USGS
science for a changing world

Prepared in cooperation with the Standing Rock Sioux Reservation

Water, Bed-Sediment, and Fish-Tissue Quality within the Standing Rock Sioux Reservation, North Dakota and South Dakota, September 2006

Scientific Investigations Report 2007–5268

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

Water, Bed-Sediment, and Fish-Tissue Quality within the Standing Rock Sioux Reservation, North Dakota and South Dakota, September 2006

By William C. Damschen and Robert F. Lundgren

Prepared in cooperation with the Standing Rock Sioux Reservation

Scientific Investigations Report 2007–5268

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

U.S. Department of the Interior
DIRK KEMPTHORNE, Secretary

U.S. Geological Survey
Mark D. Myers, Director

U.S. Geological Survey, Reston, Virginia: 2007

For product and ordering information:
World Wide Web: *http://www.usgs.gov/pubprod*
Telephone: 1–888–ASK–USGS

For more information on the USGS—the Federal source for science about the Earth, its natural and living resources, natural hazards, and the environment:
World Wide Web: *http://www.usgs.gov*
Telephone: 1–888–ASK–USGS

Suggested citation:
Damschen, W.C., and Lundgren, R.F., 2007, Water, bed-sediment, and fish-tissue quality within the Standing Rock Sioux Reservation, North Dakota and South Dakota, September 2006: U.S. Geological Survey Scientific Investigations Report 2007–5268, 29 p.

Contents

Figures

Tables

Conversion Factors and Datum

Multiply	By	To obtain
	Length	
mile (mi)	1.609	kilometer (km)
	Area	
acre	0.4047	hectare (ha)
	Volume	
gallon (gal)	3.785	liter (L)
	Mass	
pound, avoirdupois (lb)	0.4536	kilogram (kg)

Temperature in degrees Celsius (°C) may be converted to degrees Fahrenheit (°F) as follows:

$$°F=(1.8\times°C)+32$$

Specific conductance is given in microsiemens per centimeter at 25 degrees Celsius (µS/cm at 25°C).

Concentrations of chemical constituents in water are given either in milligrams per liter (mg/L) or micrograms per liter (µg/L).

Horizontal coordinate information is referenced to the North American Datum of 1927 (NAD 27).

Water, Bed-Sediment, and Fish-Tissue Quality within the Standing Rock Sioux Reservation, North Dakota and South Dakota, September 2006

By William C. Damschen and Robert F. Lundgren

Abstract

During September 2006, samples from public water-delivery systems, ground water, surface water, bed-sediment, and fish-tissue sources were collected at 32 locations within the Standing Rock Sioux Reservation and analyzed to aid in the evaluation of any immediate water-quality concerns. Samples were collected from Solen, Selfridge, and Fort Yates, North Dakota, water-delivery systems and included raw water samples and treated water samples from water users on the water-delivery systems. Samples from the Solen and Selfridge systems were analyzed for dissolved major inorganic and dissolved minor and trace inorganic concentrations. Samples from the Fort Yates system were analyzed for dissolved major inorganic concentrations, dissolved minor and trace inorganic concentrations, total and dissolved nutrient concentrations, total and dissolved organic carbon concentrations, and volatile organic compound concentrations. Water samples were collected from ground-water wells throughout the reservation only in North Dakota and analyzed for dissolved major inorganic concentrations and dissolved minor and trace inorganic concentrations. Water samples were collected at locations on the Missouri River and its major tributaries within the reservation and analyzed for dissolved major inorganic concentrations and dissolved minor and trace inorganic concentrations; bed sediment was collected at these sites and analyzed for minor and trace inorganic concentrations. Fish-tissue and liver samples were collected from several species on the Missouri River near Fort Yates and analyzed for minor and trace inorganic concentrations. Results of the water-quality analysis revealed very little of concern, with the exception of elevated boron concentrations in the drinking water and ground water in the area of Selfridge and Solen and minor exceedences of total trihalomethanes in the Fort Yates water-delivery system.

Introduction

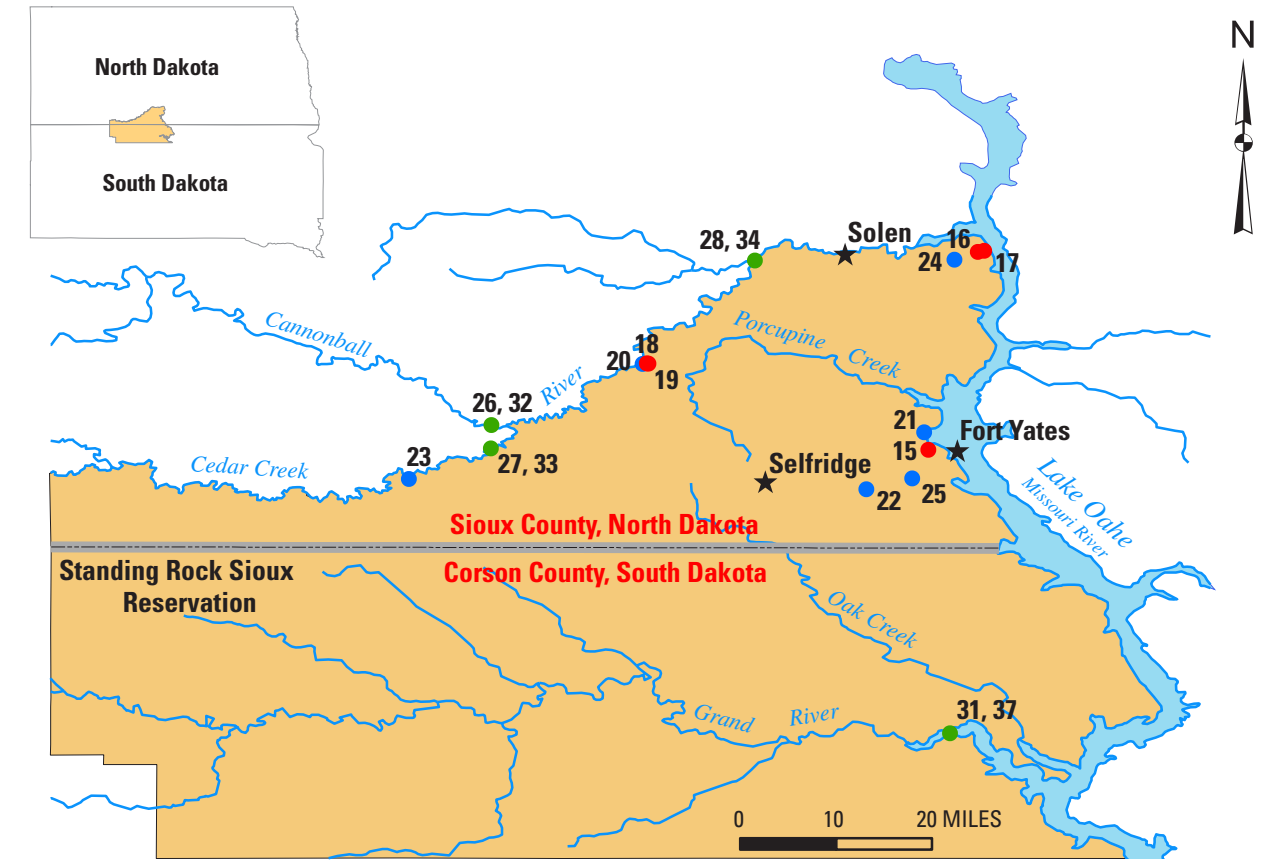
Tribal members of the Standing Rock Sioux Reservation are concerned about the quality of water from various sources on the reservation and that some of the drinking water consumed on the reservation is adversely affecting human health (Mni Sose Intertribal Rights Coalition, Inc, 2005). Water-quality data are needed to determine potential sources of poor water quality in water-delivery, surface-water, and ground-water supplies and to better understand possible links to health effects among tribal members; therefore, the U.S. Geological Survey (USGS) in cooperation with the Standing Rock Sioux Reservation developed a water-quality reconnaissance plan to investigate these concerns.

Purpose and Scope

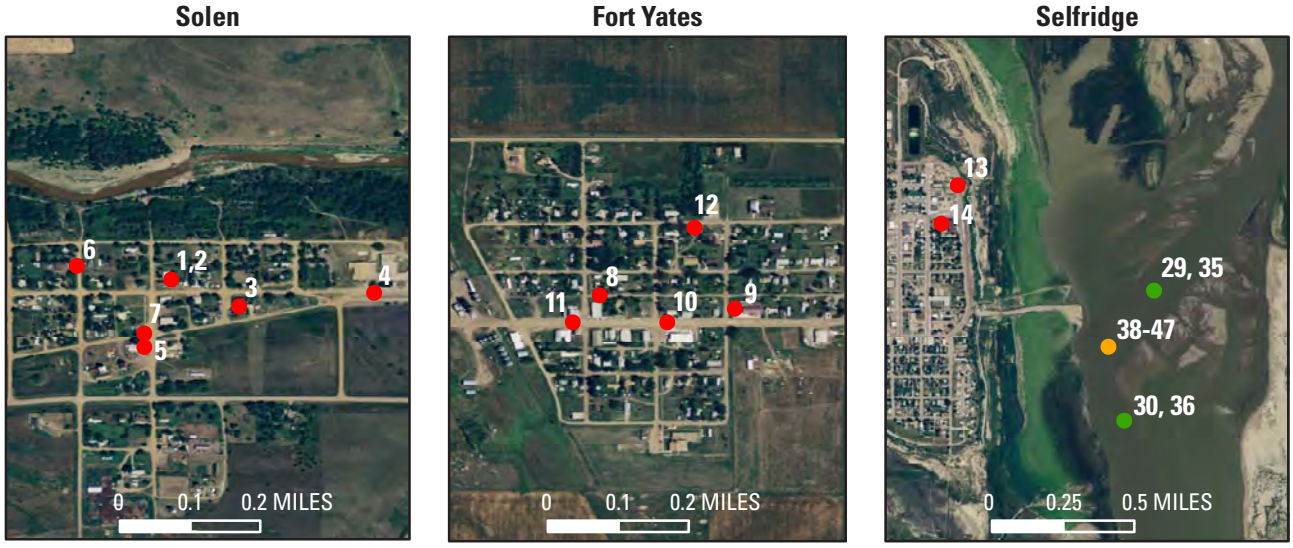
This report provides a limited overview of the water, bed-sediment, and fish-tissue quality from select water sources within the reservation in an attempt to evaluate the overall quality of the water resources on the reservation. Analytical results were compared to established standards and screening values for drinking water, bed sediment, and fish tissue. Samples were collected within the reservation from September 11 through 23, 2006, and analyzed at the USGS National Water Quality Laboratory (NWQL) in Denver, Colorado.

Study Area

The reservation is in south-central North Dakota (Sioux County) and north-central South Dakota (Corson County) and has a total land area of 2.3 million acres (fig. 1). The area is fairly well drained and includes several small streams, lakes,



Base from U.S. Geological Survey digital data, 2005, 1:2,000,000 and North Dakota Department of Transportation, 2003, 1:24,000, GCS North American 1983



Base from U.S. Department of Agriculture Farm Service Agency NAIP, 2006, 1 meter, Universal Transverse Mercator projection, Zone 14, North American Datum 1983

EXPLANATION

★ See insets for sampling locations within/near each town.

15 **Water-delivery systems**

26, 32 **Surface water and bed sediment**–first number is surface water site; second number is bed-sediment site

23 **Ground-water site**

38–47 **Fish-tissue site**

Figure 1. Locations of sample sites within the Standing Rock Sioux Reservation, North and South Dakota.

and dugouts. Surface water is the major water source for the reservation; the Missouri River provides the largest portion of the surface-water supply. Ground water is not as abundant as surface water and, where available, is usually adequate for only small-scale use (Howells, 1982). Shallow ground water is scarce and unreliable, and deep ground water, while generally more plentiful, is highly mineralized and of poor quality (*http://www.mnisose.org/profiles/strock.htm*). Surface and ground water on the reservation are used for municipal, domestic, stock-water, recreation, and irrigation purposes (Amundson, 2002).

Methods

Water-quality, bed-sediment, and fish-tissue samples were collected in North and South Dakota by USGS and Standing Rock Sioux Tribe Department of Water Resources personnel from September 11 through 23, 2006. The 32 locations where samples were collected are described in Supplement table 1–1.

Samples were collected according to U.S. Geological Survey protocols (U.S. Geological Survey, variously dated) and were analyzed at the NWQL utilizing analytical methods for constituent groups described in the following publications:

- Major inorganic and minor trace inorganic constituents in water (American Public Health Association, 1998; Faires, 1993; Fishman, 1993; Fishman and Friedman, 1989; Garbarino, 1999; Garbarino and others, 2006; Struzeski and others, 1996).
- Volatile organic compounds (Conner and others, 1998).
- Nutrients (Fishman, 1993; Patton and Truitt, 1992; Patton and Truitt, 2000).
- Minor and trace inorganic constituents in bed sediment (Arbogast, 1996; Briggs and Meier, 1999; Hageman, 2007, Taggart, 2002).
- Minor and trace inorganic constituents in fish tissue (U.S. Environmental Protection Agency, 1996; Garbarino and others, 2006; Hoffman, 1996).

Field quality assurance and quality control for the study described in this report were addressed by using the same data-collection procedures that are used in the USGS National Stream Quality Accounting Network (NASQAN) program (Kelly and others, 2001). Results for blank and replicate samples collected during 2006 for the NASQAN program in North Dakota indicate that no sample contamination was introduced by field activities (data on file at the USGS North Dakota Water Science Center, Bismarck, North Dakota).

Data Collection Network

Samples and results are grouped into the various categories as described in the following sections.

Public Drinking-Water Supply

Solen Water-Delivery System

Domestic water for Solen, North Dakota, is delivered by one public supply well located within the city. Water is treated at the well location and then distributed to the water users. Seven water samples were collected from the water-delivery system: two samples from the supply well, one raw, untreated sample (Supplement table 1–2, sample 2) and one treated sample (Supplement table 1–2, sample 1); and five samples from users on the water-delivery system (Supplement table 1–2, samples 3–7). Water samples were analyzed for dissolved major inorganic and dissolved minor and trace inorganic concentrations.

Selfridge Water-Delivery System

Domestic water for Selfridge, North Dakota, is delivered from one public supply well located within the city. Water is treated at the well and then distributed to water users. One raw water sample was collected from the supply well (Supplement table 1–3, sample 8). Four water samples were collected from water users on the water-delivery system (Supplement table 1–3, samples 9–12). Water samples were analyzed for dissolved major inorganic and dissolved minor and trace inorganic concentrations.

Fort Yates Water-Delivery System

Domestic water for Fort Yates, North Dakota, and surrounding areas is delivered by the Missouri River intake treatment facility located within the city of Fort Yates. Missouri River water is pumped into the facility and treated, then delivered to the city of Fort Yates and surrounding areas through a pipeline. Seven water samples were collected from the delivery system. A raw water sample was collected at the water intake (Supplement table 1–4, sample 13), and six water samples were collected from water users on the delivery system (Supplement table 1–4, samples 14–19). Water samples were analyzed for dissolved major inorganic and dissolved minor and trace inorganic concentrations, total and dissolved nutrients, total and dissolved organic carbon, and volatile organic compounds (VOCs).

Ground Water

Water samples were collected at six ground-water wells throughout the reservation within Sioux County, North Dakota (Supplement table 1–5, samples 20–25). Water samples were analyzed for dissolved major inorganic and dissolved minor and trace inorganic concentrations.

Surface Water and Bed Sediment

Water and bed-sediment samples were collected from six surface-water locations within the Missouri River drainage on the reservation in North and South Dakota. Water samples were analyzed for dissolved major inorganic and dissolved minor and trace inorganic concentrations (Supplement table 1–6, samples 26–31). Bed-sediment samples were analyzed for minor and trace inorganic concentrations (Supplement table 1–6, samples 32–37).

Fish Tissue

Fish-tissue samples were collected on the Missouri River near Fort Yates, North Dakota. Samples from each of 10 fish species were analyzed for minor and trace inorganic concentrations (Supplement table 1–7, samples 38–47). Additionally an individual minor and trace inorganic analysis was done on the livers of the larger species.

Established Water-Quality Standards and Health-Based Screening Levels

Under the authority of the Safe Drinking Water Act in 1974, the U.S. Environmental Protection Agency (USEPA) established a public drinking-water program. Under the act, the USEPA set limits for contaminant levels in drinking water to ensure the safety of public drinking water. Current 2007 water-quality standards are listed in table 1.

U.S. Environmental Protection Agency Maximum Contaminant Levels

The USEPA has set national water-quality standards for certain contaminants called Maximum Contaminant Levels (MCLs). MCLs are legally enforceable standards that set the maximum permissible level of a contaminant in water that is delivered to any user of a public water system. MCLs are set as close as feasible to the maximum level of a contaminant at which no known or anticipated adverse effects on human health would occur, taking into account the best available technology, treatment techniques, cost considerations, expert judgment, and public comments (U.S. Environmental Protection Agency, 2006a).

U.S. Environmental Protection Agency Secondary Maximum Contaminant Levels

In addition, the USEPA has established National Secondary Drinking Water Regulations that set non-mandatory water-quality standards for 15 contaminants. The USEPA does not enforce these Secondary Maximum Contaminant Levels (SMCLs). They are established only as guidelines to assist public water systems in managing their drinking water for aesthetic considerations, such as taste, color, and odor. These contaminants are not considered to present a risk to human health at the SMCL (U.S. Environmental Protection Agency, 1992).

U.S. Environmental Protection Agency Health Advisories

The USEPA health advisories are an estimate of acceptable drinking-water levels for a chemical substance based on health effects information. A health advisory is not a legally enforceable Federal standard, but serves as technical guidance to assist Federal, State, and local officials (U.S. Environmental Protection Agency, 2006b). The USEPA currently has 1-day, 10-day, and lifetime health advisories established to estimate the concentration of a chemical in drinking water that is not expected to cause any adverse noncarcinogenic effects.

U.S. Environmental Protection Agency Maximum Contaminant Level Goal

The USEPA Maximum Contaminant Level Goal (MCLG) is the level of a contaminant in drinking water below which there is no known or expected risk to health. MCLGs allow for a margin of safety and are non-enforceable public health goals (U.S. Environmental Protection Agency, 2006a).

U.S. Geological Survey Health-Based Screening Levels

Health-Based Screening Levels (HBSLs) are benchmark concentrations of contaminants in water that may be of potential concern for human health. HBSLs are non-enforceable guidelines that were developed by the USGS in collaboration with USEPA and others using USEPA methodologies and the most current, USEPA peer-reviewed, publicly available human-health toxicity information (Toccalino and others, 2003). The USGS and its cooperators are continuing to refine the HBSL methodology.

U.S. Environmental Protection Agency Screening Values for Contaminants in Fish Tissue

USEPA screening values (SV) are defined as concentrations of target contaminants in fish or shellfish tissue that are of potential public health concern and used as threshold values against which levels of contamination in similar tissue collected from the ambient environment can be compared. Exceedance of these SVs should be taken as an indication that more intensive site-specific monitoring and/or evaluation of human health risk should be conducted (U.S. Environmental Protection Agency, 2000a).

Table 1. Summary of established water-quality standards and health-based screening levels for selected contaminants in water.

[USEPA MCL, U.S. Environmental Protection Agency Maximum Contaminant Level; USEPA SMCL, U.S. Environmental Protection Agency Secondary Maximum Contaminant Level; HBSL, Health-Based Screening Level developed by U.S. Geological Survey, USEPA, and others; NA, not available; mg/L, milligrams per liter; µg/L, micrograms per liter]

Contaminant	Constituent type	USEPA MCL	USEPA SMCL	HBSL
Aluminum	Minor and trace inorganic constituent	NA	2 mg/L	NA
Antimony	Minor and trace inorganic constituent	6 µg/L	NA	NA
Arsenic	Minor and trace inorganic constituent	10 µg/L	NA	NA
Barium	Minor and trace inorganic constituent	2,000 µg/L	NA	NA
Beryllium	Minor and trace inorganic constituent	4 µg/L	NA	NA
Boron	Minor and trace inorganic constituent	NA	NA	1,000 µg/L
Cadmium	Minor and trace inorganic constituent	5 µg/L	NA	NA
Chloride	Major inorganic constituent	NA	250 mg/L	NA
Chromium	Minor and trace inorganic constituent	100 µg/L	NA	NA
Copper	Minor and trace inorganic constituent	1,300 µg/L	1 mg/L	NA
Fluoride	Major inorganic constituent	4,000 µg/L	2 mg/L	NA
Iron	Minor and trace inorganic constituent	NA	0.3 mg/L	NA
Lead	Minor and trace inorganic constituent	15 µg/L	NA	NA
Manganese	Minor and trace inorganic constituent	NA	0.05 mg/L	300 µg/L
Nickel	Minor and trace inorganic constituent	NA	NA	100 µg/L
Selenium	Minor and trace inorganic constituent	50 µg/L	NA	NA
Silver	Minor and trace inorganic constituent	NA	0.1 mg/L	100 µg/L
Sulfate	Major inorganic constituent	NA	250 mg/L	NA
Total Trihalomethanes (TTHMs)	Volatile organic compound	80 µg/L	NA	NA
Zinc	Minor and trace inorganic constituent	NA	5 mg/L	2,000 µg/L

Water, Bed-Sediment, and Fish-Tissue Quality

Results for sample analyses can be found in Supplement tables 1–2 through 1–7. The results were compared to USEPA water-quality standards and USGS health-based screening levels for contaminants in drinking water, ground water, surface water, and fish tissue.

Major Inorganic and Minor and Trace Inorganic Constituents in Water

Concentrations of major inorganic and minor and trace inorganic constituents in the 31 water samples collected did not exceed MCLs (figs. 2 and 3); however, arsenic in ground water approached the MCL of 10 µg/L at 2 wells (Supplement table 1–5). Fluoride, manganese, and sulfate concentrations in some samples from the Solen and Selfridge water-supply systems and from ground-water sources exceeded the SMCLs. Long-term exposure to elevated fluoride concentrations may have potential health effects of flourosis (U.S. Environmental Protection Agency, 1994). Higher concentrations of sulfate may have a laxative effect and give water a bitter taste.

Boron exceeded the HBSL of 1,000 µg/L. The USEPA does not have an MCL for boron but does have a lifetime health advisory (HA) of 1,000 µg/L (U.S. Environmental Protection Agency, 2006a). The lifetime HA is based on exposure of a 70-kg adult consuming 2 liters of water per day. Several of the boron values for the Solen and Selfridge water systems and ground-water wells exceeded the HBSL and HA. Of the 18 samples collected at these sites, 16 samples exceeded the HBSL and HA of 1,000 µg/L. The highest value was 3,440 µg/L (Supplement table 1–2, samples 2 and 7) and the lowest value was 183 µg/L (Supplement table 1–5, sample 25). Concentrations in the Solen samples ranged from 3,380 µg/L to 3,440 µg/L. Boron occurs naturally in ground water; other sources include the atmospheric deposition of coal combustion products, storage or disposal of coal ash, and production of consumer and agricultural products such as fertilizer. Ingesting large amounts of boron can be a human-health concern (Agency for Toxic Substances and Disease Registry, 1992).

Volatile Organic Compounds in Water

Of the 29 regulated VOCs analyzed for the Fort Yates water-delivery system, the four trihalomethanes (trichloromethane ($CHCl_3$); bromodichloromethane ($CHBrCl_2$); dibromochloromethane ($CHBr_2Cl$); and, tribromomethane ($CHBr_3$) were the most frequently detected VOCs in samples collected from water users on the delivery system. The relative concentrations of the four THMs in all six samples are expected in natural water that has a low bromide content (Ivahnenko and Barbash, 2004). In such waters, $CHCl_3$ is expected to be the highest concentration, $CHBrCl_2$ next largest, then $CHBr_2Cl$, and $CHBr_3$ the lowest concentration. The sum of the total THMs (TTHM) for each of the six sites was 64, 64, 115, 85, 92, and 86 µg/L, respectively. The sum of the concentrations in samples at four locations (Supplement table 1–4, samples 13–19) exceeded the MCL of 80 µg/L for TTHM (U.S. Environmental Protection Agency, 2006a). The presence of a free chlorine residual in the water being pumped into the distribution system during the September 2006 sampling period may explain the higher values (Ivahnenko and Zogorski, 2006). Until the free chlorine is removed or reduced to chloride, the THM reaction continues to form THMs, and water users at the end of a distribution may have the largest exposure (John Zogorski, U.S. Geological Survey, South Dakota Water Science Center, written commun., March 9, 2007).

The presence of trichloromethane in drinking water is a potential human-health concern. In 1986, the USEPA classified trichloromethane as a probable human carcinogen (Group B2 carcinogen) on the basis of evidence of its carcinogenicity in animals (U.S. Environmental Protection Agency, 2000b). In 1998, the USEPA revised the carcinogenicity risk assessment for trichloromethane, stating that the compound is likely to be carcinogenic to humans by all routes of exposure at concentrations high enough to cause cytotoxicity or the formation of regenerative nodules in susceptible tissues (U.S. Environmental Protection Agency, 2002). More recently, the USEPA revised the MCLG for trichloromethane to 70 µg/L on the basis of non-cancer effects (U.S. Environmental Protection Agency, 2004).

Minor and Trace Inorganic Constituents in Bed Sediment

Bed sediment collected at the surface-water sampling sites were analyzed for minor and trace inorganic constituents (Supplement table 1–6, samples 32–37). The available Federal sediment-quality screening values and standards are complex and apply to individual basins or regions other than the study area. Developing these screening values for this study area would require extensive information that is beyond the scope of this report. The North Dakota Department of Health is currently in the process of developing bed-sediment quality criteria for the State of North Dakota (Mike Ell, North Dakota Department of Health, oral commun., April 25, 2007) that can be used in the future for comparison to results in this report.

Minor and Trace Inorganic Constituents in Fish Tissue and Livers

The 10 fish-tissue samples were analyzed for 22 minor and trace inorganic constituents (Supplement table 1–7, samples 38–47). Results for four constituents that are of human health concern (arsenic, cadmium, mercury, and

selenium) were compared to SVs for this study (table 2). Of the 10 species collected only the northern pike, channel catfish, common carp, and yellow perch are considered recommended target species for inland fresh waters by the USEPA screening criteria (U.S. Environmental Protection Agency, 2000a). Target species are species that are commonly consumed in the study area and are of commercial, recreational, or subsistence value. Even though the common carp is not a popular game fish, the USEPA recommends it as a target species because it is a bottom feeder. Bottom-feeding species such as channel catfish and common carp have been used extensively to monitor a wide variety of containments (U.S. Environmental Protection Agency, 2000a). None of the samples from the target species exceeded the SVs for the selected constituents given the consumption criteria used; however, the gizzard shad, a nontarget species, did exceed the subsistence fishers SV for arsenic. The State of North Dakota administers fish advisories following USEPA guidelines for Lake Oahe and the Missouri River and its major tributaries.

Liver analyses were performed on the northern pike, channel catfish, goldeye, and the common carp. The purposes of these analyses were to evaluate the health of the individual species of fish. These results were not evaluated against any established standards because it was not in the scope of this report.

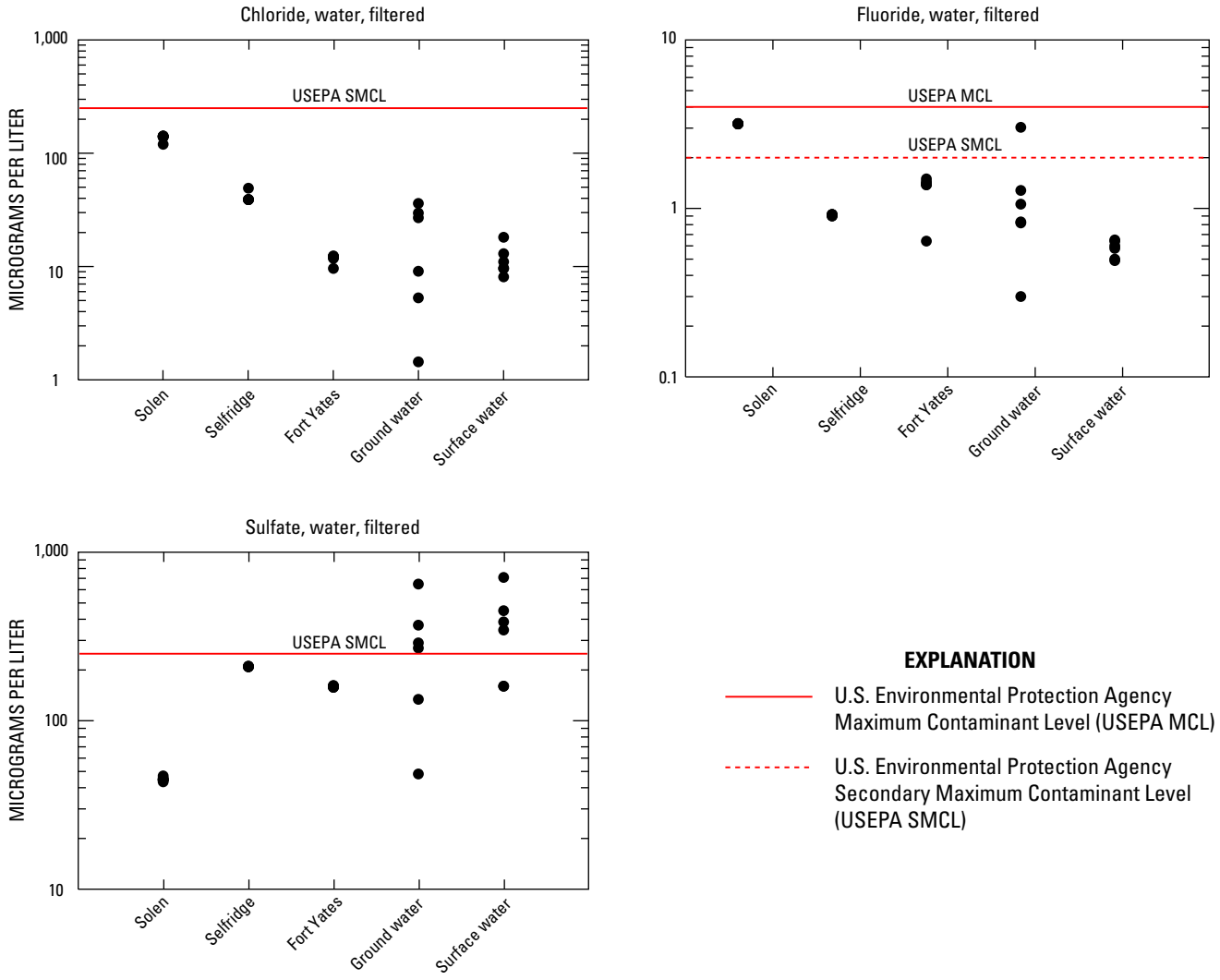


Figure 2. Major inorganic constituents in select public drinking-water sources, ground waters, and surface waters within the Standing Rock Sioux Reservation, North and South Dakota.

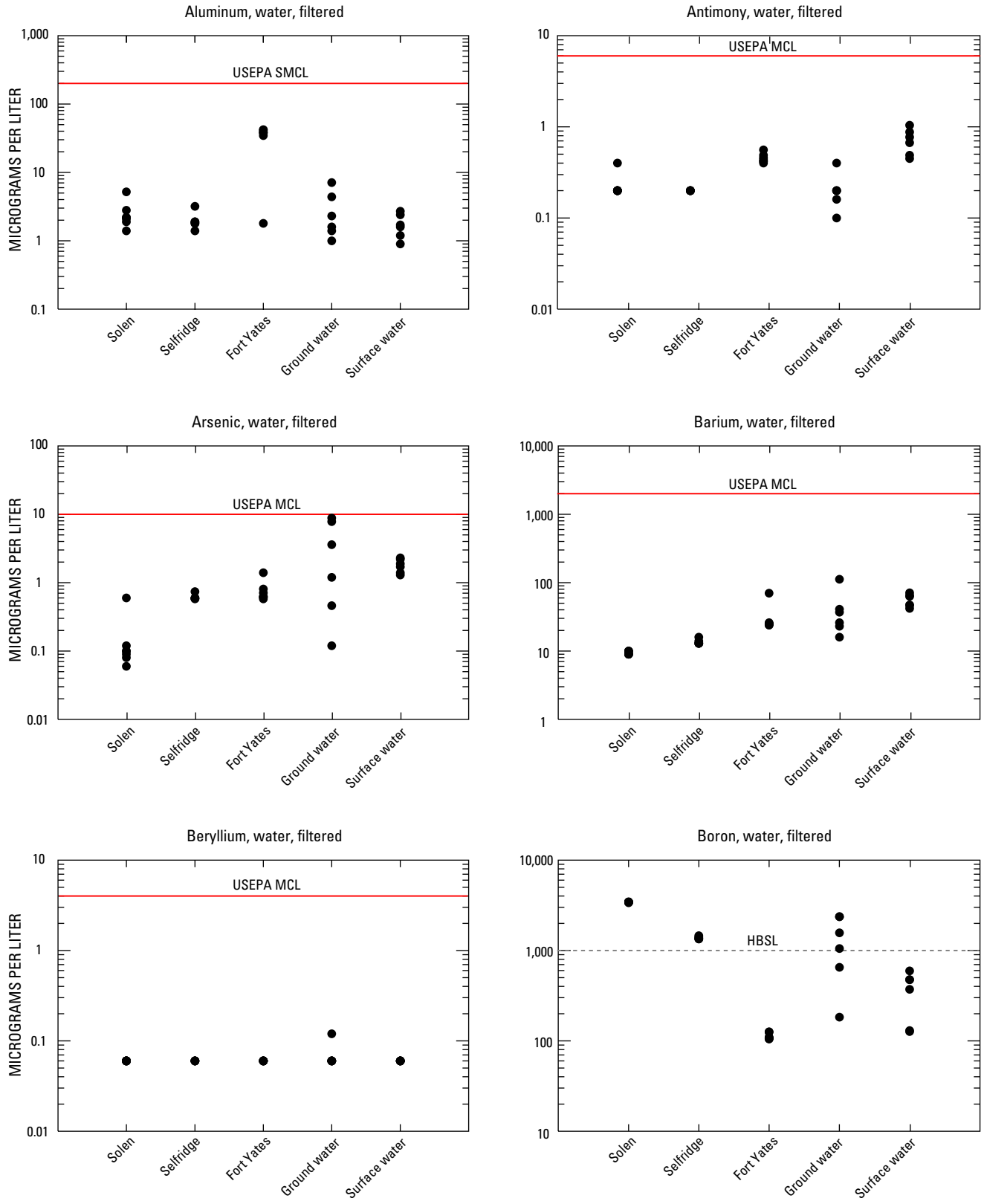


Figure 3. Minor and trace inorganic constituents in select public drinking-water sources, ground waters, and surface waters within the Standing Rock Sioux Reservation, North and South Dakota.

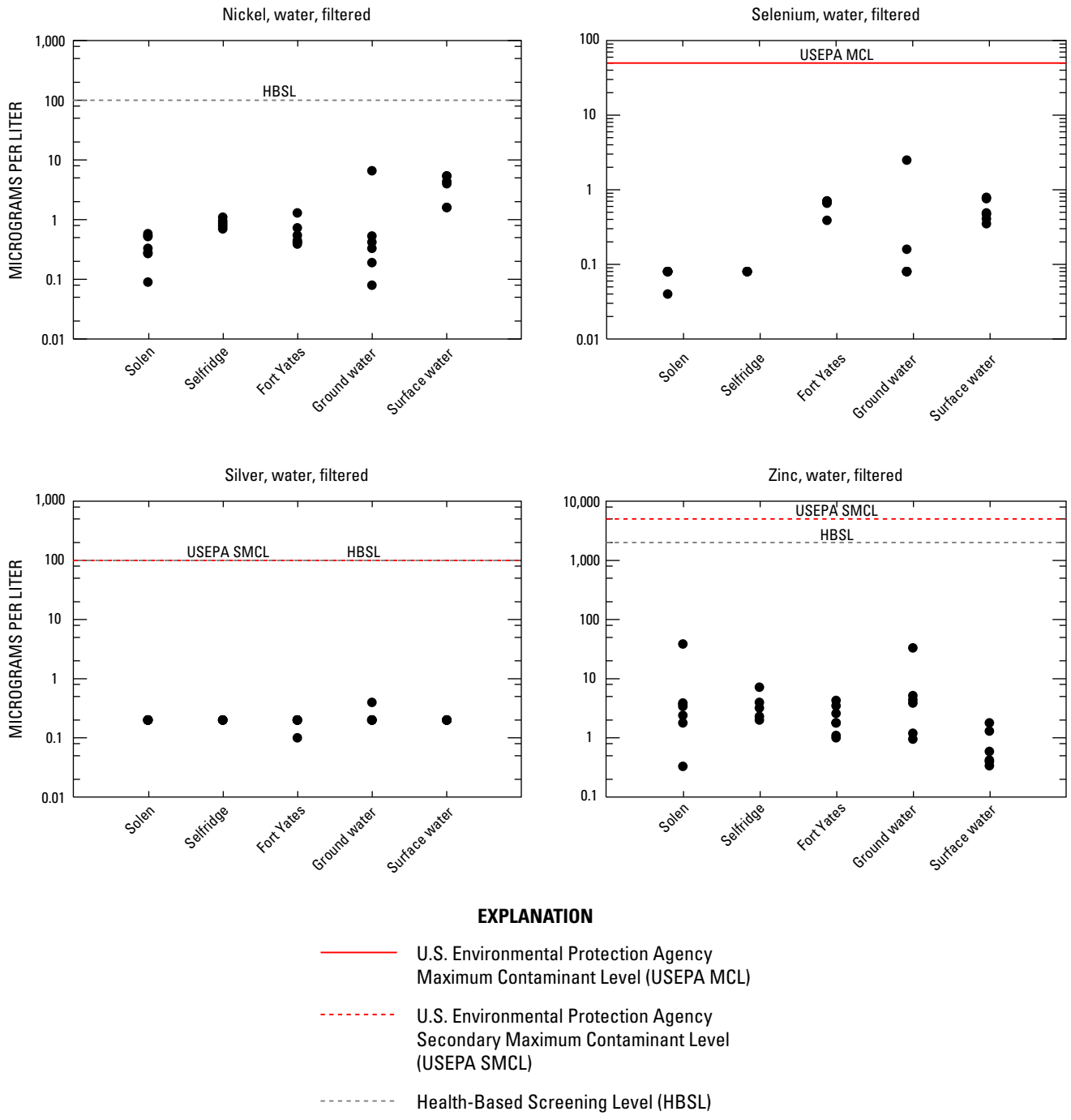


Figure 3. Minor and trace inorganic constituents in select public drinking-water sources, ground waters, and surface waters within the Standing Rock Sioux Reservation, North and South Dakota.—Continued

Table 2. Concentrations of minor and trace inorganic constituents in fish tissue and U.S. Environmental Protection Agency Screening Values for target species collected on the Missouri River near Fort Yates, North Dakota.

[Concentrations in micrograms per gram; SV, Screening Value; <, less than]

Sample number	38	39	41	47	USEPA	USEPA
Species	Northern pike	Channel catfish	Common carp	Yellow perch	SV[1]	SV[2]
Contaminant						
Arsenic	0.456	<0.1	<0.1	0.279	26	3.27
Cadmium	<.1	<.1	<.1	<.1	4,000	491
Mercury	.241	.171	2.191	.123	400	49
Selenium	2.561	2.101	3.939	3.735	20,000	2,457

[1] Recreational fishers; based on fish consumption rate of 17.5 grams per day, 70 kilograms body weight.

[2] Subsistence fishers; based on fish consumption rate of 142.4 grams per day, 70 kilograms body weight.

Summary

Water-quality samples were collected from public water-supply systems, ground water, surface water, bed sediment, and fish tissue within the Standing Rock Sioux Reservation, North and South Dakota, and analyzed to aid in the evaluation of any immediate water-quality concerns. Samples were collected at 32 locations throughout the reservation by U.S. Geological Survey and Standing Rock Sioux Tribe Department of Water Resources personnel from September 11 through 23, 2006.

None of the major inorganic or minor and trace inorganic constituents exceeded the U.S. Environmental Protection Agency (USEPA) Maximum Contaminant Levels (MCLs). Fluoride, manganese, and sulfate concentrations in several samples from the Solen and Selfridge water-delivery systems and from ground water exceeded the USEPA Secondary Maximum Contaminant Levels (SMCLs). Samples collected from the Solen and Selfridge water systems and from ground-water wells had boron concentrations greater than the Health-Based Screening Level (HBSL) of 1,000 micrograms per liter. Boron concentrations in the Solen samples exceeded the HBSL and ranged from 3,380 µg/L to 3,440 µg/L.

Of the 29 regulated Volatile Organic Compounds (VOCs) analyzed in samples from the Fort Yates water-delivery system, the four trihalomethanes (THMs) were the most frequently detected in samples collected from water users. The sum of the total THMs (TTHM) for each of the six sites was 64, 64, 115, 85, 92, and 86 micrograms per liter, respectively. The concentrations in samples from four locations exceeded the MCL of 80 micrograms per liter for TTHM. The presence of a free chlorine residual in the water being pumped into the distribution system during the September 2006 sampling period may explain the higher values. Until the free chlorine is removed or reduced to chloride, the THM reaction continues to form THMs, and water users at the end of a distribution may have the largest exposure.

Results from bed-sediment analyses were not compared to any standards, but the State of North Dakota is currently (2007) developing a set of screening standards that can be used in the future.

Minor and trace inorganic constituent concentrations did not exceed USEPA Screening Values in fish tissue of targeted species. The State of North Dakota administers fish advisories following USEPA guidelines for Lake Oahe and the Missouri River and its major tributaries.

References Cited

Agency for Toxic Substances and Disease Registry (ATSDR), 1992, Toxicological profile for boron: Atlanta, Ga., U.S. Department of Health and Human Services, Public Health Service.

American Public Health Association, 1998, Standard methods for the examination of water and wastewater (20th ed.): Washington, D.C., American Public Health Association, American Water Works Association, and Water Environment Federation, p. 3–37—3–43.

Amundson, F.D., 2002, Estimated use of water in South Dakota, 2000: U.S. Geological Survey Open-File Report 02–440, 17 p.

Arbogast, B.F., 1996, Analytical methods for the Mineral Resource Surveys Program: U.S. Geological Survey Open-File Report 96–525, 248 p.

Briggs, P.H., and Meier, A.L., 1999, The determination of forty two elements in geological materials by inductively coupled plasma-mass spectrometry: U.S. Geological Survey Open-File Report 99–166, 15 p.

Connor, B.F., Rose, D.L., Noriega, M.C., Murtagh, L.K., and Abney, S.R., 1998, Methods of analysis by the U.S. Geological Survey National Water-Quality Laboratory—determination of 86 volatile organic compounds in water by gas chromatography/mass spectrometry, including detections less than reporting limits: U.S. Geological Survey Open-File Report 97–829, 78 p.

Faires, L.M., 1993, Methods of analysis by the U.S. Geological Survey National Water Quality Laboratory—determination of metals in water by inductively coupled plasma-mass spectrometry: U.S. Geological Survey Open-File Report 92–634, 28 p.

Fishman, M.J., ed., 1993, Methods of analysis by the U.S. Geological Survey National Water Quality Laboratory—determination of inorganic and organic constituents in water and fluvial sediments: U.S. Geological Survey Open-File Report 93–125, 217 p.

Fishman, M.J., and Friedman, L.C., 1989, Methods for determination of inorganic substances in water and fluvial sediments: U.S. Geological Survey Techniques of Water-Resources Investigations, book 5, chap. A1, 545 p.

Garbarino, J.R., 1999, Methods of analysis by the U.S. Geological Survey National Water Quality Laboratory—determination of dissolved arsenic, boron, lithium, selenium, strontium, thallium, and vanadium using inductively coupled plasma-mass spectrometry: U.S. Geological Survey Open-File Report 99–093, 31 p.

Garbarino, J.R., Kanagy, L.K., and Cree, M.E., 2006, Determination of elements in natural-water, biota, sediment, and soil samples using collision/reaction cell inductively coupled plasma-mass spectrometry: U.S. Geological Survey Techniques and Methods, book 5, sec. B, chap.1, 88 p.

Hageman, P.L., 2007, Determination of mercury in aqueous and geologic materials by continuous flow-cold vapor-atomic fluorescence spectrometry (CVAFS): U.S. Geological Survey Techniques and Methods, book 5, chap. D2, 6 p.

Hoffman, G.L., 1996, Methods of analysis by the U.S. Geological Survey National Water Quality Laboratory—preparation procedure for aquatic biological material determined for trace metals: U.S. Geological Survey Open-File Report 96–362, 42 p.

Howells, L.W., 1982, Geohydrology of the Standing Rock Indian Reservation, North and South Dakota: U.S. Geological Survey Hydrologic Investigations Atlas HA–644, 5 sheets.

Ivahnenko, T., and Barbash, J.E., 2004, Chloroform in the hydrologic system—sources, transport, fate, occurrence, and effects on human health and aquatic organisms: U.S. Geological Survey Scientific Investigations Report 2004–5137, 34 p.

Ivahnenko, T., and Zogorski, J.S., 2006, Sources and occurrence of chloroform and other trihalomethanes in drinking-water supply wells in the United States, 1986–2001: U.S. Geological Survey Scientific Investigations Report 2006–5015, 13 p.

Kelly, V.J., Hooper, R.P., Aulenbach, B.T., and Janet, M., 2001, Concentrations and annual fluxes for selected water-quality constituents from the USGS National Stream Quality Accounting Network (NASQAN), 1996–2000: U.S. Geological Survey Water-Resources Investigations Report 01–4255.

Mni Sose Intertribal Rights Coalition, Inc., 2005, Standing Rock Sioux Tribe community environmental profile, accessed June 1, 2005, at *http://www.mnisose.org/profiles/strock.htm*

Patton, C.J., and Truitt, E.P., 1992, Methods of analysis by the U.S. Geological Survey National Water Quality Laboratory—determination of total phosphorus by a Kjeldahl digestion method and an automated colorimetric finish that includes dialysis: U.S. Geological Survey Open-File Report 92–146, 39 p.

Patton, C.J., and Truitt, E.P., 2000, Methods of analysis by the U.S. Geological Survey National Water Quality Laboratory—determination of ammonium plus organic nitrogen by a Kjeldahl digestion method and an automated photometric finish that includes digest cleanup by gas diffusion: U.S. Geological Survey Open-File Report 00–170, 31 p.

Struzeski, T.M., DeGiacomo, W.J., and Zayhowski, E.J., 1996, Methods of analysis by the U.S. Geological Survey National Water Quality Laboratory—determination of dissolved aluminum and boron in water by inductively coupled plasma-atomic emission spectrometry: U.S. Geological Survey Open-File Report 96–149, 17 p.

Taggart, J.E., Jr., ed., 2002, Analytical methods for chemical analysis of geologic and other materials, U.S. Geological Survey: U.S. Geological Survey Open-File Report 02–223, 20 p.

Toccalino, P.L., Nowell, L.H., Wilber, W.G., Zogorski, J.S., Donohue, J.M., Eiden, C.A., Krietzman, S.J., and Post, G.B., 2003, Development of health-based screening levels for use in state- or local-scale water-quality assessments: U.S. Geological Survey Water-Resources Investigations Report 03–4054, 22 p.

U.S. Environmental Protection Agency, 1992, Secondary Drinking Water Regulations—guidance for nuisance chemicals, accessed January 17, 2007, at *http://www.epa.gov/safewater/consumer/2ndstandards.html*

U.S. Environmental Protection Agency, 1994, Summary of EPA finalized National Primary Drinking Water Regulations: U.S. Environmental Protection Agency Region VIII, 7 p.

U.S. Environmental Protection Agency, 1996, Microwave assisted acid digestion of siliceous and organically based matrices: U.S. Environmental Protection Agency Method 3052, Revision 0, December 1996, 20 p.

U.S. Environmental Protection Agency, 2000a, Guidance for assessing chemical contaminant data for use in fish advisories: v. 1, Fish sampling and analysis (3d ed.).

U.S. Environmental Protection Agency, 2000b, Federal Register Document 40 CFR, Part 141: U.S. Environmental Protection Agency, v. 65, no. 104, p. 34404–34405.

U.S. Environmental Protection Agency, 2002, Integrated Risk Information System, accessed March 21, 2007, at *http://www.epa.gov/iris/*

U.S. Environmental Protection Agency, 2004, 2004 Edition of the drinking water standards and health advisories: Washington, D.C., Office of Water, U.S. Environmental Protection Agency, EPA 822–R–04–005, 20 p.

U.S. Environmental Protection Agency, 2006a, 2006 Edition of the drinking water standards and health advisories: Washington, D.C., Office of Water, U.S. Environmental Protection Agency, EPA 822–R–04–005, 12 p.

U.S. Environmental Protection Agency, 2006b, Setting standards for safe drinking water, accessed January 17, 2007, at *http://www.epa.gov/safewater/standard/setting.html*

U.S. Geological Survey, variously dated, National field manual for the collection of water-quality data: U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chaps. A1–A9, available online at *http://pubs.water.usgs.gov/twri9A*

Supplement. Analytical data for water, bed sediment, and fish tissue within the Standing Rock Sioux Reservation.

Table 1–1. Sample location information.

[USDA, U.S. Department of Agriculture; MRI, Municipal, Residential, and Industrial]

	Sample number	Site name	Latitude and longitude	Sample date and time	Sample location/information
Solen water-delivery system samples	1	Solen city well (treated)	46º23’ 100º47’	09/11/06 1000	Source well (treated).
	2	Solen City Well (raw)	46º23’ 100º47’	09/11/06 1205	Source well (raw water).
	3	Solen water user #1	46º23’16” 100º47’41”	09/11/06 1030	Hoffman residence, from kitchen sink.
	4	Solen water user #2	46º23’17” 100º47’31”	09/11/06 1100	Solen School, from teacher lounge sink.
	5	Solen water user #3	46º23’13” 100º47’48”	09/11/06 1140	Solen garage, from restroom sink.
	6	Solen water user #4	46º23’19” 100º47’53”	09/11/06 1235	Solen Fire Hall, from kitchen sink.
	7	Solen water user #5	46º23’14” 100º47’48”	09/11/06 1250	Solen Post Office, from restroom sink.
Selfridge water-delivery system samples	8	Selfridge city well (raw)	46º02’ 100º55’	09/14/06 0900	Source well (raw water).
	9	Selfridge water user #1	46º02’30” 100º55’14”	09/14/06 0920	USDA Service Center office, from utility sink.
	10	Selfridge water user #2	46º02’29” 100º55’19”	09/14/06 0930	Selfridge Cenex station, from restroom sink.
	11	Selfridge water user #3	46º02’29” 100º55’26”	09/14/06 0940	Selfridge Post Office, from restroom sink.
	12	Selfridge water user #4	46º02’36” 100º55’17”	09/14/06 1000	Selfridge Elementary School, from utility sink.
Fort Yates water-delivery system samples	13	Fort Yates MRI intake facility (raw)	46º05’ 100º37’	09/14/06 1245	Sample collected at intake facility raw intake.
	14	Fort Yates water user #1	46º05’39” 100º37’42”	09/14/06 1225	Standing Rock Sioux Administration Building, from basement utility sink.
	15	Fort Yates water user #2	46º05’23” 100º40’19”	09/14/06 0930	Standing Rock High School, from utility sink.
	16	Fort Yates water user #3	46º23’20” 100º35’50”	09/14/06 1415	Porcupine Community Center, from kitchen utility sink.
	17	Fort Yates water user #4	46º23’27” 100º35’16”	09/14/06 1355	Porcupine Head Start building, from restroom sink
	18	Fort Yates water user #5	46º13’14” 101º05’53”	09/14/06 1110	Cannonball School, from utility sink.
	19	Fort Yates water user #6	46º13’12” 101º05 44”	09/14/06 1030	Cannonball Community Center, from utility sink.
Ground-water samples	20	132–83–29CCC C	46º13’11” 101º06’14”	09/12/06 1145	0.4 mile west of Porcupine, N. Dak.
	21	130–80–03ABB	46º06’59”100º40’41”	09/13/06 1130	2.3 miles northwest of Fort Yates, N. Dak.
	22	129–81–01BAB	46º01’48” 100º45’56”	09/12/06 1530	7.4 miles east of Selfridge, N. Dak..
	23	130–86–28CCC2	46º02’44” 101º27’27”	09/12/06 1355	3.8 miles northwest of McLintosh, S. Dak.
	24	134–79–32ADD	46º22’39” 100º37’56”	09/13/06 1440	1 mile west of Cannonball, N. Dak.
	25	Sioux County well #6	46º02’47” 100º41’47”	09/19/06 1100	4 miles southwest of Fort Yates, N. Dak.
Surface-water water samples	26	Cannonball River near Raleigh, N. Dak.	46º07’37” 101º19’58”	09/18/06 1325	USGS station number 06351200.
	27	Cedar Creek near Raleigh, N. Dak.	46º05’30” 101º20’00”	09/18/06 1225	USGS station number 06353000.
	28	Cannonball River at Breien, N. Dak.	46º22’34” 100º56’04”	09/18/06 0900	USGS station number 06354000.
	29	Missouri River above Fort Yates, N. Dak.	46º05’33” 100º37’19”	09/19/06 1120	Collection from boat on Missouri River above Fort Yates.
	30	Missouri River below Fort Yates, N. Dak.	46º05’10” 100º36’50”	09/19/06 1105	Collection from boat on Missouri River below Fort Yates.
	31	Grand River near Wakpala, S. Dak.	45º39’40” 100º38’20”	09/18/06 1050	USGS station number 06358000.

Table 1–1. Sample location information.—Continued

[USDA, U.S. Department of Agriculture; MRI, Municipal, Residential, and Industrial]

	Sample number	Site name	Latitude and longitude	Sample date and time	Sample location/information
Bed-sediment samples	32	Cannonball River near Raleigh, N. Dak.	46º07’37” 101º19’58”	09/18/06 1325	Center of river channel.
	33	Cedar Creek near Raleigh, N. Dak.	46º05’30” 101º20’00”	09/18/06 1225	Center of river channel.
	34	Cannonball River at Breien, N. Dak.	46º22’34” 100º56’04”	09/18/06 0900	Center of river channel.
	35	Missouri River above Fort Yates, N. Dak.	46º05’33” 100º37’19”	09/19/06 1120	Center of river channel.
	36	Missouri River below Fort Yates, N. Dak.	46º05’10” 100º36’50”	09/19/06 1105	Center of river channel.
	37	Grand. River near Wakpala, S. Dak.	45º39’40” 100º38’20”	09/18/06 1050	Center of river channel.
Fish-tissue samples	38	Missouri River near Fort Yates, N. Dak. (Fish)	46º05’19” 100º36’42”	09/23/06 1200	Tissue sample from northern pike.
	39	Missouri River near Fort Yates, N. Dak. (Fish)	46º05’19” 100º36’42”	09/23/06 1205	Tissue sample from channel catfish.
	40	Missouri River near Fort Yates, N. Dak. (Fish)	46º05’19” 100º36’42”	09/23/06 1210	Tissue sample from goldeye.
	41	Missouri River near Fort Yates, N. Dak. (Fish)	46º05’19” 100º36’42”	09/23/06 1215	Tissue sample from common carp.
	42	Missouri River near Fort Yates, N. Dak. (Fish)	46º05’19” 100º36’42”	09/23/06 1220	Tissue sample from common shiner.
	43	Missouri River near Fort Yates, N. Dak. (Fish)	46º05’19” 100º36’42”	09/23/06 1225	Tissue sample from green sunfish.
	44	Missouri River near Fort Yates, N. Dak. (Fish)	46º05’19” 100º36’42”	09/23/06 1230	Tissue sample from gizzard shad.
	45	Missouri River near Fort Yates, N. Dak. (Fish)	46º05’19” 100º36’42”	09/23/06 1235	Tissue sample from orange spotted sunfish.
	46	Missouri River near Fort Yates, N. Dak. (Fish)	46º05’19” 100º36’42”	09/23/06 1240	Tissue sample from river carpsucker.
	47	Missouri River near Fort Yates, N. Dak. (Fish)	46º05’19” 100º36’42”	09/23/06 1245	Tissue sample from yellow perch.

Table 1–2. Analytical results for samples collected from the Solen water-delivery system, Standing Rock Sioux Reservation, North Dakota.

[Sample 1 is raw sample from city supply well; sample 2 is treated sample from supply well; samples 3–7 are from water users. <, less than; E, estimated]

Sample number (see table 1-1)	1	2	3	4	5	6	7
Physical properties							
pH, water, unfiltered, field, standard units	8.2	8.3	8.2	8.2	8.5	8.2	8.2
pH, water, unfiltered, laboratory, standard units	8.4	8.5	8.5	8.4	8.4	8.4	8.4
Specific conductance, water, unfiltered, laboratory, microsiemens per centimeter at 25 degrees Celsius	2,030	1,990	2,060	2,050	2,040	2,040	2,030
Specific conductance, water, unfiltered, microsiemens per centimeter at 25 degrees Celsius	2,070	1,990	2,090	2,130	2,100	2,100	2,090
Temperature, water, degrees Celsius	10.2	10.4	15.2	19.9	17.6	16.9	16.3
Major inorganic constituents							
Calcium, water, filtered, milligrams per liter	2.5	2.46	2.48	2.48	2.48	2.51	2.49
Magnesium, water, filtered, milligrams per liter	.772	.751	2.65	.759	.760	.776	.772
Potassium, water, filtered, milligrams per liter	2.56	2.45	2.58	2.46	2.49	2.57	2.55
Sodium, water, filtered, milligrams per liter	488	477	488	479	488	502	499
Acid neutralizing capacity, water, unfiltered, fixed endpoint (pH 4.5) titration, laboratory, milligrams per liter as calcium carbonate	870	866	880	871	869	870	870
Chloride, water, filtered, milligrams per liter	139	120	141	142	140	142	140
Fluoride, water, filtered, milligrams per liter	3.2	3.2	3.2	3.2	3.2	3.2	3.2
Silica, water, filtered, milligrams per liter	16.6	16.7	16.6	15.9	16.4	15.6	16.2
Sulfate, water, filtered, milligrams per liter	45.7	47	44.4	44.7	44.8	44.7	43.4
Minor and trace inorganic contituents							
Aluminum, water, filtered, micrograms per liter	2	E1	5	2	2	3	2
Antimony, water, filtered, micrograms per liter	<.20	<.20	<.20	<.40	<.20	<.20	<.20
Arsenic, water, filtered, micrograms per liter	<.06	E0.12	<.10	<.10	<.06	<.09	<.08
Barium, water, filtered, micrograms per liter	10	9	10	9	9	10	9
Beryllium, water, filtered, micrograms per liter	<.06	<.06	<.06	<.06	<.06	<.06	<.06
Boron, water, filtered, micrograms per liter	3,430	3,440	3,430	3,420	3,380	3,430	3,440
Cadmium, water, filtered, micrograms per liter	.28	<.04	.05	.04	E.03	.04	E.02
Chromium, water, filtered, micrograms per liter	<2	<2	<2	<2	<2	<2	<2
Copper, water, filtered, micrograms per liter	75.7	.93	80.8	363	63.8	68.4	57.2
Iron, water, filtered, micrograms per liter	51	41	17	32	38	31	40
Lead, water, filtered, micrograms per liter	.28	.24	.42	1.63	.38	1.6	.29
Manganese, water, filtered, micrograms per liter	4.7	4.4	6	1.9	1.6	1	1.6
Nickel, water, filtered, micrograms per liter	.27	.09	.58	.52	.33	.54	.28
Selenium, water, filtered, micrograms per liter	<.08	<.08	<.08	E.04	<.08	<.08	<.08
Silver, water, filtered, micrograms per liter	<.2	<.2	<.2	<.2	<.2	<.2	<.2
Thallium, water, filtered, micrograms per liter	<.04	<.04	<.04	<.04	<.04	<.04	<.04
Zinc, water, filtered, micrograms per liter	1.8	E.33	3.4	3.9	3.7	38.7	2.4

Table 1–3. Analytical results for samples collected from the Selfridge water-delivery system, Standing Rock Sioux Reservation, North Dakota.

[Sample 8 is raw sample from supply well; samples 9–12 are from water users. <, less than; E, estimated]

Sample number (see table 1-1)	8	9	10	11	12
Physical properties					
pH, water, unfiltered, field, standard units	8.1	8.2	8.2	8.2	8.1
pH, water, unfiltered, laboratory, standard units	8.3	8.3	8.4	8.3	8.3
Specific conductance, water, unfiltered, laboratory, microsiemens per centimeter at 25 degrees Celsius	1,410	1,360	1,360	1,370	1,370
Specific conductance, water, unfiltered, microsiemens per centimeter at 25 degrees Celsius	1,440	1,400	1,390	1,390	1,390
Temperature, water, degrees Celsius	17.1	18	16.7	16.8	18.4
Major inorganic constituents					
Calcium, water, filtered, milligrams per liter	5.49	5.36	5.38	5.37	5.25
Magnesium, water, filtered, milligrams per liter	.992	1	1.02	.984	1.02
Potassium, water, filtered, milligrams per liter	1.78	1.66	1.61	1.63	1.65
Sodium, water, filtered, milligrams per liter	315	306	306	306	300
Acid neutralizing capacity, water, unfiltered, fixed endpoint (pH 4.5) titration, laboratory, milligrams per liter as calcium carbonate	445	440	440	440	440
Chloride, water, filtered, milligrams per liter	49.1	39	39	39	39
Fluoride, water, filtered, milligrams per liter	.9	.9	.9	.9	.9
Silica, water, filtered, milligrams per liter	17.8	16.6	16.8	16.6	16.6
Sulfate, water, filtered, milligrams per liter	209	211	210	209	210
Minor and trace inorganic constituents					
Aluminum, water, filtered, micrograms per liter	2	2	E1	2	3
Antimony, water, filtered, micrograms per liter	<.20	<.20	<.20	<.20	<.20
Arsenic, water, filtered, micrograms per liter	.74	.58	.59	.59	.6
Barium, water, filtered, micrograms per liter	16	13	13	14	13
Beryllium, water, filtered, micrograms per liter	<.06	<.06	<.06	<.06	<.06
Boron, water, filtered, micrograms per liter	1,460	1,370	1,340	1,410	1,350
Cadmium, water, filtered, micrograms per liter	<.04	<.04	<.04	<.04	<.04
Chromium, water, filtered, micrograms per liter	<6	<2	<2	<6	<6
Copper, water, filtered, micrograms per liter	1.3	160	25.2	56	41.6
Iron, water, filtered, micrograms per liter	108	57	61	55	60
Lead, water, filtered, micrograms per liter	.29	.23	.22	.20	.26
Manganese, water, filtered, micrograms per liter	13.1	8.7	9	8.2	9.4
Nickel, water, filtered, micrograms per liter	.70	1.1	.86	.78	.95
Selenium, water, filtered, micrograms per liter	<.08	<.08	<.08	<.08	<.08
Silver, water, filtered, micrograms per liter	<.2	<.2	<.2	<.2	<.2
Thallium, water, filtered, micrograms per liter	<.04	<.04	<.04	<.04	<.04
Zinc, water, filtered, micrograms per liter	7.2	2.3	4	2	3.2

Table 1–4. Analytical results for samples collected from the Fort Yates water-delivery system, Standing Rock Sioux Reservation, North Dakota.

[Sample 13 is raw sample from water intake; samples 14–19 are from water users. <, less than; E, estimated; THM, trihalomethane]

Sample number (see table 1-1)	13	14	15	16	17	18	19
Physical properties							
pH, water, unfiltered, field, standard units	8.2	9.2	9	9.1	9.2	9.2	9.2
pH, water, unfiltered, laboratory, standard units	8.4	9.3	9.2	9.3	9.4	9.3	9.3
Specific conductance, water, unfiltered, laboratory, microsiemens per centimeter at 25 degrees Celsius	659	528	532	523	528	530	523
Specific conductance, water, unfiltered, microsiemens per centimeter at 25 degrees Celsius	666	531	532	534	532	529	520
Temperature, water, degrees Celsius	20	21.2	15.6	21.6	18.6	19.7	20.6
Major inorganic constituents							
Calcium, water, filtered, milligrams per liter	48.8	33.6	32.4	31.4	34.1	33.3	32.5
Magnesium, water, filtered, milligrams per liter	19.4	7.09	7.65	6.77	6.17	6.8	6.76
Potassium, water, filtered, milligrams per liter	4.03	4.28	4.16	4.11	4.27	4.31	4.17
Sodium, water, filtered, milligrams per liter	58.2	61.8	59.4	60.2	61.1	61	60.6
Acid neutralizing capacity, water, unfiltered, fixed endpoint (pH 4.5) titration, laboratory, milligrams per liter, as calcium carbonate	165	65	66	63	65	65	64
Chloride, water, filtered, milligrams per liter	9.6	12.2	12.1	12.4	12.2	11.8	12.1
Fluoride, water, filtered, milligrams per liter	.60	1.4	1.5	1.4	1.4	1.4	1.4
Silica, water, filtered, milligrams per liter	5.84	6.09	6.17	5.97	5.89	6.07	6
Sulfate, water, filtered, milligrams per liter	158	160	161	161	158	158	162
Organic carbon, water, filtered, milligrams per liter	3.2	2.7	2.5	2.4	2.9	2.7	3
Organic carbon, water, unfiltered, milligrams per liter	4.1	2.2	2.3	1.8	2.1	1.9	1.8
Nutrients							
Ammonia plus organic nitrogen, water, filtered, milligrams per liter, as nitrogen	0.27	0.21	0.37	0.22	0.35	0.37	0.38
Ammonia plus organic nitrogen, water, unfiltered, milligrams per liter, as nitrogen	.33	.12	.14	.12	E.08	.14	.13
Ammonia, water, filtered, milligrams per liter as nitrogen	.013	E.008	<.010	<.010	<.010	<.010	<.010
Nitrite plus nitrate, water, filtered, milligrams per liter, as nitrogen	.10	.11	.11	.11	.11	.13	.12
Nitrite, water, filtered, milligrams per liter, as nitrogen	E.001	<.002	<.002	<.002	<.002	<.002	<.002
Orthophosphate, water, filtered, milligrams per liter, as phosphorus	.006	.137	.134	.163	.138	.159	.137
Phosphorus, water, filtered, milligrams per liter	<.04	.34	.29	.32	.32	.31	.34
Phosphorus, water, unfiltered, milligrams per liter	.04	.34	.30	.31	.32	.32	.33

Table 1–4. Analytical results for samples collected from the Fort Yates water-delivery system, Standing Rock Sioux Reservation, North Dakota.—Continued

[Sample 13 is raw sample from water intake; samples 14–19 are from water users. <, less than; E, estimated; THM, trihalomethane]

Sample number (see table 1-1)	13	14	15	16	17	18	19
Minor and trace inorganic constituents							
Aluminum, water, filtered, micrograms per liter	2	39	35	42	38	42	39
Antimony, water, filtered, micrograms per liter	.46	.40	.49	.42	.56	.44	.42
Arsenic, water, filtered, micrograms per liter	1.4	.58	.81	.61	.62	.71	.63
Barium, water, filtered, micrograms per liter	70	24	24	25	26	25	25
Beryllium, water, filtered, micrograms per liter	<.06	<.06	<.06	<.06	<.06	<.06	<.06
Boron, water, filtered, micrograms per liter	125	110	126	105	108	108	105
Cadmium, water, filtered, micrograms per liter	<.04	<.04	<.04	<.04	E.02	<.04	<.04
Chromium, water, filtered, micrograms per liter	<2	E1	<2	<2	E1	E1	<2
Copper, water, filtered, micrograms per liter	13	5.9	4.6	7.7	3.4	.85	5.1
Iron, water, filtered, micrograms per liter	<6	<6	<6	7	<6	<6	<6
Lead, water, filtered, micrograms per liter	.1	E.06	E.06	.15	.15	E.05	.57
Manganese, water, filtered, micrograms per liter	4.4	<.6	<.6	E.3	<.6	<.6	<.6
Nickel, water, filtered, micrograms per liter	1.3	.55	.73	.39	.42	.42	.45
Selenium, water, filtered, micrograms per liter	.71	.68	.39	.69	.69	.70	.66
Silver, water, filtered, micrograms per liter	<.2	<.2	E.1	<.2	<.2	<.2	<.2
Thallium, water, filtered, micrograms per liter	<.04	<.04	<.04	<.04	<.04	<.04	<.04
Zinc, water, filtered, micrograms per liter	1.8	1.8	4.3	1.1	3.5	1	2.6
Volatile inorganic compounds							
1,1,1-Trichloroethane, water, unfiltered, recoverable, micrograms per liter	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,1,2-Trichloro-1,2,2-trifluoroethane, water, unfiltered, recoverable, micrograms per liter	<.1	<.1	<.1	<.1	<.1	<.1	<.1
1,1-Dichloroethane, water, unfiltered, recoverable, micrograms per liter	<.1	<.1	<.1	<.1	<.1	<.1	<.1
1,1-Dichloroethene, water, unfiltered, recoverable, micrograms per liter	<.1	<.1	<.1	<.1	<.1	<.1	<.1
1,2-Dichlorobenzene, water, unfiltered, recoverable, micrograms per liter	<.1	<.1	<.1	<.1	<.1	<.1	<.1
1,2-Dichloroethane, water, unfiltered, recoverable, micrograms per liter	<.2	<.2	<.2	<.2	<.2	<.2	<.2
1,2-Dichloroethane-d4, surrogate, Schedule 2090, water, unfiltered, percent recovery	111	109	114	111	111	109	111
1,2-Dichloropropane, water, unfiltered, recoverable, micrograms per liter	<.1	<.1	<.1	<.1	<.1	<.1	<.1
1,3-Dichlorobenzene, water, unfiltered, recoverable, micrograms per liter	<.1	<.1	<.1	<.1	<.1	<.1	<.1
1,4-Dichlorobenzene, water, unfiltered, recoverable, micrograms per liter	<.1	<.1	<.1	<.1	<.1	<.1	<.1
1-Bromo-4-fluorobenzene, surrogate, VOC schedules, water, unfiltered, percent recovery	96.5	97.4	99.8	97.5	97.6	99.1	98.3
Benzene, water, unfiltered, recoverable, micrograms per liter	<.1	<.1	<.1	<.1	<.1	<.1	<.1

Table 1–4. Analytical results for samples collected from the Fort Yates water-delivery system, Standing Rock Sioux Reservation, North Dakota.—Continued

[Sample 13 is raw sample from water intake; samples 14–19 are from water users. <, less than; E, estimated; THM, trihalomethane]

Sample number (see table 1-1)	13	14	15	16	17	18	19
Volatile inorganic compounds—Continued							
(THM) Bromodichloromethane, water, unfiltered, recoverable, micrograms per liter	<0.1	16.2	16.8	20.5	19	18	19.2
Chlorobenzene, water, unfiltered, recoverable, micrograms per liter	<.1	<.1	<.1	<.1	<.1	<.1	<.1
cis-1,2-Dichloroethene, water, unfiltered, recoverable, micrograms per liter	<.1	<.1	<.1	<.1	<.1	<.1	<.1
(THM) Dibromochloromethane, water, unfiltered, recoverable, micrograms per liter	<.2	6.6	6.8	7.9	7.5	7.7	7.6
Dichlorodifluoromethane, water, unfiltered, recoverable, micrograms per liter	<.2	<.2	<.2	<.2	<.2	<.2	<.2
Dichloromethane, water, unfiltered, recoverable, micrograms per liter	<.2	<.2	<.2	<.2	<.2	<.2	<.2
Diethyl ether, water, unfiltered, recoverable, micrograms per liter	<.2	<.2	<.2	<.2	<.2	<.2	<.2
Diisopropyl ether, water, unfiltered, recoverable, micrograms per liter	<.2	<.2	<.2	<.2	<.2	<.2	<.2
Ethylbenzene, water, unfiltered, recoverable, micrograms per liter	<.1	<.1	<.1	<.1	<.1	<.1	<.1
Methyl *tert*-pentyl ether, water, unfiltered, recoverable, micrograms per liter	<.2	<.2	<.2	<.2	<.2	<.2	<.2
m-Xylene plus *p*-xylene, water, unfiltered, recoverable, micrograms per liter	<.2	<.2	<.2	E.2	<.2	E.1	E.1
o-Xylene, water, unfiltered, recoverable, micrograms per liter	<.1	<.1	<.1	<.1	<.1	<.1	<.1
Styrene, water, unfiltered, recoverable, micrograms per liter	<.1	<.1	<.1	<.1	<.1	<.1	<.1
tert-Butyl ethyl ether, water, unfiltered, recoverable, micrograms per liter	<.1	<.1	<.1	<.1	<.1	<.1	<.1
Methyl *tert*-butyl ether, water, unfiltered, recoverable, micrograms per liter	<.2	<.2	<.2	<.2	<.2	<.2	<.2
Tetrachloroethene, water, unfiltered, recoverable, micrograms per liter	<.1	<.1	<.1	<.1	<.1	<.1	<.1
Tetrachloromethane, water, unfiltered, recoverable, micrograms per liter	<.2	<.2	<.2	0.2	<.2	0.3	0.3
Toluene, water, unfiltered, recoverable, micrograms per liter	<.1	<.1	<.1	<.1	<.1	<.1	<.1
Toluene-d8, surrogate, Schedule 2090, water, unfiltered, percent recovery	101	101	102	101	101	101	100
trans-1,2-Dichloroethene, water, unfiltered, recoverable, micrograms per liter	<.1	<.1	<.1	<.1	<.1	<.1	<.1
(THM) Tribromomethane, water, unfiltered, recoverable, micrograms per liter	<.2	.6	.6	.8	.7	.7	.7
Trichloroethene, water, unfiltered, recoverable, micrograms per liter	<.1	<.1	<.1	<.1	<.1	<.1	<.1

Table 1–4. Analytical results for samples collected from the Fort Yates water-delivery system, Standing Rock Sioux Reservation, North Dakota.—Continued

[Sample 13 is raw sample from water intake; samples 14–19 are from water users. <, less than; E, estimated; THM, trihalomethane]

Sample number (see table 1-1)	13	14	15	16	17	18	19
Volatile inorganic compounds—Continued							
Trichlorofluoromethane, water, unfiltered, recoverable, micrograms per liter	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
(THM) Trichloromethane, water, unfiltered, recoverable, micrograms per liter	<.1	40.6	40.2	86	58.1	65.8	58.7
Vinyl chloride, water, unfiltered, recoverable, micrograms per liter	<.2	<.2	<.2	<.2	<.2	<.2	<.2

Table 1–5. Analytical results for samples collected from select ground-water sources, Standing Rock Sioux Reservation, North Dakota.

[<, less than; E, estimated; M, verified but not quantified]

Sample number (see table 1-1)	20	21	22	23	24	25
Physical properties						
pH, water, unfiltered, laboratory, standard units	8.5	8.4	8	8.1	8.6	7.5
Specific conductance, water, unfiltered, laboratory, microsiemens per centimeter at 25 degrees Celsius	2,660	1,580	1,080	1,840	1,930	1,340
Specific conductance, water, unfiltered, microsiemens per centimeter at 25 degrees Celsius	2,710	1,580	1,080	1,860	1,950	1,360
Temperature, water, degrees Celsius	11.4	11.9	12.1	11.1	11.3	13.7
Major inorganic constituents						
Magnesium, water, filtered, milligrams per liter	5.97	6.21	17.1	20.2	.664	69.9
Potassium, water, filtered, milligrams per liter	10.4	3.84	4.48	5.45	1.39	9.11
Sodium, water, filtered, milligrams per liter	630	361	179	350	462	110
Acid neutralizing capacity, water, unfiltered, fixed endpoint (pH 4.5) titration, laboratory, milligrams per liter, as calcium carbonate	754	747	509	603	697	516
Chloride, water, filtered, milligrams per liter	9.09	5.29	36.1	27	29.7	1.44
Fluoride, water, filtered, milligrams per liter	1.1	1.3	.8	.8	3	.3
Silica, water, filtered, milligrams per liter	40.3	23.6	27.4	25.1	15.2	15.9
Sulfate, water, filtered, milligrams per liter	648	134	48.4	369	290	270
Minor and trace inorganic constituents						
Aluminum, water, filtered, micrograms per liter	4	2	M	E1	7	<2
Antimony, water, filtered, micrograms per liter	<.40	E.16	<.20	<.20	E.10	<.20
Arsenic, water, filtered, micrograms per liter	.46	8.8	7.8	3.6	1.2	E.12
Barium, water, filtered, micrograms per liter	23	37	112	16	26	41
Beryllium, water, filtered, micrograms per liter	<.12	<.06	<.06	<.06	<.06	<.06
Boron, water, filtered, micrograms per liter	2,370	1,570	651	1,050	2,370	183
Cadmium, water, filtered, micrograms per liter	<.08	<.04	E.02	E.02	.04	E.02
Chromium, water, filtered, micrograms per liter	<6	<2	<6	<6	<10	E1
Copper, water, filtered, micrograms per liter	<.80	E.26	<.40	<.40	.57	48.7
Iron, water, filtered, micrograms per liter	88	86	364	267	49	10
Lead, water, filtered, micrograms per liter	<.16	E.04	E.06	E.04	3.84	E.04
Manganese, water, filtered, micrograms per liter	162	84.1	41.6	122	36.6	206
Nickel, water, filtered, micrograms per liter	.33	.42	.19	.08	.53	6.6
Selenium, water, filtered, micrograms per liter	<.16	<.08	<.08	<.08	<.08	2.5
Silver, water, filtered, micrograms per liter	<.4	<.2	<.2	<.2	<.2	<.2
Thallium, water, filtered, micrograms per liter	<.08	<.04	<.04	<.04	<.04	<.04
Zinc, water, filtered, micrograms per liter	E1.2	.95	3.9	4.4	33.3	5.2

Table 1–6. Analytical results for samples collected from select surface-water and bed-sediment sources, Standing Rock Sioux Reservation, North and South Dakota.

[Second sample number is bed-sediment sample. <, less than; E, estimated; M, verified but not quantified]

Sample number (see table 1-1)	26, 32	27, 33	28, 34	29, 35	30, 36	31, 37
Physical properties						
pH, water, unfiltered, laboratory, standard units	8.6	9	8.7	8.4	8.4	8.9
Specific conductance, water, unfiltered, laboratory, microsiemens per centimeter at 25 degrees Celsius	1,370	1,410	1,360	648	649	2,280
Specific conductance, water, unfiltered, microsiemens per centimeter at 25 degrees Celsius	1,380	1,460	1,380	655	655	2,340
Temperature, water, degrees Celsius	9.2	11.2	7.2	11.4	11.4	8.2
Major inorganic constituents						
Magnesium, water, filtered, milligrams per liter	27.1	28.6	19.1	19.6	19.6	26
Potassium, water, filtered, milligrams per liter	9.76	12	8.93	3.84	3.87	11.1
Sodium, water, filtered, milligrams per liter	221	242	247	58.3	59.4	456
Acid neutralizing capacity, water, unfiltered, fixed endpoint (pH 4.5) titration, laboratory, milligrams per liter as calcium carbonate	317	272	343	165	165	473
Chloride, water, filtered, milligrams per liter	11	8.11	18.1	9.65	9.63	13
Fluoride, water, filtered, milligrams per liter	.50	.50	.60	.70	.60	.58
Silica, water, filtered, milligrams per liter	4.17	.93	3.41	6.11	6.03	1.1
Sulfate, water, filtered, milligrams per liter	386	451	345	160	160	710
Minor and trace inorganic constituents						
Antimony, water, filtered, micrograms per liter	0.67	0.77	0.88	0.45	0.49	1
Arsenic, water, filtered, micrograms per liter	1.3	2.3	1.7	1.9	2.2	1.4
Barium, water, filtered, micrograms per liter	71	42	47	63	65	47.3
Beryllium, water, filtered, micrograms per liter	<.06	<.06	<.06	<.06	<.06	<.06
Boron, water, filtered, micrograms per liter	371	475	594	130	127	476
Cadmium, water, filtered, micrograms per liter	.05	E.03	.05	<.04	<.04	.09
Chromium, water, filtered, micrograms per liter	<2.0	<2	<2	<2	<2	<6
Copper, water, filtered, micrograms per liter	1.1	2.6	2.8	1.5	1.5	2.02
Iron, water, filtered, micrograms per liter	<6	E5	<6	<6	<6	<18
Lead, water, filtered, micrograms per liter	<.08	E.04	E.06	E.04	<.08	E.04
Manganese, water, filtered, micrograms per liter	6.8	1.2	1	4.7	5.2	<1.8
Nickel, water, filtered, micrograms per liter	4.39	5.4	5.4	1.6	1.6	4.02
Selenium, water, filtered, micrograms per liter	.47	.49	.76	.41	.35	.8
Silver, water, filtered, micrograms per liter	<.2	<.2	<.2	<.2	<.2	<.2
Thallium, water, filtered, micrograms per liter	E.02	E.02	<.04	<.04	<.04	<.04
Zinc, water, filtered, micrograms per liter	E.4	E.34	E.59	1.8	1.3	E.4

Table 1–6. Analytical results for samples collected from select surface-water and bed-sediment sources, Standing Rock Sioux Reservation, North and South Dakota.—Continued

[Second sample number is bed-sediment sample. <, less than; E, estimated; M, verified but not quantified]

Sample number (see table 1-1)	26, 32	27, 33	28, 34	29, 35	30, 36	31, 37
Major, minor, and trace inorganic constituents in bed sediment						
Antimony, bed sediment smaller than 62.5 microns, wet sieved, field, total digestion, dry weight, micrograms per gram	6.9	1.1	3.3	0.5	0.4	1
Arsenic, bed sediment smaller than 62.5 microns, wet sieved, field, total digestion, dry weight, micrograms per gram	120	4.6	59	7.3	6.1	7.6
Barium, bed sediment smaller than 62.5 microns, wet sieved, field, total digestion, dry weight, micrograms per gram	810	450	820	940	840	683
Beryllium, bed sediment smaller than 62.5 microns, wet sieved, field, total digestion, dry weight, micrograms per gram	2.1	2.1	1.5	1.2	1	2.3
Bismuth, bed sediment smaller than 177 microns, wet sieved, field, total digestion, dry weight, micrograms per gram	M	M	M	M	<.06	.29
Cadmium, bed sediment smaller than 62.5 microns, wet sieved, field, total digestion, dry weight, micrograms per gram	.70	.40	.30	.10	.10	.38
Calcium, bed sediment smaller than 62.5 microns, wet sieved, field, total digestion, dry weight, micrograms per gram	8,400	12,000	7,400	26,000	23,000	10,600
Inorganic carbon, bed sediment smaller than 62.5 microns, wet sieved (native water), field, recoverable, dry weight, percent	.6	1.3	.5	1.3	.8	1.1
Organic carbon, bed sediment smaller than 62.5 microns, wet sieved (native water), field, recoverable, dry weight, percent	.2	.4	.2	.9	.7	.2
Carbon (inorganic plus organic), bed sediment smaller than 62.5 microns, wet sieved (native water), field, recoverable, dry weight, percent	.3	.9	.3	.4	.1	1
Cerium, bed sediment smaller than 62.5 microns, wet sieved, field, total digestion, dry weight, micrograms per gram	31	73	31	62	45	60
Cesium, bed sediment smaller than 62.5 microns, wet sieved, field, total digestion, dry weight, micrograms per gram	1.2	4.8	1.7	2.2	1.4	5.9
Chromium, bed sediment smaller than 62.5 microns, wet sieved, field, total digestion, dry weight, micrograms per gram	24	62	30	50	42	113
Cobalt, bed sediment smaller than 62.5 microns, wet sieved, field, total digestion, dry weight, micrograms per gram	32	8	18	7	6	15.2
Copper, bed sediment smaller than 62.5 microns, wet sieved, field, total digestion, dry weight, micrograms per gram	22	22	14	12	5	36

Table 1–6. Analytical results for samples collected from select surface-water and bed-sediment sources, Standing Rock Sioux Reservation, North and South Dakota.—Continued

[Second sample number is bed-sediment sample. <, less than; E, estimated; M, verified but not quantified]

Sample number (see table 1-1)	26, 32	27, 33	28, 34	29, 35	30, 36	31, 37
Major, minor, and trace inorganic constituents in bed sediment—Continued						
Gallium, bed sediment smaller than 62.5 microns, wet sieved, field, total digestion, dry weight, micrograms per gram	5	17	8	9	8	21
Iron, bed sediment smaller than 62.5 microns, wet sieved, field, total digestion, dry weight, micrograms per gram	230,000	29,000	100,000	17,000	14,000	43,900
Lanthanum, bed sediment smaller than 62.5 microns, wet sieved, field, total digestion, dry weight, micrograms per gram	18	37	18	31	24	32
Lead, bed sediment smaller than 62.5 microns, wet sieved, field, total digestion, dry weight, micrograms per gram	23	21	17	11	10	19
Lithium, bed sediment smaller than 62.5 microns, wet sieved, field, total digestion, dry weight, micrograms per gram	7	30	12	18	13	37
Magnesium, bed sediment smaller than 62.5 microns, wet sieved, field, total digestion, dry weight, micrograms per gram	2,700	14,000	4,800	12,000	9,700	13,200
Manganese, bed sediment smaller than 62.5 microns, wet sieved, field, total digestion, dry weight, micrograms per gram	4,200	320	1,800	280	230	630
Mercury, bed sediment smaller than 62.5 microns, wet sieved, field, total digestion, dry weight, micrograms per gram	.03	.04	.03	.04	<.02	.10
Molybdenum, bed sediment smaller than 62.5 microns, wet sieved, field, total digestion, dry weight, micrograms per gram	18	1.5	6.8	.5	.4	1.3
Nickel, bed sediment smaller than 62.5 microns, wet sieved, field, total digestion, dry weight, micrograms per gram	75	22	43	16	12	42
Niobium, bed sediment smaller than 62.5 microns, wet sieved, field, total digestion, dry weight, micrograms per gram	3	17	5	10	7	18
Phosphorus, bed sediment smaller than 62.5 microns, wet sieved, field, total digestion, dry weight, micrograms per gram	1,100	490	710	700	540	550
Potassium, bed sediment smaller than 62.5 microns, wet sieved, field, total digestion, dry weight, micrograms per gram	8,300	16,000	14,000	16,000	15,000	16,000
Rubidium, bed sediment smaller than 62.5 microns, wet sieved, field, total digestion, dry weight, micrograms per gram	29.2	70.8	45	55.2	45.5	78.8
Scandium, bed sediment smaller than 62.5 microns, wet sieved, field, total digestion, dry weight, micrograms per gram	8	11	6	6	5	18
Selenium, bed sediment smaller than 62.5 microns, wet sieved, field, total digestion, dry weight, micrograms per gram	3.8	.34	1.4	.16	.08	.79

Table 1–6. Analytical results for samples collected from select surface-water and bed-sediment sources, Standing Rock Sioux Reservation, North and South Dakota.—Continued

[Second sample number is bed-sediment sample. <, less than; E, estimated; M, verified but not quantified]

Sample number (see table 1-1)	26, 32	27, 33	28, 34	29, 35	30, 36	31, 37
Major, minor, and trace inorganic constituents in bed sediment—Continued						
Silver, bed sediment smaller than 62.5 microns, wet sieved, field, total digestion, dry weight, micrograms per gram	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Sodium, bed sediment smaller than 62.5 microns, wet sieved, field, total digestion, dry weight, micrograms per gram	3,400	8,700	7,800	11,000	11,000	6,900
Strontium, bed sediment smaller than 62.5 microns, wet sieved, field, total digestion, dry weight, micrograms per gram	120	170	170	210	210	190
Sulfur, bed sediment smaller than 62.5 microns, wet sieved, field, total digestion, dry weight, percent	.06	.05	.09	<.05	<.05	.10
Thallium, bed sediment smaller than 62.5 microns, dry sieved, total digestion, dry weight, micrograms per gram	M	M	M	M	M	M
Thorium, bed sediment smaller than 62.5 microns, wet sieved, field, total digestion, dry weight, micrograms per gram	4	13	4	9	6	11
Titanium, bed sediment smaller than 62.5 microns, wet sieved, field, total digestion, dry weight, micrograms per gram	660	2,900	1,100	2,400	1,800	4,500
Uranium, bed sediment smaller than 62.5 microns, wet sieved, field, total digestion, dry weight, micrograms per gram	4.3	4	2.4	1.9	1.4	2.9
Vanadium, bed sediment smaller than 62.5 microns, wet sieved, field, total digestion, dry weight, micrograms per gram	100	85	81	56	42	178
Yttrium, bed sediment smaller than 62.5 microns, wet sieved, field, total digestion, dry weight, micrograms per gram	28	26	20	17	13	23
Zinc, bed sediment smaller than 62.5 microns, wet sieved, field, total digestion, dry weight, micrograms per gram	140	95	85	45	32	130

Table 1–7. Analytical results for fish-tissue and liver samples collected from the Missouri River near Fort Yates, North Dakota.

[<, less than; E, estimated; NA, not analyzed]

Sample number (see table 1-1)	38	39	40	41	42	43	44	45	46	47
Species	Northern pike	Channel catfish	Goldeye	Common carp	Common shiner	Green sunfish	Gizzard shad	Orange spotted sunfish	River carpsucker	Yellow perch
					Fish tissue					
Antimony, biota, tissue, recoverable, dry weight, micrograms per gram	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Arsenic, biota, tissue, recoverable, dry weight, micrograms per gram	.456	<.1	.117	<.1	.710	.268	3.603	.417	1.475	.279
Barium, biota, tissue, recoverable, dry weight, micrograms per gram	.1	<.1	1.1	.5	19.2	11.6	44.2	18.6	36.5	15.2
Beryllium, biota, tissue, recoverable, dry weight, micrograms per gram	<.1	<.1	<.1	<.1	<.1	<.1	.1	<.1	<.1	<.1
Boron, biota, tissue, recoverable, dry weight, micrograms per gram	.5	.5	.4	.7	1.3	1.1	3.7	1.2	2.1	2.1
Cadmium, biota, tissue, recoverable, dry weight, micrograms per gram	<.1	<.1	<.1	<.1	<.1	<.1	.1	<.1	<.1	<.1
Chromium, biota, tissue, recoverable, dry weight, micrograms per gram	<.5	<.5	<.5	<.5	1	.8	5	.8	2	.8
Cobalt, biota, tissue, recoverable, dry weight, micrograms per gram	<.1	<.1	<.1	<.1	.2	.2	1.5	.2	.6	.2
Copper, biota, tissue, recoverable, dry weight, micrograms per gram	.9	.6	.9	1.5	1.9	.7	7.6	1.1	3.3	1.3
Iron, biota, tissue, recoverable, dry weight, micrograms per gram	13.3	11.9	25.3	107	294	145	3,260	98.4	898	257
Lead, biota, tissue, recoverable, dry weight, micrograms per gram	<.1	<.1	<.1	<.1	.2	.2	1.6	.1	.5	.2
Manganese, biota, tissue, recoverable, dry weight, micrograms per gram	1.1	.4	.2	.6	21.6	29.2	65.2	36.3	23.6	32.7
Mercury, biota, tissue, recoverable, dry weight, micrograms per gram	.241	.171	.804	2.191	.117	.361	.017	.222	.560	.123
Molybdenum, biota, tissue, recoverable, dry weight, micrograms per gram	<.1	<.1	<.1	<.1	.2	.1	.2	.2	.1	<.1

Table 1–7. Analytical results for fish-tissue and liver samples collected from the Missouri River near Fort Yates, North Dakota.—Continued

[<, less than; E, estimated; NA, not analyzed]

Sample number (see table 1-1)	38	39	40	41	42	43	44	45	46	47
Species	Northern pike	Channel catfish	Goldeye	Common carp	Common shiner	Green sunfish	Gizzard shad	Orange spotted sunfish	River carpsucker	Yellow perch
Nickel, biota, tissue, recoverable, dry weight, micrograms per gram	<0.1	<0.1	<0.1	<0.1	0.8	0.08	3.9	0.9	1.5	0.6
Selenium, biota, tissue, recoverable, dry weight, micrograms per gram	2.561	2.101	3.764	3.939	3.305	3.578	3.800	5.654	4.048	3.735
Silver, biota, tissue, recoverable, dry weight, micrograms per gram	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1
Strontium, biota, tissue, recoverable, dry weight, micrograms per gram	1.9	.7	.4	3.4	189	151	68.7	231	227	87.4
Vanadium, biota, tissue, recoverable, dry weight, micrograms per gram	<.1	<.1	<.1	<.1	.940	.572	9.853	2.264	3.077	.982
Zinc, biota, tissue, recoverable, dry weight, micrograms per gram	22	15.6	16	84.9	109	122	74.4	138	90.9	76.8
Uranium, biota, tissue, recoverable, dry weight, micrograms per gram	<.1	<.1	<.1	<.1	<.1	<.1	.2	<.1	<.1	<.1
Water present, biota, tissue, recoverable, dry weight, percent	75.7	65.8	67.4	82	78.4	75.4	74.7	79.4	77.4	75.7
Fish livers										
Aluminum	E4.249	25.6	E5.230	34.84	NA	NA	NA	NA	NA	NA
Silver	<.1	<.1	<.1	<.1	NA	NA	NA	NA	NA	NA
Arsenic	1.142	.372	<.1	.879	NA	NA	NA	NA	NA	NA
Boron	.239	.184	.544	<.2	NA	NA	NA	NA	NA	NA
Barium	.197	.380	.671	.160	NA	NA	NA	NA	NA	NA
Beryllium	<.1	<.1	<.1	<.1	NA	NA	NA	NA	NA	NA
Cadmium	<.1	<.1	.453	1.738	NA	NA	NA	NA	NA	NA
Cobalt	.0920	<.1	.129	.229	NA	NA	NA	NA	NA	NA
Chromium	<.5	<.5	<.5	<.5	NA	NA	NA	NA	NA	NA
Copper	26.2	6.319	3.113	7.956	NA	NA	NA	NA	NA	NA
Iron	765.1	1,793	294.7	2,361	NA	NA	NA	NA	NA	NA
Mercury	.024	.194	.087	.147	NA	NA	NA	NA	NA	NA
Manganese	2.232	3.407	.822	4.353	NA	NA	NA	NA	NA	NA

Table 1–7. Analytical results for fish-tissue and liver samples collected from the Missouri River near Fort Yates, North Dakota.—Continued

[<, less than; E, estimated; NA, not analyzed]

Sample number (see table 1-1)	38	39	40	41	42	43	44	45	46	47
Species	Northern pike	Channel catfish	Goldeye	Common carp	Common shiner	Green sunfish	Gizzard shad	Orange spotted sunfish	River carpsucker	Yellow perch
					Fish livers—Continued					
Molybdenum	0.327	<0.1	0.162	0.522	NA	NA	NA	NA	NA	NA
Nickel	<.1	<.1	.153	<.1	NA	NA	NA	NA	NA	NA
Lead	<.1	<.1	<.1	<.1	NA	NA	NA	NA	NA	NA
Antimony	<.1	<.1	<.1	<.1	NA	NA	NA	NA	NA	NA
Selenium	6.755	7.423	3.604	10.518	NA	NA	NA	NA	NA	NA
Strontium	.379	2.08	.671	1.1	NA	NA	NA	NA	NA	NA
Uranium	<.1	<.1	<.1	<.1	NA	NA	NA	NA	NA	NA
Vanadium	<.1	1.62	.635	3.397	NA	NA	NA	NA	NA	NA
Zinc	86.89	78.29	232.1	72.36	NA	NA	NA	NA	NA	NA

Publishing support provided by:
Helena Publishing Service Center

For more information concerning this publication, contact:
Director, USGS North Dakota Water Science Center
821 E. Interstate Ave.
Bismarck, ND 58503
(406) 457–5900

Or visit the North Dakota Water Science Center Web site at:
http://nd.water.usgs.gov

Damschen and Lundgren—**Water, Bed-Sediment, and Fish-Tissue Quality within the Standing Rock Sioux Reservation, North Dakota and South Dakota, September 2006**—Scientific Investigations Report 2007–5268