UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

DISTRIBUTION OF RADIONUCLIDE AND TRACE-ELEMENTS IN GROUND WATER, GRASSES, AND SURFICIAL SEDIMENTS ASSOCIATED WITH THE ALLUVIAL AQUIFER ALONG THE PUERCO RIVER, NORTHEASTERN ARIZONA--A RECONNAISSANCE SAMPLING PROGRAM

By Robert H. Webb, Glen R. Rink, and Barbara O. Favor

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DEPARTMENT OF THE INTERIOR

DONALD PAUL HODEL, Secretary

U.S. GEOLOGICAL SURVEY

Dallas L. Peck, Director

Index terms for this report are as follows: *Radioactivity, *Radioactivity Effects, *Mining, *Streamflow, Groundwater Contamination, Infiltration, Puerco River, New Mexico, Arizona.

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CONVERSION FACTORS

For readers who prefer to use metric units, conversion factors for the terms in this report are listed below:

Multiply inch-pound unit	By	To obtain metric unit
foot (ft)	0.3048	meter (m)
square foot (ft^2)	0.0929	square meter (m^2)
mile (mi)	1.609	kilometer (km)
square mile (mi^2)	2.590	square kilometer (km^2)
cubic foot per second (ft^3/s)	0.02832	cubic meter per second (m^3/s)
million gallons (Mgal)	3.785	cubic meter (m^3)
milligram per liter (mg/L) (mg/L)	1,000	microgram per liter ($\mu g/L$)
microgram per liter ($\mu g/L$) ($\mu g/L$)	0.667	picocurie per liter (pCi/L)
parts per million (ppm)	1	milligrams per gram (mm/g)
ton, short	0.9072	megagram (Mg)

National Geodetic Vertical Datum of 1929 (NGVD of 1929): A geodetic datum derived from a general adjustment of the first-order level nets of both the United States and Canada, formerly called mean sea level.

DISTRIBUTION OF RADIONUCLIDE AND TRACE ELEMENTS IN GROUND WATER, GRASSES, AND SURFICIAL SEDIMENTS ASSOCIATED WITH THE ALLUVIAL AQUIFER ALONG THE PUERCO RIVER, NORTHEASTERN ARIZONA-- A RECONNAISSANCE SAMPLING PROGRAM

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ABSTRACT

Ground water, perennial grass, and sediments were sampled for trace elements and (or) radionuclides in the Puerco River basin in northeastern Arizona. The concentrations of gross alpha radioactivity minus uranium equals or exceeds 15 pCi/L in 5 of 14 wells sampled. The concentration of radium-226 plus radium-228 exceeds the primary water-quality standard of 5 pCi/L in one well. The concentration of uranium exceeds a recommended limit of 0.035 mg/L in two wells. Perennial grass and sediment samples have low concentrations of radionuclides. The concentration of trace elements in the sediment samples was not unusual. Water quality of surface water in the Puerco River at Chambers varied as a function of the suspended-sediment concentration. Concentrations of total gross alpha have fluctuated from 12 to 11,200 pCi/L. Concentrations of total gross beta fluctuated from 45 to 4,500 pCi/L.

INTRODUCTION

The Puerco River, which has a drainage area of about 3,000 mi^2, is in the southeastern part of the Colorado Plateau (fig. 1). The river heads in the Chuska and Zuni Mountains in northeastern Arizona and northwestern New Mexico and flows west-southwest to the confluence with the Little Colorado River east of Holbrook, Arizona.

Before 1950, the Puerco River was an ephemeral alluvial stream. Peak discharges occur in response to spring runoff and summer thunderstorms that produce flashy flow events. In the period between the 1950's and the mid-1980's, the Puerco River changed in the upper part of the basin (fig. 1) from an ephemeral to a perennial stream to at least the Arizona-New Mexico border and possibly as much as a few miles downstream from Chambers, Arizona (Shuey, 1986). The source of the perennial flow was effluent from dewatering activities associated with uranium mines and mills northeast of Gallup, New Mexico. Effluent that was discharged from a sewage-treatment plant in Gallup was also a contributing factor. The effluent from the mining activities and natural runoff contained "environmentally significant" amounts of radioactive lead-210, radium-226, radium-228, and uranium as well as many trace elements--specifically lead, molybdenum, and selenium--and sulfates (Arizona Department of Health Services, 1986). In

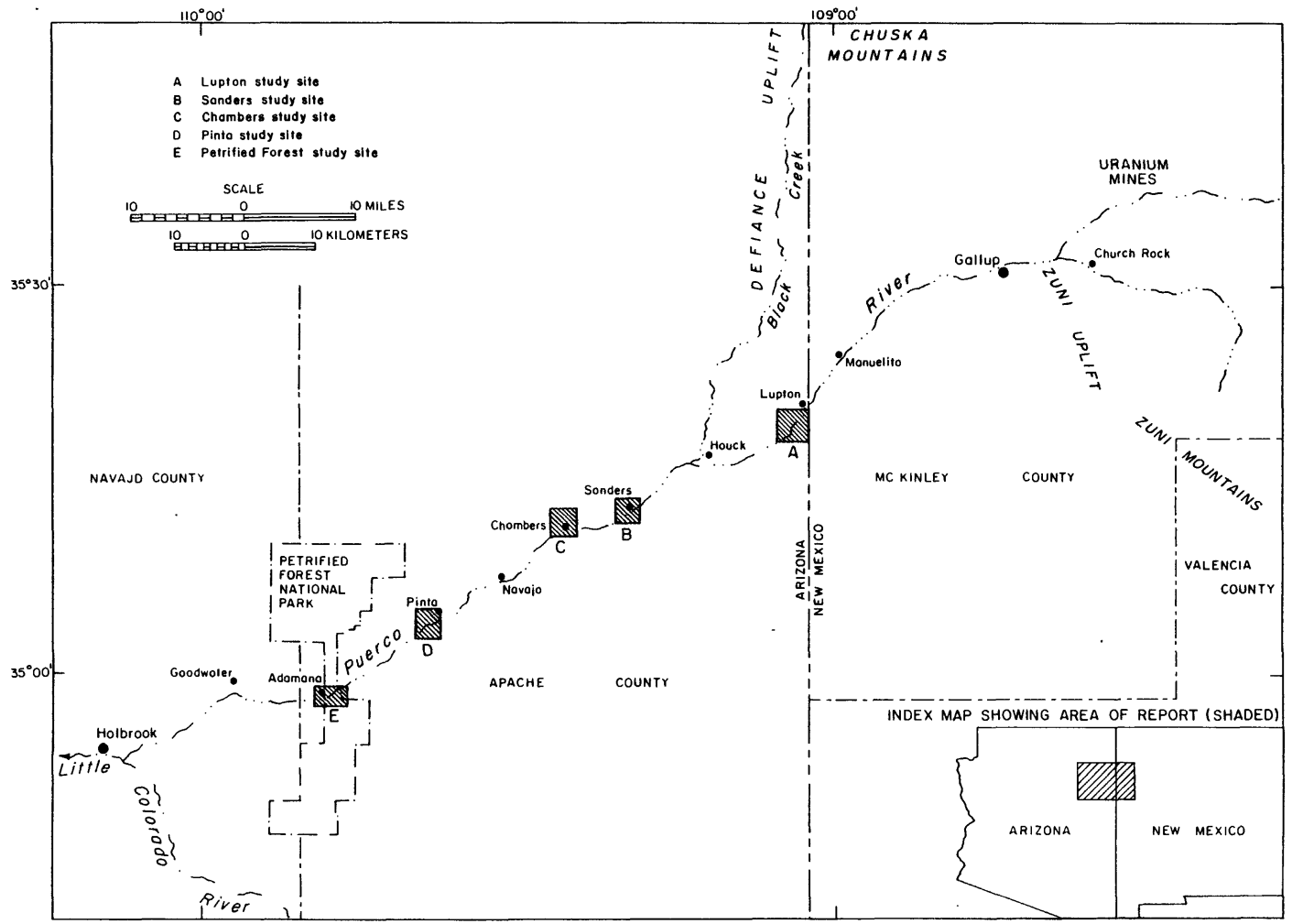


Figure 1.--Puerco River basin in northeastern Arizona and northwestern New Mexico and locations of transects.

July 1979, a tailings-pond dam failed at a uranium mill northeast of Gallup. Large amounts of thorium-230, thorium-232, radium-226, radium-228, uranium, and sulfates were released into the Puerco River (Weimer and others, 1981).

Because of the radionuclide and trace-element contamination in the basin, there is concern that the ground water in the alluvium of the Puerco River may not be safe for human consumption. In 1985, the Navajo and Hopi Indian Relocation Commission (NHIRC) funded a study on ground-water quality in the Puerco River basin prior to relocation of Navajo Indians into the area south of Sanders and Chambers, Arizona. Conflicting results from studies funded by NHIRC (Western Technologies, Inc., 1985) and Arizona Department of Health Services (1986) and a study by Shuey (1986) suggest that the extent of contamination in the Puerco River basin of Arizona is not known. At a meeting of representatives of NHIRC, Indian Health Service, Bureau of Indian Affairs; U.S. Environmental Protection Agency (EPA); and U.S. Geological Survey in July 1986, NHIRC and EPA proposed that the U.S. Geological Survey assess water-quality in ground water within Puerco River basin to determine if this resource was contaminated.

Purpose and Scope

The purpose of this study is to provide a preliminary assessment of radionuclide and trace-element contamination of the alluvial aquifer in the Puerco River basin between Lupton, Arizona, and Petrified Forest National Park (fig. 1). Radionuclides and trace elements that either occur naturally in the surface and ground water or are related to discharges and (or) tailings spills at uranium mines and mills in New Mexico (fig. 1) may have contaminated the aquifer. In addition, samples of vegetation growing near the Puerco River and surficial sediments were analyzed for contaminants. The scope of the study was limited to a reconnaissance-level sampling program in concert with an evaluation of existing data and reports to develop preliminary estimates of the areal extent and severity of the contamination. The study was completed in cooperation with NHIRC.

Acknowledgments

The authors thank the following people for permission to sample their private wells for water quality: Raymond Fitzgerald, Doug Hart, Ena Hoover, Larry Maennche, Joanna McDonald, and Mrs. Marvin Porter. Pat Paulsell, Jr., provided access to the Arizona Windsong well at Sanders. Paul Kanitz, Navajo Tribal Utility Authority and Indian Health Service; Marion Clarke, Petrified Forest National Park; Gerry Walters, Santa Fe Railroad; and Chuck Bent, Puerco Elementary School at Sanders provided access to wells under their control and gave permission to take samples. Dan Owens, Navajo Tribal Utility Authority; Ed Swanson, Arizona Department of Health Services; Terry Curley, Indian Health Services; Michelle Moustakas, U.S. Environmental Protection Agency; Chris Shuey, Southwest Research Center; Marian Clarke, Petrified Forest National Park; and Gerry Walters, Santa Fe Railroad provided unpublished water-quality data on the

wells sampled in this study. Chris Shuey, Michelle Moustakas, and Ed Swanson provided background literature on the radionuclide releases from mining activities in New Mexico. John Rote and Dean Radtke, U.S. Geological Survey, assisted with the collection of samples.

HISTORY OF RADIONUCLIDE RELEASES IN THE PUERCO RIVER BASIN

Uranium mining began in the 1950's in the Puerco River basin, and mines were established northeast of Gallup (fig. 1). The discharge of effluent waters from the mines created perennial flow in the Puerco River as far downstream as Chambers until mining ceased in the 1960's. Mining resumed in 1969, and effluent waters from the mines created perennial flow in the river until mining stopped again in February 1986 (Shuey, 1986).

Effluent waters from the mines were a potential source of radionuclides in the Puerco River basin. Radionuclides are derived from the natural radioactive decay of uranium (fig. 2) and have half-lives that range from seconds to billions of years. The amount of radionuclides in effluent water from mining activities in the 1950's and early 1960's is unknown.

Permits under the National Pollutant Discharge Elimination System (NPDES) were required when the mines reopened in 1969 in an attempt to control the level of radioactive material in effluent water. Under the conditions of the permits, effluent water could contain as much as 3 picocuries per liter (pCi/L) of dissolved radium-226, as much as 10 pCi/L of total radium-226, and as much as 2.0 milligrams per liter (mg/L) of total uranium (Chris Shuey, Southwest Research and Information Center, Albuquerque, New Mexico, written commun., 1987). The 1986 water-quality standards applicable to the Puerco River basin in Arizona are presented in table 1. The amount of radium-226 in water supplies forms the base for monitoring drinking-water supplies in the United States (fig. 3). The EPA primary water-quality standard is 5.0 pCi/L for total radium-226 plus radium-228, and 0.035 mg/L of total uranium is a recommended limit (Lappenbusch and Cothern, 1985). Shuey (1982) reported 63 violations of the NPDES permits between 1980 and 1983.

Additional discharges of radionuclides into the Puerco River occurred after a tailings pond dam failed at the United Nuclear Corporation's Church Rock Mill on July 16, 1979 (Millard and others, 1984; Shuey, 1982; Weimer and others, 1981). An estimated 1,100 tons of tailings and 94 Mgal of liquid were released into the Puerco River (Weimer and others, 1981). The tailings contained large quantities of thorium-230, radium-226, and sulfates. Analysis of a sample of the liquid in the tailing pond indicated concentrations of 210 and 10,225 pCi/L of radium-226 and thorium-230, respectively. The pH of the liquid was 1.9, and the concentration of uranium was about 4 mg/L (Weimer and others, 1981).

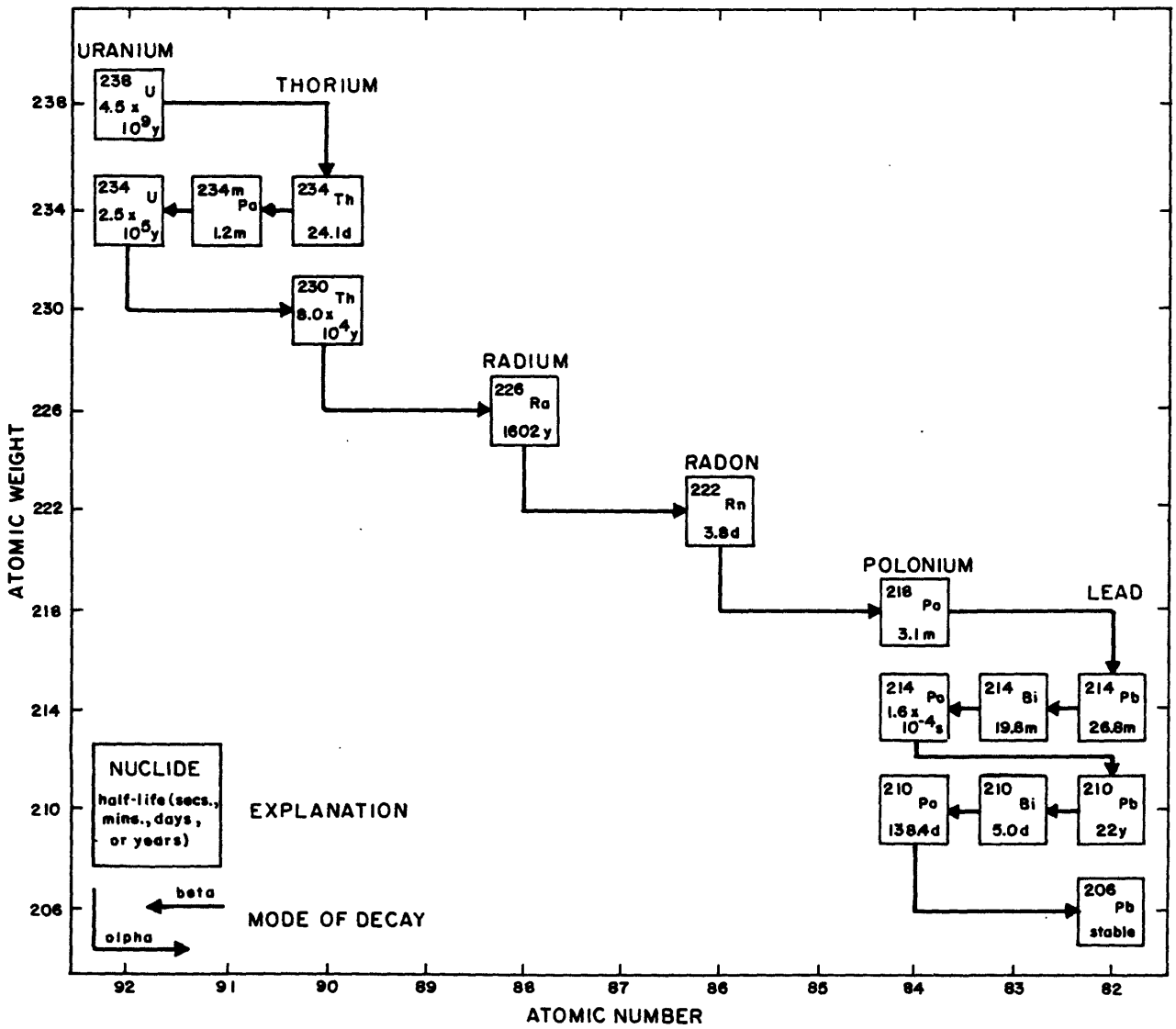


Figure 2.--Dominant mode of radioactive decay of uranium-238 (from Landa, 1980).

Water and sediments were sampled extensively throughout the Puerco River basin after the spill of 1979. Concentrations of thorium-230 in sediments commonly exceeded 30 pCi/g as far as 40 mi downstream from the mine (Weimer and others, 1981). After the spill of 1979, the concentration decreased with time to an average of 9 pCi/g in the same reach (Millard and others, 1984).

Table 1.--Water-quality standards of the U.S. Environmental Protection Agency and (or) the State of Arizona for selected inorganic constituents

[Values are in milligrams per liter of total constituent unless otherwise noted. Dashed indicate that no data are available.]

Constituent	U.S. Environmental Protection Agency standard[3]	Arizona State standards[1] [2]			
		Surface water		Drinking water	
		Irrigation	Livestock	Community	Noncommunity
Arsenic	0.05	2.0	0.2	0.05	0.10
Barium	1	---	---	1	2
Boron	---	1.00	---	---	---
Cadmium	.010	.05	.05	.01	.02
Chloride	[4]250	---	---	([5])	([5])
Chromium (total)	.05	1.00	1.00	.05	.05
Copper	[4]1	5.0	.5	([5])	([5])
Dissolved solids	[4]500	---	---	([5])	([5])
Fluoride	4.0	---	---	[6]1.4-2.4	6.0
Gross alpha (picocuries per liter)	[7]15.00	---	---	[7]15.0	[7]15.0
Gross alpha and gross beta (picocuries per liter)	---	30.0	30.0	---	---
Iron	[4].3	---	---	([5])	([5])
Lead	.05	10.0	.10	.05	.1
Manganese	[4].05	10.0	---	([5])	([5])
Mercury	.002	---	.01	.002	.004
pH (units)	---	4.5-9.0	6.5-9.0	([5])	([5])
Radium-226 and 228 (picocuries per liter)	5.0	5.0	5.0	5.0	5.0
Selenium	.01	.02	.05	.01	.02

Table 1.--Water-quality standards of the U.S. Environmental Protection Agency and (or) the State of Arizona for selected inorganic constituents--Continued

Constituent	U.S. Environmental Protection Agency standard[3]	Arizona State Standards [1] [2]			
		Surface water		Drinking water	
		Irrigation	Livestock	Community	Noncommunity
Silver.....	0.05	-------	---------	0.05	0.10
Sulfate.....	[4]250	-------	---------	([5])	([5])
Uranium.....	[8].035	-------	---------	[8].035	[8].035
Zinc.....	[4]5.0	10.0	25.0	([5])	([5])

[1]McClennan, J.J., 1984, Official compilation of administrative rules and regulations: Phoenix, Arizona, State of Arizona report, Supplement 84-3, p. 68-84.

[2]_____ 1986, Official compilation of administrative rules and regulations: Phoenix, Arizona, State of Arizona report, Advance Supplement 86-4, p. 1-49.

[3]U.S. Environmental Protection Agency, 1986a, Maximum contaminant levels (subpart B of part 141, National Interim Primary Drinking-Water Regulations): U.S. Code of Federal Regulations, Title 40, Parts 100 to 149, revised as of July 1, 1986, p. 524-528.

[4]U.S. Environmental Protection Agency, 1986b, Secondary maximum contaminant levels (Section 143.3 of part 143, National Secondary Drinking-Water Regulations): U.S. Code of Federal Regulations, Title 40, Parts 100 to 149, revised as of July 1, 1986, p. 587-590.

[5]To be monitored.

[6]Fluoride standards are a function of mean annual maximum daily air temperature.

[7]Includes radium-226 but excludes radon and uranium. See figure 3 for the flow-chart regulations on interpretation of gross alpha results.

[8]Lappenbusch, W.L., and Cothern, C.R., 1985, Regulatory development of the interim and revised regulations for radioactivity in drinking water--past and present issues and problems: Health Physics, v. 48, p. 535-551.

On July 16, 1979, radionuclide concentrations in unfiltered samples from the Puerco River were 6,910 pCi/L of uranium, 12,000 pCi/L of thorium-230, 1.0 pCi/L of radium-226, 260 pCi/L of lead-210, and 38 pCi/L of polonium-210 at sites in New Mexico (Millard and others, 1984). The maximum gross alpha radioactivity, or the total radioactivity emitted by radionuclides with the alpha mode of decay (fig. 2) was 130,000 pCi/L on the day of the spill near the Church Rock Mill and 26,000 to 40,000 pCi/L at Gallup (Shuey, 1982). During a flood on July 16, 1986, Chris Shuey (Southwest Research Center, written commun., 1987) measured gross alphas of 1,700 to 2,200 pCi/L in the Puerco River at Lupton, Arizona.

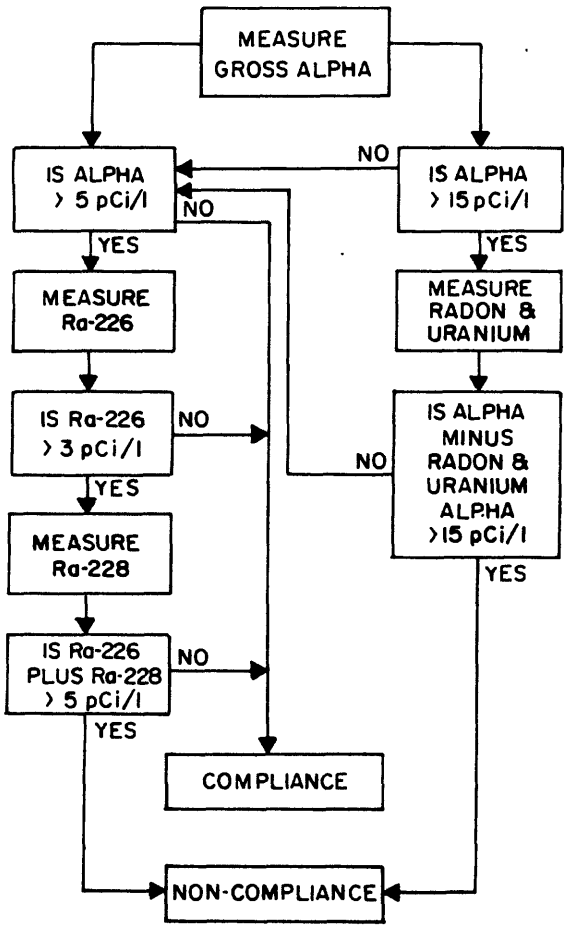


Figure 3.--Flow chart from gross alpha particle activity used in monitoring public water supplies (from Lappenbusch and Cothern, 1985).

After the spill of 1979, shallow wells in the alluvial aquifer of the Puerco River were monitored in New Mexico and Arizona. The wells in New Mexico revealed some contamination by radionuclides (Gallaher and Cary, 1986). Large increases and fluctuations in gross alpha radioactivity, uranium, and sulfates are shown in data from the wells in Arizona (Shuey, 1982). Radionuclides may not have moved through the alluvial aquifer because radionuclides can be sorbed and retained on clay particles (Landa, 1980).

Monitoring of surface water in the Puerco River has revealed contamination by nonradioactive trace elements. Selenium concentrations that were four times the standard of 0.01 mg/L were measured in the Puerco River near the uranium mines (U.S. Environmental Protection Agency, 1975), this level dropped below the standard at Gallup. Concentrations of total arsenic, copper, manganese, lead, and dissolved selenium at five sites in Arizona were above the water-quality standards of the State of Arizona

(table 1) in samples taken in February, April, and June 1985 (Arizona Department of Health Services, 1986). Although these elements are associated with uranium deposits, there is little evidence to link high concentrations of these trace elements with mining activities.

Sampling of surface and ground water in the Puerco River basin has indicated that water-quality standards have been exceeded for several trace elements and radionuclides. The source of the elevated concentrations may be related either to mining activities or to the natural concentrations. No trace element or radionuclide data are available for the period before the mining activities of the 1950's or for the period before the resumption of mining in 1969. On the basis of chemical data from three wells in the alluvium of the Puerco River basin in Arizona, Harrell and Eckel (1939) indicate premining concentrations of 285 mg/L of sulfate, 44 mg/L of chloride, and 754 mg/L of total dissolved solids. The concentrations are similar to concentrations measured in December 1986. (See "Results of Sampling, December 1-6, 1986.")

HYDROGEOLOGIC SETTING AND SAMPLING STRATEGY

In this area of sparse water, the Puerco River provides surface flow for livestock and some agricultural use and recharge of ground water in the alluvium, which is an important source for domestic use. In the area of Chambers and Sanders the population is expected to expand from a few hundred to as much as 5,000 to 10,000 people as a result of the relocation of Navajo Indians into the area. The demographic shift will occur within the next 5 to 15 years. Use of ground water will shift to domestic and public supply as a result of this demographic shift; however, available surface water in the Puerco River will be used for livestock and agriculture and will be supplemented with ground water from the alluvium during periods of no flow.

The geology of the Puerco River basin consists of Paleozoic and Mesozoic sedimentary rocks that dip slightly to the northeast. Steeply-dipping north-south-trending fault zones displace these rocks. The Defiance and Zuni Uplifts occur to the north and east, respectively (Cooley and others, 1969). The rocks of Tertiary and Quaternary age in the area relatively are undeformed. Major uranium and minor coal deposits are within the Jurassic Morrison Formation to the east and northwest of Gallup. Uranium also occurs in the Petrified Forest Member of the Triassic Chinle Formation in the western half of the basin. Natural erosion of exposed bedrock containing uranium and other radionuclides is the source for background radiation in the regional water resources and sediments (Weimer and others, 1981).

Flow in the Puerco River, augmented by mine drainage as well as sewage effluent, occurs primarily in the channel in New Mexico. As flow moves into Arizona, however, the ability of the alluvium to transmit water increases, and the surface flow diminishes as the water infiltrates into the alluvium. Disparate events such as flows entering the Puerco River from undisturbed tributary basins and the mine tailing spill in July 1979 cause wide fluctuations in the concentrations of radionuclides entering

Arizona. Flow events may cause the remobilization of sediments deposited in the aftermath of the tailings spill, providing another mechanism to create wide fluctuations in the concentration of radionuclides carried by the Puerco River into Arizona. It therefore is postulated that the alluvial material along the Puerco River in Arizona has been recharged by water of widely fluctuating quality.

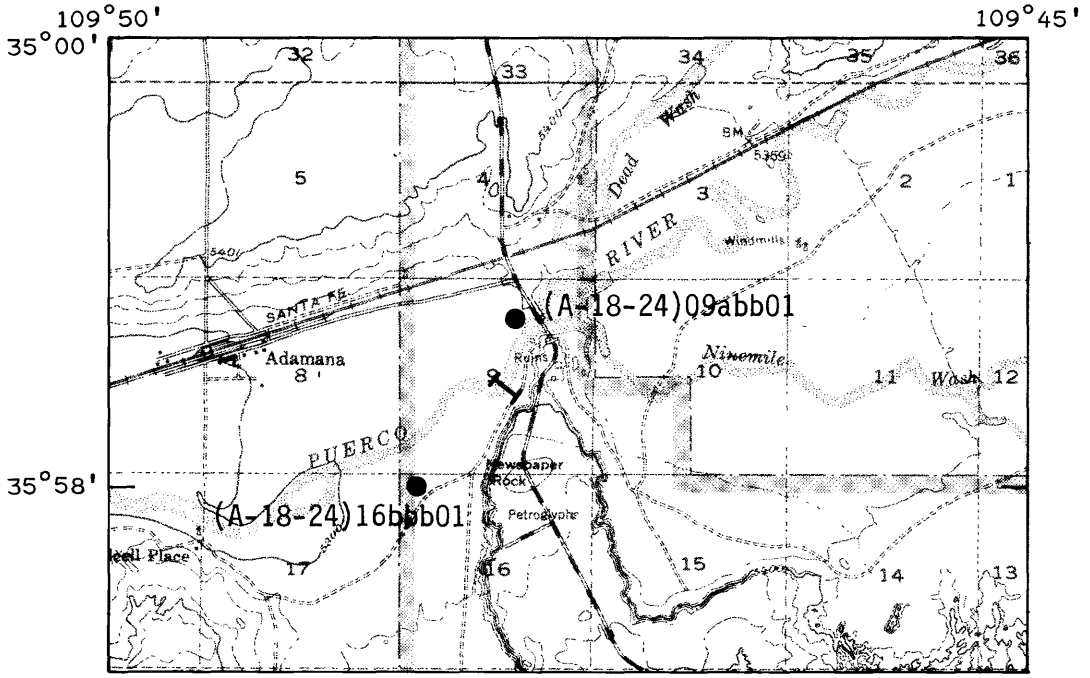
As there are no large withdrawals from the adjacent aquifers in the vicinity of the river, it is probable that there is little movement of water between the alluvial material and the adjacent aquifers under present conditions. Radionuclide contamination of the alluvial material, therefore, is likely to be greatest in areas close to the channel and may diminish with distance from the channel. The fluctuating quality of the recharge waters and the varying distances that surface flow extends along the river during flow events leads to an expectation of fluctuation in contaminant concentrations in the alluvium immediately adjacent to the channel.

A sampling strategy was based on this concept of the character of the system. Five transects along the river through the area of interest were selected (fig. 1). Part of the selection criteria was the availability of wells at varying distances from the river in order to assess the lateral extent of radionuclide distribution at each transect. Analysis of ground water in wells in the five transects determined the distribution of contaminants along the length of the river. Some of the wells that were selected for sampling were chosen because prior sampling offered an opportunity to evaluate changes in contaminant levels over time.

METHODS

Ground-water, perennial-grass, and sediment samples were collected during December 1-6, 1986. Five transects were established (fig. 1), and each site had two to four wells (figs. 4-8). The well-numbering system used in Arizona is shown in figure 9.

Ground water was sampled at 14 wells and one spring to obtain representative samples of water in the alluvial aquifer using U.S. Geological Survey techniques (Wood, 1976). Wells with electric lifts were pumped and monitored until temperature, dissolved oxygen, pH, and conductivity became constant. Samples were taken from spigots as close to the well head as possible. If possible, the well head was isolated from storage tanks to prevent back flow. Windmills were run over several days where possible, and samples were taken when temperature, pH, and conductivity were constant. Begay well, (A-22-31)08aad01), which is a hand-dug well with a cement casing near Lupton (fig. 8), was pumped with an electric-suction pump until temperature, pH, and conductivity were constant.



BASE FROM U.S. GEOLOGICAL SURVEY
PETRIFIED FOREST 1:62,500, 1955

0 ½ 1 2 MILES
0 .5 1 2 KILOMETERS

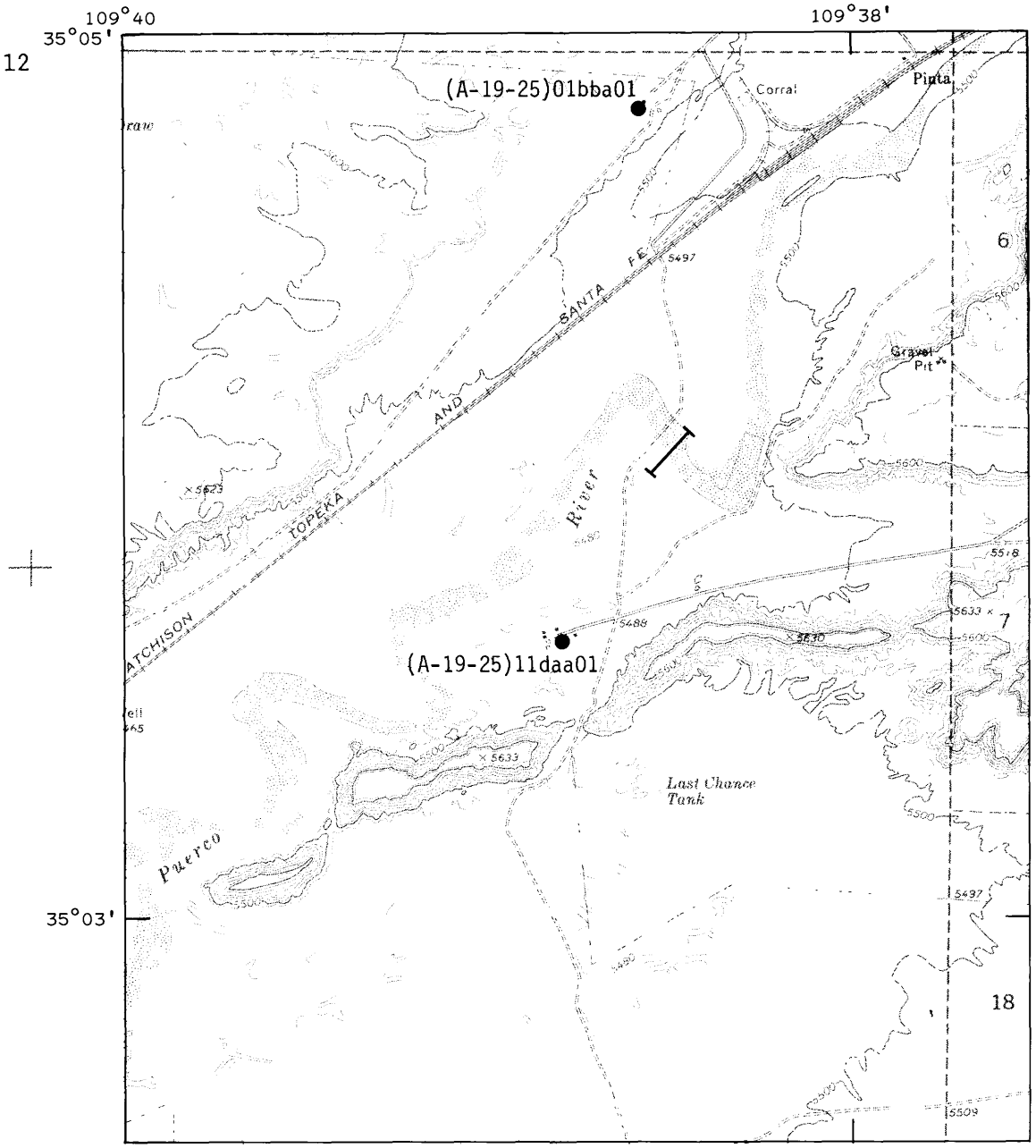
CONTOUR INTERVAL 25 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

E X P L A N A T I O N

(A-18-24)09abb01 ● WELL—Number indicates well location

⊢—⊣ SOIL AND VEGETATION TRANSECT

Figure 4.--Transects and wells at Petrified Forest, Arizona.



BASE FROM U.S. GEOLOGICAL SURVEY
PINTA 1:24,000, 1972

0 ½ 1 MILE
0 .5 1 KILOMETER

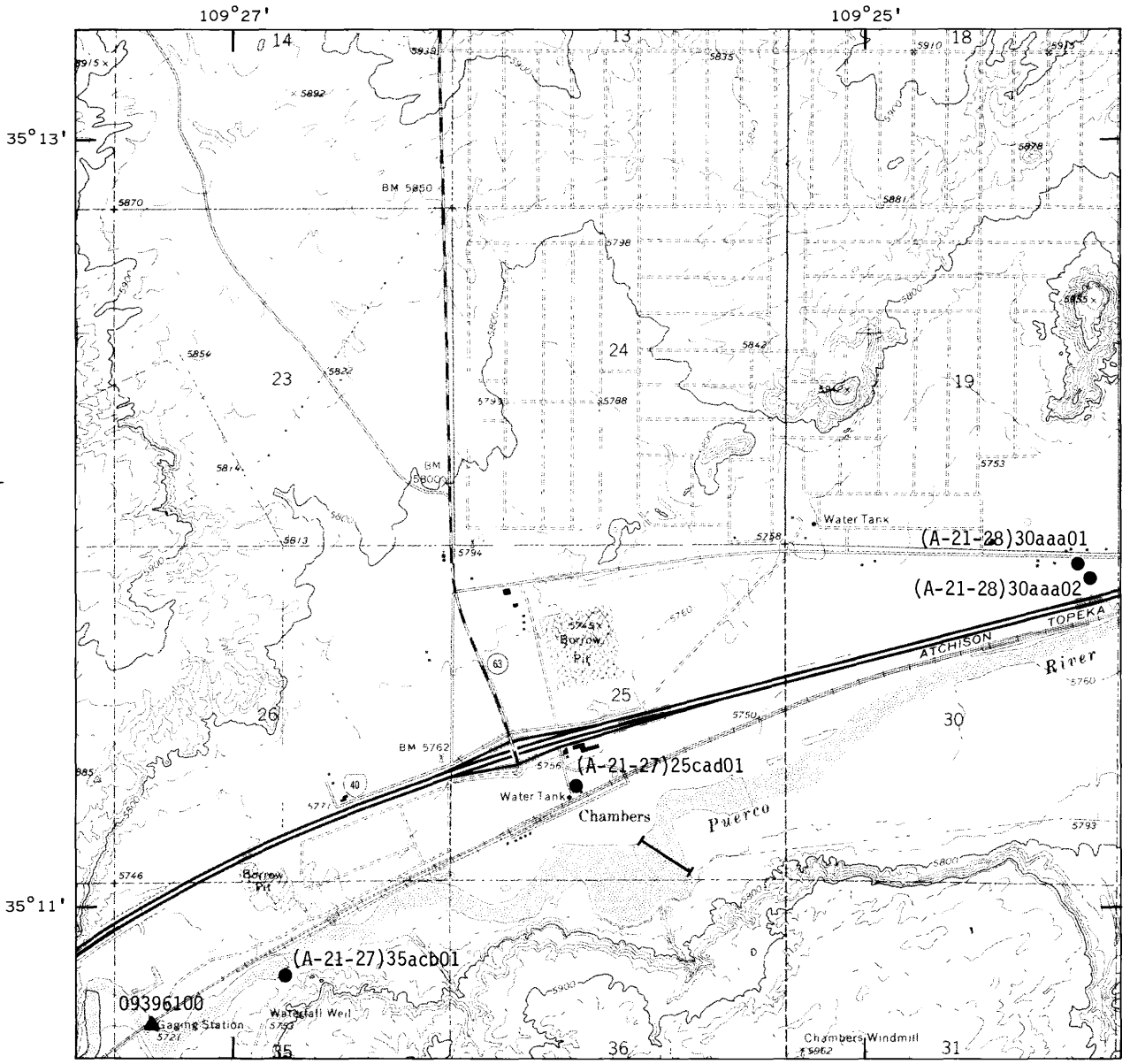
CONTOUR INTERVAL 25 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

EXPLANATION

(A-19-25)11daa01 ● WELL—Number indicates well location

SOIL AND VEGETATION TRANSECT

Figure 5.--Transects and wells at Pinta, Arizona.



BASE FROM U.S. GEOLOGICAL SURVEY
CHAMBERS, 1:24,000, 1971

0 ½ 1 MILE
0 .5 1 KILOMETER

CONTOUR INTERVAL 25 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

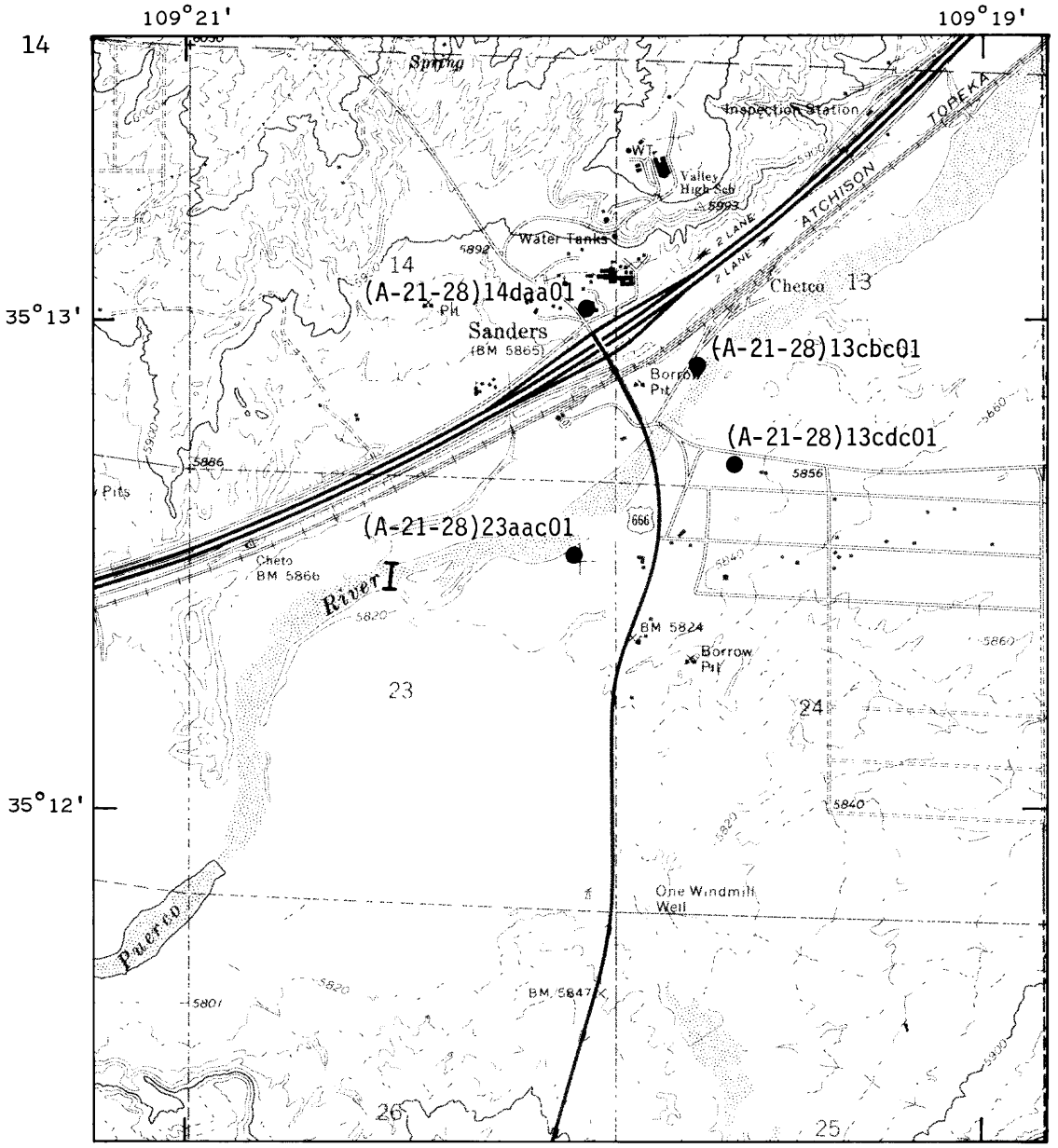
EXPLANATION

(A-21-27)25cad01 ● WELL—Number indicates well location

09396100 ▲ GAGING STATION—Number is gaging-station number

SOIL AND VEGETATION TRANSECT

Figure 6.--Transects and wells at Chambers, Arizona.



BASE FROM U.S. GEOLOGICAL SURVEY
SANDERS 1:24,000, 1971

0 ½ 1 MILE
0 .5 1 KILOMETER

CONTOUR INTERVAL 25 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

EXPLANATION

(A-21-28)13cdc01 ● WELL—Number indicates well location

SOIL AND VEGETATION TRANSECT

Figure 7.--Transects and wells at Sanders, Arizona.

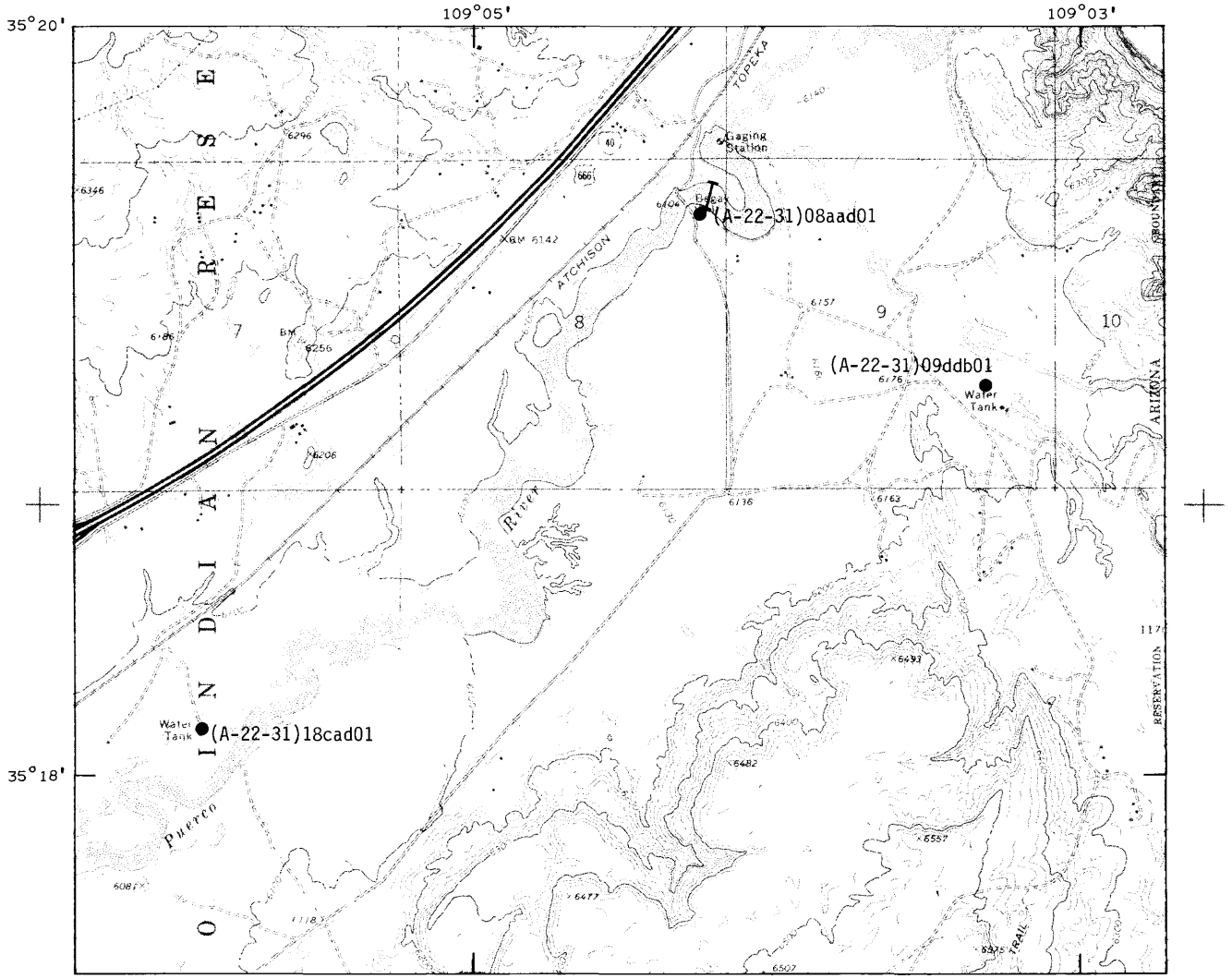
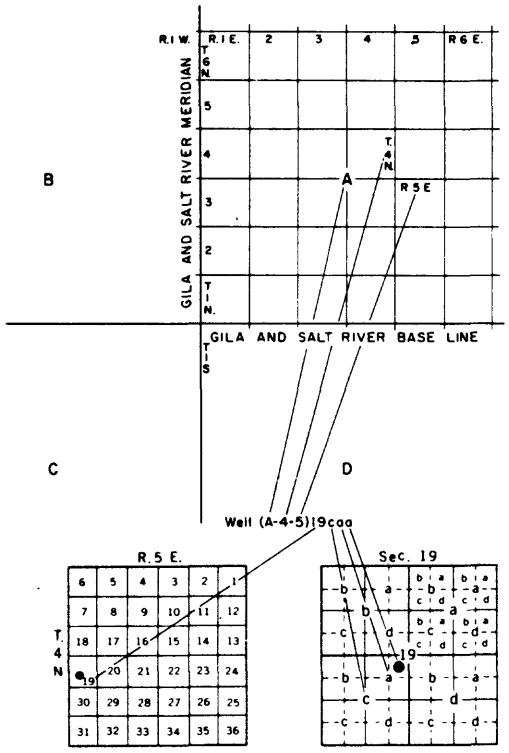


Figure 8.--Transects and wells at Lupton, Arizona.



The well numbers used by the Geological Survey in Arizona are in accordance with the Bureau of Land Management's system of land subdivision. The land survey in Arizona is based on the Gila and Salt River meridian and base line, which divide the State into four quadrants. These quadrants are designated counterclockwise by the capital letters A, B, C, and D. All land north and east of the point of origin is in A quadrant, that north and west in B quadrant, that south and west in C quadrant, and that south and east in D quadrant. The first digit of a well number indicates the township, the second the range, and the third the section in which the well is situated. The lowercase letters a, b, c, and d after the section number indicate the well location within the section. The first letter denotes a particular 160-acre tract, the second the 40-acre tract, and the third the 10-acre tract. These letters also are assigned in a counterclockwise direction, beginning in the northeast quarter. If the location is known within the 10-acre tract, three lowercase letters are shown in the well number. In the example shown, well number (A-4-5)19caa designates the well as being in the NE¼NE¼SW¼ sec. 19, T. 4 N., R. 5 E. Where more than one well is within a 10-acre tract, consecutive numbers beginning with 1 are added as suffixes.

Figure 9.--Well-numbering system in Arizona.

The ground-water sample was then split into subsamples at each well. Subsamples for common ions such as sulfate and chloride were filtered through a 0.45-micron filter and acidified with nitric acid to a pH of less than 2. The common-ion analytical results, therefore, represent the amount of dissolved constituent. Subsamples for trace elements such as arsenic and cadmium were not filtered but were acidified with nitric acid to a pH of less than 2. The trace-element analytical results, therefore, represent the total (dissolved and colloidal) amount of the constituent in the ground water. Subsamples for radionuclide analysis were neither filtered nor acidified in the field, but were acidified in the laboratory approximately 2 weeks after the date of collection. The common-ion and trace-element subsamples were analyzed by the U.S. Geological Survey, Arvada, Colorado; the radionuclide samples were analyzed by Accu-Labs Research, Incorporated,[1] of Wheatridge, Colorado. Three replicate samples were analyzed from the Sanders Elementary School well, (A-21-28)13cbc01, for quality-assurance purposes.

Perennial grass and sediment samples were collected for chemical analysis from representative sites near each cluster of wells (figs. 4-8). Sediment samples were collected from the channel, whereas both sediment and vegetation samples were collected from the flood plain and a terrace adjacent to the channel. The flood plain is discontinuous along the Puerco River, occurs 1 to 3 ft above the channel, and is overtopped by floodwaters during floods that occur one or more times over a period of 2 to 3 years. The terrace, adjacent to the banks of the Puerco River, is about 10 to 30 ft above the channel of the river. There was no evidence of recent flooding of the terrace. Terrace samples, therefore, should represent historic concentrations of radionuclides and trace elements in sediments and vegetation, whereas flood-plain and channel samples represent potentially contaminated conditions.

Perennial grass was sampled by harvesting the above-ground foliage of any species of perennial grass in an area of about 2,000 to 4,000 ft^2. Plants were harvested randomly and composited to form a representative sample from either the flood plain or the terrace. The samples were analyzed for lead-210, polonium-210, radium-226, radium-228, thorium-228, thorium-230, thorium-232, and total uranium. The foliage was nearly air dry at the time of collection. Perennial-grass samples were analyzed by U.S. Testing, Richland, Washington.

Sediment samples were collected in 0.5 to 2.0-ounce samples at regular intervals over a 2,000- to 4,000-square-foot area and composited into 2.5 to 3.0-pound samples. Each sample was divided into two subsamples for radionuclide and trace-element analysis. The radionuclide subsamples were oven dried at 60°C for 48 hours before shipment to the laboratory. The trace-element samples were chilled and maintained at or below 4°C until shipment to prevent spoilage and (or) biological uptake of the trace elements within the sample. Both types of subsamples were analyzed by the U.S. Geological Survey, Branch of Isotope Geology, Lakewood, Colorado.

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[1]Use of firm names in this report is for identification purposes only and does not constitute endorsement by the U.S. Geological Survey.

Radionuclide concentrations that are measured from radioactive decay are expressed in picocuries per liter (pCi/L)± counting error (CE). The CE expressed in Appendix A and the tables containing data is ± one standard deviation of the counting statistics of radioactive decay. Uranium concentrations, which were determined chemically instead of radiometrically, are expressed in micrograms per liter (μg/L). The concentration of uranium in micrograms per liter can be multiplied by 0.667 to obtain a concentration of picocuries per liter. This conversion requires the assumption of a constant activity ratio of uranium-238 to uranium-234, which may not be valid in ground water (Robert Zielinski, U.S. Geological Survey, oral commun., 1987). The method of measurement of gross alpha excluded radon gas from the reported concentrations.

RESULTS OF SAMPLING, DECEMBER 1-6, 1986

Ground-Water Quality

The water quality of wells sampled in this study is characterized by high total dissolved solids, generally high sulfate and manganese concentrations, and variable concentrations of radionuclides and trace elements (table 2 and appendix 1). All of the wells exceed one or more primary standards, secondary standards, or recommended levels of the EPA or the State of Arizona (table 3). For example, all of the wells had a higher concentration of dissolved solids and two-thirds of the wells had higher concentrations of sulfate and manganese than the EPA secondary standards (tables 1 and 3).

The EPA primary standard for gross alpha (table 1, footnote 8; and fig. 3) is 15 pCi/L after uranium is removed and 5 pCi/L for radium-226 plus radium-228. A concentration of 15 pCi/L of gross alpha minus uranium was equaled or exceeded in five of the 14 wells that were sampled (table 3). The lowest concentration of gross alpha after uranium was removed is -2, which reflects inaccuracy in either the laboratory measurement technique or the conversion of concentrations of uranium from micrograms per liter to picocuries per liter (table 4; see "Methods"). The concentrations in the five wells that equal or exceed the standard range from 15 to 21 pCi/L (table 4). The concentration of radium-226 plus radium-228 exceeds 5 pCi/L in well (A-21-28)14daa01, which is a private well in Sanders.

The concentrations of most trace elements for which water-quality standards exist (table 1) are low in the wells that were sampled. The EPA primary standard for cadmium is 0.01 mg/L. Only one well, (A-19-25)11daa01, which is a private well at Pinta, had a concentration of cadmium greater than 0.01 mg/L. Strontium, for which no water-quality standard has been established, ranges in concentration from 0.38 to 3.4 mg/L and averages 1.0 mg/L in the 14 wells and one spring. The concentration of strontium of ground water, however, ranges from 0.01 to 5 mg/L (Stumm and Morgan, 1970).

Table 2.--List of well numbers, locations, and common names as used in this report

Common name	Well number	Unique identification	Transect location	Depth (feet)	Water use
Private windmill	(A-18-24)16bbb01	345757109482001	Petrified Forest	---	Stock
Petrified Forest Well No. 2	(A-18-24)09abb01	345850109475001	Petrified Forest	100	Public supply
Private well	(A-19-25)01bba01	350451109383401	Pinta	54	Private
Private well	(A-19-25)11daa01	350338109384801	Pinta	55	Private
Waterfall Spring	(A-21-27)35acb01	351047109265001	Chambers	---	Unused
ATSF Well No. 3	(A-21-27)25cad01	351119109255301	Chambers	91	Public supply
Private well	(A-21-28)30aaa01	351157109241701	Chambers	40	Private
Private well	(A-21-28)30aaa02	351152109241601	Chambers	---	Private
Private well	(A-21-28)14daa01	351302109195901	Sanders	145	Private
Sanders School well	(A-21-28)13cbc01	351254109194501	Sanders	160	Public supply
Windsong utility well	(A-21-28)23aac01	351224109202401	Sanders	175	Public supply
Private well	(A-21-28)13cdc01	351241109193101	Sanders	111	Private
Navajo windmill 18T-347A	(A-22-31)18cad01	351810109055301	Lupton	108	Stock
Begay well	(A-22-31)08aad01	351933109041701	Lupton	10	Unused
Project 77-712	(A-22-31)09ddb01	351858109031701	Lupton	104	Unused

Radionuclides in Vegetation

The concentrations of radionuclides in vegetation samples generally are low and are not significantly different between samples from the potentially contaminated flood plain and the uncontaminated terrace (table 5). The concentrations of uranium in samples from the flood plain, however, average twice the concentrations measured in samples from the terrace (table 5). Uranium can be absorped into the roots of plants; concentrations of uranium in grasses on soil-covered mine tailings (Dreesen and Williams, 1982) are of the same order of magnitude as the concentrations in table 5.

Chemistry of Sediment Samples

The concentrations of trace elements in sediment samples are similar among the channel, flood plain, and terrace (table 6). Certain rare earths, such as cerium and gallium that normally are associated with mineralized areas, are present in measurable concentrations. The trace elements with the highest concentrations are barium, manganese, and strontium (table 6).

Table 3.--Number of wells that equal or exceed water-quality standards of the U.S. Environmental Protection Agency and (or) State of Arizona

[Samples were taken between December 1-6, 1986]

Constituent	U.S. Environmental Protection Agency standard	Arizona State community standards	Arizona State noncommunity standards
Dissolved solids.	[1]15	([2])	([2])
Sulfate.....	[1]10	([2])	([2])
Manganese.....	[1]10	([2])	([2])
Iron.....	[1] 8	([2])	([2])
Cadmium.....	1	1	0
Chloride.....	[1] 1	([2])	([2])
Radium-226 and 228.....	1	1	1
Uranium.....	([2])	2	2
Gross alpha minus uranium..	5	5	5

[1]Recommended secondary standard (Table. 1).
[2]No standards.

The concentration of radionuclides in the sediment samples are low (table 7) and comparable to the concentration expected in normal sandstones (Chuck Busch, U.S. Geological Survey, oral commun., 1987). The concentrations are not different among samples taken in the channel, flood plain, or terrace. The low concentrations of radionuclides, especially thorium-230, is unusual because concentrations of radionuclides in sediments along the Puerco River were high in 1979 (Weimer and others, 1981). An unfiltered streamflow sample taken in July 1986 had a gross alpha concentration of 2,000 pCi/L (Chris Shuey, Southwest Research Center, written commun., 1987).

Table 4.--Measurements of radioactivity used to assess exceedence of water-quality standards for wells in the Puerco River basin, December 1-6, 1986

[Underlined values indicate that a water-quality standard was exceeded]

Transect	Well name	Well number	Gross alpha (picocuries per liter ± CE)[1]	Gross alpha minus uranium (picocuries per liter)
Lupton	Begay	(A-22-31)08aad01	27±9	12
	Project 77-712	(A-22-31)09ddb01	40±6	<u>15</u>
	18T-347A	(A-22-31)18cad01	28±10	10
Sanders	School	(A-22-18)13cbc01	29±6[2]	<u>16</u>
	Windsong	(A-21-28)23aac01	20±5	<u>15</u>
	Private	(A-21-28)14daa01	34±7	<u>21</u>
	Private	(A-21-28)13cdc01	14±4	7
Chambers	ATSF No. 3	(A-21-27)25cad01	15±5	4
	Private	(A-21-28)30aaa01	27±8	14
	Private	(A-21-28)30aaa02	28±7	13
	Waterfall Spring	(A-21-27)35acb01	9±4	-2
Pinta	Private	(A-19-25)11daa01	42±8	<u>17</u>
	Private	(A-19-25)01bba01	4±4	-2
Petrified Forest	Petrified Forest #2	(A-18-24)09abb01	5±4	4
	Windmill	(A-18-24)16bbb01	23±6	12

[1]CE is counting error expressed as ±1 standard deviation.

[2]Value represents one of three samples. The other two are below the water-quality standards. See Appendix 1.

Table 5.--Radionuclide concentrations in Puerco River grass samples

[Values are in picocuries per gram dry weight except for uranium, which is in micrograms per gram dry weight.]

Constituent	Site	Lupton	Sanders	Chambers	Pinta	Petrified Forest	Average
Lead-210.....	Flood plain	1.33±0.71	2.54±0.84	1.06±0.45	1.85±0.64	1.50±0.64	1.66
	Terrace	1.84±0.71	2.53±0.86	2.43±0.73	1.86±0.69	1.77±0.75	2.09
Polonium-210...	Flood plain	4.74±0.23	2.00±0.07	0.49±0.03	6.24±0.03	1.13±0.05	2.92
	Terrace	2.24±0.16	2.80±0.06	1.40±0.06	1.53±0.06	1.42±0.06	1.88
Radium-226.....	Flood plain	0.21±0.09	0.12±0.07	0.18±0.12	0.20±0.08	0.14±0.09	0.17
	Terrace	0.10±0.09	0.17±0.09	0.37±0.12	0.27±0.09	0.15±0.09	0.21
Radium-228.....	Flood plain	0.18±0.12	0.19±0.13	0.20±0.18	0.21±0.13	0.25±0.16	0.21
	Terrace	0.20±0.16	0.25±0.17	0.18±0.16	0.19±0.13	0.29±0.19	0.22
Thorium-228....	Flood plain	0.11±0.02	0.08±0.02	0.06±0.02	0.09±0.02	0.07±0.02	0.08
	Terrace	0.04±0.01	0.10±0.03	0.12±0.03	0.10±0.02	0.07±0.02	0.09
Thorium-230....	Flood plain	0.05±0.02	0.06±0.02	0.05±0.02	0.05±0.01	0.03±0.01	0.05
	Terrace	0.03±0.01	0.07±0.02	0.05±0.02	0.04±0.01	0.03±0.01	0.04
Thorium-232....	Flood plain	0.06±0.02	0.07±0.02	0.06±0.02	0.06±0.02	0.04±0.01	0.06
	Terrace	0.03±0.01	0.08±0.02	0.08±0.02	0.04±0.02	0.02±0.01	0.05
Uranium.....	Flood plain	0.26	0.37	0.45	1.02	0.22	0.46
	Terrace	0.11	0.21	0.12	0.46	0.18	0.22

TIME SERIES OF HISTORIC WATER QUALITY OF SELECTED WELLS

Historical water-quality data were collected for the wells that were sampled in December 1986. Of the 14 wells and 1 spring sampled, historic data were available for 7 wells and 1 spring (appendix 1). The samples were collected by many different agencies, notably EPA and the Indian Health Service, and were analyzed by several different laboratories. Consequently, the collection techniques that were used and the quality of the data are unknown. Only samples taken in December 1986, and in 1969, 1974, and 1975 were collected and analyzed by the U.S. Geological Survey.

Begay Well

Records for Begay well, (A-22-31)08aad01 (table 2 and fig. 8) include 32 water-quality measurements including measurements for December 1986. Most of the data are for gross alpha, radium-226, chlorides, and sulfates. The time series for gross alpha, chlorides, and sulfates (fig. 10) shows that concentrations fluctuated with time. For example, sulfates rose from about 500 mg/L to 1,200-1,500 mg/L after the spill of 1979 and declined after 1981 (fig. 10). The concentrations of gross alpha, however, fluctuated during the same period. The gross alpha concentrations measured in 1986 are not unusual in comparison with the highest historic concentrations.

Table 6.--Trace elements in Puerco River sediment samples

[Values are in parts per million.]

Constituent	Site	Lupton	Sanders	Chambers	Pinta	Petrified Forest	Average
Arsenic.....	Channel	<10	<10	<40	<10	<10	<10
	Flood plain	<10	<10	<10	<10	<10	<10
	Terrace	<10	<10	<10	<10	<10	<10
Barium.....	Channel	620	600	620	670	710	640
	Flood plain	670	600	590	600	650	620
	Terrace	540	560	610	590	710	600
Cadmium.....	Channel	<2	<2	<2	<2	<2	<2
	Flood plain	<2	<2	<2	<2	<2	<2
	Terrace	<2	<2	<2	<2	<2	<2
Cerium.....	Channel	40	41	48	58	56	49
	Flood plain	38	48	41	36	34	39
	Terrace	35	38	41	31	42	37
Chromium.....	Channel	17	21	21	37	30	25
	Flood plain	21	25	19	18	16	20
	Terrace	20	16	20	15	24	19
Cobalt.....	Channel	5	6	7	8	8	7
	Flood plain	6	7	6	5	4	6
	Terrace	5	5	5	4	6	5
Copper.....	Channel	5	6	7	8	8	7
	Flood plain	6	7	6	5	4	6
	Terrace	5	5	5	4	6	5
Gallium.....	Channel	7	8	9	11	10	9
	Flood plain	8	10	9	7	5	8
	Terrace	7	7	8	7	8	7
Lanthanum.....	Channel	22	22	26	31	30	26
	Flood plain	20	26	22	19	19	21
	Terrace	19	20	22	17	23	20
Lead.....	Channel	18	16	16	66	24	28
	Flood plain	16	17	15	14	13	15
	Terrace	15	14	15	12	16	14
Lithium.....	Channel	14	17	18	25	23	19
	Flood plain	19	20	17	15	15	17
	Terrace	14	15	16	15	18	16
Manganese.....	Channel	240	260	290	360	370	300
	Flood plain	380	300	270	230	250	290
	Terrace	240	230	270	220	330	260

Table 6.--Trace elements in Puerco River sediment samples--Continued

Constituent	Site	Lupton	Sanders	Chambers	Pinta	Petrified Forest	Average
Neodymium.....	Channel	19	20	23	28	27	23
	Flood plain	19	24	20	17	17	19
	Terrace	17	17	21	15	21	18
Nickel.....	Channel	6	8	10	13	12	10
	Flood plain	11	9	8	7	6	8
	Terrace	6	7	9	6	9	8
Silver.....	Channel	<2	<2	<2	<2	<2	<2
	Flood plain	<2	<2	<2	<2	<2	<2
	Terrace	<2	<2	<2	<2	<2	<2
Strontium.....	Channel	120	130	150	180	180	150
	Flood plain	150	140	130	130	130	140
	Terrace	97	110	120	130	140	120
Thorium.....	Channel	5	5	8	10	9	7
	Flood plain	5	7	6	5	5	6
	Terrace	5	5	6	4	6	5
Vanadium.....	Channel	29	35	41	52	47	41
	Flood plain	39	45	37	30	30	36
	Terrace	29	31	34	28	37	32
Yttrium.....	Channel	13	13	16	18	17	15
	Flood plain	12	16	14	11	11	13
	Terrace	11	11	13	10	14	12
Zinc.....	Channel	29	31	36	49	40	37
	Flood plain	27	40	33	24	21	29
	Terrace	26	28	29	22	28	27

Sanders School Well

A total of 22 historic water-quality measurements have been made for the Sanders School Well, (A-21-28)13cbc01 (table 2, fig. 8, and appendix 1). A comparison of concentrations in 1969 with concentrations in 1986 shows a slight rise in chloride and sulfate and little historic fluctuation (fig. 11). Gross alpha, however, fluctuates from 0 to 29 pCi/L (fig. 11).

Private Well at Sanders

A private well, (A-21-28)14daa01 at Sanders, Arizona (table 2, fig. 8), has 8 historic water-quality measurements including the samples collected in December 1986 (appendix 1). The chloride concentrations generally remained constant between 1979 and 1986; whereas the sulfate concentration decreased by about 100 mg/L for the same period (fig. 12). The gross alpha concentration fluctuated, but the concentrations measured in December 1986 are similar to other historic concentrations (fig. 12).

Table 7.--Radionuclide concentrations in Puerco River sediment samples

[Values are in picocuries per gram dry weight, except for total uranium which is in parts per million. Detection limit for total uranium is 0.01 parts per million. Dashes indicate that the isotope was below detection limits of about 0.5 picocuries per gram of thorium-230.]

Constituent	Site	Lupton	Sanders	Chambers	Pinta	Petrified Forest	Accuracy, in percent
Lead-210.....	Channel	0.92	0.92	1.13	1.26	1.21	±3
	Flood plain	1.12	1.28	1.05	0.89	0.92	±3
	Terrace	1.12	1.03	1.39	1.10	1.17	±3
Radium-226.....	Channel	0.74	0.72	0.87	1.02	0.91	±5
	Flood plain	0.66	0.90	0.84	0.67	0.56	±5
	Terrace	0.63	0.62	0.75	0.57	0.79	±5
Radium-228.....	Channel	0.66	0.73	0.77	0.93	0.81	±5
	Flood plain	0.63	0.83	0.77	0.58	0.51	±5
	Terrace	0.72	0.58	0.68	0.51	0.71	±5
Thorium-230....	Channel	0.7	1.4	1.7	1.3	1.0	±20
	Flood plain	0.9	1.6	1.4	0.8	0.9	±20
	Terrace	---	1.2	1.0	1.1	1.2	±20
Thorium-232....	Channel	0.75	0.72	0.87	1.09	0.92	±5
	Flood plain	0.65	0.91	0.80	0.66	0.58	±5
	Terrace	0.58	0.61	0.76	0.59	0.78	±5
Uranium-238....	Channel	0.85	0.96	1.2	1.4	1.1	±10
	Flood plain	0.8	1.2	1.0	1.4	0.7	±10
	Terrace	0.71	0.7	0.78	0.55	0.84	±10
Total uranium..	Channel	2.5	2.6	3.1	3.2	2.8	---
	Flood plain	2.0	3.4	3.4	2.0	1.7	---
	Terrace	1.8	1.8	2.7	1.4	2.2	---

Petrified Forest Well Number 2

The main well for Petrified Forest National Park, (A-18-24)09abb01 (table 2, fig. 5), has 31 historic water-quality measurements including the sampling of December 1986. With the exception of an anomalous concentration of sulfate measured in 1976, the concentrations of gross alpha, chloride, and sulfate are nearly constant in the 11 years of record (fig. 13). Quality of water in this well may represent the historic water quality in the alluvial aquifer (fig. 13).

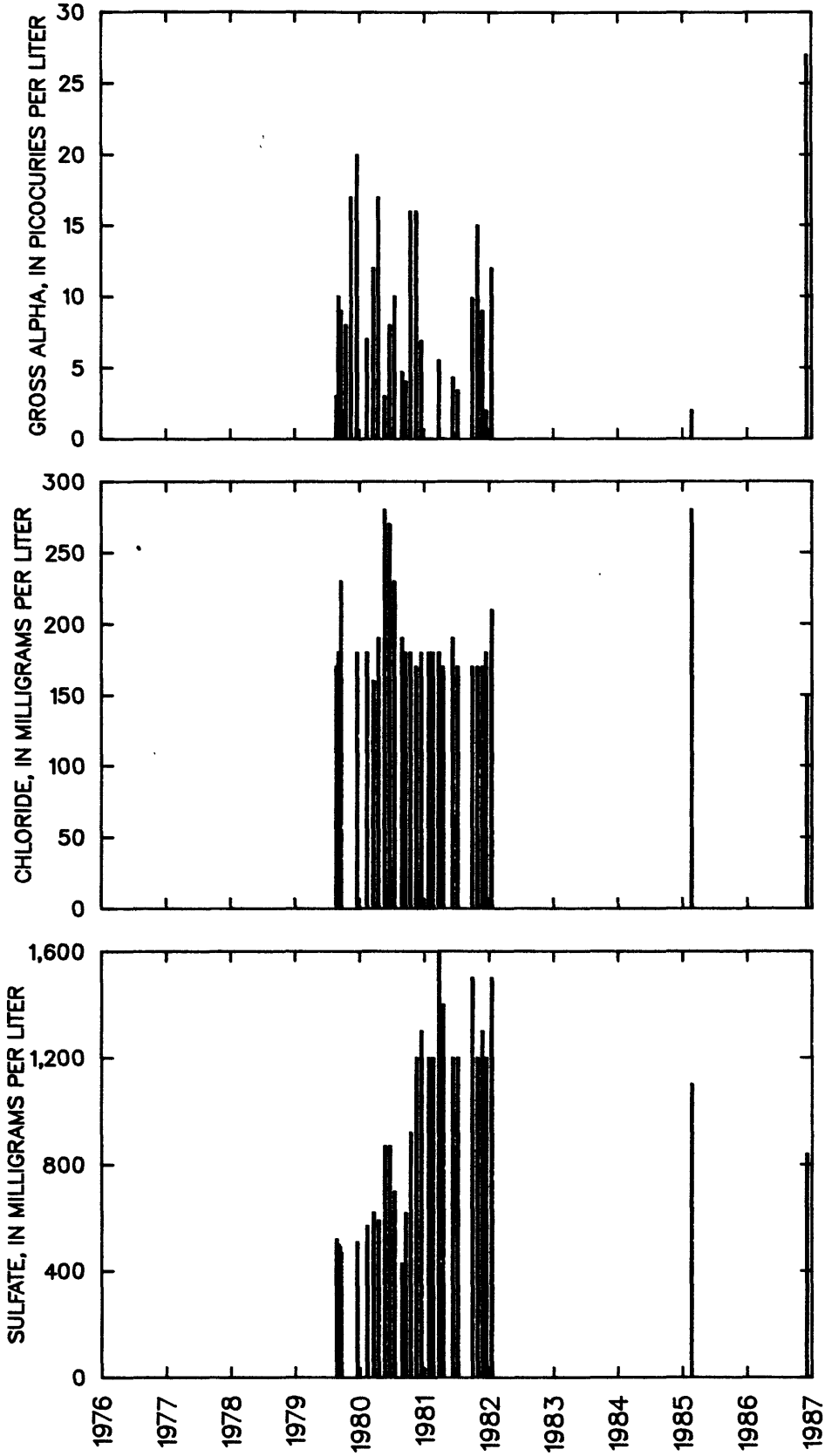

Figure 10.--Time series of selected chemical constituents in Begay well, (A-22-31)08aad01, near Lupton, Arizona.

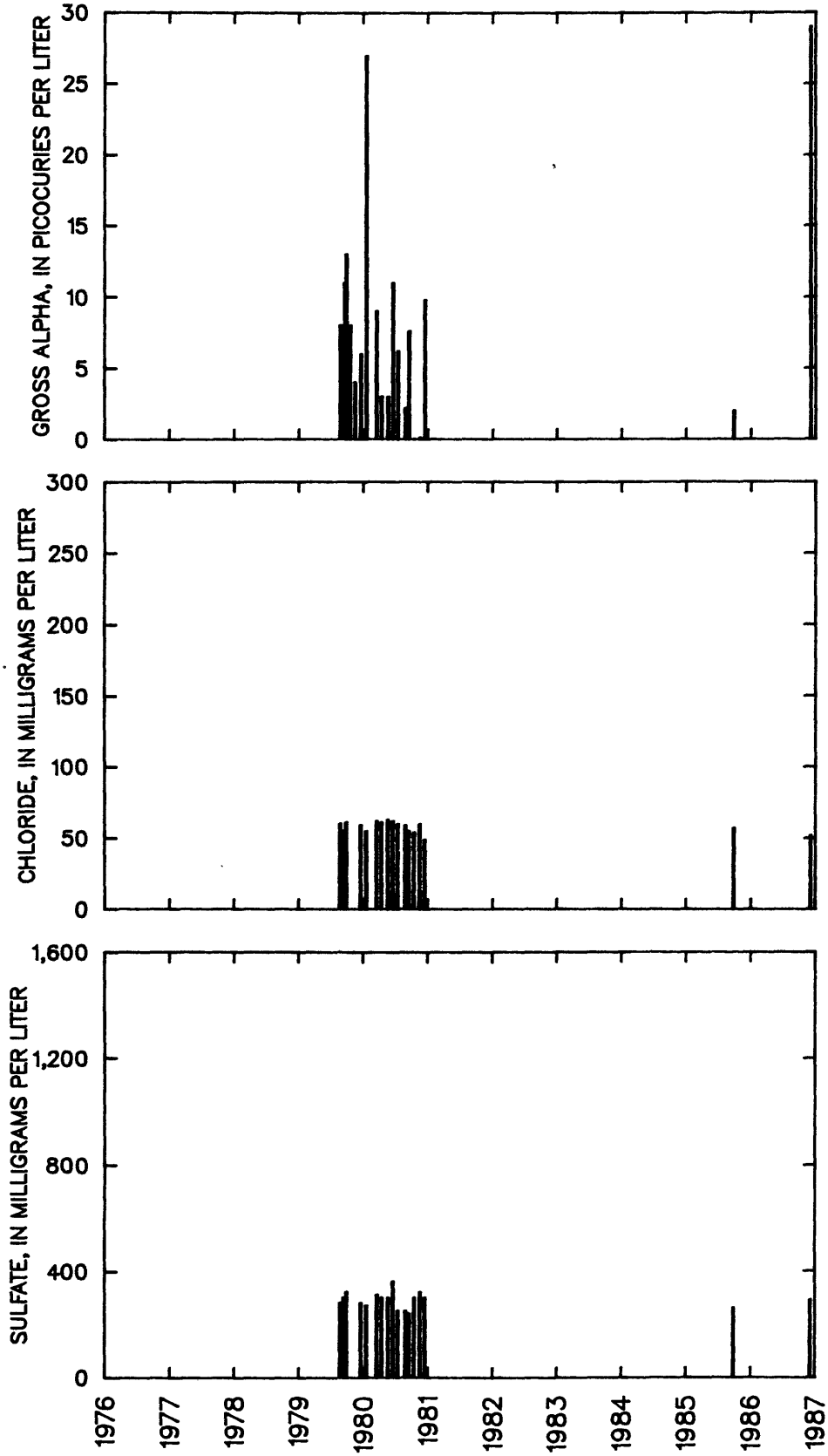

Figure 11.--Time series of selected chemical constituents in the Sanders Elementary School well, (A-21-28)13cbc01.

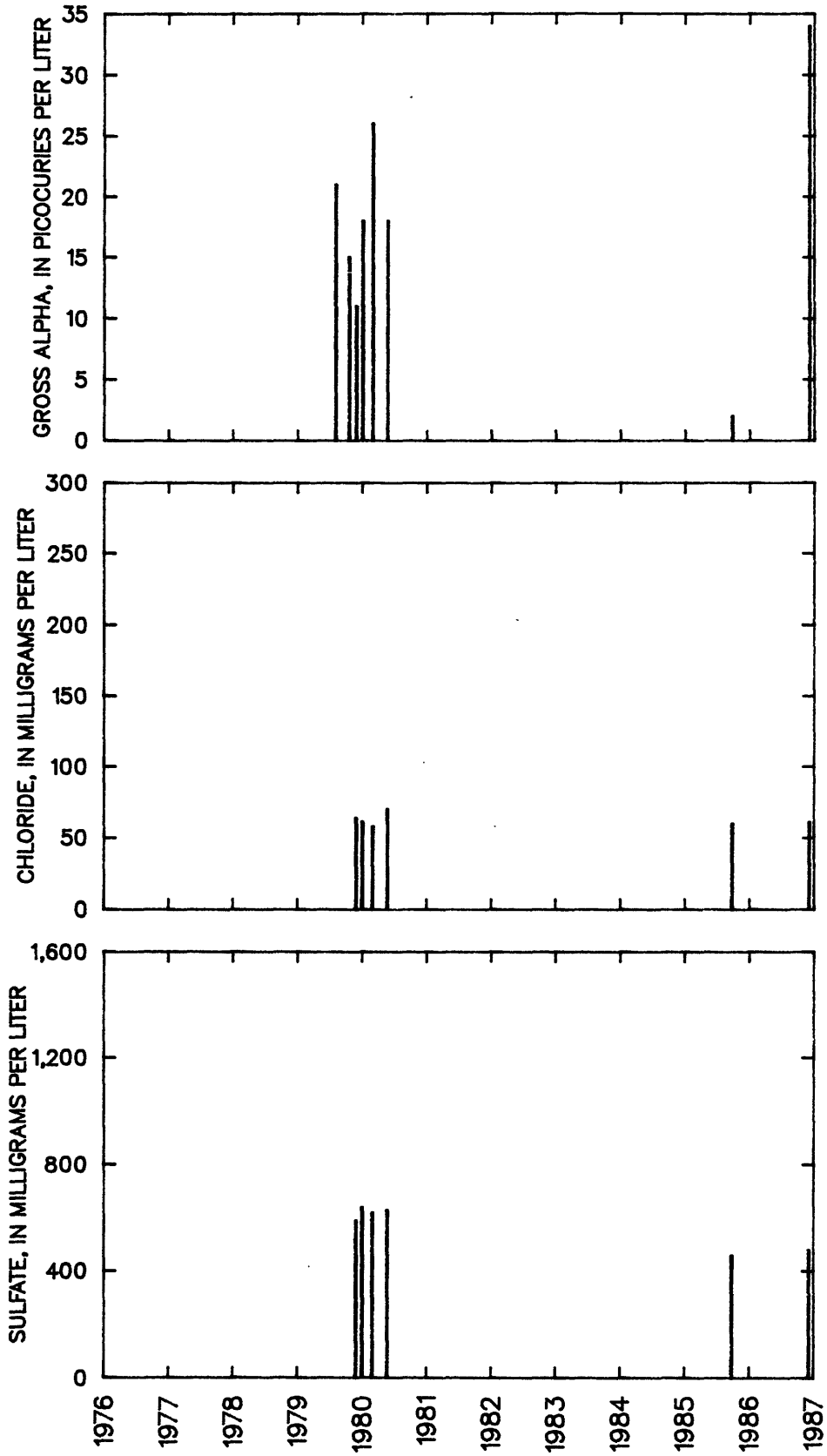

Figure 12.--Time series of selected chemical constituents in a private well, (A-21-28)14daa01, at Sanders, Arizona.

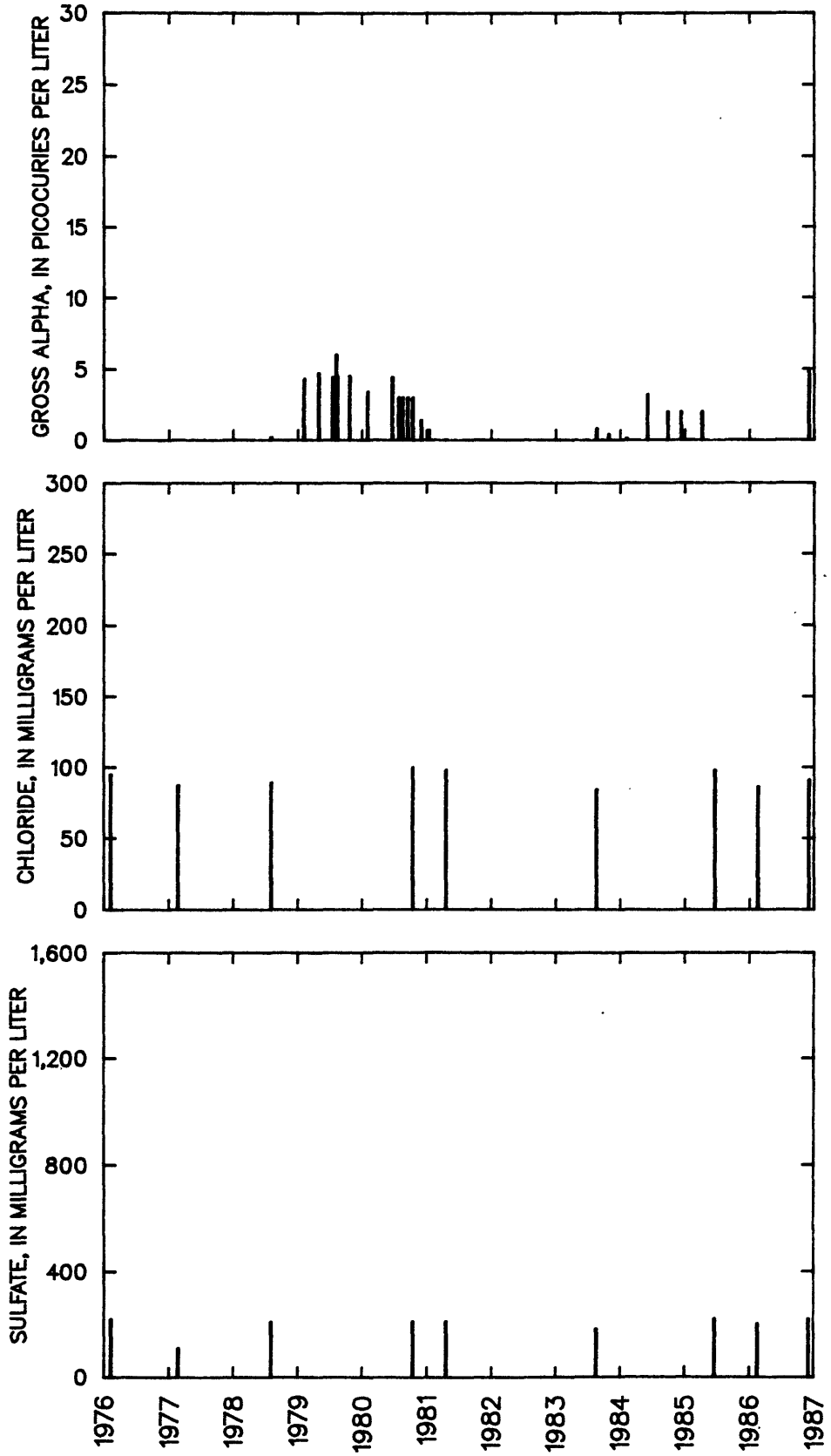

Figure 13.--Time series of selected chemical constituents in Petrified Forest well number 2, (A-18-24)09abb01, Petrified Forest National Park, Arizona.

WATER QUALITY OF THE PUERCO RIVER AT CHAMBERS, ARIZONA

Samples of water-quality in surface water were collected at many sites along the Puerco River (Arizona Department of Health Services, 1986). A total of 29 water-quality samples have been collected at or near the gaging station at Chambers (appendix B). Of these samples, samples collected in 1982, 1983, and 1984 were analyzed by the U.S. Geological Survey.

The historic data indicate high concentrations of several trace elements and radionuclides. The highest concentrations are associated with high suspended-sediment concentrations (appendix B; Chris Shuey, Southwest Research Center, written commun., 1987). For example, total arsenic and total copper concentrations measured in 1985 exceed water-quality standards of the State of Arizona (Arizona Department of Health Services, 1986). The total gross alpha ranges from 12 to 11,200 pCi/L, and concentrations commonly range from 200 to 2,000 pCi/L (appendix B). The total concentration of dissolved gross alpha fluctuates from <3 to 320 pCi/L. The concentration of gross beta ranges from 45 to 4,500 pCi/L (appendix B).

The time series for total uranium, chloride, and sulfates fluctuates in 1979 apparently as a result of the spill of 1979 (fig. 14). After 1980, the concentrations of these constituents generally is stable. For example, the concentration of total uranium is about 0.1 mg/L between 1980 and 1985.

SUMMARY

Ground water, perennial grass, and sediments were sampled for trace elements and (or) radionuclides in the Puerco River basin in northeastern Arizona. Ground water was sampled in 14 wells and 1 spring at varying distances from the Puerco River. Historic water-quality data were used to illustrate changes in water quality with time in four of the wells. Perennial grass was sampled from a flood plain that is periodically inundated by floodwaters and from a terrace that represents uncontaminated conditions. Sediments were collected from the channel, the flood plain, and the terrace. Historic water-quality data for the Puerco River at Chambers were included for comparison.

The U.S. Environmental Protection Agency primary water-quality standards are 15 pCi/L for gross alpha minus uranium and 5 pCi/L for radium-226 plus radium-228. The concentration of gross alpha minus uranium equals or exceeds 15 pCi/L in 5 of 14 wells sampled. The concentration of radium-226 plus radium-228 exceeds of 5 pCi/L in one well. The concentration of uranium exceeds a recommended limit of 0.035 mg/L in two wells. Large fluctuations were observed in the time series for gross alpha concentrations in four wells.

Perennial grass and sediment samples have low concentrations of radionuclides. The perennial grass samples showed no differences between samples taken from the flood plain or the terrace. Sediment samples showed no difference among samples from the channel, flood plain, or terrace. No unusual concentrations of trace elements were measured in the sediment samples.

Water quality of surface water in the Puerco River at Chambers varied as a function of the suspended-sediment concentration. Concentrations of total gross alpha have fluctuated from 12 to 11,200 pCi/L. Concentrations of total gross beta fluctuated from 45 to 4,500 pCi/L. In many samples, trace-element and radionuclide concentrations exceeded water-quality standards of the State of Arizona.

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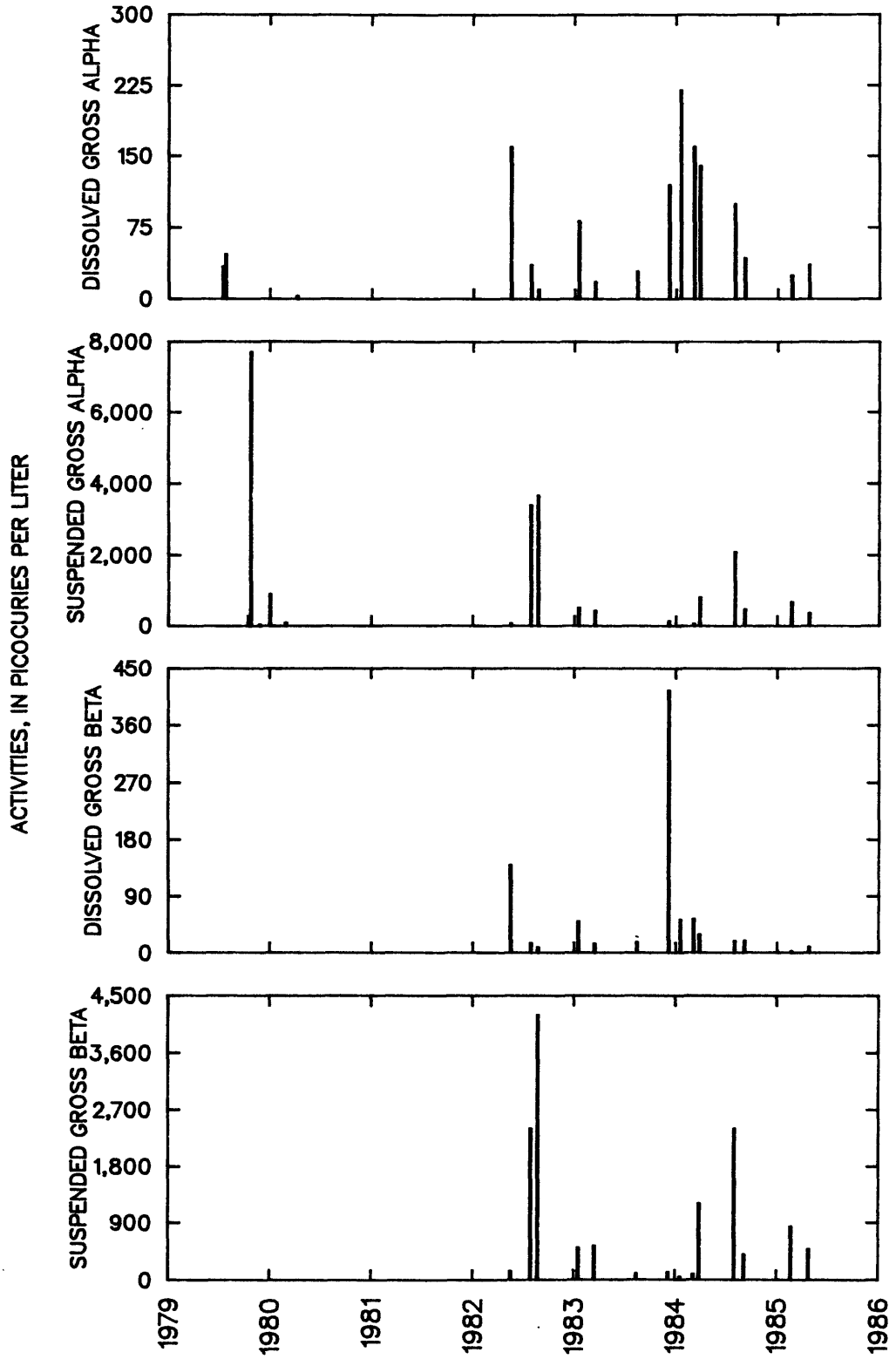
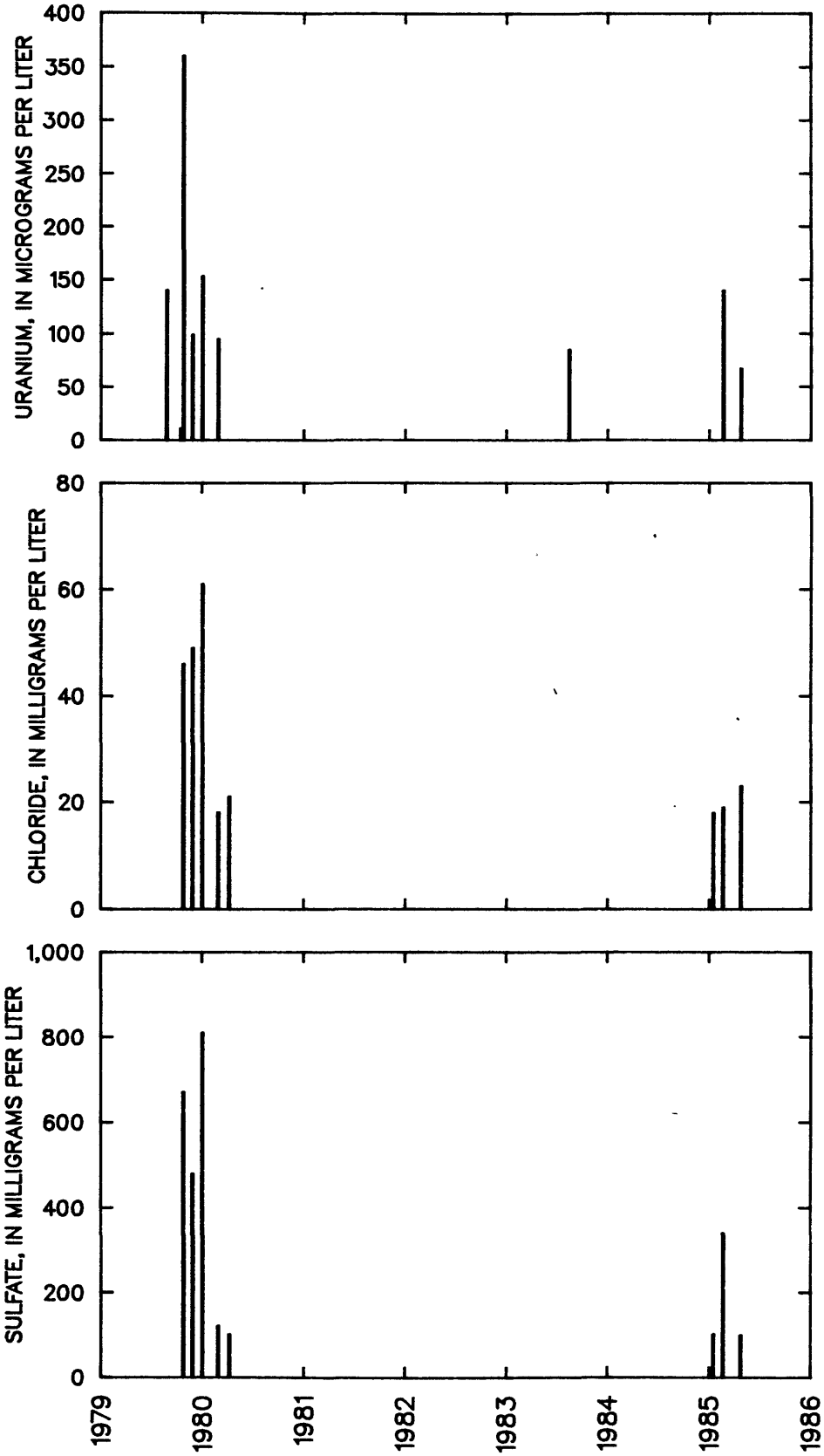


Figure 14.--Time series of selected chemical constituents in the Puerco River at Chambers, Arizona.



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APPENDIX A

Water-quality data for selected wells in Puerco River study area

Well name: Begay well.
Site identification: 351933109041701.
Altitude of land surface: 6,105 feet above National Geodetic Vertical Datum (NGVD) of 1929, determined from U.S. Geological Survey topographic maps.
Date well constructed: 1960's
Transect: Lupton.
Local well number: (A-22-31)08aad01.
Depth of well: 10.1 feet.
Water level: 6.9 feet.
Primary use: Unused.
Casing type: Concrete.

DATE	SPECIFIC CONDUCTANCE (US/CM)	PH (STANDARD UNITS)	PH LAB (STANDARD UNITS)	CALCIUM TOTAL RECOVERABLE (MG/L AS CA)	CALCIUM DISSOLVED (MG/L AS CA)	MAGNESIUM, TOTAL RECOVERABLE (MG/L AS MG)	MAGNESIUM, DISSOLVED (MG/L AS MG)	SODIUM, TOTAL RECOVERABLE (MG/L AS NA)	SODIUM, DISSOLVED (MG/L AS NA)	SODIUM ADSORPTION RATIO
APR 1968										
15.....	1,870	--	7.60	--	64	--	14	--	340	10
AUG 1979										
23.....	--	--	--	--	--	--	--	--	--	--
SEPT										
04.....	2,400	8.00	--	45	--	15	--	380	--	--
10.....	--	--	--	--	--	--	--	--	--	--
18.....	--	--	--	--	--	--	--	--	--	--
27.....	--	--	--	--	--	--	--	--	--	--
OCT										
15.....	--	--	--	--	--	--	--	--	--	--
NOV										
14.....	--	--	--	--	--	--	--	--	--	--
DEC										
18.....	--	--	--	--	--	--	--	--	--	--
FEB 1980										
12.....	--	--	--	--	--	--	--	--	--	--
MAR										
19.....	--	--	--	--	--	--	--	--	--	--
APR										
16.....	--	--	--	--	--	--	--	--	--	--
MAY										
21.....	--	--	--	--	--	--	--	--	--	--
JUN										
17.....	--	--	--	--	--	--	--	--	--	--
JUL										
15.....	--	--	--	--	--	--	--	--	--	--
AUG										
27.....	--	--	--	--	--	--	--	--	--	--

APPENDIX A

Water-quality data for selected wells in Puerco River study area--Continued

Well name: Begay well. Transect: Lupton.

DATE	POTASSIUM, TOTAL RECOVERABLE (MG/L AS K)	POTASSIUM, DISSOLVED (MG/L AS K)	BICARBONATE WH WAT TOTAL FIELD (MG/L AS HCO3)	CARBONATE WH WAT TOTAL FIELD (MG/L AS CO3)	SULFATE (MG/L AS SO4)	SULFATE DISSOLVED (MG/L AS SO4)	CHLORIDE, DISSOLVED (MG/L AS CL)	FLUORIDE, TOTAL (MG/L AS F)	FLUORIDE, DISSOLVED (MG/L AS F)	ALUMINUM, TOTAL RECOVERABLE (UG/L AS AL)
APR 1968										
15.....	--	3.1	560	0	--	240	180	--	0.8	--
AUG 1979										
23.....	--	--	--	--	520	--	170	--	--	--
SEPT										
04.....	4.4	--	--	--	500	--	180	--	--	<200
10.....	--	--	--	--	490	--	170	--	--	--
18.....	--	--	--	--	470	--	23	--	--	--
27.....	--	--	--	--	--	--	--	--	--	--
OCT										
15.....	--	--	--	--	--	--	--	--	--	--
NOV										
14.....	--	--	--	--	--	--	--	--	--	--
DEC										
18.....	--	--	--	--	510	--	180	--	--	--
FEB 1980										
12.....	--	--	--	--	570	--	180	--	--	--
MAR										
19.....	--	--	--	--	620	--	160	--	--	--
APR										
16.....	--	--	--	--	590	--	190	--	--	--
MAY										
21.....	--	--	--	--	870	--	280	--	--	--
JUN										
17.....	--	--	--	--	870	--	270	--	--	--
JUL										
15.....	--	--	--	--	70	--	230	--	--	--
AUG										
27.....	--	--	--	--	430	--	190	--	--	--

APPENDIX A

Water-quality data for selected wells in Puerco River study area--Continued

Well name: Begay well. Transect: Lupton.

DATE	ANTIMONY, TOTAL (UG/L AS SB)	ARSENIC TOTAL (UG/L AS AS)	BARIUM, TOTAL RECOVERABLE (UG/L AS BA)	BERYLLIUM, TOTAL RECOVERABLE (UG/L AS BE)	CADMIUM TOTAL RECOVERABLE (UG/L AS CD)	CHROMIUM, TOTAL RECOVERABLE (UG/L AS CR)	COPPER, TOTAL RECOVERABLE (UG/L AS CU)	IRON, TOTAL RECOVERABLE (UG/L AS FE)	LEAD, TOTAL RECOVERABLE (UG/L AS PB)	MANGANESE, TOTAL RECOVERABLE (UG/L AS MN)
APR 1968										
15.....	--	--	--	--	--	--	--	90	--	0
AUG 1979										
23.....	--	--	--	--	--	--	--	--	--	--
SEPT										
04.....	<600	<5	<100	<5.0	<5	<10	<20	310	<30	<10
10.....	--	--	--	--	--	--	--	--	--	--
18.....	--	--	--	--	--	--	--	--	--	--
27.....	--	--	--	--	--	--	--	--	--	--
OCT										
15.....	--	--	--	--	--	--	--	--	--	--
NOV										
14.....	--	--	--	--	--	--	--	--	--	--
DEC										
18.....	--	--	--	--	--	--	--	--	--	--
FEB 1980										
12.....	--	--	--	--	--	--	--	--	--	--
MAR										
19.....	--	--	--	--	--	--	--	--	--	--
APR										
16.....	--	--	--	--	--	--	--	--	--	--
MAY										
21.....	--	--	--	--	--	--	--	--	--	--
JUN										
17.....	--	--	--	--	--	--	--	--	--	--
JUL										
15.....	--	110	<100	--	<4	<10	--	--	50	--
AUG										
27.....	--	20	--	--	--	--	--	--	--	--

APPENDIX A

Water-quality data for selected wells in Puerco River study area--Continued

Well name: Begay well. Transect: Lupton.

DATE	MOLYBDENUM, TOTAL RECOVERABLE (UG/L AS MO)	NICKEL, TOTAL RECOVERABLE (UG/L AS NI)	SELENIUM, TOTAL (UG/L AS SE)	SILVER, TOTAL RECOVERABLE (UG/L AS AG)	VANADIUM, TOTAL (UG/L AS V)	ZINC, TOTAL RECOVERABLE (UG/L AS ZN)	ALPHA, TOTAL (PCI/L)	ALPHA, TOTAL, COUNTING ERROR (PCI/L)	BETA, TOTAL (PCI/L)	BETA, TOTAL, COUNTING ERROR (PCI/L)
APR 1968										
15.....	--	--	--	--	--	--	--	--	--	--
AUG 1979										
23.....	--	--	--	--	--	--	<3.0	--	--	--
SEPT										
04.....	<100	<20	<5	<20	<10	<60	10	4.0	6.0	5.0
10.....	--	--	--	--	--	--	9.0	3.0	--	--
18.....	--	--	--	--	--	--	9.0	2.0	--	--
27.....	--	--	--	--	--	--	<2.0	--	--	--
OCT										
15.....	--	--	--	--	--	--	8.0	2.0	--	--
NOV										
14.....	--	--	--	--	--	--	17	4.0	--	--
DEC										
18.....	--	--	--	--	--	--	20	2.0	--	--
FEB 1980										
12.....	--	--	--	--	--	--	7.0	1.0	--	--
MAR										
19.....	--	--	--	--	--	--	12	3.0	--	--
APR										
16.....	--	--	--	--	--	--	17	3.0	--	--
MAY										
21.....	--	--	--	--	--	--	<3.0	--	--	--
JUN										
17.....	--	--	--	--	--	--	8.0	0.8	--	--
JUL										
15.....	--	--	73	<10	--	--	10	1.0	--	--
AUG										
27.....	--	--	11	--	--	--	<4.7	--	--	--

Water-quality data for selected wells in Puerco River study area--Continued

Well name: Begay well. Transect: Lupton.

DATE	LEAD 210 DISSOLVED (PCI/L)	LEAD 210 DISSOLVED COUNT ERROR (PCI/L)	POLONIUM 210 DISSOLVED (PCI/L)	POLONIUM 210 DISSOLVED COUNTING ERROR (PCI/L)	RADIUM 226, DISSOLVED (PCI/L)	RADIUM 226 DISS. COUNTING ERROR (PCI/L)	THORIUM 230 DISSOLVED (PCI/L)	THORIUM 230 DISSOLVED COUNT ERROR (PCI/L)	URANIUM NATURAL TOTAL (UG/L AS U)	URANIUM NATURAL TOTAL (PCI/L AS U)
APR 1968										
15.....	--	--	--	--	--	--	--	--	--	--
AUG 1979										
23.....	--	--	--	--	--	--	--	--	--	--
SEPT										
04.....	0	0.7	0	0.1	<0.3	--	0	0.2	8.0	--
10.....	--	--	--	--	<0.3	--	--	--	--	--
18.....	--	--	--	--	<0.3	--	--	--	--	--
27.....	--	--	--	--	--	--	--	--	--	--
OCT										
15.....	--	--	--	--	<0.3	--	--	--	--	--
NOV										
14.....	--	--	--	--	<0.3	--	--	--	--	13
DEC										
18.....	--	--	--	--	<0.3	--	--	--	--	12
FEB 1980										
12.....	--	--	--	--	--	--	--	--	--	--
MAR										
19.....	--	--	--	--	<0.3	--	--	--	--	12
APR										
16.....	--	--	--	--	--	--	--	--	--	--
MAY										
21.....	--	--	--	--	--	--	--	--	--	--
JUN										
17.....	--	--	--	--	<0.3	--	--	--	--	--
JUL										
15.....	--	--	--	--	0	0.3	--	--	--	--
AUG										
27.....	--	--	--	--	--	--	--	--	--	--

Water-quality data for selected wells in Puerco River study area--Continued

Well name: Begay well. Transect: Lupton.

DATE	SULFATE (MG/L AS SO4)	CHLORIDE, DISSOLVED (MG/L AS CL)	ARSENIC TOTAL (UG/L AS AS)	BARIUM, TOTAL RECOVERABLE (UG/L AS BA)	CADMIUM TOTAL RECOVERABLE (UG/L AS CD)	CHROMIUM, TOTAL RECOVERABLE (UG/L AS CR)	COPPER, TOTAL RECOVERABLE (UG/L AS CU)	LEAD, TOTAL RECOVERABLE (UG/L AS PB)
SEP 1980								
16.....	620	180	18	40	<9	<10	--	30
OCT								
15.....	920	180	14	300	<4	<10	40	40
NOV								
17.....	1,200	170	--	--	--	--	--	--
DEC								
15.....	1,300	180	--	--	--	--	--	--
JAN 1981								
26.....	1,200	180	--	--	--	--	--	--
FEB								
18.....	1,200	180	--	--	--	--	--	--
MAR								
24.....	1,600	180	--	--	--	--	--	--
APR								
17.....	1,400	170	--	--	--	--	--	--
JUN								
10.....	1,200	190	--	--	--	--	--	--
JUL								
08.....	1,200	170	--	--	--	--	--	--
SEP								
28.....	1,500	170	--	--	--	--	--	--
OCT								
28.....	1,200	170	--	--	--	--	--	--
NOV								
28.....	1,300	170	--	--	--	--	--	--
DEC								
14.....	1,200	180	--	--	--	--	--	--
JAN 1982								
15.....	1,500	210	--	--	--	--	--	--

Water-quality data for selected wells in Puerco River study area--Continued

Well name: Begay well. Transect: Lupton.

DATE	SELENIUM, TOTAL (UG/L AS SE)	SILVER, TOTAL RECOVERABLE (UG/L AS AG)	ALPHA, TOTAL (PCI/L)	ALPHA, TOTAL, COUNTING ERROR (PCI/L)	RADIUM 226, DISSOLVED (PCI/L)	RADIUM 226 DISS. COUNTING ERROR (PCI/L)	URANIUM NATURAL TOTAL (UG/L AS U)	URANIUM NATURAL TOTAL (PCI/L AS U)
SEP 1980								
16.....	10	<10	4.0	2.5	0.4	0.2	--	--
OCT								
15.....	<5	<10	16	10	0.4	0.2	--	--
NOV								
17.....	--	--	16	10	0.4	0.2	--	25
DEC								
15.....	--	--	6.9	6.6	0.5	0.3	--	--
JAN 1981								
26.....	--	--	0	7.3	--	--	--	--
FEB								
18.....	--	--	0	2.6	--	--	--	--
MAR								
24.....	--	--	5.5	10	<0.3	--	--	--
APR								
17.....	--	--	0	7.4	<0.3	--	--	--
JUN								
10.....	--	--	4.3	10	0	0.3	--	15
JUL								
08.....	--	--	3.4	8.4	0	0.5	--	--
SEP								
28.....	--	--	9.9	6.5	0	0.5	--	--
OCT								
28.....	--	--	15	10	0	0.5	0.0	14
NOV								
28.....	--	--	9.0	8.0	0	0.5	--	12
DEC								
14.....	--	--	<2.0	--	--	--	--	--
JAN 1982								
15.....	--	--	12	--	--	--	--	--

Water-quality data for selected wells in Puerco River study area--Continued

Well name: Begay well. Transect: Lupton.

DATE	SPECIFIC CONDUCTANCE (US/CM)	PH (STANDARD UNITS)	PH LAB (STANDARD UNITS)	TEMPERATURE (°C)	TURBIDITY (NTU)	BAROMETRIC PRESSURE (MM OF HG)	OXYGEN, DISSOLVED (MG/L)	OXYGEN, DISSOLVED (PERCENT SATURATION)	CALCIUM TOTAL RECOVERABLE (MG/L AS CA)	CALCIUM DISSOLVED (MG/L AS CA)	MAGNESIUM, TOTAL RECOVERABLE (MG/L AS MG)
FEB 1985											
21.....	3,640	7.50	--	5.0	--	--	--	--	170	--	40
DEC 1986											
03.....	2,550	7.80	7.80	11.0	21	611	8.3	95	--	90	--

DATE	MAGNESIUM, DISSOLVED (MG/L AS MG)	SODIUM, TOTAL RECOVERABLE (MG/L AS NA)	SODIUM, DISSOLVED (MG/L AS NA)	SODIUM ADSORPTION RATIO	POTASSIUM, TOTAL RECOVERABLE (MG/L AS K)	POTASSIUM, DISSOLVED (MG/L AS K)	ALKALINITY WH WAT TOTAL FIELD (MG/L AS CACO3)	ALKALINITY WH WAT TOTAL LAB (MG/L AS CACO3)	SULFATE (MG/L AS SO4)	SULFATE DISSOLVED (MG/L AS SO4)	CHLORIDE, DISSOLVED (MG/L AS CL)
FEB 1985											
21.....	--	660	--	--	9.6	--	--	--	1,100	--	280
DEC 1986											
03.....	20	--	470	12	--	3.2	341	342	--	840	150

DATE	FLUORIDE, TOTAL (MG/L AS F)	FLUORIDE, DISSOLVED (MG/L AS F)	SILICA, DISSOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180°C DISSOLVED (MG/L)	SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	SOLIDS, DISSOLVED (TONS PER AC-FT)	ALUMINUM, TOTAL RECOVERABLE (UG/L AS AL)	ARSENIC TOTAL (UG/L AS AS)	ARSENIC SUSPENDED TOTAL (UG/L AS AS)	ARSENIC DISSOLVED (UG/L AS AS)	BARIUM, TOTAL RECOVERABLE (UG/L AS BA)
FEB 1985											
21.....	0.4	--	--	--	--	--	--	--	4	<2	--
DEC 1986											
03.....	--	0.5	9.9	1,790	1,800	2.4	1,100	1	--	--	<100

Water-quality data for selected wells in Puerco River study area--Continued

Well name: Begay well. Transect: Lupton.

DATE	BORON, TOTAL RECOV-ERABLE (UG/L AS B)	CADMIUM TOTAL RECOV-ERABLE (UG/L AS CD)	CHRO-MIUM, TOTAL RECOV-ERABLE (UG/L AS CR)	COBALT, TOTAL RECOV-ERABLE (UG/L AS CO)	COPPER, TOTAL RECOV-ERABLE (UG/L AS CU)	COPPER, DIS-SOLVED (UG/L AS CU)	IRON, TOTAL RECOV-ERABLE (UG/L AS FE)	IRON, DIS-SOLVED (UG/L AS FE)	LEAD, TOTAL RECOV-ERABLE (UG/L AS PB)	LEAD, DIS-SOLVED (UG/L AS PB)	MANGA-NESE, TOTAL RECOV-ERABLE (UG/L AS MN)
FEB 1985											
21.....	--	--	--	--	21	10	1,400	170	<5	<5	1,400
DEC 1986											
03.....	650	<1	<1	<1	7	--	970	--	<5	--	1,600

DATE	MANGA-NESE, DIS-SOLVED (UG/L AS MN)	MOLYB-DENUM, TOTAL RECOV-ERABLE (UG/L AS MO)	MOLYB-DENUM, DIS-SOLVED (UG/L AS MO)	NICKEL, TOTAL RECOV-ERABLE (UG/L AS NI)	SELE-NIUM, TOTAL (UG/L AS SE)	SILVER, TOTAL RECOV-ERABLE (UG/L AS AG)	STRON-TIUM, TOTAL RECOV-ERABLE (UG/L AS SR)	VANA-DIUM, TOTAL (UG/L AS V)	VANA-DIUM, DIS-SOLVED (UG/L AS V)	ZINC, TOTAL RECOV-ERABLE (UG/L AS ZN)	ZINC, DIS-SOLVED (UG/L AS ZN)
FEB 1985											
21.....	1,400	<5	<5	--	<5	--	--	<5	<5	70	31
DEC 1986											
03.....	--	6	--	7	<1	<1	1,600	--	--	30	--

DATE	ALPHA, TOTAL (PCI/L)	ALPHA, TOTAL, COUNT-ING ERROR (PCI/L)	ALPHA, DIS-SOLVED (PCI/L)	ALPHA, DIS-SOLVED, COUNT-ING ERROR (PCI/L)	BETA, TOTAL (PCI/L)	BETA, TOTAL, COUNT-ING ERROR (PCI/L)	BETA, DIS-SOLVED (PCI/L)	BETA, DIS-SOLVED, COUNT-ING ERROR (PCI/L)	LEAD 210 DIS-SOLVED (PCI/L)	LEAD 210 DIS-SOLVED COUNT ERROR (PCI/L)	POLO-NIUM 210 DIS-SOLVED (PCI/L)
FEB 1985											
21.....	<2.0	16	10	15	<8.0	21	8.0	15	0.1	1.5	0.5
DEC 1986											
03.....	27	9.0	--	--	4.0	5.0	--	--	0.3	0.3	--

APPENDIX A

Water-quality data for selected wells in Puerco River study area--Continued

Well name: Begay well. Transect: Lupton.

DATE	POLONIUM 210 DISCOUNTING ERROR (PCI/L)	RADIUM 226, TOTAL (PCI/L)	RADIUM 226, DISSOLVED (PCI/L)	RADIUM 226 DISS. COUNTING ERROR (PCI/L)	RADIUM 228, TOTAL (PCI/L)	RADIUM 228, TOTAL, COUNTING ERROR (PCI/L)	THORIUM 230 DISSOLVED (PCI/L)	THORIUM 230 DISSOLVED COUNT ERROR (PCI/L)	URANIUM NATURAL TOTAL (UG/L AS U)	URANIUM NATURAL DISSOLVED (UG/L AS U)
FEB 1985										
21.....	0.7	1.2	0	0.2	--	--	0.1	0.1	24	22
DEC 1986										
03.....	--	--	0.1	0.1	1.3	0.6	0.2	0.2	22	--

Water-quality data for selected wells in Puerco River study area--Continued

Well name: Project 77-712.
Site identification: 351858109031701.
Altitude of land surface: 6,185 feet above National Geodetic Vertical Datum (NGVD) of 1929, determined from U.S. Geological Survey topographic maps.
Date well constructed: 1984
Primary use: Unused.

Transect: Lupton.
Local well number: (A-22-31)09ddb01.
Depth of well: 102 feet.
Water level: 46.9 feet.
Type of lift: Turbine.
Depth drilled: 102 feet.
Casing type: 12-inch diameter steel pipe.

DATE	SPECIFIC CONDUCTANCE (US/CM)	PH (STANDARD UNITS)	PH LAB (STANDARD UNITS)	TEMPERATURE (°C)	TURBIDITY (NTU)	BAROMETRIC PRESSURE (MM OF HG)	OXYGEN, DISSOLVED (MG/L)	OXYGEN, DISSOLVED (PERCENT SATURATION)	CALCIUM TOTAL RECOVERABLE (MG/L AS CA)	CALCIUM DISSOLVED (MG/L AS CA)	MAGNESIUM, TOTAL RECOVERABLE (MG/L AS MG)
APR 1985											
03.....	--	--	--	--	--	--	--	--	--	--	--
OCT											
22.....	775	--	8.50	--	--	--	--	--	25	--	6.8
29.....	798	--	8.40	--	--	--	--	--	21	--	3.9
NOV											
12.....	--	--	8.44	--	--	--	--	--	26	--	9.2
26.....	--	--	8.50	--	--	--	--	--	27	--	2.4
DEC											
18.....	--	--	--	--	--	--	--	--	--	--	--
DEC 1986											
03.....	910	7.90	8.00	14.0	0.3	608	2.1	26	--	18	--

DATE	MAGNESIUM, DISSOLVED (MG/L AS MG)	SODIUM, TOTAL RECOVERABLE (MG/L AS NA)	SODIUM, DISSOLVED (MG/L AS NA)	SODIUM ADSORPTION RATIO	POTASSIUM, TOTAL RECOVERABLE (MG/L AS K)	POTASSIUM, DISSOLVED (MG/L AS K)	BICARBONATE WH WAT TOTAL FIELD MG/L AS HCO3	CARBONATE WH WAT TOTAL FIELD MG/L AS CO3	ALKALINITY WH WAT TOTAL FIELD MG/L AS CACO3	ALKALINITY WH WAT TOTAL LAB MG/L AS CACO3	SULFATE (MG/L AS SO4)
APR 1985											
03.....	--	--	--	--	--	--	--	--	--	--	--
OCT											
22.....	--	210	--	--	1.2	--	390	--	--	--	65
29.....	--	240	--	--	1.6	--	340	34	--	334	71
NOV											
12.....	--	240	--	--	1.6	--	340	34	--	334	71
26.....	--	180	--	--	7.7	--	370	6	--	310	60
DEC											
18.....	--	--	--	--	--	--	--	--	--	--	--
DEC 1986											
03.....	2.9	--	190	11	--	0.4	--	--	368	358	--

APPENDIX A

Water-quality data for selected wells in Puerco River study area--Continued

Well name: Project 77-712. Transect: Lupton.

DATE	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, TOTAL (MG/L AS F)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180°C DIS-SOLVED (MG/L)	SOLIDS, SUM OF CONSTI-TUENTS, DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	ALUM-INUM, TOTAL RECOV-ERABLE (UG/L AS AL)	ARSENIC TOTAL (UG/L AS AS)
APR 1985										
03.....	--	--	--	--	--	--	--	--	--	--
OCT										
22.....	--	32	--	--	--	--	--	--	--	--
29.....	--	32	0.8	--	--	--	--	--	--	--
NOV										
12.....	--	32	--	0.78	--	--	--	--	--	--
26.....	--	37	--	--	--	--	--	--	--	--
DEC										
18.....	--	--	--	--	--	--	--	--	--	--
DEC 1986										
03.....	65	31	--	0.8	14	556	540	0.76	20	4

DATE	BARIUM, TOTAL RECOV-ERABLE (UG/L AS BA)	BORON, TOTAL RECOV-ERABLE (UG/L AS B)	CADMIUM TOTAL RECOV-ERABLE (UG/L AS CD)	CHRO-MIUM, TOTAL RECOV-ERABLE (UG/L AS CR)	COBALT, TOTAL RECOV-ERABLE (UG/L AS CO)	COPPER, TOTAL RECOV-ERABLE (UG/L AS CU)	IRON, TOTAL RECOV-ERABLE (UG/L AS FE)	LEAD, TOTAL RECOV-ERABLE (UG/L AS PB)	MANGA-NESE, TOTAL RECOV-ERABLE (UG/L AS MN)	MOLYB-DENUM, TOTAL RECOV-ERABLE (UG/L AS MO)
APR 1985										
03.....	--	--	--	--	--	--	--	--	--	--
OCT										
22.....	--	--	--	--	--	--	--	--	--	--
29.....	--	--	--	--	--	--	--	--	--	--
NOV										
12.....	--	--	--	--	--	--	--	--	--	--
26.....	--	--	--	--	--	--	--	--	--	--
DEC										
18.....	--	--	--	--	--	--	--	--	--	--
DEC 1986										
03.....	<100	590	<1	<1	<1	6	50	9	30	8

Water-quality data for selected wells in Puerco River study area--Continued

Well name: Project 77-712. Transect: Lupton.

DATE	NICKEL, TOTAL RECOV-ERABLE (UG/L AS NI)	SELE-NIUM, TOTAL (UG/L AS SE)	SILVER, TOTAL RECOV-ERABLE (UG/L AS AG)	STRON-TIUM, TOTAL RECOV-ERABLE (UG/L AS SR)	ZINC, TOTAL RECOV-ERABLE (UG/L AS ZN)	GROSS ALPHA TOTAL (UG/L AS U NATRL)	ALPHA, TOTAL (PCI/L)	ALPHA, TOTAL, COUNT-ING ERROR (PCI/L)	BETA, TOTAL (PCI/L)	BETA, TOTAL, COUNT-ING ERROR (PCI/L)
APR 1985										
03.....	--	--	--	--	--	25	18	2.0	--	--
OCT										
22.....	--	--	--	--	--	--	--	--	--	--
29.....	--	--	--	--	--	--	--	--	--	--
NOV										
12.....	--	--	--	--	--	--	--	--	--	--
26.....	--	--	--	--	--	11	10	--	2.3	--
DEC										
18.....	--	--	--	--	--	12	8.3	1.2	--	--
DEC 1986										
03.....	<1	5	<1	410	90	--	40	6.0	8.0	3.0

DATE	LEAD 210 DIS-SOLVED (PCI/L)	LEAD 210 DIS-SOLVED COUNT ERROR (PCI/L)	RADIUM 226, DIS-SOLVED (PCI/L)	RADIUM 226 DISS. COUNT-ING ERROR (PCI/L)	RADIUM 228, TOTAL (PCI/L)	RADIUM 228, TOTAL, COUNT-ING ERROR (PCI/L)	THORIUM 230 DIS-SOLVED (PCI/L)	THORIUM 230 DIS-SOLVED COUNT ERROR (PCI/L)	URANIUM NATURAL TOTAL (UG/L AS U)	URANIUM NATURAL TOTAL (PCI/L AS U)
APR 1985										
03.....	0.7	0.7	0.1	0.03	--	--	0.3	0.2	37	27
OCT										
22.....	--	--	--	--	--	--	--	--	--	--
29.....	--	--	--	--	--	--	--	--	--	--
NOV										
12.....	--	--	--	--	--	--	--	--	--	--
26.....	--	--	--	--	--	--	--	--	--	--
DEC										
18.....	--	--	--	--	--	--	--	--	--	--
DEC 1986										
03.....	<0.1	0.3	0.1	0.1	0.3	0.5	0.4	0.2	38	--

Water-quality data for selected wells in Puerco River study area--Continued

Well name: Navajo windmill 18T-347A.
Site identification: 351810109055301.
Altitude of land surface: 6,145 feet above National Geodetic Vertical Datum (NGVD) of 1929, determined from U.S. Geological Survey topographic maps.
Depth drilled: 102 feet.
Date well constructed: 1957.
Transect: Lupton.
Local well number: (A-22-31)18cad01.
Depth of well: 102 feet.
Water level: 36.5 feet.
Type of lift: Piston.
Primary use: Stock.
Casing type: 10-inch diameter steel pipe.

DATE	SPECIFIC CONDUCTANCE (US/CM)	PH (STANDARD UNITS)	PH LAB (STANDARD UNITS)	TEMPERATURE (°C)	TURBIDITY (NTU)	CALCIUM DISSOLVED (MG/L AS CA)	MAGNESIUM, DISSOLVED (MG/L AS MG)	SODIUM, DISSOLVED (MG/L AS NA)	SODIUM ADSORPTION RATIO	POTASSIUM, DISSOLVED (MG/L AS K)	BICARBONATE WH WAT TOTAL FIELD MG/L AS HCO3
MAR 1973											
26.....	1,910	8.40	--	--	--	66	13	370	11	3.9	310
DEC 1986											
05.....	1,450	8.25	8.30	11.5	1.0	30	9.3	300	13	1.2	--

DATE	CARBONATE WH WAT TOTAL FIELD (MG/L AS CO3)	ALKALINITY WH WAT TOTAL FIELD (MG/L AS CACO3)	SULFATE DISSOLVED (MG/L AS SO4)	CHLORIDE, DISSOLVED (MG/L AS CL)	FLUORIDE, DISSOLVED (MG/L AS F)	SILICA, DISSOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180°C DISSOLVED (MG/L)	SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	SOLIDS, DISSOLVED (TONS PER AC-FT)	NITROGEN, NITRATE TOTAL (MG/L AS NO3)	ALUMINUM, TOTAL RECOVERABLE (UG/L AS AL)
MAR 1973											
26.....	19	287	360	140	0.66	--	--	1,100	--	0.12	--
DEC 1986											
05.....	--	418	240	76	0.8	6.2	848	910	1.2	--	80

DATE	ARSENIC TOTAL (UG/L AS AS)	BARIUM, TOTAL RECOVERABLE (UG/L AS BA)	BORON, TOTAL RECOVERABLE (UG/L AS B)	CADMIUM TOTAL RECOVERABLE (UG/L AS CD)	CHROMIUM, TOTAL RECOVERABLE (UG/L AS CR)	COBALT, TOTAL RECOVERABLE (UG/L AS CO)	COPPER, TOTAL RECOVERABLE (UG/L AS CU)	IRON, TOTAL RECOVERABLE (UG/L AS FE)	IRON, DISSOLVED (UG/L AS FE)	LEAD, TOTAL RECOVERABLE (UG/L AS PB)	MANGANESE, TOTAL RECOVERABLE (UG/L AS MN)
MAR 1973											
26.....	--	--	--	--	--	--	--	--	M0	--	--
DEC 1986											
05.....	<1	<100	380	<1	<1	<1	32	1,500	--	<5	80

Water-quality data for selected wells in Puerco River study area--Continued

Well name: Navajo windmill 18T-347A. Transect: Lupton.

DATE	MOLYBDENUM, TOTAL RECOVERABLE (UG/L AS MO)	NICKEL, TOTAL RECOVERABLE (UG/L AS NI)	SELENIUM, TOTAL (UG/L AS SE)	SILVER, TOTAL RECOVERABLE (UG/L AS AG)	STRONTIUM, TOTAL RECOVERABLE (UG/L AS SR)	VANADIUM, DISSOLVED (UG/L AS V)	ZINC, TOTAL RECOVERABLE (UG/L AS ZN)	ALPHA, TOTAL (PCI/L)	ALPHA, TOTAL, COUNTING ERROR (PCI/L)	BETA, TOTAL (PCI/L)
MAR 1973										
26.....	--	--	--	--	--	--	--	--	--	--
DEC 1986										
05.....	11	3	<1	<1	730	<30	280	23	6.0	4.0

DATE	BETA, TOTAL, COUNTING ERROR (PCI/L)	LEAD 210 DISSOLVED (PCI/L)	LEAD 210 DISSOLVED COUNT ERROR (PCI/L)	RADIUM 226, DISSOLVED (PCI/L)	RADIUM 226 DISS. COUNTING ERROR (PCI/L)	RADIUM 228, TOTAL (PCI/L)	RADIUM 228, TOTAL, COUNTING ERROR (PCI/L)	THORIUM 230 DISSOLVED (PCI/L)	THORIUM 230 DISSOLVED COUNT ERROR (PCI/L)	URANIUM NATURAL TOTAL (UG/L AS U)
MAR 1973										
26.....	--	--	--	--	--	--	--	--	--	--
DEC 1986										
05.....	3.0	0.4	0.3	0	0.1	0	0.5	0	0.1	20

Water-quality data for selected wells in Puerco River study area--Continued

Well name: Sanders school.
Site identification: 351254109194501.
Altitude of land surface: 5,820 feet above National Geodetic Vertical Datum (NGVD) of 1929, determined from U.S. Geological Survey topographic maps.
Date well constructed: 1969
Transect: Sanders.
Local well number: (A-21-28)13cbc01.
Depth of well: 160 feet.
Water level:. 120 feet.
Primary use: Public supply.

DATE	SPECIFIC CONDUCTANCE (US/CM)	PH (STANDARD UNITS)	CALCIUM DISSOLVED (MG/L AS CA)	MAGNESIUM, DISSOLVED (MG/L AS MG)	SODIUM, DISSOLVED (MG/L AS NA)	SODIUM ADSORPTION RATIO	BICARBONATE WH WAT TOTAL FIELD MG/L AS HCO3	CARBONATE WH WAT TOTAL FIELD MG/L AS CO3	ALKALINITY WH WAT TOTAL FIELD MG/L AS CACO3	SULFATE (MG/L AS SO4)
JUN 1969										
00.....	909	--	78	12	130	4	200	0	167	--
MAR 1974										
27.....	909	7.70	81	11	77	2	190	0	159	--
AUG 1979										
23.....	--	--	--	--	--	--	--	--	--	280
SEPT										
11.....	--	--	--	--	--	--	--	--	--	300
17.....	--	--	--	--	--	--	--	--	--	290
27.....	--	--	--	--	--	--	--	--	--	320
OCT										
15.....	--	--	--	--	--	--	--	--	--	--
17.....	--	--	--	--	--	--	--	--	--	--
NOV										
15.....	--	--	--	--	--	--	--	--	--	--
DEC										
18.....	--	--	--	--	--	--	--	--	--	280
JAN 1980										
18.....	--	--	--	--	--	--	--	--	--	270
MAR										
17.....	--	--	--	--	--	--	--	--	--	310
APR										
14.....	--	--	--	--	--	--	--	--	--	300
MAY										
21.....	--	--	--	--	--	--	--	--	--	300
JUN										
17.....	--	--	--	--	--	--	--	--	--	360
JUL										
15.....	--	--	--	--	--	--	--	--	--	250

APPENDIX A

Water-quality data for selected wells in Puerco River study area--Continued

Well name: Sanders school. Transect: Sanders.

DATE	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)	SOLIDS, SUM OF CONSTI-TUENTS, DIS-SOLVED (MG/L)	NITRO-GEN, NITRATE DIS-SOLVED (MG/L AS N)	NITRO-GEN, NITRATE DIS-SOLVED (MG/L AS NO3)	ARSENIC TOTAL (UG/L AS AS)	BARIUM, TOTAL RECOV-ERABLE (UG/L AS BA)	CADMIUM TOTAL RECOV-ERABLE (UG/L AS CD)
JUN 1969									
00.....	230	44	0.7	560	1.80	8.0	--	--	--
MAR 1974									
27.....	270	48	0.76	560	0.90	4.0	--	--	--
AUG 1979									
23.....	--	60	--	--	--	--	--	--	--
SEP									
11.....	--	55	--	--	--	--	--	--	--
17.....	--	51	--	--	--	--	--	--	--
27.....	--	61	--	--	--	--	--	--	--
OCT									
15.....	--	--	--	--	--	--	--	--	--
17.....	--	--	--	--	--	--	<4	70	<5
NOV									
15.....	--	--	--	--	--	--	--	--	--
DEC									
18.....	--	59	--	--	--	--	--	--	--
JAN 1980									
18.....	--	55	--	--	--	--	--	--	--
MAR									
17.....	--	62	--	--	--	--	--	--	--
APR									
14.....	--	61	--	--	--	--	--	--	--
MAY									
21.....	--	63	--	--	--	--	--	--	--
JUN									
17.....	--	62	--	--	--	--	--	--	--
JUL									
15.....	--	60	--	--	--	--	--	--	--

APPENDIX A

Water-quality data for selected wells in Puerco River study area--Continued

Well name: Sanders school. Transect: Sanders.

DATE	CHROMIUM, TOTAL RECOVERABLE (UG/L AS CR)	IRON, TOTAL RECOVERABLE (UG/L AS FE)	LEAD, TOTAL RECOVERABLE (UG/L AS PB)	SELENIUM, TOTAL (UG/L AS SE)	SILVER, TOTAL RECOVERABLE (UG/L AS AG)	ALPHA, TOTAL (PCI/L)	ALPHA, TOTAL, COUNTING ERROR (PCI/L)	RADIUM 226, DISSOLVED (PCI/L)	RADIUM 226 DISS. COUNTING ERROR (PCI/L)
JUN 1969									
00.....	--	<50	--	--	--	--	--	--	--
MAR 1974									
27.....	--	<50	--	--	--	--	--	--	--
AUG 1979									
23.....	--	--	--	--	--	8.0	1.0	<0.3	--
SEP									
11.....	--	--	--	--	--	8.0	1.0	<0.3	--
17.....	--	--	--	--	--	11	1.0	<0.3	--
27.....	--	--	--	--	--	13	1.0	<0.3	--
OCT									
15.....	--	--	--	--	--	7.0	1.0	0.8	0.3
17.....	<20	--	<50	5	<20	8.0	1.0	<0.3	--
NOV									
15.....	--	--	--	--	--	<4.0	--	--	--
DEC									
18.....	--	--	--	--	--	6.0	1.0	<0.3	--
JAN 1980									
18.....	--	--	--	--	--	27	3.0	<0.3	--
MAR									
17.....	--	--	--	--	--	9.0	1.0	<0.3	--
APR									
14.....	--	--	--	--	--	<3.0	--	--	--
MAY									
21.....	--	--	--	--	--	<3.0	--	--	--
JUN									
17.....	--	--	--	--	--	11	1.0	<0.3	--
JUL									
15.....	--	--	--	--	--	6.2	2.4	<0.3	--

Water-quality data for selected wells in Puerco River study area--Continued

Well name: Sanders school. Transect: Sanders.

DATE	SPECIFIC CONDUCTANCE (US/CM)	PH (STANDARD UNITS)	PH LAB (STANDARD UNITS)	TEMPERATURE (°C)	TURBIDITY (NTU)	BAROMETRIC PRESSURE (MM OF HG)	OXYGEN, DISSOLVED (MG/L)	OXYGEN, DISSOLVED (PERCENT SATURATION)	CALCIUM TOTAL RECOVERABLE (MG/L AS CA)	CALCIUM DISSOLVED (MG/L AS CA)	MAGNESIUM, TOTAL RECOVERABLE (MG/L AS MG)	MAGNESIUM, DISSOLVED (MG/L AS MG)
AUG 1980												
27.....	--	--	--	--	--	--	--	--	--	--	--	--
SEP												
16.....	--	--	--	--	--	--	--	--	--	--	--	--
OCT												
15.....	--	--	--	--	--	--	--	--	--	--	--	--
NOV												
17.....	--	--	--	--	--	--	--	--	--	--	--	--
DEC												
15.....	--	--	--	--	--	--	--	--	--	--	--	--
SEP 1985												
26.....	--	--	7.10	--	--	--	--	--	100	--	19	--
DEC 1986												
04.....	1,100	7.60	7.70	13.0	0.1	619	0.5	6	--	90	--	16
DEC												
04.....	1,100	7.60	7.70	13.0	0.1	619	0.5	6	--	92	--	16
DEC												
04.....	1,100	7.60	7.70	13.0	0.2	619	0.5	6	--	91	--	16

Water-quality data for selected wells in Puerco River study area--Continued

Well name: Sanders school. Transect: Sanders.

DATE	SODIUM, TOTAL RECOVERABLE (MG/L AS NA)	SODIUM, DISSOLVED (MG/L AS NA)	SODIUM ADSORPTION RATIO	POTASSIUM, DISSOLVED (MG/L AS K)	ALKALINITY WH WAT TOTAL FIELD MG/L AS CACO3	ALKALINITY WH WAT TOTAL LAB MG/L AS CACO3	SULFATE (MG/L AS SO4)	SULFATE DISSOLVED (MG/L AS SO4)	CHLORIDE, DISSOLVED (MG/L AS CL)	FLUORIDE, TOTAL (MG/L AS F)	FLUORIDE, DISSOLVED (MG/L AS F)	SILICA, DISSOLVED (MG/L AS SIO2)
AUG 1980												
27.....	--	--	--	--	--	--	250	--	59	--	--	--
SEP												
16.....	--	--	--	--	--	--	240	--	55	--	--	--
OCT												
15.....	--	--	--	--	--	--	300	--	54	--	--	--
NOV												
17.....	--	--	--	--	--	--	320	--	60	--	--	--
DEC												
15.....	--	--	--	--	--	--	300	--	49	--	--	--
SEP 1985												
26.....	150	--	--	--	--	225	260	--	57	0.6	--	--
DEC 1986												
04.....	--	140	4	2.0	236	222	--	290	52	--	0.8	15
DEC												
04.....	--	140	4	2.0	236	224	--	290	51	--	0.8	15
DEC												
04.....	--	140	4	1.9	236	223	--	290	51	--	0.8	15

Water-quality data for selected wells in Puerco River study area--Continued

Well name: Sanders school. Transect: Sanders.

DATE	SOLIDS, RESIDUE AT 180°C DIS-SOLVED (MG/L)	SOLIDS, SUM OF CONSTI-TUENTS, DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	ALUM-INUM, TOTAL RECOV-ERABLE (UG/L AS AL)	ARSENIC TOTAL (UG/L AS AS)	BARIUM, TOTAL RECOV-ERABLE (UG/L AS BA)	BORON, TOTAL RECOV-ERABLE (UG/L AS B)	CADMIUM TOTAL RECOV-ERABLE (UG/L AS CD)	CHRO-MIUM, TOTAL RECOV-ERABLE (UG/L AS CR)	COBALT, TOTAL RECOV-ERABLE (UG/L AS CO)	COPPER, TOTAL RECOV-ERABLE (UG/L AS CU)
AUG 1980											
27.....	--	--	--	--	--	--	--	--	--	--	--
SEP											
16.....	--	--	--	--	9	300	--	<9	<10	--	--
OCT											
15.....	--	--	--	--	<4	300	--	<4	<10	--	--
NOV											
17.....	--	--	--	--	--	--	--	--	--	--	--
DEC											
15.....	--	--	--	--	--	--	--	--	--	--	--
SEP 1985											
26.....	--	--	--	--	<20	<100	--	<5	<20	--	<50
DEC 1986											
04.....	661	750	0.9	<10	1	<100	190	<1	<1	<1	9
DEC											
04.....	692	750	0.94	60	1	<100	200	<1	<1	1	57
DEC											
04.....	654	750	0.89	40	1	<100	200	<1	<1	<1	7

Water-quality data for selected wells in Puerco River study area--Continued

Well name: Sanders school. Transect: Sanders.

DATE	IRON, TOTAL RECOV-ERABLE (UG/L AS FE)	LEAD, TOTAL RECOV-ERABLE (UG/L AS PB)	MANGA-NESE, TOTAL RECOV-ERABLE (UG/L AS MN)	MOLYB-DENUM, TOTAL RECOV-ERABLE (UG/L AS MO)	NICKEL, TOTAL RECOV-ERABLE (UG/L AS NI)	SELE-NIUM, TOTAL (UG/L AS SE)	SILVER, TOTAL RECOV-ERABLE (UG/L AS AG)	STRON-TIUM, TOTAL RECOV-ERABLE (UG/L AS SR)	ZINC, TOTAL RECOV-ERABLE (UG/L AS ZN)	ALPHA, TOTAL (PCI/L)	ALPHA, TOTAL, COUNT-ING ERROR (PCI/L)
AUG 1980											
27.....	--	--	--	--	--	--	--	--	--	2.2	3.0
SEP											
16.....	--	60	--	--	--	<5	<10	--	--	7.6	4.0
OCT											
15.....	--	<30	--	--	--	<5	<10	--	--	0	4.8
NOV											
17.....	--	--	--	--	--	--	--	--	--	0.1	5.4
DEC											
15.....	--	--	--	--	--	--	--	--	--	9.8	4.2
SEP 1985											
26.....	<100	<20	<50	--	--	<10	<20	--	<50	<2.0	--
DEC 1986											
04.....	40	8	30	7	<1	1	<1	760	20	29	6.0
DEC											
04.....	160	<5	30	7	3	1	<1	760	30	20	5.0
DEC											
04.....	50	11	30	7	<1	1	<1	780	10	16	4.0

Water-quality data for selected wells in Puerco River study area--Continued

Well name: Sanders school. Transect: Sanders.

DATE	BETA, TOTAL (PCI/L)	BETA, TOTAL, COUNTING ERROR (PCI/L)	LEAD 210 DISSOLVED (PCI/L)	LEAD 210 DISSOLVED COUNT ERROR (PCI/L)	RADIUM 226, DISSOLVED (PCI/L)	RADIUM 226 DISS. COUNTING ERROR (PCI/L)	RADIUM 228, TOTAL (PCI/L)	RADIUM 228, TOTAL, COUNTING ERROR (PCI/L)	THORIUM 230 DISSOLVED (PCI/L)	THORIUM 230 DISSOLVED COUNT ERROR (PCI/L)	URANIUM NATURAL TOTAL (UG/L AS U)
AUG 1980											
27.....	--	--	--	--	--	--	--	--	--	--	--
SEP											
16.....	--	--	--	--	<0.3	--	--	--	--	--	--
OCT											
15.....	--	--	--	--	--	--	--	--	--	--	--
NOV											
17.....	--	--	--	--	--	--	--	--	--	--	--
DEC											
15.....	--	--	--	--	0	0.3	--	--	--	--	--
SEP 1985											
26.....	9.0	3.0	--	--	<0.6	--	<1.0	--	--	--	14
DEC 1986											
04.....	6.0	3.0	0.7	0.4	0	0.1	0.5	0.6	0	0.1	20
DEC											
04.....	6.0	3.0	0.9	0.4	0.1	0.1	<0.3	0.4	0.4	0.1	16
DEC											
04.....	6.0	3.0	0.9	0.4	0.1	0.1	<0.3	0.6	0	0.1	16

Water-quality data for selected wells in Puerco River study area--Continued

Well name: Windsong Utility.
Site identification: 351224109202401.
Altitude of land surface: 5,830 feet above National Geodetic Vertical Datum (NGVD) of 1929, determined from U.S. Geological Survey topographic maps.
Water level: 59.0 feet.
Date well constructed: Unknown.
Transect: Sanders.
Local well number: (A-21-28)23aac01.
Depth of well: 175 feet.
Depth drilled: 175 feet.
Type of lift: Submersible.
Primary use: Public supply.
Casing type: 12-inch diameter steel pipe.

DATE	SPECIFIC CONDUCTANCE (US/CM)	PH (STANDARD UNITS)	PH LAB (STANDARD UNITS)	TEMPERATURE, AIR (°C)	TEMPERATURE (°C)	TURBIDITY (NTU)	BAROMETRIC PRESSURE (MM OF HG)	OXYGEN, DISSOLVED (MG/L)	OXYGEN, DISSOLVED (PERCENT SATURATION)	CALCIUM DISSOLVED (MG/L AS CA)	MAGNESIUM, DISSOLVED (MG/L AS MG)
DEC 1986											
02.....	1,060	7.75	7.90	10.0	13.0	0.2	617	1.0	12	88	15

DATE	SODIUM, DISSOLVED (MG/L AS NA)	SODIUM ADSORPTION RATIO	POTASSIUM, DISSOLVED (MG/L AS K)	ALKALINITY WH WAT TOTAL FIELD MG/L AS CACO3	ALKALINITY WH WAT TOTAL LAB MG/L AS CACO3	SULFATE DISSOLVED (MG/L AS SO4)	CHLORIDE, DISSOLVED (MG/L AS CL)	FLUORIDE, DISSOLVED (MG/L AS F)	SILICA, DISSOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180°C DISSOLVED (MG/L)	SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)
DEC 1986											
02.....	120	3	2.9	216	213	280	50	0.5	13	669	700

DATE	SOLIDS, DISSOLVED (TONS PER AC-FT)	ALUMINUM, TOTAL RECOVERABLE (UG/L AS AL)	ARSENIC TOTAL (UG/L AS AS)	BARIUM, TOTAL RECOVERABLE (UG/L AS BA)	BORON, TOTAL RECOVERABLE (UG/L AS B)	CADMIUM TOTAL RECOVERABLE (UG/L AS CD)	CHROMIUM, TOTAL RECOVERABLE (UG/L AS CR)	COBALT, TOTAL RECOVERABLE (UG/L AS CO)	COPPER, TOTAL RECOVERABLE (UG/L AS CU)	IRON, TOTAL RECOVERABLE (UG/L AS FE)	LEAD, TOTAL RECOVERABLE (UG/L AS PB)
DEC 1986											
02.....	0.91	10	1	<100	170	<1	<1	<1	6	20	<5

Water-quality data for selected wells in Puerco River study area--Continued

Well name: Windsong Utility. Transect: Sanders.

DATE	MANGANESE, TOTAL RECOVERABLE (UG/L AS MN)	MOLYBDENUM, TOTAL RECOVERABLE (UG/L AS MO)	NICKEL, TOTAL RECOVERABLE (UG/L AS NI)	SELENIUM, TOTAL (UG/L AS SE)	SILVER, TOTAL RECOVERABLE (UG/L AS AG)	STRONTIUM, TOTAL RECOVERABLE (UG/L AS SR)	ZINC, TOTAL RECOVERABLE (UG/L AS ZN)	ALPHA, TOTAL (PCI/L)	ALPHA, TOTAL, COUNTING ERROR (PCI/L)	BETA, TOTAL (PCI/L)
DEC 1986										
02.....	<10	6	<1	3	<1	720	20	20	5.0	1.0

DATE	BETA, TOTAL, COUNTING ERROR (PCI/L)	LEAD 210 DISSOLVED (PCI/L)	LEAD 210 DISSOLVED COUNT ERROR (PCI/L)	RADIUM 226, DISSOLVED (PCI/L)	RADIUM 226 DISS. COUNTING ERROR (PCI/L)	RADIUM 228, TOTAL (PCI/L)	RADIUM 228, TOTAL, COUNTING ERROR (PCI/L)	THORIUM 230 DISSOLVED (PCI/L)	THORIUM 230 DISSOLVED COUNT ERROR (PCI/L)	URANIUM NATURAL TOTAL (UG/L AS U)
DEC 1986										
02.....	3.0	0.3	0.4	0.3	0.1	<0.4	0.6	0	0.1	8.0

APPENDIX A

Water-quality data for selected wells in Puerco River study area--Continued

Well name: Private well at Sanders.
Site identification: 351241109193101.
Altitude of land surface: 5,840 feet above National Geodetic Vertical Datum (NGVD) of 1929, determined from U.S. Geological Survey topographic maps.
Water level: 65 feet.
Date well constructed: Unknown.
Transect: Sanders.
Local well number: (A-21-28)13cdc01.
Depth of well: 111 feet.
Depth drilled: 111 feet.
Type of lift: Submersible.
Primary use: Domestic.
Casing type: 6-inch diameter steel pipe.

DATE	SPECIFIC CONDUCTANCE (US/CM)	PH (STANDARD UNITS)	PH LAB (STANDARD UNITS)	TEMPERATURE (°C)	TURBIDITY (NTU)	BAROMETRIC PRESSURE (MM OF HG)	OXYGEN, DISSOLVED (MG/L)	OXYGEN, DISSOLVED (PERCENT SATURATION)	CALCIUM DISSOLVED (MG/L AS CA)	MAGNESIUM, DISSOLVED (MG/L AS MG)	SODIUM, DISSOLVED (MG/L AS NA)
DEC 1986											
04.....	860	7.40	7.70	14.0	0.9	618	0.4	5	75	24	63

DATE	SODIUM ADSORPTION RATIO	POTASSIUM, DISSOLVED (MG/L AS K)	ALKALINITY WH WAT TOTAL FIELD MG/L AS CACO3	ALKALINITY WH WAT TOTAL LAB MG/L AS CACO3	SULFATE DISSOLVED (MG/L AS SO4)	CHLORIDE, DISSOLVED (MG/L AS CL)	FLUORIDE, DISSOLVED (MG/L AS F)	SILICA, DISSOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180°C DISSOLVED (MG/L)	SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	SOLIDS, DISSOLVED (TONS PER AC-FT)
DEC 1986											
04.....	2	6.0	261	244	140	36	0.5	11	431	510	0.59

DATE	ALUMINUM, TOTAL RECOVERABLE (UG/L AS AL)	ARSENIC TOTAL (UG/L AS AS)	BARIUM, TOTAL RECOVERABLE (UG/L AS BA)	BORON, TOTAL RECOVERABLE (UG/L AS B)	CADMIUM TOTAL RECOVERABLE (UG/L AS CD)	CHROMIUM, TOTAL RECOVERABLE (UG/L AS CR)	COBALT, TOTAL RECOVERABLE (UG/L AS CO)	COPPER, TOTAL RECOVERABLE (UG/L AS CU)	IRON, TOTAL RECOVERABLE (UG/L AS FE)	LEAD, TOTAL RECOVERABLE (UG/L AS PB)
DEC 1986										
04.....	<10	1	<100	160	<1	<1	<1	5	360	<5

Water-quality data for selected wells in Puerco River study area--Continued

Well name: Private well at Sanders. Transect: Sanders.

DATE	MANGANESE, TOTAL RECOVERABLE (UG/L AS MN)	MOLYBDENUM, TOTAL RECOVERABLE (UG/L AS MO)	NICKEL, TOTAL RECOVERABLE (UG/L AS NI)	SELENIUM, TOTAL (UG/L AS SE)	SILVER, TOTAL RECOVERABLE (UG/L AS AG)	STRONTIUM, TOTAL RECOVERABLE (UG/L AS SR)	ZINC, TOTAL RECOVERABLE (UG/L AS ZN)	ALPHA, TOTAL (PCI/L)	ALPHA, TOTAL, COUNTING ERROR (PCI/L)	BETA, TOTAL (PCI/L)
DEC 1986										
04.....	<10	3	1	<1	<1	930	70	14	4.0	7.0

DATE	BETA, TOTAL, COUNTING ERROR (PCI/L)	LEAD 210 DISSOLVED (PCI/L)	LEAD 210 DISSOLVED COUNT ERROR (PCI/L)	RADIUM 226, DISSOLVED (PCI/L)	RADIUM 226 DISS. COUNTING ERROR (PCI/L)	RADIUM 228, TOTAL (PCI/L)	RADIUM 228, TOTAL, COUNTING ERROR (PCI/L)	THORIUM 230 DISSOLVED (PCI/L)	THORIUM 230 DISSOLVED COUNT ERROR (PCI/L)	URANIUM NATURAL TOTAL (UG/L AS U)
DEC 1986										
04.....	3.0	0.4	0.4	0	0.1	0.4	0.6	0	0.1	10

Water-quality data for selected wells in Puerco River study area--Continued

Well name: Private well at Sanders.
Site identification: 351302109195901.
Altitude of land surface: 5,870 feet above National Geodetic Vertical Datum (NGVD) of 1929, determined from U.S. Geological Survey topographic maps.
Date well constructed: 1941.
Casing type: 6-inch diameter steel pipe.
Transect: Sanders.
Local well number: (A-21-28)14daa01.
Depth of well: 145 feet.
Depth drilled: 155 feet.
Type of lift: Submersible.
Primary use: Domestic.

DATE	SPECIFIC CONDUCTANCE (US/CM)	PH (STANDARD UNITS)	PH LAB (STANDARD UNITS)	TEMPERATURE (°C)	TURBIDITY (NTU)	BAROMETRIC PRESSURE (MM OF HG)	OXYGEN, DISSOLVED (MG/L)	OXYGEN, DISSOLVED (PERCENT SATURATION)	CALCIUM TOTAL RECOVERABLE (MG/L AS CA)	CALCIUM DISSOLVED (MG/L AS CA)	MAGNESIUM, TOTAL RECOVERABLE (MG/L AS MG)	MAGNESIUM, DISSOLVED (MG/L AS MG)
AUG 1979												
02.....	--	--	--	--	--	--	--	--	--	--	--	--
OCT												
17.....	--	--	--	--	--	--	--	--	--	--	--	--
NOV												
27.....	--	--	--	--	--	--	--	--	--	--	--	--
JAN 1980												
02.....	--	--	--	--	--	--	--	--	--	--	--	--
FEB												
28.....	--	--	--	--	--	--	--	--	--	--	--	--
MAY												
22.....	--	--	--	--	--	--	--	--	--	--	--	--
SEP 1985												
24.....	--	--	6.70	--	--	--	--	--	240	--	53	--
DEC 1986												
04.....1,530		7.30	7.50	15.0	1.3	619	4.8	59	--	210	--	53

APPENDIX A

Water-quality data for selected wells in Puerco River study area--Continued

Well name: Private well at Sanders. Transect: Sanders.

DATE	SODIUM, TOTAL RECOVERABLE (MG/L AS NA)	SODIUM, DISSOLVED (MG/L AS NA)	SODIUM ADSORPTION RATIO	POTASSIUM, DISSOLVED (MG/L AS K)	ALKALINITY WH WAT TOTAL FIELD MG/L AS CACO3	ALKALINITY WH WAT TOTAL LAB MG/L AS CACO3	SULFATE (MG/L AS SO4)	SULFATE DISSOLVED (MG/L AS SO4)	CHLORIDE, DISSOLVED (MG/L AS CL)	FLUORIDE, TOTAL (MG/L AS F)	FLUORIDE, DISSOLVED (MG/L AS F)	SILICA, DISSOLVED (MG/L AS SIO2)
AUG 1979												
02.....	--	--	--	--	--	--	--	--	--	--	--	--
OCT												
17.....	--	--	--	--	--	--	--	--	--	--	--	--
NOV												
27.....	--	--	--	--	--	--	590	--	64	--	--	--
JAN 1980												
02.....	--	--	--	--	--	--	640	--	61	--	--	--
FEB												
28.....	--	--	--	--	--	--	620	--	58	--	--	--
MAY												
22.....	--	--	--	--	--	--	630	--	70	--	--	--
SEP 1985												
24.....	46	--	--	--	--	293	460	--	60	0.8	--	--
DEC 1986												
04.....	--	43	0.7	7.9	311	307	--	480	61	--	1.0	7.4

APPENDIX A

Water-quality data for selected wells in Puerco River study area--Continued

Well name: Private well at Sanders. Transect: Sanders.

DATE	SOLIDS, RESIDUE AT 180°C DISSOLVED (MG/L)	SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	SOLIDS, DISSOLVED (TONS PER AC-FT)	ALUMINUM, TOTAL RECOVERABLE (UG/L AS AL)	ARSENIC TOTAL (UG/L AS AS)	BARIUM, TOTAL RECOVERABLE (UG/L AS BA)	BORON, TOTAL RECOVERABLE (UG/L AS B)	CADMIUM TOTAL RECOVERABLE (UG/L AS CD)	CHROMIUM, TOTAL RECOVERABLE (UG/L AS CR)	COBALT, TOTAL RECOVERABLE (UG/L AS CO)	COPPER, TOTAL RECOVERABLE (UG/L AS CU)	IRON, TOTAL RECOVERABLE (UG/L AS FE)
AUG 1979												
02.....	--	--	--	--	--	--	--	--	--	--	--	--
OCT												
17.....	--	--	--	--	--	--	--	--	--	--	--	--
NOV												
27.....	--	--	--	--	--	--	--	--	--	--	--	--
JAN 1980												
02.....	--	--	--	--	--	--	--	--	--	--	--	--
FEB												
28.....	--	--	--	--	--	--	--	--	--	--	--	--
MAY												
22.....	--	--	--	--	--	--	--	--	--	--	--	--
SEP 1985												
24.....	--	--	--	--	<20	<100	--	5	<20	--	<50	11,000
DEC 1986												
04.....1,040		1,000	1.4	30	<1	<100	570	<1	<1	30	4	300

Water-quality data for selected wells in Puerco River study area--Continued

Well name: Private well at Sanders. Transect: Sanders.

DATE	LEAD, TOTAL RECOV-ERABLE (UG/L AS PB)	MANGA-NESE, TOTAL RECOV-ERABLE (UG/L AS MN)	MOLYB-DENUM, TOTAL RECOV-ERABLE (UG/L AS MO)	NICKEL, TOTAL RECOV-ERABLE (UG/L AS NI)	SELE-NIUM, TOTAL (UG/L AS SE)	SILVER, TOTAL RECOV-ERABLE (UG/L AS AG)	STRON-TIUM, TOTAL RECOV-ERABLE (UG/L AS SR)	ZINC, TOTAL RECOV-ERABLE (UG/L AS ZN)	ALPHA, TOTAL (PCI/L)	ALPHA, TOTAL, COUNT-ING ERROR (PCI/L)	BETA, TOTAL (PCI/L)
AUG 1979											
02.....	--	--	--	--	--	--	--	--	21	2.0	--
OCT											
17.....	--	--	--	--	--	--	--	--	15	2.0	--
NOV											
27.....	--	--	--	--	--	--	--	--	11	2.0	--
JAN 1980											
02.....	--	--	--	--	--	--	--	--	18	2.0	--
FEB											
28.....	--	--	--	--	--	--	--	--	26	3.0	--
MAY											
22.....	--	--	--	--	--	--	--	--	18	1.0	--
SEP 1985											
24.....	<20	540	--	--	<10	<20	--	5,300	<2.0	--	17
DEC 1986											
04.....	6	630	4	8	5	<1	3,400	450	34	7.0	19

Water-quality data for selected wells in Puerco River study area--Continued

Well name: Private well at Sanders. Transect: Sanders.

DATE	BETA, TOTAL, COUNTING ERROR (PCI/L)	LEAD 210 DISSOLVED (PCI/L)	LEAD 210 DISSOLVED COUNT ERROR (PCI/L)	RADIUM 226, DISSOLVED (PCI/L)	RADIUM 226 DISS. COUNTING ERROR (PCI/L)	RADIUM 228, TOTAL (PCI/L)	RADIUM 228, TOTAL, COUNTING ERROR (PCI/L)	THORIUM 230 DISSOLVED (PCI/L)	THORIUM 230 DISSOLVED COUNT ERROR (PCI/L)	URANIUM NATURAL TOTAL (UG/L AS U)	URANIUM NATURAL TOTAL (PCI/L AS U)
AUG 1979											
02.....	--	--	--	--	--	--	--	--	--	--	17
OCT											
17.....	--	--	--	2.3	3.0	--	--	--	--	--	6.0
NOV											
27.....	--	--	--	--	--	--	--	--	--	--	--
JAN 1980											
02.....	--	--	--	--	--	--	--	--	--	--	--
FEB											
28.....	--	--	--	--	--	--	--	--	--	--	--
MAY											
22.....	--	--	--	1.2	0.4	--	--	--	--	10	--
SEP 1985											
24.....	4.0	--	--	<0.6	--	<1.0	--	--	--	10	--
DEC 1986											
04.....	3.0	0.7	0.4	4.3	0.2	3.1	0.5	0	0.1	19	--

APPENDIX A

Water-quality data for selected wells in Puerco River study area--Continued

Well name: Waterfall Spring. Transect: Chambers.
Site identification: 351047109265001. Local well number: (A-21-27)35acb01.

Altitude of land surface: 5,720 feet above National Geodetic Vertical Datum (NGVD) of 1929, determined from U.S. Geological Survey topographic maps.

DATE	SPECIFIC CONDUCTANCE (US/CM)	PH (STANDARD UNITS)	PH LAB (STANDARD UNITS)	TEMPERATURE (°C)	TURBIDITY (NTU)	BAROMETRIC PRESSURE (MM OF HG)	OXYGEN, DISSOLVED (MG/L)	OXYGEN, DISSOLVED (PERCENT SATURATION)	CALCIUM TOTAL RECOVERABLE (MG/L AS CA)	CALCIUM DISSOLVED (MG/L AS CA)	MAGNESIUM, TOTAL RECOVERABLE (MG/L AS MG)	MAGNESIUM, DISSOLVED (MG/L AS MG)
SEP 1985												
25.....	--	--	--	--	--	--	--	--	48	--	12	--
DEC 1986												
03.....	1,060	7.80	7.80	14.0	0.2	619	0.6	7	--	47	--	11

DATE	SODIUM, TOTAL RECOVERABLE (MG/L AS NA)	SODIUM, DISSOLVED (MG/L AS NA)	SODIUM ADSORPTION RATIO	POTASSIUM, DISSOLVED (MG/L AS K)	ALKALINITY WH WAT TOTAL FIELD (MG/L AS CACO3)	ALKALINITY WH WAT TOTAL LAB (MG/L AS CACO3)	SULFATE (MG/L AS SO4)	SULFATE DISSOLVED (MG/L AS SO4)	CHLORIDE, DISSOLVED (MG/L AS CL)	FLUORIDE, TOTAL (MG/L AS F)	FLUORIDE, DISSOLVED (MG/L AS F)	SILICA, DISSOLVED (MG/L AS SIO2)
SEP 1985												
25.....	170	--	--	--	--	234	190	--	46	0.6	--	--
DEC 1986												
03.....	--	180	6	7.6	218	--	--	270	43	--	0.7	12

DATE	SOLIDS, RESIDUE AT 180°C DISSOLVED (MG/L)	SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	SOLIDS, DISSOLVED (TONS PER AC-FT)	ALUMINUM, TOTAL RECOVERABLE (UG/L AS AL)	ARSENIC TOTAL (UG/L AS AS)	BARIUM, TOTAL RECOVERABLE (UG/L AS BA)	BORON, TOTAL RECOVERABLE (UG/L AS B)	CADMIUM TOTAL RECOVERABLE (UG/L AS CD)	CHROMIUM, TOTAL RECOVERABLE (UG/L AS CR)	COBALT, TOTAL RECOVERABLE (UG/L AS CO)	COPPER, TOTAL RECOVERABLE (UG/L AS CU)
SEP 1985											
25.....	--	--	--	--	<20	<100	--	<5	<20	--	<50
DEC 1986											
03.....	676	700	0.92	20	1	<100	250	<1	<1	<1	4

APPENDIX A

Water-quality data for selected wells in Puerco River study area--Continued

Well name: Waterfall Spring. Transect: Chambers.

DATE	IRON, TOTAL RECOV-ERABLE (UG/L AS FE)	LEAD, TOTAL RECOV-ERABLE (UG/L AS PB)	MANGA-NESE, TOTAL RECOV-ERABLE (UG/L AS MN)	MOLYB-DENUM, TOTAL RECOV-ERABLE (UG/L AS MO)	NICKEL, TOTAL RECOV-ERABLE (UG/L AS NI)	SELE-NIUM, TOTAL (UG/L AS SE)	SILVER, TOTAL RECOV-ERABLE (UG/L AS AG)	STRON-TIUM, TOTAL RECOV-ERABLE (UG/L AS SR)	ZINC, TOTAL RECOV-ERABLE (UG/L AS ZN)	ALPHA, TOTAL (PCI/L)	ALPHA, TOTAL, COUNT-ING ERROR (PCI/L)
SEP 1985											
25.....	1,900	<20	<50	--	--	<10	<20	--	<50	<2.0	--
DEC 1986											
03.....	40	<5	<10	7	1	<1	<1	890	10	9.0	4.0

DATE	BETA, TOTAL (PCI/L)	BETA, TOTAL, COUNT-ING ERROR (PCI/L)	LEAD 210 DIS-SOLVED (PCI/L)	LEAD 210 DIS-SOLVED COUNT ERROR (PCI/L)	RADIUM 226, DIS-SOLVED (PCI/L)	RADIUM 226 DISS. COUNT-ING ERROR (PCI/L)	RADIUM 228, TOTAL (PCI/L)	RADIUM 228, TOTAL, COUNT-ING ERROR (PCI/L)	THORIUM 230 DIS-SOLVED (PCI/L)	THORIUM 230 DIS-SOLVED COUNT ERROR (PCI/L)	URANIUM NATURAL TOTAL (UG/L AS U)
SEP 1985											
25.....	13	4.0	--	--	<0.6	--	<1.0	--	--	--	8.0
DEC 1986											
03.....	7.0	3.0	0.5	0.4	0.9	0.1	<0.1	0.4	0.2	0.1	16

Water-quality data for selected wells in Puerco River study area--Continued

Well name: Private well at Chambers.
Site identification: 351152109241601.
Altitude of land surface: 5,750 feet above National Geodetic Vertical Datum (NGVD) of 1929, determined from U.S. Geological Survey topographic maps.
Date well constructed: Unknown.
Transect: Chambers.
Local well number: (A-21-28)30aaa02.
Water level: 23.5 feet.
Type of lift: Submersible.
Primary use: Domestic.
Casing type: 6-inch diameter steel pipe.

DATE	SPECIFIC CONDUCTANCE (US/CM)	PH (STANDARD UNITS)	PH LAB (STANDARD UNITS)	TEMPERATURE (°C)	TURBIDITY (NTU)	CALCIUM DISSOLVED (MG/L AS CA)	MAGNESIUM, DISSOLVED (MG/L AS MG)	SODIUM, DISSOLVED (MG/L AS NA)	SODIUM ADSORPTION RATIO	POTASSIUM, DISSOLVED (MG/L AS K)
DEC 1986										
01.....	1,700	7.30	7.80	14.5	1.4	130	32	200	4	2.5

DATE	ALKALINITY WH WAT TOTAL FIELD MG/L AS CACO3	ALKALINITY WH WAT TOTAL LAB MG/L AS CACO3	SULFATE DISSOLVED (MG/L AS SO4)	CHLORIDE, DISSOLVED (MG/L AS CL)	FLUORIDE, DISSOLVED (MG/L AS F)	SILICA, DISSOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180°C DISSOLVED (MG/L)	SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	SOLIDS, DISSOLVED (TONS PER AC-FT)	ALUMINUM, TOTAL RECOVERABLE (UG/L AS AL)
DEC 1986										
01.....	355	340	480	88	0.5	15	1,090	1,200	1.5	10

DATE	ARSENIC TOTAL (UG/L AS AS)	BARIUM, TOTAL RECOVERABLE (UG/L AS BA)	BORON, TOTAL RECOVERABLE (UG/L AS B)	CADMIUM TOTAL RECOVERABLE (UG/L AS CD)	CHROMIUM, TOTAL RECOVERABLE (UG/L AS CR)	COBALT, TOTAL RECOVERABLE (UG/L AS CO)	COPPER, TOTAL RECOVERABLE (UG/L AS CU)	IRON, TOTAL RECOVERABLE (UG/L AS FE)	LEAD, TOTAL RECOVERABLE (UG/L AS PB)	MANGANESE, TOTAL RECOVERABLE (UG/L AS MN)
DEC 1986										
01.....	1	<100	330	<1	<1	2	10	790	<5	140

Water-quality data for selected wells in Puerco River study area--Continued

Well name: Private well at Chambers. Transect: Chambers.

DATE	MOLYBDENUM, TOTAL RECOVERABLE (UG/L AS MO)	NICKEL, TOTAL RECOVERABLE (UG/L AS NI)	SELENIUM, TOTAL (UG/L AS SE)	SILVER, TOTAL RECOVERABLE (UG/L AS AG)	STRONTIUM, TOTAL RECOVERABLE (UG/L AS SR)	ZINC, TOTAL RECOVERABLE (UG/L AS ZN)	ALPHA, TOTAL (PCI/L)	ALPHA, TOTAL, COUNTING ERROR (PCI/L)	BETA, TOTAL (PCI/L)	BETA, TOTAL, COUNTING ERROR (PCI/L)
DEC 1986										
01.....	7	2	1	<1	1,300	80	28	7.0	12	4.0

DATE	LEAD 210 DISSOLVED (PCI/L)	LEAD 210 DISSOLVED COUNT ERROR (PCI/L)	RADIUM 226, DISSOLVED (PCI/L)	RADIUM 226 DISS. COUNTING ERROR (PCI/L)	RADIUM 228, TOTAL (PCI/L)	RADIUM 228, TOTAL, COUNTING ERROR (PCI/L)	THORIUM 230 DISSOLVED (PCI/L)	THORIUM 230 DISSOLVED COUNT ERROR (PCI/L)	URANIUM NATURAL TOTAL (UG/L AS U)
DEC 1986									
01.....	0.7	0.4	0	0.1	1.2	1.3	0	0.1	23

Water-quality data for selected wells in Puerco River study area--Continued

Well name: Private well at Chambers.
Site identification: 351157109241701.
Altitude of land surface: 5,750 feet above National Geodetic Vertical Datum (NGVD) of 1929, determined from U.S. Geological Survey topographic maps.
Date well constructed: 1963
Casing type: 6-inch diameter steel pipe.

Transect: Chambers.
Local well number: (A-21-28)30aaa01.
Depth of well: 68.5 feet.
Water level: 7.94 feet.
Type of lift: Submersible.
Primary use: Domestic.

DATE	SPECIFIC CONDUCTANCE (US/CM)	PH (STANDARD UNITS)	PH LAB (STANDARD UNITS)	TEMPERATURE (°C)	TURBIDITY (NTU)	BAROMETRIC PRESSURE (MM OF HG)	OXYGEN, DISSOLVED (MG/L)	OXYGEN, DISSOLVED (PERCENT SATURATION)	CALCIUM DISSOLVED (MG/L AS CA)	MAGNESIUM, DISSOLVED (MG/L AS MG)	SODIUM, DISSOLVED (MG/L AS NA)
DEC 1986											
04.....	2,100	7.60	7.80	15.0	6.1	620	0.5	6	190	59	220

DATE	SODIUM ADSORPTION RATIO	POTASSIUM, DISSOLVED (MG/L AS K)	ALKALINITY WH WAT TOTAL FIELD (MG/L AS CACO3)	SULFATE DISSOLVED (MG/L AS SO4)	CHLORIDE, DISSOLVED (MG/L AS CL)	FLUORIDE, DISSOLVED (MG/L AS F)	SILICA, DISSOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DISSOLVED (MG/L)	SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	SOLIDS, DISSOLVED (TONS PER AC-FT)	ALUMINUM, TOTAL RECOVERABLE (UG/L AS AL)
DEC 1986											
04.....	4	1.8	249	760	140	0.6	15	1,470	1,500	2.0	490

DATE	ARSENIC TOTAL (UG/L AS AS)	BARIUM, TOTAL RECOVERABLE (UG/L AS BA)	BORON, TOTAL RECOVERABLE (UG/L AS B)	CADMIUM TOTAL RECOVERABLE (UG/L AS CD)	CHROMIUM, TOTAL RECOVERABLE (UG/L AS CR)	COBALT, TOTAL RECOVERABLE (UG/L AS CO)	COPPER, TOTAL RECOVERABLE (UG/L AS CU)	IRON, TOTAL RECOVERABLE (UG/L AS FE)	LEAD, TOTAL RECOVERABLE (UG/L AS PB)	MANGANESE, TOTAL RECOVERABLE (UG/L AS MN)
DEC 1986										
04.....	2	<100	380	<1	<1	<1	31	1,500	<5	390

Water-quality data for selected wells in Puerco River study area--Continued

Well name: Private well at Chambers. Transect: Chambers.

DATE	MOLYBDENUM, TOTAL RECOVERABLE (UG/L AS MO)	NICKEL, TOTAL RECOVERABLE (UG/L AS NI)	SELENIUM, TOTAL (UG/L AS SE)	SILVER, TOTAL RECOVERABLE (UG/L AS AG)	STRONTIUM, TOTAL RECOVERABLE (UG/L AS SR)	VANADIUM, DISSOLVED (UG/L AS V)	ZINC, TOTAL RECOVERABLE (UG/L AS ZN)	ALPHA, TOTAL (PCI/L)	ALPHA, TOTAL, COUNTING ERROR (PCI/L)	BETA, TOTAL (PCI/L)
DEC 1986										
04.....	6	3	7	<1	1,800	<100	40	27	8.0	<2.0

DATE	BETA, TOTAL, COUNTING ERROR (PCI/L)	LEAD 210 DISSOLVED (PCI/L)	LEAD 210 DISSOLVED COUNT ERROR (PCI/L)	RADIUM 226, DISSOLVED (PCI/L)	RADIUM 226 DISS. COUNTING ERROR (PCI/L)	RADIUM 228, TOTAL (PCI/L)	RADIUM 228, TOTAL, COUNTING ERROR (PCI/L)	THORIUM 230 DISSOLVED (PCI/L)	THORIUM 230 DISSOLVED COUNT ERROR (PCI/L)	URANIUM NATURAL TOTAL (UG/L AS U)
DEC 1986										
04.....	4.0	0.4	0.4	0.1	0.1	0.5	0.5	0.1	0.1	19

Water-quality data for selected wells in Puerco River study area--Continued

Well name: ATSF No. 3.
Site identification: 351119109255301.
Altitude of land surface: 5,750 feet above National Geodetic Vertical Datum (NGVD) of 1929, determined from U.S. Geological Survey topographic maps.
Water level: 38.0 feet.
Date well constructed: 1956.
Transect: Chambers.
Local well number: (A-21-27)25cad01.
Depth of well: 91.0 feet.
Depth drilled: 91.0 feet.
Type of lift: Submersible.
Primary use: Public supply.
Casing type: 16-inch diameter steel pipe.

DATE	SPECIFIC CONDUCTANCE (US/CM)	PH (STANDARD UNITS)	PH LAB (STANDARD UNITS)	TEMPERATURE (°C)	TURBIDITY (NTU)	CALCIUM TOTAL RECOVERABLE (MG/L AS CA)	CALCIUM DISSOLVED (MG/L AS CA)	MAGNESIUM, TOTAL RECOVERABLE (MG/L AS MG)	MAGNESIUM, DISSOLVED (MG/L AS MG)	SODIUM, TOTAL RECOVERABLE (MG/L AS NA)	SODIUM, DISSOLVED (MG/L AS NA)
NOV 1975											
19.....	1,100	--	--	--	--	--	84	--	17	--	170
DEC 1979											
31.....	--	--	--	--	--	44	--	10	--	380	--
OCT 1980											
13.....	--	7.71	--	--	--	44	--	10	--	39	--
FEB 1983											
14.....	--	--	7.90	--	--	83	--	16	--	150	--
JAN 1986											
14.....	--	7.57	--	19.0	--	--	--	--	--	--	--
DEC											
01.....	1,300	7.50	7.70	14.5	0.2	--	100	--	21	--	160

DATE	SODIUM ADSORPTION RATIO	POTASSIUM, TOTAL RECOVERABLE (MG/L AS K)	POTASSIUM, DISSOLVED (MG/L AS K)	BICARBONATE WH WAT TOTAL FIELD (MG/L AS HCO3)	ALKALINITY WH WAT TOTAL FIELD (MG/L AS CACO3)	ALKALINITY WH WAT TOTAL LAB (MG/L AS CACO3)	SULFATE (MG/L AS SO4)	SULFATE DISSOLVED (MG/L AS SO4)	CHLORIDE, DISSOLVED (MG/L AS CL)	FLUORIDE, TOTAL (MG/L AS F)	FLUORIDE, DISSOLVED (MG/L AS F)
NOV 1975											
19.....	5	--	2.7	340	276	--	--	270	44	--	0.7
DEC 1979											
31.....	--	2.1	--	--	--	--	--	--	--	--	--
OCT 1980											
13.....	--	--	--	--	--	243	490	--	41	1	--
FEB 1983											
14.....	--	--	--	--	--	438	260	--	42	0.7	--
JAN 1986											
14.....	--	--	--	--	--	--	--	--	53	--	--
DEC											
01.....	4	--	2.6	--	265	259	--	340	61	--	0.8

Water-quality data for selected wells in Puerco River study area--Continued

Well name: ATSF No. 3. Transect: Chambers.

DATE	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180°C DIS-SOLVED (MG/L)	SOLIDS, SUM OF CONSTI-TUENTS, DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N)	PHOS-PHORUS, ORTHO, DIS-SOLVED (MG/L AS P)	PHOS-PHATE, ORTHO, DIS-SOLVED (MG/L AS PO4)	ALUM-INUM, TOTAL RECOV-ERABLE (UG/L AS AL)	ARSENIC TOTAL (UG/L AS AS)	BARIUM, TOTAL RECOV-ERABLE (UG/L AS BA)
NOV 1975										
19.....	13	763	770	1.0	1.70	0.16	0.49	--	--	--
DEC 1979										
31.....	6.0	--	--	--	--	--	--	80	<10	900
OCT 1980										
13.....	--	--	--	--	--	--	--	--	--	<200
FEB 1983										
14.....	--	--	--	--	--	--	--	--	<20	<50
JAN 1986										
14.....	--	--	--	--	--	--	--	--	--	--
DEC										
01.....	14	797	860	1.1	--	--	--	20	1	<100

DATE	BORON, TOTAL RECOV-ERABLE (UG/L AS B)	BORON, DIS-SOLVED (UG/L AS B)	CADMIUM TOTAL RECOV-ERABLE (UG/L AS CD)	CHRO-MIUM, TOTAL RECOV-ERABLE (UG/L AS CR)	COBALT, TOTAL RECOV-ERABLE (UG/L AS CO)	COPPER, TOTAL RECOV-ERABLE (UG/L AS CU)	IRON, TOTAL RECOV-ERABLE (UG/L AS FE)	IRON, DIS-SOLVED (UG/L AS FE)	LEAD, TOTAL RECOV-ERABLE (UG/L AS PB)	MANGA-NESE, TOTAL RECOV-ERABLE (UG/L AS MN)
NOV 1975										
19.....	--	270	--	--	--	--	--	<10	--	--
DEC 1979										
31.....	280	--	<1	<10	--	60	<10	--	<10	340
OCT 1980										
13.....	--	--	--	--	--	--	--	--	--	340
FEB 1983										
14.....	--	--	<10	<50	--	<50	<100	--	<50	220
JAN 1986										
14.....	--	--	--	--	--	--	--	--	--	--
DEC										
01.....	250	--	<1	10	<1	10	190	--	<5	190

Water-quality data for selected wells in Puerco River study area--Continued

Well name: ATSF No. 3. Transect: Chambers.

DATE	MOLYBDENUM, TOTAL RECOVERABLE (UG/L AS MO)	NICKEL, TOTAL RECOVERABLE (UG/L AS NI)	SELENIUM, TOTAL (UG/L AS SE)	SILVER, TOTAL RECOVERABLE (UG/L AS AG)	STRONTIUM, TOTAL RECOVERABLE (UG/L AS SR)	VANADIUM, TOTAL (UG/L AS V)	ZINC, TOTAL RECOVERABLE (UG/L AS ZN)	ALPHA, TOTAL (PCI/L)	ALPHA, TOTAL, COUNTING ERROR (PCI/L)	BETA, TOTAL (PCI/L)
NOV 1975										
19.....	--	--	--	--	--	--	--	--	--	--
DEC 1979										
31.....	<10	10	20	<1	--	<2	<10	0	2.5	0
OCT 1980										
13.....	--	--	--	--	--	--	--	--	--	--
FEB 1983										
14.....	--	--	<10	<50	--	--	<50	--	--	--
JAN 1986										
14.....	--	--	--	--	--	--	--	--	--	--
DEC										
01.....	6	23	2	<1	840	--	30	15	5.0	3.0

DATE	BETA, TOTAL, COUNTING ERROR (PCI/L)	LEAD 210 DISSOLVED (PCI/L)	LEAD 210 DISSOLVED COUNT ERROR (PCI/L)	RADIUM 226, DISSOLVED (PCI/L)	RADIUM 226 DISS. COUNTING ERROR (PCI/L)	RADIUM 228, TOTAL (PCI/L)	RADIUM 228, TOTAL, COUNTING ERROR (PCI/L)	THORIUM 230 DISSOLVED (PCI/L)	THORIUM 230 DISSOLVED COUNT ERROR (PCI/L)	URANIUM NATURAL TOTAL (UG/L AS U)
NOV 1975										
19.....	--	--	--	--	--	--	--	--	--	--
DEC 1979										
31.....	2.0	--	--	--	--	--	--	--	--	--
OCT 1980										
13.....	--	--	--	--	--	--	--	--	--	--
FEB 1983										
14.....	--	--	--	--	--	--	--	--	--	--
JAN 1986										
14.....	--	--	--	--	--	--	--	--	--	--
DEC										
01.....	3.0	0.6	0.4	0.1	0.1	1.2	0.6	0.2	0.1	16

Water-quality data for selected wells in Puerco River study area--Continued

Well name: Private well at Pinta.
Site identification: 350451109383401.
Altitude of land surface: 5,510 feet above National Geodetic Vertical Datum (NGVD) of 1929, determined from U.S. Geological Survey topographic maps.
Primary use: Domestic.
Date well constructed: Unknown.
Transect: Pinta.
Local well number: (A-19-25)01bba01.
Depth of well: 54.0 feet.
Water level: 14.7 feet.
Type of lift: Submersible.
Casing type: 8-inch diameter steel pipe.

DATE	SPECIFIC CONDUCTANCE (US/CM)	PH (STANDARD UNITS)	PH LAB (STANDARD UNITS)	TEMPERATURE (°C)	TURBIDITY (NTU)	BAROMETRIC PRESSURE (MM OF HG)	OXYGEN, DISSOLVED (MG/L)	OXYGEN, DISSOLVED (PERCENT SATURATION)	CALCIUM DISSOLVED (MG/L AS CA)	MAGNESIUM, DISSOLVED (MG/L AS MG)	SODIUM, DISSOLVED (MG/L AS NA)
DEC 1986											
05.....	1,160	8.10	8.00	15.5	19	624	0.5	6	30	6.8	220

DATE	SODIUM ADSORPTION RATIO	POTASSIUM, DISSOLVED (MG/L AS K)	ALKALINITY WH WAT TOTAL FIELD MG/L AS CACO3	ALKALINITY WH WAT TOTAL LAB MG/L AS CACO3	SULFATE DISSOLVED (MG/L AS SO4)	CHLORIDE, DISSOLVED (MG/L AS CL)	FLUORIDE, DISSOLVED (MG/L AS F)	SILICA, DISSOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180°C DISSOLVED (MG/L)	SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	SOLIDS, DISSOLVED (TONS PER AC-FT)
DEC 1986											
05.....	10	1.8	449	431	100	52	1.1	22	698	700	0.95

DATE	ALUMINUM, TOTAL RECOVERABLE (UG/L AS AL)	ARSENIC TOTAL (UG/L AS AS)	BARIUM, TOTAL RECOVERABLE (UG/L AS BA)	BORON, TOTAL RECOVERABLE (UG/L AS B)	CADMIUM TOTAL RECOVERABLE (UG/L AS CD)	CHROMIUM, TOTAL RECOVERABLE (UG/L AS CR)	COBALT, TOTAL RECOVERABLE (UG/L AS CO)	COPPER, TOTAL RECOVERABLE (UG/L AS CU)	IRON, TOTAL RECOVERABLE (UG/L AS FE)	LEAD, TOTAL RECOVERABLE (UG/L AS PB)
DEC 1986										
05.....	2,400	3	200	470	4	<1	1	76	2,300	<5

Water-quality data for selected wells in Puerco River study area--Continued

Well name: Private well at Pinta. Transect: Pinta.

DATE	MANGANESE, TOTAL RECOVERABLE (UG/L AS MN)	MOLYBDENUM, TOTAL RECOVERABLE (UG/L AS MO)	NICKEL, TOTAL RECOVERABLE (UG/L AS NI)	SELENIUM, TOTAL (UG/L AS SE)	SILVER, TOTAL RECOVERABLE (UG/L AS AG)	STRONTIUM, TOTAL RECOVERABLE (UG/L AS SR)	ZINC, TOTAL RECOVERABLE (UG/L AS ZN)	ALPHA, TOTAL (PCI/L)	ALPHA, TOTAL, COUNTING ERROR (PCI/L)	BETA, TOTAL (PCI/L)
DEC 1986										
05.....	310	21	<1	<1	<1	380	100	4.0	4.0	5.0

DATE	BETA, TOTAL, COUNTING ERROR (PCI/L)	LEAD 210 DISSOLVED (PCI/L)	LEAD 210 DISSOLVED COUNT ERROR (PCI/L)	RADIUM 226, DISSOLVED (PCI/L)	RADIUM 226 DISS. COUNTING ERROR (PCI/L)	RADIUM 228, TOTAL (PCI/L)	RADIUM 228, TOTAL, COUNTING ERROR (PCI/L)	THORIUM 230 DISSOLVED (PCI/L)	THORIUM 230 DISSOLVED COUNT ERROR (PCI/L)	URANIUM NATURAL TOTAL (UG/L AS U)
DEC 1986										
05.....	3.0	0.8	0.4	0.2	0.1	<0.6	0.5	0	0.1	9.0

APPENDIX A

Water-quality data for selected wells in Puerco River study area--Continued

Well name: Private well at Pinta.
Site identification: 350338109384801.
Altitude of land surface: 5,490 feet above National Geodetic Vertical Datum (NGVD) of 1929, determined from U.S. Geological Survey topographic maps.
Primary use: Domestic.
Date well constructed: Unknown.

Transect: Pinta.
Local well number: (A-18-25)11daa01.
Depth of well: 55.0 feet.
Water level: 13.9 feet.
Type of lift: Submersible.
Casing type: 6-inch diameter steel pipe.

DATE	SPECIFIC CONDUCTANCE (US/CM)	PH (STANDARD UNITS)	PH LAB (STANDARD UNITS)	TEMPERATURE (°C)	TURBIDITY (NTU)	BAROMETRIC PRESSURE (MM OF HG)	OXYGEN, DISSOLVED (MG/L)	OXYGEN, DISSOLVED (PERCENT SATURATION)	CALCIUM DISSOLVED (MG/L AS CA)	MAGNESIUM, DISSOLVED (MG/L AS MG)	SODIUM, DISSOLVED (MG/L AS NA)
DEC 1986											
05.....	1,400	7.90	8.10	15.5	0.5	626	0.5	6	41	10	270

DATE	SODIUM ADSORPTION RATIO	POTASSIUM, DISSOLVED (MG/L AS K)	ALKALINITY WH WAT TOTAL FIELD MG/L AS CACO3	ALKALINITY WH WAT TOTAL LAB MG/L AS CACO3	SULFATE DISSOLVED (MG/L AS SO4)	CHLORIDE, DISSOLVED (MG/L AS CL)	FLUORIDE, DISSOLVED (MG/L AS F)	SILICA, DISSOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180°C DISSOLVED (MG/L)	SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	SOLIDS, DISSOLVED (TONS PER AC-FT)
DEC 1986											
05.....	10	1.5	358	325	330	50	1.2	19	1,180	940	1.6

DATE	ALUMINUM, TOTAL RECOVERABLE (UG/L AS AL)	ARSENIC TOTAL (UG/L AS AS)	BARIUM, TOTAL RECOVERABLE (UG/L AS BA)	BORON, TOTAL RECOVERABLE (UG/L AS B)	CADMIUM TOTAL RECOVERABLE (UG/L AS CD)	CHROMIUM, TOTAL RECOVERABLE (UG/L AS CR)	COBALT, TOTAL RECOVERABLE (UG/L AS CO)	COPPER, TOTAL RECOVERABLE (UG/L AS CU)	IRON, TOTAL RECOVERABLE (UG/L AS FE)	LEAD, TOTAL RECOVERABLE (UG/L AS PB)
DEC 1986										
05.....	120	5	<100	540	17	<1	<1	27	360	<5

Water-quality data for selected wells in Puerco River study area--Continued

Well name: Private windmill.
Site identification: 345757109482001.
Altitude of land surface: 5,320 feet above National Geodetic Vertical Datum (NGVD) of 1929, determined from U.S. Geological Survey topographic maps.
Date well constructed: Unknown.
Transect: Petrified Forest.
Local well number: (A-18-24)16bbb01.
Primary use: Domestic.
Type of lift: Piston.
Casing type: 8-inch diameter steel pipe.

DATE	SPECIFIC CONDUCTANCE (US/CM)	PH (STANDARD UNITS)	PH LAB (STANDARD UNITS)	TEMPERATURE (°C)	CALCIUM DISSOLVED (MG/L AS CA)	MAGNESIUM, DISSOLVED (MG/L AS MG)	SODIUM, DISSOLVED (MG/L AS NA)	SODIUM ADSORPTION RATIO	POTASSIUM, DISSOLVED (MG/L AS K)	BICARBONATE WH WAT TOTAL FIELD MG/L AS HCO3	CARBONATE WH WAT TOTAL FIELD MG/L AS CO3
DEC 1986											
06.....	2,780	8.15	8.30	14.5	10	3.2	590	43	0.9	830	0

DATE	ALKALINITY WH WAT TOTAL FIELD MG/L AS CACO3	ALKALINITY WH WAT TOTAL LAB MG/L AS CACO3	SULFATE DISSOLVED (MG/L AS SO4)	CHLORIDE, DISSOLVED (MG/L AS CL)	FLUORIDE, DISSOLVED (MG/L AS F)	SILICA, DISSOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180°C DISSOLVED (MG/L)	SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	SOLIDS, DISSOLVED (TONS PER AC-FT)	ALUMINUM, TOTAL RECOVERABLE (UG/L AS AL)
DEC 1986										
06.....	678	663	260	390	1.4	16	1,600	1,700	2.2	10

DATE	ARSENIC TOTAL (UG/L AS AS)	BARIUM, TOTAL RECOVERABLE (UG/L AS BA)	BORON, TOTAL RECOVERABLE (UG/L AS B)	CADMIUM TOTAL RECOVERABLE (UG/L AS CD)	CHROMIUM, TOTAL RECOVERABLE (UG/L AS CR)	COBALT, TOTAL RECOVERABLE (UG/L AS CO)	COPPER, TOTAL RECOVERABLE (UG/L AS CU)	IRON, TOTAL RECOVERABLE (UG/L AS FE)	LEAD, TOTAL RECOVERABLE (UG/L AS PB)	MANGANESE, TOTAL RECOVERABLE (UG/L AS MN)
DEC 1986										
06.....	12	100	870	<1	<1	1	9	210	<5	280

Water-quality data for selected wells in Puerco River study area--Continued

Well name: Private windmill. Transect: Petrified Forest.

DATE	MOLYBDENUM, TOTAL RECOVERABLE (UG/L AS MO)	NICKEL, TOTAL RECOVERABLE (UG/L AS NI)	SELENIUM, TOTAL (UG/L AS SE)	SILVER, TOTAL RECOVERABLE (UG/L AS AG)	STRONTIUM, TOTAL RECOVERABLE (UG/L AS SR)	VANADIUM, DISSOLVED (UG/L AS V)	ZINC, TOTAL RECOVERABLE (UG/L AS ZN)	ALPHA, TOTAL (PCI/L)	ALPHA, TOTAL, COUNTING ERROR (PCI/L)	BETA, TOTAL (PCI/L)
DEC 1986										
06.....	45	<1	<1	<1	500	<140	70	28	10	10

DATE	BETA, TOTAL, COUNTING ERROR (PCI/L)	LEAD 210 DISSOLVED (PCI/L)	LEAD 210 DISSOLVED COUNT ERROR (PCI/L)	RADIUM 226, DISSOLVED (PCI/L)	RADIUM 226 DISS. COUNTING ERROR (PCI/L)	RADIUM 228, TOTAL (PCI/L)	RADIUM 228, TOTAL, COUNTING ERROR (PCI/L)	THORIUM 230 DISSOLVED (PCI/L)	THORIUM 230 DISSOLVED COUNT ERROR (PCI/L)	URANIUM NATURAL TOTAL (UG/L AS U)
DEC 1986										
06.....	6.0	0	0.3	0	0.2	<0.2	2.8	0	0.3	24

APPENDIX A

Water-quality data for selected wells in Puerco River study area--Continued

Well name: Petrified Forest No. 2.
Site identification: 345850109475001.
Altitude of land surface: 5,316 feet above National Geodetic Vertical Datum (NGVD) of 1929, determined from U.S. Geological Survey topographic maps.
Date well constructed: 1958.
Casing type: 8-inch diameter steel pipe.
Transect: Petrified Forest.
Local well number: (A-18-24)09abb01.
Depth drilled: 110 feet.
Water level: 13.0 feet.
Type of lift: Turbine.
Primary use: Public supply.

DATE	SPECIFIC CONDUCTANCE (US/CM)	PH (STANDARD UNITS)	TEMPERATURE (°C)	CALCIUM TOTAL RECOVERABLE (MG/L AS CA)	CALCIUM DISSOLVED (MG/L AS CA)	MAGNESIUM, TOTAL RECOVERABLE (MG/L AS MG)	MAGNESIUM, DISSOLVED (MG/L AS MG)	SODIUM, TOTAL RECOVERABLE (MG/L AS NA)	SODIUM, DISSOLVED (MG/L AS NA)	SODIUM ADSORPTION RATIO	POTASSIUM, TOTAL RECOVERABLE (MG/L AS K)
SEP 1975											
26.....	1,680	7.60	18.0	--	26	--	6.6	--	320	15	--
FEB 1976											
09.....	--	--	18.0	22	25	6.5	7.4	310	320	15	1.9
FEB 1977											
22.....	--	--	--	--	--	--	--	--	--	--	--
AUG 1978											
03.....	--	--	--	27	--	6.0	--	300	--	--	--
DEC											
14.....	--	--	--	--	--	--	--	--	--	--	--
FEB 1979											
05.....	--	--	--	--	--	--	--	--	--	--	--
APR											
30.....	--	--	--	--	--	--	--	--	--	--	--
JUL											
17.....	--	--	--	--	--	--	--	--	--	--	--
31.....	--	--	--	--	--	--	--	--	--	--	--
AUG											
07.....	--	--	--	--	--	--	--	--	--	--	--
14.....	--	--	--	--	--	--	--	--	--	--	--
OCT											
22.....	--	--	--	--	--	--	--	--	--	--	--
FEB 1980											
02.....	--	--	--	--	--	--	--	--	--	--	--
JUN											
20.....	--	--	--	--	--	--	--	--	--	--	--
JUL											
28.....	--	--	--	--	--	--	--	--	--	--	--
AUG											
18.....	--	--	--	--	--	--	--	--	--	--	--

Water-quality data for selected wells in Puerco River study area--Continued

Well name: Petrified Forest No. 2. Transect: Petrified Forest.

DATE	POTASSIUM, DISSOLVED (MG/L AS K)	BICARBONATE WH WAT TOTAL FIELD (MG/L AS HCO3)	CARBONATE WH WAT TOTAL FIELD (MG/L AS CO3)	ALKALINITY WH WAT TOTAL FIELD (MG/L AS CACO3)	ALKALINITY WH WAT TOTAL LAB (MG/L AS CACO3)	SULFATE (MG/L AS SO4)	SULFATE DISSOLVED (MG/L AS SO4)	CHLORIDE, DISSOLVED (MG/L AS CL)	FLUORIDE, TOTAL (MG/L AS F)	FLUORIDE, DISSOLVED (MG/L AS F)	SILICA, DISSOLVED (MG/L AS SIO2)
SEP 1975											
26.....	1.6	530	0	431	--	--	210	110	--	1.1	20
FEB 1976											
09.....	2.0	540	0	--	439	--	220	95	--	1.2	18
FEB 1977											
22.....	--	--	--	--	--	110	--	87	1.0	--	--
AUG 1978											
03.....	--	--	--	--	416	210	--	89	1.2	--	--
DEC											
14.....	--	--	--	--	--	--	--	--	--	--	--
FEB 1979											
05.....	--	--	--	--	--	--	--	--	--	--	--
APR											
30.....	--	--	--	--	--	--	--	--	--	--	--
JUL											
17.....	--	--	--	--	--	--	--	--	--	--	--
31.....	--	--	--	--	--	--	--	--	--	--	--
AUG											
07.....	--	--	--	--	--	--	--	--	--	--	--
14.....	--	--	--	--	--	--	--	--	--	--	--
OCT											
22.....	--	--	--	--	--	--	--	--	--	--	--
FEB 1980											
02.....	--	--	--	--	--	--	--	--	--	--	--
JUN											
20.....	--	--	--	--	--	--	--	--	--	--	--
JUL											
28.....	--	--	--	--	--	--	--	--	--	--	--
AUG											
18.....	--	--	--	--	--	--	--	--	--	--	--

Water-quality data for selected wells in Puerco River study area--Continued

Well name: Petrified Forest No. 2. Transect: Petrified Forest.

DATE	SOLIDS, RESIDUE AT 180 DEG. C DISSOLVED (MG/L)	SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	SOLIDS, DISSOLVED (TONS PER AC-FT)	NITROGEN, NO2+NO3 DISSOLVED (MG/L AS N)	PHOSPHORUS, ORTHO, DISSOLVED (MG/L AS P)	PHOSPHATE, ORTHO, DISSOLVED (MG/L AS PO4)	ARSENIC TOTAL (UG/L AS AS)	ARSENIC DISSOLVED (UG/L AS AS)	BARIUM, TOTAL RECOVERABLE (UG/L AS BA)	BORON, DISSOLVED (UG/L AS B)	CADMIUM TOTAL RECOVERABLE (UG/L AS CD)
SEP 1975											
26.....	974	950	1.3	0.01	0.13	0.4	--	--	--	610	--
FEB 1976											
09.....	--	950	1.3	--	--	--	1	1	--	580	<10
FEB 1977											
22.....	--	--	--	--	--	--	5	--	20	--	8
AUG 1978											
03.....	--	--	--	--	--	--	<5	--	<1	--	<5
DEC											
14.....	--	--	--	--	--	--	--	--	--	--	--
FEB 1979											
05.....	--	--	--	--	--	--	--	--	--	--	--
APR											
30.....	--	--	--	--	--	--	--	--	--	--	--
JUL											
17.....	--	--	--	--	--	--	--	--	--	--	--
31.....	--	--	--	--	--	--	--	--	--	--	--
AUG											
07.....	--	--	--	--	--	--	--	--	--	--	--
14.....	--	--	--	--	--	--	--	--	--	--	--
OCT											
22.....	--	--	--	--	--	--	--	--	--	--	--
FEB 1980											
02.....	--	--	--	--	--	--	--	--	--	--	--
JUN											
20.....	--	--	--	--	--	--	--	--	--	--	--
JUL											
28.....	--	--	--	--	--	--	--	--	--	--	--
AUG											
18.....	--	--	--	--	--	--	--	--	--	--	--

Water-quality data for selected wells in Puerco River study area--Continued

Well name: Petrified Forest No. 2. Transect: Petrified Forest.

DATE	CADMIUM DIS-SOLVED (UG/L AS CD)	CHRO-MIUM, TOTAL RECOV-ERABLE (UG/L AS CR)	CHRO-MIUM, DIS-SOLVED (UG/L AS CR)	COBALT, TOTAL RECOV-ERABLE (UG/L AS CO)	COBALT, DIS-SOLVED (UG/L AS CO)	COPPER, TOTAL RECOV-ERABLE (UG/L AS CU)	COPPER, DIS-SOLVED (UG/L AS CU)	IRON, TOTAL RECOV-ERABLE (UG/L AS FE)	IRON, DIS-SOLVED (UG/L AS FE)	LEAD, TOTAL RECOV-ERABLE (UG/L AS PB)	LEAD, DIS-SOLVED (UG/L AS PB)
SEP 1975											
26.....	--	--	--	--	--	--	--	--	20	--	--
FEB 1976											
09.....	0	0	0	<10	1	<10	1	350	330	<100	1
FEB 1977											
22.....	--	24	--	--	--	3	--	30	--	20	--
AUG 1978											
03.....	--	<10	--	--	--	<50	--	2,500	--	<20	--
DEC											
14.....	--	--	--	--	--	--	--	890	--	--	--
FEB 1979											
05.....	--	--	--	--	--	--	--	--	--	--	--
APR											
30.....	--	--	--	--	--	--	--	--	--	--	--
JUL											
17.....	--	--	--	--	--	--	--	--	--	--	--
31.....	--	--	--	--	--	--	--	--	--	--	--
AUG											
07.....	--	--	--	--	--	--	--	--	--	--	--
14.....	--	--	--	--	--	--	--	--	--	--	--
OCT											
22.....	--	--	--	--	--	--	--	--	--	--	--
FEB 1980											
02.....	--	--	--	--	--	--	--	--	--	--	--
JUN											
20.....	--	--	--	--	--	--	--	--	--	--	--
JUL											
28.....	--	--	--	--	--	--	--	--	--	--	--
AUG											
18.....	--	--	--	--	--	--	--	--	--	--	--

APPENDIX A

Water-quality data for selected wells in Puerco River study area--Continued

Well name: Petrified Forest No. 2. Transect: Petrified Forest.

DATE	MANGANESE, TOTAL RECOVERABLE (UG/L AS MN)	MANGANESE, DISSOLVED (UG/L AS MN)	MERCURY DISSOLVED (UG/L AS HG)	SELENIUM, TOTAL (UG/L AS SE)	SILVER, TOTAL RECOVERABLE (UG/L AS AG)	ZINC, TOTAL RECOVERABLE (UG/L AS ZN)	ZINC, DISSOLVED (UG/L AS ZN)	ALPHA, TOTAL (PCI/L)	ALPHA, TOTAL, COUNTING ERROR (PCI/L)	BETA, TOTAL (PCI/L)	BETA, TOTAL, COUNTING ERROR (PCI/L)
SEP 1975											
26.....	--	--	--	--	--	--	--	--	--	--	--
FEB 1976											
09.....	260	240	0	0	--	30	10	--	--	--	--
FEB 1977											
22.....	140	--	--	4	4	150	--	--	--	--	--
AUG 1978											
03.....	570	--	--	<5	<10	260	--	0.2	1.4	--	--
DEC											
14.....	280	--	--	--	--	--	--	--	--	--	--
FEB 1979											
05.....	--	--	--	--	--	--	--	<4.3	--	<2.9	--
APR											
30.....	--	--	--	--	--	--	--	<4.7	--	2.6	1.4
JUL											
17.....	--	--	--	--	--	--	--	<4.4	--	<1.9	--
31.....	--	--	--	--	--	--	--	<4.0	--	<5.8	--
AUG											
07.....	--	--	--	--	--	--	--	<6.0	--	4.2	2.2
14.....	--	--	--	--	--	--	--	<4.5	--	<3.1	--
OCT											
22.....	--	--	--	--	--	--	--	4.5	--	4.0	--
FEB 1980											
02.....	--	--	--	--	--	--	--	<3.4	--	<4.6	--
JUN											
20.....	--	--	--	--	--	--	--	<4.4	--	<4.3	--
JUL											
28.....	--	--	--	--	--	--	--	<3.0	--	4.5	6.0
AUG											
18.....	--	--	--	--	--	--	--	<3.0	--	9.0	5.0

Water-quality data for selected wells in Puerco River study area--Continued

Well name: Petrified Forest No. 2. Transect: Petrified Forest.

DATE	SPECIFIC CONDUCTANCE (US/CM)	PH LAB (STANDARD UNITS)	CALCIUM TOTAL RECOVERABLE (MG/L AS CA)	MAGNESIUM, TOTAL RECOVERABLE (MG/L AS MG)	SODIUM, TOTAL RECOVERABLE (MG/L AS NA)	POTASSIUM, TOTAL RECOVERABLE (MG/L AS K)	BICARBONATE WH WAT TOTAL FIELD (MG/L AS HCO3)	CARBONATE WH WAT TOTAL FIELD (MG/L AS CO3)	ALKALINITY WH WAT TOTAL LAB (MG/L AS CACO3)	SULFATE (MG/L AS SO4)
SEP 1980										
16.....	--	--	--	--	--	--	--	--	--	--
OCT										
14.....	1,130	--	26	6.6	320	1.5	550	--	450	210
DEC										
02.....	--	--	--	--	--	--	--	--	--	--
JAN 1981										
12.....	--	--	--	--	--	--	--	--	--	--
APR										
20.....	1,500	8.60	27	4.6	340	1.7	530	11	433	210
AUG 1983										
19.....	1,520	8.20	29	5.8	300	1.6	550	7	460	180
OCT										
27.....	--	--	--	--	--	--	--	--	--	--
FEB 1984										
06.....	--	--	--	--	--	--	--	--	--	--
JUN										
04.....	--	--	--	--	--	--	--	--	--	--
AUG										
03.....	--	8.13	--	--	--	--	--	--	459	--
SEP										
27.....	--	--	--	--	--	--	--	--	--	--
DEC										
11.....	--	--	--	--	--	--	--	--	--	--
APR 1985										
08.....	--	--	--	--	--	--	--	--	--	--
JUN										
19.....	1,470	7.70	32	6.0	320	2.0	550	0	--	220
FEB 1986										
18.....	1,550	8.10	28	5.0	300	3.0	520	0	--	200

Water-quality data for selected wells in Puerco River study area--Continued

Well name: Petrified Forest No. 2. Transect: Petrified Forest.

DATE	CHLORIDE, DISSOLVED (MG/L AS CL)	FLUORIDE, TOTAL (MG/L AS F)	SOLIDS, RESIDUE AT 180 DEG. C DISSOLVED (MG/L)	ARSENIC TOTAL (UG/L AS AS)	BARIUM, TOTAL RECOVERABLE (UG/L AS BA)	CADMIUM TOTAL RECOVERABLE (UG/L AS CD)	CHROMIUM, TOTAL RECOVERABLE (UG/L AS CR)	COPPER, TOTAL RECOVERABLE (UG/L AS CU)	IRON, TOTAL RECOVERABLE (UG/L AS FE)
SEP 1980									
16.....	--	--	--	--	--	--	--	--	--
OCT									
14.....	100	--	--	--	--	--	--	13	1,200
DEC									
02.....	--	--	--	--	--	--	--	--	--
JAN 1981									
12.....	--	--	--	--	--	--	--	--	--
APR									
20.....	98	1.4	--	<1	<100	<1	<10	10	520
AUG 1983									
19.....	84	1.3	--	<1	200	<3	<29	<7	3,100
OCT									
27.....	--	--	--	--	--	--	--	--	--
FEB 1984									
06.....	--	--	--	--	--	--	--	--	--
JUN									
04.....	--	--	--	--	--	--	--	--	--
AUG									
03.....	--	--	970	--	--	--	--	--	--
SEP									
27.....	--	--	--	--	--	--	--	--	--
DEC									
11.....	--	--	--	--	--	--	--	--	--
APR 1985									
08.....	--	--	--	--	--	--	--	--	--
JUN									
19.....	98	1.1	--	<30	<500	<5	<30	<100	1,100
FEB 1986									
18.....	86	1.0	--	<30	<500	<5	<30	<100	400

Water-quality data for selected wells in Puerco River study area--Continued

Well name: Petrified Forest No. 2. Transect: Petrified Forest.

DATE	LEAD, TOTAL RECOV-ERABLE (UG/L AS PB)	MANGA-NESE, TOTAL RECOV-ERABLE (UG/L AS MN)	SELE-NIUM, TOTAL (UG/L AS SE)	SILVER, TOTAL RECOV-ERABLE (UG/L AS AG)	ZINC, TOTAL RECOV-ERABLE (UG/L AS ZN)	ALPHA, TOTAL (PCI/L)	ALPHA, TOTAL, COUNT-ING ERROR (PCI/L)	BETA, TOTAL (PCI/L)	BETA, TOTAL, COUNT-ING ERROR (PCI/L)
SEP 1980									
16.....	--	--	--	--	--	<3.0	--	5.6	9.0
OCT									
14.....	--	240	--	--	60	<3.0	--	6.0	4.0
DEC									
02.....	--	--	--	--	--	<1.4	5.2	6.8	5.0
JAN 1981									
12.....	--	--	--	--	--	<0.7	5.2	2.5	4.1
APR									
20.....	<1	240	<1	<1	20	0	2.3	1.5	5.8
AUG 1983									
19.....	<2	250	<2	19	360	0.8	1.6	2.9	2.5
OCT									
27.....	--	--	--	--	--	0.4	0.5	2.3	0.8
FEB 1984									
06.....	--	--	--	--	--	0.1	0.5	1.1	1.1
JUN									
04.....	--	--	--	--	--	3.2	2.4	2.0	2.3
AUG									
03.....	--	--	--	--	--	--	--	--	--
SEP									
27.....	--	--	--	--	--	<2.0	--	--	--
DEC									
11.....	--	--	--	--	--	<2.0	--	--	--
APR 1985									
08.....	--	--	--	--	--	<2.0	--	--	--
JUN									
19.....	<30	240	<5	<30	200	--	--	--	--
FEB 1986									
18.....	<30	220	<5	<30	100	--	--	--	--

Water-quality data for selected wells in Puerco River study area--Continued

Well name: Petrified Forest No. 2. Transect: Petrified Forest.

DATE	SPECIFIC CONDUCTANCE (US/CM)	PH (STANDARD UNITS)	PH LAB (STANDARD UNITS)	TEMPERATURE (°C)	TURBIDITY (NTU)	BAROMETRIC PRESSURE (MM OF HG)	OXYGEN, DISSOLVED (MG/L)	OXYGEN, DISSOLVED (PERCENT SATURATION)	CALCIUM DISSOLVED (MG/L AS CA)	MAGNESIUM, DISSOLVED (MG/L AS MG)	SODIUM, DISSOLVED (MG/L AS NA)
DEC 1986											
02.....	1,550	8.00	8.00	16.0	0.4	631	0.4	5	25	5.8	300

DATE	SODIUM ADSORPTION RATIO	POTASSIUM, DISSOLVED (MG/L AS K)	ALKALINITY WH WAT TOTAL FIELD (MG/L AS CACO3)	ALKALINITY WH WAT TOTAL LAB (MG/L AS CACO3)	SULFATE DISSOLVED (MG/L AS SO4)	CHLORIDE, DISSOLVED (MG/L AS CL)	FLUORIDE, DISSOLVED (MG/L AS F)	SILICA, DISSOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DISSOLVED (MG/L)	SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	SOLIDS, DISSOLVED (TONS PER AC-FT)
DEC 1986											
02.....	15	1.5	450	442	220	91	1.2	20	938	930	1.3

DATE	ALUMINUM, TOTAL RECOVERABLE (UG/L AS AL)	ARSENIC TOTAL (UG/L AS AS)	BARIUM, TOTAL RECOVERABLE (UG/L AS BA)	BORON, TOTAL RECOVERABLE (UG/L AS B)	CADMIUM TOTAL RECOVERABLE (UG/L AS CD)	CHROMIUM, TOTAL RECOVERABLE (UG/L AS CR)	COBALT, TOTAL RECOVERABLE (UG/L AS CO)	COPPER, TOTAL RECOVERABLE (UG/L AS CU)	IRON, TOTAL RECOVERABLE (UG/L AS FE)	LEAD, TOTAL RECOVERABLE (UG/L AS PB)
DEC 1986										
02.....	20	<1	200	610	<1	5	<1	5	390	<5

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APPENDIX A

Water-quality data for selected wells in Puerco River study area--Continued

Well name: Petrified Forest No. 2. Transect: Petrified Forest.

DATE	MANGANESE, TOTAL RECOVERABLE (UG/L AS MN)	MOLYBDENUM, TOTAL RECOVERABLE (UG/L AS MO)	NICKEL, TOTAL RECOVERABLE (UG/L AS NI)	SELENIUM, TOTAL (UG/L AS SE)	SILVER, TOTAL RECOVERABLE (UG/L AS AG)	STRONTIUM, TOTAL RECOVERABLE (UG/L AS SR)	ZINC, TOTAL RECOVERABLE (UG/L AS ZN)	ALPHA, TOTAL (PCI/L)	ALPHA, TOTAL, COUNTING ERROR (PCI/L)	BETA, TOTAL (PCI/L)
DEC 1986										
02.....	220	14	1	<1	<1	540	20	5.0	4.0	2.0

DATE	BETA, TOTAL, COUNTING ERROR (PCI/L)	LEAD 210 DISSOLVED (PCI/L)	LEAD 210 DISSOLVED COUNT ERROR (PCI/L)	RADIUM 226, DISSOLVED (PCI/L)	RADIUM 226 DISS. COUNTING ERROR (PCI/L)	RADIUM 228, TOTAL (PCI/L)	RADIUM 228, TOTAL, COUNTING ERROR (PCI/L)	THORIUM 230 DISSOLVED (PCI/L)	THORIUM 230 DISSOLVED COUNT ERROR (PCI/L)	URANIUM NATURAL TOTAL (UG/L AS U)
DEC 1986										
02.....	3.0	0.3	0.4	0.1	0.1	<0.4	0.6	<0.1	0.1	1.0

APPENDIX B

APPENDIX B

09396100 Puerco River near Chambers, Ariz.

LOCATION.--Lat 35°10'42", long 109°27'15", in SW¼NW¼ sec.35, T.21 N., R.27 E., Apache County, Hydrologic Unit 15020007, on upstream side of right abutment of Atchison, Topeka, and Santa Fe Railway Co. bridge, 1.5 mi southwest of Chambers.
DRAINAGE AREA.--2,160 mi^2, approximately.

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--Water years 1971-72 (annual maximums only), January 1973 to current year (discharge above 500 ft^3/s only)
EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 17,800 ft^3/s Sept. 30, 1971, gage height, 9.65 ft; no flow observed on many days each year.

WATER-QUALITY DATA

DATE	STREAM-FLOW, INSTAN-TANEOUS (CFS)	SPE-CIFIC CON-DUCT-ANCE (US/CM)	PH (STAND-ARD UNITS)	TEMPER-ATURE, AIR (°C)	TEMPER-ATURE (°C)	SULFATE (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	ALUM-INUM, DIS-SOLVED (UG/L AS AL)	ARSENIC DIS-SOLVED (UG/L AS AS)	BARIUM, DIS-SOLVED (UG/L AS BA)	CADMIUM DIS-SOLVED (UG/L AS CD)	LEAD, DIS-SOLVED (UG/L AS PB)
JUL 1979												
17.....	--	--	--	--	--	--	--	--	--	--	--	--
26.....	--	4,730	6.15	--	26.0	--	--	--	--	--	--	--
26.....	--	4,500	2.30	--	25.0	--	--	5,800	11	190	2	55
26.....	--	5,500	6.10	--	26.5	--	--	--	<5	250	<1	<5
26.....	--	4,700	5.70	--	26.0	--	--	--	<5	160	2	<5
OCT												
16.....	--	--	--	--	--	280	--	--	--	--	--	--
25.....	--	--	--	--	--	620	39	--	--	--	--	--
25.....	--	--	--	--	--	620	43	--	--	--	--	--
25.....	--	--	--	--	--	670	46	--	--	--	--	--
NOV												
27.....	--	--	--	--	--	480	49	--	--	--	--	--
JAN 1980												
02.....	--	--	--	--	--	810	61	--	--	--	--	--
FEB												
28.....	--	--	--	--	--	120	18	--	--	--	--	--
APR												
08.....	--	--	--	--	--	100	21	--	--	--	--	--
MAY 1982												
18.....	--	--	--	--	--	--	--	--	--	--	--	--
18.....	0.04	1,220	8.70	--	24.0	--	--	--	--	--	--	--
JUL												
29.....	388	930	--	26.0	25.5	--	--	--	--	--	--	--
AUG												
24.....	1,920	--	--	27.0	22.0	--	--	--	--	--	--	--
JAN 1983												
17.....	79	--	--	--	6.0	--	--	--	--	--	--	--
MAR												
16.....	291	400	--	--	13.0	--	--	--	--	--	--	--

09396100 Puerco River near Chambers, Ariz.--Continued

WATER-QUALITY DATA--CONTINUED

DATE	MERCURY DIS-SOLVED (UG/L AS HG)	MOLYB-DENUM, DIS-SOLVED (UG/L AS MO)	SILVER, TOTAL RECOV-ERABLE (UG/L AS AG)	SILVER, DIS-SOLVED (UG/L AS AG)	VANA-DIUM, DIS-SOLVED (UG/L AS V)	ZINC, DIS-SOLVED (UG/L AS ZN)	GROSS ALPHA, DIS-SOLVED (UG/L AS U-NAT)	ALPHA, DIS-SOLVED (PCI/L)	ALPHA, DIS-SOLVED, COUNT-ING ERROR (PCI/L)	ALPHA, SUS-PENDED TOTAL (PCI/L)	ALPHA, SUSP. TOTAL, COUNT-ING ERROR (PCI/L)	GROSS ALPHA, SUSP. TOTAL (PCI/L AS U-NAT)
JUL 1979												
17.....	--	--	--	--	--	--	--	34	--	--	--	--
26.....	--	--	--	--	--	--	--	99	13	--	--	--
26.....	<50	<10	<1	<1	30	1,300	--	34	8.0	--	--	--
26.....	<50	16	--	<1	<10	<500	--	38	10	--	--	--
26.....	<0.5	<10	--	<0	<10	<500	--	<15	--	--	--	--
OCT												
16.....	--	--	--	--	--	--	--	--	--	280	--	--
25.....	--	--	--	--	--	--	--	--	--	6,000	--	--
25.....	--	--	--	--	--	--	--	--	--	5,900	--	--
25.....	--	--	--	--	--	--	--	--	--	11,200	--	--
NOV												
27.....	--	--	--	--	--	--	--	--	--	43	2.0	--
JAN 1980												
02.....	--	--	--	--	--	--	--	--	--	900	40	--
FEB												
28.....	--	--	--	--	--	--	--	--	--	90	9.0	--
APR												
08.....	--	--	--	--	--	--	--	<3.0	--	--	--	--
MAY 1982												
18.....	--	--	--	--	--	--	--	--	--	--	--	--
18.....	--	--	--	--	--	--	240	--	--	--	--	68
JUL												
29.....	--	--	--	--	--	--	53	--	--	--	--	3,400
AUG												
24.....	--	--	--	--	--	--	15	--	--	--	--	--
JAN 1983												
17.....	--	--	--	--	--	--	120	--	--	--	--	--
MAR												
16.....	--	--	--	--	--	--	26	--	--	--	--	--

09396100 Puerco River near Chambers, Ariz.--Continued

WATER-QUALITY DATA--CONTINUED

DATE	GROSS ALPHA, DIS-SOLVED (PCI/L AS U-NAT)	GROSS ALPHA, SUSP. TOTAL (UG/L AS U-NAT)	GROSS BETA, DIS-SOLVED (PCI/L AS CS-137)	GROSS BETA, SUSP. TOTAL (PCI/L AS CS-137)	GROSS BETA, DIS-SOLVED (PCI/L AS SR/YT-90)	GROSS BETA, SUSP. TOTAL (PCI/L AS SR/YT-90)	RADIUM 226, DIS-SOLVED (PCI/L)	RADIUM 226 DISS. COUNT-ING ERROR (PCI/L)	URANIUM NATURAL TOTAL (UG/L AS U)	SEDI-MENT, SUS-PENDED (MG/L)	SEDI-MENT, DIS-CHARGE, SUS-PENDED (T/DAY)
JUL 1979											
17.....	--	--	--	--	--	--	0.1	--	--	--	--
26.....	--	--	--	--	--	--	0.2	0.05	--	--	--
26.....	--	--	--	--	--	--	0.1	0.02	70	--	--
26.....	--	--	--	--	--	--	0.2	0.1	140	--	--
26.....	--	--	--	--	--	--	--	--	11	--	--
OCT											
16.....	--	--	--	--	--	--	0.5	--	11	--	--
25.....	--	--	--	--	--	--	0.4	--	338	--	--
25.....	--	--	--	--	--	--	0.5	--	248	--	--
25.....	--	--	--	--	--	--	6.2	--	360	--	--
NOV											
27.....	--	--	--	--	--	--	<0.3	--	99	--	--
JAN 1980											
02.....	--	--	--	--	--	--	4.3	0.3	153	--	--
FEB											
28.....	--	--	--	--	--	--	8.8	0.7	95	--	--
APR											
08.....	--	--	--	--	--	--	--	--	--	--	--
MAY 1982											
18.....	--	--	--	--	--	--	--	--	--	--	--
18.....	160	100	41	140	40	140	--	--	--	--	--
JUL											
29.....	36	5,000	16	2,500	15	2,400	--	--	--	111,000	116,000
AUG											
24.....	10	<5,500	8.0	4,500	7.6	4,200	--	--	--	--	--
JAN 1983											
17.....	82	<770	50	510	48	480	--	--	--	--	--
MAR											
16.....	18	<650	14	560	14	530	--	--	--	20,900	16,400

09396100 Puerco River near Chambers, Ariz.--Continued

WATER-QUALITY DATA--CONTINUED

DATE	STREAM-FLOW, INSTAN-TANEOUS (CFS)	SPE-CIFIC CON-DUCT-ANCE (US/CM)	PH (STAND-ARD UNITS)	PH LAB (STAND-ARD UNITS)	TEMPER-ATURE, AIR (°C)	TEMPER-ATURE (°C)	TUR-BID-ITY (NTU)	BARO-METRIC PRES-SURE (MM OF HG)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION)	CALCIUM TOTAL RECOV-ERABLE (MG/L AS CA)
AUG 1983											
15.....	39	914	--	--	--	24.0	--	--	--	--	--
DEC											
07.....	6.7	--	8.10	8.10	5.0	2.0	3,400	627	11.2	--	--
JAN 1984											
19.....	2.3	1,230	8.50	--	0.5	0.0	290	623	11.5	97	--
MAR											
07.....	4.2	1,190	8.40	--	13.0	12.0	450	625	8.4	96	--
28.....	60	1,180	8.40	--	5.0	9.5	6,400	622	8.2	--	--
AUG											
01.....	4.4	1,850	8.10	7.60	31.5	30.0	120	625	5.0	--	--
SEP											
06.....	3.0	810	8.70	--	24.5	28.5	150	626	6.0	--	--
JAN 1985											
16.....	--	793	9.20	--	--	--	--	--	--	--	--
FEB											
21.....	--	245	7.90	--	--	4.0	--	--	--	--	840
APR											
25.....	--	240	7.60	--	--	12.0	--	--	--	--	310

09396100 Puerco River near Chambers, Ariz.--Continued

WATER-QUALITY DATA--CONTINUED

DATE	CALCIUM DIS-SOLVED (MG/L AS CA)	MAGNE-SIUM, TOTAL RECOV-ERABLE (MG/L AS MG)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, TOTAL RECOV-ERABLE (MG/L AS NA)	SODIUM, DIS-SOLVED (MG/L AS NA)	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, TOTAL RECOV-ERABLE (MG/L AS K)	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	BICAR-BONATE WH WAT TOTAL FIELD (MG/L AS HCO3)	CAR-BONATE WH WAT. TOTAL FIELD (MG/L AS CO3)	ALKA-LINITY WH WAT TOTAL FIELD (MG/L AS CACO3
AUG 1983											
15.....	--	--	--	--	--	--	--	--	--	--	--
DEC											
07.....	--	--	--	--	--	--	--	--	--	--	186
JAN 1984											
19.....	--	--	--	--	--	--	--	--	--	--	256
MAR											
07.....	--	--	--	--	--	--	--	--	--	--	233
28.....	--	--	--	--	--	--	--	--	--	--	280
AUG											
01.....	--	--	--	--	--	--	--	--	--	--	191
SEP											
06.....	--	--	--	--	--	--	--	--	--	--	136
JAN 1985											
16.....	70	--	24	--	67	2	--	3.9	320	9	--
FEB											
21.....	--	81	--	87	--	--	61	--	--	--	--
APR											
25.....	--	43	--	73	--	--	8.7	--	--	--	--

09396100 Puerco River near Chambers, Ariz.--Continued

WATER-QUALITY DATA--CONTINUED

DATE	SULFATE (MG/L AS SO4)	CHLORIDE, DISSOLVED (MG/L AS CL)	FLUORIDE, TOTAL (MG/L AS F)	FLUORIDE, DISSOLVED (MG/L AS F)	SOLIDS, RESIDUE AT 105 (°C), SUSPENDED (MG/L)	ARSENIC TOTAL (UG/L AS AS)	ARSENIC DISSOLVED (UG/L AS AS)	BORON, DISSOLVED (UG/L AS B)	COPPER, TOTAL RECOVERABLE (UG/L AS CU)	COPPER, DISSOLVED (UG/L AS CU)	IRON, TOTAL RECOVERABLE (UG/L AS FE)
AUG 1983											
15.....	--	--	--	--	--	--	--	--	--	--	--
DEC											
07.....	--	--	--	--	3,180	--	--	--	--	--	--
JAN 1984											
19.....	--	--	--	--	308	--	--	--	--	--	--
MAR											
07.....	--	--	--	--	1,620	--	--	--	--	--	--
28.....	--	--	--	--	21,800	--	--	--	--	--	--
AUG											
01.....	--	--	--	--	74,200	--	--	--	--	--	--
SEP											
06.....	--	--	--	--	16,500	--	--	--	--	--	--
JAN 1985											
16.....	100	18	--	0.28	--	--	--	1	--	--	--
FEB											
21.....	340	19	0.5	--	--	390	2	--	540	7	490,000
APR											
25.....	98	23	0.4	--	--	190	3	--	160	7	150,000

09396100 Puerco River near Chambers, Ariz.--Continued

WATER-QUALITY DATA--CONTINUED

DATE	IRON, DISSOLVED (UG/L AS FE)	LEAD, TOTAL RECOVERABLE (UG/L AS PB)	LEAD, DISSOLVED (UG/L AS PB)	MANGANESE, TOTAL RECOVERABLE (UG/L AS MN)	MANGANESE, DISSOLVED (UG/L AS MN)	MERCURY TOTAL RECOVERABLE (UG/L AS HG)	MOLYBDENUM, TOTAL RECOVERABLE (UG/L AS MO)	MOLYBDENUM, DISSOLVED (UG/L AS MO)	SELENIUM, TOTAL (UG/L AS SE)	VANADIUM, TOTAL (UG/L AS V)	VANADIUM, DISSOLVED (UG/L AS V)
AUG 1983											
15.....	--	--	--	--	--	--	--	--	--	--	--
DEC											
07.....	--	--	--	--	--	0.4	--	--	7	--	--
JAN 1984											
19.....	--	--	--	--	--	0.1	--	--	6	--	--
MAR											
07.....	--	--	--	--	--	0.6	--	--	5	--	--
28.....	--	--	--	--	--	0.9	--	--	5	--	--
AUG											
01.....	--	--	--	--	--	4.0	--	--	--	--	--
SEP											
06.....	--	--	--	--	--	0.9	--	--	2	--	--
JAN 1985											
16.....	--	--	--	--	--	--	--	--	--	--	--
FEB											
21.....	30	440	<5	12,000	<5	--	9	15	<5	690	<5
APR											
25.....	<10	120	<5	4,000	<5	--	<5	23	<5	230	<5

09396100 Puerco River near Chambers, Ariz.--Continued

WATER-QUALITY DATA--CONTINUED

DATE	ZINC, TOTAL RECOV-ERABLE (UG/L AS ZN)	ZINC, DIS-SOLVED (UG/L AS ZN)	GROSS ALPHA, DIS-SOLVED (UG/L AS U-NAT)	ALPHA, TOTAL (PCI/L)	ALPHA, TOTAL, COUNT-ING ERROR (PCI/L)	ALPHA, DIS-SOLVED (PCI/L)	ALPHA, DIS-SOLVED, COUNT-ING ERROR (PCI/L)	ALPHA, SUS-PENDED TOTAL (PCI/L)	GROSS ALPHA, SUSP. TOTAL (PCI/L AS U-NAT)	GROSS ALPHA, DIS-SOLVED (PCI/L AS U-NAT)	GROSS ALPHA, SUSP. TOTAL (UG/L AS U-NAT)
AUG 1983											
15.....	--	--	43	--	--	--	--	--	--	29	<2,200
DEC											
07.....	--	--	170	--	--	--	--	--	140	120	210
JAN 1984											
19.....	--	--	320	--	--	--	--	--	12	220	18
MAR											
07.....	--	--	240	--	--	--	--	--	68	160	100
28.....	--	--	200	--	--	--	--	--	820	140	1,200
AUG											
01.....	--	--	100	--	--	--	--	--	--	--	<3,200
SEP											
06.....	--	--	43	--	--	--	--	--	--	--	710
JAN 1985											
16.....	--	--	--	--	--	--	--	--	--	--	--
FEB											
21.....	1,n00	24	--	700	330	25	5.0	--	--	--	--
APR											
25.....	540	6	--	410	120	36	11	0	--	--	--

09396100 Puerco River near Chambers, Ariz.--Continued

WATER-QUALITY DATA--CONTINUED

DATE	BETA, TOTAL (PCI/L)	BETA, TOTAL, COUNTING ERROR (PCI/L)	BETA, DISSOLVED (PCI/L)	BETA, DISSOLVED, COUNTING ERROR (PCI/L)	GROSS BETA, DISSOLVED (PCI/L AS CS-137)	GROSS BETA, SUSP. TOTAL (PCI/L AS CS-137)	GROSS BETA, DISSOLVED (PCI/L AS SR/YT-90)	GROSS BETA, SUSP. TOTAL (PCI/L AS SR/YT-90)	LEAD 210 DISSOLVED (PCI/L)	POLONIUM 210 DISSOLVED (PCI/L)
AUG 1983										
15.....	--	--	--	--	17	1,000	14	950	--	--
DEC										
07.....	--	--	--	--	45	120	39	100	--	--
JAN 1984										
19.....	--	--	--	--	53	45	46	38	--	--
MAR										
07.....	--	--	--	--	54	92	47	79	--	--
28.....	--	--	--	--	29	1,200	25	1,000	--	--
AUG										
01.....	--	--	--	--	19	2,400	16	2,000	--	--
SEP										
06.....	--	--	--	--	19	400	16	340	--	--
JAN 1985										
16.....	--	--	--	--	--	--	--	--	--	--
FEB										
21.....	840	310	2.0	3.0	--	--	--	--	25	36.0
APR										
25.....	490	100	9.0	9.0	---	--	--	--	11	9.9

09396100 Puerco River near Chambers, Ariz.--Continued

WATER-QUALITY DATA--CONTINUED

DATE	POLONIUM 210 DISCOUNTING ERROR (PCI/L)	RADIUM 226, DISSOLVED (PCI/L)	RADIUM 226 DISS. COUNTING ERROR (PCI/L)	RA-226, DISSOLVED, PLANCHET COUNT (PCI/L)	THORIUM 230 DISSOLVED (PCI/L)	THORIUM 230 DISSOLVED COUNT ERROR (PCI/L)	URANIUM NATURAL TOTAL (UG/L AS U)	URANIUM NATURAL DISSOLVED (UG/L AS U)	SEDIMENT, SUSPENDED (MG/L)	SEDIMENT, DISCHARGE, SUSPENDED (T/DAY)
AUG 1983										
15.....	--	--	--	0.2	--	--	85	36	--	--
DEC										
07.....	--	--	--	0.1	--	--	--	--	3,300	60
JAN 1984										
19.....	--	--	--	<0.1	--	--	--	--	474	2.9
MAR										
07.....	--	--	--	<0.1	--	--	--	--	1,940	22
28.....	--	--	--	<0.1	--	--	--	--	36,000	5,830
AUG										
01.....	--	--	--	0.2	--	--	--	--	78,700	935
SEP										
06.....	--	--	--	0.2	--	--	--	--	1,330	11
JAN 1985										
16.....	--	--	--	--	--	--	--	--	--	--
FEB										
21.....	4.0	28	3.0	--	45.0	12.0	140	--	--	--
APR										
25.....	2.1	10	3.0	--	14.0	1.0	67	--	--	--