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NATIONAL URANIUM RESOURCE EVALUATION PROGRAM

HYDROGEOCHEMICAL AND STREAM SEDIMENT
RECONNAISSANCE BASIC DATA FOR
RAPID CITY NTMS QUADRANGLE, SOUTH DAKOTA

Uranium Resource Evaluation Project

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A computer readable magnetic tape containing measurement, analysis, and location data may be purchased from the GJOIS Project, UCC-ND Computer Applications Dept., 4500 North Building, Oak Ridge National Laboratory, P. O. Box X, Oak Ridge, Tennessee 37830.

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NATIONAL URANIUM RESOURCE EVALUATION PROGRAM

**HYDROGEOCHEMICAL AND STREAM SEDIMENT
RECONNAISSANCE BASIC DATA FOR
RAPID CITY NTMS QUADRANGLE, SOUTH DAKOTA**

Uranium Resource Evaluation Project

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HYDROGEOCHEMICAL AND STREAM SEDIMENT
RECONNAISSANCE BASIC DATA FOR
RAPID CITY NTMS QUADRANGLE, SOUTH DAKOTA

INTRODUCTION

The National Uranium Resource Evaluation (NURE) Program was established by the U. S. Atomic Energy Commission, now the U. S. Department of Energy (DOE), in the spring of 1973 to assess uranium resources and to identify favorable areas for detailed uranium exploration throughout the United States. The principal objectives of the NURE Program are: (1) to provide a comprehensive in-depth assessment of the nation's uranium resources for national energy planning, and (2) to identify areas favorable for uranium resources. A NURE Program report covering uranium resource assessment in 116 National Topographic Map Series (NTMS) 1° x 2° quadrangles, which contain 100% of the currently estimated uranium resources, is targeted for 1980. The complete resource assessment of the 272 highest-priority quadrangles is scheduled for completion in 1985, and the first comprehensive assessment report of the entire United States is scheduled for completion in 1988. This program, which is being administered by DOE, is expected to increase the activity of commercial exploration for uranium in the United States.

The NURE Program consists of five parts:

1. Hydrogeochemical and Stream Sediment Reconnaissance (HSSR) Program,
2. Aerial Radiometric and Magnetic Survey,
3. Surface Geologic Investigations,
4. Drilling for Geologic Information, and
5. Geophysical Technology Development.

The objective of the HSSR Program is to provide information to be used in accomplishing the overall NURE Program objectives. This is accomplished by reconnaissance of surface water, groundwater, stream sediment, and lake sediment. The survey is being conducted by three Government-owned laboratories. Union Carbide Corporation, Nuclear Division (UCC-ND), under contract with DOE, is conducting its survey in 154 NTMS 1° x 2° quadrangles which cover approximately 2,500,000 km² (1,000,000 mi²) of the Central United States (see Figure 1). This area includes most of the states of Texas, Oklahoma, Kansas, Nebraska, South Dakota, North Dakota, Minnesota, Wisconsin, Michigan, Indiana, Illinois, and Iowa, as well as parts of Arkansas, Missouri, New Mexico, and Ohio. Described herein are the results of the work done by UCC-ND in the Rapid City NTMS Quadrangle, South Dakota.

Figure 1

INDEX MAP SHOWING THE ORGDP AREA OF RESPONSIBILITY
FOR THE HSSR SURVEY, THE RAPID CITY QUADRANGLE,
AND QUADRANGLES FOR WHICH BASIC DATA REPORTS
HAVE BEEN OPEN FILED

GEOLOGY

LOCATION AND GEOLOGIC SETTING

The Rapid City Quadrangle covers a surface area of approximately 17,662 km² (6,814 mi²) in west central South Dakota, between lat. 44° and 45° N. and long. 102° and 104° W. The survey area, outlined on the generalized geologic map of South Dakota (Figure 2), includes parts of Butte, Lawrence, Meade, and Pennington Counties. A generalized geologic map, along with a stratigraphic column listing geologic codes used in this report, is presented in Figure 3 and Plate 7.

The Rapid City Quadrangle consists of gently rolling hills and prairies of the Missouri Plateau Physiographic Province and mountains of the Black Hills Physiographic Province. The Missouri Plateau covers most of the quadrangle and is subdivided into Cretaceous Tablelands in the northeast, Cretaceous Pierre Hills in the northwest and central part of the area, and Tertiary Tablelands in the southeast. The Black Hills are located in the southwest and are characterized by uplifted igneous, metamorphic, and sedimentary rocks ranging from Precambrian to Cenozoic. Total relief in the Rapid City Quadrangle ranges from an elevation less than 610 m (2,000 ft) in the east to over 1,983 m (6,500 ft) in the southwest.

LITHOLOGY AND ENVIRONMENTS OF DEPOSITION

The Precambrian core of the Black Hills is largely composed of metamorphosed sedimentary rocks with lesser amounts of metabasalt, meta-gabbros, granites, and pegmatites. Metamorphic grade decreases from a sillimanite zone south of the quadrangle to a biotite zone in the northern Black Hills and then increases to the northeast beneath the Paleozoic cover (Redden and Norton, 1975). The oldest granite cropping out in the northern Black Hills is approximately 2.5 billion years old (Zartman and Stern, 1967). Black Hills Precambrian rocks have undergone at least three and up to as many as six separate episodes of deformation and probably two metamorphic events (Redden and Norton, 1975).

During the Paleozoic, the Black Hills area was near the eastern shoreline of a great seaway in the Rocky Mountain area. Except for the Minnelusa Formation which thickens to the south, Paleozoic sedimentary units are thinnest in the area of the Black Hills and thicken to the north (Redden and Norton, 1975).

The Cambrian Deadwood Formation, with a thickness of 122 m (400 ft), represents the oldest sedimentary rocks in the study area. The formation is primarily buff to brown sandstone, with greenish-gray shale and carbonates. A pebble conglomerate locally underlies a basal quartzite (Gries, 1975).

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Figure 2

GENERALIZED GEOLOGIC MAP OF SOUTH DAKOTA
(AFTER KING, ET AL, 1974)

STRATIGRAPHIC COLUMN FOR THE RAPID CITY QUADRANGLE

ERA	SYSTEM	SERIES	GEOLOGIC MAP CODE	GEOLOGIC GROUP	GEOLOGIC FORMATION	MAXIMUM THICKNESS	
						METERS	FEET
CENOZOIC	QUATERNARY	HOLOCENE	QAL		ALLUVIUM	15	50
	TERTIARY	OLIGOCENE	TOW	WHITE RIVER GROUP	BRULE FORMATION	183	600
					CHADRON FORMATION		
		PALEOCENE	TPFL		LUDLOW FORMATION	107	350
			TPPR		PORPHYRIES GRORUDITE, PHONOLITE, QUARTZ MONZONITE AND RHYOLITE		
	CRETACEOUS		KGMH		HELL CREEK FORMATION	130	425
			KGMF		FOX HILLS FORMATION	76	250
			KGMP		PIERRE SHALE	534	1,750
			KNC		NIOBRARA MARL AND CARLILE SHALE	235	770
			KGCG		GREENHORN LIMESTONE	110	360
			KGDS		GRANEROS SHALE WITH BELLE FOURCHE, MOWRY, AND SKULL CREEK SHALE MEMBERS	290	950
			KFL	INYAN KARA GROUP	FALL RIVER FORMATION AND LAKOTA FORMATION	168	550
	JURASSIC		JMS		MORRISON AND SUNDANCE FORMATIONS	198	650
PALEOZOIC	TRIASSIC		TRSP		SPEARFISH FORMATION	213	700
	PERMIAN		PEMO		MINNEKAHTA LIMESTONE AND SPEICHE SHALE	50	165
	PENNSYLVANIAN		PMIN		MINNELUSA FORMATION	213	700
	MISSISSIPPIAN		MIPE		PAHASAPA AND ENGLEWOOD LIMESTONES	204	670
	CAMBRIAN		CDEA		DEADWOOD FORMATION	122	400
PRECAMBRIAN			PCMS		AMPHIBOLITE, SCHIST, QUARTZITE, SANDSTONE, ARKOSIC GRIT, AND CONGLOMERATE		

SOURCES OF GEOLOGY:

COBBAN, W. A., "CRETACEOUS ROCKS ON THE NORTH FLANK OF THE BLACK HILLS UPLIFT," BILLINGS GEOLOGICAL SOCIETY GUIDEBOOK, THIRD ANNUAL FIELD CONFERENCE, BLACK HILLS-WILLISTON BASIN, PP. 86-88 (1952).

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WAAGE, K. M., STRATIGRAPHY OF THE INYAN KARA GROUP IN THE BLACK HILLS, U. S. GEOLOGICAL SURVEY, BULLETIN 1081-B, PP. 11-90 (1959).

LEGEND FOR FIGURE 3

Figure 3
GENERALIZED GEOLOGIC MAP OF THE RAPID CITY QUADRANGLE

Lying unconformably on the Deadwood Formation is the Mississippian Englewood Limestone. This formation is a red to lavender argillaceous dolomite, 12 to 21 m (40 to 70 ft) thick, which grades upward into the overlying Pahasapa Formation (Gries, 1975).

The Pahasapa Limestone consists of 183 m (600 ft) of dolomite, limestone, and anhydrite. Following deposition of the Pahasapa, a karst topography developed on its surface (Gries, 1975).

Overlying the karst surface is the Permo-Pennsylvanian Minnelusa Formation, which is 153 to 214 m (500 to 700 ft) thick. It consists of a lower Pennsylvanian segment composed of a basal red shale, dolomites, black radioactive shales, anhydrite, and thin sandstone layers. A red shale marker bed separates the Lower Pennsylvanian segment from the Upper Permian segment of the Minnelusa Formation. The Permian segment consists of a lower unit of dolomite, anhydrite, and sandstone. The upper portion of this segment consists of sandstone with dolomite and, locally, a cap of very cherty dolomite (Gries, 1975).

Unconformably overlying the Minnelusa Formation is the Permian Opeche Shale which consists of 26 to 38 m (85 to 125 ft) of red silty shale, fine red sand, gypsum, and anhydrite (Gries, 1975).

Gray to purple, thin-bedded Minnekahta Limestone overlies the Opeche Shale. It consists of 11 to 23 m (35 to 40 ft) of a lower red shaley unit, a pure limestone unit, a shaley zone, and an upper pure limestone (Gries, 1975).

Conformably overlying the Minnekahta Limestone and extending from the Permian into the Triassic is the Spearfish Formation. The Spearfish Formation consists of 214 m (700 ft) of siltstone, sandstone, and shale redbeds with some gypsum beds (Gries, 1975).

Unconformably overlying the Spearfish Formation is the Upper Jurassic Sundance Formation. The Sundance Formation is a marine deposit consisting of 61 to 92 m (200 to 300 ft) of alternating sandstones and shales (Merewether, 1975).

Conformably overlying the Sundance Formation is the Morrison Formation. The Late Jurassic Morrison Formation is a sequence of interbedded, varicolored shale, sandstone, and limestone. It was probably deposited in streams and lakes of a broad floodplain (McKee, et al, 1956).

The Early Cretaceous Inyan Kara Group lies unconformably over the Morrison Formation and includes the Lakota Formation and the Fall River Formation. The Lakota Formation consists of 168 m (550 ft) of cross-bedded, channel-fill sandstones, shales, and locally some limestone. The Upper Lakota Formation is composed of a varicolored noncalcareous claystone and sandstone, which separates it from the Fall River Formation (Merewether, 1975). The Fall River Formation consists of 37 to 46

m (120 to 150 ft) of well-bedded, fine-grained sandstone, with some interbedded siltstone and clay (Waage, 1959). The Inyan Kara Group represents a change in depositional environments from the continental Lakota Formation to the marginal marine Fall River Formation (Merewether, 1975).

The Graneros Shale consists of three shale members: Skull Creek, Mowry, and Belle Fourche. The Skull Creek Shale, oldest member of the Graneros Shale, conformably overlies the Fall River Formation and consists of 76 m (250 ft) of concretion-bearing dark gray, noncalcareous, marine shale (Cobban, 1952). Unconformably overlying the Skull Creek Shale is the Mowry Shale, which consists of up to 76 m (250 ft) of gray, noncalcareous, marine shale, interbedded with bentonite (Gries, 1952). The Belle Fourche Shale conformably overlies the Mowry Shale and consists of as much as 137 m (450 ft) of soft, gray, concretion-bearing, shale and bentonite. The Belle Fourche Shale was deposited in an inland sea (Merewether, 1975).

Overlying the Belle Fourche Shale is the Late Cretaceous Greenhorn Limestone, a marine unit of fossiliferous, calcareous shale and limestone, about 110 m (360 ft) thick (Cobban, 1952).

The Greenhorn Limestone is conformable with the overlying Late Cretaceous Carlile Shale, which is a marine shale 168 m (550 ft) thick (Cobban, 1952). The Carlile Shale is composed of a lower dark gray shale with abundant light gray calcareous concretions; a middle zone of interbedded siltstone, shale, and sandstone; and an upper concretion-bearing soft, dark gray shale (Knechtel and Patterson, 1962).

The Late Cretaceous Niobrara Marl, which lies unconformably on the Carlile Shale (Tourtelot and Cobban, 1968) is composed of approximately 67 m (220 ft) of calcareous shale, limestone, and thin beds of bentonite, which were deposited in a broad inland seaway (Gries, 1952).

The Late Cretaceous Pierre Shale lies conformably on and interfingers with the Niobrara Marl (Schultz, 1965). The Pierre Shale consists of up to 534 m (1,750 ft) of concretion-bearing gray shale, which was deposited in the last Cretaceous sea that covered the quadrangle.

In the northern and eastern parts of the quadrangle, the Late Cretaceous Fox Hills Formation lies conformably above and interfingers with the Pierre Shale. North of the quadrangle, the Fox Hills Formation attains a thickness of 122 m (400 ft), but is considerably thinner elsewhere in the quadrangle and in many areas has been completely removed. The Fox Hills Formation is composed of sandstone and sandy shale, which were deposited in shallow waters along the western edge of the Niobrara seaway (Merewether, 1975).

The Late Cretaceous Hell Creek Formation thins southward and has been eroded from most of the quadrangle. It lies conformably on and interfingers with the Fox Hills Formation. The Hell Creek Formation consists

mostly of sandy shale, lenticular crossbedded sandstone, and thin beds of lignite of continental origin (Merewether, 1975).

There are erosional remnants of the Paleocene Ludlow Formation in the extreme northern part of the quadrangle. The Ludlow Formation lies conformably above the Hell Creek Formation and is composed of interbedded lignite, shale, and loosely consolidated tan sandstone of non-marine origin (Harksen, 1975).

Erosional remnants of the Oligocene White River Group crop out in the extreme northern and southern parts of the quadrangle. Nonmarine in origin, the White River Group lies unconformably on most formations from Precambrian to Paleocene, and can be subdivided into the basal Chadron Formation and overlying Brule Formation. The Chadron Formation is composed of dark gray bentonite and light gray tuffaceous claystone, siltstone, sandstone, and arkose interbedded with thin, lenticular beds of limestone. The Brule Formation is composed of massive, modular, pinkish-gray calcareous claystone, tuffaceous siltstone, and channel sandstone.

A belt of Tertiary igneous rocks crops out in the northern Black Hills. The intrusions have various compositions including: porphyries, granodite, phonolite, quartz monzonite, and rhyolite. Precambrian through Mesozoic rocks are intruded by sills, dikes, plugs, ring dikes, small stocks, and laccoliths. Intrusive domes have brought older metamorphic rocks to the surface. All authors agree assimilation of the country rock was extremely limited and intrusions were forcibly injected (Redden, 1975). A total of twelve different age determinations on six different rock types range from 38.8 to 60.5 million years, virtually bracketing the Eocene (Shapiro, 1971).

Quaternary terrace gravels, alluvium, colluvium, and eolian deposits exist locally throughout the quadrangle.

STRUCTURE

Three structural features dominate the Rapid City Quadrangle: (1) Williston Basin, (2) Black Hills Uplift, and (3) Tertiary Domes superimposed on the Black Hills Uplift.

The northeastern part of the Rapid City Quadrangle lies on the southwestern flank of the Williston Basin. The Williston Basin is a huge basin which covers a large part of the states of North Dakota, South Dakota, and Montana, as well as Saskatchewan, Canada.

The Black Hills Uplift, occurring in the southwestern corner of the Rapid City Quadrangle, is an eastern expression of the Laramide Orogeny. The main uplift of the Black Hills occurred after deposition of the Late Cretaceous Hell Creek Formation and prior to the Tertiary intrusions. Numerous minor structures found on the flanks of the Black Hills include

the following: the Rapid City, Piedmont, Whitewood, Belle Fourche, La Flamme, Chicago Creek, and Colony anticlines; the Fanny Peak and Little Elk Creek monoclines; and many faults (Lisenbee, 1975).

Tertiary intrusives are found in a 16-km (10 mi) wide belt trending N 75° W across the northern Black Hills. Sedimentary cover forms a simple dome over large intrusions that are mostly or entirely beneath the surface. Monoclines and faults are present where erosion has exposed the intrusives (Lisenbee, 1975).

HYDROLOGY

Principal aquifers in the Rapid City Quadrangle are the Inyan Kara, Sundance, Minnelusa, Pahasapa, and alluvium deposits.

The Inyan Kara aquifer consists of the Lakota and Fall River Formations. Water is obtained from the permeable sandstone units within each of these formations. Water in the Inyan Kara aquifer is under artesian conditions, in many cases flowing, and underlies all of the quadrangle, except where eroded away in the interior of the Black Hills. The aquifer ranges in depth from zero at outcrop around the Black Hills to several thousand feet in the northeast (Anonymous, 1975).

The Sundance aquifer has approximately the same areal extent as the Inyan Kara aquifer in the quadrangle. Water is obtained from the permeable sandstone and limestone units, primarily in and near the outcrop area in the Black Hills.

The Minnelusa aquifer is the major water-bearing unit in the northern Black Hills. Permeable sandstone units can yield more than 3,800 μ m (1,000 gpm) of good quality water (Anonymous, 1975).

The Pahasapa aquifer produces water from limestones and dolomites. The Pahasapa aquifer has approximately the same areal extent as the preceding aquifers and yields large quantities of good to saline water under high artesian head.

Quaternary alluvium deposits are locally an important source of ground-water in the quadrangle. Because of the impermeability of most surface formations and the great depths to major aquifers, the alluvium deposits are the only economical source of water available.

Locally, shallow wells are found to produce from minor aquifers, including the following: Precambrian, Deadwood, Minnekahta, Spearfish, Morrison, Carlile-Niobrara, Pierre, and Fox Hills.

URANIUM OCCURRENCES

To date, no major economical occurrences of uranium have been found in the Rapid City Quadrangle. South of the quadrangle, uranium has been

mined from sandstone units within the Inyan Kara Group. Minor occurrences of uranium minerals have been found in Precambrian zoned pegmatites (Schnabel, 1975); quartz-pebble conglomerates (Hills, 1977, 1979); and in the Deadwood, Minnelusa, Spearfish and Pierre Formations (Schnabel, 1975).

SAMPLE COLLECTION

CHRONOLOGY OF THE SURVEY

Sampling in the Rapid City Quadrangle began in May 1979 and was completed in October 1979. Laboratory analyses, as well as compilation and verification of all field and laboratory data, were completed by May 1980. The final field and laboratory data base used to illustrate the statistical and symbol plots of uranium and uranium-related parameters for this report was completed in May 1980.

FIELD PROCEDURES

Stream sediment and groundwater sampling was performed, under contract, by personnel of the South Dakota School of Mines and Technology in Rapid City, South Dakota. A total of 417 groundwater and 514 stream sediment samples was collected within the boundaries of the Rapid City Quadrangle, South Dakota. Spring and well water samples are reported together as groundwater. Plates 1 and 4 are overlays at a scale of 1:250,000 showing sample locations for groundwater sites and stream sediment sites, respectively. Drainage basins are drawn on Plate 4 to indicate the area represented by the stream sediment samples. Groundwater coverage is sparse in the rangeland of central and northwestern portions of the quadrangle.

Detailed information regarding techniques in sample collection, recording site data, field equipment, and field measurements may be found in the following reports: "Hydrogeochemical and Stream Sediment Reconnaissance Procedures of the Uranium Resource Evaluation Project" (Arendt, et al, 1979), "Procedures Manual for Groundwater Reconnaissance Sampling (Uranium Resource Evaluation Project, March 1978), and "Procedures Manual for Stream Sediment Reconnaissance Sampling" (Uranium Resource Evaluation Project, May 1978). Field observations were recorded on the field form shown in Table C-2 and are included in the microfiche in Appendix C.

CONTAMINATION

Precautions were taken to avoid the possibility of collecting contaminated samples. Wells which were affected by chlorination, water-softening, or filtering devices were not sampled if the water could not be taken before the water passed through such devices. Any well that had not been pumped recently was allowed to run long enough to flush the

system. The fact that it had no recent use was noted on the field form. Since the possibility for contamination is high in dug wells, these are noted on the field form. Any wells thought to be contaminated were noted as such on the field form. Sediment samples were collected upstream from road crossings wherever possible. Visible signs of contamination, the presence of cultivated areas, or oil fields upstream from a sample site were noted on the field form.

The majority of the Rapid City Quadrangle is rangeland; therefore, cattle are a possible contaminant in stream sediment samples. There is limited crop production of wheat, corn, and small grains. Ammonium nitrate is the most popular fertilizer (South Dakota Crop and Livestock Reporting Service, 1976). Numerous abandoned gold mines are located in the Black Hills. The operating Homestake gold mine has produced gold since 1875 and is the state's major mining industry. Lead-silver, lead-zinc, and iron deposits have been mined in the past. The metropolitan area around Rapid City in the southwestern part of the quadrangle might also be a potential source of contamination.

CHEMICAL ANALYSIS

All samples collected in the survey area were returned to the URE Project laboratory in Oak Ridge, Tennessee for preparation and analysis. The elements determined and the analytical techniques used along with the appropriate detection limits are given in Table 1. These detection limits are considered the best average during normal operation; however, some variables have values reported below these limits. All water samples were received in 250-ml polyethylene bottles and were filtered through 0.45- μ m cellulose acetate paper. Stream sediment samples were dried overnight at 85°C and sieved to collect the <150- μ m fraction. Part of the sediment sample was dissolved in 10 ml of 1:1 nitric-hydrofluoric acid. The analytical procedures which were used have been described by Cagle (1977) and Arendt, et al (December 1979). All observed data from all samples are included in the microfiche in Appendix C.

QUALITY CONTROL

MEASUREMENTS CONTROL

Procedures used to analyze URE Project reconnaissance samples require that calibration standards, check samples, and blanks be analyzed along with normal samples to ensure the validity of reported results. A measurements control program provides information concerning precision and reliability of these measurements. Control samples of two water batches and three sediment batches are submitted anonymously along with routine samples on a daily basis. Statistical summaries of results

Table 1

DETECTION LIMITS OF VARIABLES DETERMINED IN WATER AND SEDIMENT SAMPLES

Variable	Method	Detection Limits	
		Sediment (ppm)	Water (ppb)
U-FL	Fluorometry	0.25	0.2
U-MS	Mass Spectrometry-Isotope Dilution	--	0.02
U-NT	Neutron Activation-Delayed Neutron Count	0.02	--
As	Atomic Absorption	0.1	0.5
Se	Atomic Absorption	0.1	0.2
Ag	Plasma Source Emission Spectrometry	2	2
Al	Plasma Source Emission Spectrometry	0.05(a)	10
B	Plasma Source Emission Spectrometry	10	4
Ba	Plasma Source Emission Spectrometry	2	2
Be	Plasma Source Emission Spectrometry	1	1
Ca	Plasma Source Emission Spectrometry	0.05(a)	0.1(b)
Ce	Plasma Source Emission Spectrometry	10	30
Co	Plasma Source Emission Spectrometry	4	2
Cr	Plasma Source Emission Spectrometry	1	4
Cu	Plasma Source Emission Spectrometry	2	2
Fe	Plasma Source Emission Spectrometry	0.05(a)	10
Hf	Plasma Source Emission Spectrometry	15	--
K	Plasma Source Emission Spectrometry	0.05(a)	0.1(b)
La	Plasma Source Emission Spectrometry	2	--
Li	Plasma Source Emission Spectrometry	1	2
Mg	Plasma Source Emission Spectrometry	0.05(a)	0.1(b)
Mn	Plasma Source Emission Spectrometry	4	2
Mo	Plasma Source Emission Spectrometry	4	4
Na	Plasma Source Emission Spectrometry	0.05(a)	0.1(b)
Nb	Plasma Source Emission Spectrometry	4	--
Ni	Plasma Source Emission Spectrometry	2	4
P	Plasma Source Emission Spectrometry	5	40
Pb	Plasma Source Emission Spectrometry	10	--
Sc	Plasma Source Emission Spectrometry	1	1
Si	Plasma Source Emission Spectrometry	--	0.1(b)
Sr	Plasma Source Emission Spectrometry	1	2
Th	Plasma Source Emission Spectrometry	2	--
Ti	Plasma Source Emission Spectrometry	10	2
V	Plasma Source Emission Spectrometry	2	4
Y	Plasma Source Emission Spectrometry	1	1
Zn	Plasma Source Emission Spectrometry	2	4
Zr	Plasma Source Emission Spectrometry	2	2
SO ₄	Spectrophotometry	--	5(b)
Cl	Spectrophotometry	--	10(b)

(a) Detection limits expressed in percent.

(b) Detection limits expressed in ppm.

reported on control samples, which were analyzed with the samples included in this survey, are given in Tables 2 and 3. Results of uranium analysis of water and sediment control samples obtained from the Ames Laboratory as part of the Multilaboratory Analytical Quality Control for the HSSR Program are reported by D'Silva, et al (1980).

PRINCIPAL COMPONENT ERROR ANALYSIS

A principal component analysis of data from well water and stream sediment samples was used to produce an ordered list of samples using the eigenvalue statistics as described by Kane, et al (1977), where the most extreme samples were listed first. Additional unusual samples were identified if single-element measurements were outside a three standard deviation confidence interval around the mean. Laboratory and field data from the unusual samples identified by this procedure were reviewed. Seven well water samples (402676, 403002, 403003, 403204, 403217, 403281, and 403617) and seven stream sediment samples (402800, 402801, 402828, 402839, 403231, 403571, and 403777) which appeared to be the most unusual were submitted for reanalysis. Original results were compared to the results from reanalysis. Of more than 400 individual analyses that were compared, the only results which were considered to be in error in the original analysis and require corrections were the U-FL value for Sediment Sample 403571, arsenic and selenium values for Sediment Samples 402828, 402839, 403231, and multielement values for Sediment Samples 403231, 403571, 403777. This low error rate for unusual samples indicates a high level of reliability for the laboratory measurements.

GEOCHEMICAL RESULTS

GEOCHEMICAL DISTRIBUTIONS IN GROUNDWATER

Sample site locations for groundwater samples collected in the Rapid City Quadrangle are shown on Plate 1 at the 1:250,000 scale. Symbol plots for uranium and specific conductance are presented at this scale on Plates 2 and 3 and at the 1:1,000,000 scale in Figures A-1b and A-2b, respectively. A map of major producing horizons sampled is presented in Figure 4. The samples which had hydrogen sulfide odor at the time of collection were noted. The number of groundwater samples collected from each producing unit is presented in Table 4.

Observed data for the variables uranium, specific conductance, 1,000·uranium/specific conductance, boron, calcium, potassium, lithium, magnesium, selenium, strontium, and sulfate are listed in Table A-3. The figures in Appendix A present log frequency, lognormal probability, percentile and symbol plots for these variables plus barium and total alkalinity.

Table 2

SUMMARY OF MEASUREMENTS CONTROL RESULTS OBTAINED WITH GROUNDWATER SAMPLES FROM THE RAPID CITY QUADRANGLE

Element	Method	Batch L-4				Batch H-4			
		No. of Samples	Mean (ppb)	Standard Deviation (ppb)	Coefficient of Variation	No. of Samples	Mean (ppb)	Standard Deviation (ppb)	Coefficient of Variation
U	FL(a)	17	0.75	0.351	0.47	11	10.87	0.897	0.08
AS	AA(b)	20	3.3	1.11	0.33	17	0.6	0.31	0.55
SE	AA	20	1.2	0.31	0.26	17	0.8	0.24	0.29
AL	PS(c)	13	92.0	20.2	0.22	18	330.0	25.0	0.08
B	PS	13	1,570.0	62.2	0.04	19	69.0	4.6	0.07
BA	PS	12	140.0	3.3	0.02	19	31.0	1.4	0.05
CA	PS	14	10,000.0	850.0	0.08	18	91,400.0	6,190.0	0.07
CO	PS	14	20.0	4.1	0.20	17	90.0	2.9	0.03
CR	PS	14	93.0	5.6	0.06	18	18.0	1.8	0.10
CU	PS	8	45.0	1.8	0.04	18	202.0	23.3	0.11
FE	PS	13	103.0	7.2	0.07	18	960.0	50.7	0.05
K	PS	14	1,800.0	229.0	0.13	17	19,490.0	937.0	0.05
LI	PS	14	16.0	1.1	0.07	18	100.0	5.6	0.06
MG	PS	14	9,200.0	420.0	0.05	18	67,900.0	2,710.0	0.04
MN	PS	14	20.0	2.3	0.11	16	96.0	4.1	0.04
MO	PS	13	24.0	10.1	0.41	13	11.0	6.3	0.57
NA	PS	14	1,600.0	150.0	0.10	18	43,800.0	2,120.0	0.05
NI	PS	13	195.0	10.7	0.05	18	37.0	6.2	0.16
P	PS	13	90.0	23.8	0.26	17	4,493.0	134.3	0.03
SC	PS	13	63.0	2.8	0.04	17	11.0	0.5	0.05
SI	PS	14	870.0	164.0	0.19	18	7,940.0	371.0	0.05
SR	PS	14	56.29	2.644	0.05	18	5,012.55	170.85	0.03
TI	PS	13	118.0	8.2	0.07	18	33.0	4.4	0.11
V	PS	12	9.0	1.5	0.15	18	41.0	3.5	0.08
Y	PS	14	9.0	1.4	0.14	18	45.0	2.4	0.05
ZN	PS	14	498.0	42.7	0.09	18	45.0	24.3	0.54

(a) Fluorometric analysis.

(b) Atomic absorption.

(c) Plasma source emission spectroscopy.

Table 3
SUMMARY OF MEASUREMENTS CONTROL RESULTS OBTAINED
WITH STREAM SEDIMENT SAMPLES FROM THE RAPID CITY QUADRANGLE

Element	Method	Batch Q-1				Batch R-3				Batch S-3			
		No. of Samples	Mean (ppm)	Standard Deviation (ppm)	Coefficient of Variation	No. of Samples	Mean (ppm)	Standard Deviation (ppm)	Coefficient of Variation	No. of Samples	Mean (ppm)	Standard Deviation (ppm)	Coefficient of Variation
U	FL(a)	40	0.79	0.268	0.34	37	4.26	0.469	0.11	38	23.52	2.674	0.09
U	NI(b)	39	0.67	0.160	0.24	50	4.91	0.102	0.02	35	26.25	0.797	0.03
AS	AA(c)	17	1.8	0.25	0.14	27	3.6	0.64	0.18	19	26.4	3.11	0.12
SE	AA	12	0.5	0.31	0.57	28	0.2	0.43	2.02	20	1.4	0.62	0.45
AL	PS(d)	36	9,700.0	490.0	0.05	39	34,100.0	2,730.0	0.08	30	48,700.0	3,430.0	0.07
B	PS	38	7.0	3.5	0.46	34	20.0	7.1	0.34	30	61.0	10.3	0.17
BA	PS	38	130.0	14.6	0.11	39	454.0	51.0	0.11	32	314.0	31.1	0.10
BE	PS	37	0.0	0.6	0.94	40	0.0	10.3	10.27	32	2.0	4.0	1.74
CA	PS	38	1,200.0	100.0	0.08	40	3,100.0	300.0	0.10	31	16,900.0	80.0	0.06
CE	PS	37	19.08	3.677	0.19	39	68.82	7.196	0.10	29	55.59	4.968	0.09
CO	PS	38	4.0	2.7	0.59	40	10.0	2.2	0.20	31	33.0	3.1	0.09
CR	PS	38	14.0	2.1	0.14	39	28.0	3.2	0.11	32	65.0	6.6	0.10
CU	PS	35	3.0	0.8	0.22	38	20.0	1.5	0.07	30	69.0	2.9	0.04
FE	PS	37	9,700.0	390.0	0.04	40	18,000.0	1,070.0	0.06	30	40,800.0	2,070.0	0.05
K	PS	37	1,900.0	190.0	0.10	38	9,900.0	930.0	0.09	31	17,200.0	2,000.0	0.12
LI	PS	37	9.0	0.8	0.08	39	23.0	1.8	0.08	32	35.0	3.6	0.10
MG	PS	38	1,100.0	50.0	0.05	39	2,200.0	110.0	0.05	32	5,600.0	260.0	0.05
MN	PS	37	317.0	9.9	0.03	40	1,909.0	87.8	0.05	30	404.0	15.9	0.04
MO	PS	1	0.0	0.0	0.0	40	2.0	0.9	0.41	29	43.0	3.7	0.08
NA	PS	1	0.0	0.0	0.0	40	1,600.0	190.0	0.13	31	1,600.0	220.0	0.14
NB	PS	37	2.0	0.7	0.32	41	8.0	4.3	0.49	33	2.0	1.6	0.58
NI	PS	37	6.0	1.0	0.16	41	20.0	3.1	0.15	30	108.0	6.3	0.06
P	PS	36	70.0	6.0	0.09	35	2,149.0	217.3	0.10	28	1,441.0	83.8	0.06
PB	PS	28	5.0	3.0	0.50	27	38.0	5.6	0.14	28	21.0	3.6	0.16
SC	PS	38	1.0	0.6	0.31	41	5.0	0.8	0.15	32	10.0	0.8	0.08
SR	PS	36	19.17	1.320	0.07	39	55.33	4.054	0.07	32	85.56	6.133	0.07
TH	PS	38	2.0	1.7	0.74	41	8.0	2.8	0.34	33	8.0	2.5	0.30
TI	PS	38	572.0	54.8	0.10	39	3,321.0	369.9	0.11	32	2,123.0	174.9	0.08
V	PS	35	20.0	0.9	0.04	38	55.0	4.4	0.08	30	166.0	6.7	0.04
Y	PS	37	4.0	0.3	0.08	39	20.0	1.7	0.08	30	33.0	1.6	0.05
ZN	PS	36	13.0	2.1	0.16	35	93.0	7.5	0.08	29	185.0	12.0	0.06
ZR	PS	38	30.0	2.9	0.10	38	136.0	10.9	0.08	31	83.0	6.0	0.07
HF	PS	27	2.11	1.577	0.75	27	3.83	2.685	0.70	28	1.95	1.455	0.75
LA	PS	28	20.89	3.023	0.14	27	78.00	15.056	0.19	28	90.61	4.787	0.05

(a) Fluorimetric analysis.

(b) Neutron activation delayed neutron count.

(c) Atomic absorption.

(d) Plasma source emission spectroscopy.

Table 4

DISTRIBUTION OF SAMPLES BY GEOLOGIC UNIT FROM THE RAPID CITY QUADRANGLE

<u>Geologic Unit</u>	<u>Geologic Unit Code</u>	<u>No. of Groundwater Samples</u>	<u>No. of Sediment Samples</u>
Alluvium	QAL	1	3
White River Group	TOW	2	1
Ludlow Formation	TPFL	1	0
Tertiary Intrusives	TPPR	2	1
Hell Creek Formation	KGMH	19	17
Fox Hills Formation	KGMF	70	40
Pierre Shale	KGMP	165	244
Niobrara Marl and Carlile Shale	KNC	13	27
Greenhorn Limestone	KGCG	0	0
Graneros Shale	KGDS	10	43
Inyan Kara Group	KFL	53	10
Morrison and Sundance Formations	JMS	4	0
Spearfish Formation	TRSP	4	10
Minnekahta Limestone and Opeche Shale	PEMO	0	3
Minnelusa Formation	PMIN	23	12
Pahasapa and Englewood Limestones	MIPE	17	25
Deadwood Formation	CDEA	8	7
Precambrian Units	PCMS	<u>25</u>	<u>34</u>
Total		417	477

Uranium

Figure A-1b indicates groundwaters with uranium concentrations greater than 22.83 ppb (85th percentile) are scattered over the north central to south central portion of the quadrangle between long. 102°30' to 103°20' W. The percentile plot (Figure A-1a) shows the highest group of uranium values occurs in waters produced from the Pierre Shale and the group composed of the Niobrara Marl, Carlile Shale, and Graneros Shale.

Clusters of groundwater samples with high uranium concentrations occur as follows from north to south: (1) in northwestern Meade County between lat. 44°50' and 44°57' N. and between long. 102°40' and 103° W.; (2) as scattered locations in the central area of the quadrangle in Meade County; and (3) in northern Pennington County, the south central portion of the survey area. All of these waters were produced from the Pierre Shale.

Most groundwaters with uranium concentrations less than 0.31 ppb (15th percentile) occur along the outer corners of the quadrangle. These groundwaters with low uranium content were produced from many geologic units though most are produced from the Inyan Kara Group. The uranium percentile plot (Figure A-1a) shows the Inyan Kara Group having a median uranium value of 0.2 ppb compared with a 3.6-ppb median value for all geologic units in the quadrangle. Other formations exhibiting low uranium values are the Morrison and Sundance Formations, Pahasapa and Englewood Limestones, Deadwood Formation, and Precambrian units.

The correlation matrix (Table A-2) indicates a significant positive correlation with coefficients of greater than 0.35 for both Pearson and Spearman correlations between uranium and specific conductance, calcium, lithium, potassium, magnesium, strontium; and sulfate. There is a significant negative correlation coefficient of less than 0.31 between uranium and pH.

Specific Conductance

Figure A-2b indicates that most groundwaters with specific conductance values greater than 4,277 $\mu\text{mhos/cm}$ (85th percentile) occur in the northeastern portion of the quadrangle and as isolated wells scattered over most of the quadrangle (except for the southwestern corner). These groundwaters were produced primarily from the Pierre Shale. The percentile plot (Figure A-2a) indicates the Pierre Shale has the highest median specific conductance value of 2,374.9 $\mu\text{mhos/cm}$ as compared with the median value of 1,532.9 $\mu\text{mhos/cm}$ for all geologic units.

Groundwater samples with specific conductance values less than 629 $\mu\text{mhos/cm}$ (15th percentile) are located in the southwestern corner of the quadrangle in the northern Black Hills. These groundwater samples were produced from several geologic units, including the Pahasapa and Englewood Limestones, Deadwood Formation, and Precambrian units. The percentile plot (Figure A-2a) indicates these units have the lowest specific conductance values.

The correlation matrix (Table A-2) indicates significant positive correlations with coefficients for both Pearson and Spearman correlations greater than 0.35 between specific conductance and uranium, boron, chloride, potassium, lithium, selenium, sulfate, strontium, and total alkalinity. There is a significant negative correlation coefficient of less than 0.45 between specific conductance and barium.

Related Variables

Some members of the Pierre Shale are black, organic shales. A possible source for uranium in the Pierre Shale is the smectite or bentonite beds. The organic-rich black shales have higher radioactivity and uranium content than the surrounding shales (Tourtelot, 1956).

Most groundwaters with uranium concentrations greater than 22.83 ppb (85th percentile) were collected from scattered localities in the Pierre Shale. Associated with the high uranium values are high concentrations of calcium, potassium, magnesium, and strontium, which indicate the presence of carbonates. Calcareous shales possibly retain more uranium than the noncalcareous shales (Tourtelot, 1956).

Barium, lithium, specific conductance, and sulfate correlate strongly with calcium, potassium, magnesium, and strontium. This grouping indicates high salinity.

The Rapid City Quadrangle consists of lithologically diverse geologic units. Most groundwater samples were produced from the Cretaceous formations with relatively few produced from the Paleozoic and Precambrian formations of the Black Hills. Multiple populations sampled make comparison between individual geologic units difficult, and the sparsity of samples from units in the Black Hills restricts evaluation.

Summary of Groundwater Data

Areas that appear most promising for uranium mineralization are located in the Pierre Shale in the central portion of the quadrangle. Waters produced from this area have high values for calcium, potassium, magnesium, strontium, and specific conductance and are associated with the high uranium concentrations. Lithium and sulfate also correlate strongly in the areas showing high uranium concentrations. Uranium is possibly held in black shale members within the Pierre Shale as a urano-organic compound. Geologic units in the northern Black Hills differ lithologically and chemically from the geologic units in the remainder of the quadrangle. Therefore, units in the Black Hills should perhaps be evaluated separately rather than comparatively with the Tertiary and Cretaceous units of the quadrangle.

GEOCHEMICAL DISTRIBUTIONS IN STREAM SEDIMENTS

Sample site locations for stream sediments collected in the Rapid City Quadrangle are shown on Plate 4 at the 1:250,000 scale. The symbol plot for the hot-acid-soluble uranium as determined by fluorometric analysis (U-FL) is presented at the 1:250,000 scale in Plate 5 and at the 1:1,000,000 scale in Figure B-1b. The symbol plot for thorium is presented at the 1:250,000 scale in Plate 6 and at the 1:1,000,000 scale in Figure B-4b. The stream sediment data subset includes all stream sediment samples collected from basins in the Rapid City Quadrangle that average approximately 25 km² (10 mi²). This data subset is used to generate Tables B-1 and B-2 and the figures in Appendix B. There were 477 stream sediment samples collected from the major stratigraphic units of the survey area, and the distribution by geologic unit is presented in Table 4. Results from all stream sediment samples collected from the Rapid City Quadrangle are included in Table B-3 and in the microfiche in Appendix C.

Observed data for the variables U-FL, U-NT, U-FL/U-NT, thorium, cobalt, copper, iron, nickel, vanadium, yttrium, and zinc are listed in Table B-3. The figures in Appendix B represent log frequency, log-normal probability, percentile, and symbol plots for these same variables, plus arsenic, chromium, and scandium.

Uranium

The percentile plots for U-FL and U-NT (Figures B-1a and B-2a, respectively) indicate the high median values are in sediments derived from the Precambrian units, the Pierre Shale, and the group consisting of the Graneros Shale, Niobrara Marl, and Carlile Shale. The symbol plots (Figures B-1b and B-2b, respectively) locate most U-FL and U-NT values above the 85th percentile (3.87 and 4.65, respectively) as occurring in sediments from the Pierre Shale. Some high uranium values also occur in sediments from the Graneros Shale and from Paleozoic and Precambrian units in the northern Black Hills.

Clusters of sediment samples with high U-FL and U-NT values occur: (1) in the north central area of the quadrangle between lat. 44°43' and 45° N. and long. 103° and 103°22' W. These sediments were derived from the Pierre Shale; (2) in two clusters in the central part of the survey area between lat. 44°15' and 44°35' N. and long. 102°25' and 103° W. These sediments were derived from the Pierre Shale; and (3) in the south central section of the quadrangle between lat. 44° and 44°05' N. and long. 102°42' and 102°52' W. These high values are in sediments from the Pierre Shale and surround an outcrop of the Oligocene White River Group.

Scattered high U-FL and U-NT values are found in the Paleozoic and Precambrian units of the Black Hills and in the surrounding strip of the Graneros Shale.

The correlation matrix (Table B-2) shows a positive correlation coefficient of greater than 0.40 for both Pearson and Spearman correlations between U-FL and U-NT, arsenic, cobalt, copper, iron, nickel, scandium, vanadium, yttrium, and zinc. There is a negative correlation coefficient of less than 0.18 between U-FL and calcium.

Thorium

Thorium values greater than 10 ppm (the 85th percentile) are found scattered over the quadrangle, occurring mostly in sediments from the Pierre Shale. Some sediment samples with high thorium concentrations correlate with high U-FL areas, as shown by one cluster in the central area of the quadrangle in the Pierre Shale. Isolated samples in the Pierre Shale, Graneros Shale, and the Paleozoic units have corresponding high values for U-FL and thorium.

The correlation matrix (Table B-2) indicates significant positive correlation coefficients of greater than 0.35 for both Pearson and Spearman correlations between thorium and cerium, cobalt, chromium, copper, iron, lithium, nickel, scandium, titanium, vanadium, yttrium, zinc, and zirconium. There is a significant negative correlation coefficient of less than 0.15 between thorium and calcium and sodium.

Related Variables

In the north central area of the quadrangle, sediments with high uranium values correspond approximately with high values for arsenic, cobalt, and yttrium. These sediment samples were collected from the Pierre Shale.

The U-FL/U-NT values are relatively low, sometimes less than 0.64 (the 15th percentile) for the cluster of high U-NT values in the central area of the quadrangle at lat. 44°20' N. between long. 102°45' and 103° W. This horizontal string of sediment samples has high values for titanium and zirconium, indicating heavy or resistate minerals, which appear to be related to the high insoluble uranium concentrations (values for titanium and zirconium may be found in the microfiche). The cluster of high U-NT values has corresponding high concentrations (above the 85th percentile) for arsenic, cobalt, copper, iron, nickel, scandium, thorium, vanadium, yttrium, and zinc. These sediments are derived from the Pierre Shale.

In the extreme northwestern corner of the survey area, the indicators of resistate minerals and chromium, nickel, scandium, thorium, vanadium, and zinc are strongly correlated. No high uranium values are associated with these variables. The sediments in this area are derived from the Pierre Shale.

In the Black Hills, sediments from the Paleozoic units with low U-FL and U-NT values (less than the 15th percentile) have corresponding low

values for cobalt, chromium, iron, nickel, scandium, titanium, vanadium, yttrium, zinc, and zirconium. Samples from the Precambrian units have isolated high concentrations of uranium with corresponding anomalous concentrations for arsenic, cobalt, copper, iron, nickel, and zinc, and medium to high values for titanium and zirconium.

Summary of the Stream Sediment Data

The stream sediment data indicate three groups of sediment samples with high uranium concentrations in the Pierre Shale. Scattered localities in the Graneros Shale and in the Paleozoic and Precambrian units of the northern Black Hills exhibit anomalous uranium concentrations. These areas usually have associated high values for arsenic, cobalt, and yttrium. The Precambrian units exhibit a totally different composition from the surrounding Paleozoic units. No areas show strong potential for uranium mineralization and no structural or geochemical trends have been indicated by the stream sediment data.

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APPENDIX A
GROUNDWATER

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APPENDIX A

GROUNDWATER

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Table A-1

STATISTICAL SUMMARY FOR GROUNDWATER OF THE RAPID CITY QUADRANGLE

NO. SAMPLES ANALYZED		BELOW							COEFFICIENT		LN TRANSFORMATION			
ELEMENT	VALUES	DETECTION LIMIT	DETECTION LIMIT	MINIMUM VALUE	MAXIMUM VALUE	MEAN	MEDIAN	MODE	STANDARD DEVIATION	OF VARIATION	MEAN	S. D.	ROBUST	
													MEAN	S. D.
U	371	46	<0.20	<0.20	86.83	10.57	3.63	0.39	13.507	1.278	1.41	1.56	1.09	1.85
SP	417			153	21487	2350	1532	1228	2334.0	1.0	7.38	0.88	7.37	0.87
U/SP	417			0.01	68.97	5.17	2.72	0.22	7.348	1.421	0.52	1.87	0.60	1.81
U/B	417			0.03	663.08	56.33	28.25	2.35	80.673	1.432	2.61	2.31	2.74	2.30
U/SO	417			0.04	4052.00	82.74	13.26	1.86	303.778	3.672	2.45	2.18	2.47	2.19
AG	151	266	<2	<2	8	3	<2	<2	1.3	0.4	1.06	0.37		
AL	123	294	<10	<10	714	43	<10	<10	74.1	1.7	3.36	0.78		
AS	87	330	<0.5	<0.5	10.5	1.7	<0.5	<0.5	1.94	1.17	0.12	0.78		
B	417			7	3489	469	279	25	588.4	1.3	5.29	1.50	5.32	1.51
BA	408	9	<2	<2	321	22	10	5	40.8	1.8	2.46	1.03	2.37	1.08
BE	47	370	<1	<1	1	1	<1	<1	0.0	0.0	0.0	0.0		
CA	417			0.3	514.1	107.5	64.1	3.9	113.11	1.05	3.96	1.48	4.04	1.57
CO	194	223	<2	<2	10	3	<2	<2	1.9	0.5	1.27	0.46		
CR	59	358	<4	<4	17	6	<4	<4	2.9	0.5	1.77	0.38		
CU	103	314	<2	<2	184	14	<2	<2	28.0	1.9	1.93	1.04		
FE	159	258	<10	<10	651	28	<10	<10	63.9	2.3	2.89	0.67		
K	417			0.1	75.4	6.0	4.4	2.0	6.64	1.11	1.42	0.87	1.43	0.86
LI	414	3	<2	<2	1043	131	87	4	145.2	1.1	4.21	1.37	4.24	1.41
MG	416	1	<0.1	<0.1	973.2	49.5	26.0	1.4	84.47	1.71	2.87	1.78	2.95	1.92
MN	273	144	<2	<2	2699	135	4	<2	362.8	2.7	2.90	1.89		
MO	199	218	<4	<4	74	11	<4	<4	9.5	0.8	2.28	0.60		
NA	417			0.2	1128.0	214.4	149.9	9.9	219.21	1.02	4.41	1.84	4.52	1.75
NI	78	339	<4	<4	19	6	<4	<4	2.9	0.4	1.83	0.36		
P	26	391	<40	<40	1688	189	<40	<40	394.2	2.1	4.46	0.97		
SC	48	369	<1	<1	6	1	<1	<1	0.8	0.7	0.12	0.35		
SE	370	47	<0.2	<0.2	6.8	0.5	0.4	0.5	0.42	0.85	-0.83	0.46	-0.95	0.51
SI	417			0.1	22.8	5.1	4.6	4.2	2.49	0.49	1.52	0.49	1.53	0.38
SR	417			5	13463	1570	958	69	1910.6	1.2	6.52	1.51	6.56	1.42
TI	74	343	<2	<2	142	10	<2	<2	23.1	2.3	1.61	0.88		
V	157	260	<4	<4	88	14	<4	<4	13.2	0.9	2.41	0.74		
Y	141	276	<1	<1	3	1	<1	<1	0.4	0.3	0.12	0.27		
ZN	400	17	<4	<4	4851	153	45	8	427.4	2.8	3.94	1.31	3.79	1.35
ZR	168	249	<2	<2	11	3	<2	<2	1.8	0.5	1.22	0.43		
T-AK	417			20	1516	328	283	264	184.7	0.6	5.66	0.52	5.67	0.47
M-AK	417			20	1450	325	282	274	179.9	0.6	5.66	0.51	5.67	0.46
P-AK	417			0	108	5	0	0	15.1	2.9				
CL	220	196	<10	<10	751	69	11	<10	116.7	1.7	3.64	0.95		
NA/C	416			0.04	98.82	13.34	7.03	0.58	17.226	1.251	1.73	1.49	1.77	1.47
PH	417			5.8	9.1	7.6	7.5	7.3	0.53	0.07				
SO4	400	17	<5	<5	7365	742	291	26	1049.1	1.4	5.64	1.61	5.55	1.92

NOTE: Refer to Table 1, Page 24 and Table C-1, Page C-4 for concentration units and symbol definitions.

Table A-1

CORRELATION MATRIX FOR GROUNDWATER
OF THE RAPID CITY QUADRANGLE

CORRELATION MATRIX FOR GROUNDWATER OF THE RAPID CITY QUADRANGLE

L-U	1.00 (371)									
	0.68***									
L-CA	0.67*** (371)	L-CA	1.00 (417)							
	0.69***	0.96***								
L-MG	0.71*** (371)	0.95*** (416)	L-MG	1.00 (416)						
	0.66***	0.86***	0.81***							
L-SR	0.62*** (371)	0.90*** (417)	0.85*** (416)	L-SR	1.00 (417)					
	0.48***	0.59***	0.58***	0.72***						
L-K	0.50*** (371)	0.62*** (417)	0.60*** (416)	0.72*** (417)	L-K	1.00 (417)				
	-0.11	-0.27***	-0.29***	-0.23***	-0.12*					
L-MO	-0.09 (175)	-0.26*** (199)	-0.25*** (198)	-0.20*** (199)	-0.12* (199)	L-MO	1.00 (199)			
	-0.37***	-0.68***	-0.69***	-0.50***	-0.32***					
PH	-0.32*** (371)	-0.63*** (417)	-0.61*** (416)	-0.51*** (417)	-0.34*** (417)	0.36***	PH	1.00 (417)		
	0.18***	0.02	0.02	0.16***	0.13**	-0.02	0.04			
L-SE	0.15*** (330)	0.04 (370)	0.05 (369)	0.14*** (370)	0.11** (370)	0.00 (180)	0.09* (370)	L-SE	1.00 (370)	
	0.20***	-0.08	-0.11**	0.19***	0.07	0.07	0.22***			
LTAK	0.18*** (371)	0.03 (417)	0.05 (416)	0.18*** (417)	0.10** (417)	0.05 (199)	0.12** (417)	0.47***	LTAK	1.00 (417)
	0.20***	-0.13*	-0.11	0.01	-0.02	0.17*	0.11	0.24***		
L-CL	0.32*** (196)	0.05 (220)	0.07 (220)	0.12* (220)	0.02 (220)	0.12 (104)	0.11* (220)	0.23*** (205)	0.32*** (220)	
	0.01	0.26***	0.31***	0.28***	0.27***	-0.10	-0.30***	0.13**	0.14**	
L-MN	0.02 (249)	0.24*** (273)	0.26*** (272)	0.29*** (273)	0.33*** (273)	-0.06 (121)	-0.22*** (273)	0.09 (245)	0.16*** (273)	
	0.13**	0.24***	0.24***	0.19***	0.20***	0.10	-0.20***	0.13**	0.01	
L-ZN	0.13** (361)	0.17*** (400)	0.18*** (399)	0.15*** (400)	0.21*** (400)	0.08 (193)	-0.14*** (400)	0.07 (356)	0.01 (400)	
	0.38***	0.30***	0.26***	0.58***	0.47***	0.03	0.02	0.42***	0.60***	
L-SP	0.38*** (371)	0.12*** (417)	0.10*** (416)	0.60*** (417)	0.46*** (417)	0.02 (199)	-0.01 (417)	0.42*** (370)	0.61*** (417)	
	0.40***	0.43***	0.40***	0.67***	0.59***	-0.05	-0.08	0.27***	0.34***	
LSO4	0.40*** (355)	0.59*** (400)	0.58*** (399)	0.73*** (400)	0.57*** (400)	-0.06 (196)	-0.16*** (400)	0.30*** (357)	0.37*** (400)	
	0.36***	0.22***	0.19***	0.56***	0.61***	-0.03	0.04	0.36***	0.54***	
L-LI	0.37*** (368)	0.38*** (414)	0.39*** (413)	0.59*** (414)	0.61*** (414)	-0.07 (197)	-0.03 (414)	0.40*** (367)	0.57*** (414)	
	0.22***	-0.05	-0.07	0.34***	0.46***	0.13*	0.27***	0.37***	0.57***	
L-NA	0.16*** (371)	0.04 (417)	0.05 (416)	0.30*** (417)	0.34*** (417)	0.13* (199)	0.28*** (417)	0.49*** (370)	0.64*** (417)	
	0.22***	-0.03	-0.08	0.33***	0.37***	0.18**	0.24***	0.43***	0.63***	
L-D	0.21*** (371)	0.07 (417)	0.06 (416)	0.30*** (417)	0.34*** (417)	0.15** (199)	0.23*** (417)	0.47*** (370)	0.64*** (417)	
	0.02	-0.00	-0.00	-0.18***	-0.23***	-0.07	-0.11**	-0.10*	-0.11**	
L-BA	0.01 (365)	-0.06 (408)	-0.08* (408)	-0.23*** (408)	-0.21*** (408)	-0.09 (194)	-0.10** (408)	-0.14*** (364)	-0.24*** (408)	
	0.19***	0.13***	0.12**	0.06	0.08*	-0.04	-0.22***	-0.08	-0.08*	
L-SI	0.26*** (371)	0.10** (417)	0.09* (416)	-0.02 (417)	-0.01 (417)	-0.09 (199)	-0.23*** (417)	-0.11** (370)	-0.23*** (417)	

- NOTE: (1) Pearson correlation/Spearman correlation/(sample size).
If either element has a concentration below the laboratory detection limits, it is omitted from the pairwise computations.
- (2) Significance levels: *-10%, **-5%, ***-1%.

L-CL									
1.00 (220)									
-0.13 (152)	L-MN								
	1.00 (273)								
0.03 (213)	0.19*** (262)	L-ZN							
0.08 (213)	0.18*** (262)	1.00 (400)							
0.47*** (220)	0.28*** (273)	0.12** (400)	L-SP						
0.50*** (220)	0.26*** (273)	0.08* (400)	1.00 (417)						
-0.01 (220)	0.27*** (266)	0.10* (384)	0.81*** (400)	LSO4					
0.19*** (220)	0.29*** (266)	0.09* (384)	0.84*** (400)	1.00 (400)					
0.26*** (220)	0.31*** (272)	0.04 (397)	0.81*** (414)	0.80*** (398)	L-LI				
0.30*** (220)	0.32*** (272)	0.07 (397)	0.85*** (414)	0.79*** (398)	1.00 (414)				
0.39*** (220)	0.26*** (273)	-0.04 (400)	0.76*** (417)	0.71*** (400)	0.92*** (414)	L-NA			
0.45*** (220)	0.28*** (273)	-0.01 (400)	0.84*** (417)	0.68*** (400)	0.85*** (414)	1.00 (417)			
0.49*** (220)	0.15** (273)	0.02 (400)	0.75*** (417)	0.61*** (400)	0.83*** (414)	0.86*** (417)	L-B		
0.50*** (220)	0.15** (273)	0.04 (400)	0.77*** (417)	0.56*** (400)	0.78*** (414)	0.84*** (417)	1.00 (417)		
0.27*** (217)	-0.22*** (267)	0.07 (392)	-0.46*** (408)	-0.59*** (391)	-0.52*** (405)	-0.54*** (408)	-0.45*** (408)	L-BA	
0.01 (217)	-0.22*** (267)	0.09* (392)	-0.52*** (408)	-0.56*** (391)	-0.53*** (405)	-0.57*** (408)	-0.46*** (408)	1.00 (408)	L-SI
0.02 (220)	-0.01 (273)	0.04 (400)	-0.11** (417)	-0.19*** (400)	-0.08* (414)	-0.10** (417)	-0.16*** (417)	0.26*** (408)	
-0.04 (220)	-0.08 (273)	-0.01 (400)	-0.22*** (417)	-0.25*** (400)	-0.18*** (414)	-0.26*** (417)	-0.24*** (417)	0.35*** (408)	1.00 (417)

Figure A-1a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR URANIUM (PPB)
IN GROUNDWATER OF THE RAPID CITY QUADRANGLE

A-11

Figure A-1b

GEOCHEMICAL DISTRIBUTION OF URANIUM (PPB) IN GROUNDWATER OF THE RAPID CITY QUADRANGLE

Figure A-2a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR SPECIFIC CONDUCTANCE ($\mu\text{MHOS}/\text{CM}$)
 IN GROUNDWATER OF THE RAPID CITY QUADRANGLE

Figure A-2b

GEOCHEMICAL DISTRIBUTION OF SPECIFIC CONDUCTANCE (μ MHOS/CM) IN GROUNDWATER OF THE RAPID CITY QUADRANGLE

Figure A-3a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR $1,000 \cdot \text{URANIUM/SPECIFIC CONDUCTANCE}$ IN GROUNDWATER OF THE RAPID CITY QUADRANGLE

A-15

Figure A-3b

GEOCHEMICAL DISTRIBUTION OF 1,000-URANIUM/SPECIFIC CONDUCTANCE IN GROUNDWATER OF THE RAPID CITY QUADRANGLE

Figure A-4a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR BORON (PPB)
IN GROUNDWATER OF THE RAPID CITY QUADRANGLE

Figure A-4b

GEOCHEMICAL DISTRIBUTION OF BORON (PPB) IN GROUNDWATER OF THE RAPID CITY QUADRANGLE

Figure A-5a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR BARIUM (PPB)
IN GROUNDWATER OF THE RAPID CITY QUADRANGLE

Figure A-5b

GEOCHEMICAL DISTRIBUTION OF BARIUM (PPB) IN GROUNDWATER OF THE RAPID CITY QUADRANGLE

Figure A-6a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR CALCIUM (PPM)
IN GROUNDWATER OF THE RAPID CITY QUADRANGLE

Figure A-6b

GEOCHEMICAL DISTRIBUTION OF CALCIUM (PPM) IN GROUNDWATER OF THE RAPID CITY QUADRANGLE

Figure A-7a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR POTASSIUM (PPM)
IN GROUNDWATER OF THE RAPID CITY QUADRANGLE

A-23

Figure A-7b

GEOCHEMICAL DISTRIBUTION OF POTASSIUM (PPM) IN GROUNDWATER OF THE RAPID CITY QUADRANGLE

Figure A-8a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR LITHIUM (PPB)
IN GROUNDWATER OF THE RAPID CITY QUADRANGLE

Figure A-8b

GEOCHEMICAL DISTRIBUTION OF LITHIUM (PPB) IN GROUNDWATER OF THE RAPID CITY QUADRANGLE

Figure A-9a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR MAGNESIUM (PPM)
IN GROUNDWATER OF THE RAPID CITY QUADRANGLE

Figure A-9b

GEOCHEMICAL DISTRIBUTION OF MAGNESIUM (PPM) IN GROUNDWATER OF THE RAPID CITY QUADRANGLE

Figure A-10a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR SELENIUM (PPB)
IN GROUNDWATER OF THE RAPID CITY QUADRANGLE

Figure A-10b

GEOCHEMICAL DISTRIBUTION OF SELENIUM (PPB) IN GROUNDWATER OF THE RAPID CITY QUADRANGLE

Figure A-11a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR STRONTIUM (PPB)
IN GROUNDWATER OF THE RAPID CITY QUADRANGLE

A-31

Figure A-11b
GEOCHEMICAL DISTRIBUTION OF STRONTIUM (PPB) IN GROUNDWATER OF THE RAPID CITY QUADRANGLE

Figure A-12a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR SULFATE (PPM)
IN GROUNDWATER OF THE RAPID CITY QUADRANGLE

Figure A-12b

GEOCHEMICAL DISTRIBUTION OF SULFATE (PPM) IN GROUNDWATER OF THE RAPID CITY QUADRANGLE

Figure A-13a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR TOTAL ALKALINITY (PPM)
IN GROUNDWATER OF THE RAPID CITY QUADRANGLE

Figure A-13b

GEOCHEMICAL DISTRIBUTION OF TOTAL ALKALINITY (PPM) IN GROUNDWATER OF THE RAPID CITY QUADRANGLE

Table A-3

PARTIAL DATA LISTING FOR GROUNDWATER OF THE RAPID CITY QUADRANGLE

OR SAMPLE NUMBER	D. O. E. ST LAT	SAMPLE LCNG	NUMBER L TY REP	U (PPB)	SP UMHOS/CM	U/SP	B (PPB)	CA (PPM)	K (PPM)	LI (PPB)	MG (PPM)	SE (PPB)	SR (PPB)	SO4 (PPM)
402600	46-44.090	-103.293	-3-01-	4.75	665	7.13	11	48.5	1.4	5	19.1	0.2	254	26
402602	46-44.120	-103.363	-3-03-	0.63	415	1.64	14	39.5	1.7	4	17.3	<0.2	94	<5
402605	46-44.053	-103.326	-3-03-	1.63	417	3.90	16	43.3	1.3	5	22.5	0.2	115	<5
402608	46-44.051	-103.284	-3-03-	3.90	516	7.55	23	59.0	3.5	17	20.6	0.2	443	64
402609	46-44.095	-103.271	-3-03-	2.47	393	6.28	15	39.0	1.6	7	18.7	0.3	159	13
402612	46-44.025	-102.084	-3-03-	11.72	221	52.93	176	243.7	3.5	80	78.2	0.5	1714	830
402616	46-44.041	-102.020	-3-03-	9.97	1495	6.67	414	76.9	3.9	92	26.0	0.6	590	345
402623	46-44.069	-102.161	-3-03-	<0.20	2013	0.05	1737	5.4	2.5	73	0.6	0.5	83	315
402625	46-44.035	-102.222	-3-03-	<0.20	2904	0.03	1780	11.1	4.0	87	0.8	0.5	151	144
402626	46-44.078	-102.222	-3-03-	2.21	9116	0.24	828	2.1	0.7	46	0.1	0.3	20	25
402627	46-44.113	-102.233	-3-03-	0.34	1570	0.22	1338	4.6	1.4	70	0.6	0.5	54	145
402628	46-44.107	-102.158	-3-03-	<0.20	1946	0.05	1737	5.4	2.2	77	0.5	0.4	73	315
402629	46-44.091	-102.042	-3-03-	<0.20	1731	0.06	717	1.1	1.4	90	0.2	0.7	50	285
402633	46-44.070	-102.069	-3-03-	0.42	1339	0.31	1551	1.9	2.1	79	0.2	0.7	30	50
402634	46-44.185	-102.227	-3-03-	0.48	1662	0.29	1812	3.5	1.8	91	0.4	0.5	56	208
402635	46-44.254	-102.206	-3-03-	1.38	3930	0.35	1592	49.8	6.4	343	19.6	0.5	1351	1147
402637	46-44.241	-102.170	-3-03-	25.10	6295	3.99	355	362.0	8.0	271	168.0	0.6	3243	2426
402638	46-44.244	-102.167	-3-03-	8.96	4902	1.83	622	201.6	6.5	243	81.5	1.0	2867	1830
402641	46-44.184	-102.030	-3-03-	8.10	4838	1.67	1028	134.2	10.8	439	54.7	0.7	2357	1658
402643	46-44.243	-102.093	-3-03-	<0.20	4220	0.02	2036	5.3	3.2	378	1.0	0.9	287	243
402644	46-44.164	-102.110	-3-03-	13.01	1260	10.32	159	108.2	7.1	131	48.1	0.4	1025	208
402645	46-44.147	-102.172	-3-03-	0.20	1671	0.12	1838	4.0	1.6	93	0.6	0.6	62	214
402646	46-44.091	-102.113	-3-03-	0.21	2457	0.09	1893	7.7	3.2	122	1.1	0.5	141	446
402649	46-44.054	-103.402	-3-01-	1.12	5619	0.20	13	46.3	2.1	5	17.9	0.3	100	34
402650	46-44.084	-103.439	-3-03-	0.70	531	1.32	16	47.6	1.4	6	17.5	0.3	117	27
402653	46-44.144	-103.455	-3-03-	1.93	541	3.56	16	39.1	1.6	3	24.1	0.3	80	<5
402656	46-44.030	-103.473	-3-01-	<0.20	479	0.21	10	20.1	3.7	2	9.9	<0.2	61	29
402660	46-44.873	-102.904	-3-03-	43.41	2865	15.15	128	186.9	5.5	150	76.0	0.9	2493	738
402661	46-44.877	-102.953	-3-03-	0.42	4792	0.09	459	32.6	6.5	312	7.9	0.7	833	1431
402664	46-44.951	-102.839	-3-03-	4.66	2104	2.21	28	196.2	4.6	77	57.3	0.5	1788	600
402665	46-44.978	-102.959	-3-03-	0.45	4123	0.11	383	59.3	4.6	226	14.8	0.7	1241	1233
402669	46-44.913	-102.990	-3-03-	26.80	8801	3.04	826	358.4	12.6	433	166.2	0.7	5667	3900
402670	46-44.895	-102.764	-3-03-	26.83	2051	13.08	30	110.5	0.8	118	51.8	0.5	1264	465
402672	46-44.927	-102.768	-3-03-	16.98	3586	4.73	74	146.1	2.1	150	47.1	0.6	1958	990
402676	46-44.862	-102.838	-3-03-	32.39	5333	6.07	296	274.7	7.2	314	121.4	0.5	4421	5668
402679	46-44.867	-102.820	-3-03-	71.06	6739	10.54	348	376.4	6.5	358	184.9	0.8	5402	2596
402680	46-44.888	-102.847	-3-03-	47.48	7672	6.19	159	368.9	4.2	275	261.6	0.9	6355	3404
402682	46-44.141	-103.317	-3-03-	4.61	1613	2.86	39	278.6	2.3	14	60.0	0.3	13463	777
402684	46-44.141	-103.269	-3-03-	3.56	534	6.66	22	57.6	1.9	7	21.2	0.3	385	51
402686	46-44.177	-103.352	-3-03-	4.11	621	6.61	13	60.7	0.7	3	32.3	0.3	143	21
402689	46-44.233	-103.387	-3-03-	2.13	668	3.19	12	74.2	1.2	4	27.0	0.3	2058	68
402690	46-44.232	-103.322	-3-03-	<0.20	1661	0.06	365	35.6	4.1	207	12.4	0.2	1003	472
402692	46-44.235	-103.271	-3-03-	3.35	1253	2.67	74	156.8	3.1	20	66.0	0.3	2640	373
402695	46-44.196	-103.293	-3-03-	7.27	1183	6.14	114	154.5	10.0	66	38.7	1.8	3865	349
402696	46-44.192	-103.334	-3-03-	2.81	720	3.90	18	85.4	1.2	7	28.0	0.4	752	94
402697	46-44.092	-103.369	-3-03-	1.39	608	2.28	13	44.8	0.9	2	35.5	0.5	159	30
402700	46-44.015	-103.464	-3-01-	<0.20	488	0.20	14	37.1	2.8	3	12.1	0.4	114	82
402701	46-44.002	-103.254	-3-03-	3.85	689	5.59	29	87.9	3.1	24	23.2	0.6	2280	98
402702	46-44.010	-103.314	-3-81-	1.57	505	3.11	21	42.2	2.1	9	18.1	0.3	299	23
402708	46-44.788	-102.777	-3-03-	3.93	1452	2.71	65	58.8	5.3	133	22.2	0.4	556	1158
402709	46-44.766	-102.835	-3-03-	6.82	1218	5.60	72	99.0	14.9	106	27.1	0.3	1857	159
402714	46-44.968	-103.147	-3-03-	9.59	651	14.73	59	53.5	3.9	37	34.8	0.3	780	48
402715	46-44.982	-103.130	-3-03-	9.68	807	11.98	43	72.7	1.9	38	37.2	0.5	819	60
402716	46-44.966	-103.110	-3-03-	11.42	979	11.66	38	80.2	3.1	46	34.1	0.5	1343	86
402719	46-44.963	-103.051	-3-03-	<0.20	1683	0.06	291	34.2	3.0	120	11.1	0.4	926	394

Table A-3, Continued

PARTIAL DATA LISTING FOR GROUNDWATER OF THE RAPID CITY QUADRANGLE

OR SAMPLE NUMBER	D. O. E. ST LAT	SAMPLE LONG	NUMBER L TY REP	U (PPB)	SP UMHOS/CM	U/SP	B (PPB)	CA (PPM)	K (PPM)	LI (PPB)	MG (PPM)	SE (PPB)	SR (PPB)	SO4 (PPM)
402720	46-44.904	-103.012	-3-03-	62.63	7146	8.76	395	485.7	6.0	394	149.4	0.9	5388	2602
402741	46-44.462	-103.466	-3-01-	0.33	1392	0.24	90	15.7	5.6	116	6.9	0.2	422	312
402749	46-44.466	-103.370	-3-03-	0.20	618	0.32	95	2.2	1.6	57	0.6	0.2	62	146
402752	46-44.472	-103.321	-3-03-	6.85	1399	4.89	132	139.5	4.9	36	51.0	0.4	2507	356
402754	46-44.476	-103.260	-3-03-	13.02	3004	4.33	661	162.2	5.3	177	137.1	0.3	3514	1481
402756	46-44.422	-103.368	-3-03-	40.72	1234	32.98	671	62.8	4.9	63	33.5	0.2	1240	199
402757	46-44.422	-103.323	-3-03-	19.07	1075	17.74	346	61.5	3.1	54	27.8	0.3	770	136
402758	46-44.425	-103.285	-3-03-	25.06	1413	17.73	871	60.8	5.7	103	31.5	0.4	847	328
402759	46-44.384	-103.286	-3-02-	1.00	740	1.35	30	5.5	2.9	82	1.8	0.3	133	179
402761	46-44.389	-103.435	-3-03-	1.57	496	3.16	53	56.4	6.4	34	18.0	0.5	1197	111
402762	46-44.423	-103.442	-3-03-	1.11	1197	0.93	55	121.9	4.0	17	32.6	0.3	1883	333
402763	46-44.290	-103.483	-3-01-	2.32	613	3.78	7	43.9	0.9	4	26.5	0.4	321	21
402768	46-44.297	-103.279	-3-03-	23.01	2506	9.18	341	234.8	3.9	154	82.0	0.4	4316	741
402769	46-44.279	-103.269	-3-03-	0.33	970	0.34	108	1.5	1.7	83	0.5	0.2	52	177
402772	46-44.345	-103.433	-3-03-	3.43	1134	3.02	50	120.3	4.5	22	35.6	0.4	2434	300
402774	46-44.345	-103.401	-3-03-	1.14	608	1.87	87	53.9	9.4	51	18.4	0.3	1587	83
402775	46-44.317	-103.365	-3-03-	0.32	1042	0.31	139	5.1	4.3	74	2.2	0.6	187	199
402778	46-44.307	-103.293	-3-03-	2.71	921	2.94	40	33.7	8.6	95	15.5	0.2	1186	229
402781	46-44.303	-103.400	-3-03-	8.62	484	17.78	13	50.6	1.9	5	23.1	<0.2	226	<5
402782	46-44.255	-103.192	-3-03-	9.24	1185	7.79	62	126.1	2.1	33	61.2	<0.2	2009	229
402783	46-44.290	-103.148	-3-03-	25.11	3936	6.38	1430	208.4	9.1	289	152.2	<0.2	3351	1116
402785	46-44.327	-103.109	-3-03-	8.57	2457	3.49	383	122.3	10.8	321	63.0	<0.2	2148	654
402787	46-44.360	-103.100	-3-03-	17.22	1968	8.75	436	107.5	5.7	157	33.4	0.3	1405	436
402794	46-44.470	-103.131	-3-03-	10.82	1821	5.94	444	75.6	4.0	105	29.6	<0.2	1168	295
402797	46-44.052	-103.799	-3-01-	<0.20	2E3	0.05	23	10.8	11.1	2	2.7	<0.2	27	<5
402793	46-44.077	-103.806	-3-03-	0.34	395	0.86	10	13.1	5.8	18	7.8	<0.2	31	31
402807	46-44.880	-103.723	-3-03-	28.80	5321	5.41	796	218.2	6.3	200	166.5	0.4	2450	1250
402816	46-44.643	-103.967	-3-03-	0.46	2569	0.18	137	122.7	16.6	150	53.0	0.4	3242	675
402818	46-44.651	-103.893	-3-03-	8.59	3606	2.38	318	241.3	16.3	180	151.9	0.6	3495	1760
402827	46-44.786	-103.972	-3-03-	0.47	1126	0.42	190	1.2	1.1	58	0.3	0.5	24	168
402840	46-44.466	-103.788	-3-03-	3.15	2860	1.10	42	495.5	2.3	10	45.7	0.5	9801	1241
402841	46-44.457	-103.828	-3-03-	2.21	774	2.85	17	83.4	2.6	5	25.2	0.4	1155	17
402843	46-44.400	-103.808	-3-03-	3.83	437	8.75	24	61.5	4.3	9	15.4	0.4	1161	77
402844	46-44.339	-103.794	-3-03-	2.10	662	3.17	30	59.7	2.4	5	15.1	<0.2	619	58
402845	46-44.342	-103.836	-3-03-	0.86	569	1.01	9	43.7	0.7	3	11.0	<0.2	76	7
402846	46-44.281	-103.805	-3-03-	0.74	653	1.13	11	56.2	0.8	<2	26.6	0.2	54	<5
402847	46-44.302	-103.783	-3-03-	1.81	648	2.79	15	58.6	1.6	5	14.8	0.2	104	<5
402849	46-44.298	-103.867	-3-03-	3.25	765	4.25	17	60.6	1.4	5	34.0	0.4	80	<5
402852	46-44.133	-103.756	-3-03-	1.75	548	3.19	18	47.9	2.9	4	11.7	0.4	75	10
402853	46-44.156	-103.838	-3-03-	1.25	663	1.88	13	54.7	1.2	3	28.5	0.6	75	<5
402851	46-44.474	-103.897	-3-03-	1.98	669	2.96	11	56.2	1.1	3	26.1	0.4	130	<5
402863	46-44.341	-103.917	-3-03-	1.24	694	1.78	10	43.4	1.5	4	29.5	0.4	104	<5
402902	46-44.049	-102.542	-3-03-	23.06	1906	12.09	454	99.1	6.8	80	54.3	<0.2	1416	505
402905	46-44.095	-102.536	-3-03-	1.72	2191	0.78	429	183.5	9.2	170	75.4	<0.2	2435	735
402906	46-44.043	-102.622	-3-03-	5.75	2192	2.62	254	190.7	7.7	95	36.6	<0.2	1106	675
402908	46-44.104	-102.629	-3-03-	3.25	1426	2.28	337	121.3	11.2	106	38.0	<0.2	1137	273
402909	46-44.133	-102.629	-3-03-	38.13	1002	38.02	149	89.3	5.4	118	35.3	0.3	876	63
402910	46-44.096	-102.746	-3-03-	2.47	4257	0.58	962	358.0	15.4	415	103.7	<0.2	5038	1773
402911	46-44.095	-102.679	-3-03-	14.77	959	15.39	334	65.8	4.8	57	21.7	<0.2	691	153
402912	46-44.095	-102.680	-3-03-	37.50	2061	18.19	756	108.1	6.3	109	41.2	1.9	573	460
402915	46-44.054	-102.678	-3-03-	5.69	2171	2.62	270	129.1	4.9	118	20.3	0.4	1100	430
402919	46-44.154	-102.731	-3-03-	6.29	10609	0.59	1541	429.9	20.6	693	451.2	0.6	5067	5460
402922	46-44.135	-102.617	-3-03-	<0.20	1253	0.08	73	22.9	2.9	73	4.7	<0.2	705	301
402923	46-44.125	-102.578	-3-03-	26.78	1969	13.60	581	111.8	8.1	221	51.4	0.4	1544	475
402925	46-44.186	-102.536	-3-03-	11.81	1581	7.47	437	112.5	1.8	103	64.0	0.4	1236	287

Table A-3, Continued

PARTIAL DATA LISTING FOR GROUNDWATER OF THE RAPID CITY QUADRANGLE

OR SAMPLE NUMBER	D. O. E. ST	SAMPLE LAT	NUMBER LCNG	NUMBER L TY REP	U (PPB)	SP LMHOS/CM	U/SP	B (PPB)	CA (PPM)	K (PPM)	LI (PPB)	MC (PPM)	SE (PPB)	SR (PPB)	SO4 (PPM)
402926	46-44.236	-102.733	-3-03-		13.84	4737	2.92	672	411.4	14.2	353	139.1	0.3	6887	2124
402927	46-44.082	-102.766	-3-03-		5.02	2355	2.10	397	152.2	8.4	159	38.6	0.9	1706	865
402933	46-44.535	-102.538	-3-03-		17.07	1554	10.98	309	75.8	13.0	130	45.1	0.7	816	155
402934	46-44.555	-102.548	-3-03-		6.94	839	8.26	173	61.1	7.3	75	17.3	0.6	776	74
402935	46-44.547	-102.581	-3-03-		27.60	1687	16.36	379	81.3	5.6	114	29.5	0.7	784	210
402936	46-44.561	-102.668	-3-03-		11.75	634	13.51	63	73.3	2.7	19	12.6	0.4	308	27
402937	46-44.527	-102.597	-3-03-		6.20	1276	4.86	212	56.1	7.7	183	26.6	0.5	1050	220
402938	46-44.607	-102.559	-3-03-		21.71	1453	14.94	830	59.9	7.2	53	21.1	0.9	799	295
402942	46-44.695	-102.553	-3-03-		0.41	1537	0.27	628	1.7	0.7	41	0.2	0.5	42	203
402944	46-44.720	-102.548	-3-03-		0.27	1649	0.16	443	3.4	1.7	154	0.3	0.5	69	208
402946	46-44.663	-102.536	-3-03-		2.55	1240	2.06	445	48.6	5.1	49	16.5	0.5	493	192
402948	46-44.622	-102.643	-3-03-		17.63	1259	14.00	151	90.1	15.7	43	30.6	0.4	1421	99
402951	46-44.704	-102.653	-3-03-		1.38	1281	1.08	276	62.3	10.6	76	13.4	0.5	1100	230
402954	46-44.733	-102.653	-3-03-		0.20	1277	0.08	344	14.2	5.5	130	2.0	0.4	297	145
402955	46-44.730	-102.585	-3-03-		0.65	1058	0.61	321	1.3	0.8	108	0.1	0.5	25	106
402956	46-44.716	-102.646	-3-03-		0.49	1529	0.32	276	72.3	11.6	178	13.0	0.5	1137	289
402957	46-44.739	-102.693	-3-03-		0.75	1743	0.43	366	3.6	2.1	77	0.5	0.6	94	298
402958	46-44.695	-102.691	-3-03-		0.34	1203	0.28	359	2.6	3.1	52	0.3	0.6	60	135
402959	46-44.653	-102.734	-3-03-		36.50	2341	15.59	87	214.5	6.7	54	39.9	0.4	1787	95
402960	46-44.620	-102.748	-3-03-		0.71	1675	0.42	338	47.6	9.6	124	19.5	0.7	1070	415
402961	46-44.644	-102.663	-3-03-		18.29	1388	13.18	243	39.7	14.5	54	15.2	0.3	860	128
402963	46-44.138	-102.938	-3-03-		23.74	2889	8.22	652	106.2	10.9	279	57.9	0.4	1896	810
402964	46-44.178	-102.929	-3-03-		10.13	754	13.43	251	35.3	5.9	65	12.1	1.2	534	57
402970	46-44.103	-102.893	-3-03-		2.43	1097	2.21	246	32.3	5.1	86	9.7	0.4	546	252
402971	46-44.113	-102.922	-3-03-		8.05	1459	5.52	129	151.6	4.1	62	47.9	0.3	1881	289
402992	46-44.187	-102.795	-3-03-		3.01	2043	1.47	370	113.2	7.3	193	45.8	0.4	1742	570
402993	46-44.093	-102.816	-3-03-		24.51	1175	20.78	343	45.4	7.2	105	13.7	0.3	568	194
402994	46-44.133	-102.866	-3-03-		21.38	1096	19.50	322	24.2	7.2	94	10.2	0.4	382	202
402996	46-44.238	-102.682	-3-03-		21.59	1254	16.67	282	38.7	8.9	96	15.3	0.2	657	191
402997	46-44.093	-102.554	-3-03-		19.13	3007	6.36	309	98.7	9.0	141	45.5	0.3	1736	909
402998	46-44.183	-102.888	-3-03-		30.80	1708	18.03	95	77.7	8.8	114	19.4	0.2	1003	309
402999	46-44.081	-102.870	-3-03-		27.40	1759	15.58	153	60.1	8.7	153	13.7	0.2	870	360
403000	46-44.221	-102.830	-3-03-		5.20	1444	3.60	256	72.1	5.4	123	34.2	0.3	1178	340
403001	46-44.037	-102.872	-3-03-		22.12	964	22.93	336	35.3	10.0	46	11.3	0.8	814	120
403002	46-44.053	-102.946	-3-03-		23.86	1485	22.80	708	24.2	12.0	73	9.0	0.5	780	155
403003	46-44.037	-102.830	-3-03-		86.83	3550	24.46	534	150.8	18.1	406	94.1	0.5	3486	1229
403006	46-44.087	-103.564	-3-03-		6.70	558	12.01	17	32.3	1.3	17	29.1	0.5	184	84
403008	46-44.142	-103.575	-3-03-		0.87	407	2.13	18	32.4	0.7	4	15.7	0.3	154	21
403025	46-44.103	-103.737	-3-03-		0.54	459	1.08	34	44.2	0.6	7	21.2	0.4	277	32
403028	46-44.124	-103.719	-3-03-		0.44	491	0.90	14	65.8	6.8	8	19.2	0.2	208	67
403029	46-44.196	-103.533	-3-03-		0.44	341	1.29	19	41.4	3.7	7	12.2	<0.2	117	10
403030	46-44.004	-103.709	-3-03-		0.84	444	1.69	16	51.4	2.4	7	20.3	<0.2	128	<5
403031	46-44.003	-103.644	-3-03-		1.06	457	2.32	14	52.5	2.5	7	20.4	<0.2	131	5
403032	46-44.100	-103.513	-3-03-		1.24	570	2.17	14	73.3	2.1	3	24.1	<0.2	258	34
403033	46-44.181	-103.605	-3-03-		0.31	245	1.26	15	24.6	1.1	7	12.1	<0.2	121	5
403034	46-44.193	-103.633	-3-03-		0.47	292	1.61	16	19.1	1.7	11	16.8	<0.2	78	10
403035	46-44.227	-103.676	-3-03-		0.51	314	1.62	20	14.9	0.9	11	18.4	0.2	72	31
403036	46-44.230	-103.671	-3-03-		0.46	153	2.99	12	9.2	1.2	6	4.6	<0.2	55	14
403040	46-44.002	-103.504	-3-03-		0.58	266	2.18	17	24.9	1.7	11	6.4	<0.2	109	8
403041	46-44.082	-103.645	-3-03-		10.39	716	14.50	58	48.8	4.4	12	39.0	0.3	287	5
403042	46-44.062	-103.655	-3-03-		10.13	555	18.23	58	48.2	4.5	12	36.1	0.4	283	<5
403052	46-44.467	-103.512	-3-03-		10.03	2977	3.37	69	459.8	2.5	16	87.3	0.2	4776	1318
403053	46-44.466	-103.577	-3-03-		10.76	2952	3.64	71	465.3	2.4	15	85.4	0.2	4754	1399
403055	46-44.466	-103.648	-3-03-		0.59	391	1.51	25	36.6	3.3	5	10.3	0.3	105	10
403058	46-44.467	-103.721	-3-03-		1.15	422	2.72	18	45.6	1.7	5	18.5	0.3	266	14

Table A-3, Continued

PARTIAL DATA LISTING FOR GROUNDWATER OF THE RAPID CITY QUADRANGLE

OR SAMPLE NUMBER	D. O. E. ST LAT	SAMPLE LONG	NUMBER L TY REP	U (PPB)	SP UMHOS/CM	U/SP	B (PPB)	CA (PPM)	K (PPM)	LI (PPB)	MG (PPM)	SE (PPB)	SR (PPB)	SO4 (PPM)
403059	46-44.444	-103.717	-3-03-	1.25	406	3.07	19	45.5	1.6	5	19.0	0.3	268	10
403060	46-44.415	-103.709	-3-03-	0.97	435	2.23	27	35.5	2.8	6	10.5	0.3	107	7
403065	46-44.422	-103.569	-3-03-	1.06	311	3.40	28	35.8	2.8	6	10.5	0.2	107	<5
403068	46-44.386	-103.590	-3-03-	1.33	420	3.16	23	47.9	2.2	7	18.8	0.3	125	<5
403069	46-44.379	-103.504	-3-03-	1.19	309	3.84	171	1.0	0.1	2	1.0	0.8	5	17
403071	46-44.325	-103.710	-3-03-	1.16	389	2.98	22	47.4	2.2	7	19.0	0.4	124	5
403072	46-44.329	-103.645	-3-03-	0.58	422	1.37	29	35.7	2.8	6	10.5	0.2	107	8
403073	46-44.274	-103.707	-3-03-	0.68	422	1.61	27	35.2	2.9	6	10.7	0.2	105	8
403074	46-44.280	-103.636	-3-03-	1.30	317	4.10	28	35.6	2.7	5	10.4	0.2	105	9
403075	46-44.271	-103.574	-3-03-	1.13	425	2.60	24	35.2	3.3	5	10.1	0.3	108	10
403076	46-44.272	-103.530	-3-03-	0.83	317	2.62	27	35.2	2.9	6	10.8	<0.2	105	7
403202	46-44.093	-102.446	-3-03-	2.64	670	2.72	117	78.9	4.1	39	19.0	0.3	501	230
403204	46-44.030	-102.382	-3-03-	28.57	9356	3.05	750	392.0	44.3	754	973.2	0.5	6734	5420
403205	46-44.141	-102.472	-3-03-	7.25	3223	2.25	292	322.0	6.8	124	95.0	0.4	2093	1428
403206	46-44.191	-102.486	-3-03-	8.19	876	9.34	130	83.4	2.2	49	25.4	0.3	647	97
403208	46-44.219	-102.491	-3-03-	16.01	1023	15.64	415	66.8	2.7	117	22.2	0.5	592	165
403211	46-44.128	-102.446	-3-01-	11.69	1499	7.79	104	190.2	3.7	56	42.7	0.3	1257	585
403214	46-44.093	-102.295	-3-03-	0.90	2069	0.43	1305	11.7	2.5	120	0.5	0.5	157	572
403215	46-44.017	-102.471	-3-03-	25.94	4606	5.63	550	367.6	7.6	393	135.5	0.5	3821	2129
403217	46-44.096	-102.342	-3-01-	48.17	2410	19.98	338	294.9	13.4	117	67.2	0.3	2157	694
403218	46-44.007	-102.279	-3-03-	0.93	1511	0.62	1224	15.9	4.5	212	3.5	0.4	210	326
403219	46-44.025	-102.297	-3-03-	0.30	4266	0.07	1757	72.1	9.5	412	11.5	0.5	1124	1454
403220	46-44.140	-102.219	-3-03-	14.90	3770	3.95	507	490.1	10.9	217	93.5	0.5	3481	1827
403221	46-44.164	-102.358	-3-03-	4.46	2755	1.60	552	313.0	9.2	191	98.4	0.8	3121	1182
403224	46-44.188	-102.266	-3-03-	0.38	777	0.49	651	5.2	0.5	58	1.0	0.6	81	48
403226	46-44.233	-102.420	-3-03-	8.13	2612	3.11	242	246.6	5.6	125	67.7	0.3	2488	1094
403227	46-44.229	-102.385	-3-01-	4.57	672	6.80	121	59.5	6.1	35	16.0	0.5	667	77
403229	46-44.053	-103.127	-3-03-	44.23	5773	7.66	1739	494.6	19.4	180	330.5	1.2	7006	2490
403229	46-44.010	-103.132	-3-03-	3.55	4256	0.83	589	514.1	16.0	621	175.0	1.7	5249	2286
403232	46-44.031	-103.250	-3-03-	5.88	1273	4.62	40	178.5	5.3	25	61.0	<0.2	1683	524
403233	46-44.104	-103.149	-3-03-	6.94	723	9.59	30	89.8	4.6	28	21.4	<0.2	1237	160
403234	46-44.114	-103.066	-3-03-	34.60	7800	4.44	1029	365.3	6.9	307	394.0	0.4	6837	3600
403235	46-44.109	-103.030	-3-03-	0.31	3569	0.09	1159	91.4	12.2	283	29.0	0.3	2508	1305
403240	46-44.126	-103.190	-3-03-	3.43	762	4.50	50	99.3	6.3	28	25.4	<0.2	1626	188
403241	46-44.054	-103.000	-3-03-	6.01	1025	5.86	201	86.5	7.6	64	27.0	0.4	939	312
403243	46-44.008	-103.001	-3-03-	7.11	1616	4.40	184	146.6	33.7	67	54.3	0.6	1119	275
403245	46-44.006	-103.049	-3-03-	4.26	2344	1.82	614	167.1	6.7	142	84.5	0.4	2161	890
403250	46-44.503	-102.758	-3-03-	38.31	4235	5.04	291	195.2	4.7	227	86.5	0.6	2179	1692
403257	46-44.622	-102.765	-3-03-	0.72	3532	0.20	594	116.8	12.2	233	57.9	0.6	2666	1161
403260	46-44.645	-102.807	-3-03-	0.45	1923	0.23	304	65.0	10.6	194	26.4	0.4	1488	535
403262	46-44.661	-102.837	-3-03-	27.35	5706	4.79	319	327.3	7.5	557	130.4	0.9	3812	2610
403265	46-44.699	-102.799	-3-03-	5.14	982	5.25	62	103.5	7.5	74	31.5	0.4	738	146
403267	46-44.747	-102.797	-3-03-	12.88	638	20.17	49	61.3	6.0	61	21.7	0.2	711	52
403271	46-44.144	-103.027	-3-03-	14.41	1153	12.49	222	99.1	6.5	93	39.8	0.8	1338	291
403272	46-44.187	-103.028	-3-03-	6.08	1484	4.09	215	121.9	4.5	167	34.1	0.3	1268	80
403274	46-44.238	-103.001	-3-03-	7.68	1280	6.00	321	107.9	7.0	167	28.4	0.3	1071	67
403275	46-44.218	-103.066	-3-03-	13.07	3090	4.23	559	211.8	4.6	170	98.8	0.6	3758	1067
403276	46-44.239	-103.131	-3-03-	5.23	1123	4.65	79	155.8	4.6	38	54.7	0.3	2203	69
403278	46-44.217	-103.182	-3-01-	26.81	1545	17.35	211	200.6	2.4	82	34.4	0.3	1194	115
403281	46-44.109	-103.189	-3-03-	22.35	5401	4.14	824	306.8	56.6	943	389.5	0.4	2022	4028
403282	46-44.178	-103.186	-3-03-	2.99	752	3.97	69	62.8	6.6	60	20.0	0.3	1615	180
403283	46-44.556	-103.206	-3-03-	20.00	4540	4.40	774	324.3	11.6	395	185.3	0.3	4797	1148
403288	46-44.517	-103.195	-3-03-	13.17	1552	8.27	398	103.5	4.5	94	40.1	0.4	1589	419
403291	46-44.512	-103.132	-3-03-	9.25	1218	7.59	246	43.9	3.8	84	17.9	1.2	784	239
403301	46-44.551	-103.408	-3-03-	4.89	2044	2.39	514	107.8	9.8	160	60.1	0.6	2292	664

Table A-3, Continued

PARTIAL DATA LISTING FOR GROUNDWATER OF THE RAPID CITY QUADRANGLE

OR SAMPLE NUMBER	D. O. F. ST LAT	SAMPLE LONG	NUMBER L TY REP	U (PPB)	SP UMHOS/CM	U/SP	B (PPB)	CA (PPM)	K (PPM)	LI (PPB)	MG (PPM)	SE (PPB)	SR (PPB)	SO4 (PPM)
403304	46-44.505	-103.466	-3-03-	13.08	3620	3.61	418	343.9	6.5	149	122.5	0.5	3071	1598
403305	46-44.614	-103.448	-3-03-	<0.20	972	0.10	70	2.2	0.9	54	1.3	0.4	56	220
403306	46-44.604	-103.392	-3-03-	21.12	9227	2.29	710	271.8	32.3	374	508.3	2.2	4795	4126
403307	46-44.615	-103.265	-3-01-	23.23	2102	11.05	209	229.5	4.2	85	102.3	0.4	2650	904
403310	46-44.620	-103.325	-3-03-	38.32	2493	15.37	362	248.2	14.5	116	132.7	0.4	3278	1050
403311	46-44.545	-103.459	-3-01-	2.73	882	3.09	55	47.2	5.0	78	14.0	0.4	972	247
403313	46-44.555	-103.348	-3-03-	<0.20	848	0.12	49	6.5	2.7	76	1.8	0.4	171	218
403315	46-44.519	-103.308	-3-03-	71.31	2048	34.81	815	94.3	3.2	227	80.0	0.7	2087	651
403316	46-44.515	-103.257	-3-03-	0.25	1150	0.22	190	1.0	0.7	56	0.3	0.4	29	177
403317	46-44.702	-103.466	-3-03-	36.11	4937	7.31	771	294.5	6.8	252	129.6	0.6	3245	2160
403319	46-44.632	-103.446	-3-03-	33.93	2648	12.81	343	261.1	7.5	100	140.1	0.3	3054	1233
403320	46-44.644	-103.406	-3-03-	<0.20	1330	0.08	59	70.1	8.9	84	20.7	<0.2	1188	452
403322	46-44.506	-103.652	-3-03-	<0.20	446	0.22	25	38.3	2.5	13	11.5	<0.2	121	49
403323	46-44.516	-103.720	-3-03-	7.83	772	10.14	85	71.6	11.0	30	37.3	<0.2	1273	71
403328	46-44.558	-103.727	-3-03-	3.47	997	3.48	70	147.2	4.0	15	38.6	<0.2	1830	258
403329	46-44.648	-103.710	-3-03-	10.77	1226	8.78	92	161.5	4.1	22	34.7	0.3	2167	456
403331	46-44.660	-103.652	-3-03-	11.87	1585	7.48	48	192.2	9.4	41	55.5	0.4	2848	723
403332	46-44.686	-103.727	-3-03-	<0.20	1363	0.07	1967	1.4	2.1	49	0.6	0.3	58	77
403334	46-44.703	-103.552	-3-03-	<0.20	1272	0.08	66	85.3	13.9	73	26.7	0.2	1584	398
403336	46-44.661	-103.579	-3-03-	<0.20	854	0.12	36	13.7	5.9	92	4.5	0.2	251	224
403338	46-44.520	-103.605	-3-03-	28.72	3218	3.92	134	377.0	13.4	150	154.0	0.3	4484	1741
403340	46-44.518	-103.522	-3-03-	27.97	1426	19.60	199	125.4	3.4	42	53.3	0.4	979	135
403341	46-44.558	-103.566	-3-03-	<0.20	740	0.14	57	45.9	6.6	53	14.0	0.3	818	137
403342	46-44.565	-103.534	-3-03-	<0.20	934	0.11	54	6.3	2.0	63	1.6	0.3	121	232
403344	46-44.596	-103.517	-3-03-	35.87	5114	7.01	264	435.0	33.5	84	275.2	0.3	2940	2505
403350	46-44.061	-103.855	-3-01-	1.07	503	2.12	9	36.1	0.8	2	29.0	0.5	49	8
403354	46-44.076	-103.905	-3-01-	0.88	522	1.68	15	51.0	0.6	2	25.5	0.6	62	<5
403356	46-44.015	-103.551	-3-01-	0.58	637	1.54	9	60.5	0.4	<2	29.9	0.4	61	5
403357	46-44.029	-103.951	-3-01-	1.06	560	1.89	13	59.3	0.4	<2	27.4	0.4	55	5
403358	46-44.022	-103.782	-3-03-	0.48	351	1.37	20	24.0	2.9	9	6.1	0.3	64	16
403361	46-44.114	-103.650	-3-01-	0.74	553	1.34	10	65.7	0.7	3	22.8	0.4	182	7
403500	46-44.383	-102.065	-3-03-	<0.20	4561	0.02	2000	3.0	2.8	197	0.6	0.7	245	63
403505	46-44.401	-102.115	-3-03-	<0.20	3365	0.03	1760	2.3	1.9	135	0.4	0.7	118	72
403506	46-44.477	-102.042	-3-01-	1.79	1225	1.46	549	51.0	1.6	73	12.4	0.4	590	195
403509	46-44.302	-102.048	-3-03-	6.52	1405	4.64	117	137.4	3.8	75	58.0	<0.2	1079	383
403510	46-44.341	-102.059	-3-03-	4.53	2709	1.67	784	139.1	5.0	182	72.7	0.4	1911	925
403513	46-44.324	-102.127	-3-03-	<0.20	4530	0.02	2951	5.3	1.9	125	2.1	0.7	421	63
403517	46-44.290	-102.178	-3-03-	19.40	7051	2.75	547	362.8	9.0	285	171.5	0.4	3406	2982
403519	46-44.336	-102.176	-3-03-	<0.20	2319	0.04	896	1.5	1.1	159	0.1	0.5	51	292
403523	46-44.438	-102.245	-3-01-	3.42	650	5.26	234	25.5	3.1	52	12.5	0.4	336	152
403526	46-44.287	-102.228	-3-03-	<0.20	1902	3.05	297	2.6	1.6	117	0.3	<0.2	54	832
403527	46-44.359	-102.121	-3-03-	3.64	1507	2.41	514	20.8	75.4	218	4.2	0.5	326	221
403530	46-44.309	-102.025	-3-03-	6.65	4999	1.33	1649	174.1	14.5	520	64.4	0.5	2553	1488
403531	46-44.308	-102.026	-3-03-	<0.20	2888	0.03	1733	36.7	4.2	284	4.5	0.4	657	594
403532	46-44.367	-102.191	-3-03-	14.48	847	17.08	296	117.3	9.0	172	48.6	0.3	1915	294
403533	46-44.416	-102.050	-3-03-	<0.20	3478	0.03	2829	1.6	1.3	127	0.2	0.6	115	223
403537	46-44.437	-102.187	-3-01-	3.63	514	7.05	80	64.0	2.4	25	9.8	0.3	405	84
403538	46-44.458	-102.232	-3-01-	5.02	419	11.98	58	58.1	2.1	20	10.4	<0.2	435	36
403540	46-44.484	-102.160	-3-03-	7.26	2160	3.36	378	151.5	6.7	75	40.8	0.7	1348	760
403541	46-44.564	-102.474	-3-03-	1.74	1115	1.56	337	126.6	7.5	150	43.0	0.3	724	282
403543	46-44.533	-102.478	-3-03-	6.24	1509	4.13	330	73.7	7.9	106	50.8	0.3	1220	300
403544	46-44.548	-102.346	-3-03-	7.56	453	15.68	18	51.9	1.6	12	13.6	<0.2	238	18
403545	46-44.536	-102.391	-3-03-	0.37	1769	0.21	1116	12.1	1.4	120	3.9	<0.2	292	68
403546	46-44.578	-102.394	-3-03-	5.43	833	6.52	40	62.3	2.2	25	26.1	0.6	402	37
403547	46-44.579	-102.286	-3-03-	4.27	1343	3.18	124	93.5	4.4	88	45.5	0.6	1331	192

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Table A-3, Continued

PARTIAL DATA LISTING FOR GROUNDWATER OF THE RAPID CITY QUADRANGLE

OR SAMPLE NUMBER	D. O. E. ST LAT	SAMPLE LCNG	NUMBER L TY REP	U (PPB)	SP UMHNS/CM	U/SP	B (PPB)	CA (PPM)	K (PPM)	LI (PPB)	MC (PPM)	SE (PPB)	SR (PPB)	SO4 (PPM)
403549	46-44.577	-102.138	-3-03-	50.32	7574	6.31	902	366.3	8.9	456	183.6	0.7	5902	3014
403553	46-44.574	-102.221	-3-03-	<0.20	3693	0.03	1848	21.9	2.1	179	4.9	0.7	544	856
403554	46-44.531	-102.208	-3-03-	<0.20	7087	0.01	1987	103.7	4.3	279	22.4	0.6	3108	2246
403555	46-44.579	-102.057	-3-03-	11.40	11079	1.03	1606	388.1	31.1	562	193.2	0.5	7482	4662
403556	46-44.560	-102.083	-3-03-	<0.20	5449	0.02	3489	2.4	1.6	160	0.5	1.1	271	10
403563	46-44.526	-102.031	-3-03-	<0.20	5388	0.02	3454	1.8	1.3	133	0.4	0.9	225	10
403564	46-44.519	-102.095	-3-03-	<0.20	5548	0.02	3435	2.1	1.5	147	0.4	0.8	272	10
403565	46-44.593	-102.459	-3-03-	6.49	1074	6.04	342	122.5	19.8	131	25.8	0.6	2356	229
403567	46-44.653	-102.465	-3-03-	2.00	1253	1.60	101	177.7	18.1	114	33.3	0.4	2322	450
403568	46-44.605	-102.345	-3-03-	1.69	1057	1.54	173	107.9	6.5	51	40.5	0.4	650	298
403573	46-44.611	-102.421	-3-03-	0.31	793	0.39	489	4.2	1.3	37	0.8	0.4	66	66
403575	46-44.669	-102.391	-3-03-	0.22	1217	0.18	326	84.3	8.5	151	21.8	0.3	1947	332
403576	46-44.658	-102.361	-3-03-	0.43	2071	0.21	915	26.3	3.6	139	6.3	0.4	683	708
403577	46-44.662	-102.357	-3-03-	4.09	1391	2.94	342	107.4	6.8	87	30.1	0.4	1103	342
403578	46-44.662	-102.276	-3-03-	0.54	4502	0.12	1983	27.4	3.8	208	7.2	0.6	907	1594
403582	46-44.496	-102.386	-3-03-	8.20	8957	0.91	1363	335.2	13.9	632	132.7	0.6	8454	4168
403583	46-44.654	-102.231	-3-03-	6.82	5384	1.27	990	157.5	7.7	298	76.6	0.4	3880	2298
403584	46-44.453	-102.349	-3-03-	0.27	2290	0.12	646	1.7	1.5	113	0.2	0.6	63	426
403589	46-44.449	-102.404	-3-03-	0.32	2022	0.16	266	1.9	1.9	93	0.1	0.3	53	524
403590	46-44.471	-102.286	-3-03-	38.09	12002	3.17	1226	338.9	14.4	477	298.8	0.4	7565	5872
403591	46-44.600	-102.287	-3-03-	4.29	2734	1.57	419	103.7	7.2	97	33.3	0.6	1161	978
403592	46-44.704	-102.326	-3-03-	8.84	1767	5.00	389	109.2	6.4	120	43.4	0.4	1387	525
403594	46-44.753	-102.370	-3-03-	0.48	2890	0.17	514	75.4	4.9	173	27.4	0.4	1902	942
403595	46-44.711	-102.403	-3-03-	<0.20	2743	0.04	837	17.3	3.6	186	3.2	0.7	524	645
403596	46-44.622	-102.222	-3-03-	<0.20	3266	0.03	1874	15.4	2.5	105	2.5	0.6	434	783
403597	46-44.700	-102.193	-3-03-	7.71	2354	3.27	332	141.5	4.6	99	45.0	0.5	1559	749
403600	46-44.707	-102.103	-3-03-	41.64	12652	3.29	429	410.7	15.1	578	203.6	0.7	8758	3472
403602	46-44.607	-102.154	-3-03-	10.55	8121	1.30	1185	272.2	12.8	741	206.0	6.8	6732	3476
403604	46-44.629	-102.146	-3-03-	<0.20	5978	0.02	1519	153.1	5.9	266	37.5	0.5	3993	2442
403605	46-44.676	-102.109	-3-03-	4.89	3614	1.35	671	49.3	5.1	228	11.1	0.7	1013	1164
403606	46-44.610	-102.088	-3-03-	9.93	7260	1.37	974	306.1	7.4	331	136.5	0.7	5429	3062
403610	46-44.687	-102.484	-3-03-	0.93	1063	0.87	335	61.2	7.3	83	19.8	0.3	1128	161
403611	46-44.742	-102.484	-3-03-	10.41	4501	2.31	519	77.8	8.4	323	75.3	0.6	1834	1314
403612	46-44.788	-102.492	-3-03-	24.25	5214	4.65	309	214.8	6.6	290	97.1	0.4	3599	2100
403614	46-44.799	-102.544	-3-03-	17.20	3821	4.50	408	94.1	7.6	260	61.7	0.5	2117	1163
403615	46-44.802	-102.645	-3-03-	34.89	5434	6.42	482	282.4	10.7	297	184.7	1.7	7626	2340
403617	46-44.799	-102.597	-3-23-	45.20	21487	2.10	623	344.6	9.7	797	233.6	0.5	10473	7365
403621	46-44.833	-102.624	-3-03-	0.74	7758	0.10	897	107.4	6.0	401	30.4	0.4	3389	2918
403623	46-44.847	-102.652	-3-03-	14.09	3373	4.18	277	122.0	7.4	217	51.9	0.5	2312	1191
403625	46-44.892	-102.650	-3-03-	0.31	1776	0.17	351	25.0	4.7	160	9.0	0.2	774	548
403627	46-44.934	-102.678	-3-03-	33.07	1652	20.01	157	67.7	4.3	84	24.8	0.5	1462	269
403628	46-44.959	-102.686	-3-03-	12.90	1954	6.47	218	32.2	3.0	63	13.0	0.4	553	370
403629	46-44.843	-102.490	-3-03-	2.32	1257	1.79	158	57.4	6.8	112	29.5	0.3	1217	237
403630	46-44.897	-102.540	-3-03-	41.84	1017	41.13	154	56.1	7.4	85	24.7	0.4	1501	239
403632	46-44.890	-102.610	-3-03-	0.86	2239	0.61	348	11.7	4.0	140	6.6	0.3	320	498
403634	46-44.934	-102.582	-3-03-	2.20	1031	2.13	77	76.6	4.3	57	12.3	0.2	1453	219
403637	46-44.965	-102.585	-3-03-	1.25	2604	0.48	557	8.5	3.5	94	1.1	0.5	329	664
403639	46-44.782	-102.425	-3-03-	35.62	7564	4.70	693	86.1	6.9	483	63.8	0.5	3616	3000
403640	46-44.866	-102.469	-3-03-	0.63	7399	0.09	649	276.2	18.2	1043	224.6	0.3	8739	3528
403641	46-44.930	-102.527	-3-03-	0.45	766	0.04	109	32.7	5.4	81	7.9	0.3	997	57
403645	46-44.932	-102.403	-3-03-	0.52	1724	0.30	691	1.0	1.2	62	0.1	0.4	36	166
403646	46-44.937	-102.476	-3-03-	<0.20	1650	0.06	490	2.2	1.9	72	0.2	0.4	61	223
403647	46-44.970	-102.481	-3-03-	0.48	1416	0.34	410	2.2	2.3	85	0.3	0.6	64	179
403650	46-44.823	-102.439	-3-03-	4.43	1739	2.55	138	76.4	8.5	136	34.3	0.3	1324	467
403653	46-44.813	-102.347	-3-03-	0.26	5349	0.05	1550	19.6	4.4	283	4.5	0.7	920	1760

Table A-3, Continued

PARTIAL DATA LISTING FOR GROUNDWATER OF THE RAPID CITY QUADRANGLE

ON SAMPLE NUMBER	D. O. E. ST LAT	SAMPLE LCNG	NUMBER L TY REP	U (PPB)	SP UMHQS/CM	U/SP	B (PPB)	CA (PPM)	K (PPM)	LI (PPB)	MG (PPM)	SE (PPB)	SR (PPB)	S04 (PPM)
403654	46-44.869	-102.312	-3-03-	19.40	8205	2.37	688	188.4	18.3	284	149.5	0.8	5295	2668
403655	46-44.847	-102.264	-3-03-	<0.20	3303	0.03	1841	5.9	2.5	96	1.0	0.7	219	563
403656	46-44.825	-102.358	-3-03-	8.08	1638	4.93	92	90.2	2.9	52	40.6	0.5	693	392
403657	46-44.750	-102.298	-3-03-	3.39	4182	0.81	687	119.0	10.3	309	66.8	0.6	3390	1614
403660	46-44.749	-102.228	-3-03-	15.82	1742	9.08	323	53.4	4.4	156	28.2	0.5	970	478
403664	46-44.857	-102.244	-3-03-	0.60	4028	0.15	1856	11.0	3.2	132	1.7	0.9	427	1096
403665	46-44.907	-102.223	-3-03-	0.25	3186	0.08	1997	4.5	2.1	84	0.8	0.3	174	135
403670	46-44.755	-102.218	-3-03-	0.40	3553	0.11	1362	16.3	3.1	202	3.0	0.6	492	863
403672	46-44.759	-102.129	-3-03-	0.45	2022	0.22	1886	15.3	2.2	98	5.3	0.4	352	521
403673	46-44.750	-102.162	-3-03-	9.82	3266	3.01	457	143.8	9.3	184	88.8	0.4	1578	1214
403674	46-44.735	-102.040	-3-03-	20.35	8751	2.31	1318	260.8	8.5	516	87.9	0.5	4561	3424
403678	46-44.817	-102.028	-3-03-	0.61	6154	0.10	1983	32.1	2.9	200	3.4	0.4	1074	1542
403679	46-44.806	-102.171	-3-03-	0.73	4058	0.18	1002	64.3	5.7	216	27.5	0.4	2338	1139
403681	46-44.976	-102.043	-3-03-	0.61	3840	0.16	1578	15.1	3.2	131	2.6	0.5	456	840
403682	46-44.948	-102.029	-3-03-	0.63	4054	0.16	1999	9.7	2.4	134	1.2	0.6	327	808
403683	46-44.895	-102.032	-3-03-	0.93	5340	0.17	1630	34.9	3.8	244	6.3	0.6	1188	1541
403684	46-44.875	-102.072	-3-03-	14.24	5185	2.75	1634	37.8	4.9	253	18.1	0.9	1399	1549
403687	46-44.850	-102.070	-3-03-	1.04	2965	0.35	1180	8.6	2.5	171	2.1	0.6	246	577
403688	46-44.854	-102.156	-3-03-	17.20	3255	5.28	242	142.1	3.0	136	70.4	0.3	2773	588
403690	46-44.973	-102.095	-3-03-	6.78	2973	2.28	892	16.9	2.0	100	5.1	0.6	283	410
403692	46-44.585	-102.168	-3-03-	0.49	1849	0.26	1382	2.1	1.1	56	0.3	0.7	52	189
403699	46-44.988	-102.332	-3-03-	2.53	5530	0.46	817	90.6	5.7	230	17.3	1.7	2437	1315
403701	46-44.913	-102.327	-3-03-	2.27	1600	1.42	540	21.0	3.1	105	4.6	0.4	435	251
403704	46-44.882	-102.370	-3-03-	0.44	1002	0.44	125	55.8	3.9	56	22.1	0.3	795	226
403707	46-44.726	-103.842	-3-03-	0.57	5672	0.09	517	254.4	8.8	257	86.1	<0.2	6387	2338
403709	46-44.689	-103.852	-3-03-	0.57	1042	0.55	35	5.6	2.9	97	2.0	0.5	134	212
403710	46-44.691	-103.923	-3-03-	0.62	2605	0.24	259	51.7	4.2	129	20.4	0.4	1759	1018
403714	46-44.703	-103.546	-3-03-	0.41	1835	0.22	92	3.0	3.5	54	1.1	0.2	82	608
403715	46-44.727	-103.585	-3-03-	<0.20	726	0.14	30	2.5	4.1	43	1.1	0.4	58	164
403718	46-44.750	-103.893	-3-03-	<0.20	1035	0.10	49	1.1	1.7	49	0.3	0.4	25	306
403720	46-44.699	-103.779	-3-03-	12.50	1015	12.31	37	115.6	6.4	30	39.1	0.2	1497	271
403724	46-44.646	-103.777	-3-03-	0.26	646	0.38	927	25.8	4.9	135	14.2	0.4	167	124
403725	46-44.649	-103.837	-3-03-	<0.20	3224	0.03	76	54.0	10.4	175	27.0	0.3	1487	1410
403729	46-44.606	-103.780	-3-03-	7.65	1212	5.98	48	220.5	3.9	16	48.5	0.4	3158	637
403730	46-44.566	-103.791	-3-03-	7.11	798	3.90	35	85.3	4.6	19	32.5	0.5	678	132
403731	46-44.542	-103.844	-3-03-	3.90	253	3.11	57	171.6	2.0	14	48.2	0.2	2294	428
403736	46-44.602	-103.829	-3-03-	2.23	588	3.99	11	53.5	0.9	4	21.4	0.3	188	15
403738	46-44.510	-103.508	-3-01-	2.99	648	4.61	27	67.5	2.2	8	28.5	0.8	1719	5
403739	46-44.510	-103.565	-3-03-	1.70	737	2.31	23	73.6	2.2	7	29.2	0.4	366	<5
403742	46-44.556	-103.892	-3-03-	5.59	1964	2.82	64	308.8	1.7	14	52.3	0.3	5027	788
403745	46-44.562	-103.567	-3-03-	4.18	1799	2.32	43	308.7	1.3	10	43.5	0.4	2630	647
403747	46-44.616	-103.917	-3-03-	<0.20	2709	0.04	150	249.1	17.2	143	97.7	0.4	6127	1224
403753	46-44.031	-103.068	-3-03-	6.85	2943	2.33	769	221.8	9.8	198	110.0	<0.2	4340	1107
403754	46-44.047	-103.089	-3-01-	12.29	1122	10.95	399	97.5	6.5	99	46.0	<0.2	2372	218
403755	46-44.327	-102.410	-3-03-	12.31	178	52.97	619	63.3	4.7	99	26.1	<0.2	1034	475
403757	46-44.372	-102.374	-3-03-	9.59	710	13.50	131	60.2	3.5	23	12.5	<0.2	621	84
403758	46-44.374	-102.494	-3-03-	<0.20	1954	0.05	267	2.8	0.8	62	0.4	0.5	65	445
403761	46-44.321	-102.475	-3-03-	34.62	2751	12.58	372	258.6	9.9	194	79.9	0.2	2627	740
403763	46-44.296	-102.247	-3-03-	<0.20	1842	0.05	260	2.4	1.0	84	0.2	0.6	49	485
403765	46-44.293	-102.490	-3-03-	13.44	915	14.68	132	88.8	5.0	56	24.7	0.5	607	100
403767	46-44.270	-102.435	-3-03-	10.92	1458	7.29	340	94.0	6.3	75	40.2	0.4	1321	369
403768	46-44.378	-102.334	-3-03-	5.12	883	6.93	234	55.6	4.0	42	15.4	<0.2	736	183
403769	46-44.484	-102.481	-3-03-	9.43	893	9.43	74	107.7	4.1	71	36.3	0.5	1340	23
403770	46-44.422	-102.502	-3-03-	22.69	566	23.48	241	88.7	4.8	78	37.2	0.3	928	162
403772	46-44.255	-102.612	-3-03-	2.26	744	3.04	208	40.4	3.0	59	5.5	<0.2	546	57

Table A-3, Continued

PARTIAL DATA LISTING FOR GROUNDWATER OF THE RAPID CITY QUADRANGLE

OR SAMPLE NUMBER	D. O. E. ST	SAMPLE LAT	NUMBER LCNG	L TY REP	U (PPB)	SP UMHOS/CM	U/SP	B (PPB)	CA (PPM)	K (PPM)	LI (PPB)	MG (PPM)	SE (PPB)	SR (PPB)	SO4 (PPM)
403774	46-44.274	-102.547	-3-03-		23.10	7952	2.89	850	506.9	14.6	315	676.1	0.4	7425	3748
403779	46-44.299	-102.698	-3-03-		27.80	3569	7.79	678	292.7	5.2	184	160.8	<0.2	2804	1549
403781	46-44.265	-102.645	-3-03-		17.84	1770	10.08	614	108.0	4.3	136	39.2	0.3	1253	93
403782	46-44.313	-102.528	-3-03-		33.07	1719	19.23	292	202.5	5.9	68	78.8	0.4	2258	632
403783	46-44.432	-102.554	-3-03-		0.75	1277	0.59	160	63.9	3.5	38	16.7	0.3	704	73
403786	46-44.426	-102.622	-3-03-		40.23	4289	9.40	842	244.9	10.3	219	116.9	0.3	4330	1629
403787	46-44.427	-102.624	-3-03-		32.63	3333	9.79	664	164.1	8.4	190	80.7	0.5	3011	1219
403789	46-44.422	-102.681	-3-03-		47.24	3294	14.34	333	258.9	10.4	228	118.5	0.6	3217	1302
403790	46-44.443	-102.671	-3-03-		0.52	1186	0.44	377	80.2	5.3	89	34.4	0.3	1071	323
403791	46-44.445	-102.676	-3-03-		6.74	1285	5.24	151	138.4	3.3	41	25.8	0.3	784	265
403792	46-44.445	-102.721	-3-03-		33.71	1767	19.08	229	188.6	6.7	86	73.4	0.3	1415	584
403793	46-44.450	-102.563	-3-03-		23.50	3623	6.49	340	285.9	9.6	179	176.7	0.4	3667	1370
403795	46-44.362	-102.651	-3-03-		7.14	4299	1.66	429	405.5	9.2	194	125.9	0.2	4357	2052
403796	46-44.363	-102.696	-3-03-		2.86	461	6.19	131	49.0	2.0	19	6.0	0.3	428	43
403797	46-44.373	-102.691	-3-03-		5.48	1436	3.82	752	14.9	3.7	151	3.6	0.4	271	186
403798	46-44.415	-102.721	-3-01-		14.11	849	16.61	338	64.9	4.7	85	30.0	0.3	876	120
403800	46-44.357	-102.999	-3-03-		7.51	2845	2.64	395	211.5	6.0	204	81.8	0.8	2276	995
403802	46-44.387	-102.965	-3-03-		7.70	5555	1.38	737	239.1	8.4	383	93.4	0.6	3488	2556
403803	46-44.432	-102.919	-3-03-		35.67	1828	19.51	436	131.6	7.6	86	45.4	0.4	1844	284
403805	46-44.411	-102.881	-3-03-		27.20	2213	12.29	451	89.2	7.5	124	34.6	0.3	1410	580
403809	46-44.368	-102.924	-3-03-		6.00	1019	5.88	247	63.8	4.4	71	23.7	0.2	796	172
403811	46-44.356	-102.900	-3-03-		0.22	1259	0.17	155	5.6	0.8	43	1.4	0.3	101	235
403822	46-44.373	-102.864	-3-03-		11.02	1580	6.97	256	82.8	4.9	64	25.7	1.6	947	321
403823	46-44.473	-102.919	-3-03-		10.23	1148	8.91	627	40.6	5.7	125	12.6	0.5	664	202
403824	46-44.372	-103.030	-3-03-		21.33	3466	6.15	756	87.7	9.4	363	69.3	0.4	2195	842
403831	46-44.423	-103.189	-3-03-		32.95	2439	13.50	1245	49.2	6.2	199	50.5	0.8	1371	574
403845	46-44.804	-103.873	-3-03-		<0.20	2616	0.04	358	9.7	3.2	114	4.0	0.3	243	930
403846	46-44.809	-103.845	-3-03-		0.20	710	0.28	51	1.7	3.4	32	1.0	0.4	32	175
403851	46-44.868	-103.896	-3-03-		0.21	1536	0.14	73	6.2	4.4	51	2.6	0.4	111	256
403863	46-44.900	-103.801	-3-03-		48.43	5815	8.33	860	342.8	8.2	262	155.9	0.5	3660	2336
403869	46-44.917	-103.858	-3-03-		0.53	1032	0.51	106	3.0	1.3	32	0.3	0.7	25	198
403883	46-44.990	-103.933	-3-03-		<0.20	698	0.14	90	0.3	1.0	24	<0.1	0.3	5	101

APPENDIX B
STREAM SEDIMENT

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APPENDIX B

STREAM SEDIMENT

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Table B-1

STATISTICAL SUMMARY FOR STREAM SEDIMENT OF THE RAPID CITY QUADRANGLE

NO. SAMPLES ANALYZED		LN TRANSFORMATION												
BELOW														
ELEMENT	VALUES	MEASURABLE DETECTION LIMIT	DETECTION LIMIT	MINIMUM VALUE	MAXIMUM VALUE	MEAN	MEDIAN	MODE	STANDARD DEVIATION	COEFFICIENT OF VARIATION	LN TRANSFORMATION			
											MEAN	S. D.	MEAN	S. D.
U-FL	471			1.09	12.40	2.88	2.71	2.72	1.208	0.419	0.98	0.38	0.98	0.39
U-NT	475			1.20	16.40	3.57	3.30	3.50	1.428	0.400	1.21	0.33	1.20	0.32
TH	463	8	<2	<2	16	7	7	7	2.6	0.4	1.94	0.39	1.94	0.42
U/TU	470			0.13	2.90	0.82	0.81	0.84	0.199	0.243	-0.23	0.25	-0.22	0.22
TH/U	470			0.15	5.00	2.21	2.14	2.60	0.876	0.357	0.69	0.49	0.73	0.45
AG	3	468	<2	<2	4	3	<2	<2	1.0	0.3	1.06	0.35		
AL	471			0.17	9.30	5.17	5.22	5.57	1.357	0.270	1.60	0.34	1.62	0.31
AS	471			0.6	935.2	11.1	4.8	3.4	51.15	4.61	1.66	0.85	1.62	0.76
B	454	17	<10	<10	203	50	42	45	31.9	0.6	3.76	0.66	3.71	0.66
BA	471			34	12550	892	772	641	825.2	0.9	6.64	0.51	6.63	0.45
BE	465	6	<1	<1	6	1	<1	<1	0.6	0.4	0.26	0.35		
CA	470	1	<0.05	<0.05	22.68	2.10	1.23	0.75	2.544	1.211	0.34	0.83	0.31	0.85
CE	470	1	<10	<10	112	46	46	45	12.4	0.3	3.81	0.28	3.82	0.27
CO	447	24	<4	<4	48	9	8	6	5.6	0.6	2.18	0.47	2.11	0.53
CR	471			1	107	45	43	40	16.8	0.4	3.75	0.41	3.77	0.37
CU	470	1	<2	<2	401	21	18	15	20.5	1.0	2.90	0.51	2.90	0.51
FE	471			0.11	29.32	2.86	2.50	2.49	1.876	0.655	0.93	0.49	0.93	0.48
K	471			0.22	2.83	1.37	1.36	1.37	0.386	0.283	0.27	0.31	0.28	0.31
LI	471			2	104	32	29	29	15.7	0.5	3.38	0.47	3.38	0.45
MG	470	1	<0.05	<0.05	5.26	0.92	0.84	0.77	0.460	0.499	-0.16	0.38	-0.18	0.35
MM	471			16	5811	569	419	362	553.0	1.0	6.10	0.67	6.08	0.65
MO	91	380	<4	<4	24	5	<4	<4	2.9	0.5	1.70	0.36		
NA	469	2	<0.05	<0.05	2.47	0.59	0.51	0.42	0.341	0.574	-0.68	0.58	-0.67	0.59
NB	359	112	<4	<4	11	4	<4	<4	1.3	0.3	1.57	0.23		
NI	471			2	122	26	23	22	14.0	0.5	3.14	0.50	3.14	0.48
P	471			71	3179	872	831	872	278.8	0.3	6.72	0.32	6.73	0.28
SC	470	1	<1	<1	15	7	7	6	2.6	0.4	1.91	0.39	1.93	0.40
SE	422	49	<0.1	<0.1	4.5	0.8	0.6	0.4	0.75	0.89	-0.47	0.77	-0.65	0.99
SR	471			5	849	170	149	118	90.6	0.5	5.04	0.44	5.03	0.40
TI	471			96	7718	2272	2237	2482	775.8	0.3	7.67	0.36	7.69	0.29
V	471			6	332	98	82	67	53.8	0.5	4.45	0.54	4.45	0.52
Y	471			1	71	15	15	15	5.0	0.3	2.68	0.33	2.70	0.28
ZN	471			4	511	109	99	92	61.2	0.6	4.57	0.52	4.58	0.51
ZR	471			3	123	71	70	67	15.7	0.2	4.24	0.27	4.25	0.21

NOTE: Refer to Table 1, Page 24 and Table C-1, Page C-4 for concentration units and symbol definitions.

Table B-1

CORRELATION MATRIX FOR STREAM SEDIMENT OF THE RAPID CITY QUADRANGLE

CORRELATION MATRIX FOR STATION L-BA
OF THE RAPID CITY QUADRANGLE

L-U	1.00 (471)														
LUNT	0.77000 (470)	1.00 (475)													
L-CU	0.55000 (470)	0.59000 (469)	1.00 (470)												
L-ZN	0.54000 (471)	0.56000 (470)	0.84000 (470)	1.00 (471)											
L-CO	0.49000 (447)	0.49000 (445)	0.82000 (447)	0.77000 (447)	1.00 (447)										
L-NI	0.52000 (471)	0.54000 (470)	0.86000 (470)	0.85000 (471)	0.88000 (447)	1.00 (471)									
L-FE	0.47000 (471)	0.51000 (470)	0.80000 (470)	0.81000 (471)	0.85000 (447)	0.88000 (471)	1.00 (471)								
L-AS	0.44000 (471)	0.47000 (470)	0.68000 (470)	0.61000 (471)	0.63000 (447)	0.59000 (471)	0.63000 (471)	1.00 (471)							
L-SE	0.35000 (422)	0.45000 (421)	0.46000 (421)	0.46000 (422)	0.42000 (402)	0.40000 (422)	0.43000 (422)	0.47000 (422)	1.00 (422)						
L-BA	0.27000 (471)	0.38000 (470)	0.37000 (470)	0.45000 (471)	0.41000 (447)	0.51000 (471)	0.53000 (471)	0.23000 (471)	0.18000 (422)	1.00 (471)					
L-SR	0.21000 (471)	0.20000 (470)	0.12000 (470)	0.18000 (471)	0.10000 (447)	0.25000 (471)	0.28000 (471)	0.00 (471)	0.13000 (422)	0.51000 (471)	1.00 (471)				
L-MN	0.25000 (471)	0.26000 (470)	0.39000 (470)	0.34000 (471)	0.54000 (447)	0.38000 (471)	0.47000 (471)	0.39000 (471)	0.13000 (422)	0.22000 (471)	0.25000 (471)	1.00 (471)			
L-TH	0.24000 (463)	0.33000 (462)	0.42000 (462)	0.36000 (463)	0.36000 (442)	0.42000 (463)	0.35000 (463)	0.32000 (463)	0.22000 (416)	0.33000 (463)	0.12000 (463)	0.17000 (463)	1.00 (463)		
L-CE	0.35000 (473)	0.40000 (469)	0.47000 (470)	0.44000 (470)	0.45000 (447)	0.47000 (470)	0.46000 (470)	0.22000 (470)	0.09 (421)	0.38000 (470)	0.14000 (470)	0.30000 (470)	0.43000 (462)		
L-AL	0.34000 (471)	0.37000 (470)	0.59000 (470)	0.68000 (471)	0.54000 (447)	0.71000 (471)	0.69000 (471)	0.22000 (471)	0.07 (422)	0.65000 (471)	0.41000 (471)	0.18000 (471)	0.39000 (463)		
L-TI	0.32000 (471)	0.43000 (470)	0.66000 (470)	0.62000 (471)	0.53000 (447)	0.67000 (471)	0.69000 (471)	0.20000 (471)	0.15000 (422)	0.78000 (471)	0.46000 (471)	0.32000 (471)	0.44000 (463)		
L-Y	0.44000 (471)	0.49000 (470)	0.59000 (470)	0.65000 (471)	0.57000 (447)	0.73000 (471)	0.68000 (471)	0.27000 (471)	0.20000 (469)	0.64000 (471)	0.43000 (471)	0.24000 (471)	0.42000 (463)		
L-ZR	0.33000 (471)	0.41000 (470)	0.65000 (470)	0.61000 (471)	0.55000 (447)	0.66000 (471)	0.65000 (471)	0.36000 (471)	0.21000 (422)	0.49000 (471)	0.26000 (471)	0.31000 (471)	0.43000 (463)		
L-CR	0.40000 (471)	0.54000 (470)	0.77000 (470)	0.73000 (471)	0.60000 (447)	0.85000 (471)	0.88000 (471)	0.27000 (471)	0.06 (422)	0.56000 (471)	0.29000 (471)	0.20000 (471)	0.46000 (463)		
L-SC	0.45000 (470)	0.51000 (469)	0.74000 (470)	0.74000 (470)	0.66000 (447)	0.81000 (470)	0.76000 (470)	0.39000 (470)	0.26000 (421)	0.58000 (470)	0.28000 (470)	0.15000 (470)	0.49000 (462)		
L-V	0.44000 (471)	0.52000 (470)	0.70000 (470)	0.78000 (471)	0.63000 (447)	0.82000 (471)	0.78000 (471)	0.38000 (471)	0.28000 (422)	0.64000 (471)	0.32000 (471)	0.11000 (471)	0.47000 (463)		
L-LI	0.38000 (471)	0.42000 (470)	0.67000 (470)	0.71000 (471)	0.64000 (447)	0.77000 (471)	0.80000 (471)	0.37000 (471)	0.27000 (422)	0.60000 (471)	0.30000 (471)	0.09000 (471)	0.45000 (463)		
L-P	0.35000 (471)	0.36000 (470)	0.44000 (470)	0.66000 (471)	0.34000 (447)	0.51000 (471)	0.56000 (471)	0.29000 (471)	0.23000 (422)	0.28000 (471)	0.21000 (471)	0.19000 (471)	0.25000 (463)		
L-CA	-0.26000 (470)	-0.31000 (469)	-0.30000 (470)	-0.38000 (470)	-0.21000 (447)	-0.30000 (470)	-0.36000 (470)	-0.05 (470)	0.08 (421)	-0.23000 (470)	0.32000 (470)	-0.01 (470)	-0.17000 (462)		
L-MG	-0.04 (470)	-0.1100 (469)	0.13000 (470)	0.06 (470)	0.18000 (447)	0.20000 (470)	0.31000 (470)	0.1100 (470)	0.23000 (470)	0.09 (421)	0.20000 (470)	-0.00 (470)	0.1100 (462)		
L-K	0.07 (471)	0.13000 (470)	0.31000 (470)	0.40000 (470)	0.18000 (447)	0.39000 (471)	0.39000 (471)	0.17000 (471)	-0.06 (422)	0.44000 (471)	0.14000 (471)	0.04 (471)	0.31000 (463)		
L-NA	-0.03 (469)	-0.04 (468)	-0.06 (469)	-0.04 (469)	-0.00 (447)	0.02 (469)	0.07 (469)	-0.21000 (469)	-0.32000 (421)	0.41000 (469)	0.35000 (469)	0.04 (469)	-0.00 (461)		

—

L-CE

1.00
(470)

L-AL

0.56***
0.43***
(470)

1.00
(471)

L-TI

0.62***
0.47***
(470)

0.89***
0.28***
(471)

1.00
(471)

L-V

0.64***
0.50***
(470)

0.84***
0.78***
(471)

0.81***
0.77***
(471)

1.00
(471)

L-ZR

0.59***
0.49***
(470)

0.74***
0.60***
(471)

0.78***
0.67***
(471)

0.78***
0.73***
(471)

1.00
(471)

L-CR

0.43***
0.36***
(470)

0.87***
0.82***
(471)

0.81***
0.79***
(471)

0.75***
0.71***
(471)

0.78***
0.79***
(471)

1.00
(471)

L-SC

0.51***
0.41***
(470)

0.91***
0.89***
(470)

0.84***
0.84***
(470)

0.81***
0.81***
(470)

0.73***
0.71***
(470)

0.93***
0.92***
(470)

1.00
(470)

L-V

0.32***
0.24***
(470)

0.80***
0.78***
(471)

0.78***
0.76***
(471)

0.75***
0.77***
(471)

0.66***
0.63***
(471)

0.90***
0.91***
(471)

0.90***
0.89***
(470)

1.00
(471)

L-LI

0.34***
0.29***
(470)

0.83***
0.82***
(471)

0.74***
0.74***
(471)

0.76***
0.76***
(471)

0.69***
0.66***
(471)

0.87***
0.86***
(471)

0.87***
0.87***
(470)

0.89***
0.88***
(471)

1.00
(471)

L-P

0.26***
0.15***
(470)

0.56***
0.40***
(471)

0.44***
0.29***
(471)

0.56***
0.42***
(471)

0.44***
0.26***
(471)

0.60***
0.50***
(471)

0.52***
0.48***
(470)

0.55***
0.57***
(471)

0.58***
0.53***
(471)

1.00
(471)

L-CA

-0.47***
-0.40***
(470)

-0.53***
-0.32***
(470)

-0.49***
-0.34***
(470)

-0.44***
-0.30***
(470)

-0.44***
-0.36***
(470)

-0.37***
-0.25***
(470)

-0.44***
-0.29***
(470)

-0.34***
-0.17***
(470)

-0.29***
-0.17***
(470)

-0.26***
-0.21***
(470)

1.00
(470)

L-MG

-0.28***
-0.08***
(470)

0.07
0.35***
(470)

-0.01
0.26***
(470)

-0.03
0.14***
(470)

-0.01
0.11***
(470)

0.25***
0.40***
(470)

0.17***
0.36***
(470)

0.21***
0.33***
(470)

0.28***
0.42***
(470)

0.03
0.13***
(470)

0.49***
0.47***
(470)

1.00
(470)

L-K

0.42***
0.33***
(470)

0.72***
0.62***
(471)

0.59***
0.52***
(471)

0.49***
0.38***
(471)

0.55***
0.42***
(471)

0.59***
0.46***
(471)

0.54***
0.47***
(470)

0.47***
0.36***
(471)

0.61***
0.50***
(471)

0.37***
0.25***
(471)

-0.35***
-0.24***
(470)

0.08
0.22***
(470)

1.00
(471)

L-NA

0.25***
0.24***
(469)

0.44***
0.37***
(469)

0.39***
0.36***
(469)

0.13***
0.05
(469)

-0.03
-0.12***
(469)

0.12***
0.07
(469)

0.21***
0.13***
(469)

0.07
0.00
(469)

0.13***
0.10***
(469)

-0.05
-0.07
(469)

-0.20***
-0.09***
(469)

0.04
0.15***
(469)

0.51***
0.50***
(469)

1.00
(469)

Figure B-1a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR SOLUBLE URANIUM (PPM)
IN STREAM SEDIMENT OF THE RAPID CITY QUADRANGLE

Figure B-1b

GEOCHEMICAL DISTRIBUTION OF SOLUBLE URANIUM (PPM) IN STREAM SEDIMENT OF THE RAPID CITY QUADRANGLE

Figure B-2a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR URANIUM BY NEUTRON ACTIVATION (PPM) IN STREAM SEDIMENT OF THE RAPID CITY QUADRANGLE

Figure B-3a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR URANIUM FLUOROMETRIC/
URANIUM NEUTRON ACTIVATION IN STREAM SEDIMENT OF THE RAPID CITY QUADRANGLE

Figure B-3b

GEOCHEMICAL DISTRIBUTION OF URANIUM FLUOROMETRIC/URANIUM NEUTRON ACTIVATION
IN STREAM SEDIMENT OF THE RAPID CITY QUADRANGLE

Figure B-4a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR THORIUM (PPM)
IN STREAM SEDIMENT OF THE RAPID CITY QUADRANGLE

Figure B-4b

GEOCHEMICAL DISTRIBUTION OF THORIUM (PPM) IN STREAM SEDIMENT OF THE RAPID CITY QUADRANGLE

Figure B-5a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR ARSENIC (PPM)
 IN STREAM SEDIMENT OF THE RAPID CITY QUADRANGLE

B-19

Figure B-5b

GEOCHEMICAL DISTRIBUTION OF ARSENIC (PPM) IN STREAM SEDIMENT OF THE RAPID CITY QUADRANGLE

Figure B-6a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR COBALT (PPM)
IN STREAM SEDIMENT OF THE RAPID CITY QUADRANGLE

Figure B-6b

GEOCHEMICAL DISTRIBUTION OF COBALT (PPM) IN STREAM SEDIMENT OF THE RAPID CITY QUADRANGLE

Figure B-7a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR CHROMIUM (PPM)
IN STREAM SEDIMENT OF THE RAPID CITY QUADRANGLE

Figure B-7b

GEOCHEMICAL DISTRIBUTION OF CHROMIUM (PPM) IN STREAM SEDIMENT OF THE RAPID CITY QUADRANGLE

Figure B-8a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR COPPER (PPM)
IN STREAM SEDIMENT OF THE RAPID CITY QUADRANGLE

Figure B-8b

GEOCHEMICAL DISTRIBUTION OF COPPER (PPM) IN STREAM SEDIMENT OF THE RAPID CITY QUADRANGLE

Figure B-9a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR IRON (%)
IN STREAM SEDIMENT OF THE RAPID CITY QUADRANGLE

Figure B-9b

GEOCHEMICAL DISTRIBUTION OF IRON (%) IN STREAM SEDIMENT OF THE RAPID CITY QUADRANGLE

Figure B-10a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR NICKEL (PPM)
 IN STREAM SEDIMENT OF THE RAPID CITY QUADRANGLE

Figure B-10b

GEOCHEMICAL DISTRIBUTION OF NICKEL (PPM) IN STREAM SEDIMENT OF THE RAPID CITY QUADRANGLE

Figure B-11a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR SCANDIUM (PPM)
IN STREAM SEDIMENT OF THE RAPID CITY QUADRANGLE

Figure B-11b

GEOCHEMICAL DISTRIBUTION OF SCANDIUM (PPM) IN STREAM SEDIMENT OF THE RAPID CITY QUADRANGLE

Figure B-12a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR VANADIUM (PPM)
IN STREAM SEDIMENT OF THE RAPID CITY QUADRANGLE

Figure B-12b

GEOCHEMICAL DISTRIBUTION OF VANADIUM (PPM) IN STREAM SEDIMENT OF THE RAPID CITY QUADRANGLE

Figure B-13a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR YTTRIUM (PPM)
IN STREAM SEDIMENT OF THE RAPID CITY QUADRANGLE

Figure B-13b

GEOCHEMICAL DISTRIBUTION OF YTTRIUM (PPM) IN STREAM SEDIMENT OF THE RAPID CITY QUADRANGLE

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Figure B-14b
GEOCHEMICAL DISTRIBUTION OF ZINC (PPM) IN STREAM SEDIMENT OF THE RAPID CITY QUADRANGLE

Table B-3

PARTIAL DATA LISTING FOR STREAM SEDIMENT OF THE RAPID CITY QUADRANGLE

OR SAMPLE NUMBER	D. D. ST	E. SAMPLE LAT	NUMBER LONG L TY REP	J (PPM)	J-NT (PPM)	U/TU	TH (PPM)	CD (PPM)	CU (PPM)	FE (%)	NI (PPM)	V (PPM)	Y (PPM)	ZN (PPM)
402601	46-44.098	-103.315	-3-15-	2.35	2.10	1.12	3	4	9	1.20	14	40	7	55
402603	46-44.066	-103.322	-3-15-	1.17	1.60	0.73	2	<4	5	0.50	6	19	4	20
402604	46-44.047	-103.317	-3-15-	1.47	1.90	0.77	6	4	8	1.06	14	38	7	39
402606	46-44.044	-103.305	-3-15-	1.39	1.50	0.93	3	<4	9	0.94	11	29	7	45
402607	46-44.052	-103.271	-3-15-	1.80	2.00	0.90	3	6	14	1.82	15	51	13	75
402610	46-44.092	-103.259	-3-12-	1.91	2.30	0.83	5	8	14	2.07	20	55	9	76
402613	46-44.029	-102.078	-3-15-	2.87	2.80	1.02	6	7	18	2.33	20	83	15	97
402617	46-44.043	-102.014	-3-15-	1.64	2.60	0.63	5	6	10	2.03	14	66	12	91
402618	46-44.026	-102.030	-3-12-	2.41	2.70	0.89	6	9	16	2.68	22	89	14	109
402619	46-44.047	-102.097	-3-15-	1.86	2.70	0.69	10	8	16	2.50	17	81	17	113
402620	46-44.045	-102.089	-3-15-	3.48	2.90	1.20	7	9	19	2.92	23	98	16	127
402621	46-44.029	-102.110	-3-15-	2.52	2.90	0.87	6	7	14	2.27	19	78	15	91
402622	46-44.029	-102.132	-3-15-	2.71	2.80	0.97	9	7	16	2.27	17	75	14	107
402624	46-44.054	-102.209	-3-15-	2.98	2.80	1.06	11	8	13	2.13	15	67	15	84
402631	46-44.126	-102.030	-3-12-	3.56	3.00	1.19	6	7	16	2.68	20	88	14	115
402632	46-44.132	-102.030	-3-15-	2.25	2.80	0.80	7	8	15	2.53	20	85	16	106
402636	46-44.234	-102.151	-3-15-	3.13	3.30	0.95	9	12	16	2.93	21	83	16	84
402639	46-44.179	-102.140	-3-12-	2.21	2.80	0.79	6	7	14	2.14	17	73	15	72
402640	46-44.181	-102.097	-3-15-	2.46	2.60	0.95	5	8	15	2.48	21	85	16	76
402642	46-44.187	-102.035	-3-15-	2.86	3.90	0.73	7	10	18	4.09	23	133	22	106
402647	46-44.000	-102.163	-3-15-	2.44	2.30	0.87	9	7	16	2.20	18	72	22	66
402648	46-44.046	-103.344	-3-15-	2.72	2.70	1.01	9	10	20	2.70	24	62	12	55
402651	46-44.122	-103.431	-3-15-	2.57	3.00	0.86	7	13	39	2.86	30	86	15	89
402652	46-44.135	-103.411	-3-15-	2.10	2.00	1.05	9	6	11	1.37	23	48	10	46
402655	46-44.158	-103.462	-3-15-	2.75	3.00	0.92	10	10	18	2.72	22	70	19	74
402657	46-44.929	-102.996	-3-12-	2.22	2.40	0.92	3	5	8	1.36	12	44	10	62
402658	46-44.912	-102.965	-3-15-	2.18	2.60	0.84	4	8	14	2.31	23	75	14	65
402663	46-44.952	-102.841	-3-12-	2.48	3.40	0.73	7	10	17	2.35	24	69	14	110
402666	46-44.980	-102.918	-3-15-	2.62	2.70	0.97	5	6	11	1.69	18	57	15	62
402668	46-44.955	-102.964	-3-15-	2.54	3.20	0.79	3	5	7	1.09	13	35	10	43
402671	46-44.879	-102.775	-3-15-	2.42	2.70	0.90	5	8	13	2.24	22	68	13	90
402673	46-44.936	-102.778	-3-12-	2.13	2.50	0.85	5	7	13	1.75	21	63	13	55
402674	46-44.926	-102.763	-3-15-	1.93	3.00	0.64	4	5	17	1.95	18	67	15	92
402675	46-44.856	-102.842	-3-15-	3.20	4.17	0.77	3	8	17	2.67	20	89	15	93
402681	46-44.889	-102.850	-3-15-	2.52	2.90	0.87	7	8	12	2.29	19	70	16	63
402683	46-44.144	-103.310	-3-15-	3.01	2.31	1.30	7	4	9	1.05	11	33	10	26
402685	46-44.170	-103.333	-3-15-	3.25	2.61	1.25	7	6	15	1.79	16	59	13	69
402687	46-44.202	-103.380	-3-15-	1.95	1.65	1.18	7	<4	6	0.78	11	31	6	19
402688	46-44.250	-103.416	-3-15-	1.64	2.14	0.77	5	4	7	1.17	8	27	9	23
402694	46-44.225	-103.272	-3-15-	2.01	3.20	0.63	6	6	22	2.27	21	78	20	90
402698	46-44.126	-103.362	-3-15-	1.42	2.34	0.61	8	5	13	1.41	15	47	11	46
402699	46-44.092	-103.463	-3-15-	2.22	3.47	0.64	9	11	23	2.93	23	76	14	83
402703	46-44.761	-103.040	-3-12-	4.31	4.99	0.86	13	15	26	3.54	36	125	21	119
402704	46-44.826	-103.071	-3-12-	5.66	5.52	1.03	8	18	31	4.39	45	145	23	141
402705	46-44.859	-103.008	-3-12-	4.34	4.60	0.94	13	12	24	3.73	32	136	19	118
402706	46-44.863	-102.782	-3-15-	2.16	2.50	0.86	4	6	13	2.02	18	68	15	60
402707	46-44.859	-102.767	-3-15-	2.73	3.50	0.78	5	8	16	2.30	22	80	15	71
402710	46-44.835	-102.886	-3-15-	2.41	3.20	0.75	6	8	17	2.55	23	88	17	78
402711	46-44.917	-103.147	-3-12-	3.57			10	12	23	3.47	31	142	19	116
402712	46-44.913	-103.182	-3-12-	4.25	4.26	1.00	8	12	21	3.21	29	115	19	100
402713	46-44.943	-103.155	-3-15-	4.86	4.90	0.99	4	6	14	1.91	18	68	15	75
402717	46-44.950	-103.101	-3-15-	6.27	5.88	1.07	5	7	19	2.16	22	73	15	84
402718	46-44.954	-103.095	-3-12-	3.06	3.10	0.99	3	6	13	2.15	19	63	14	136
402721	46-44.914	-103.010	-3-15-	1.64	2.00	0.63	7	7	14	1.96	19	66	14	61
402723	46-44.930	-103.006	-3-15-	1.50	2.30	0.65	6	5	9	1.34	13	46	12	46

Table B-3, Continued

PARTIAL DATA LISTING FOR STREAM SEDIMENT OF THE RAPID CITY QUADRANGLE

OR SAMPLE NUMBER	D. O. E. ST LAT	SAMPLE LONG	NUMBER L TY REP	U (PP4)	U-NT (PP4)	U/TU	TH (PP4)	CO (PPM)	CU (PPM)	FE (%)	NI (PPM)	V (PPM)	Y (PPM)	ZN (PPM)
402724	46-44.908	-103.061	-3-15-	2.80	7.24	0.39	9	8	15	2.19	23	84	15	74
402727	46-44.793	-103.451	-3-12-	3.54	4.44	0.80	6	11	34	3.96	37	178	20	140
402728	46-44.848	-103.410	-3-15-	3.65	4.43	0.82	6	20	43	5.79	54	201	21	184
402729	46-44.893	-103.403	-3-15-	3.62	4.26	0.85	7	24	38	5.32	46	192	27	167
402730	46-44.895	-103.398	-3-15-	4.21	4.39	0.96	9	22	36	5.31	43	180	22	168
402731	46-44.895	-103.389	-3-15-	3.45	4.22	0.82	9	27	38	6.42	48	164	22	180
402732	46-44.902	-103.425	-3-15-	3.34	5.11	0.65	5	24	37	5.68	45	189	25	185
402734	46-44.838	-103.348	-3-12-	3.87	4.72	0.82	9	15	38	5.00	44	213	20	172
402735	46-44.847	-103.352	-3-15-	3.03	4.63	0.65	10	16	37	5.07	40	204	23	169
402736	46-44.859	-103.339	-3-15-	3.09	4.05	0.76	8	13	31	4.58	37	191	18	153
402737	46-44.857	-103.335	-3-15-	2.95	3.90	0.76	8	17	34	5.30	41	198	22	167
402738	46-44.782	-103.280	-3-15-	3.75	4.72	0.79	9	18	37	5.70	47	193	23	175
402739	46-44.767	-103.314	-3-15-	4.44	5.44	0.82	9	25	58	7.75	62	198	25	266
402740	46-44.460	-103.464	-3-15-	4.62	5.00	0.92	10	13	19	2.19	29	72	17	101
402742	46-44.454	-103.490	-3-15-	6.00	6.80	0.88	3	32	23	2.80	42	81	34	159
402743	46-44.460	-103.496	-3-12-	2.77	3.30	0.84	5	5	15	1.79	13	55	14	67
402744	46-44.470	-103.489	-3-15-	2.73	3.00	0.91	7	6	17	2.04	16	64	16	80
402746	46-44.483	-103.489	-3-15-	3.06	4.30	0.71	9	15	17	3.01	30	70	17	106
402747	46-44.490	-103.484	-3-12-	2.77	3.50	0.79	3	12	13	2.72	23	50	13	81
402748	46-44.500	-103.448	-3-15-	2.77	4.20	0.66	7	10	18	2.38	25	77	15	101
402750	46-44.461	-103.370	-3-12-	2.69	3.50	0.77	3	4	11	1.30	11	55	10	64
402751	46-44.469	-103.350	-3-12-	2.52	4.60	0.55	4	6	25	1.83	15	64	10	126
402753	46-44.489	-103.330	-3-15-	2.95	4.00	0.74	5	6	18	2.24	20	97	14	88
402755	46-44.474	-103.267	-3-15-	3.35	3.60	0.93	5	11	34	3.08	32	117	14	150
402760	46-44.402	-103.331	-3-15-	4.08	5.30	0.77	7	8	17	2.15	32	148	13	112
402765	46-44.384	-103.425	-3-15-	2.44	2.70	0.90	7	6	15	1.97	15	59	14	68
402766	46-44.402	-103.302	-3-15-	5.34	4.00	1.33	6	8	20	2.72	29	194	15	156
402771	46-44.271	-103.274	-3-15-	3.72	4.50	0.83	9	7	27	2.06	29	107	13	114
402776	46-44.310	-103.351	-3-15-	1.92	2.50	0.77	5	4	9	1.38	11	40	10	87
402777	46-44.304	-103.342	-3-15-	2.93	3.60	0.81	7	7	17	2.18	16	70	17	84
402779	46-44.309	-103.288	-3-15-	3.15	3.60	0.88	4	9	20	2.11	29	81	15	131
402780	46-44.303	-103.400	-3-12-	1.33	2.20	0.60	6	5	8	1.20	10	32	10	58
402784	46-44.292	-103.154	-3-12-	2.93	3.50	0.81	9	10	24	2.87	30	147	16	150
402786	46-44.347	-103.115	-3-15-	2.92	2.80	1.04	6	12	29	3.51	33	144	14	149
402788	46-44.349	-103.082	-3-15-	3.84	3.90	0.98	6	18	32	3.87	51	147	16	183
402789	46-44.345	-103.063	-3-15-	2.31	2.80	0.82	7	13	31	3.47	42	155	16	130
402790	46-44.356	-103.073	-3-15-	2.49	3.22	0.77	6	13	28	3.47	35	133	14	118
402791	46-44.374	-103.132	-3-15-	2.13	3.40	0.63	5	10	24	3.26	30	107	18	103
402792	46-44.486	-103.210	-3-15-	1.81	2.90	0.62	8	7	17	2.20	21	82	15	77
402793	46-44.491	-103.202	-3-15-	2.19	3.00	0.73	6	6	15	2.32	17	56	13	67
402795	46-44.476	-103.105	-3-15-	3.09	3.10	1.00	10	12	29	3.57	35	130	15	117
402799	46-44.122	-103.757	-3-12-	2.22	4.80	0.46	9	11	40	3.37	35	78	12	166
402800	46-44.131	-103.783	-3-12-	7.83	2.70	2.90	2	48	36	14.68	122	71	23	611
402801	46-44.133	-103.766	-3-12-	1.82	2.90	0.63	4	6	13	29.32	12	174	5	131
402802	46-44.804	-103.548	-3-15-	3.32	5.10	0.65	<2	10	16	2.64	26	139	13	103
402804	46-44.810	-103.648	-3-15-	2.55	3.30	0.77	7	9	20	2.92	31	175	17	122
402805	46-44.820	-103.680	-3-15-	4.33	4.40	0.98	8	10	16	2.80	27	149	14	111
402806	46-44.843	-103.707	-3-15-	2.67	3.23	0.83	7	10	19	2.90	31	165	14	120
402808	46-44.878	-103.722	-3-12-	5.41	6.40	0.85	0	8	20	2.66	28	171	13	140
402809	46-44.902	-103.712	-3-15-	2.02	3.20	0.63	10	10	18	3.00	30	153	14	121
402810	46-44.893	-103.710	-3-15-	2.43	3.40	0.71	6	9	17	2.97	28	140	13	111
402811	46-44.862	-103.571	-3-15-	3.01	3.50	0.86	7	18	42	5.30	47	187	20	194
402812	46-44.861	-103.550	-3-15-	3.01	3.50	0.86	7	20	39	5.35	41	190	20	185
402813	46-44.875	-103.548	-3-15-	3.01	3.50	0.86	8	17	35	4.87	37	180	19	161
402817	46-44.647	-103.975	-3-15-	3.11	3.40	0.91	7	10	17	2.40	17	74	16	80

Table B-3, Continued

PARTIAL DATA LISTING FOR STREAM SEDIMENT OF THE RAPID CITY QUADRANGLE

OR SAMPLE NUMBER	D. O. ST	E. SAMPLE LAT	NUMBER LONG L TY REP	U (PPM)	J-NT (PPM)	U/TU	TH (PPM)	CO (PPM)	CU (PPM)	FE (%)	NI (PPM)	V (PPM)	Y (PPM)	ZN (PPM)
402819	46-44.652	-103.898	-3-15-	1.96	3.40	0.58	9	11	15	2.47	19	62	15	81
402822	46-44.751	-103.892	-3-15-	3.31	4.40	0.75	10	7	17	2.01	23	100	16	92
402824	46-44.756	-103.921	-3-15-	2.46	3.40	0.72	6	5	14	1.89	18	94	16	79
402825	46-44.752	-103.973	-3-15-	5.31	5.70	0.93	8	13	28	2.42	32	114	24	141
402826	46-44.772	-103.947	-3-12-	3.31	3.90	0.85	9	5	16	1.75	18	84	15	75
402828	46-44.371	-103.750	-3-15-	4.93	5.30	0.93	13	13	52	4.79	41	89	13	209
402829	46-44.293	-103.869	-3-12-	1.49	1.40	1.06	7	<4	7	0.97	7	23	6	35
402830	46-44.303	-103.867	-3-15-	1.70	2.40	0.71	8	7	10	2.45	16	43	13	40
402831	46-44.315	-103.888	-3-12-	1.13	1.50	0.75	7	<4	7	1.17	10	28	8	40
402832	46-44.335	-103.965	-3-15-	1.56	2.30	0.68	6	5	12	1.45	14	48	10	72
402833	46-44.373	-103.919	-3-12-	1.35	1.20	1.12	3	<4	8	0.83	7	29	6	28
402834	46-44.394	-103.912	-3-12-	1.43	1.70	0.84	6	<4	11	1.04	14	42	7	56
402835	46-44.401	-103.893	-3-12-	5.20	6.60	0.79	9	18	45	4.83	33	86	17	225
402836	46-44.434	-103.875	-3-15-	1.30	1.80	0.72	9	4	10	1.20	18	51	9	33
402837	46-44.499	-103.895	-3-15-	2.08	2.20	0.95	5	4	13	1.45	14	46	10	70
402838	46-44.488	-103.868	-3-15-	1.51	2.30	0.66	5	4	13	1.41	13	44	11	76
402839	46-44.474	-103.796	-3-15-	6.44	7.80	0.83	9	13	43	4.80	31	96	14	274
402842	46-44.478	-103.848	-3-15-	1.70	2.40	0.71	5	6	19	1.96	20	56	13	77
402849	46-44.272	-103.909	-3-15-	1.46	2.10	0.70	6	5	14	1.41	14	43	9	81
402850	46-44.265	-103.918	-3-15-	2.13	2.70	0.79	7	6	13	1.59	15	53	12	69
402851	46-44.327	-103.893	-3-12-	4.53	5.10	0.89	9	6	14	2.19	17	52	11	95
402854	46-44.145	-103.845	-3-12-	1.35	1.50	0.90	5	5	8	2.05	15	42	5	55
402855	46-44.144	-103.844	-3-12-	1.38	1.70	0.81	6	5	10	2.08	15	45	7	78
402856	46-44.180	-103.758	-3-12-	3.42	4.10	0.83	9	15	48	6.79	53	89	12	207
402858	46-44.178	-103.758	-3-12-	3.39	3.40	1.00	13	18	24	5.02	43	71	12	211
402859	46-44.230	-103.922	-3-15-	1.57	2.20	0.71	7	5	12	1.34	12	47	9	62
402860	46-44.229	-103.920	-3-15-	1.44	2.20	0.65	8	5	12	1.40	12	42	9	81
402862	46-44.337	-103.514	-3-12-	4.58	4.40	1.04	5	4	6	1.32	6	34	8	58
402900	46-44.037	-102.583	-3-12-	3.26	3.00	1.09	7	9	15	2.76	22	100	15	125
402901	46-44.017	-102.585	-3-15-	3.96	4.10	0.97	9	19	34	4.98	42	158	23	213
402903	46-44.025	-102.599	-3-15-	3.42	3.50	0.95	6	12	26	3.75	31	141	19	161
402907	46-44.045	-102.623	-3-15-	2.73	2.80	0.98	6	9	17	2.46	22	84	14	93
402914	46-44.055	-102.664	-3-15-	3.48	4.66	0.75	6	11	20	3.27	29	123	16	126
402916	46-44.045	-102.661	-3-15-	3.19	5.80	0.55	7	12	21	2.92	28	117	15	107
402917	46-44.028	-102.650	-3-15-	3.57	6.68	0.55	<2	13	18	3.10	38	97	15	105
402920	46-44.222	-102.586	-3-15-	3.54	3.90	0.91	5	12	19	3.04	26	109	14	110
402921	46-44.189	-102.681	-3-15-	3.57	4.25	0.85	7	8	18	2.87	22	102	13	102
402928	46-44.054	-102.690	-3-15-	2.99	4.02	0.74	8	11	22	3.28	28	119	15	114
402929	46-44.515	-102.592	-3-15-	2.70	3.30	0.61	7	6	12	2.02	16	61	13	66
402930	46-44.518	-102.629	-3-15-	4.50	6.40	0.70	6	4	13	1.42	11	44	11	91
402931	46-44.517	-102.633	-3-15-	2.92	4.30	0.68	5	4	12	1.48	13	50	12	84
402932	46-44.510	-102.636	-3-12-	4.14	6.30	0.70	9	9	14	2.33	20	72	12	87
402940	46-44.614	-102.564	-3-15-	5.75	4.10	1.23	6	5	15	1.60	14	58	15	63
402941	46-44.684	-102.564	-3-15-	2.32	2.50	0.93	7	4	8	1.39	12	44	14	66
402943	46-44.706	-102.553	-3-15-	2.92	2.50	0.81	5	<4	7	1.19	12	41	13	45
402949	46-44.686	-102.641	-3-15-	1.72	2.70	0.64	6	6	12	1.70	16	54	15	102
402950	46-44.697	-102.650	-3-12-	2.9	2.50	0.88	8	9	15	2.35	24	72	17	86
402952	46-44.718	-102.655	-3-15-	1.72	2.50	0.69	8	5	15	1.44	13	48	14	70
402953	46-44.720	-102.643	-3-15-	2.35	2.90	0.98	8	6	20	1.98	19	65	17	120
402962	46-44.191	-102.951	-3-15-	3.37	3.68	0.92	11	10	25	3.51	34	120	19	120
402965	46-44.127	-102.828	-3-15-	2.58	3.35	0.80	9	13	25	3.46	31	119	19	114
402966	46-44.094	-102.805	-3-15-	2.58	3.40	0.76	9	10	22	3.33	29	107	17	116
402967	46-44.095	-102.778	-3-15-	2.98	5.00	0.60	11	10	26	3.42	28	119	19	113
402968	46-44.095	-102.756	-3-15-	2.25	3.80	0.59	10	8	21	2.79	25	102	18	91
402969	46-44.103	-102.879	-3-12-	2.78	3.70	0.75	7	10	23	2.78	27	103	18	139

Table B-3, Continued

PARTIAL DATA LISTING FOR STREAM SEDIMENT OF THE RAPID CITY QUADRANGLE

OR SAMPLE NUMBER	D. O. ST	E. SAMPLE LAT	NUMBER LONG	TY L	REP TY	U (PPM)	U-NT (PPM)	U/TU	TH (PPM)	CO (PPM)	CU (PPM)	FE (%)	NI (PPM)	V (PPM)	Y (PPM)	ZN (PPM)
402972	46-44.010	-102.794	-3-15-			12.40	12.90	0.96	4	7	17	2.09	19	74	13	112
402973	46-44.005	-102.830	-3-15-			4.46	8.40	0.53	8	10	19	2.97	26	113	16	108
402975	46-44.013	-102.885	-3-12-			5.06	6.80	0.74	8	8	16	2.27	21	86	14	94
402976	46-44.019	-102.901	-3-15-			1.95	3.40	0.57	8	8	17	2.27	18	75	15	168
402977	46-44.011	-102.923	-3-15-			2.32	3.30	0.70	5	8	17	2.47	20	87	16	92
402978	46-44.010	-102.943	-3-15-			2.75	3.40	0.81	5	10	17	2.80	25	97	14	104
402979	46-44.006	-102.964	-3-15-			2.52	3.70	0.68	7	8	15	2.25	17	75	14	80
402980	46-44.017	-102.990	-3-15-			2.98	4.40	0.68	5	10	27	3.16	72	129	19	113
402981	46-44.201	-102.768	-3-15-			2.85	3.40	0.84	7	7	19	2.25	20	76	16	85
402982	46-44.181	-102.816	-3-15-			3.83	4.30	0.89	10	7	16	2.05	20	73	15	97
402983	46-44.181	-102.788	-3-15-			4.53	5.10	0.89	7	6	17	2.25	19	79	16	91
402984	46-44.181	-102.773	-3-15-			2.01	3.30	0.61	8	8	19	2.47	23	92	16	77
402985	46-44.181	-102.758	-3-15-			2.88	4.00	0.72	8	8	19	2.55	26	95	17	87
402986	46-44.083	-102.871	-3-15-			2.26	3.30	0.68	11	8	23	2.72	26	104	17	87
402987	46-44.079	-102.864	-3-15-			2.26	3.40	0.66	10	8	24	2.91	27	114	20	93
402988	46-44.080	-102.848	-3-15-			2.70	4.10	0.66	4	8	20	2.64	23	97	18	91
402989	46-44.068	-102.810	-3-15-			5.52	8.28	0.68	7	10	21	2.41	24	86	16	111
402990	46-44.069	-102.775	-3-15-			3.31	3.80	0.87	7	7	20	2.60	24	92	18	91
402991	46-44.083	-102.928	-3-15-			2.47	3.10	0.80	5	7	16	2.27	21	87	14	98
403005	46-44.081	-103.561	-3-15-			4.56	4.90	0.93	12	17	50	4.41	39	83	13	201
403007	46-44.090	-103.549	-3-15-			4.28	4.80	0.89	7	15	42	3.36	32	74	11	191
403009	46-44.169	-103.503	-3-12-			1.91	2.30	0.79	7	9	25	2.80	21	62	10	91
403010	46-44.147	-103.507	-3-12-			2.83	3.60	0.79	10	15	38	3.73	46	81	11	172
403011	46-44.203	-103.506	-3-12-			1.26	1.60	0.79	6	8	17	1.08	20	27	6	50
403012	46-44.197	-103.537	-3-12-			2.65	3.40	0.78	9	21	32	4.75	51	77	10	237
403013	46-44.239	-103.581	-3-12-			6.48	6.00	1.08	8	18	65	3.86	45	108	17	216
403014	46-44.224	-103.612	-3-12-			4.10	3.80	1.08	11	36	35	5.33	65	82	13	266
403015	46-44.215	-103.610	-3-12-			4.41	3.80	1.16	9	36	31	5.25	59	77	12	198
403016	46-44.107	-103.645	-3-15-			2.86	4.00	0.71	11	21	60	4.31	49	92	15	262
403017	46-44.124	-103.698	-3-12-			2.71	3.50	0.77	5	23	38	5.77	67	77	11	226
403018	46-44.122	-103.731	-3-12-			3.54	4.40	0.80	7	21	68	11.01	49	82	11	276
403020	46-44.114	-103.695	-3-15-			3.79	4.70	0.81	8	22	51	7.54	68	101	12	458
403021	46-44.114	-103.679	-3-15-			6.69	7.50	0.89	7	20	75	3.70	49	89	15	333
403023	46-44.069	-103.526	-3-15-			4.32	4.20	1.03	9	13	32	3.38	29	83	12	164
403024	46-44.002	-103.514	-3-12-			4.84	4.00	1.21	5	14	33	3.91	31	81	12	227
403026	46-44.062	-103.701	-3-15-			3.54	3.40	1.04	8	10	27	2.90	23	63	11	127
403027	46-44.062	-103.688	-3-12-			2.51	3.50	0.70	6	12	33	3.18	28	72	12	142
403038	46-44.060	-103.656	-3-12-			2.98	4.30	0.69	6		69	3.95	67	79	14	190
403043	46-44.075	-103.749	-3-12-			1.58	3.20	0.49		5	19	2.31	23	50	8	50
403044	46-44.034	-103.623	-3-15-			1.36	2.20	0.62	6	7	16	2.15	19	47	8	48
403045	46-44.267	-103.712	-3-12-			1.71	2.50	0.68	6	7	11	2.09	16	38	10	58
403046	46-44.294	-103.559	-3-12-			1.54	2.10	0.78	2	4	5	1.61	9	25	8	32
403048	46-44.334	-103.627	-3-12-			6.20	7.00	0.89	15	33	401	5.26	50	73	17	491
403049	46-44.379	-103.506	-3-15-			2.37	2.60	0.91	8	9	16	2.47	18	73	16	139
403050	46-44.392	-103.522	-3-15-			2.11	2.60	0.81	7	9	17	2.43	19	70	16	138
403051	46-44.468	-103.509	-3-15-			3.46	2.80	1.24	7	8	18	2.64	19	75	16	129
403054	46-44.485	-103.628	-3-15-			2.50	2.40	1.04	3	5	14	1.36	11	45	10	96
403056	46-44.483	-103.724	-3-15-			1.15	2.00	0.57	3	<4	7	0.68	6	21	7	23
403057	46-44.481	-103.730	-3-15-			2.10	2.50	0.84	2	5	14	1.47	14	43	10	305
403061	46-44.417	-103.655	-3-15-			1.72	2.40	0.72	5	5	12	1.38	15	42	10	49
403062	46-44.387	-103.628	-3-15-			1.31	2.00	0.65	5	<4	7	0.73	8	23	7	25
403063	46-44.396	-103.585	-3-15-			2.29	2.70	0.85	4	5	12	1.57	13	53	11	54
403064	46-44.385	-103.584	-3-15-			2.13	2.60	0.82	<2	<4	12	1.15	11	39	10	66
403066	46-44.370	-103.595	-3-15-			1.85	2.70	0.69	2	<4	9	1.13	10	37	10	36

Table B-3, Continued

PARTIAL DATA LISTING FOR STREAM SEDIMENT OF THE RAPID CITY QUADRANGLE

DR SAMPLE NUMBER	D. O. E. ST LAT	SAMPLE LONG	NUMBER L TY REP	U (PPM)	U-NT (PPM)	U/TU	TH (PPM)	CO (PPM)	CU (PPM)	FE (%)	NI (PPM)	V (PPM)	Y (PPM)	ZN (PPM)
403067	46-44.354	-103.589	-3-15-	2.00	2.60	0.77	7	6	13	1.71	16	58	12	54
403200	46-44.063	-102.453	-3-15-	2.95	3.50	0.84	9	17	32	4.15	40	140	21	140
403201	46-44.071	-102.454	-3-15-		3.80									
403203	46-44.100	-102.441	-3-12-	2.88	3.40	0.85	6	10	15	4.59	21	90	13	123
403207	46-44.187	-102.491	-3-12-	3.47	3.30	1.05	9	11	21	3.34	32	137	18	104
403209	46-44.147	-102.407	-3-12-	3.72	3.50	1.03	10	12	27	3.66	33	139	18	119
403210	46-44.120	-102.377	-3-15-	2.83	3.40	0.83	7	12	21	3.31	30	124	15	151
403212	46-44.121	-102.413	-3-12-	3.72	4.00	0.93	11	13	29	3.84	34	174	20	129
403213	46-44.114	-102.420	-3-15-	2.73	5.40	0.51	14	12	22	3.94	29	138	21	108
403216	46-44.149	-102.387	-3-15-	4.26	3.50	1.22	6	10	22	3.64	33	152	15	159
403223	46-44.147	-102.280	-3-12-	2.10	3.00	0.70	7	8	12	2.58	20	81	14	98
403225	46-44.242	-102.435	-3-15-	2.69	3.50	0.83	9	12	21	3.47	31	126	16	151
403231	46-44.013	-103.156	-3-15-	7.46	8.90	0.84	9	35	26	2.28	65	103	18	185
403237	46-44.119	-103.115	-3-15-	2.83	3.20	0.88	7	8	18	2.09	23	82	11	113
403238	46-44.110	-103.152	-3-15-	4.17	4.40	0.95	9	9	26	2.82	31	199	14	181
403239	46-44.120	-103.192	-3-15-	2.70	3.10	0.87	10	8	16	2.27	26	83	19	77
403242	46-44.033	-103.070	-3-12-	2.04	3.20	0.64	3	8	18	2.15	20	77	11	91
403244	46-44.012	-103.001	-3-15-	3.39	4.30	0.79	5	7	15	2.07	17	65	12	95
403246	46-44.016	-103.034	-3-15-	2.01	3.50	0.57	12	10	25	2.71	29	105	15	105
403247	46-44.017	-103.038	-3-15-	3.03	4.50	0.67	6	6	24	2.35	22	89	14	101
403249	46-44.519	-102.879	-3-12-	2.41	5.13	0.47	6	11	26	2.53	31	127	18	106
403252	46-44.537	-102.799	-3-12-	7.73	9.30	0.83	9	7	15	2.20	17	74	14	67
403253	46-44.561	-102.910	-3-15-	2.07	3.20	0.65	6	6	13	2.32	17	75	15	63
403254	46-44.591	-102.984	-3-15-	3.86	4.43	0.87	12	11	24	2.43	31	128	19	104
403255	46-44.601	-102.981	-3-15-	2.74	3.70	0.74	5	7	16	2.39	18	85	14	64
403256	46-44.619	-102.997	-3-15-	3.05	5.03	0.61	9	11	22	3.16	25	118	18	95
403258	46-44.618	-102.767	-3-12-	3.09	3.90	0.79	8	6	13	1.85	13	50	13	63
403259	46-44.640	-102.766	-3-15-	1.09	2.60	0.42	7	6	9	1.69	14	46	11	49
403261	46-44.672	-102.810	-3-12-	1.90	2.60	0.73	10	6	9	1.85	12	56	13	54
403264	46-44.672	-102.842	-3-12-	3.28	3.10	1.06	10	5	12	2.15	17	68	15	58
403266	46-44.733	-102.787	-3-15-	2.53	2.40	1.05	7	4	13	1.41	12	45	12	75
403268	46-44.749	-102.859	-3-15-	3.25	3.61	0.90	9	8	17	2.52	23	76	15	77
403269	46-44.749	-102.896	-3-12-	2.86	3.20	0.89	4	10	14	3.00	22	87	18	70
403270	46-44.140	-103.044	-3-12-	5.10	5.50	0.91	14	15	19	2.23	29	115	15	106
403273	46-44.213	-103.015	-3-15-	2.07	3.10	0.67	3	10	26	2.63	29	102	17	99
403277	46-44.161	-103.192	-3-15-	3.46	2.90	1.19	5	10	27	2.50	32	67	13	71
403279	46-44.228	-103.238	-3-15-	3.57	5.10	0.70	8	10	24	2.53	37	110	18	92
403280	46-44.236	-103.151	-3-15-	2.80	3.20	0.87	4	7	22	2.38	26	133	15	139
403284	46-44.573	-103.211	-3-15-	3.27	3.00	1.09	7	11	24	3.15	29	120	13	141
403285	46-44.575	-103.225	-3-15-	2.02	3.00	0.67	9	8	18	2.93	21	95	15	134
403287	46-44.542	-103.186	-3-15-	2.37	3.10	0.76	10	9	21	2.94	26	100	14	145
403289	46-44.508	-103.175	-3-12-	2.76	3.30	0.84	10	11	25	3.03	33	143	14	112
403290	46-44.500	-103.188	-3-12-	1.68	2.70	0.62	3	6	13	1.89	19	68	13	67
403293	46-44.634	-103.128	-3-15-	2.22	2.60	0.85	8	14	30	2.58	35	156	16	126
403294	46-44.647	-103.121	-3-12-	2.79	3.60	0.78	9	22	42	5.50	48	191	22	184
403295	46-44.672	-103.070	-3-15-	4.02	4.00	1.00	8	18	41	5.96	46	198	23	182
403296	46-44.617	-103.153	-3-12-	2.65	3.60	0.74	7	18	46	5.67	52	198	22	166
403297	46-44.568	-103.111	-3-15-	2.19	2.90	0.76	7	13	31	3.82	34	165	16	122
403298	46-44.600	-103.070	-3-15-	2.99	3.30	0.91	12	27	55	7.22	59	245	25	220
403299	46-44.530	-103.074	-3-15-	2.64	3.00	0.88	10	19	42	4.86	54	189	18	161
403300	46-44.531	-103.056	-3-15-	2.57	2.90	0.89	10	20	46	5.68	58	229	20	188
403302	46-44.588	-103.471	-3-15-	3.56	4.40	0.81	13	6	22	2.21	32	193	17	115
403303	46-44.583	-103.463	-3-12-	4.33	5.10	0.85	8	6	23	2.52	27	172	20	117
403309	46-44.577	-103.333	-3-12-	4.02	4.90	0.82	7	13	20	4.05	23	119	14	106
403312	46-44.554	-103.349	-3-12-	2.71	3.20	0.85	8	7	18	2.61	23	149	14	112

Table B-3, Continued

PARTIAL DATA LISTING FOR STREAM SEDIMENT OF THE RAPID CITY QUADRANGLE

OR. SAMPLE NUMBER	D. O. E. ST LAT	SAMPLE LONG	NUMBER L TY REP	U (PPM)	U-NT (PPM)	U/TU	TH (PPM)	CO (PPM)	CU (PPM)	FE (%)	NI (PPM)	V (PPM)	Y (PPM)	ZN (PPM)
403321	46-44.668	-103.295	-3-15-	2.35	3.20	0.73	6	12	28	3.64	31	134	17	120
403324	46-44.545	-103.729	-3-15-	2.53	3.10	0.82	8	6	22	2.18	18	58	15	102
403325	46-44.559	-103.749	-3-15-	1.93	2.90	0.67	4	5	16	1.64	15	53	14	80
403326	46-44.561	-103.723	-3-15-	2.35	2.90	0.81	10	10	19	2.78	24	83	18	111
403327	46-44.579	-103.743	-3-15-	2.20	3.00	0.73	9	10	18	2.53	21	69	18	76
403330	46-44.656	-103.742	-3-15-	6.35	6.00	1.06	13	36	32	3.38	113	134	43	220
403333	46-44.711	-103.741	-3-15-	2.71	3.60	0.75	2	5	20	1.78	15	76	16	65
403339	46-44.521	-103.605	-3-15-	1.75	3.00	0.58	8	8	18	1.97	17	60	16	66
403343	46-44.572	-103.538	-3-15-	2.11	3.30	0.64	9	<4	16	2.99	20	75	17	92
403345	46-44.612	-103.588	-3-15-	3.87	5.00	0.77	13	9	25	2.55	34	111	22	101
403346	46-44.598	-103.587	-3-15-	4.91	5.50	0.89	12	<4	21	3.13	23	93	21	105
403347	46-44.032	-103.842	-3-12-	1.11	2.30	0.48	3	6	8	1.50	10	31	9	46
403348	46-44.030	-103.856	-3-12-	1.36	2.50	0.54	5	5	15	1.51	14	41	11	42
403349	46-44.047	-103.869	-3-12-	1.36	2.40	0.57	8	6	8	1.62	12	37	12	37
403351	46-44.063	-103.893	-3-12-	1.38	2.40	0.57	6	5	8	1.55	11	40	10	40
403353	46-44.059	-103.896	-3-12-	1.24	2.30	0.54	6	4	9	1.19	10	35	10	41
403355	46-44.047	-103.997	-3-12-	2.44	1.90	1.28	5	<4	10	0.87	10	34	8	47
403359	46-44.045	-103.770	-3-12-	2.73	3.90	0.70	9	22	52	5.07	38	85	13	123
403360	46-44.028	-103.779	-3-15-	3.69	4.40	0.84	10	17	48	4.56	33	79	12	124
403362	46-44.151	-103.996	-3-15-	2.04	2.40	0.85	5	6	18	1.80	16	56	12	113
403501	46-44.477	-102.058	-3-15-	1.36	3.20	0.58	6	6	10	1.96	14	57	15	65
403502	46-44.451	-102.076	-3-12-	2.61	3.60	0.72	8	12	27	3.16	32	112	17	116
403503	46-44.399	-102.123	-3-12-	3.07	3.30	0.93	7	11	21	3.35	30	116	19	105
403504	46-44.401	-102.117	-3-15-	2.69	2.80	0.96	9	11	21	3.28	31	121	19	100
403507	46-44.413	-102.048	-3-15-	2.63	3.10	0.85	7	12	26	3.66	36	138	19	124
403508	46-44.428	-102.065	-3-15-	2.49	3.10	0.80	11	13	25	3.62	35	136	18	122
403511	46-44.354	-102.037	-3-12-	3.17	3.10	1.02	6	9	20	2.97	30	111	16	103
403512	46-44.324	-102.124	-3-15-	2.89	2.90	1.00	7	9	19	2.97	27	106	19	109
403514	46-44.322	-102.130	-3-15-	2.39	3.10	0.77	8	9	18	2.81	25	103	17	93
403515	46-44.257	-102.137	-3-15-	2.95	3.00	0.98	6	10	23	3.30	31	132	17	103
403516	46-44.284	-102.147	-3-12-	2.90	3.70	0.78	7	9	17	2.72	23	93	17	89
403520	46-44.294	-102.102	-3-12-	4.41	4.80	0.92	5	9	16	3.04	25	98	14	100
403521	46-44.287	-102.108	-3-12-	3.11	3.60	0.86	6	10	22	3.37	32	131	18	100
403522	46-44.337	-102.137	-3-15-	2.90	3.00	0.97	9	10	21	3.60	34	138	17	106
403524	46-44.373	-102.133	-3-15-	3.09	3.30	0.94	6	11	25	3.89	36	148	21	123
403525	46-44.375	-102.120	-3-15-	2.61	3.00	0.87	9	13	21	3.63	33	127	21	102
403528	46-44.353	-102.121	-3-15-	3.66	3.10	1.18	8	10	22	3.58	34	128	20	112
403529	46-44.353	-102.132	-3-15-	3.33	2.80	1.19	9	10	24	3.57	33	137	18	124
403534	46-44.401	-102.127	-3-15-	3.09	3.20	0.97	10	12	24	4.09	35	147	21	117
403535	46-44.460	-102.229	-3-12-	2.49	2.60	0.96	8	9	13	2.65	22	89	17	79
403536	46-44.438	-102.170	-3-15-	3.18	3.20	0.99	11	11	23	3.56	37	131	23	109
403539	46-44.476	-102.139	-3-15-	2.22	3.20	0.69	8	6	7	2.17	13	58	16	47
403548	46-44.579	-102.138	-3-12-	2.97	3.10	0.96	7	10	23	3.31	32	117	19	109
403550	46-44.534	-102.212	-3-15-	3.04	2.50	1.22	6	7	12	2.29	17	70	15	77
403551	46-44.486	-102.134	-3-12-	2.19	4.00	0.55	9	9	16	3.42	27	114	18	92
403552	46-44.599	-102.325	-3-12-	1.33	2.30	0.58	8	4	7	1.25	10	39	10	44
403557	46-44.568	-102.343	-3-12-	1.37	2.20	0.62	9	5	9	1.77	12	48	12	61
403558	46-44.553	-102.404	-3-15-	1.19	2.20	0.54	5	4	8	1.60	11	45	11	54
403559	46-44.540	-102.404	-3-12-	2.15	2.40	0.90	9	5	11	2.13	12	57	12	65
403560	46-44.535	-102.481	-3-12-	1.62	2.10	0.77	8	4	6	2.23	7	34	9	44
403561	46-44.513	-102.420	-3-12-	2.11	2.60	0.81	6	7	12	2.41	21	76	13	70
403562	46-44.501	-102.320	-3-12-	2.97	2.80	1.06	5	8	13	2.22	19	70	13	70
403566	46-44.632	-102.465	-3-15-	1.81	2.50	0.72	9	5	16	1.81	14	65	14	92
403569	46-44.657	-102.290	-3-12-	1.91	2.40	0.80	6	6	10	2.01	14	64	13	65
403570	46-44.671	-102.285	-3-12-	2.87	3.00	0.96	8	6	16	2.09	15	65	15	95

Table B-3, Continued

PARTIAL DATA LISTING FOR STREAM SEDIMENT OF THE RAPID CITY QUADRANGLE

OR SAMPLE NUMBER	D. O. E. ST LAT	SAMFLE _LONG	NUMBER L TY REP	U (PPM)	U-NT (PPM)	U/TU	TH (PPM)	CO (PPM)	CU (PPM)	FE (%)	NI (PPM)	V (PPM)	Y (PPM)	ZN (PPM)
403571	46-44.752	-102.442	-3-12-	1.88	2.10	0.90	6	4	11	1.72	10	52	12	76
403572	46-44.755	-102.460	-3-12-	2.05	2.30	0.89	10	6	12	1.96	14	60	13	72
403579	46-44.669	-102.224	-3-12-	2.42	2.50	0.97	7	5	13	1.92	14	64	13	84
403580	46-44.687	-102.226	-3-12-	2.19	2.80	0.78	5	7	13	2.12	16	67	13	114
403581	46-44.698	-102.215	-3-15-	2.55	3.70	0.69	7	7	14	2.18	16	68	15	93
403585	46-44.442	-102.311	-3-12-	2.72	2.80	0.97	4	8	13	2.53	20	81	15	76
403586	46-44.439	-102.318	-3-12-	2.96	3.50	0.85	11	13	24	3.85	34	129	19	120
403588	46-44.402	-102.391	-3-15-	3.37	3.50	0.96	8	14	27	3.89	36	142	18	164
403593	46-44.738	-102.378	-3-12-	3.53	3.80	0.93	5	7	21	2.40	22	72	13	88
403598	46-44.710	-102.156	-3-15-	2.41	2.70	0.89	4	8	16	2.39	21	78	14	76
403599	46-44.718	-102.101	-3-12-	2.93	2.70	1.09	9	9	19	2.50	25	83	14	93
403601	46-44.621	-102.005	-3-12-	3.43	2.90	1.18	9	11	23	3.39	32	116	18	109
403603	46-44.625	-102.144	-3-12-	2.82	2.50	1.13	12	8	16	2.35	20	79	15	84
403607	46-44.606	-102.092	-3-12-	2.60	3.10	0.84	5	11	22	2.43	31	112	20	102
403608	46-44.621	-102.059	-3-12-	2.08	2.98	0.70	7	10	18	2.95	27	92	16	91
403609	46-44.687	-102.490	-3-12-	1.69	2.20	0.77	8	5	8	1.33	11	40	11	53
403613	46-44.802	-102.528	-3-12-	2.16	2.60	0.83	7	6	11	1.93	15	61	11	64
403616	46-44.817	-102.631	-3-12-	2.24	2.50	0.90	8	7	14	2.13	18	66	16	70
403618	46-44.803	-102.592	-3-12-	2.10	2.90	0.72	7	6	12	2.13	15	62	12	72
403619	46-44.802	-102.558	-3-12-	2.39	2.70	0.89	5	7	12	2.01	20	69	15	64
403624	46-44.855	-102.656	-3-15-	2.03	2.70	0.75	7	7	14	2.18	19	71	14	75
403626	46-44.916	-102.656	-3-12-	2.00	2.50	0.80	7	6	8	1.52	15	53	12	54
403631	46-44.887	-102.544	-3-15-	1.69	2.00	0.84	3	4	8	1.23	9	41	10	51
403633	46-44.905	-102.625	-3-12-	1.35	2.10	0.64	<2	<4	4	1.04	9	30	9	28
403635	46-44.923	-102.599	-3-15-	1.72	2.40	0.72	<2	7	12	1.70	19	60	13	70
403636	46-44.936	-102.592	-3-15-	2.00	2.50	0.80	9	7	15	1.69	20	65	13	78
403638	46-44.967	-102.599	-3-12-	2.24	2.60	0.86	6	8	11	1.76	19	65	13	63
403642	46-44.907	-102.515	-3-12-	1.53	2.30	0.67	10	4	5	1.05	11	38	11	37
403643	46-44.915	-102.510	-3-12-	1.98	2.70	0.73	9	8	9	1.78	17	57	13	58
403644	46-44.908	-102.456	-3-12-	1.82	2.70	0.67	5	9	14	2.23	22	69	15	83
403648	46-44.823	-102.365	-3-12-	1.40	2.40	0.58	8	7	11	2.08	17	61	12	68
403649	46-44.832	-102.384	-3-12-	1.82	2.20	0.83	6	5	9	1.49	12	43	11	66
403652	46-44.823	-102.323	-3-12-	1.54	2.50	0.62	4	6	10	1.60	16	55	12	62
403658	46-44.749	-102.308	-3-12-	2.07	2.80	0.74	5	8	19	2.58	23	90	15	99
403659	46-44.755	-102.256	-3-12-	1.83	2.50	0.73	7	8	17	2.32	21	77	15	87
403662	46-44.768	-102.343	-3-15-	2.25	2.70	0.83	8	8	13	2.24	23	67	12	75
403663	46-44.863	-102.251	-3-12-	1.77	2.30	0.77	3	5	11	1.70	15	52	11	83
403666	46-44.910	-102.277	-3-12-	2.42	2.80	0.86	4	7	12	1.67	17	55	12	70
403667	46-44.853	-102.215	-3-15-	1.91	2.30	0.83	2	5	15	1.90	16	65	13	95
403669	46-44.757	-102.208	-3-12-	1.40	2.90	0.48	5	6	13	1.94	18	62	14	65
403671	46-44.777	-102.171	-3-12-	1.62	3.00	0.54	10	8	17	2.43	22	81	18	76
403675	46-44.731	-102.037	-3-12-	2.77	3.60	0.77	12	11	20	3.73	39	143	19	116
403677	46-44.814	-102.058	-3-15-	1.75	2.80	0.63	3	7	12	2.57	19	85	17	75
403680	46-44.803	-102.181	-3-12-	1.94	3.00	0.65	4	7	17	2.27	21	72	15	76
403685	46-44.854	-102.064	-3-15-	1.87	3.20	0.58	11	7	14	1.54	20	68	15	66
403686	46-44.852	-102.073	-3-15-	1.79	2.70	0.66	6	6	11	1.94	19	64	14	58
403689	46-44.852	-102.174	-3-12-	2.21	3.10	0.71	5	6	13	1.89	17	62	13	68
403691	46-44.987	-102.132	-3-12-	2.29	3.20	0.72	8	<4	8	1.71	12	53	11	70
403693	46-44.939	-102.219	-3-15-	1.98	2.60	0.76	5	<4	2	1.27	7	39	11	41
403695	46-44.939	-102.239	-3-12-	3.43	3.50	0.98	5	8	16	2.07	23	70	15	66
403696	46-44.938	-102.247	-3-12-	2.85	3.80	0.75	8	9	15	2.07	26	74	15	68
403697	46-44.947	-102.269	-3-15-	3.05	4.20	0.73	6	8	14	1.63	21	53	12	68
403698	46-44.950	-102.266	-3-12-	1.90	3.50	0.54	3	8	15	2.24	25	74	15	66
403700	46-44.929	-102.182	-3-15-	3.37	2.90	1.16	6	7	13	1.67	19	57	15	52
403702	46-44.897	-102.360	-3-15-	5.55	5.40	1.03	3	4	12	1.58	14	48	11	82

Table B-3, Continued

PARTIAL DATA LISTING FOR STREAM SEDIMENT OF THE RAPID CITY QUADRANGLE

OR SAMPLE NUMBER	D. O. E. ST LAT	SAMPLE LONG	NUMBER L TY REP	U (PPM)	U-NT (PPM)	U/TU	TH (PPM)	CO (PPM)	CU (PPM)	FE (%)	NI (PPM)	V (PPM)	Y (PPM)	ZN (PPM)
403703	46-44.909	-102.375	-3-15-	2.59	2.70	0.96	<2	5	8	1.29	19	48	14	40
403705	46-44.911	-102.698	-3-12-	2.80	2.70	1.04	7	7	14	1.97	18	62	14	69
403706	46-44.920	-102.759	-3-12-	3.56	3.00	1.19	8	8	15	2.53	22	69	16	70
403708	46-44.718	-103.818	-3-15-	3.30	4.00	0.82	7	8	31	2.50	31	130	15	94
403711	46-44.685	-103.923	-3-15-	2.38	3.20	0.74	8	15	21	4.13	29	91	23	113
403712	46-44.699	-103.548	-3-15-	2.80	3.40	0.82	10	8	24	3.26	25	112	22	108
403717	46-44.735	-103.883	-3-15-	4.92	5.00	0.98	6	11	21	2.76	27	141	18	107
403719	46-44.706	-103.752	-3-12-	4.70	4.20	1.12	10	9	29	3.21	32	130	16	100
403721	46-44.671	-103.808	-3-15-	5.55	5.10	1.09	13	5	25	2.32	19	95	18	114
403722	46-44.661	-103.807	-3-15-	6.85	5.67	1.21	7	13	15	2.51	18	70	15	99
403723	46-44.651	-103.808	-3-15-	3.87	4.10	0.94	8	6	19	1.79	23	59	15	87
403726	46-44.643	-103.842	-3-12-	3.37	3.50	0.96	10	9	17	2.49	20	70	16	81
403727	46-44.625	-103.807	-3-15-	3.50	3.50	1.00	10	5	16	1.75	14	57	14	74
403728	46-44.613	-103.780	-3-15-	3.31	3.60	0.92	9	7	19	2.37	22	67	15	90
403732	46-44.585	-103.828	-3-12-	1.83	2.00	0.91	8	4	9	1.27	12	33	11	31
403733	46-44.597	-103.813	-3-15-	1.60	2.30	0.70	11	5	11	1.29	10	36	10	38
403734	46-44.602	-103.812	-3-15-	2.55	3.30	0.77	8	8	15	1.95	15	62	15	60
403735	46-44.582	-103.849	-3-12-	1.20	1.70	0.71	3	<4	6	0.81	5	23	8	25
403737	46-44.517	-103.883	-3-15-	1.97	2.40	0.82	5	4	10	1.19	12	38	10	47
403740	46-44.526	-103.588	-3-15-	1.78	2.30	0.77	7	5	14	1.56	16	43	12	46
403741	46-44.540	-103.911	-3-15-	1.97	2.50	0.79	8	8	18	2.52	23	68	16	67
403744	46-44.575	-103.937	-3-12-	2.50	2.60	0.96	4	<4	10	1.41	14	39	12	37
403746	46-44.575	-103.976	-3-12-	1.84	3.50	0.53	13	7	25	2.51	19	59	22	88
403749	46-44.639	-103.930	-3-12-	3.21	3.30	0.97	4	8	12	2.33	14	52	15	55
403750	46-44.017	-103.191	-3-12-	4.42	5.00	0.88	4	13	22	7.92	104	66	71	323
403751	46-44.041	-103.194	-3-15-	3.95	5.00	0.79	5	8	21	2.48	22	78	16	113
403752	46-44.046	-103.193	-3-15-	3.67	4.70	0.78	6	6	19	2.02	20	74	17	71
403756	46-44.354	-102.362	-3-15-	1.96	3.20	0.61	13	6	10	1.87	13	62	13	57
403759	46-44.372	-102.458	-3-15-	3.19	3.20	1.00	12	11	23	3.32	31	139	17	129
403760	46-44.375	-102.444	-3-15-	3.50	3.40	1.03	5	10	22	3.24	30	142	16	127
403762	46-44.302	-102.345	-3-15-	2.81	3.10	0.91	7	9	18	2.92	26	107	17	106
403764	46-44.330	-102.264	-3-12-	2.17	2.60	0.83	8	7	13	2.15	17	68	14	78
403771	46-44.482	-102.489	-3-15-	2.19	2.50	0.88	6	8	17	2.40	20	77	14	89
403773	46-44.256	-102.611	-3-12-	4.51	5.00	0.90	8	16	29	3.56	38	144	18	169
403775	46-44.269	-102.542	-3-12-	2.93	3.50	0.84	7	10	19	2.87	28	115	15	113
403776	46-44.255	-102.511	-3-15-	5.10	5.70	0.89	8	10	23	3.11	27	111	15	135
403777	46-44.257	-102.568	-3-15-	2.11	16.40	0.13	8	8	22	2.33	19	96	13	117
403778	46-44.258	-102.727	-3-12-	3.32	3.60	0.92	7	11	19	2.82	25	112	15	101
403784	46-44.367	-102.567	-3-15-	3.35	3.50	0.96	8	10	24	2.98	29	137	15	118
403785	46-44.444	-102.639	-3-15-	4.54	4.70	0.97	11	11	32	3.52	36	160	18	143
403799	46-44.388	-102.842	-3-15-		3.10									
403801	46-44.396	-103.000	-3-15-		2.80									
403804	46-44.471	-102.925	-3-15-		2.70									
403809	46-44.342	-102.832	-3-15-		3.60									
403812	46-44.341	-102.853	-3-15-	4.05	8.40	0.48	14	18	37	6.33	42	157	24	186
403813	46-44.334	-102.864	-3-15-	3.75	4.30	0.87	9	18	36	5.55	40	138	19	179
403814	46-44.333	-102.878	-3-15-	3.15	4.60	0.68	8	18	39	6.06	44	152	21	167
403815	46-44.331	-102.907	-3-15-	4.19	6.00	0.70	12	18	38	6.36	44	172	24	165
403816	46-44.327	-102.921	-3-15-	4.37	7.30	0.60	15	19	39	6.50	49	167	27	174
403817	46-44.325	-102.949	-3-15-	3.03	5.70	0.53	9	21	38	6.01	45	179	21	164
403818	46-44.329	-102.962	-3-15-	3.73	7.90	0.47	15	18	38	6.94	44	177	25	177
403819	46-44.333	-102.989	-3-15-	4.31	7.00	0.62	12	19	37	6.60	45	175	24	166
403820	46-44.339	-102.811	-3-15-	4.34	6.00	0.72	13	22	37	6.26	46	175	24	168
403821	46-44.359	-102.874	-3-15-	3.56	3.50	1.02	8	10	25	3.63	30	141	16	112
403825	46-44.388	-103.190	-3-15-	2.83	3.60	0.79	5	<4	<2	0.11	2	6	1	4

Table B-3, Continued

PARTIAL DATA LISTING FOR STREAM SEDIMENT OF THE RAPID CITY QUADRANGLE

OR SAMPLE NUMBER	D. O. ST	E. SAMPLE LAT	NUMBER LONG	NUMBER LTY REP	U (PPM)	J-NT (PPM)	U/TU	TH (PPM)	CO (PPM)	CU (PPM)	FE (%)	NI (PPM)	V (PPM)	Y (PPM)	ZN (PPM)
403826	46-44.389	-103.164	-3-15-		4.69	6.20	0.76	7	<4	18	2.03	18	84	12	98
403827	46-44.369	-103.248	-3-15-		3.85	4.40	0.87	9	<4	18	2.05	21	123	17	99
403828	46-44.358	-103.234	-3-15-		2.92	3.60	0.81	5	4	13	1.61	17	93	14	79
403829	46-44.363	-103.189	-3-15-		2.80	3.30	0.85	8	7	17	2.21	23	130	17	115
403830	46-44.359	-103.181	-3-15-		2.63	3.20	0.82	8	5	14	1.85	18	111	15	120
403832	46-44.420	-103.036	-3-15-		3.76	4.40	0.85	9	5	19	2.11	23	127	17	100
403833	46-44.459	-103.074	-3-15-		3.01	3.10	0.97	7	5	15	2.05	20	121	15	101
403847	46-44.836	-103.863	-3-15-		4.22	5.20	0.81	6	7	24	2.53	43	212	21	123
403848	46-44.839	-103.869	-3-12-		3.19	3.80	0.84	9	8	24	2.82	36	212	20	166
403849	46-44.847	-103.882	-3-15-		3.61	4.50	0.80	12	8	29	3.31	44	261	24	195
403850	46-44.851	-103.883	-3-15-		3.74	4.20	0.89	13	11	26	3.76	46	275	21	196
403852	46-44.865	-103.894	-3-12-		2.56	3.20	0.80	14	11	23	3.64	39	246	19	193
403853	46-44.873	-103.942	-3-15-		4.66	4.90	0.95	15	8	29	2.54	41	226	22	161
403854	46-44.828	-103.846	-3-15-		1.34	4.90	0.27	11	8	26	2.73	37	220	21	163
403855	46-44.765	-103.770	-3-15-		1.40	3.80	0.37	10	7	20	2.20	25	144	18	121
403856	46-44.799	-103.799	-3-15-		1.48	3.80	0.39	11	9	23	3.09	39	219	22	175
403857	46-44.815	-103.823	-3-15-		2.50	3.50	0.71	11	8	22	2.43	31	165	18	138
403858	46-44.839	-103.838	-3-15-		2.05	3.60	0.57	14	12	27	3.78	42	276	19	204
403859	46-44.833	-103.762	-3-15-		2.11	4.50	0.47	12	11	33	3.32	47	332	19	214
403860	46-44.858	-103.862	-3-15-		2.29	3.20	0.72	8	10	21	3.13	30	173	17	157
403861	46-44.871	-103.755	-3-15-		1.51	3.30	0.49	9	12	26	3.47	41	205	20	173
403862	46-44.883	-103.760	-3-15-		1.24	3.80	0.33	12	14	30	4.00	46	254	21	201
403864	46-44.916	-103.793	-3-12-		1.65	3.50	0.47	13	13	24	3.47	46	229	20	184
403865	46-44.968	-103.812	-3-15-		1.44	3.50	0.41	6	18	36	4.28	44	160	21	193
403866	46-44.903	-103.814	-3-15-		2.06	3.30	0.62	7	10	21	3.30	30	186	17	165
403867	46-44.908	-103.829	-3-15-		2.36	3.50	0.67	9	15	24	3.75	54	310	21	215
403868	46-44.914	-103.825	-3-15-		2.05	2.90	0.71	6	10	19	3.05	30	179	17	159
403871	46-44.954	-103.870	-3-12-		2.53	3.30	0.77	7	14	30	3.67	33	132	18	161
403874	46-44.882	-103.912	-3-15-		2.83	3.20	0.88	13	11	23	3.34	36	212	20	189
403875	46-44.891	-103.958	-3-15-		3.25	3.10	1.05	7	10	21	3.11	33	188	16	174
403876	46-44.900	-103.966	-3-15-		2.68	3.30	0.81	5	9	21	2.89	32	186	17	164
403877	46-44.909	-103.984	-3-15-		3.40	3.60	0.94	9	10	23	2.81	35	192	20	162
403878	46-44.939	-103.910	-3-15-		2.32	3.40	0.68	<2	5	15	3.53	41	266	22	210
403879	46-44.939	-103.912	-3-12-		2.47	3.20	0.77	<2	<4	5	2.84	18	148	13	139
403880	46-44.950	-103.930	-3-15-		2.44	3.50	0.70	16	15	23	3.74	51	285	24	214
403881	46-44.975	-103.932	-3-15-		2.78	3.50	0.79	8	16	30	3.76	54	188	20	152
403882	46-44.989	-103.959	-3-15-		4.16	4.20	0.99	9	15	25	3.45	41	214	22	152

APPENDIX C
MICROFICHE OF FIELD AND LABORATORY DATA

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APPENDIX C

MICROFICHE OF FIELD AND LABORATORY DATA

LIST OF TABLES

<u>No.</u>	<u>Title</u>	<u>Page</u>
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C-2	Oak Ridge Geochemical Sampling Form Showing Field Data Recorded on Microfiche	C-5
	Microfiche	C-7

Table C-1

COMPUTER CODE LIST OF GEOCHEMICAL VARIABLES

Variable(a)	Code	Variable(a)	Code
Uranium Measured by Fluorometry(b)	U-FL	Scandium	SC
Uranium Measured by Mass Spectrometry(b)	U-MS	Silicon	SI
Uranium Measured by Neutron Activation	U-NT	Strontium	SR
Arsenic	AS	Thorium	TH
Selenium	SE	Titanium	TI
Silver	AG	Vanadium	V
Aluminum	AL	Yttrium	Y
Boron	B	Zinc	ZN
Barium	BA	Zirconium	ZR
Beryllium	BE	Sulfate (ppm)	SO ₄
Calcium	CA	Chloride (ppm)	CL
Cerium	CE	Conductivity from Lab (μmhos/cm)	CT-L
Cobalt	CO	Conductivity from Field (μmhos/cm)	CT-F
Chromium	CR	Dissolved Oxygen (ppm)	DO
Copper	CU	Air Temperature (°C)	ATEM
Iron	FE	Water Temperature (°C)	WTEM
Hafnium	HF	pH	PH
Potassium	K	pH Measured by Lo Ion Paper	PH-P
Lanthanum	LA	Total Alkalinity (ppm)	T-AK
Lithium	LI	M-Alkalinity (ppm)	M-AK
Manganese	MG	P-Alkalinity (ppm)	P-AK
Molybdenum	MO	Carbonate (ppm)(c)	CB
Sodium	NA	Bicarbonate (ppm)(c)	BC
Niobium	NB	Undissociated Carbonic Acid (ppm)(c)	CAB
Nickel	NI	U-NT/U-FL	TU/U
Phosphorus	P	U-FL/U-NT	U/TU
Lead	PB	TH/U-NT	TH/U
Platinum	PT	1,000·U/SP	U/SP
		1,000·U/B	U/B
		1,000·U/SO	U/SO

(a) If natural logarithm of variable is used, L or L- precedes the variable code.

(b) If method is not specified for waters, U-FL is used, except where value is below laboratory detection limit in which case U-MS is substituted if it is available.

(c) These variables were approximated using cubic spline functions to fit the curves in Hem (1970), p. 155.

Table C-2

OAK RIDGE GEOCHEMICAL SAMPLING FORM SHOWING FIELD DATA RECORDED ON MICROFICHE

OAK RIDGE GEOCHEMICAL SAMPLING FORM

<div style="border: 1px solid black; padding: 2px; display: inline-block;"> <div style="border: 1px solid black; padding: 2px; display: inline-block;">1</div> <div style="display: inline-block; vertical-align: middle;">Card Number</div> </div>		<div style="border: 1px solid black; padding: 2px; display: inline-block;"> <div style="border: 1px solid black; padding: 2px; display: inline-block;">1</div> <div style="display: inline-block; vertical-align: middle;">Card Number</div> </div>	
GENERAL SITE DATA			
Attach Identical Sample Number Here <div style="border: 1px solid black; padding: 2px; display: inline-block;"> <div style="border: 1px solid black; padding: 2px; display: inline-block;">1</div> <div style="display: inline-block; vertical-align: middle;">Card Number</div> </div>			
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <div style="border: 1px solid black; padding: 2px; display: inline-block;"> <div style="border: 1px solid black; padding: 2px; display: inline-block;">8</div> <div style="display: inline-block; vertical-align: middle;">Site Number</div> </div> </div> <div style="width: 45%;"> <div style="border: 1px solid black; padding: 2px; display: inline-block;"> <div style="border: 1px solid black; padding: 2px; display: inline-block;">12</div> <div style="display: inline-block; vertical-align: middle;">Map Code</div> </div> </div> </div>			
Sample Type			
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <div style="border: 1px solid black; padding: 2px; display: inline-block;"> <div style="border: 1px solid black; padding: 2px; display: inline-block;">M</div> <div style="display: inline-block; vertical-align: middle;">Stream Sediment</div> </div> </div> <div style="width: 45%;"> <div style="border: 1px solid black; padding: 2px; display: inline-block;"> <div style="border: 1px solid black; padding: 2px; display: inline-block;">19</div> <div style="display: inline-block; vertical-align: middle;">Replicate Letter (A-Z)</div> </div> </div> </div>			
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <div style="border: 1px solid black; padding: 2px; display: inline-block;"> <div style="border: 1px solid black; padding: 2px; display: inline-block;">H</div> <div style="display: inline-block; vertical-align: middle;">Lake Sediment</div> </div> </div> <div style="width: 45%;"> <div style="border: 1px solid black; padding: 2px; display: inline-block;"> <div style="border: 1px solid black; padding: 2px; display: inline-block;">20</div> <div style="display: inline-block; vertical-align: middle;">Hour</div> </div> </div> </div>			
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <div style="border: 1px solid black; padding: 2px; display: inline-block;"> <div style="border: 1px solid black; padding: 2px; display: inline-block;">S</div> <div style="display: inline-block; vertical-align: middle;">Stream Water</div> </div> </div> <div style="width: 45%;"> <div style="border: 1px solid black; padding: 2px; display: inline-block;"> <div style="border: 1px solid black; padding: 2px; display: inline-block;">21</div> <div style="display: inline-block; vertical-align: middle;">Day</div> </div> </div> </div>			
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <div style="border: 1px solid black; padding: 2px; display: inline-block;"> <div style="border: 1px solid black; padding: 2px; display: inline-block;">W</div> <div style="display: inline-block; vertical-align: middle;">Well Water</div> </div> </div> <div style="width: 45%;"> <div style="border: 1px solid black; padding: 2px; display: inline-block;"> <div style="border: 1px solid black; padding: 2px; display: inline-block;">22</div> <div style="display: inline-block; vertical-align: middle;">Month</div> </div> </div> </div>			
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <div style="border: 1px solid black; padding: 2px; display: inline-block;"> <div style="border: 1px solid black; padding: 2px; display: inline-block;">P</div> <div style="display: inline-block; vertical-align: middle;">Spring Water</div> </div> </div> <div style="width: 45%;"> <div style="border: 1px solid black; padding: 2px; display: inline-block;"> <div style="border: 1px solid black; padding: 2px; display: inline-block;">23</div> <div style="display: inline-block; vertical-align: middle;">Year</div> </div> </div> </div>			
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <div style="border: 1px solid black; padding: 2px; display: inline-block;"> <div style="border: 1px solid black; padding: 2px; display: inline-block;">L</div> <div style="display: inline-block; vertical-align: middle;">Lake Water</div> </div> </div> <div style="width: 45%;"> <div style="border: 1px solid black; padding: 2px; display: inline-block;"> <div style="border: 1px solid black; padding: 2px; display: inline-block;">24</div> <div style="display: inline-block; vertical-align: middle;">Collector's Initials</div> </div> </div> </div>			
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<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <div style="border: 1px solid black; padding: 2px; display: inline-block;"> <div style="border: 1px solid black; padding: 2px; display: inline-block;">B</div> <div style="display: inline-block; vertical-align: middle;">Plant</div> </div> </div> <div style="width: 45%;"> <div style="border: 1px solid black; padding: 2px; display: inline-block;"> <div style="border: 1px solid black; padding: 2px; display: inline-block;">26</div> <div style="display: inline-block; vertical-align: middle;">Field Sheet Status</div> </div> </div> </div>			
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <div style="border: 1px solid black; padding: 2px; display: inline-block;"> <div style="border: 1px solid black; padding: 2px; display: inline-block;">F</div> <div style="display: inline-block; vertical-align: middle;">Soil</div> </div> </div> <div style="width: 45%;"> <div style="border: 1px solid black; padding: 2px; display: inline-block;"> <div style="border: 1px solid black; padding: 2px; display: inline-block;">27</div> <div style="display: inline-block; vertical-align: middle;">Original</div> </div> </div> </div>			
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <div style="border: 1px solid black; padding: 2px; display: inline-block;"> <div style="border: 1px solid black; padding: 2px; display: inline-block;">G</div> <div style="display: inline-block; vertical-align: middle;">Rock</div> </div> </div> <div style="width: 45%;"> <div style="border: 1px solid black; padding: 2px; display: inline-block;"> <div style="border: 1px solid black; padding: 2px; display: inline-block;">28</div> <div style="display: inline-block; vertical-align: middle;">Correction</div> </div> </div> </div>			
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Table C-2, Continued

OAK RIDGE GEOCHEMICAL SAMPLING FORM
SHOWING FIELD DATA RECORDED ON MICROFICHE

STREAM OR LAKE SEDIMENT**Sample Condition**

31
D
W

Dry
wet**Sample Treatment**

32
N
S
Q

None
Sieved
Other

33	34

Number of Grains

35	36

% Organic Material (Field Estimate)

GENERAL WATER SAMPLES**Water Sample Treatment**

37
N
F
C
A
Q

None
Filtrate Only
Acidified Only
Acidified and Filtered
Other**Depth of Visibility (m)**

38	39	40

C = Clear

41	42	43	44	45

Conductivity
($\mu\text{mhos/cm}$)

46	47	48

Dissolved O₂ (ppm)

49	50	51

Temperature (°C)

52	53	54

pH

55
P

pH by Lo-Ion Paper

56	57	58	59

Total Alkalinity (ppm)

60	61	62	63

P Alkalinity (ppm)

64	65	66	67

M Alkalinity (ppm)

Appearance of Water

68
C
M
A
Q

Clear
Murky
Algal
Other

69	70	71	72	73

Discharge (liters/min)

REMARKS (Card 4)

74	75	76	77

Identification of Producing Horizon
(Geologic Unit Code)**Confidence of Producing Horizon Identification**

78
H
R
S

High Degree
Probable
Possible**Source of Producing Horizon Identification**

79
P
W
U
G
Q

Publication
Owner
User
Geologic Inference
Other

80
3

Card Number

WELL WATER**Type of Well**

81
D
P
G
U
Q

Drilled
Drive Point
Dug
Unknown
Other**Power Classification**

82
A
E
G
W
H
Q

Artesian Flow
Electric
Gasoline
Wind
Hand
Other**Casing**

83
N
S
G
P
U
Q

None (Below Water Table)
Steel
Galvanized
Plastic
Unknown
Other**Pipe Composition**

84
F
Z
C
P
U
Q

Steel
Galvanized
Copper
Plastic
Unknown
Other**Sample Location**

85	86	87

Meters from Well Head
H = Holding Tank (Use Remarks)**Where Sample Taken
With Respect To Pressure Tank**

88
B
A
N
F

Before
After
No Pressure Tank
From Pressure Tank (Use Remarks)**Use of Well**

89
M
H
S
I
A
X
Y
Z
N
Q

Municipal
Household
Stock
Irrigation
All of above
H and S
H and I
S and I
None
Other**Frequency of Pumping**

90
C
F
I
R

Constant (hourly)
Frequent (daily)
Infrequent (weekly)
Rare (no recent use)**Depth to top of Producing Horizon**

91	92	93	94

(Meters)

Confidence of Producing Depth

92
H
R
S

High
Probable
Possible**Source of Producing Depth Information**

93
P
W
U
G
Q

Publication
Owner
User
Geologic Inference
Other**Total Well Depth**

94	95	96	97

(Meters)

Confidence of Total Depth

95
H
R
S

High
Probable
Possible**Source of Total Depth Information**

96
P
W
U
G
Q

Publications
Owner
User
Geologic Inference
Other**LAKE WATER****Type of Lake**

97
N
M

Natural
Manmade**Lake Area**

98	99	00	01

(sq km)

MICROFICHE OF FIELD AND LABORATORY DATA

CONTENTS

<u>Laboratory Data</u>	<u>Page</u>
Well Water (W)	1-24
Stream Sediment (M)	25-54
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RAPID CITY QUAD
RASC DATA

06/23/80

PAGE 1

LEGEND

◇ SPRING WATER
○ WELL WATER

PLATE 1
RAPID CITY QUADRANGLE
GROUNDWATER SAMPLE
LOCATION MAP

SCALE 1: 250000
417 SAMPLES PLOTTED

PLATE 2
 RAPID CITY QUADRANGLE
 SYMBOL PLOT
 GROUNDWATER
 URANIUM (PPB)
 SCALE 1: 250000
 417 SAMPLES PLOTTED

SYMBOL RANGES FOR PLOTTED VARIABLE (X)		
+	0 ≤ X <	182
x	182 ≤ X <	310
.	310 ≤ X <	414
.	414 ≤ X <	487
o	487 ≤ X <	649
o	649 ≤ X <	966
o	966 ≤ X <	1281
o	1281 ≤ X <	1770
o	1770 ≤ X <	2807
o	2807 ≤ X <	4193
o	4193 ≤ X <	5417
o	5417 ≤ X <	7164
o	7164 ≤ X <	8931
■	8931 ≤ X <	11924
★	X ≥	11924

PLATE 3
RAPID CITY QUADRANGLE
SYMBOL PLOT
GROUNDWATER
SPECIFIC CONDUCTANCE (UMHOS/CM)
SCALE 1: 250000
417 SAMPLES PLOTTED

LEGEND
 □ STREAM SEDIMENT

PLATE 4
 RAPID CITY QUADRANGLE
 STREAM SEDIMENT SAMPLE LOCATION
 AND DRAINAGE BASIN MAP

SCALE 1: 250000
 514 SAMPLES PLOTTED

SYMBOL RANGES FOR PLOTTED VARIABLE (X)		
+	$0.0 \leq X < 1.12$	
x	$1.12 \leq X < 1.25$	
.	$1.25 \leq X < 1.38$	
.	$1.38 \leq X < 1.57$	
o	$1.57 \leq X < 1.83$	
o	$1.83 \leq X < 2.13$	
o	$2.13 \leq X < 2.50$	
o	$2.50 \leq X < 2.86$	
o	$2.86 \leq X < 3.31$	
o	$3.31 \leq X < 3.82$	
o	$3.82 \leq X < 4.43$	
o	$4.43 \leq X < 4.98$	
o	$4.98 \leq X < 6.24$	
■	$6.24 \leq X < 7.63$	
★	$X \geq 7.63$	

PLATE 5
 RAPID CITY QUADRANGLE
 SYMBOL PLOT
 STREAM SEDIMENT
 URANIUM FLUOROMETRIC (ppm)

SCALE 1: 250000
 471 SAMPLES PLOTTED

SYMBOL RANGES FOR PLOTTED VARIABLE (X)		
+	$0 \leq X <$	2
x	$2 \leq X <$	3
.	$3 \leq X <$	4
o	$4 \leq X <$	5
o	$5 \leq X <$	6
o	$6 \leq X <$	7
o	$7 \leq X <$	8
o	$8 \leq X <$	9
o	$9 \leq X <$	10
o	$10 \leq X <$	11
o	$11 \leq X <$	12
o	$12 \leq X <$	14
o	$14 \leq X <$	15
★	$X \geq$	15

PLATE 6
RAPID CITY QUADRANGLE
SYMBOL PLOT
STREAM SEDIMENT
THORIUM (PPM)
SCALE 1: 250000
471 SAMPLES PLOTTED

ERA	SYSTEM	SERIES	GEOL. GROUP	GEOL. FORMATION	MAXIMUM THICKNESS FEET	FEET
CENOZOIC	QUATERNARY	HOLOCENE	QAL	ALLUVIUM	15	50
				BRULE FORMATION	183	600
	TERTIARY	OLIGOCENE	TOW	CHAURON FORMATION	107	350
				LYGLOW FORMATION	107	350
		PALEOCENE	TPFR	PURPHYRAE GROUNDITE, PHONOLITE, QUARTZ MONZONITE AND RHYOLITE	130	425
				HELL CREEK FORMATION	76	250
	CRETACEOUS			FOX HILLS FORMATION	534	1,750
				PIERRE SHALE	235	770
				NOBBERA MARL AND CARLELE SHALE	115	360
				CRENULON L. LIMESTONE	290	950
				GRANEROS SHALE WITH BELLE FOURCHE MEMBER AND SKULL CREEK SHALE MEMBERS	168	550
				FALL RIVER FORMATION AND LAKOTA FORMATION	198	650
PALEOZOIC	JURASSIC			MORRISON AND SUNDANCE FORMATIONS	213	700
				SPARFISH FORMATION	50	165
	TRIASSIC			MINNEKAHTA LIMESTONE AND OPECHE SHALE	213	700
				MINNELUSA FORMATION	204	670
	PERMIAN			FAHASAPA AND ENGLEWOOD LIMESTONES	122	400
				DEADWOOD FORMATION		
PRECAMBRIAN				AMPHIBOLITE, SCHIST, QUARTZITE, SANDSTONE, GNEISS, GRIT, AND CONGLOMERATE		

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LEGEND
 COUNTY LINE
 GEOLOGIC CONTACT

PLATE 7
 GENERALIZED GEOLOGIC MAP
 RAPID CITY QUADRANGLE,
 SOUTH DAKOTA