livers, Yakima River Basin, Washington, 1989-90—Continued

Site reference number	Station number	Site name	Date	Field number	Percent moisture	Alu-minum	Arsenic
		Salmoniformes (mountain whitefish) Salmonidae *Prosopium williamsoni*					
33	12503950	Yakima River at Parker	11- 6-90	YK0329TF	--	--	.30
42	12507525	Yakima River below Toppenish Cr at RM 79.6 near Granger	11- 7-90	YK0377TF	--	--	.40
50	12510500	Yakima River at Kiona	10-31-89	YK0042TF	74.8	<3.0	<.20
			10-31-89	YK0042TF	74.8	<3.0	<.20
			11-10-90	YK0407TF	--	--	.20
		Salmoniformes (rainbow trout) Salmonidae *Oncorhynchus mykiss*					
1	12478100	Waptus River at mouth near Roslyn	11- 2-89	YK0066TF	76.9	10	<.90
3	12479720	Jungle Creek near mouth near Cle Elum	5- 2-89	YK0006TF	82.4	23	<9.0
5	12480000	Teanaway River below Forks near Cle Elum	11- 6-89	YK0125TF	79.4	<7.0	<.40
8	12481900	Taneum Creek at Taneum Meadow near Thorp	11- 3-90	YK0267TF	--	--	<.20
12	12483190	South Fork Manastash Creek near Ellensburg	11- 2-90	YK0241TF	--	--	<.50
19	12484500	Yakima River at Umtanum	5- 3-89	YK0016TF	81.2	10	<.20
			5- 3-89	YK0016TF	81.2	11	.20
			11- 5-90	YK0300TF	--	--	<.50
20	12484550	Umtanum Creek near mouth at Umtanum	5- 3-89	YK0012TF	85.2	9.0	<.20
			11- 7-89	YK0146TF	83.5	<3.0	<.20
			11- 5-90	YK0299TF	--	--	<.50
22	12489100	Rattlesnake Creek above North Fork Rattlesnake Cr near Nile	11- 6-89	YK0127TF	75.5	<10	<.70
29	12500442	Wide Hollow Cr at old sewage treatment plant at Union Gap	11- 5-90	YK0310TF	--	--	<.30
57	12507594	Satus Creek above Wilson-Charley Canyon near Toppenish	11- 9-89	YK0162TF	77.8	10	<.40

Table 33. Concentrations of major and minor elements in fish livers, Yakima River Basin, Washington, 1989-90—Continued

Station number	Date	Barium	Beryllium	Boron	Cadmium	Calcium	Chromium	Cobalt	Copper	Iron	Lead	Magnesium
Cypriniformes (bridgelip sucker) Catostomidae *Catostomus columbianus*												
12484480	11- 6-89	0.10	<0.10	<2.0	<0.20	--	<1.0	--	7.7	288	<4.0	<544
12500437	5- 1-89	.30	<.10	<2.0	<.20	--	3.3	--	19	150	<4.0	389
12505460	11- 3-89	.40	<.10	<3.0	<.30	--	2.0	--	18	411	<6.0	1,170
	11- 8-90	--	--	--	.07	270	.55	0.19	9.6	253	.21	424
Salmoniformes (brook trout) Salmonidae *Salvelinus fontinalis*												
12483750	11- 2-90	--	--	--	.12	180	1.0	.50	90	987	<.19	572
Cypriniformes (carp) Cyprinidae *Cyprinus carpio*												
12503950	11- 6-90	--	--	--	.46	47	.35	.18	28	411	.23	228
12507585	11- 1-89	.20	<.10	<2.0	.79	--	<1.0	--	100	548	<4.0	552
12510500	11-10-90	--	--	--	2.5	610	.48	.22	55	474	.22	398
Cypriniformes (chiselmouth) Cyprinidae *Acrocheilus alutaceus*												
12500430	10-31-90	--	--	--	.03	67	1.3	.11	18	139	.20	200
12500442	11- 8-89	1.4	<.30	<5.0	<.50	--	<3.0	--	150	479	<10	1,100
Salmoniformes (cutthroat trout) Salmonidae *Oncorhynchus clarki*												
12500900	11- 6-90	--	--	--	.08	210	.84	.40	7.2	1,130	.24	568

Table 33. Concentrations of major and minor elements in fish livers, Yakima River Basin, Washington, 1989-90—Continued

Station number	Date	Barium	Beryllium	Boron	Cadmium	Calcium	Chromium	Cobalt	Copper	Iron	Lead	Magnesium
Cypriniformes (largescale sucker) Catostomidae *Catostomus macrocheilus*												
12499000	11- 6-90	--	--	--	0.39	130	0.63	0.23	29	570	0.29	519
12503950	11- 7-89	<0.10	<0.10	<2.0	<.20	--	<1.0	--	11	695	<4.0	681
	11- 6-90	--	--	--	.26	88	.74	.45	25	456	<.12	462
	11- 6-90	--	--	--	.34	91	.83	.51	22	521	.15	534
	11- 6-90	--	--	--	.36	91	.77	.44	21	317	.24	505
12507508	11- 3-89	<.10	<.10	<2.0	<.20	--	<1.0	--	19	429	<4.0	608
	11- 3-89	<.10	<.10	<2.0	<.20	--	<1.0	--	15	212	<4.0	518
12507525	11- 7-90	--	--	--	.36	120	.62	.46	26	609	.17	382
	11- 7-90	--	--	--	.44	160	.59	.53	22	619	.22	390
12507585	11- 1-89	<.10	<.10	<2.0	.50	--	<1.0	--	26	761	<4.0	685
12508620	11- 3-89	<.10	<.10	<2.0	.40	--	<1.0	--	27	778	<4.0	711
	11- 7-90	--	--	--	.03	88	.50	.12	26	171	.17	315
12508850	11- 1-89	<.10	<.10	<2.0	.60	--	<1.0	--	29	736	<4.0	531
12509050	11- 9-90	--	--	--	.22	70	.56	.38	26	602	.27	323
12509710	10-30-89	6.4	<.90	20	<2.0	--	<9.0	--	110	550	<40	1,400
12510500	10-31-89	<.10	<.10	<2.0	.50	--	<1.0	--	24	663	<4.0	588
	10-31-89	<.10	<.10	<2.0	.50	--	<1.0	--	23	668	<4.0	579
	10-31-89	<.10	<.10	<2.0	.40	--	<1.0	--	16	409	<4.0	420
	11-10-90	--	--	--	.43	92	.58	.24	32	638	.17	376
Salmoniformes (mountain whitefish) Salmonidae *Prosopium williamsoni*												
12479500	11- 2-89	<.10	< .10	<2.0	<.20	--	<1.0	--	6.1	395	<4.0	752
	11- 5-90	--	--	--	--	--	--	--	--	--	--	--
	11- 5-90	--	--	--	.15	170	1.1	.51	6.8	281	.21	602
	11- 5-90	--	--	--	.11	160	1.1	.26	5.2	234	.23	603
12484440	10-31-90	--	--	--	.04	150	1.0	.41	6.8	121	.20	676
12484500	11- 7-89	<.10	<.10	<2.0	<.20	--	<1.0	--	5.8	201	<4.0	818
12499000	11- 6-90	--	--	--	.11	140	.82	.47	7.5	428	.23	547
	11- 6-90	--	--	--	.07	120	.74	.65	6.4	386	.22	479
	11- 6-90	--	--	--	.08	160	.89	.41	5.3	266	<.13	692

Table 33. Concentrations of major and minor elements in fish livers, Yakima River Basin, Washington, 1989-90—Continued

Station number	Date	Barium	Beryllium	Boron	Cadmium	Calcium	Chromium	Cobalt	Copper	Iron	Lead	Magnesium
Salmoniformes (mountain whitefish) Salmonidae *Prosopium williamsoni*												
12503950	11- 6-90	--	--	--	0.12	150	0.84	0.38	5.6	275	0.27	518
12507525	11- 7-90	--	--	--	.19	150	.69	.84	11	710	.20	507
12510500	10-31-89	<0.10	< <0.10	<2.0	1.1	--	<1.0	--	9.6	413	<4.0	794
	10-31-89	<.10	< <.10	<2.0	1.2	--	<1.0	--	9.6	408	<4.0	782
	11-10-90	--	--	--	1.4	150	.64	.60	7.7	523	.31	458
Salmoniformes (rainbow trout) Salmonidae *Oncorhynchus mykiss*												
12478100	11- 2-89	.50	<.40	< 8.0	1.0	--	<4.0	--	110	2,750	20	1,300
12479720	5- 2-89	.40	<.20	5.0	.40	--	<2.0	--	18	613	8.0	742
12480000	11- 6-89	.40	<.20	<4.0	<.40	--	2.0	--	64	1,250	9.0	1,410
12481900	11- 3-90	--	--	--	.16	160	.94	.25	33	495	.16	634
12483190	11- 2-90	--	--	--	.17	130	.99	.18	100	826	.16	628
12484500	5- 3-89	<.10	<.10	<2.0	<.20	--	<1.0	--	130	1,300	4.0	718
	5- 3-89	<.10	<.10	< 2.0	<.20	--	<1.0	--	130	1,320	4.0	719
	11- 5-90	--	--	--	.10	150	.75	.46	290	965	.13	452
12484550	5- 3-89	.20	<.10	3.0	<.30	--	<1.0	--	55	1,030	6.0	765
	11- 7-89	<.10	<.10	<2.0	<.20	--	<1.0	--	64	777	4.0	687
	11- 5-90	--	--	--	.23	150	.84	.32	100	953	.17	490
12489100	11- 6-89	.50	<.30	<7.0	1.0	--	<3.0	--	82	1,310	10	1,200
12500442	11- 5-90	--	--	--	.06	250	.85	.44	480	723	.19	523
12507594	11- 9-89	.20	<.20	<4.0	<.40	--	<2.0	--	160	1,130	7.0	1,190

Table 33. Concentrations of major and minor elements in fish livers, Yakima River Basin, Washington, 1989-90—Continued

Station number	Date	Manga-nese	Mercury	Molyb-denum	Nickel	Selenium	Silver	Strontium	Thallium	Titanium	Vanadium	Zinc
Cypriniformes (bridgelip sucker) Catostomidae *Catostomus columbianus*												
12484480	11- 6-89	4.2	0.05	<1.0	<2.0	2.0	<2.0	0.45	<6.0	--	<0.30	0.55
12500437	5- 1-89	6.7	.06	<1.0	<1.0	1.9	<2.0	<1.0	<6.0	--	<.30	56
12505460	11- 3-89	13	.08	2.0	<2.0	6.1	<3.0	1.0	<9.0	--	.70	137
	11- 8-90	11	.05	.69	<.07	4.2	.07	--	--	1.5	.25	50
Salmoniformes (brook trout) Salmonidae *Salvelinus fontinalis*												
12483750	11- 2-90	4.3	.40	.73	<.09	1.2	.55	--	--	1.1	.46	125
Cypriniformes (carp) Cyprinidae *Cyprinus carpio*												
12503950	11- 6-90	2.2	.30	.18	<.06	2.2	.24	--	--	.39	.45	160
12507585	11- 1-89	5.1	.38	<1.0	<2.0	4.2	3.0	.49	<6.0	--	1.3	890
12510500	11-10-90	3.8	.42	.49	<.06	3.8	.45	--	--	1.0	.58	634
Cypriniformes (chiselmouth) Cyprinidae *Acrocheilus alutaceus*												
12500430	10-31-90	2.4	.13	.08	.16	2.0	.13	--	--	.73	.15	29
12500442	11- 8-89	13	.09	<3.0	<4.0	13	<5.0	1.5	<20	--	1.0	149
Salmoniformes (cutthroat trout) Salmonidae *Oncorhynchus clarki*												
12500900	11- 6-90	3.8	.25	.52	.09	2.0	<.02	--	--	.88	<.01	84

Table 33. Concentrations of major and minor elements in fish livers, Yakima River Basin, Washington, 1989-90—Continued

Station number	Date	Manga-nese	Mercury	Molyb-denum	Nickel	Selenium	Silver	Strontium	Thallium	Titanium	Vanadium	Zinc
Cypriniformes (largescale sucker) Catostomidae *Catostomus macrocheilus*												
12499000	11- 6-90	6.0	0.14	0.60	<0.09	2.4	0.06	--	--	0.73	0.34	102
12503950	11- 7-89	8.1	.21	<1.0	<2.0	2.6	<2.0	0.20	<6.0	--	.50	86
	11- 6-90	6.2	.45	.60	.16	2.9	.14	--	--	.78	.44	97
	11- 6-90	6.0	.52	.59	.21	3.1	.17	--	--	.62	.41	108
	11- 6-90	7.1	.43	.59	.15	2.8	.11	--	--	.66	.49	98
12507508	11- 3-89	6.8	.33	<1.0	<2.0	2.9	<2.0	.20	<6.0	--	.60	88
	11- 3-89	5.8	.16	<1.0	<2.0	2.1	<2.0	.20	<6.0	--	.30	65
12507525	11- 7-90	8.6	--	.69	.11	--	.10	--	--	.57	.56	79
	11- 7-90	9.3	.40	.56	.14	4.8	.10	--	--	.68	.52	76
12507585	11- 1-89	7.6	.30	<1.0	<2.0	4.2	<2.0	.20	<6.0	--	.60	119
12508620	11- 3-89	9.9	.27	<1.0	<2.0	3.3	<2.0	.20	<6.0	--	1.0	116
	11- 7-90	11	.05	.59	<.07	1.9	.06	--	--	.77	<.01	60
12508850	11- 1-89	10	.23	<1.0	< 2.0	5.2	<2.0	.30	<6.0	--	1.1	104
12509050	11- 9-90	5.9	.35	.61	<.05	4.0	.11	--	--	.46	.75	74
12509710	10-30-89	19	.18	<9.0	<10	13	<20	7.6	<50	--	<3.0	236
12510500	10-31-89	8.7	.31	<1.0	<2.0	4.2	<2.0	.32	<6.0	--	1.3	92
	10-31-89	8.7	.31	<1.0	<2.0	4.0	<2.0	.32	<6.0	--	1.1	91
	10-31-89	10	.21	<1.0	<2.0	2.8	<2.0	.38	<6.0	--	.60	70
	11-10-90	9.9	.30	.66	<.06	4.5	.11	--	--	.69	.50	85
Salmoniformes (mountain whitefish) Salmonidae *Prosopium williamsoni*												
12479500	11- 2-89	4.6	.91	<1.0	<2.0	9.5	<2.0	.55	<6.0	--	.30	77
	11- 5-90	--	.60	--	--	9.3	--	--	--	--	--	--
	11- 5-90	5.5	.75	.38	.24	8.8	.03	--	--	.69	.43	69
	11- 5-90	4.8	.80	.42	.12	6.6	<.02	--	--	.55	.03	66
12484440	10-31-90	6.0	.40	.55	<.07	4.9	.02	--	--	.78	.41	79
12484500	11- 7-89	7.2	.60	<1.0	<2.0	4.2	<2.0	.20	<6.0	--	.90	79
12499000	11- 6-90	5.1	1.0	.49	<.06	5.0	.02	--	--	.67	.24	69
	11- 6-90	5.4	.98	.49	<.06	6.3	<.02	--	--	.55	.15	65
	11- 6-90	7.7	1.0	.38	<.06	3.8	.02	--	--	.58	.15	74

Table 33. Concentrations of major and minor elements in fish livers, Yakima River Basin, Washington, 1989-90—Continued

Station number	Date	Manganese	Mercury	Molybdenum	Nickel	Selenium	Silver	Strontium	Thallium	Titanium	Vanadium	Zinc
Salmoniformes (mountain whitefish) Salmonidae *Prosopium williamsoni*												
12503950	11- 6-90	5.4	1.3	0.38	<0.06	4.5	0.02	--	--	0.74	0.61	0 57
12507525	11- 7-90	4.8	1.2	.50	<.06	12	.08	--	--	.76	1.6	79
12510500	10-31-89	6.1	.56	<1.0	<2.0	11	<2.0	0.20	<6.0	--	.40	76
	10-31-89	6.0	.59	<1.0	< 2.0	11	<2.0	.20	<6.0	--	.50	76
	11-10-90	3.9	.76	.46	<.06	15	.02	--	--	.56	.35	68
Salmoniformes (rainbow trout) Salmonidae *Oncorhynchus mykiss*												
12478100	11- 2-89	12	.27	<4.0	<7.0	13	20	1.6	<30	--	<1.0	226
12479720	5- 2-89	6.4	.32	<2.0	<2.0	5.4	<4.0	<2.0	<10	--	<.60	103
12480000	11- 6-89	12	.17	<2.0	<4.0	6.9	4.0	1.2	<10	--	<.70	192
12481900	11- 3-90	6.3	.33	.52	.35	7.2	.49	--	--	.68	<.01	75
12483190	11- 2-90	5.2	.16	.57	<.08	3.8	.71	--	--	.68	.24	78
12484500	5- 3-89	7.3	.21	<1.0	<1.0	7.1	<2.0	<1.0	<6.0	--	.80	109
	5- 3-89	7.4	.22	<1.0	< 1.0	7.3	<2.0	<1.0	<6.0	--	.60	109
	11- 5-90	5.4	.27	.68	.36	8.1	2.0	--	--	.12	.57	80
12484550	5- 3-89	7.5	.27	<2.0	<2.0	5.4	<3.0	<1.0	<9.0	--	1.0	107
	11- 7-89	5.1	.23	1.0	<2.0	3.5	<2.0	.40	<6.0	--	.80	95
	11- 5-90	4.1	.38	.86	<.08	4.3	.42	--	--	.89	.60	81
12489100	11- 6-89	9.6	.12	<3.0	<5.0	11	<7.0	1.3	<20	--	<1.0	175
12500442	11- 5-90	6.9	.35	.71	<.09	31	.46	--		.76	1.3	84
12507594	11- 9-89	8.2	.18	<2.0	<3.0	2.2	<4.0	.79	<10	--	<.60	168

Table 34. Concentrations of major and minor elements in whole fish, Yakima River Basin, Washington, 1989-90

[All concentrations are reported in micrograms per gram (µg/g), dry weight, unless otherwise noted; lower limits of determination may differ for some elements due to the use of different methods of determination; rows of data with identical field numbers represent samples that were split into two or more samples in the lab; "--" = not determined; "<" = less than; organism taxa are listed in the table as follows:

Order (common name)
Family
Genus species]

Site reference number	Station number	Site name	Date	Field number	Percent moisture	Aluminum	Arsenic	Barium	Beryllium
		Salmoniformes (rainbow trout)							
		Salmonidae							
		Oncorhynchus mykiss							
13	12488250	American River at Hells Crossing near Nile	11- 6-89	YK0128TF	76.5	9.0	<0.20	0.90	--
			11- 6-89	YK0129TF	78.0	16	<.20	1.2	
		Perciformes (sculpin)							
		Cottidae							
		Cottus spp.							
6	12479500	Yakima River at Cle Elum	11- 5-90	YK0305TF	--	--	.10	--	--
8	12481900	Taneum Creek at Taneum Meadow near Thorp	11- 3-90	YK0266TF	--	--	<.10	--	--
			11- 3-90	YK0266TF	--	--	<.10	--	--
12	12483190	South Fork Manastash Creek near Ellensburg	11- 2-90	YK0239TF	--	--	<.10	--	--
7	12483750	Naneum Creek below High Creek near Ellensburg	11- 2-90	YK0243TF	--	--	<.10	--	--
			11- 2-90	YK0243TF	--	--	<.10	--	--
			11- 2-90	YK0244TF	--	--	<.10	--	--
			11- 2-90	YK0245TF	--	--	<.10	--	--
20	12484550	Umtanum Creek near mouth at Umtanum	11- 5-90	YK0298TF	--	--	<.10	--	--
13	12488250	American River at Hells Crossing near Nile	11- 6-89	YK0130TF	78.4	380	.30	6.1	.09
			11- 6-89	YK0130TF	78.4	420	.30	6.8	.10
			11- 1-90	YK0222TF	--	--	.50	--	--
			11- 1-90	YK0222TF	--	--	.50	--	--
			11- 1-90	YK0223TF	--	--	.40	--	--
			11- 1-90	YK0224TF	--	--	.40	--	--

Table 34. Concentrations of major and minor elements in whole fish, Yakima River Basin, Washington, 1989-90—Continued

Site reference number	Station number	Site name	Date	Field number	Percent moisture	Aluminum	Arsenic	Barium	Beryllium
		Perciformes (sculpin) Cottidae *Cottus* spp.							
22	12489100	Rattlesnake Creek above North Fork Rattlesnake Creek near Nile	11- 1-90	YK0226TF	--	--	0.30	--	--
			11- 1-90	YK0227TF	--	--	.20	--	--
			11- 1-90	YK0227TF	--	--	.10	--	--
			11- 1-90	YK0228TF	--	--	.20	--	--
34	12500900	South Fork Ahtanum Creek above Conrad Ranch near Tampico	11- 6-90	YK0338TF	--	--	.10	--	--
			11- 6-90	YK0339TF	--	--	<.10	--	--
31	12502500	Ahtanum Creek at Union Gap	11- 6-90	YK0349TF	--	--	.20	--	--
			11- 6-90	YK0349TF	--	--	.20	--	--
			11- 6-90	YK0350TF	--	--	.20	--	--
			11- 6-90	YK0351TF	--	--	.20	--	--
			11- 6-90	YK0352TF	--	--	.20	--	--
57	12507594	Satus Creek above Wilson-Charley Canyon near Toppenish	11- 7-90	YK0369TF	--	--	.30	--	--
			11- 7-90	YK0370TF	--	--	.20	--	--
			11- 7-90	YK0371TF	--	--	.30	--	--
53	12508500	Satus Creek below Dry Creek near Toppenish	11- 7-90	YK0356TF	--	--	.20	--	--
			11- 7-90	YK0356TF	--	--	.20	--	--
			11- 7-90	YK0357TF	--	--	.20	--	--
			11- 7-90	YK0358TF	--	--	.20	--	--
47	12508620	Satus Creek at gage at Satus	11- 7-90	YK0354TF	--	--	.20	--	--

Table 34. Concentrations of major and minor elements in whole fish, Yakima River Basin, Washington, 1989-90—Continued

Station number	Date	Boron	Cadmium	Chromium	Copper	Iron	Lead	Magnesium	Manganes	Mercury	Molybdenum	Nickel	Selenium	Silver	Strontium	Thallium	Vanadium	Zinc
Salmoniformes (rainbow trout) Salmonidae *Oncorhynchus mykiss*																		
12488250	11- 6-89	<2.0	<0.20	1.0	1.9	66	<4.0	1,070	6.0	0.09	<1.0	<2.0	1.3	<2.0	11	<6.0	<0.30	91
12488250	11- 6-89	<2.0	<.20	1.0	2.1	78	<4.0	1,130	8.3	.15	<1.0	<2.0	1.5	<2.0	12	<6.0	<.30	99
Perciformes (sculpin) Cottidae *Cottus* spp.																		
12479500	11- 5-90	--	--	--	--	--	--	--	--	.13	--	--	1.6	--	--	--	--	--
12481900	11- 3-90	--	--	--	--	--	--	--	--	.29	--	--	5.3	--	--	--	--	--
	11- 3-90	--	--	--	--	--	--	--	--	.28	--	--	5.5	--	--	--	--	--
12483190	11- 2-90	--	--	--	--	--	--	--	--	.19	--	--	1.7	--	--	--	--	--
12483750	11- 2-90	--	--	--	--	--	--	--	--	.32	--	--	1.0	--	--	--	--	--
	11- 2-90	--	--	--	--	--	--	--	--	.36	--	--	1.0	--	--	--	--	--
	11- 2-90	--	--	--	--	--	--	--	--	.31	--	--	1.0	--	--	--	--	--
	11- 2-90	--	--	--	--	--	--	--	--	.23	--	--	80	--	--	--	--	--
12484550	11- 5-90	--	--	--	--	--	--	--	--	.31	--	--	1.7	--	--	--	--	--
12488250	11- 6-89	<2.0	<.20	2.0	2.5	449	<4.0	1,390	21	.14	<.90	<1.0	3.3	<2.0	47	<5.0	1.2	83
	11- 6-89	<2.0	<.20	2.0	2.6	506	<4.0	1,550	24	.14	<1.0	<2.0	3.6	<2.0	52	<6.0	1.3	92
	11- 1-90	--	--	--	--	--	--	--	--	.24	--	--	3.1	--	--	--	--	--
	11- 1-90	--	--	--	--	--	--	--	--	.18	--	--	3.3	--	--	--	--	--
	11- 1-90	--	--	--	--	--	--	--	--	.17	--	--	3.2	--	--	--	--	--

Table 34. Concentrations of major and minor elements in whole fish, Yakima River Basin, Washington, 1989-90—Continued

Station number	Date	Boron	Cadmium	Chromium	Copper	Iron	Lead	Magnesium	Manganes	Mercury	Molybdenum	Nickel	Selenium	Silver	Strontium	Thallium	Vanadium	Zinc
	11- 1-90	--	--	--	--	--	--	--	--	.18	--	--	3.4	--	--	--	--	--
						Perciformes (sculpin)												
						Cottidae												
						Cottus spp.												
12489100	11- 1-90	--	--	--	--	--	--	--	--	.12	--	--	7.0	--	--	--	--	--
	11- 1-90	--	--	--	--	--	--	--	--	.27	--	--	4.7	--	--	--	--	--
	11- 1-90	--	--	--	--	--	--	--	--	.28	--	--	4.1	--	--	--	--	--
	11- 1-90	--	--	--	--	--	--	--	--	.11	--	--	5.2	--	--	--	--	--
12500900	11- 6-90	--	--	--	--	--	--	--	--	.23	--	--	1.1	--	--	--	--	--
	11- 6-90	--	--	--	--	--	--	--	--	.20	--	--	1.0	--	--	--	--	--
12502500	11- 6-90	--	--	--	--	--	--	--	--	.19	--	--	2.6	--	--	--	--	--
	11- 6-90	--	--	--	--	--	--	--	--	.24	--	--	2.6	--	--	--	--	--
	11- 6-90	--	--	--	--	--	--	--	--	.16	--	--	2.7	--	--	--	--	--
	11- 6-90	--	--	--	--	--	--	--	--	.28	--	--	2.8	--	--	--	--	--
	11- 6-90	--	--	--	--	--	--	--	--	.29	--	--	2.5	--	--	--	--	--
12507594	11- 7-90	--	--	--	--	--	--	--	--	.15	--	--	.40	--	--	--	--	--
	11- 7-90	--	--	--	--	--	--	--	--	.13	--	--	.60	--	--	--	--	--
	11- 7-90	--	--	--	--	--	--	--	--	.10	--	--	.60	--	--	--	--	--
12508500	11- 7-90	--	--	--	--	--	--	--	--	.07	--	--	.20	--	--	--	--	--
	11- 7-90	--	--	--	--	--	--	--	--	.12	--	--	.20	--	--	--	--	--
	11- 7-90	--	--	--	--	--	--	--	--	.09	--	--	.20	--	--	--	--	--
	11- 7-90	--	--	--	--	--	--	--	--	.07	--	--	.20	--	--	--	--	--
12508620	11- 7-90	--	--	--	--	--	--	--	--	.11	--	--	1.4	--	--	--	--	--

Table 34. Concentrations of major and minor elements in whole fish, Yakima River Basin, Washington, 1989-90—Continued

Station number	Date	Manganese	Mercury	Molyb-denum	Nickel	Selenium	Silver	Strontium	Thallium	Vanadium	Zinc
Salmoniformes (rainbow trout) Salmonidae *Oncorhynchus mykiss*											
12488250	11- 6-89	6.0	0.09	<1.0	<2.0	1.3	<2.0	11	<6.0	<0.30	91
	11- 6-89	8.3	.15	<1.0	<2.0	1.5	<2.0	12	<6.0	<.30	99
Perciformes (sculpin) Cottidae *Cottus* spp.											
12479500	11- 5-90	--	.13	--	--	1.6	--	--	--	--	--
12481900	11- 3-90	--	.29	--	--	5.3	--	--	--	--	--
	11- 3-90	--	.28	--	--	5.5	--	--	--	--	--
12483190	11- 2-90	--	.19	--	--	1.7	--	--	--	--	--
12483750	11- 2-90	--	.32	--	--	1.0	--	--	--	--	--
	11- 2-90	--	.36	--	--	1.0	--	--	--	--	--
	11- 2-90	--	.31	--	--	1.0	--	--	--	--	--
	11- 2-90	--	.23	--	--	.80	--	--	--	--	--
12484550	11- 5-90	--	.31	--	--	1.7	--	--	--	--	--
12488250	11- 6-89	21	.14	<.90	<1.0	3.3	<2.0	47	<5.0	1.2	83
	11- 6-89	24	.14	<1.0	<2.0	3.6	<2.0	52	<6.0	1.3	92
	11- 1-90	--	.24	--	--	3.1	--	--	--	--	--
	11- 1-90	--	.18	--	--	3.3	--	--	--	--	--
	11- 1-90	--	.17	--	--	3.2	--	--	--	--	--
	11- 1-90	--	.18	--	--	3.4	--	--	--	--	--
12489100	11- 1-90	--	.12	--	--	7.0	--	--	--	--	--
	11- 1-90	--	.27	--	--	4.7	--	--	--	--	--
	11- 1-90	--	.28	--	--	4.1	--	--	--	--	--
	11- 1-90	--	.11	--	--	5.2	--	--	--	--	--
12500900	11- 6-90	--	.23	--	--	1.1	--	--	--	--	--
	11- 6-90	--	.20	--	--	1.0	--	--	--	--	--

Table 34. Concentrations of major and minor elements in whole fish, Yakima River Basin, Washington, 1989-90—Continued

Station number	Date	Manganese	Mercury	Molyb-denum	Nickel	Selenium	Silver	Strontium	Thallium	Vanadium	Zinc
				Perciformes (sculpin) Cottidae *Cottus* spp.							
12479500	11- 5-90	--	0.13	--	--	1.6	--	--	--	--	--
12502500	11- 6-90	--	.19	--	--	2.6	--	--	--	--	--
	11- 6-90	--	.24	--	--	2.6	--	--	--	--	--
	11- 6-90	--	.16	--	--	2.7	--	--	--	--	--
	11- 6-90	--	.28	--	--	2.8	--	--	--	--	--
	11- 6-90	--	.29	--	--	2.5	--	--	--	--	--
12507594	11- 7-90	--	.15	--	--	.40	--	--	--	--	--
	11- 7-90	--	.13	--	--	.60	--	--	--	--	--
	11- 7-90	--	.10	--	--	.60	--	--	--	--	--
12508500	11- 7-90	--	.07	--	--	.20	--	--	--	--	--
	11- 7-90	--	.12	--	--	.20	--	--	--	--	--
	11- 7-90	--	.09	--	--	.20	--	--	--	--	--
	11- 7-90	--	.07	--	--	.20	--	--	--	--	--
12508620	11- 7-90	--	.11	--	--	1.4	--	--	--	--	--

Table 35. Concentrations of mercury in fish muscle, Yakima River Basin, Washington, 1991

[All concentrations are reported in micrograms per gram (µg/g), dry weight; s = a single sample was split into two samples at the lab and each split was analyzed; d = two duplicate fish-muscle samples were taken from one fish in the field—one from the left side of the fish, and one from the right side; organism taxa are listed in the table as follows:

Order (common name)
Family
Genus species]

Site reference number	Station number	Site name	Date	Field number	Mercury
		Cypriniformes (largescale sucker) Catostomidae *Catostomus macrocheilus*			
50	12510500	Yakima River at Kiona	10-31-91	YK0612TF	0.41
			10-31-91	YK0613TF	.84
			10-31-91	YK0614TF	s .89
			10-31-91	YK0614TF	s 1.0
			10-31-91	YK0615TF	1.6
			10-31-91	YK0616TF	d .98
			10-31-91	YK0616TF	d 1.0
		Salmoniformes (mountain whitefish) Salmonidae *Prosopium williamsoni*			
50	12510500	Yakima River at Kiona	10-31-91	YK0637TF	.23
			10-31-91	YK0638TF	.38
			10-31-91	YK0639TF	s .58
			10-31-91	YK0639TF	s .29
			10-31-91	YK0640TF	.31
			10-31-91	YK0641TF	d .25
			10-31-91	YK0641TF	d .28
		Salmoniformes (rainbow trout) Salmonidae *Oncorhynchus mykiss*			
8	12481900	Taneum Creek at Taneum Meadow near Thorp	10-29-91	YK0544TF	.32
			10-29-91	YK0545TF	s .20
			10-29-91	YK0545TF	s .20
			10-29-91	YK0546TF	.25
			10-29-91	YK0547TF	.25
19	12484500	Yakima Rivaer at Umtanum	10-29-91	YK0543TF	.30
22	12489100	Rattlesnake Creek above North Fork Rattlesnake Creek near Nile	10-30-91	YK0588TF	.18
			10-30-91	YK0589TF	.17
			10-30-91	YK0590TF	.21
			10-30-91	YK0591TF	d .20
			10-30-91	YK0591TF	.17

Table 36. Ancillary data for composite fish and clam samples, Yakima River Basin, Washington, 1989-91

[mm = millimeters; age of fish were determined from scale samples and are expressed in years, for example, 0 = less than 1 year, 1 = greater than 1 year but less than 2 years; Ave. = Average; "--" = not determined; N/A = not applicable; I = immature (was unable to determine sex of fish); M = male; F = female; N = no abnormalities were found on the fish; Y = abnormalities were found on the fish and may include, but are not limited to, the presence of parasites, eroded fins, hemorraging, scars, or lesions; MS = Middle School; nr = near; blw = below; R = River; RM = river mile; abv = above; Cr = Creek; STP = sewage treatment plant; S.F. = South Fork; Br = Bridge; N.F. = North Fork; Cyn = Canyon; organism taxa are listed in the table as follows:

Order (common name)
Family
Genus species]

Site reference number	Station number	Site name	Sampling date	Field number	Organism: Number	Length (mm)	Weight (grams)	Age (years)	Sex	Abnormalities present
				Cypriniformes (bridgelip sucker)						
				Catostomidae						
				Catostomus columbianus						
16	12484480	Cherry Creek at Thrall	11-06-89	YK0123TF	1	245	149	1	I	--
					2	204	100	1	I	--
					3	191	78	1	I	--
					4	262	199	2	I	--
					5	230	125	2	I	--
					6	257	162	2	I	--
					---	--------	--------			
					Ave.	232	136			
27	12500437	Wide Hollow Creek at West Valley M.S. nr Ahtanum	05-01-89	YK0002TF	1	202	100	--	M	--
					2	194	105	--	M	--
					3	230	150	--	M	--
					4	216	130	--	M	--
					5	262	210	--	M	--
					6	245	180	--	M	--
					7	190	90	--	M	--
					8	222	140	--	M	--
					9	212	110	--	M	--
					10	186	80	--	M	--
					---	--------	--------			
					Ave.	216	130			
40	12505460	Granger Drain at mouth nr Granger	11-03-89	YK0072TF	1	216	91	1	I	--
					2	208	84	0	F	--
					3	194	74	1	I	--
					4	221	103	1	I	--
					5	204	92	2	M	--
					6	228	126	1	I	--
					7	203	75	1	F	--
					8	193	77	1	M	--
					9	198	76	1	M	--
					10	155	36	1	F	--
					---	--------	--------			
					Ave.	202	83			

Table 36. Ancillary data for composite fish and clam samples, Yakima River Basin, Washington, 1989-91—Continued

Site reference number	Station number	Site name	Sampling date	Field number	Organism					Abnormalities present
					Number	Length (mm)	Weight (grams)	Age (years)	Sex	
		Cypriniformes (bridgelip sucker)								
		Catostomidae								
		Catostomus columbianus								
40	12505460	Granger Drain at mouth nr Granger	11-08-90	YK0387TF	1	196	77	3	F	N
					2	201	79	1	F	N
					3	214	105	2	M	N
					4	197	82	2	M	N
					5	202	87	2	M	N
					6	226	120	3	M	Y
					7	213	107	3	F	N
					8	197	75	3	M	N
					9	192	74	2	F	N
					10	168	52	1	M	N
					Ave.	201	86			
		Salmoniformes (brook trout)								
		Salmonidae								
		Salvelinus fontinalis								
7	12483750	Naneum Creek blw High Creek nr Ellensburg	11-02-90	YK0246TF	1	261	147	1	M	N
					2	205	67	1	F	N
					3	162	36	0	M	N
					4	218	97	0	M	N
					5	225	110	1	M	N
					6	175	42	1	F	N
					7	166	34	1	F	N
					8	160	33	0	M	N
					9	161	37	0	I	N
					Ave.	193	67			
		Cypriniformes (carp)								
		Cyprinidae								
		Cyprinus carpio								
33	12503950	Yakima River at Parker	11-06-90	YK0328TF	1	642	3,557	--	M	N
					2	606	3,315	--	M	Y
					3	551	2,276	--	M	Y
					4	555	2,548	--	M	N
					Ave.	589	2,924			

Table 36. Ancillary data for composite fish and clam samples, Yakima River Basin, Washington, 1989-91—Continued

Site reference number	Station number	Site name	Sampling date	Field number	Organism				Abnormalities present
					Number	Length (mm)	Weight (grams)	Age (years)	Sex	
		Cypriniformes (carp) Cyprinidae *Cyprinus carpio*								
48	12507585	Yakima R at RM 72 abv Satus Cr nr Sunnyside	11-01-89	YK0057TF	1	451	1,251	--	F	--
					2	479	1,636	--	F	--
					3	494	1,700	--	F	--
					4	551	2,183	--	F	--
					5	466	1,621	--	F	--
					6	498	1,724	--	M	--
					7	514	1,872	--	M	--
					8	407	967	--	F	--
					9	458	1,183	--	M	--
					10	444	1,417	--	F	--
					Ave.	476	1,555			
50	12510500	Yakima River at Kiona	11-10-90	YK0405TF	1	526	2,233	--	M	N
					2	551	2,027	--	M	Y
					3	552	2,458	--	F	Y
					4	537	2,121	--	M	N
					5	443	2,170	--	F	N
					6	500	1,778	--	F	N
					7	593	3,316	--	F	N
					8	522	2,236	--	F	N
					9	580	2,882	--	F	Y
					10	476	1,502	--	M	N
					Ave.	528	2,272			
		Cypriniformes (chiselmouth) Cyprinidae *Acrocheilus alutaceus*								
30	12500430	Moxee Drain at Thorp Road nr Union Gap	10-31-90	YK0219TF	1	233	149	2	F	N
					2	201	75	3	F	N
					3	237	110	3	F	Y
					4	215	87	3	F	N
					5	211	88	2	F	N
					6	201	82	2	I	N
					7	204	78	2	I	N
					Ave.	215	96			
29	12500442	Wide Hollow Creek at old STP at Union Gap	11-08-89	YK0156TF	1	170	37	0	I	--
					2	150	28	0	I	--
					3	160	33	0	I	--
					4	165	39	0	I	--
					5	145	25	0	I	--
					6	146	26	0	I	--
					7	136	21	0	I	--
					8	136	21	0	I	--
					9	146	25	0	I	--
					10	137	21	0	I	--
					Ave.	149	28			

Table 36. Ancillary data for composite fish and clam samples, Yakima River Basin, Washington, 1989-91—Continued

Site reference number	Station number	Site name	Sampling date	Field number	Organism					Abnormalities present
					Number	Length (mm)	Weight (grams)	Age (years)	Sex	
		Salmoniformes (cutthroat trout) Salmonidae *Oncorhynchus clarki*								
34	12500900	S.F. Ahtanum Cr abv Conrad Ranch nr Tampico	11-06-90	YK0336TF	1	169	37	1	I	N
					2	191	56	1	M	N
					3	181	52	1	M	N
					4	198	64	1	F	N
					5	196	68	1	M	Y
					6	196	68	1	M	N
					7	171	40	1	I	N
					8	163	31	1	I	N
					9	208	80	1	M	N
					10	215	86	1	M	N
					Ave.	189	58			
		Cypriniformes (largescale sucker) Catostomidae *Catostomus macrocheilus*								
26	12499000	Naches River nr North Yakima	11-06-90	YK0330TF	1	520	1,175	6	F	N
					2	497	1,186	6	F	N
					3	435	799	5	I	N
					4	495	1,175	4	F	N
					5	530	1,298	5	F	N
					6	510	1,303	5	M	N
					7	470	901	5	I	Y
					8	460	1,016	5	M	N
					9	468	955	4	F	N
					10	490	982	4	M	N
					Ave.	488	1,079			
33	12503950	Yakima River at Parker	11-07-89	YK0142TF	1	434	797	--	M	--
					2	466	974	--	F	--
					3	445	767	--	M	--
					4	449	710	--	F	--
					5	441	792	--	M	--
					6	491	1,049	--	F	--
					7	477	982	--	F	--
					8	441	762	--	M	--
					9	496	1,159	--	F	--
					10	489	922	--	F	--
					Ave.	463	891			
33	12503950	Yakima River at Parker	11-06-90	YK0325TF	1	483	1,117	6	F	N
					2	494	1,005	6	F	N
					3	464	901	5	M	N
					4	556	1 601	6	F	Y
					5	438	986	5	M	N
					6	442	851	4	F	N
					7	386	580	4	M	N
					8	427	715	6	F	N
					9	501	1,220	5	F	N
					10	457	865	5	M	N
					Ave.	465	984			

Table 36. Ancillary data for composite fish and clam samples, Yakima River Basin, Washington, 1989-91—Continued

Site reference number	Station number	Site name	Sampling date	Field number	Organism				Abnormalities present
					Number	Length (mm)	Weight (grams)	Age (years)	Sex	
		Cypriniformes (largescale sucker)								
		Catostomidae								
		Catostomus macrocheilus								
33	12503950	Yakima River at Parker	11-06-90	YK0326TF	1	451	912	4	M	N
					2	463	879	4	F	N
					3	439	823	4	F	N
					4	450	761	4	F	N
					5	421	667	5	M	N
					6	448	856	4	M	N
					7	514	1,263	5	F	N
					8	487	989	5	F	Y
					9	480	934	6	F	N
					10	492	1,047	6	F	Y
					Ave.	465	913			
33	12503950	Yakima River at Parker	11-06-90	YK0327TF	1	440	793	5	F	N
					2	494	1,001	5	F	N
					3	401	636	5	M	N
					4	488	992	4	F	N
					5	520	1,462	5	F	Y
					6	491	1,100	6	F	N
					7	411	632	6	F	N
					8	472	970	6	F	N
					9	476	1,011	5	F	Y
					10	447	935	4	M	Y
					Ave.	464	953			
43	12507508	Toppenish Cr at Indian Church Road nr Granger	11-03-89	YK0074TF	1	553	1,518	4	F	--
					2	469	1,175	3	M	--
					3	527	1,408	4	F	--
					4	482	1,060	3	F	--
					5	476	1,102	3	F	--
					6	443	990	3	M	--
					7	476	1,250	4	F	--
					8	406	661	3	I	--
					9	521	1,300	4	F	--
					10	568	1,735	4	F	--
					Ave.	492	1,220			
43	12507508	Toppenish Cr at Indian Church Road nr Granger	11-03-89	YK0075TF	1	425	768	2	F	--
					2	474	1,153	3	F	--
					3	488	1,206	4	F	--
					4	500	1,360	4	F	--
					5	443	908	2	M	--
					6	439	833	5	M	--
					7	493	938	3	F	--
					8	424	875	2	M	--
					9	287	230	1	I	--
					10	259	174	1	I	--
					Ave.	423	844			

Table 36. Ancillary data for composite fish and clam samples, Yakima River Basin, Washington, 1989-91—Continued

Site reference number	Station number	Site name	Sampling date	Field number	Organism					Abnormalities present
					Number	Length (mm)	Weight (grams)	Age (years)	Sex	
		Cypriniformes (largescale sucker)								
		Catostomidae								
		Catostomus macrocheilus								
42	12507525	Yakima R blw Toppenish Cr at RM 79.6 nr Granger	11-07-90	YK0373TF	1	471	873	5	F	N
					2	545	1,565	6	F	N
					3	430	725	5	F	N
					4	449	868	4	M	Y
					5	464	885	4	M	N
					6	463	999	6	F	N
					7	422	773	4	M	N
					8	465	851	3	F	N
					9	425	782	4	M	N
					10	416	681	5	M	N
					Ave.	455	900			
42	12507525	Yakima R blw Toppenish Cr at RM 79.6 nr Granger	11-07-90	YK0376TF	1	417	670	4	M	N
					2	434	794	5	F	N
					3	451	750	5	I	Y
					4	422	718	5	M	N
					5	413	768	5	M	Y
					6	422	667	4	F	N
					7	410	718	5	M	N
					8	451	863	5	F	N
					Ave.	428	744			
48	12507585	Yakima R at RM 72 abv Satus Cr nr Sunnyside	11-01-89	YK0054TF	1	471	985	--	F	N
					2	516	1,167	--	F	N
					3	457	986	--	F	N
					4	435	732	--	M	N
					5	415	684	--	M	N
					6	474	987	--	F	Y
					7	466	878	--	F	N
					8	459	886	--	F	N
					9	442	809	--	F	N
					10	539	1,420	--	F	N
					Ave.	467	953			
47	12508620	Satus Creek at gage at Satus	11-03-89	YK0077TF	1	506	1,238	3	F	--
					2	485	1,134	3	F	--
					3	494	1,231	3	F	--
					4	510	1,098	3	F	--
					5	483	1,108	4	F	--
					6	440	785	3	F	--
					7	193	71	1	I	--
					8	191	63	1	I	--
					Ave.	413	841			

Table 36. Ancillary data for composite fish and clam samples, Yakima River Basin, Washington, 1989-91—Continued

Site reference number	Station number	Site name	Sampling date	Field number	Organism					Abnormalities present
					Number	Length (mm)	Weight (grams)	Age (years)	Sex	
		Cypriniformes (largescale sucker) Catostomidae *Catostomus macrocheilus*								
47	12508620	Satus Creek at gage at Satus	11-07-90	YK0362TF	1	330	360	3	--	N
					2	217	104	2	--	N
					3	206	76	2	--	N
					4	193	71	2	--	N
					5	197	81	2	--	N
					6	213	100	2	--	N
					7	181	53	1	--	N
					8	184	59	1	--	N
					9	163	44	1	--	N
					10	176	53	1	--	N
					Ave.	206	100			
52	12508850	Sulphur Creek Wasteway near Sunnyside	11-01-89	YK0053TF	1	499	1,113	--	F	Y
					2	511	1,167	--	F	N
					3	452	959	--	M	N
					4	429	821	--	M	N
					5	454	982	--	M	N
					6	389	660	--	M	N
					7	442	857	--	M	N
					8	523	1,378	--	F	N
					9	445	910	--	M	N
					10	519	1,304	--	F	N
					Ave.	466	1,015			
56	12509050	Yakima River at Euclid Br at RM 55 nr Grandview	11-09-90	YK0399TF	1	488	1,066	5	F	N
					2	451	967	6	M	Y
					3	415	716	4	M	Y
					4	410	821	5	M	N
					5	478	857	6	F	Y
					6	446	746	5	F	Y
					7	470	884	5	F	Y
					8	411	661	3	M	Y
					9	484	985	5	F	Y
					10	426	704	3	M	Y
					Ave.	448	841			
54	12509710	Spring Creek at mouth at Whitstran	10-30-89	YK0021TF	1	140	19	--	I	--
					2	140	21	--	I	--
					3	156	32	--	I	--
					4	135	20	--	I	--
					5	134	17	--	I	--
					6	150	24	--	I	--
					Ave.	142	22			

Table 36. Ancillary data for composite fish and clam samples, Yakima River Basin, Washington, 1989-91—Continued

Site reference number	Station number	Site name	Sampling date	Field number	Organism					Abnormalities present
					Number	Length (mm)	Weight (grams)	Age (years)	Sex	
			Cypriniformes (largescale sucker)							
			Catostomidae							
			Catostomus macrocheilus							
50	12510500	Yakima River at Kiona	10-31-89	YK0043TF	1	479	1,237	2	M	--
					2	566	2,007	6	F	--
					3	582	1,982	5	F	--
					4	499	1,247	2	F	--
					5	516	1,602	1	F	--
					6	484	1,129	1	M	--
					7	535	1,547	4	F	--
					8	542	1,672	2	F	--
					9	470	1,056	1	M	--
					10	506	1,438	2	F	--
					Ave.	518	1,492			
50	12510500	Yakima River at Kiona	11-10-90	YK0406TF	1	502	1,340	6	M	N
					2	418	723	4	M	N
					3	437	1,035	3	M	Y
					4	521	1,390	5	M	Y
					5	545	1,484	6	F	N
					6	571	1,873	7	F	N
					7	368	603	2	F	N
					8	464	1,115	5	F	N
					9	460	1,054	5	M	N
					10	413	840	3	M	N
					Ave.	470	1,146			
50	12510500	Yakima River at Kiona	10-31-91	YK0612TF	1	475	1,225	5	F	N
					2	450	1,057	6	M	N
					3	429	800	5	M	N
					Ave.	451	1,027			
50	12510500	Yakima River at Kiona	10-31-91	YK0613TF	1	460	1,193	7	M	N
					2	510	1,584	6	M	N
					3	478	1,214	7	F	N
					Ave.	483	1,330			
50	12510500	Yakima River at Kiona	10-31-91	YK0614TF	1	480	1,169	6	F	N
					2	482	1,150	5	M	N
					3	485	1,350	6	M	N
					Ave.	482	1,223			
50	12510500	Yakima River at Kiona	10-31-91	YK0615TF	1	508	1,232	7	M	N
					2	520	1,581	6	M	N
					3	458	1,325	5	M	Y
					Ave.	495	1,379			
50	12510500	Yakima River at Kiona	10-31-91	YK0616TF	1	482	1,297	6	F	N
					2	490	1,288	5	M	N
					3	501	1,337	7	M	N
					Ave.	491	1,307			

Table 36. Ancillary data for composite fish and clam samples, Yakima River Basin, Washington, 1989-91—Continued

Site reference number	Station number	Site name	Sampling date	Field number	Organism					Abnormalities present
					Number	Length (mm)	Weight (grams)	Age (years)	Sex	
		Salmoniformes (mountain whitefish) Salmonidae *Prosopium williamsoni*								
6	12479500	Yakima River at Cle Elum	11-02-89	YK0068TF	1	360	395	6	M	--
					2	373	572	6	F	--
					3	361	384	5	M	--
					4	336	360	--	M	--
					5	303	250	--	F	--
					6	300	229	--	M	--
					7	306	249	--	M	--
					8	318	267	--	M	--
					9	302	244	--	M	--
					10	312	307	--	F	--
					Ave.	327	326			
6	12479500	Yakima River at Cle Elum	11-05-90	YK0306TF	1	281	187	4	M	N
					2	291	228	4	F	N
					3	322	315	5	M	N
					4	318	318	4	F	N
					5	274	170	5	M	N
					6	295	249	4	F	N
					7	307	267	5	M	N
					8	338	316	7	M	N
					9	313	255	6	F	N
					10	280	184	6	M	N
					Ave.	302	249			
6	12479500	Yakima River at Cle Elum	11-05-90	YK0307TF	1	316	288	5	F	N
					2	361	379	6	M	N
					3	312	265	5	F	N
					4	277	203	4	M	N
					5	282	173	--	M	N
					6	325	288	5	F	N
					7	376	435	7	M	N
					8	261	185	4	F	N
					9	312	279	5	F	N
					10	267	214	4	F	Y
					Ave.	309	271			
6	12479500	Yakima River at Cle Elum	11-05-90	YK0308TF	1	311	243	3	M	Y
					2	306	270	4	M	N
					3	292	203	3	F	N
					4	281	205	4	M	N
					5	334	340	3	F	N
					6	300	258	3	M	N
					7	316	305	3	F	N
					8	275	246	4	F	Y
					9	294	257	2	F	Y
					10	296	236	4	F	N
					Ave.	301	256			

Table 36. Ancillary data for composite fish and clam samples, Yakima River Basin, Washington, 1989-91—Continued

Site reference number	Station number	Site name	Sampling date	Field number	Organism					Abnormalities present
					Number	Length (mm)	Weight (grams)	Age (years)	Sex	
		Salmoniformes (mountain whitefish) Salmonidae Prosopium williamsoni								
14	12484440	Cherry Creek abv Wipple Wasteway at Thrall	10-31-90	YK0210TF	1	342	420	5	F	N
					2	299	276	3	F	N
					3	239	109	4	M	N
					4	237	106	3	M	N
					5	241	125	4	M	N
					6	175	44	1	M	N
					7	177	47	1	M	N
					8	164	33	1	M	N
					9	167	36	1	M	N
					10	174	42	1	M	N
					Ave.	222	124			
19	12484500	Yakima River at Umtanum	11-07-89	YK0144TF	1	366	415	3	M	--
					2	381	475	4	F	--
					3	416	553	5	F	--
					4	248	141	2	M	--
					5	280	207	5	M	--
					6	309	229	2	F	--
					7	279	220	2	M	--
					8	368	474	5	F	--
					9	181	49	2	M	--
					10	180	48	1	M	--
					Ave.	301	281			
26	12499000	Naches River nr North Yakima	11-06-90	YK0333TF	1	346	286	6	M	N
					2	370	501	6	F	N
					3	311	273	4	M	N
					4	335	377	4	M	N
					5	360	432	6	F	Y
					6	325	338	5	F	N
					7	246	133	3	F	N
					8	350	393	6	F	Y
					9	300	255	4	M	N
					10	260	148	4	I	N
					Ave.	320	314			
26	12499000	Naches River nr North Yakima	11-06-90	YK0334TF	1	303	250	4	M	N
					2	350	390	5	M	Y
					3	362	383	6	M	N
					4	335	383	6	F	Y
					5	325	343	6	F	Y
					6	244	122	6	F	N
					7	253	146	3	M	N
					8	246	121	4	M	N
					9	296	251	5	M	N
					10	261	165	4	I	N
					Ave.	298	255			

Table 36. Ancillary data for composite fish and clam samples, Yakima River Basin, Washington, 1989-91—Continued

Site reference number	Station number	Site name	Sampling date	Field number	Organism					Abnormalities present
					Number	Length (mm)	Weight (grams)	Age (years)	Sex	
		Salmoniformes (mountain whitefish) Salmonidae *Prosopium williamsoni*								
26	12499000	Naches River nr North Yakima	11-06-90	YK0335TF	1	372	411	3	M	N
					2	305	324	4	F	Y
					3	360	454	4	F	N
					4	292	216	4	M	Y
					5	327	314	5	M	N
					6	417	802	7	F	Y
					7	324	334	4	F	N
					8	328	354	5	F	Y
					9	360	462	5	F	N
					10	285	257	4	M	N
					Ave.	337	392			
33	12503950	Yakima River at Parker	11-06-90	YK0329TF	1	336	372	7	F	N
					2	369	422	7	F	Y
					3	330	348	6	F	Y
					4	380	409	9	F	N
					5	342	302	6	M	N
					6	339	316	6	M	N
					7	345	387	7	F	Y
					8	250	130	4	F	N
					9	272	166	4	F	N
					10	370	517	6	F	Y
					Ave.	333	337			
42	12507525	Yakima R blw Toppenish Cr at RM 79.6 nr Granger	11-07-90	YK0377TF	1	365	413	5	M	N
					2	331	327	4	M	N
					3	362	417	6	M	N
					4	323	281	5	M	N
					5	309	241	4	F	N
					6	297	246	4	M	N
					7	343	399	5	M	N
					8	298	231	4	M	N
					9	333	297	6	F	N
					10	337	290	5	F	N
					Ave.	330	314			
50	12510500	Yakima River at Kiona	10-31-89	YK0042TF	1	350	416	--	M	--
					2	385	547	--	F	--
					3	318	279	--	M	--
					4	411	513	--	M	--
					5	374	494	--	F	--
					6	356	477	--	F	--
					7	384	581	--	F	--
					8	367	463	--	M	--
					9	329	357	--	M	--
					10	359	407	--	M	--
					Ave.	363	453			

Table 36. Ancillary data for composite fish and clam samples, Yakima River Basin, Washington, 1989-91—Continued

Site reference number	Station number	Sites name	Sampling date	Field number	Organism					Abnormalities present
					Number	Length (mm)	Weight (grams)	Age (years)	Sex	
		Salmoniformes (mountain whitefish) Salmonidae *Prosopium williamsoni*								
50	12510500	Yakima River at Kiona	11-10-90	YK0407TF	1	356	461	7	M	N
					2	404	600	6	M	N
					3	341	392	6	M	N
					4	344	372	4	M	N
					5	347	371	6	M	Y
					6	383	516	6	F	Y
					7	318	271	4	M	N
					8	323	350	5	M	N
					9	427	715	7	M	Y
					10	361	470	5	F	Y
					Ave.	360	452			
50	12510500	Yakima River at Kiona	10-31-91	YK0637TF	1	391	625	6	F	N
					2	380	576	6	M	N
					3	331	432	5	M	N
					Ave.	367	544			
50	12510500	Yakima River at Kiona	10-31-91	YK0638TF	1	357	462	4	M	N
					2	373	587	5	F	N
					3	377	525	5	M	N
					Ave.	369	525			
50	12510500	Yakima River at Kiona	10-31-91	YK0639TF	1	350	458	6	M	N
					2	390	561	5	M	Y
					3	371	623	6	F	N
					Ave.	370	547			
50	12510500	Yakima River at Kiona	10-31-91	YK0640TF	1	393	732	6	F	N
					2	371	564	5	M	N
					3	355	505	6	M	N
					Ave.	373	600			
50	12510500	Yakima River at Kiona	10-31-91	YK0641TF	1	381	615	6	M	Y
					2	365	445	6	M	N
					3	365	540	6	F	N
					Ave.	370	533			

Table 36. Ancillary data for composite fish and clam samples, Yakima River Basin, Washington, 1989-91—Continued

Site reference number	Station number	Site name	Sampling date	Field number	Organism					Abnormalities present
					Number	Length (mm)	Weight (grams)	Age (years)	Sex	
		Salmoniformes (rainbow trout) Salmonidae *Oncorhynchus mykiss*								
1	12478100	Waptus River at mouth near Roslyn	11-02-89	YK0066TF	1	152	29	2	M	--
					2	132	21	1	M	--
					3	151	29	2	M	--
					4	158	32	2	F	--
					5	109	11	1	I	--
					6	156	32	2	I	--
					7	128	18	2	M	--
					8	170	37	2	M	--
					9	130	17	1	I	--
					Ave.	143	25			
3	12479720	Jungle Creek near mouth near Cle Elum	05-02-89	YK0006TF	1	141	28	--	I	--
					2	133	27	--	I	--
					3	131	26	--	I	--
					4	126	21	--	I	--
					5	117	18	--	I	--
					6	134	27	--	I	--
					7	113	16	--	I	--
					8	108	17	--	I	--
					9	108	12	--	I	--
					10	95	10	--	I	--
					Ave.	121	20			
5	12480000	Teanaway River below Forks near Cle Elum	11-06-89	YK0125TF	1	166	42	1	I	--
					2	175	44	1	M	--
					3	195	57	1	I	--
					4	149	30	1	I	--
					5	161	34	1	I	--
					6	150	31	1	I	--
					7	160	36	1	M	--
					8	173	45	1	M	--
					9	138	22	1	M	--
					10	150	27	1	I	--
					Ave.	162	37			
8	12481900	Taneum Creek at Taneum Meadow nr Thorp	11-03-90	YK0267TF	1	225	117	3	F	N
					2	179	52	2	F	N
					3	190	60	2	M	N
					4	205	77	2	M	N
					5	182	54	2	M	N
					6	182	52	2	M	N
					7	170	48	2	F	N
					8	165	42	2	M	N
					9	185	63	1	F	N
					10	158	36	1	M	N
					Ave.	184	60			
8	12481900	Taneum Creek at Taneum Meadow nr Thorp	10-29-91	YK0544TF	1	205	100	2	F	N
					2	210	91	2	M	N
					3	209	97	2	F	N
					Ave.	208	96			

Table 36. Ancillary data for composite fish and clam samples, Yakima River Basin, Washington, 1989-91—Continued

Site reference number	Station number	Site name	Sampling date	Field number	Organism					Abnormalities present
					Number	Length (mm)	Weight (grams)	Age (years)	Sex	
		Salmoniformes (rainbow trout) Salmonidae *Oncorhynchus mykiss*								
8	12481900	Taneum Creek at Taneum Meadow nr Thorp	10-29-91	YK0545TF	1	211	103	3	M	N
					2	192	70	2	F	N
					3	176	60	2	M	N
					Ave.	193	78			
8	12481900	Taneum Creek at Taneum Meadow nr Thorp	10-29-91	YK0546TF	1	216	113	2	M	N
					2	165	46	2	F	N
					3	181	61	2	F	N
					Ave.	187	73			
8	12481900	Taneum Creek at Taneum Meadow nr Thorp	10-29-91	YK0547TF	1	209	98	2	F	N
					2	187	73	2	M	N
					3	182	55	2	M	N
					Ave.	193	75			
12	12483190	South Fork Manastash Creek nr Ellensburg	11-02-90	YK0241TF	1	217	92	3	F	N
					2	203	76	--	F	Y
					3	241	132	2	F	Y
					4	223	103	2	M	Y
					5	175	45	1	F	Y
					6	174	51	2	M	Y
					7	151	27	1	M	N
					8	151	29	2	F	N
					Ave.	192	69			
19	12484500	Yakima River at Umtanum	05-03-89	YK0016TF	1	317	295	--	--	--
					2	334	375	--	--	--
					3	341	370	--	--	--
					4	260	175	--	--	--
					5	259	175	--	--	--
					6	260	175	--	--	--
					7	304	300	--	--	--
					8	104	52	--	--	--
					9	157	48	--	--	--
					10	146	34	--	--	--
					Ave.	248	200			
19	12484500	Yakima River at Umtanum	11-05-90	YK0300TF	1	382	531	4	M	Y
					2	316	289	4	M	Y
					3	303	296	4	M	N
					4	266	158	2	M	N
					5	205	87	3	F	Y
					6	247	137	3	M	Y
					7	290	190	3	F	N
					8	336	299	4	F	N
					Ave.	293	248			

Table 36. Ancillary data for composite fish and clam samples, Yakima River Basin, Washington, 1989-91—Continued

Site reference number	Station number	Site name	Sampling date	Field number	Organism					Abnormalities present
					Number	Length (mm)	Weight (grams)	Age (years)	Sex	
		Salmoniformes (rainbow trout) Salmonidae *Oncorhynchus mykiss*								
19	12484500	Yakima River at Umtanum	10-29-91	YK0543TF	1	312	279	3	F	N
					2	306	276	3	M	N
					3	263	209	3	M	N
					Ave.	294	255			
20	12484550	Umtanum Creek nr mouth at Umtanum	05-03-89	YK0012TF	1	--	--	--	--	--
					Ave.	N/A	N/A			
20	12484550	Umtanum Creek nr mouth at Umtanum	11-07-89	YK0146TF	1	214	98	--	I	--
					2	152	37	--	I	--
					3	134	27	--	M	--
					4	136	24	--	I	--
					5	255	169	--	I	--
					6	207	96	--	M	--
					7	199	84	--	F	--
					8	236	120	--	M	--
					9	257	165	--	M	--
					10	199	86	--	I	--
					Ave.	199	91			
20	12484550	Umtanum Creek nr mouth at Umtanum	11-05-90	YK0299TF	1	186	67	2	I	N
					2	235	135	2	M	N
					3	202	84	2	I	N
					4	182	56	2	F	N
					5	201	76	2	I	Y
					6	187	64	2	I	N
					7	180	62	1	M	N
					8	161	47	1	M	N
					Ave.	192	74			
13	12488250	American River at Hells Crossing nr Nile	11-06-89	YK0128TF	1	90	6	0	--	--
					2	109	12	0	--	--
					3	96	7	0	--	--
					4	84	5	0	--	--
					5	97	9	0	--	--
					6	90	7	0	--	--
					7	91	6	0	--	--
					8	93	9	0	--	--
					9	91	7	0	--	--
					10	82	6	0	--	--
					Ave.	92	7			
13	12488250	American River at Hells Crossing nr Nile	11-06-89	YK0129TF	1	83	5	0	--	--
					2	85	6	0	--	--
					3	89	6	0	--	--
					4	81	5	0	--	--
					5	80	5	0	--	--
					6	80	4	0	--	--
					7	83	6	0	--	--
					8	82	5	0	--	--
					9	80	5	0	--	--
					10	73	3	0	--	--
					Ave.	82	5			

Table 36. Ancillary data for composite fish and clam samples, Yakima River Basin, Washington, 1989-91—Continued

Site reference number	Station number	Site name	Sampling date	Field number	Organism					Abnormalities present
					Number	Length (mm)	Weight (grams)	Age (years)	Sex	
		Salmoniformes (rainbow trout) Salmonidae *Oncorhynchus mykiss*								
22	12489100	Rattlesnake Cr abv N.F. Rattlesnake Cr nr Nile	11-06-89	YK0127TF	1	185	52	2	I	--
					2	143	27	1	M	--
					3	141	24	1	I	--
					4	129	18	1	I	--
					5	134	22	1	I	--
					6	149	32	1	I	--
					7	137	26	1	M	--
					8	111	13	1	I	--
					9	111	13	1	I	--
					10	111	11	1	I	--
					Ave.	135	24			
22	12489100	Rattlesnake Cr abv N.F. Rattlesnake Cr nr Nile	10-30-91	YK0588TF	1	237	131	2	M	N
					2	165	38	2	M	N
					3	160	33	1	I	N
					Ave.	187	67			
22	12489100	Rattlesnake Cr abv N.F. Rattlesnake Cr nr Nile	10-30-91	YK0589TF	1	162	33	2	M	N
					2	160	36	--	I	N
					3	224	102	3	M	N
					Ave.	182	57			
22	12489100	Rattlesnake Cr abv N.F. Rattlesnake Cr nr Nile	10-30-91	YK0590TF	1	164	43	1	M	N
					2	184	49	2	F	N
					3	232	122	3	M	N
					Ave.	193	71			
22	12489100	Rattlesnake Cr abv N.F. Rattlesnake Cr nr Nile	10-30-91	YK0591TF	1	195	60	2	M	N
					2	189	55	2	F	N
					3	218	90	2	M	N
					Ave.	201	68			

Table 36. Ancillary data for composite fish and clam samples, Yakima River Basin, Washington, 1989-91—Continued

Site reference number	Station number	Site name	Sampling date	Field number	Organism					Abnormalities present
					Number	Length (mm)	Weight (grams)	Age (years)	Sex	
		Salmoniformes (rainbow trout) Salmonidae *Oncorhynchus mykiss*								
29	12500442	Wide Hollow Creek at old STP at Union Gap	11-05-90	YK0310TF	1	205	89	2	I	N
					2	230	139	2	M	N
					3	202	81	2	M	N
					4	200	77	1	I	N
					5	194	69	2	I	N
					6	171	43	2	I	N
					7	165	41	1	I	N
					8	167	49	1	I	N
					9	159	36	1	I	N
					10	152	34	2	I	N
					Ave.	185	66			
57	12507594	Satus Cr abv Wilson-Charley Cyn nr Toppenish	11-09-89	YK0162TF	1	131	19	0	I	--
					2	151	28	1	I	--
					3	154	34	1	M	--
					4	142	25	1	I	--
					5	147	24	1	I	--
					6	146	27	1	I	--
					7	141	29	1	M	--
					8	140	22	1	M	--
					9	185	60	1	M	--
					10	197	72	1	M	--
					Ave.	153	34			
		Perciformes (sculpin) Cottidae *Cottus spp.*								
6	12479500	Yakima River at Cle Elum	11-05-90	YK0305TF	1	75	5	--	--	N
					2	82	9	--	--	N
					3	85	9	--	--	N
					4	73	5	--	--	N
					5	86	9	--	--	N
					6	79	7	--	--	N
					7	58	2	--	--	N
					8	61	2	--	--	N
					9	42	1	--	--	N
					10	43	1	--	--	N
					Ave.	68	5			
8	12481900	Taneum Creek at Taneum Meadow nr Thorp	11-03-90	YK0266TF	1	88	10	--	--	N
					2	94	11	--	--	N
					3	80	8	--	--	N
					4	92	9	--	--	N
					5	95	12	--	--	N
					6	85	8	--	--	N
					7	85	8	--	--	N
					8	90	9	--	--	N
					9	80	7	--	--	N
					10	77	6	--	--	N
					Ave.	87	9			

Table 36. Ancillary data for composite fish and clam samples, Yakima River Basin, Washington, 1989-91—Continued

Site reference number	Station number	Site name	Sampling date	Field number	Organism				Abnormalities present
					Number	Length (mm)	Weight (grams)	Age (years)	Sex	
		Perciformes (sculpin) Cottidae *Cottus spp.*								
12	12483190	South Fork Manastash Creek nr Ellensburg	11-02-90	YK0239TF	1	66	3	--	--	N
					2	68	3	--	--	N
					3	66	4	--	--	N
					4	69	4	--	--	N
					5	70	4	--	--	N
					6	68	4	--	--	N
					7	75	5	--	--	N
					8	71	4	--	--	N
					9	67	3	--	--	N
					10	62	3	--	--	N
					Ave.	68	4			
7	12483750	Naneum Creek blw High Creek nr Ellensburg	11-02-90	YK0243TF	1	105	16	--	--	N
					2	83	6	--	--	N
					3	70	4	--	--	N
					4	79	6	--	--	N
					5	143	48	--	--	N
					6	110	20	--	--	N
					7	82	8	--	--	N
					8	60	3	--	--	N
					9	75	5	--	--	N
					10	86	8	--	--	N
					Ave.	89	12			
7	12483750	Naneum Creek blw High Creek nr Ellensburg	11-02-90	YK0244TF	1	84	6	--	--	N
					2	136	42	--	--	N
					3	74	5	--	--	N
					4	88	10	--	--	N
					5	71	4	--	--	N
					6	78	5	--	--	N
					7	79	5	--	--	N
					8	74	5	--	--	N
					9	72	5	--	--	N
					10	68	3	--	--	N
					Ave.	82	9			
7	12483750	Naneum Creek blw High Creek nr Ellensburg	11-02-90	YK0245TF	1	127	31	--	--	N
					2	117	20	--	--	N
					3	71	4	--	--	N
					4	72	4	--	--	N
					5	88	9	--	--	N
					6	72	5	--	--	N
					7	69	4	--	--	N
					8	76	6	--	--	N
					9	73	4	--	--	N
					10	75	5	--	--	N
					Ave.	84	9			

Table 36. Ancillary data for composite fish and clam samples, Yakima River Basin, Washington, 1989-91—Continued

Site reference number	Station number	Site name	Sampling date	Field number	Organism				Abnormalities present
					Number	Length (mm)	Weight (grams)	Age (years)	Sex	
		Perciformes (sculpin)								
		Cottidae								
		Cottus spp.								
20	12484550	Umtanum Creek nr mouth at Umtanum	11-05-90	YK0298TF	1	48	1	--	--	N
					2	55	3	--	--	N
					3	51	2	--	--	N
					4	60	2	--	--	N
					5	48	1	--	--	N
					6	47	1	--	--	N
					7	46	1	--	--	N
					8	50	2	--	--	N
					9	45	1	--	--	N
					10	64	4	--	--	N
					Ave.	51	2			
13	12488250	American River at Hells Crossing nr Nile	11-06-89	YK0130TF	1	88	8	--	--	--
					2	72	4	--	--	--
					3	95	9	--	--	--
					4	91	9	--	--	--
					5	89	8	--	--	--
					6	88	7	--	--	--
					7	85	6	--	--	--
					8	85	6	--	--	--
					9	95	11	--	--	--
					10	85	7	--	--	--
					Ave.	87	8			
13	12488250	American River at Hells Crossing nr Nile	11-01-90	YK0222TF	1	81	6	--	--	N
					2	89	6	--	--	N
					3	88	8	--	--	N
					4	90	9	--	--	N
					5	79	6	--	--	N
					6	74	4	--	--	N
					7	72	4	--	--	N
					8	69	3	--	--	N
					9	80	6	--	--	N
					10	86	7	--	--	N
					Ave.	81	6			
13	12488250	American River at Hells Crossing nr Nile	11-01-90	YK0223TF	1	95	10	--	--	N
					2	79	5	--	--	N
					3	83	6	--	--	N
					4	81	6	--	--	N
					5	87	8	--	--	N
					6	89	8	--	--	N
					7	80	5	--	--	N
					8	76	5	--	--	N
					9	75	4	--	--	N
					10	82	7	--	--	N
					Ave.	83	6			

Table 36. Ancillary data for composite fish and clam samples, Yakima River Basin, Washington, 1989-91—Continued

Site reference number	Station number	Site name	Sampling date	Field number	Organism				Abnormalities present
					Number	Length (mm)	Weight (grams)	Age (years)	Sex	
		Perciformes (sculpin) Cottidae *Cottus* spp.								
13	12488250	American River at Hells Crossing nr Nile	11-01-90	YK0224TF	1	65	3	--	--	N
					2	80	5	--	--	N
					3	62	3	--	--	N
					4	80	6	--	--	N
					5	66	3	--	--	N
					6	79	5	--	--	N
					7	81	6	--	--	N
					8	65	3	--	--	N
					9	69	4	--	--	N
					10	82	6	--	--	N
					Ave.	73	4			
22	12489100	Rattlesnake Cr abv N.F. Rattlesnake Cr nr Nile	11-01-90	YK0226TF	1	72	4	--	--	N
					2	65	4	--	--	N
					3	70	4	--	--	N
					4	64	3	--	--	N
					5	74	4	--	--	N
					6	74	5	--	--	N
					7	83	6	--	--	N
					8	59	2	--	--	N
					9	51	1	--	--	N
					10	57	2	--	--	N
					Ave.	67	4			
22	12489100	Rattlesnake Cr abv N.F. Rattlesnake Cr nr Nile	11-01-90	YK0227TF	1	142	41	--	--	N
					2	123	26	--	--	N
					3	122	24	--	--	N
					4	149	54	--	--	N
					5	117	16	--	--	N
					6	112	17	--	--	N
					7	112	17	--	--	N
					8	116	21	--	--	N
					9	145	40	--	--	N
					10	144	34	--	--	N
					Ave.	128	29			
22	12489100	Rattlesnake Cr abv N.F. Rattlesnake Cr nr Nile	11-01-90	YK0228TF	1	98	11	--	--	N
					2	89	8	--	--	N
					3	100	12	--	--	N
					4	96	10	--	--	N
					5	83	7	--	--	N
					6	91	9	--	--	N
					7	85	7	--	--	N
					8	78	6	--	--	N
					9	83	7	--	--	N
					10	76	5	--	--	N
					Ave.	88	8			

Table 36. Ancillary data for composite fish and clam samples, Yakima River Basin, Washington, 1989-91—Continued

Site reference number	Station number	Site name	Sampling date	Field number	Organism				Abnormalities present
					Number	Length (mm)	Weight (grams)	Age (years)	Sex	
		Perciformes (sculpin) Cottidae *Cottus* spp.								
34	12500900	S.F. Ahtanum Cr abv Conrad Ranch nr Tampico	11-06-90	YK0338TF	1	96	9	--	--	N
					2	78	5	--	--	N
					3	83	6	--	--	N
					4	91	9	--	--	N
					5	91	7	--	--	N
					6	87	7	--	--	N
					7	87	7	--	--	N
					8	86	7	--	--	N
					9	79	6	--	--	N
					10	72	4	--	--	N
					Ave.	85	7			
34	12500900	S.F. Ahtanum Cr abv Conrad Ranch nr Tampico	11-06-90	YK0339TF	1	75	5	--	--	N
					2	68	4	--	--	N
					3	65	3	--	--	N
					4	76	5	--	--	N
					5	65	3	--	--	N
					6	66	3	--	--	N
					7	73	4	--	--	N
					8	74	5	--	--	N
					9	71	4	--	--	N
					10	68	5	--	--	N
					Ave.	70	4			
31	12502500	Ahtanum Creek at Union Gap	11-06-90	YK0349TF	1	82	7	--	--	N
					2	106	17	--	--	N
					3	101	18	--	--	N
					4	98	15	--	--	N
					5	100	14	--	--	N
					6	107	17	--	--	N
					7	72	4	--	--	N
					8	90	9	--	--	N
					9	95	12	--	--	N
					10	102	16	--	--	N
					Ave.	95	13			
31	12502500	Ahtanum Creek at Union Gap	11-06-90	YK0350TF	1	103	15	--	--	N
					2	92	12	--	--	N
					3	98	14	--	--	N
					4	96	15	--	--	N
					5	101	13	--	--	N
					6	90	10	--	--	N
					7	99	13	--	--	N
					8	95	13	--	--	N
					9	102	15	--	--	N
					10	98	13	--	--	N
					Ave.	97	13			

Table 36. Ancillary data for composite fish and clam samples, Yakima River Basin, Washington, 1989-91—Continued

Site reference number	Station number	Site name	Sampling date	Field number	Organism				Abnormalities present
					Number	Length (mm)	Weight (grams)	Age (years)	Sex	
		Perciformes (sculpin)								
		Cottidae								
		Cottus spp.								
31	12502500	Ahtanum Creek at Union Gap	11-06-90	YK0351TF	1	69	4	--	--	N
					2	103	15	--	--	N
					3	97	13	--	--	N
					4	95	12	--	--	N
					5	98	12	--	--	N
					6	109	16	--	--	N
					7	95	11	--	--	N
					8	100	14	--	--	N
					9	105	17	--	--	N
					10	112	21	--	--	N
					Ave.	98	14			
31	12502500	Ahtanum Creek at Union Gap	11-06-90	YK0352TF	1	134	39	--	--	N
					2	90	10	--	--	N
					3	93	9	--	--	N
					4	74	5	--	--	N
					5	68	4	--	--	N
					6	85	8	--	--	N
					7	74	5	--	--	N
					8	61	3	--	--	N
					Ave.	82	9			
57	12507594	Satus Cr abv Wilson-Charley Cyn nr Toppenish	11-07-90	YK0369TF	1	77	6	--	--	N
					2	81	6	--	--	N
					3	89	9	--	--	N
					4	60	2	--	--	N
					5	32	1	--	--	N
					6	90	9	--	--	N
					7	82	7	--	--	N
					8	101	13	--	--	N
					9	72	5	--	--	N
					10	131	32	--	--	N
					Ave.	82	9			
57	12507594	Satus Cr abv Wilson-Charley Cyn nr Toppenish	11-07-90	YK0370TF	1	56	2	--	--	N
					2	110	16	--	--	N
					3	87	9	--	--	N
					4	88	8	--	--	N
					5	78	6	--	--	N
					6	82	6	--	--	N
					7	70	4	--	--	N
					8	84	7	--	--	N
					9	76	5	--	--	N
					10	60	2	--	--	N
					Ave.	79	7			

Table 36. Ancillary data for composite fish and clam samples, Yakima River Basin, Washington, 1989-91—Continued

Site reference number	Station number	Site name	Sampling date	Field number	Organism					Abnormalities present
					Number	Length (mm)	Weight (grams)	Age (years)	Sex	
		Perciformes (sculpin) Cottidae *Cottus* spp.								
57	12507594	Satus Cr abv Wilson-Charley Cyn nr Toppenish	11-07-90	YK0371TF	1	80	6	--	--	N
					2	62	3	--	--	N
					3	83	7	--	--	N
					4	70	4	--	--	N
					5	81	6	--	--	N
					6	78	5	--	--	N
					7	59	2	--	--	N
					8	65	3	--	--	N
					9	72	4	--	--	N
					10	63	3	--	--	N
					Ave.	71	4			
53	12508500	Satus Creek blw Dry Creek nr Toppenish	11-07-90	YK0356TF	1	54	2	--	--	N
					2	51	2	--	--	N
					3	56	3	--	--	N
					4	48	2	--	--	N
					5	66	4	--	--	N
					6	50	2	--	--	N
					7	61	3	--	--	N
					8	61	3	--	--	N
					9	66	4	--	--	N
					10	47	1	--	--	N
					Ave.	56	3			
53	12508500	Satus Creek blw Dry Creek nr Toppenish	11-07-90	YK0357TF	1	72	5	--	--	N
					2	89	9	--	--	N
					3	83	8	--	--	N
					4	65	4	--	--	N
					5	75	6	--	--	N
					6	69	5	--	--	N
					7	61	3	--	--	N
					8	64	4	--	--	N
					9	55	2	--	--	N
					10	56	2	--	--	N
					Ave.	69	5			
53	12508500	Satus Creek blw Dry Creek nr Toppenish	11-07-90	YK0358TF	1	61	3	--	--	N
					2	55	2	--	--	N
					3	48	1	--	--	N
					4	51	2	--	--	N
					5	49	2	--	--	N
					6	48	2	--	--	N
					7	55	2	--	--	N
					8	52	2	--	--	N
					9	49	2	--	--	N
					10	50	2	--	--	N
					Ave.	52	2			

Table 36. Ancillary data for composite fish and clam samples, Yakima River Basin, Washington, 1989-91—Continued

Site reference number	Station number	Site name	Sampling date	Field number	Organism					Abnormalities present
					Number	Length (mm)	Weight (grams)	Age (years)	Sex	
		Perciformes (sculpin)								
		Cottidae								
		Cottus spp.								
47	12508620	Satus Creek at gage at Satus	11-07-90	YK0354TF	1	76	6	--	--	N
					2	71	6	--	--	N
					3	77	6	--	--	N
					4	81	8	--	--	N
					5	66	5	--	--	N
					6	81	8	--	--	N
					7	78	7	--	--	N
					8	74	5	--	--	N
					9	70	4	--	--	N
					10	69	5	--	--	N
					Ave.	74	6			
		Veneroida (Asiatic clam)								
		Corbiculidae								
		Corbicula fluminea								
42	12507525	Yakima R blw Toppenish Cr at RM 79.6 nr Granger	11-04-90	YK0374TC	1	22.6	--	--	--	N/A
					2	30.9	--	--	--	N/A
					3	14.0	--	--	--	N/A
					4	21.7	--	--	--	N/A
					5	12.3	--	--	--	N/A
					6	21.3	--	--	--	N/A
					7	16.5	--	--	--	N/A
					8	16.4	--	--	--	N/A
					9	15.9	--	--	--	N/A
					10	28.4	--	--	--	N/A
					11	22.2	--	--	--	N/A
					12	20.6	--	--	--	N/A
					13	15.9	--	--	--	N/A
					14	14.2	--	--	--	N/A
					15	15.5	--	--	--	N/A
					16	15.9	--	--	--	N/A
					17	15.1	--	--	--	N/A
					18	14.0	--	--	--	N/A
					19	14.2	--	--	--	N/A
					Ave.	18.3				
48	12507585	Yakima R at RM 72 abv Satus Cr nr Sunnyside	11-01-89	YK0104TC	1	30.4	--	--	--	N/A
					2	24.3	--	--	--	N/A
					3	24.2	--	--	--	N/A
					4	23.7	--	--	--	N/A
					5	27.4	--	--	--	N/A
					6	21.9	--	--	--	N/A
					7	30.4	--	--	--	N/A
					8	30.2	--	--	--	N/A
					9	22.4	--	--	--	N/A
					10	22.6	--	--	--	N/A
					11	23.5	--	--	--	N/A
					12	25.0	--	--	--	N/A
					13	23.6	--	--	--	N/A
					14	27.5	--	--	--	N/A
					15	23.6	--	--	--	N/A
					16	22.8	--	--	--	N/A
					17	27.5	--	--	--	N/A
					18	22.0	--	--	--	N/A
					Ave.	25.2				

Table 36. Ancillary data for composite fish and clam samples, Yakima River Basin, Washington, 1989-91—Continued

Site reference number	Station number	Site name	Sampling date	Field number	Organism					Abnormalities present
					Number	Length (mm)	Weight (grams)	Age (years)	Sex	
		Veneroida (Asiatic clam) Corbiculidae *Corbicula fluminea*								
48	12507585	Yakima R at RM 72 abv Satus Cr nr Sunnyside	11-01-89	YK0105TC	1	26.5	--	--	--	N/A
					2	31.8	--	--	--	N/A
					3	22.5	--	--	--	N/A
					4	30.0	--	--	--	N/A
					5	24.8	--	--	--	N/A
					6	24.1	--	--	--	N/A
					7	23.0	--	--	--	N/A
					8	25.3	--	--	--	N/A
					9	23.5	--	--	--	N/A
					10	26.2	--	--	--	N/A
					11	31.8	--	--	--	N/A
					12	23.1	--	--	--	N/A
					13	31.1	--	--	--	N/A
					14	22.5	--	--	--	N/A
					15	25.9	--	--	--	N/A
					16	24.8	--	--	--	N/A
					17	26.6	--	--	--	N/A
					18	24.1	--	--	--	N/A
					---	--------				
56	12509050	Yakima River at Euclid Br at RM 55 nr Grandview	10-31-89	YK0083TC	1	32.9	--	--	--	N/A
					2	37.7	--	--	--	N/A
					3	30.4	--	--	--	N/A
					4	36.6	--	--	--	N/A
					5	24.3	--	--	--	N/A
					6	30.0	--	--	--	N/A
					7	23.3	--	--	--	N/A
					8	23.9	--	--	--	N/A
					9	25.1	--	--	--	N/A
					10	27.6	--	--	--	N/A
					11	30.2	--	--	--	N/A
					12	28.9	--	--	--	N/A
					13	31.4	--	--	--	N/A
					14	23.3	--	--	--	N/A
					15	29.5	--	--	--	N/A
					16	34.6	--	--	--	N/A
					17	21.6	--	--	--	N/A
					18	17.3	--	--	--	N/A
					19	22.7	--	--	--	N/A
					20	14.2	--	--	--	N/A
					21	16.6	--	--	--	N/A
					---	--------				
					Ave.	26.8				

Table 36. Ancillary data for composite fish and clam samples, Yakima River Basin, Washington, 1989-91—Continued

Site reference number	Station number	Site name	Sampling date	Field number	Organism					Abnormalities present
					Number	Length (mm)	Weight (grams)	Age (years)	Sex	
		Veneroida (Asiatic clam) Corbiculidae *Corbicula fluminea*								
56	12509050	Yakima River at Euclid Br at RM 55 nr Grandview	11-04-90	YK0363TC	1	25.0	--	--	--	N/A
					2	21.1	--	--	--	N/A
					3	20.2	--	--	--	N/A
					4	23.9	--	--	--	N/A
					5	29.4	--	--	--	N/A
					6	25.0	--	--	--	N/A
					7	26.3	--	--	--	N/A
					8	21.6	--	--	--	N/A
					9	22.3	--	--	--	N/A
					10	27.0	--	--	--	N/A
					11	19.6	--	--	--	N/A
					12	19.4	--	--	--	N/A
					13	24.6	--	--	--	N/A
					14	27.4	--	--	--	N/A
					15	25.9	--	--	--	N/A
					16	19.5	--	--	--	N/A
					17	26.0	--	--	--	N/A
					18	17.2	--	--	--	N/A
					19	26.3	--	--	--	N/A
					20	27.5	--	--	--	N/A
					21	24.6	--	--	--	N/A
					22	24.8	--	--	--	N/A
					23	20.8	--	--	--	N/A
					24	28.3	--	--	--	N/A
					25	18.4	--	--	--	N/A
					26	20.9	--	--	--	N/A
					27	21.5	--	--	--	N/A
					---	---				
					Ave.	23.5				
56	12509050	Yakima River at Euclid Br at RM 55 nr Grandview	11-04-90	YK0362TC	1	24.9	--	--	--	N/A
					2	28.4	--	--	--	N/A
					3	23.6	--	--	--	N/A
					4	27.2	--	--	--	N/A
					5	21.2	--	--	--	N/A
					6	27.6	--	--	--	N/A
					7	22.9	--	--	--	N/A
					8	20.8	--	--	--	N/A
					9	24.2	--	--	--	N/A
					10	23.8	--	--	--	N/A
					11	18.1	--	--	--	N/A
					12	18.0	--	--	--	N/A
					13	20.3	--	--	--	N/A
					14	25.4	--	--	--	N/A
					15	15.6	--	--	--	N/A
					16	23.0	--	--	--	N/A
					17	30.4	--	--	--	N/A
					18	19.7	--	--	--	N/A
					19	19.4	--	--	--	N/A
					20	27.3	--	--	--	N/A
					21	19.7	--	--	--	N/A
					22	15.6	--	--	--	N/A
					23	23.1	--	--	--	N/A
					---	---				
					Ave.	23.6				

Table 36. Ancillary data for composite fish and clam samples, Yakima River Basin, Washington, 1989-91—Continued

Site reference number	Station number	Site name	Sampling date	Field number	Organism					Abnormalities present
					Number	Length (mm)	Weight (grams)	Age (years)	Sex	
		Veneroida (Asiatic clam) Corbiculidae *Corbicula fluminea*								
56	12509050	Yakima River at Euclid Br at RM 55 nr Grandview	11-04-90	YK0364TC	1	19.0	--	--	--	N/A
					2	19.7	--	--	--	N/A
					3	31.1	--	--	--	N/A
					4	25.8	--	--	--	N/A
					5	21.7	--	--	--	N/A
					6	21.8	--	--	--	N/A
					7	25.8	--	--	--	N/A
					8	20.5	--	--	--	N/A
					9	24.0	--	--	--	N/A
					10	23.9	--	--	--	N/A
					11	29.3	--	--	--	N/A
					12	27.5	--	--	--	N/A
					13	27.4	--	--	--	N/A
					14	20.6	--	--	--	N/A
					15	21.0	--	--	--	N/A
					16	25.4	--	--	--	N/A
					17	23.4	--	--	--	N/A
					18	26.6	--	--	--	N/A
					19	20.2	--	--	--	N/A
					20	24.7	--	--	--	N/A
					21	24.7	--	--	--	N/A
					22	28.6	--	--	--	N/A
					---	--------				
					Ave.	24.2				
54	12509710	Spring Creek at mouth at Whitstran	11-08-90	YK0409TC	1	23.5	--	--	--	N/A
					2	17.3	--	--	--	N/A
					3	19.7	--	--	--	N/A
					4	18.6	--	--	--	N/A
					5	18.5	--	--	--	N/A
					6	17.3	--	--	--	N/A
					7	17.1	--	--	--	N/A
					8	20.7	--	--	--	N/A
					9	18.5	--	--	--	N/A
					10	21.5	--	--	--	N/A
					11	20.6	--	--	--	N/A
					12	22.9	--	--	--	N/A
					13	21.4	--	--	--	N/A
					14	21.1	--	--	--	N/A
					15	17.7	--	--	--	N/A
					16	17.7	--	--	--	N/A
					17	16.4	--	--	--	N/A
					18	16.4	--	--	--	N/A
					19	22.2	--	--	--	N/A
					20	22.5	--	--	--	N/A
					21	22.1	--	--	--	N/A
					22	17.8	--	--	--	N/A
					23	21.9	--	--	--	N/A
					24	21.8	--	--	--	N/A
					25	23.3	--	--	--	N/A
					26	20.3	--	--	--	N/A
					27	25.5	--	--	--	N/A
					28	22.3	--	--	--	N/A
					29	21.3	--	--	--	N/A
					30	25.3	--	--	--	N/A
					31	23.7	--	--	--	N/A
					32	21.8	--	--	--	N/A
					33	21.9	--	--	--	N/A
					34	22.9	--	--	--	N/A
					---	--------				
					Ave.	20.7				

Table 36. Ancillary data for composite fish and clam samples, Yakima River Basin, Washington, 1989-91—Continued

Site reference number	Station number	Site name	Sampling date	Field number	Organism					Abnormalities present
					Number	Length (mm)	Weight (grams)	Age (years)	Sex	
		Veneroida (Asiatic clam) Corbiculidae *Corbicula fluminea*								
50	12510500	Yakima River at Kiona	10-30-89	YK0113TC	1	26.0	--	--	--	N/A
					2	21.6	--	--	--	N/A
					3	20.2	--	--	--	N/A
					4	23.6	--	--	--	N/A
					5	18.4	--	--	--	N/A
					6	17.2	--	--	--	N/A
					7	18.0	--	--	--	N/A
					8	19.2	--	--	--	N/A
					9	21.0	--	--	--	N/A
					10	18.2	--	--	--	N/A
					11	17.7	--	--	--	N/A
					12	15.0	--	--	--	N/A
					13	14.1	--	--	--	N/A
					14	18.1	--	--	--	N/A
					15	15.2	--	--	--	N/A
					16	15.7	--	--	--	N/A
					17	15.7	--	--	--	N/A
					18	22.0	--	--	--	N/A
					19	17.5	--	--	--	N/A
					20	18.6	--	--	--	N/A
					21	14.4	--	--	--	N/A
					22	14.5	--	--	--	N/A
					23	19.0	--	--	--	N/A
					24	15.9	--	--	--	N/A
					25	14.3	--	--	--	N/A
					26	18.6	--	--	--	N/A
					27	17.4	--	--	--	N/A
					28	16.1	--	--	--	N/A
					29	15.0	--	--	--	N/A
					30	15.1	--	--	--	N/A
					31	16.0	--	--	--	N/A
					---	---				
					Ave.	17.7				
50	12510500	Yakima River at Kiona	10-30-89	YK0114TC	1	18.9	--	--	--	N/A
					2	17.9	--	--	--	N/A
					3	20.2	--	--	--	N/A
					4	20.9	--	--	--	N/A
					5	18.9	--	--	--	N/A
					6	16.9	--	--	--	N/A
					7	22.0	--	--	--	N/A
					8	23.3	--	--	--	N/A
					9	16.9	--	--	--	N/A
					10	17.0	--	--	--	N/A
					11	18.4	--	--	--	N/A
					12	18.4	--	--	--	N/A
					13	18.4	--	--	--	N/A
					14	19.6	--	--	--	N/A
					15	16.0	--	--	--	N/A
					16	14.1	--	--	--	N/A
					17	15.0	--	--	--	N/A
					18	16.2	--	--	--	N/A
					19	16.7	--	--	--	N/A
					20	16.7	--	--	--	N/A
					21	15.8	--	--	--	N/A
					22	15.2	--	--	--	N/A
					23	18.5	--	--	--	N/A
					24	17.8	--	--	--	N/A
					25	17.2	--	--	--	N/A
					26	19.9	--	--	--	N/A
					27	16.9	--	--	--	N/A
					28	16.0	--	--	--	N/A
					29	17.2	--	--	--	N/A
					30	21.0	--	--	--	N/A
					31	16.2	--	--	--	N/A
					---	---				
					Ave.	17.9				

Table 36. Ancillary data for composite fish and clam samples, Yakima River Basin, Washington, 1989-91—Continued

Site reference number	Station number	Site name	Sampling date	Field number	Organism					Abnormalities present
					Number	Length (mm)	Weight (grams)	Age (years)	Sex	
			Veneroida (Asiatic clam) Corbiculidae *Corbicula fluminea*							
50	12510500	Yakima River at Kiona	11-04-90	YK0365TC	1	25.8	--	--	--	N/A
					2	20.2	--	--	--	N/A
					3	22.4	--	--	--	N/A
					4	19.5	--	--	--	N/A
					5	17.8	--	--	--	N/A
					6	21.2	--	--	--	N/A
					7	17.8	--	--	--	N/A
					8	23.7	--	--	--	N/A
					9	19.0	--	--	--	N/A
					10	17.9	--	--	--	N/A
					11	22.4	--	--	--	N/A
					12	18.4	--	--	--	N/A
					13	18.0	--	--	--	N/A
					14	17.3	--	--	--	N/A
					15	18.4	--	--	--	N/A
					16	18.1	--	--	--	N/A
					17	18.7	--	--	--	N/A
					18	16.1	--	--	--	N/A
					19	21.0	--	--	--	N/A
					20	19.2	--	--	--	N/A
					21	15.3	--	--	--	N/A
					22	19.4	--	--	--	N/A
					23	15.6	--	--	--	N/A
					24	15.0	--	--	--	N/A
					25	15.0	--	--	--	N/A
					26	18.2	--	--	--	N/A
					Ave.	18.9				
50	12510500	Yakima River at Kiona	11-04-90	YK0366TC	1	18.7	--	--	--	N/A
					2	21.1	--	--	--	N/A
					3	16.2	--	--	--	N/A
					4	17.7	--	--	--	N/A
					5	17.4	--	--	--	N/A
					6	17.9	--	--	--	N/A
					7	13.8	--	--	--	N/A
					8	18.1	--	--	--	N/A
					9	21.4	--	--	--	N/A
					10	25.5	--	--	--	N/A
					11	16.3	--	--	--	N/A
					12	17.8	--	--	--	N/A
					13	21.3	--	--	--	N/A
					14	17.6	--	--	--	N/A
					15	18.6	--	--	--	N/A
					16	23.2	--	--	--	N/A
					17	18.5	--	--	--	N/A
					18	17.0	--	--	--	N/A
					19	17.9	--	--	--	N/A
					20	16.7	--	--	--	N/A
					21	19.0	--	--	--	N/A
					22	17.9	--	--	--	N/A
					23	18.1	--	--	--	N/A
					24	18.5	--	--	--	N/A
					25	21.0	--	--	--	N/A
					26	17.3	--	--	--	N/A
					Ave.	18.6				

Table 36. Ancillary data for composite fish and clam samples, Yakima River Basin, Washington, 1989-91—Continued

Site reference number	Station number	Site name	Sampling date	Field number	Organism					Abnormalities present
					Number	Length (mm)	Weight (grams)	Age (years)	Sex	
			Unionoida (western pearlshell) Unionidae *Margaritifera falcata*							
19	12484500	Yakima River at Umtanum	11-04-89	YK0112TM	1	106	1	--	--	N/A
					2	108	1	--	--	N/A
					3	114	1	--	--	N/A
					4	110	1	--	--	N/A
					5	119	1	--	--	N/A
					6	119	1	--	--	N/A
					7	114	1	--	--	N/A
					8	121	1	--	--	N/A
					9	109	1	--	--	N/A
					10	108	1	--	--	N/A
					---	---	---			
					Ave.	113	1			

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APPENDIX

APPENDIX

METHODS OF DETERMINATION FOR MAJOR AND MINOR ELEMENTS IN AQUATIC BIOTA, 1989

(from protocol provided by the Environmental Trace Substances Research Center in Columbia, Missouri)

Percent-Moisture Determination

For animal tissue of sufficient size, moisture was determined by placing a weighed aliquot of sample in a Fisher Isotemp oven and drying at 103-105°C. The dried sample was weighed, and the data were entered into a computer program to generate the percent moisture and final element concentrations on a dry-weight basis.

Plants and samples too small for oven-dried moisture determination had the percent moisture calculated from the moisture lost during the freeze-drying in the Labcono Freeze-Dryer 8. The data was entered into a computer program to generate the percent moisture and final element concentrations.

Homogenization

Large tissue samples, such as whole fish, were first run through a meat grinder one or more times depending on the size of the sample. An aliquot of the ground sample was weighed and frozen. For smaller tissue samples and plant samples, the entire sample was weighed and then frozen. The frozen samples were placed in a Labcono Freeze-Dryer 8 until the moisture had been removed. The dry samples were weighed and homogenized using a blender, or Spex Industries, Inc. Model 8000 mixer/mill with tungsten-carbide vial and balls.

Arsenic and Selenium

Digestion Procedure

For arsenic, approximately 0.5 g of sample were weighed into a freshly cleaned 100-mL Kjeldahl flask. Slowly, 15 mL of concentrated, sub-boiled nitric acid (HNO_3) and 2.5 mL of concentrated, sub-boiled perchloric acid ($HClO_4$) were added. For some samples, foaming was observed. If the foaming started to become excessive, the container was cooled in a beaker of cold water. After the initial reaction had subsided, the sample was placed on low heat until the evolution of dark-red fumes had ceased. Gradually, the heat was increased until the HNO_3 had been driven off, and the reaction with $HClO_4$ had come to completion. When dense-white fumes from the $HClO_4$ were evident, the samples were heated approximately 5 minutes, and then removed from the heat and allowed to cool. Samples were diluted using deionized water in 50-mL volumetric flasks, and then transferred to clean, labeled, polyethylene bottles.

For selenium, approximately 0.5 g of sample were weighed into a freshly cleaned, 100-mL quartz-Kjeldahl flask. Slowly, 15 mL of concentrated, sub-boiled HNO_3 and 2.5 mL of concentrated, sub-boiled $HClO_4$ were added. For some samples, foaming was observed. If the foaming started to become excessive, the container was cooled in a beaker of cold water. After the initial reaction had subsided, the sample was placed on low heat until the evolution of dark-red fumes had ceased. Gradually, the heat was increased until the HNO_3 began refluxing, and then the samples were allowed to reflux overnight. (This decreased the chance for charring during the reaction with $HClO_4$.) After the refluxing, the heat was gradually increased until the HNO_3 had been driven off, and the reaction with $HClO_4$ had come to completion. When dense-white fumes from the $HClO_4$ were evident, the samples were removed from the heat and allowed to cool. Two mL of concentrated, sub-boiled hydrochloric acid (HCl) were added. The flasks were heated until the containers were hot to the touch or the samples started to boil. The samples were removed from the heat, diluted with 5-10 mL of deionized water, and cooled. The samples were then brought to volume with deionized water in a 50-mL volumetric flask and transferred to clean, labeled, polyethylene bottles.

Methods of Determination

Arsenic determinations in fish, clams, and aquatic insects by hydride-generation AAS

The Perkin-Elmer MHS-1 hydride-generation accessory was mounted on either a Perkin-Elmer Model 603 AA or Model 3030 (B) AA. An Electrodeless Discharge Lamp (EDL) was used. The instrument and EDL settings were taken from the instrument manuals. The cell was aligned in the light path of the burner chamber where a very lean flame was used for heating the cell. The standard curve was run and a quality-control sample of known concentration was run to check the standard curve. Blanks and samples were run by diluting an aliquot of the digested sample to 10 mL with 4 percent volume/volume (v/v) $HClO_4$. The amount of sample used varied with the arsenic concentration. Samples were analyzed using the method of standard additions. The peaks, from the recorder tracing, were measured with a ruler, and the slope and intercept were calculated on a calculator. The data were entered into the AA-calculation program. This program considered the following: analyte in the blank, dilution factors, sample weight, and sample volume. The data were recorded in the Laboratory Information Management System (LIMS) data base for report generation.

Arsenic determinations in plants and selenium determinations in fish, clams, plants, and aquatic insects by hydride-generation AAS

The Varian VGA-76 hydride-generation accessory was mounted on either a Perkin-Elmer Model 603 AA or Model 3030 (B) AA. An EDL was used. The instrument and EDL settings were taken from the instrument manuals. The burner mount for a Perkin-Elmer Model 10 Hydride-generator was modified slightly to hold the Varian quartz cell. The cell was aligned in the light path of the burner chamber where a lean flame was used for heating the cell.

Stock solutions were prepared for arsenic and selenium. For arsenic, concentrated, sub-boiled HCl was mixed with 1 percent sodium borohydride ($NaBH_4$); and for selenium, 50 percent v/v sub-boiled HCl was mixed with 0.6 percent $NaBH_4$. Both stock solutions were added to 0.5 percent sodium hydroxide (NaOH). The stock solutions were mixed with the digested samples, and the $NaBH_4$ served as the reductant and HCl acted as the carrier. Following addition to the stock solution, the samples were diluted with 10 percent v/v sub-boiled HCl.

Standards for arsenic and selenium were prepared by dilution of Fisher 1,000 parts per million (ppm) stock with 10 percent v/v sub-boiled HCl in the range of 0 to 20 parts per billion (ppb). The instrument was standardized to read directly in ppb using a 5.00 ppb and a 20.00 ppb Fisher standard. After the instrument was standardized, it was checked by reading other standards, such as 2.00, 10.00, and 15.00 ppb, and an instrumental quality-control sample with a known value. If the standards and quality-control sample were acceptable, the zero standard was read 10 times, and twice the standard deviation of the mean was used as the lower limit of determination. Samples were analyzed by taking an integrated reading for 3 seconds after the plateau was reached. This usually was approximately 45 seconds after the sample tube was placed in the sample. Standardization was checked every 8 to 15 samples and approximately 10 percent of the samples were checked by the method of additions to monitor matrix effects. Matrix effects were usually not significant with the VGA-76. The data was corrected for drift of the standard curve and entered into the AA calculation program. This program considered the following: analyte in the blank, dilution factors, sample weight, and sample volume. The data were recorded in the LIMS database for report generation.

Mercury

Digestion Procedure

Approximately 0.5 g of sample were weighed into a freshly cleaned 50-mL round-bottom flask with 24/40 ground-glass neck. Five mL of concentrated, sub-boiled HNO_3 were added, and the flask was placed under a 30-cm water-cooled condenser. The heat was turned up to allow the HNO_3 to reflux no more than one-third the height of the column. Samples were allowed to reflux for 2 hours, then the heat was turned off and the samples were allowed to cool. The condensers were rinsed

with 1 percent v/v HCl, and the flasks were removed. The samples were diluted with 1 percent v/v HCl in a 50-mL volumetric flask and then transferred to clean, labeled, flint-glass bottles.

Method of Determination

Equipment used for cold-vapor AAS includes: Perkin-Elmer Model 403 AA, Perkin-Elmer Model 056 recorder, Technicon Sampler I, Technicon Pump II, a glass cell with quartz windows and capillary tube for entry and exit of the mercury vapor, and a liquids-gas separator. The samples were placed in 4-mL sample cups at least three-quarters full. The samples were mixed with hydroxylamine for preliminary reduction, then stannous chloride for reduction to the mercury vapor. The vapor was separated from the liquid and passed through the cell which was mounted in the light path of the burner compartment. The peaks were recorded, and the peak heights were measured. The standardization was done with at least five standards in the range of 0 to 10 ppb. The correlation coefficient was usually 0.9999 or better and must have been at least 0.999 to have been acceptable. A standard was run every 8 to 10 samples to check for drift in the standardization. This was usually found to be less than 5 percent. Standards were preserved with 10 percent v/v HNO_3, 1 percent v/v HCl, and 0.05 percent weight/volume (w/v) potassium chromate ($K_2Cr_2O_7$). The solution concentrations were calculated and the data were entered into the AA-calculation program which considered the following: analyte in the blank, dilution factors, sample weight, and sample volume. The data were recorded in the LIMS system for report generation.

Selected Major and Minor Elements (excluding arsenic, mercury, and selenium)

Digestion Procedure

Approximately 0.5 g of sample were weighed into a freshly cleaned, 100-mL quartz-Kjeldahl flask. Slowly, 15 mL of concentrated, sub-boiled HNO_3 and 2.5 mL of concentrated, sub-boiled $HClO_4$ were added. For some samples, foaming was observed. If the foaming started to become excessive, the container was cooled in a beaker of cold water. After the initial reaction had subsided, the sample was placed on low heat until the evolution of dark-red fumes had ceased. Gradually, the heat was increased until the HNO_3 began refluxing, and then the samples were allowed to reflux overnight. (This decreased the chance for charring during the reaction with $HClO_4$.) After the refluxing, the heat was gradually increased until the HNO_3 had been driven off, and the reaction with $HClO_4$ had come to completion. When dense-white fumes from the $HClO_4$ were evident, the samples were removed from the heat and allowed to cool. Two mL of concentrated, sub-boiled HCl were added. The flasks were heated until the containers were hot to the touch or the samples started to boil. The samples were removed from the heat, diluted with 5-10 mL of deionized water, and cooled. The samples were then brought to volume with deionized water in a 50-mL volumetric flask and transferred to clean, labeled, polyethylene bottles.

Method of Determination

The instrument used for ICP analysis was a Jarrell-Ash Model 1100 Mark III with 40 analytical channels, controlled by a Digital Equipment Company (DEC) 11/23+ computer. The instrument was standardized with a series of seven standards containing 36 elements. After the standardization, the zero standard was read 10 times, and three times the standard deviation of the mean was used as the lower limit of determination. Instrumental quality-control samples were then analyzed to check the ICP operation. If the values were acceptable, the samples were analyzed. Standards were run every 10 to 15 samples to check for drift. If the drift was more than 5 percent, the instrument was restandardized. After the analyses were completed, the data were transferred to the Perkin-Elmer LIMS 2000 computer for calculation. The final lower limits of determination for each element were further increased by four percent of the magnitude of the spectral interferences from the other elements. The data were calculated using the ICP-calculation program which considered the following: analyte in the blank, standard drift, spectral interferences, sample weight, sample volume, and dilution factors.