Prepared in cooperation with the U.S. Army Corps of Engineers

Geochemical Evidence of Groundwater Flow Paths and the Fate and Transport of Constituents of Concern in the Alluvial Aquifer at Fort Wingate Depot Activity, New Mexico, 2009

Scientific Investigations Report 2013–5098

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

Cover:

Top, Looking north over igloo blocks A and B at Fort Wingate Depot Activity, New Mexico (photograph by Erika N. Curry-Elrod, U.S. Geological Survey).

Bottom, Road sign at Fort Wingate Depot Activity, New Mexico (photograph by Erika N. Curry-Elrod, U.S. Geological Survey).

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SALLY JEWELL, Secretary

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Conversion Factors and Datums

Inch/Pound to SI

Multiply	By	To obtain
	Length	
inch (in.)	2.54	centimeter (cm)
inch (in.)	25.4	millimeter (mm)
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
	Area	
acre	0.004047	square kilometer (km^2)
square mile (mi^2)	259.0	hectare (ha)
square mile (mi^2)	2.590	square kilometer (km^2)
	Flow rate	
gallon per minute (gal/min)	0.06309	liter per second (L/s)
gallon per day (gal/d)	0.003785	cubic meter per day (m^3/d)
	Hydraulic gradient	
foot per mile (ft/mi)	0.1894	meter per kilometer (m/km)

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

°C=(°F-32)/1.8

Vertical coordinate information is referenced to the North American Vertical Datum of 1988 (NAVD 88).

Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83).

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

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

Geochemical Evidence of Groundwater Flow Paths and the Fate and Transport of Constituents of Concern in the Alluvial Aquifer at Fort Wingate Depot Activity, New Mexico, 2009

By Andrew J. Robertson, U.S. Geological Survey; David W. Henry, U.S. Army Corps of Engineers; and Jeff B. Langman, U.S. Geological Survey

Abstract

As part of an environmental investigation at Fort Wingate Depot Activity, New Mexico, the U.S. Geological Survey, in cooperation with the U.S. Army Corps of Engineers, interpreted aqueous geochemical concentrations to better understand the groundwater flow paths and the fate and transport of constituents of concern in the alluvial aquifer underlying the study area. The fine-grained nature of the alluvial matrix creates a highly heterogeneous environment, which adds to the difficulty of characterizing the flow of groundwater and the fate of aqueous constituents of concern. The analysis of the groundwater geochemical data collected in October 2009 provides evidence that is used to identify four groundwater flow paths and their extent in the aquifer and indicates the dominant attenuation processes for the constituents of concern.

The extent and interaction of groundwater flow paths were delineated by the major ion concentrations and their relations to each other. Four areas of groundwater recharge to the study area were identified based on groundwater elevations, hydrogeologic characteristics, and geochemical and isotopic evidence. One source of recharge enters the study area from the saturated alluvial deposits underlying the South Fork of the Puerco River to the north of the study area. A second source of recharge is shown to originate from a leaky cistern containing production water from the San Andres-Glorieta aquifer. The other two sources of recharge are shown to enter the study area from the south: one from an arroyo valley draining an area to the south and one from hill-front recharge that passes under the reported release of perchlorate and explosive constituents. The spatial extent and interaction of groundwater originating from these various sources along identified flow paths affect the persistence and attenuation of constituents of concern.

It was determined that groundwater originating in the area of a former explosives' wash-out operation and an accidental spill of perchlorate was spatially limited, and that dilution is the primary attenuation process for these constituents. The explosive concentrations of the nitramine 1,3,5-trinitroperhydro-1,3,5-triazine (RDX) and the oxidizer perchlorate both support that determination. Unlike RDX and perchlorate, there were no detectable concentrations of trinitrotoluene (TNT) in the aquifer. Based on the chemical nature of TNT and the redox conditions found in the aquifer, it is interpreted that TNT is lost to irreversible sorption and aerobic degradation. Nitrate was ubiquitous in the alluvial groundwater in October 2009. The nitrate concentrations in wells associated with the explosives' groundwater flow path indicate attenuation primarily through dilution, similar to that of RDX. The origin of nitrate concentrations in the wells located in the Administration Area is uncertain but may have resulted from the leakage of aging clay sewage pipes that service most of the structures within that area or as a relic of a former hydrologic regime in which water from the washout operation migrated across a broader area. Sufficient data do not exist to definitively identify the location(s) of water discharge in this area, but transpiration from near the Administration Area is supported by the geochemical concentrations.

Introduction

Fort Wingate Depot Activity (hereafter referred to as the Depot) in northwestern New Mexico occupies approximately 24 square miles (mi^2) in McKinley County (fig. 1). It is located about 6 miles (mi) east of Gallup, New Mexico, and its northern boundary abuts Interstate Highway 40 (fig. 1). The Depot is contained within a small basin defined by the Zuni Mountains to the south and east, the Nutria Monocline to the west, and the South Fork of the Puerco River Valley to the north (fig. 1). Elevations range from about 6,700 feet (ft) along the Puerco River to near 8,000 ft in the Zuni Mountains in the southern part of the Depot. The majority of Depot activities (fig. 2) took place on the Quaternary alluvial fill valleys and on the moderately incised dip slopes of the Late Triassic Painted Desert Member of the Petrified Forest Formation (fig. 3).

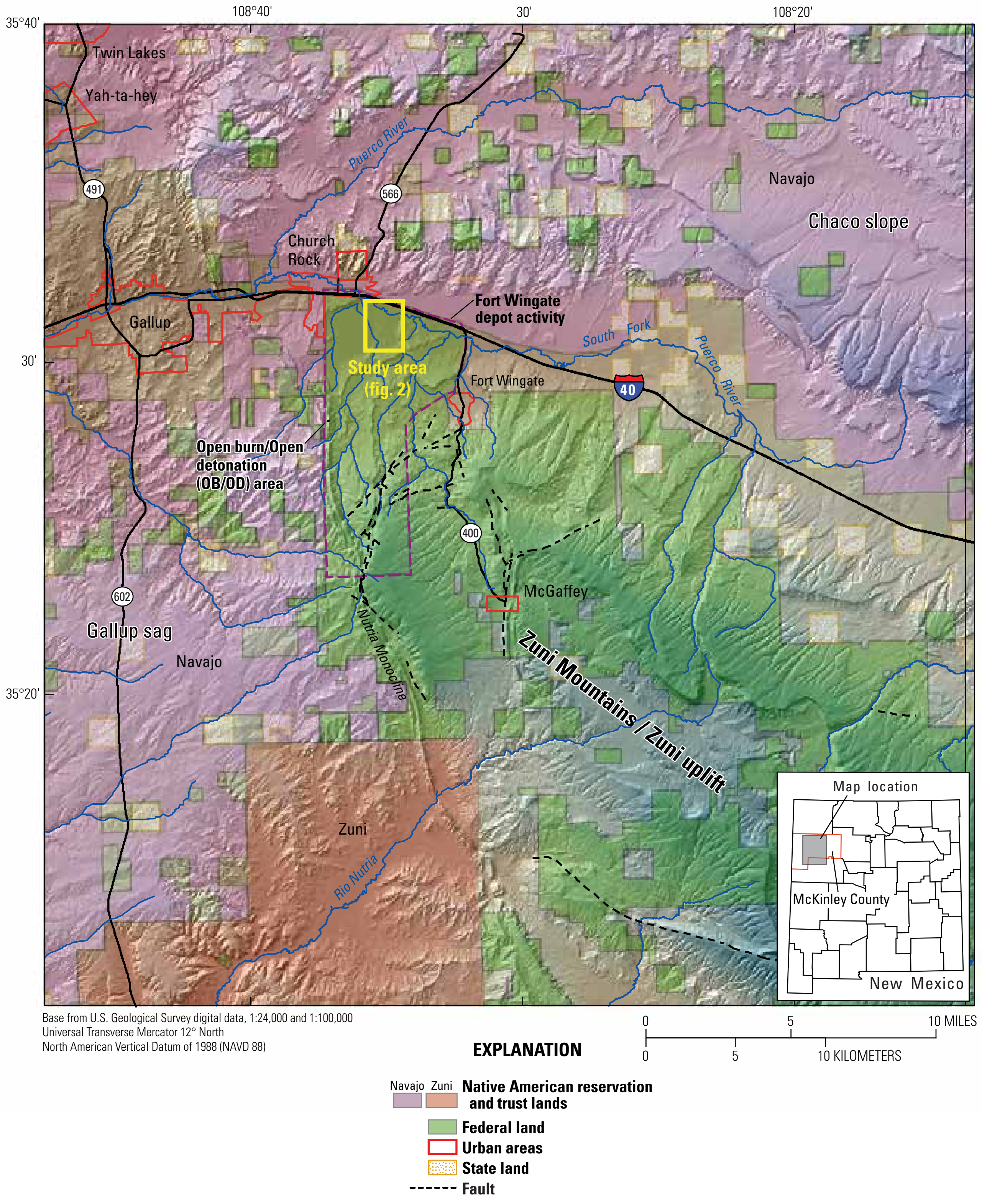


Figure 1. Location of Fort Wingate Depot Activity, New Mexico.

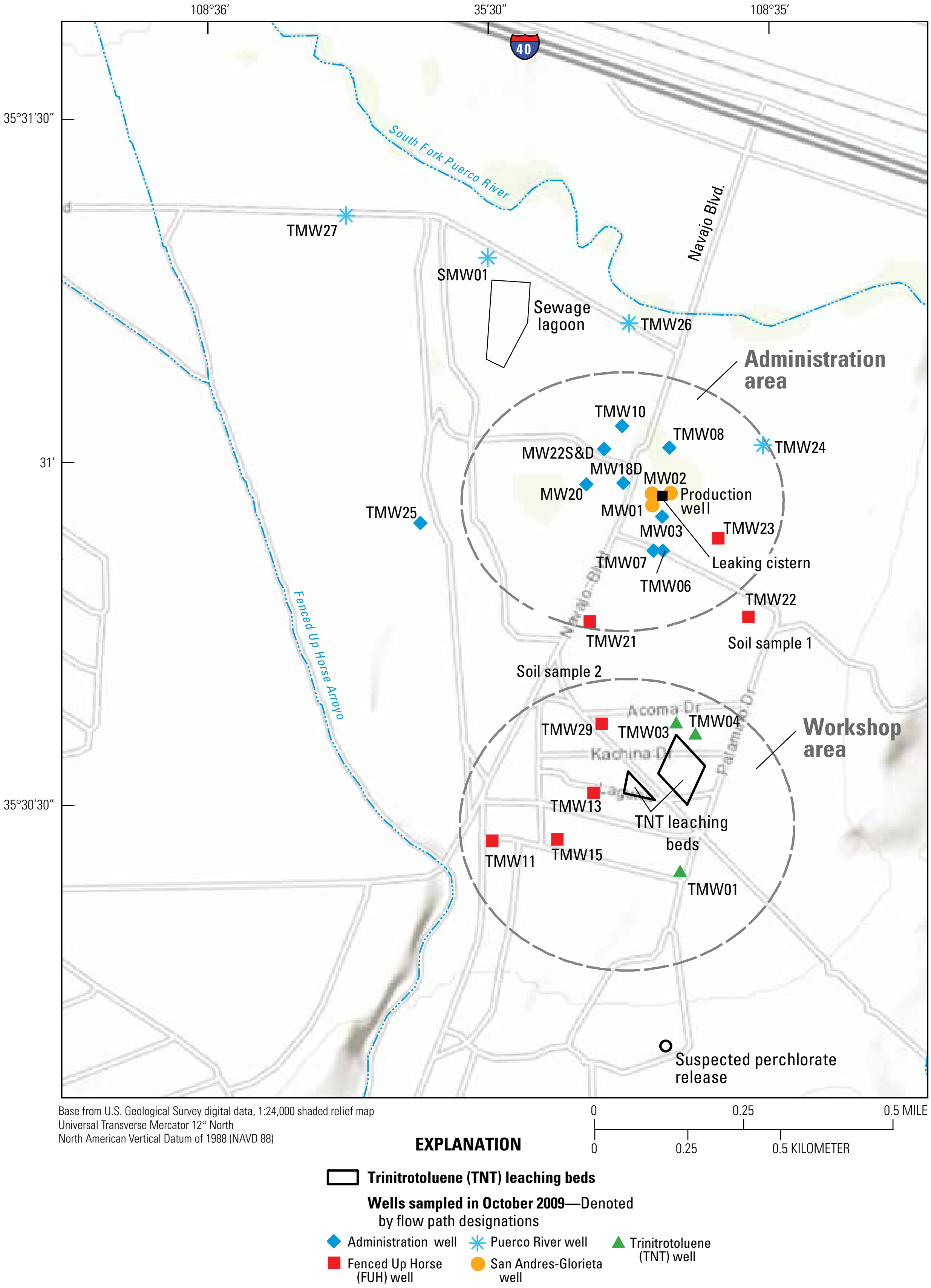
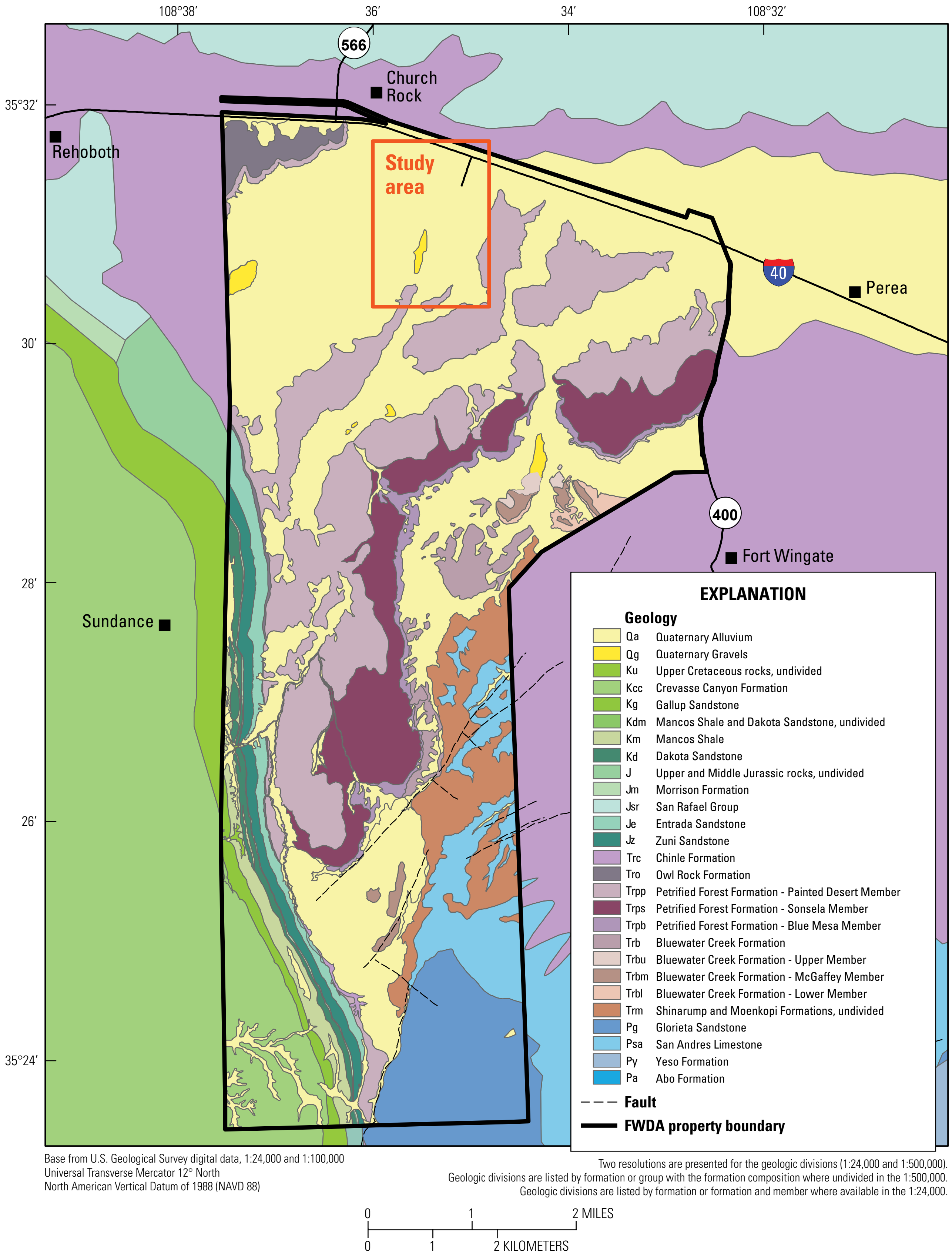


Figure 2. Study area and location of alluvial wells sampled in October 2009 at Fort Wingate Depot Activity, New Mexico.



Base from U.S. Geological Survey digital data, 1:24,000 and 1:100,000
Universal Transverse Mercator 12° North
North American Vertical Datum of 1988 (NAVD 88)

Two resolutions are presented for the geologic divisions (1:24,000 and 1:500,000).
Geologic divisions are listed by formation or group with the formation composition where undivided in the 1:500,000.
Geologic divisions are listed by formation or formation and member where available in the 1:24,000.

Figure 3. Regional surface geology at Fort Wingate Depot Activity (FWDA), New Mexico.

Fort Wingate was first established in 1860 as a cavalry outpost and has since intermittently occupied three locations in the immediate area under several names (Argonne National Laboratory, 1990; Heckert and others, 2003). The U.S. Army Ordnance Department took command of Fort Wingate in 1918, and, by 1920, the Depot was the largest munitions storage facility in the world (Heckert and others, 2003). The primary mission of the Depot from this time forward was munitions storage, including the maintenance and disposal of aging or outdated munitions and the refurbishment of small arms ammunition. The Depot also has been the site of rocket testing, including Pershing-1 missiles. The Missile Defense Agency still leases part of the property for ongoing testing. In the late 1980s, the Depot was scheduled to close under the Base Realignment and Closure (BRAC) process, and the munitions stored at the Depot were removed to other storage facilities or disposed of onsite in the Open Burn/Open Detonation (OB/OD) area (fig. 1). The Depot was deactivated, and the installation closed in January 1993.

Activities associated with the Depot's former mission have impacted the alluvial aquifer underlying the Administration and Workshop Areas (fig. 2). Constituents of concern include various industrial and military-related compounds including organic carbon products, nitrate, explosive compounds, and perchlorate. Evaluation and remediation of these constituents is presently (2012) occurring under the guidelines of a Resource Conservation and Recovery Act (RCRA) permit. Groundwater chemical monitoring to meet regulatory requirements began in 1997 and continued intermittently until 2008. A semiannual groundwater sampling program conducted by the U.S. Army Corps of Engineers (USACE), Albuquerque District, New Mexico, began in 2008 (U.S. Army Corps of Engineers, 2009, 2010, 2011c). Groundwater samples and analyses used in this report were collected in conjunction with the regulatory sampling event that took place in October 2009.

As part of the environmental investigation, the U.S. Geological Survey, in cooperation with the U.S. Army Corps of Engineers, delineated groundwater flow paths and provided an interpretation of aqueous constituent fate and transport in the alluvial aquifer underlying the Depot on the basis of an analysis of the hydrogeologic setting and groundwater geochemical and isotopic data collected in October 2009. These data and interpretation will be useful in determining appropriate actions needed to address constituents of concern found in this shallow aquifer.

Purpose and Scope

The purpose of this report is to present the geochemical evidence for groundwater flow paths and the fate and transport of constituents of concern in the alluvial aquifer at the Fort Wingate Depot Activity. This geochemical investigation aids in understanding the aquifer properties and flow paths that influence the potential pathways, sources, and sinks of constituents of concern that have been detected at the Depot. The aqueous geochemistry is characterized through a review of the geologic structure and composition at the Depot and surrounding areas and by a chemical analysis of groundwater data collected in October 2009.

Description of the Study Area

The study area is located in the north-central part of the Depot and was the location of many of the service-support activities (fig. 1). The study area is defined as the Quaternary alluvium underlying the Administration and Workshop Areas (figs. 2 and 3). Because of the low groundwater productivity of many of the alluvial monitoring wells (many wells are purged dry prior to sampling), the alluvium would likely not meet the formal definition of an "aquifer" as a water-bearing geologic unit that will yield water in a usable quantity to a well or spring (Heath, 1989). For the purposes of this report, however, the term "alluvial aquifer" is used to identify the saturated alluvial deposits at the Depot.

The Administration Area occupies approximately 800 acres in the northernmost part of the Depot and contains various housing and office facilities, equipment maintenance and warehousing facilities, as well as utility-support features. Most of the structures and utilities were built in the 1940s. The Workshop Area is approximately 700 acres and is located south of the Administration Area (fig. 2). The Workshop Area is occupied by various industrial facilities used for ammunition maintenance and renovation. The Workshop Area is the site of reported releases of explosive compounds to the groundwater from a munitions washout process that was in operation from 1941 to 1967 (PMC Environmental, 2001). Trinitrotoluene (TNT), 1,3,5-trinitroperhydro-1,3,5-triazine (RDX), and tritonal (a mixture of TNT and aluminum powder) were washed out of munitions with hot water and the solution was then dried, flaked, and packaged for reuse. Excess solution that overflowed settling tanks was diverted into unlined lagoons, known as the TNT leaching beds (fig. 2). It was reported that in late 1949 approximately 2,400 gallons per day (gal/d) of solution were disposed of in the leaching beds (Argonne National Laboratory, 1990). After the operation was shut down, the bottom sediments of the leaching bed were removed and disposed onsite in the OB/OD area (fig. 1).

Regional Geology

The Depot is located in the Navajo Section of the Colorado Plateau physiographic region (Fenneman and Johnson, 1946) within the Gallup sag and at the northwestern edge of the Zuni Mountains (Zuni uplift) (fig. 1) (Cather, 2003, 2004). The Zuni uplift is a northwest-striking, asymmetric uplift (Lorenz and Cooper, 2001). The uplift gently tilted the bedrock underlying the majority of the Depot to the northwest at an angle of approximately 5 degrees from horizontal (Lorenz and Cooper, 2001); subsequent erosion has exhumed the various Triassic sedimentary layers that are visible across the surface of the Depot (fig. 3).

The dominant topographic and structural feature at the Depot is the Nutria monocline, known locally as “The Hogback” (fig. 1). The Nutria monocline is a north-northwest to south-southeast trending monocline that dips steeply to the south-southwest and defines the west and southwest margin of the Zuni uplift. The northern boundary of the Depot terminates in the strike valley (a valley that is eroded parallel to the strike of the underlying rock formations) of the South Fork of the Puerco River. This valley represents the transition between the Zuni uplift to the south and the Chaco slope to the north.

Granites and smaller amounts of schist and gneiss of Precambrian age compose the underlying basement formation of the region and are exposed in the Zuni Mountains to the southeast (Gordon, 1961). The preservation of sedimentary deposits now visible at the surface on the Depot began in the Late Pennsylvanian epoch; the depositional environment changed from marine to continental and restricted marine by the Early Permian period (Baars, 1962). The Petrified Forest Formation of the Chinle Group is the dominant formation exposed at the Depot (fig. 3), and can be up to 800 ft thick (Anderson and others, 2003). The Petrified Forest Formation is composed of the Blue Mesa, Sonsela, and Painted Desert members (fig. 4). The Chinle Group was elevated from formation to group status by Lucas (1993) but this change has not been fully accepted (Dubiel, 1994; Woody, 2006). The Chinle Group designation is used for purposes of this report.

Climate and Vegetation

The climate of the region is arid to semiarid; precipitation has averaged 11.9 inches at the Depot (1940 to 1966), 11.3 inches at Gallup, N. Mex. (1921 to 2005), and 18.7 inches at McGaffey, N. Mex. (1923 to 2005), in the Zuni Mountains (Western Regional Climate Center, 2010). The majority of the precipitation at the Depot occurs during the monsoon season (midsummer and early fall); however, the slow release of spring snowmelt provides for a higher percentage of infiltration as compared to the precipitation from the intense monsoon thunderstorms (Anderson and others, 2003). The regional climate supports Ponderosa Pine and mixed fir forests above 7,500 ft and predominantly piñon and juniper forests from 6,800 to 7,500 ft; shrubs and grasses dominate below 6,800 ft (Anderson and others, 2003).

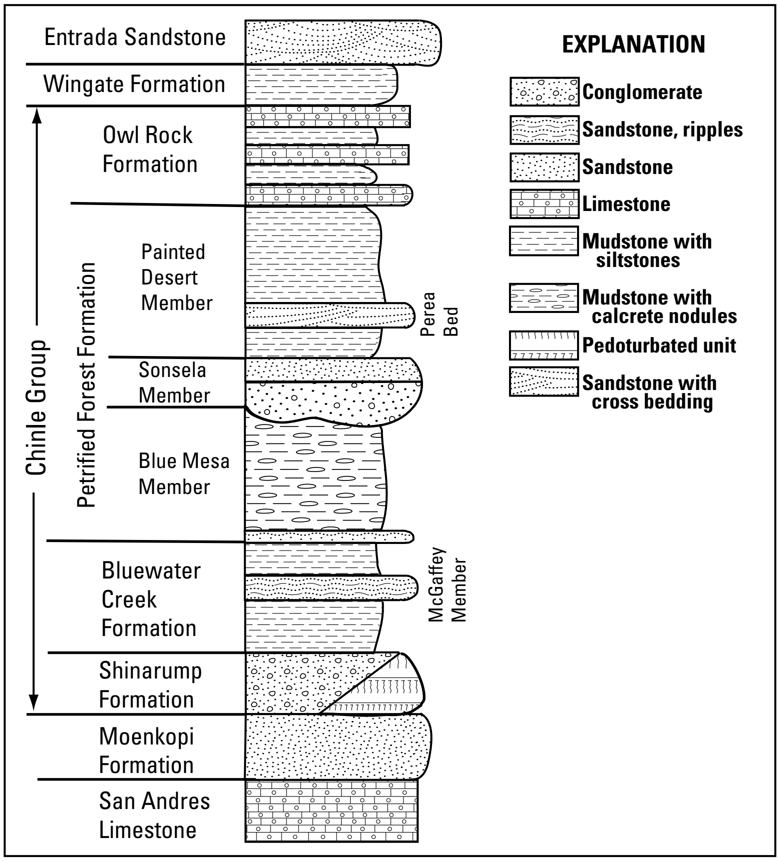


Figure 4. Generalized stratigraphy of the Chinle Group for west-central New Mexico. Modified from Heckert and others (2003).

Surface Hydrology

The Depot is located approximately 15 mi west of the Continental Divide. While no perennial streams are located within the Depot's boundaries, the surface water that collects in drainages flows northward to the South Fork of the Puerco River. The South Fork of the Puerco River joins the Puerco River just east of Gallup and is part of the larger Puerco River and Little Colorado River watersheds. The Depot contains multiple unnamed drainages that are high-gradient (100 ft/mi or greater) ephemeral streams and are typically fed by spring snowmelt or monsoon season thunderstorms (Anderson and others, 2003).

Groundwater Hydrology

There are several water-bearing units underlying the Depot (Shomaker, 1971). These include the San Andres-Glorieta Formations, the Shinarump Formation, and the Sonsela Member and several thin sandstone beds within the Painted Desert Member of the Petrified Forest Formation, as well as the Quaternary alluvium (fig. 3). In the Administration Area, the Quaternary alluvium contains interbedded layers of sediments with variable moisture content in the vertical profile (Michael Powers, U.S. Geological Survey, written commun., 2010). Groundwater in the region has been produced from the Shinarump Formation and the Sonsela Member of the Petrified Forest Formation (Errol L. Montgomery & Associates, Inc., 2003). Yields reported from these aquifers range from 5 to 50 gallons per minute (gal/min).

The San Andres-Glorieta aquifer is the principal aquifer in the region. At the Depot, the top of the San Andres-Glorieta aquifer is about 1,100 ft below land surface and has a thickness of about 200 ft (Shomaker, 1971). The San Andres-Glorieta aquifer is composed of the San Andres Limestone and the Glorieta Sandstone. The two units are considered a single aquifer because no impermeable bed separates them (Callahan and Cushman, 1954) and extensive interfingering makes determination of the contact difficult (Baldwin and Anderholm, 1992). Groundwater from the San Andres-Glorieta aquifer has been the sole source of the water used at the Depot and is produced from a single well located in the Administration Area. Water from the production well (fig. 2) is pumped to a large cistern located near the well. Until recently water was diverted into potable and nonpotable systems; the potable system has been abandoned (Argonne National Laboratory, 1990).

Previous Studies

The alluvial aquifer underlying the Depot has not been studied for the purpose of interpreting its hydrologic characteristics and their effects on the fate and transport of constituents of concern in groundwater. There are a number of private company and USACE reports (many available at http://www.ftwingate.org/) that communicate findings of the groundwater resources and contamination at the Depot as part of regulatory investigations. Shomaker (1971) summarizes the groundwater resources around the Depot area and describes the alluvium in the South Fork Puerco River Valley as being composed of several irregular subbasins and having limited storage. Additionally, there is a substantial amount of geologic work produced by the New Mexico Bureau of Geology and Mineral Resources, including a report on the geology of the Fort Wingate quadrangle (Anderson and others, 2003). A recent geophysical investigation of the study area attempted to identify possible permeable pathways within the Quaternary alluvium and the underlying Petrified Forest Formation (Michael Powers, U.S. Geological Survey, written commun., 2010). The results of this investigation included surface resistivity and seismic interpretations. Surface-resistivity data were interpreted to identify possible flow paths through thin and variable sand stringers within the shallower, drier part of the alluvium, but this technique could not identify similar structures deeper in the alluvium. Interpretation of surface-tomography data suggested that the alluvium is not fully saturated at any consistent depth with the exception of a thin layer above the bedrock contact, and seismic-reflection data were interpreted to identify the Painted Desert Member claystone, bedrock surface, and the deeper Sonsela Member of the Petrified Forest Formation. Additionally, borehole-geophysical results were used to identify deeper permeable layers in the alluvium, but data from this technique could not be used to identify connecting pathways across the extent of the aquifer.

Study Methods

The characterization of the groundwater flow paths and the fate and transport of constituents of concern in the alluvial aquifer at the Depot were completed through a review of geologic literature, drilling logs, and geophysical investigations, and from water-level and geochemical data collected by the USACE and the USGS in October 2009. Water levels were measured in 27 wells, and groundwater samples were collected from 26 of the 27 wells screened in the alluvium (fig. 2, and table 1). These monitoring wells were installed between 1996 and 2002, and many contain dedicated pumps (PMC Environmental, 2001; U.S. Army Corps of Engineers, 2011a, b, c). Water levels were obtained with graduated electric tapes measured from a surveyed mark on the top of the well casing.

Methods

Unfiltered groundwater samples were tested in the field for water temperature, pH, specific conductance, and dissolved oxygen (DO), and analyzed at a laboratory for total (unfiltered) concentrations of major elements: bicarbonate (HCO_3) from acid neutralizing capacity (ANC), bromide

Table 1. Fort Wingate Depot Activity monitoring-well information.

[USGS, U.S. Geological Survey; ft, feet; NAVD 88, North American Vertical Datum of 1988; ls, land surface; TOS, top of screen; PVC, polyvinyl chloride; NA, not available]

Site designation (fig. 2)	USGS site identification number	Land-surface elevation (ft above NAVD 88)	Well depth (ft below ls)	Casing material	Depth to TOS (ft)	TOS elevation (ft above NAVD 88)	Screen length (ft)
Production well[1]	353056108351201	6,683.2	1,350	Steel	NA	NA	NA
MW01	353055108351401	6,686.0	54	PVC	33.6	6,652.4	20
MW02	353056108351401	6,683.2	47	PVC	37.4	6,645.8	10
MW03	353054108351301	6,687.1	53	PVC	43	6,644.1	10
MW18D[2]	353057108351702	6,684.4	57	PVC	47	6,637.4	10
MW20	353057108352101	6,685.6	59	PVC	46.8	6,638.8	10
MW22S	353100108351901	6,682.7	41	PVC	31	6,651.7	10
MW22D	353100108351902	6,682.6	57	PVC	47	6,635.6	10
SMW01	353117108353101	6,667.7	50	PVC	29.9	6,637.8	20
TMW1	353023108351201	6,709.6	60	PVC	44.1	6,665.5	15
TMW3	353036108351201	6,700.2	70	PVC	49.9	6,650.3	20
TMW4	353035108351001	6,698.9	71	PVC	50.1	6,648.8	20
TMW6	353051108351301	6,688.6	55	PVC	45	6,643.6	10
TMW7	353051108351401	6,688.7	75	PVC	65	6,623.7	10
TMW8	353100108351201	6,678.3	60	PVC	30	6,648.3	30
TMW10	353102108351701	6,678.0	58	PVC	28	6,650.0	30
TMW11	353026108353201	6,716.3	80	PVC	55	6,661.3	25
TMW13	353030108352101	6,705.5	71	PVC	60.7	6,644.8	10
TMW15	353026108352501	6,711.4	71	PVC	54.6	6,656.8	15
TMW21	353045108352101	6,693.6	58	PVC	48	6,645.6	10
TMW22	353045108350401	6,690.6	62	PVC	52	6,638.6	10
TMW23	353052108350701	6,686.3	56	PVC	46	6,640.3	10
TMW24	353100108350201	6,679.1	54	PVC	44	6,635.1	10
TMW25[2]	353036108353801	6,671.4	53	PVC	42.5	6,628.9	10
TMW26	353111108351601	6,675.6	55	PVC	45	6,630.6	10
TMW27	353121108354601	6,666.3	70	PVC	60	6,606.3	10
TMW28[3]	353116108344401	6,687.8	47	PVC	37	6,650.8	10
TMW29	353036108352001	6,701.3	59	PVC	49	6,652.3	10

[1] Only deuterium as δ^2H and oxygen-18 as $\delta^{18}O$ data are available for the production well. The production well is completed in the San Andres-Glorieta aquifer rather than the alluvial aquifer.

[2] No field (pH, specific conductivity, turbidity, and dissolved oxygen) data available.

[3] No isotope, anion, total dissolved solids, or alkalinity data available.

(Br), calcium (Ca), chloride (Cl), fluoride (F), nitrate (NO_3), magnesium (Mg), sodium (Na), potassium (K), and sulfate (SO_4); trace elements: aluminum (Al), antimony (Sb), arsenic (As), barium (Ba), beryllium (Be), cadmium (Cd), chromium (Cr), cobalt (Co), copper (Cu), iron (Fe), lead (Pb), manganese (Mn), nickel (Ni), selenium (Se), silver (Ag), titanium (Ti), vanadium (V), and zinc (Zn); dissolved solids (DS); energetics, organics, and the stable isotopes of water, deuterium and oxygen-18 (δ^2H and $\delta^{18}O$ relative to Vienna Standard Mean Ocean Water [VSMOW]) (table 2). Stable isotopes of water also were collected from the Depot's production well completed in the San Andres-Glorieta aquifer. In addition, dissolved concentrations were determined for the major cations (Ca, Mg, Na, and K) and trace elements from filtered (0.45-micron filter size) samples. Appendix 1 contains the analytical results by constituent class and analytical method for samples collected in October 2009 (tables 1–1 to 1–11 in appendix 1). The dissolved major cation concentrations (Ca, Mg, Na, K) were used for the majority of the geochemical analysis because the analytical extraction process for cations includes an acid digestion that may release bound species from solid-state particles in unfiltered samples and may not reflect the aqueous groundwater composition.

The hydrogeology of the alluvial aquifer at Fort Wingate Depot Activity was initially characterized using available information about the bedrock structure and the geologic origin of the unconsolidated deposits. Given geologic constraints, the probable areas of recharge to the study area and the constraints to the subsequent flow paths were identified on the basis of topography and groundwater elevations. Groundwater elevations also were used to construct a potentiometric surface and indicate the general directions of groundwater flow. Upon establishing the likely areas of recharge and possible directions of flow, the geochemical and isotopic signature of the groundwater was used to more precisely delineate the flow paths taken by groundwater originating at each recharge source. The mineralogy of the unconsolidated deposits was examined to determine the likely geochemical reactions.

Table 2. Sample analytes and laboratory analysis methods for groundwater samples collected from Fort Wingate Depot Activity monitoring wells in October 2009.

[ºC, degrees Celsius; µS/cm, microsiemens per centimeter at 25 degrees Celsius; NTU, Nephelometric Turbidity Unit; MCAWW, Methods for Chemical Analysis of Waters and Wastes; mg/L, milligrams per liter; USACE, U.S. Army Corps of Engineers; µg/L, micrograms per liter; USGS, U.S. Geological Survey; ‰, per mil; δxX (‰) = ($Ratio_{sample}/Ratio_{standard}$ − 1) x 1,000 of specified isotope ratio]

Constituent	Description	Method/ laboratory code	Laboratory	Analytical precision
Field values	Water temperature, pH, specific conductance, turbidity	Measured with field instruments	Field collection	0.1ºC, 0.02 pH, 0.5 percent µS/cm, 0.1 NTU
Dissolved solids	Filterable residue	MCAWW 160.1[1]	TestAmerica Labs	5 mg/L
Acid neutralizing capacity	Acid neutralizing capacity as calcium carbonate	MCAWW 310.1[1]	TestAmerica Labs	1.1 mg/L
Major anions	Bromide, chloride, flouride, sulfate, nitrate	SW846 9056A[1]	TestAmerica Labs	0.06 to 1.2 mg/L
Major anions	Nitrate	MCAWW 300.1[1]	USACE contract lab	0.001 to 10 mg/L
Major cations	Calcium, magnesium, sodium, potassium	SW846 6010B[1]	USACE contract lab	0.034 to 1.1 mg/L
Trace elements	Aluminum, antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, iron, lead, manganese, nickel, selenium, silver, titanium, vanadium, and zinc	SW846 6010B, 6020[1]	USACE contract lab	0.01 to 2 µg/L
Energetics	Explosives	SW846 8330B[1]	USACE contract lab	0.01 to 10 mg/L
Energetics	Perchlorate	SW846 6860[1]	USACE contract lab	0.001 to 0.1 mg/L
Organics	Volatile organic compounds	SW846 8260C[1]	USACE contract lab	0.001 to 0.1 ug/L
Water isotopes	$^2H/^1H$, $^{18}O/^{16}O$	USGS 1142[2]	USGS Reston Stable Isotope Laboratory	2‰ as δ^2H and 0.2‰ $\delta^{18}O$

[1] U.S. Environmental Protection Agency, 2009a.

[2] Epstein and Mayeda, 1953; Revesz and Coplen, 1991.

The mineralogy discussion in this report includes the analytical results of a soil-profile investigation. Soil samples were obtained through the use of direct-push methods. Samples were collected from two locations (fig. 2,); sample site 1 was topographically flat with no evidence of surface-water features, while the second site (sample 2) was located in a small depression in a ditch designed to collect and divert water. Samples were collected at 1-ft intervals from land surface to a depth of 40 ft below land surface (bls), then at 2-ft intervals until soil saturation. Soil samples were sent to the USGS contract laboratory, TestAmerica, Arvada, Colorado, for gravimetric percent moisture analysis by American Society for Testing and Materials (ASTM) method D2216-90 and water-soluble anions leached from these samples were analyzed by U.S. Environmental Protection Agency (EPA) method SW846 9056.

Stable isotope ratios of water, hydrogen (^{2}H/^{1}H, deuterium as δ^2H) and oxygen (^{18}O/^{16}O, oxygen-18 as δ^{18}O) were used to examine the influences of different source waters and seasonal variations of recharge sources between wells. The water isotope data were used to calculate the possible volumetric contributions of San Andres-Glorieta water into the alluvial aquifer because of a leaking cistern near the production well (fig. 2) in the Administration Area. End-members for the mixing calculations were the isotope values for the sample collected from the Depot production well completed in the San Andres-Glorieta aquifer and the median isotope values for alluvial aquifer wells not influenced by leakage from the cistern or the South Fork of the Puerco River (based on hydraulic gradients and a graphical review of the δ^2H and δ^{18}O values). The isotope data were used to estimate fractional contributions of source waters by inserting the data into a binary, isotope-mixing equation for each well:

$$R_M = R_A f_A + R_B \left(1 - f_A\right) \tag{1}$$

or, by rearranging,

$$f_A = \frac{R_M - R_B}{R_A - R_B} \tag{2}$$

where

f_A is the compositional fraction of source water A in the mixture of source waters A and B (dimensionless),
R_M is the isotopic ratio in the mixture of source waters A and B (per mil),
R_B is the isotopic ratio in source water B (per mil), and
R_A is the isotopic ratio in source water A (per mil).

The values of δ^2H and δ^{18}O were used independently in the calculations as a quality-assurance check and to evaluate any possible influences on either element’s isotope ratios from matrix or other effects.

The major-element concentrations were analyzed to examine the geochemical relations of groundwater between wells that could indicate a common source of water and the isolation or mixing of flow paths within the alluvial aquifer at the Depot. The ion exchange pool at any location along a flow path reflects water-rock interactions, atmospheric inputs, clay mineralogy, water pH, and water chemistry (Bullen and Kendall, 1998). Water-rock interactions that produce mineral dissolution or adsorption can result in nonconservative solute behavior that changes the composition of groundwater as it moves through the aquifer (Langmuir, 1997). The duration of water-rock interactions can increase solute concentrations (or possibly decrease concentrations through mineral precipitation) in response to dissolution reactions with formation minerals (Bullen and Kendall, 1998). In order to determine the equilibrium state of the major precipitates, saturation indices (log of the ratio of the ion activity product and the solubility product) were computed for groundwater from all of the wells by entering all available solute concentrations into the geochemical software PHREEQC (Parkhurst and Appelo, 1999) using the PHREEQCi interface (version 2.17.0). While nonconservative species can indicate a well’s position along the flow path, conservative species may indicate flow-path mixing or recharge. Conservative species are those generally not released into groundwater from the aquifer minerals and those not likely to interact with these minerals.

In addition to anthropogenic inputs, reduction-oxidation (redox) conditions can substantially affect the chemical composition of groundwater. Along with dissolved oxygen and nitrate, the presence of the trace elements iron and manganese in solution was used to determine groundwater redox conditions based on the solubility of the element under varying redox conditions (McMahon and Chapelle, 2008).

Regression analysis and correlation statistical methods were used to characterize geochemical relations between concentrations of individual constituents and total dissolved solids. A linear regression analysis was performed on the data and evaluated for predictability with the coefficient of determination (r^2) (Helsel and Hirsch, 2002). For this report, a correlation was considered statistically significant if the p-value was less than 0.001 and r^2 was greater than 0.8.

Some analytical results are reported as estimated (E) concentrations. Concentrations reported as estimated indicate the constituent is present, but there is some type of quantitative uncertainty. It is generally the case that reported concentrations are smaller than a minimum concentration that can be reliably reported by a given analytical method but generally larger than the long-term method detection limit (Childress and others, 1999). Results reported as estimated also may result from quality concerns such as matrix effects or instrument calibrations that may affect the accuracy of the value. In addition, some analytical results are reported as undetected (U) concentrations. The undetected results are concentrations that are below the analytical detection limit.

Quality-Assurance Plan

The geochemical and water-level data presented in this report were collected by the USACE with assistance from the USGS. Groundwater-data collection was performed according to USGS quality-control (QC) and quality-assurance (QA) standards described in the USGS National Field Manual for the Collection of Water-Quality Data (U.S. Geological Survey, variously dated). Samples collected from each well were analyzed for major cations and trace elements at the USACE contract laboratory (ARS Laboratory, Albuquerque, N. Mex.); for DS, major anions (Br, Cl, F, and SO_4), and ANC (for determining HCO_3) at the USGS contract laboratory (TestAmerica, Arvada, Colo.); and for stable isotopes of water at the USGS Stable Isotope Laboratory, Reston, Va. The USACE uses the Automated Data Review Software developed by Laboratory Data Consultants, Inc. for its QA review of aqueous chemical data and a private contractor for analytical data validation. The USGS reviewed the geochemical data for comparison of QC samples. Sequential QC replicate samples were collected at randomly selected sites to evaluate sampling and laboratory variability and precision. All QC replicate sample results were within 10 percent of the environmental sample results. Groundwater samples were obtained from wells with dedicated or disposable equipment and, thus, no rinsate blanks were collected. Thirty-eight trip blanks were collected and analyzed for volatile organic compounds (VOCs). Several constituents were detected in trip blanks resulting in six methylene-chloride and carbon-disulfide results to be qualified as nondetect (U). Both laboratories analyzed laboratory blank samples, which produced nondetections for all blank samples. As further evaluation of the quality of the data, unfiltered major cations and major anions data were converted to milliequivalents per liter and examined for electrical balance. Nine of the 26 samples did not balance within 5 relative percent difference and all but 3 were within 10 relative percent difference. There were five negative and four positive excesses.

Geochemical Evidence for Groundwater Flow Paths in the Alluvial Aquifer at Fort Wingate Depot Activity

The hydrogeologic and geochemical framework that controls the movement and geochemistry of groundwater within the study area is described herein. The source and spatial influence of groundwater flow paths are interpreted from the isotopic ratios of water and the geochemical concentrations of major ions. These interpretations are constrained by hydraulic gradients and from predictable trends of conservative and nonconservative chemical behavior based on the mineralogy of alluvial deposits.

Hydrogeologic and Geochemical Framework

Analysis of the hydrogeologic and geochemical framework at the Depot is dependent upon the composition and alteration of the exhumed Chinle Group and the redeposition of Chinle-derived sediments as Quaternary alluvium. This description of the geologic environment establishes the major controls on groundwater movement within the subsurface. The mineral composition of the alluvial aquifer is important in determining the conservative and nonconservative behavior of chemical species involved in groundwater-rock interactions.

Hydrogeology

Overlying the regional basement granitic rocks are the sedimentary Permian Abo and Yeso Formations, Glorieta Sandstone, and San Andres Limestone. Overlying the Permian strata are the Triassic nonmarine, red-bed siliciclastics including the Moenkopi Formation (Middle Triassic) and the younger Chinle Group. The Chinle Group is the dominant geologic unit exposed at the Depot (figs. 3 and 4). It can be over of 1,000 ft thick in the area and is composed primarily of mudstone and siltstone with some minor sandstone and limestone components (Stone and others, 1983; Lucas and others, 2003). Deposition of the Chinle Group occurred during the Late Triassic Period in the Chinle Basin, a retro-arc basin on the western edge of the North American craton (Tanner, 2003a). The various siliciclastic sediments of the Chinle Group (fig. 4) originated from surrounding highlands such as the Mogollon Highlands in Arizona, the Uncompaghre Highlands in New Mexico and Colorado, and various upland areas in Texas such as the Amarillo-Wichita and Ouachita-Marathon uplifts. Sediments were transported from these areas by tributaries of a major fluvial system flowing northwest across an alluvial plain, where the sediments were deposited unconformably atop older Triassic deposits (Tanner, 2003b). Initial deposition occurred in paleovalleys where incision into older formations (Moenkopi and others) occurred (Stewart and others, 1972).

During the Late Cretaceous, the Laramide orogeny deformed the landscape and produced the current structural features of the Depot area (Baldwin and Anderholm, 1992). While the Zuni uplift likely has a compound tectonic history, its present configuration is thought to have been created by indentation-extrusion tectonics during the Laramide orogeny that took place approximately 75 to 35 million years ago (Chamberlin and Anderson, 1989). Erosion of the Zuni uplift has exhumed older formations at higher elevations in the Zuni Mountains (fig. 1) and progressively younger formations at lower elevations (fig. 3). Because of this erosion, the various formations of the Chinle Group—Shinarump, Bluewater Creek, Petrified Forest, and Owl Rock—are exposed at discrete locations across the Depot (fig. 3). For example, the

Sonsela Member of the Petrified Forest Formation is exposed at land surface in a band to the south and southeast of the study area (fig. 3). Southeast of the exposure, the Sonsela Member has been removed by erosion, and northwest of the exposure, the Sonsela Member is overlain by younger sediments and alluvium. Erosion of these rock layers occurs more rapidly on the softer clay and mudstones than on the more resistant interbedded sandstones. The different erosional rates have generated a series of alternating erosion-resistant cuestas (ridges with gentle slopes on one side and steep slopes on the other), and less erosion-resistant valleys in a stairstep configuration. This stairstep structure of older to younger cuestas, and the presence of relatively hydrologically impermeable geologic units (such as the mudstones of the Painted Desert Member of the Petrified Forest Formation), commonly creates aquifers that exhibit artesian conditions.

Artesian conditions have been recorded in the Sonsela Member and thin Painted Desert Member sandstone units underlying the Depot's alluvial aquifer (Callahan and Cushman, 1954; U.S. Army Corps of Engineers, 2009, 2010, 2011c). The artesian conditions found in these underlying units inherently prevent the downward migration of groundwater or constituents. In addition, no hydrologic or geologic connection was found between the alluvial deposits and the Sonsela Member or sandstones of the Painted Desert Member in the geophysical investigation performed in 2008 and 2009 (Michael Powers, U.S. Geological Survey, written commun., 2010). The small potential for cross-formational groundwater flow constrains the possible sources and sinks of alluvial groundwater, groundwater flow, and aqueous chemical species to the alluvium and the surface.

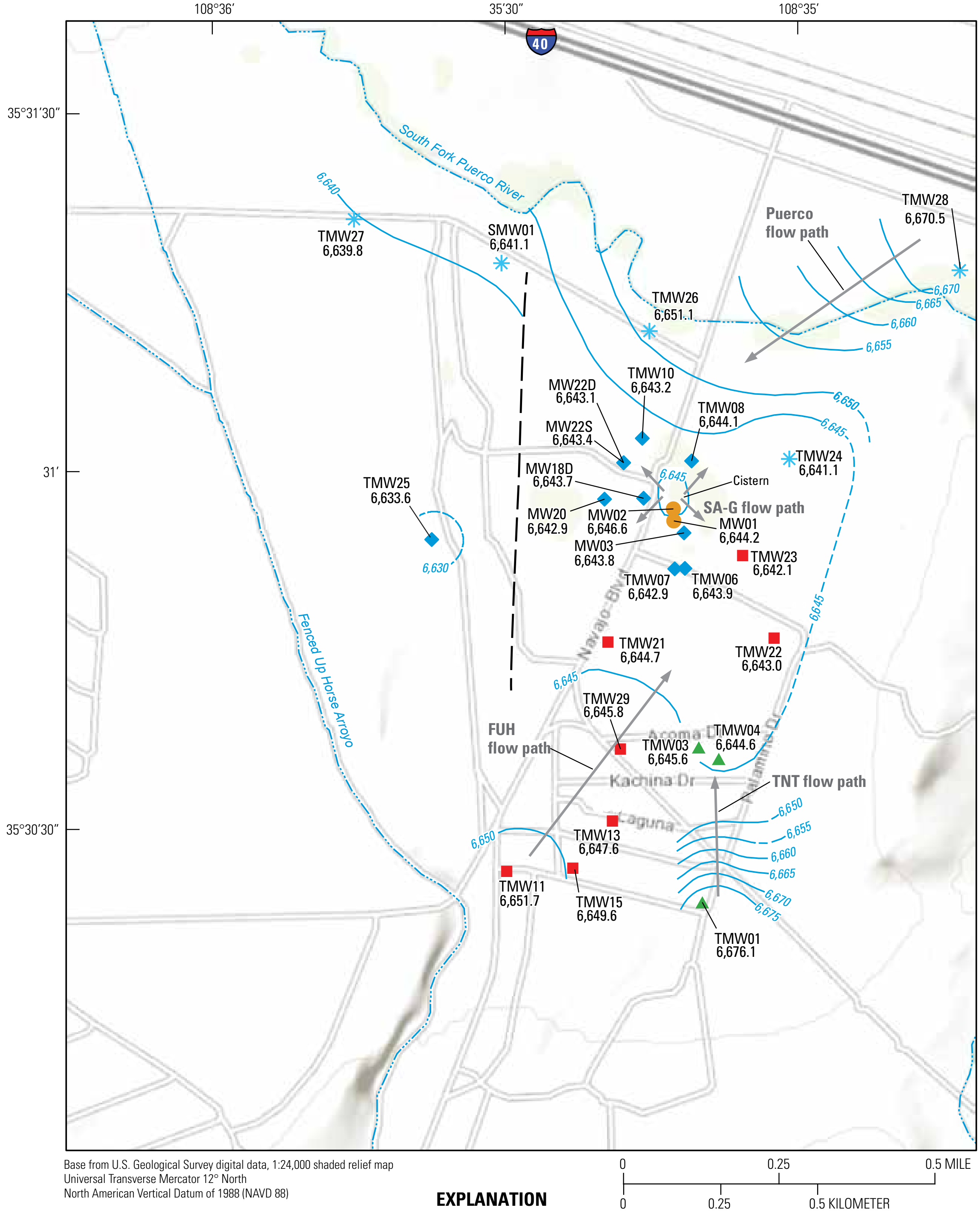
The alluvial deposits in the valleys around the Depot are composed of the detrital material from formations outcropping in the area (Leopold and Snyder, 1951). The rock outcrops of the Painted Desert Member in and around the study area provide evidence of previous erosion and the identity of the source formation from which the alluvium in the study area was derived. The Painted Desert Member can be up to 500 ft thick in the region and is composed of smectitic mudstones and thin, interbedded sandstones (Lucas and others, 1997; Tanner, 2003a). Given the predominance of mudstones in the Painted Desert Member, erosion of this member would be expected to provide abundant fine-grained material to the Depot alluvium. Drill cuttings and core descriptions from lithologic logs compiled during various investigations at the Depot describe the fine-grained nature of eroded siltstones and mudstones in the alluvial deposits (Michael Powers, U.S. Geological Survey, written commun., 2010; PMC Environmental, 2001; U.S. Army Corps of Engineers, 2011a, b). These unconsolidated deposits in the study area represent relatively low-energy alluvial deposition with interbedded sands and clays. The alluvium generally is low in hydraulic conductivity because of the large clay content, and groundwater velocities overall are low despite the presence of some sand layers because those layers are discontinuous. Therefore, it should be considered that not all wells penetrating the alluvial aquifer tap into well-connected flow paths, and that saturated deposits in which they are screened may represent somewhat isolated groundwater. This conclusion is supported by slightly dissimilar water levels in some adjacent wells (U.S. Army Corps of Engineers, 2009, 2010, 2011c). Thicknesses of the alluvial deposits in the northern part of the Depot near the Administration and Workshop Areas vary from zero to just over 100 ft (Michael Powers, U.S. Geological Survey, written commun., 2010).

The October 2009 groundwater levels measured in wells screened in the alluvial aquifer beneath the Administration and Workshop Areas indicate that the potentiometric surface generally follows the surface topography (fig. 5). In the southern part of the study area, groundwater generally flows northward; in the northern part of the study area, near the South Fork of the Puerco River, groundwater generally flows to the southwest (fig. 5). The center of the study area appears to be an area where multiple flow paths converge, and flow directions are highly variable (fig. 5). The source of groundwater levels is from the USACE semiannual groundwater report (U.S. Army Corps of Engineers, 2011c) and the potentiometric-surface contours in figure 5 were hand drawn.

Probable areas of recharge and likely groundwater flow paths were initially identified based on topography and groundwater elevations as described in the "Study Methods" section. Three possible flow paths originating at the aquifer margins were identified, and a fourth recharge source resulting in hydrologic and chemical effects that could be observed over a spatially limited area was identified near the cistern for collecting water from the Depot production well. The leaking cistern likely provides an artificial recharge source to the alluvial aquifer and creates a groundwater mound with the high centered near MW02 (fig. 5). For the purposes of discussion in this report, the aquifer has been divided spatially into four general areas, each with groundwater that appears to have originated primarily at one of these four main recharge sources. These areas are referred to as "flow paths," and they have been defined as follows:

1. A flow path originating near the southeastern boundary of the study area near well TMW01 (fig. 5). Based on the topography and geology, recharge is considered to occur as focused hill-front recharge. This proposed recharge is considered to be analogous to mountain-front recharge but at a smaller scale. The hydraulic gradient indicates that water in this area is moving northward under the TNT leaching beds. This flow path is thus referred to as the "TNT" flow path;

2. A flow path originating at the southwestern boundary of the study area near the Fenced Up Horse (FUH) arroyo (fig. 5). This flow path may receive focused recharge from topographic depressions and the ephemeral and flashy FUH arroyo and is thus referred to as the "FUH" flow path. The hydraulic gradient indicates groundwater in this area is moving north to northeast;



Base from U.S. Geological Survey digital data, 1:24,000 shaded relief map
Universal Transverse Mercator 12° North
North American Vertical Datum of 1988 (NAVD 88)

EXPLANATION

6,650 — — **Potentiometric contour**—shows elevation at which water level would have stood in tightly cased wells, October 2009. Dashed where approximately located. Contour interval 5 feet. Datum is NAVD 88

FUH flow path → **Inferred groundwater flow direction and flow path designation**

— — **Inferred bedrock subcrop**

TMW24 ✳ 6,644.1 **Well identifier and water-level elevation**—In feet above NAVD 88

Well flow path designation

- ◆ Administration well
- ■ Fenced Up Horse (FUH) well
- ✳ Puerco River well
- ● San Andres-Glorieta well
- ▲ Trinitrotoluene (TNT) well

Figure 5. Potentiometric surface of the alluvial aquifer at Fort Wingate Depot Activity, New Mexico, 2009.

3. A flow path originating from the saturated alluvial deposits underlying the South Fork of the Puerco River to the north of the study area (fig. 5) and moving southwestward is herein referred to as the “Puerco” flow path and;

4. A fourth source, suspected of originating from a leaking cistern used to store San Andres-Glorieta (SA-G) aquifer water, generates a groundwater mound near MW02 (fig. 5) and flows radially outward, and is thus referred to as the “SA-G” flow path.

The hydraulic gradients suggest that the flow paths may converge in the Administration Area. The area of groundwater discharge cannot be definitively determined, but the topography, underlying geology, and groundwater elevations limit the number of possibilities. In October 2009, TMW25, located west of the Administration area, had the lowest groundwater elevation, indicating that groundwater might move in that direction. However, a south to north-trending bedrock subcrop with an elevation above the local water table has been identified at several discrete locations through a well drilling log (drill logs on file at USACE, Albuquerque, N. Mex.), surface geophysics (Michael Powers, U.S. Geological Survey, written commun., 2010), and direct-push drilling investigations (Fred Gebhardt, U.S. Geological Survey, oral commun., 2010). While the consistency of this subcrop is unknown, the spatial expanse of the evidence from borings and seismic data where it has been identified as well as the presence of a surface lineament of quaternary gravels suggest that it extends through much of the study area.

Geochemistry

The fine-grained material composing the alluvial aquifer was reflected in the substantial suspended sediment (as inferred by the turbidity values) in the groundwater samples collected in October 2009. The groundwater samples also had dissolved-solids concentrations (as interpreted from specific-conductance values; Hem, 1985)) that varied between some wells by more than an order of magnitude (fig. 6).

The wide range of turbidity values in alluvial groundwater at the Depot reflects the heterogeneous distribution of clays in the aquifer matrices. The silt- and clay-sized grains pass easily through gravel packs and well screens, and increased hydraulic gradients with pumping likely increase sediment suspension and transport. It is common for wells at the Depot to be pumped dry during well purging prior to sample collection, which would substantially alter the local hydraulic gradients. This slow recovery of groundwater levels to pumping stresses in the monitoring wells provides direct evidence of the presence of the fine, low conductivity material composing the aquifer matrix. In addition to occurring as suspended sediment, clay minerals often occur as colloids in natural waters (Brownlow, 1979). This tendency to form colloids is thought to influence the chemical analyses, even of the filtered samples. Colloids and fine-suspended solids that can pass through a 0.45-micrometer filter and can interfere with the dissolved analytical results by releasing solid-phase species in analytical methods that include an acid preparation (such as for metals) or an acid titration (such as for alkalinity), thereby potentially resulting in laboratory reported concentrations that are higher than actual dissolved concentrations of groundwater in the aquifer.

Clay Mineralogy

The siliciclastic clay and mudstones of the Painted Desert Member, from which the alluvium in the Depot area is derived, are mainly montmorillonitic (Schultz, 1963). Montmorillonite clays have negatively charged aluminosilicate layers that are separated by cations (Jury and others, 1991). This composition and structure of the solid matrix imparts two important chemical interactions, nonconservative and conservative, between the dissolved species in the alluvial groundwater and the aquifer minerals at the Depot. The first interaction involves the nonconservative behavior of cations. Under certain circumstances, the mineral cations can be replaced by aqueous cations in a reaction known as cation exchange. The less complex, single-layer theory of clay chemistry is sufficient to describe the cation exchange in the groundwater system. In the aluminosilicate clays, monovalent cations are preferentially exchanged for divalent cations, and large atomic radii are preferentially exchanged for smaller atomic radii (Berkowitz and others, 2008). Cation exchange also obeys stoichiometry requirements, such that if one divalent cation (for example, Ca^{2+}) was to be adsorbed, two monovalent cations (for example, Na^{+}) would go into solution (Berkowitz and others, 2008). Ion exchange reactions are virtually instantaneous; on the aquifer level, however, the rate-limiting steps include the tortuous path the ion travels between aquifer solids, the dissolution of secondary minerals that contribute to the aqueous cation exchange pool, and the number of mineral binding sites with available cations for exchange. Ion exchange reactions may also influence other reactions within the aquifer. For example, the dissolution of gypsum is driven to the aqueous phase as the calcium ion is exchanged with sodium and becomes bound in the clay layers. This mineral behavior explains the high aqueous sodium concentrations in the alluvial aquifer, as well as the high sulfate associated with gypsum dissolution and high ANC associated with calcite dissolution (tables 1–2 to 1–5 in appendix 1).

The second interaction between groundwater and the clay matrix involves the conservative behavior of anions. The net negative charge on the aluminosilicate layers of clays occurs regardless of pH, but these layers tend to have slightly higher negative charges at neutral and alkaline pHs (Jury and others, 1991). Therefore, the adsorption of negatively charged anions such as sulfate, nitrate, and chloride is usually negligible at the pHs found in the alluvial groundwater (6.9 to 8.0 standard units).

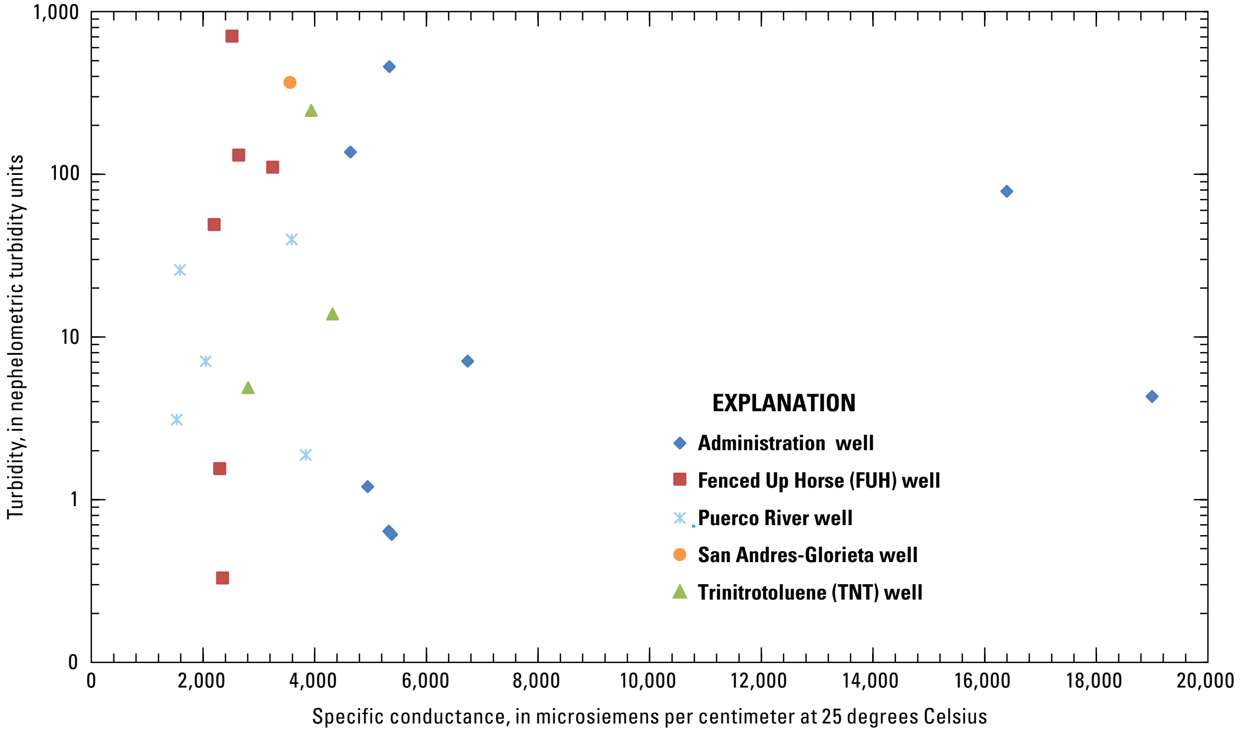


Figure 6. Turbidity and specific-conductance values for groundwater samples collected in October 2009 at Fort Wingate Depot Activity.

The piper diagram is a trilinear diagram that is useful for illustrating the hydrochemical facies of a water sample (Hem, 1985). The percentages on the axis of the diagram represent the relative abundance of ions in percent milliequivalents per volume. Examination of the major solutes in a Piper diagram (fig. 7) illustrates the sodium-dominance that likely results from cation exchange. The dominance of sodium in the groundwater is reflected in the small but linear change in the cation distribution with distance along the flow path from the recharge source, while the more scattered anion distribution reflects the competing influences of geochemical processes. The lack of a strong chloride component is an indication that halite dissolution is not a major source of excess sodium.

Secondary Minerals

Other minerals associated with the Chinle Group are carbonates (Stone and others, 1983; Lucas and others, 2003) and gypsum (Gregory, 1917; Stewart and Carlson, 1978) derived from paleosols, lacustrine sources, and calcareous fluvial rip-ups. Major ions derived from these minerals include calcium, bicarbonate, and sulfate. These same ions also are often deposited in soils through atmospheric deposition and can become significant soil components, especially in the arid southwest, where infiltration of precipitation to the water table may be negligible because of evapotranspiration (Walvoord and others, 2002).

Potential sources for sulfate in groundwater include the dissolution of anhydrite or gypsum, atmospheric deposition, and weathering of sulfidic minerals such as pyrite. Analyses of soil cores revealed sulfate at variable but higher concentrations than other anions (median concentration was 170 milligrams per kilograms [mg/kg]) throughout the entire soil column beneath a topographically flat site (fig. 2 and table 3). The sulfate concentrations were in contrast to chloride concentrations that were smaller (median concentration was 30 mg/kg), and the larger concentrations were found primarily above the root zone (down to about 30 ft below land surface) (table 3). Chloride deposited from atmospheric sources may accumulate in the soil where precipitation or surface water is being removed by evapotranspiration and is not regularly flushed through the soil profile (Wood, 1999). The difference between the distributions of sulfate and chloride concentrations in the soil depth profile strongly suggests an atmospheric origin for chloride and an authigenic mineral origin for sulfate. Anion concentrations as a function of depth in the unsaturated alluvial deposits support an anhydrite/gypsum origin for sulfate in groundwater. It also was considered that sulfate may be derived from the weathering of sulfur-rich, calcium-poor minerals such as pyrite (FeS_2) (Hem, 1985). Pyrite is common in organic-rich shales (Boggs, 2006) and can be precipitated after sediment deposition under reducing conditions. Black shales (indicative of organic richness during deposition) have been identified in

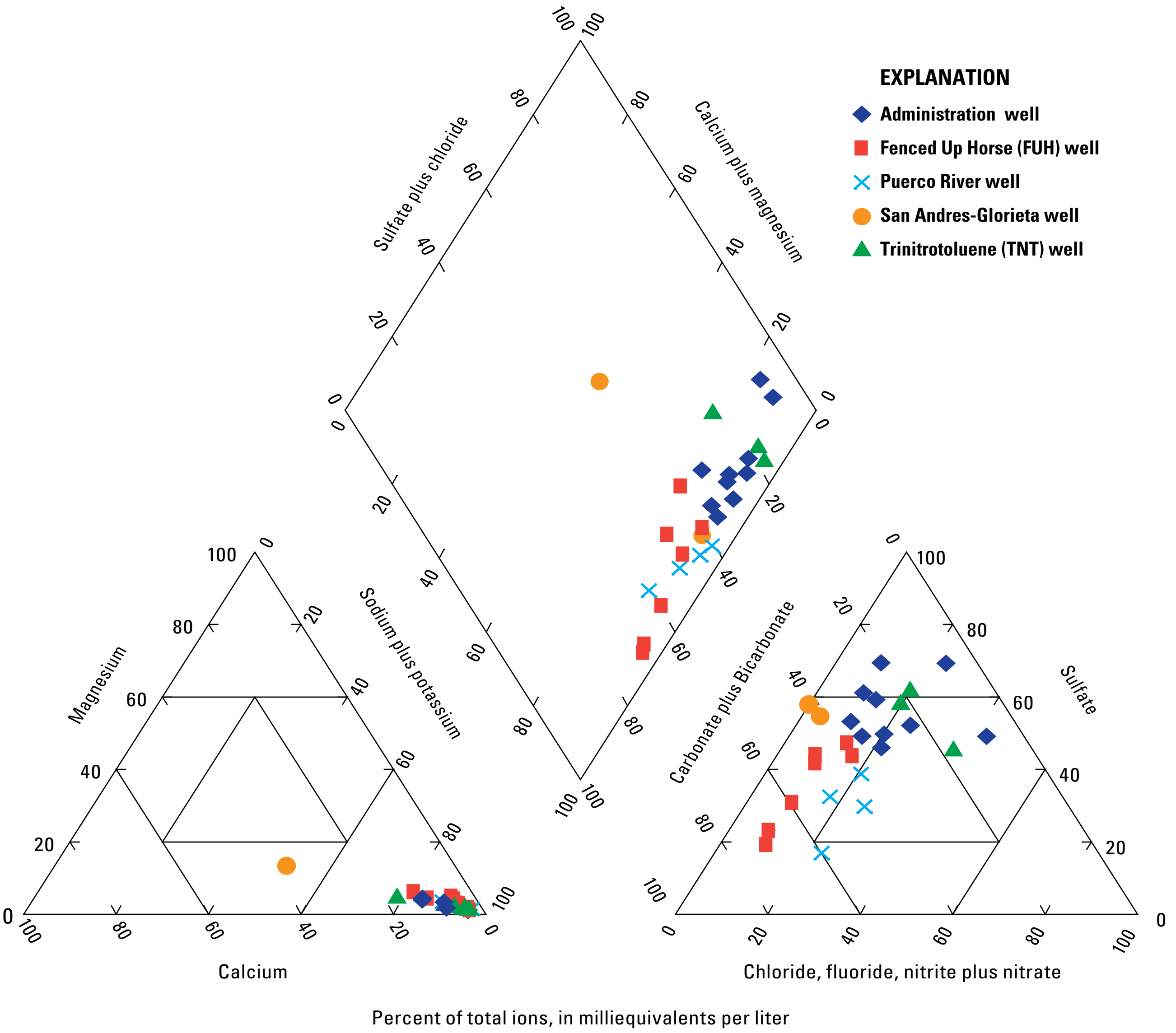


Figure 7. Piper diagram showing major ion relations in Fort Wingate Depot Activity groundwater, October 2009.

the Bluewater Creek Formation but not in the Petrified Forest Formation (Heckert and Lucas, 2003).

The capacity to neutralize an acid solution may be derived from multiple ionic species and sources. In nearly all natural waters, however, the ANC results from the activity of the carbonate and HCO_3 ions (Hem, 1985). In aquifers with neutral or slightly alkaline pH, as is the case with the alluvial aquifer in the study area, the dominant species is bicarbonate. Bicarbonate is primarily added to the groundwater through atmospheric and soil gas inputs (carbon dioxide), although increases in ANC can indicate the weathering of carbonate-rich minerals such as calcite ($CaCO_3$). According to Hem (1985), ANC in most groundwater is somewhat higher than 200 mg/L, and concentrations above 1,000 mg/L may occur in waters that are low in calcium and magnesium. The high ANC of the alluvial groundwater (400 to 1,600 mg/L as $CaCO_3$; table 1–5 in appendix 1) suggests not only a mineral origin but also reflects the cation exchange of the alluvial clays. The presence of calcite is supported by the consistent presence of effervescent reactions to hydrochloric acid throughout the soil column (Michael Powers, U.S. Geological Survey, written commun., 2010).

The common evaporite halite (NaCl) is not reported to occur in the continental deposits found in and around the Depot. Thus, the natural occurrence of chloride in groundwater at the Depot is considered to be primarily derived from atmospheric deposition. The distribution of the chloride concentrations in the anion soil investigation (table 3) supports that hypothesis. Chloride often is described as a conservative species in many groundwater systems, meaning that

Table 3. Anion concentrations in two soil profiles collected from Fort Wingate Depot Activity.

[ft bls, feet below land surface; mg/kg, milligrams per kilogram; U, undetected]

Depth (ft bls)	Moisture (percent)	Chloride (mg/kg)	Fluoride (mg/kg)	Nitrate (mg/kg)	Sulfate (mg/kg)
Sample 1 taken from site that is well drained and topographically flat					
3	8.3	30	3.3	1.0	39
4	3.5	69	3.4	1.4	70
6	4.8	26	2.3	4.3	9.1
7	6.1	21	3.4	7.7	9.1
8	9.8	100	5.4	11	120
10	9.5	130	4.7	6.0	310
11	4.0	72	2.1	2.1	260
12	4.7	180	1.9	3.0	200
14	5.5	240	2.2	5.0	210
15	4.5	170	1.5	6.5	110
16	3.2	92	1.1	7.4	69
18	3.8	66	1.1	9.6	170
19	4.1	56	1.1	9.8	190
20	7.6	100	1.5	19	550
22	5.8	57	1.6	10	270
23	5.8	59	2.0	9.8	170
24	3.6	30	1.2	4.4	110
25	4.0	37	2.3	4.2	160
26	3.5	25	1.5	3.3	92
27	2.6	28	1.3	3.3	77
28	2.2	16	1.3	2.0	54
30	5.8	20	2.8	2.9	120
31	8.5	24	5.2	3.6	240
32	10	31	6.2	4.4	300
33	7.6	18	4.3	2.7	220
34	8.8	18	4.6	2.7	310
35	12	25	4.4	3.8	360
36	5.7	16	2.9	2.1	320
37	5.3	12	2.9	1.4	170
38	3.1	7.5	2.1	0.55	110
39	4.8	14	3.3	0.68	200
42	7.5	26	2.0	3.1	110
44	10	31	3.2	1.2	270
46	8.2	28	5.0	1.3	410
48	14	34	5.6	3.6	690
50	14	22	4.5	5.6	220
52	12	19	4.0	4.8	170

Depth (ft bls)	Moisture (percent)	Chloride (mg/kg)	Fluoride (mg/kg)	Nitrate (mg/kg)	Sulfate (mg/kg)
Sample 2 taken from surface depression that is located along water collection ditch					
2	16	3.1	U	19	8.7
3	11	U	U	U	U
4	6.5	U	U	U	U
6	14	U	2.3	U	3.3
7	14	U	2.2	U	11
8	15	U	2.1	0.65	9.8
10	5.2	U	U	0.40	1.9
11	10	U	1.5	U	2.2
12	12	U	1.6	U	2.7
13	17	U	2.7	U	14
14	16	U	1.7	U	15
15	3.7	U	1.1	U	4.7
16	5.4	U	1.3	U	6.3
17	7.0	U	1.5	U	5.4
18	6.0	U	0.97	U	3.8
19	7.0	U	U	U	U
20	12	U	1.1	U	4.1
22	7.0	U	1.4	U	11
23	4.1	U	U	U	7.2
24	3.2	U	U	U	3.4
25	3.0	U	U	U	4.4
26	5.3	U	1.2	0.37	12
27	7.9	20	1.8	1.5	21
28	12	4.5	2.5	U	19
29	15	7.8	3.0	0.63	110
30	3.6	4.7	1.2	U	28
31	10	3.4	5.4	0.39	83
32	7.6	2.1	4.1	0.34	140
33	10	U	4.6	U	350
34	5.0	13	3.0	U	230
35	13	2.4	5.2	U	470
36	13	6.6	6.0	U	510
38	5.2	5.4	4.8	U	360
40	12	7.1	4.7	U	600
42	10	8.3	4.1	U	550
44	7.2	7.7	3.1	U	320
46	21	31	5.3	0.66	800
48	17	31	4.2	0.55	370

aqueous chloride typically is not added to or removed from groundwater through water-rock interactions. The high clay content of the alluvial aquifer and the conservative behavior of anions to the clays support this assumption. Because of the atmospheric origin of chloride and its conservative nature, aqueous chloride in groundwater that is isolated from any recharge, flow path mixing, or evapotranspiration is expected to remain at a constant concentration as it moves along a flow path.

Geochemical Evidence of Groundwater Recharge Sources

While the mechanisms of groundwater recharge at the Depot are beyond the scope of this report, the likely origins of groundwater flow to the study area for use as geochemical end-members were initially identified by analyzing groundwater elevations in the context of surficial and topographic features. Groundwater in wells with higher groundwater elevations flows to the downgradient wells (fig. 5) given the geologic constraints of bedrock outcrops (fig. 3). Based on the groundwater elevations and the surrounding outcrops that may allow for hill-front recharge, TMW01 appears to be located near the source of water entering the alluvium and moving north along the TNT flow path, TMW11 appears to be located near the source of water entering the study area and moving northeast along the FUH flow path, and MW02 appears to be located near the source of water entering the alluvium and moving radially outward along the SA-G flow path. Because wells TMW01, TMW11, and MW02 appear to be nearest to the origins of their respective flow paths, groundwater chemical data from these wells were used as flow-path end members for the chemical composition of groundwater. While TMW28 appears to be located nearest to the primary source of recharge for the Puerco flow path, limited chemical data prohibit examination of this well as an end member.

The isotopic composition (δ^2H and δ^{18}O) of groundwater collected from the alluvial aquifer was analyzed to spatially and temporally constrain likely sources of groundwater recharge across the Depot. The variation in isotopic composition of precipitation may allow discrimination of recharge sources because of the mass-dependent fractionation of the isotopes that result from temperature changes during the formation of precipitation and during evaporation prior to infiltration into the aquifer (Genereux and Hooper, 1998; Ingraham, 1998). This mass-dependent fractionation results because the various isotopic forms of water have different vapor pressures and freezing points. Thus, precipitation associated with warmer temperatures contains a greater amount of heavier isotopes than precipitation associated with cooler temperatures. Groundwater δ^2H and δ^{18}O values at the Depot generally plot below (to the right of) the global meteoric water line (GMWL) (Craig, 1961) (fig. 8). The overall isotopic trend has a reduced slope compared to the GMWL, typical of the arid and semi-arid Southwestern United States climate where there is a large evaporation component to the water budget (Friedman and others, 1992; Kendall, 2001).

Deuterium values in the alluvial aquifer ranged from (-107 to -74.1 ‰) and oxygen-18 ranged from (-14.4 to -9.6 ‰) (table 1–11 in appendix 1). The wide range of δ^2H and δ^{18}O values in the alluvial groundwater (fig. 8) indicates substantial differences in the isotopic composition of recharge water entering the alluvial aquifer. Groundwater sampled from the production well (completed in the San Andres-Glorieta aquifer) was isotopically the lightest of the groundwater samples (fig. 8) and is used for end-member contribution calculations. The lighter isotopic composition of the production well water may reflect recharge during a paleoclimate that was cooler thousands of years ago or be attributed to precipitation that recharged the San Andres-Glorieta aquifer in the higher elevations of the Zuni Mountains where these formations are exposed (figs. 1 and 3). Storms moving across the region are pushed upward by Zuni Mountain orographic effects, which causes cooling and increases the lighter isotopic fraction in precipitation (Coplen and others, 2000).

Based on the lighter isotopic values compared to other groundwater samples, leakage from the cistern containing water from the San Andres-Glorieta aquifer (SA-G flow path) appears to be influencing wells MW01, MW02, MW03, MW22D, and TMW10 (fig. 8). The groundwater mound formed around the leaking cistern may allow San Andres-Glorieta water to mix radially outward with the alluvial aquifer water at locations having a lower groundwater elevation. As indicated by the potentiometric surface (fig. 5), the influence of water leaking from the cistern could extend southward to TMW07, eastward to TMW24, northward to TMW10, and westward to MW20 (wells that are in and around the main buildings of the Administration Area). Groundwater from wells with δ^2H and δ^{18}O values greater than -85‰ and -11‰, respectively, are not considered to be influenced by water from the leaking cistern as the location of wells such as TMW13 and TMW29 near these values are not hydraulically within the SA-G flow path.

The contribution of San Andres-Glorieta water to the groundwater in wells that appear to be influenced by this isotopically light water (wells MW01, MW02, MW03, MW22D, and TMW10) was estimated by inserting the isotope composition in the mixing equation 2 (table 4). Median isotope values were determined for groundwater from wells considered not to be influenced by water from the leaking cistern or from the South Fork of the Puerco River alluvial basin. The range of values considered (graphically most wells between TMW01 and TMW21 on fig. 8) represents the TNT and FUH flow paths along with any local recharge in the Administration Area. The median isotope values for δ^2H and δ^{18}O in wells MW18D, MW22S, TMW01, TMW03, TMW04, TMW06, TMW07, TMW08, TMW11, TMW13, TMW15, TMW21, TMW22, TMW23, TMW25, TMW29 were calculated to be -81.95‰ and -10.64‰, respectively.

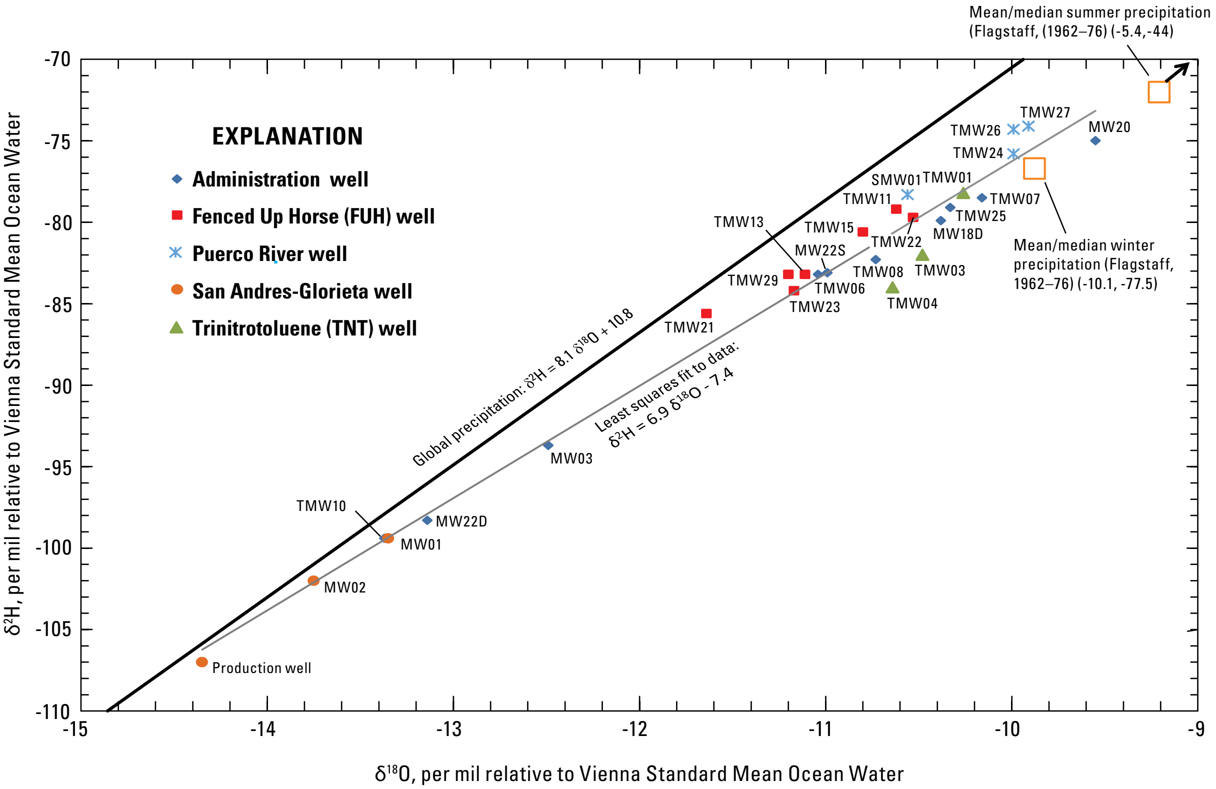


Figure 8. Water isotopes for groundwater samples collected at Fort Wingate Depot Activity, October 2009.

These values were inserted into the binary mixing equation 2 along with the isotope values from the Depot production well (-106.72 ‰ δ^2H, -14.38 ‰ $\delta^{18}O$).

Results of the calculations (table 4) indicate substantial contribution of San Andres-Glorieta water to the alluvial aquifer around the leaking cistern where a majority or near majority of the water (between 46 and 84 percent) from wells MW01–03, MW22D, and TMW10 originated as San Andres-Glorieta water. The substantial contribution of San Andres-Glorieta water to the overall volume of water in groundwater samples from wells MW01–03, MW22D, and TMW10 suggests that these wells sample parts of the aquifer that are hydraulically connected to each other. In contrast, the isotope values for groundwater from nearby wells MW18D, MW20, MW22S, TMW06–08, and TMW23 do not indicate the presence of San Andres-Glorieta water even though these wells sample locations that are hydraulically downgradient from the groundwater mound and are as close or closer to the leaking cistern as the wells influenced by San Andres-Glorieta water (figs. 5 and 8). This indicates that these wells are not hydraulically connected to the leaking cistern source and adds evidence of the aquifer heterogeneity.

Water from the other end-member wells (TMW01 and TMW11) located near likely recharge areas did not have sufficiently distinct isotopic ratios to allow for the calculation of end-member contributions (fig. 8). Some qualitative isotopic trends can, however, be described. For example, the isotopic ratios of groundwater samples collected from wells associated with the FUH and TNT flow paths typically become lighter in the downgradient direction. This distribution may reflect a pulse of isotopically heavier recharge from the summer rains that slowly move through the aquifer. Given this consideration, the anomalous isotopic ratios of TMW22 suggest that groundwater in this well is likely to receive locally sourced hill-front recharge from the outcrop to the east. In addition, groundwater isotopic ratios associated with the TNT flow path tend to exhibit more evaporative influence than the FUH wells. With the exception of SMW01, the wells associated with the Puerco flow path (TMW 24, 26, and 27) generally had the heaviest δ^2H and $\delta^{18}O$ fractions.

Isotopic variability in groundwater not influenced by water from the leaking cistern (that is, from wells with δ^2H and $\delta^{18}O$ values greater (heavier) than -85‰ and -11‰, respectively) may be influenced by seasonal variations in other recharge sources, such as recharge from the South Fork of the Puerco River, which likely influences groundwater along the northern boundary of the Depot (based on the relatively heavy isotopic composition of groundwater from wells TMW24, TMW26, and TMW27), and recharge from local precipitation (fig. 8). Seasonal variation in the isotopic composition of local precipitation is likely the result of differences in the sources of winter recharge, predominantly a result of storms moving

Table 4. Calculated fractional contributions of local recharge and San Andres-Glorieta aquifer water to groundwater found in monitoring wells influenced by water from the leaking cistern at Fort Wingate Depot Activity.

[Median isotope values (δ^2H of -81.95‰ and δ^{18}O of -10.64‰) of local recharge (wells MW18D, MW22S, TMW01, TMW03, TMW04, TMW06, TMW07, TMW08, TMW11, TMW13, TMW15, TMW21, TMW22, TMW23, TMW25, TMW29) and individual isotope values (δ^2H of -107.0‰ and δ^{18}O of -14.35‰) from the Depot production well (San Andres-Glorieta aquifer) were used as end-members to determine fractional contributions of the resulting mixture that is water influenced by the leaking cistern in the Administration Area]

Well and modeled constituent	Local recharge signal fractional contribution	San Andres-Glorieta signal fractional contribution
Well MW01		
δ^2H of water	0.31	0.69
δ^{18}O of water	0.27	0.73
Well MW02		
δ^2H of water	0.20	0.80
δ^{18}O of water	0.16	0.84
Well MW03		
δ^2H of water	0.54	0.46
δ^{18}O of water	0.51	0.49
Well MW22D		
δ^2H of water	0.35	0.65
δ^{18}O of water	0.33	0.67
Well TMW10		
δ^2H of water	0.31	0.69
δ^{18}O of water	0.27	0.73

into the area from the Pacific Coast, and summer recharge, a result of thunderstorms predominately from moisture driven northward from the Gulf of California and the Gulf of Mexico (Southwest Climate Change Network, 2010). Oceans differ in their isotopic composition by latitude. Precipitation derived from ocean water originating closer to the poles is isotopically lighter than precipitation derived from the ocean water originating at lower elevations such as the Gulf of Mexico (Schmidt and others, 1999; Coplen and others, 2000; Hoefs, 2009).

A weather station site in Flagstaff, Arizona (about 170 mi west of the Depot), has a precipitation isotopic composition data set from 1962 to 1976 that illustrates seasonality in the isotopic composition of precipitation falling in the region. For this report, the Flagstaff precipitation data were divided between precipitation occurring in winter (November through April) and precipitation occurring in summer (May through October). Each subset of data contained a large range of values, but the mean (-77.4 and -9.9 for winter and -43.9 and -5.2 for summer of δ^2H and δ^{18}O values, respectively) and median (-77.5 and -10.3 for winter and -44.0 and -5.5 for summer of δ^2H and δ^{18}O values, respectively) within each data subset were nearly identical, indicating normally distributed data. The mean seasonal precipitation isotopic values for the Flagstaff data are distinct from each other, although the Flagstaff data are substantially heavier in isotopic composition than the Depot's groundwater data (fig. 8). This difference in isotopic composition between the Flagstaff precipitation and the Depot groundwater may be because of the size and dates of samples or a real physical effect such as the rainout effect (Rayleigh distillation fractionation), where precipitation from the Pacific Ocean becomes isotopically lighter with rainout from a storm system (Clark and Fritz, 1997; Kendall, 2001). The presence of a seasonal isotopic signal in the Flagstaff precipitation data helps to illustrate one likely cause of the variability in isotopic ratios in alluvial groundwater believed to result from local recharge that is unaffected by mixing with water leaking from the production-well cistern or infiltrating from the South Fork of the Puerco River.

Geochemical Evidence for Delineation of Groundwater Flow Paths

Groundwater flow paths at the Depot were initially delineated on the basis of groundwater elevations and on likely groundwater recharge and discharge areas. Groundwater flow paths are further delineated through interpretation of the conservative and nonconservative behavior of major elements (major ions consisting of the cations of calcium and sodium, and the anions of bicarbonate, sulfate, and chloride).

Sodium was the dominant cation in the alluvial groundwater in October 2009 (fig. 9). Sodium concentrations trend linearly with DS concentrations (linear r^2 equals 0.90, p less than 0.0001) between wells and consistently comprise about 30 percent of the DS concentrations.

As suggested by the clay mineralogy, sodium may be used as a nonconservative indicator of the relative position of a well along a flow path. Samples with large sodium concentrations indicate longer time in contact with aquifer minerals and a position farther along the flow path. Conversely, samples with low sodium concentrations may be considered to be closer to the groundwater recharge source, having less time in contact with the solid matrices. Given the preferential divalent cation binding with the clays, a decrease in sodium concentrations along a flow path indicates mixing with a groundwater or recharge source with lower sodium concentrations. Saturation indices (table 5) show that halite is undersaturated in the alluvial groundwater, and thus, loss of sodium (and chloride) to precipitation reactions is unlikely. There are no other minerals that are thought to remove a substantial mass of sodium from solution as a precipitate.

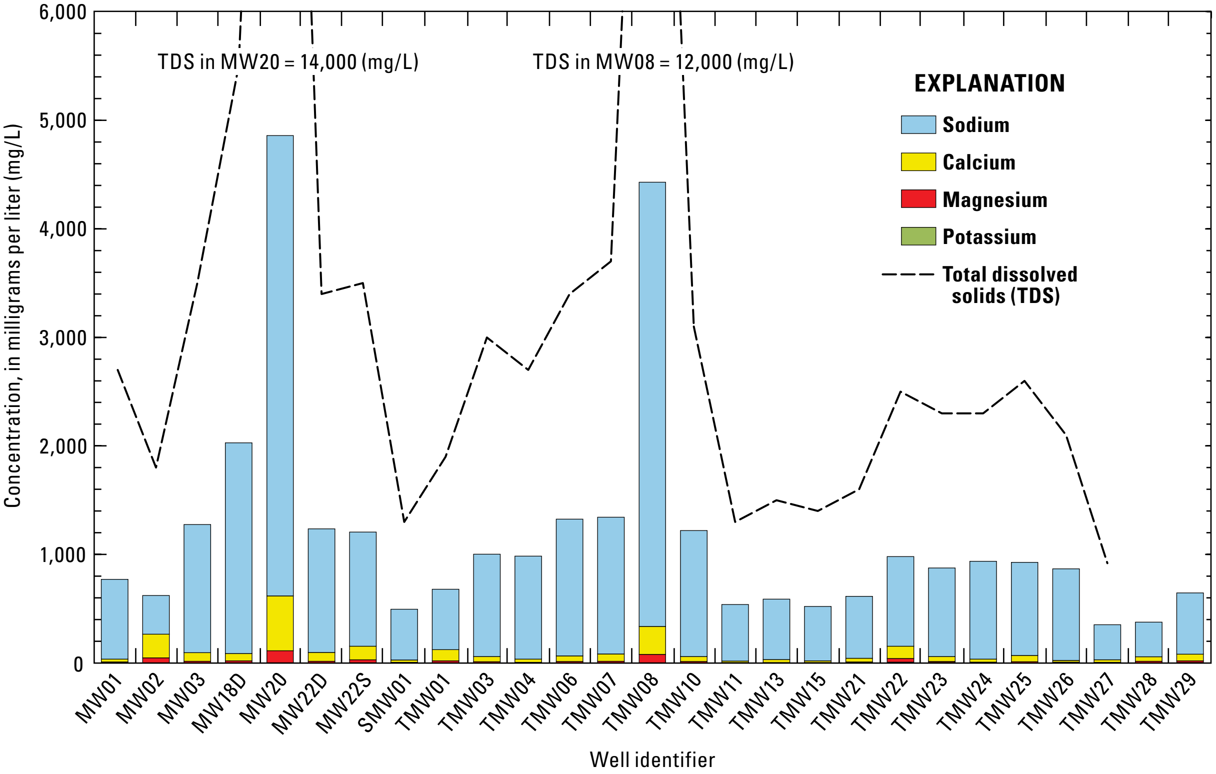


Figure 9. Dissolved-cation distribution in the Fort Wingate Depot Activity alluvial groundwater, October 2009.

The atmospheric deposition model for the origin of chloride and the conservative behavior of chloride in groundwater, described in the "Geochemistry" section, predicts relatively constant chloride concentrations along a flow path that is isolated from recharge or other flow-path mixing. When compared with DS concentrations (table 1–1 in appendix 1), which tend to increase with distance away from a potentiometric high, there is a poor linear relation (linear r^2 equals 0.30) between chloride and DS concentrations. The linear correlation is stronger between major ions and dissolved solids when the groundwater samples from three wells (MW18D, TMW08, and MW20) with DS concentrations of greater than 5,000 mg/L are included, but their inclusion biases the data set with high leverage (Helsel and Hirsch, 2002). This lack of a linear relation indicates that increases in DS concentrations along a flow path, which result from rock-water interactions, do not have a substantial effect on chloride concentrations. Changes in chloride concentrations along a hydraulic gradient might be considered an indication of mixing with groundwater or recharge that has substantially different chloride concentrations.

As shown in figure 10, atmospheric deposition weight ratios from surrounding monitoring stations (National Atmospheric Deposition Program, 2009; U.S. Environmental Protection Agency, 2009) show a nearly 1:1 ratio between Na:Cl concentrations. However, sodium concentrations in the alluvial groundwater are consistently higher than chloride concentrations, offering strong support for the origin of the two ions and their relation in the groundwater.

Hydraulic gradients and end-member wells were compared with sodium and chloride concentrations to identify the wells that were associated with each general flow path defined in the "Hydrogeology" section of this report (fig. 10). The October 2009 sodium and chloride concentrations generally followed expected patterns based on geochemical processes previously discussed, with sodium increasing in the downgradient direction as a likely result of cation exchange, while chloride remained relatively constant. Wells in the southern part of the study area were identified as belonging to the FUH or the TNT flow path based upon isotopic and chemical composition. The sodium and chloride concentrations suggest that the majority of the wells south of the Administration Area belong to the FUH flow path. The FUH influence extends north to well TMW21 (near the structures of the Administration Area) and northeast to well TMW23. The sodium and chloride concentrations in well TMW23 indicate the mixing of groundwater associated with the TNT and FUH flow paths. As suggested by the isotopic ratios of groundwater from well TMW22, the sodium and chloride ratios also indicate that some hill-front recharge probably occurs at the outcrop along the eastern margin of the study area. A necessary requirement for the flow paths in the south to establish themselves as described is that a substantially larger volume of water has to enter

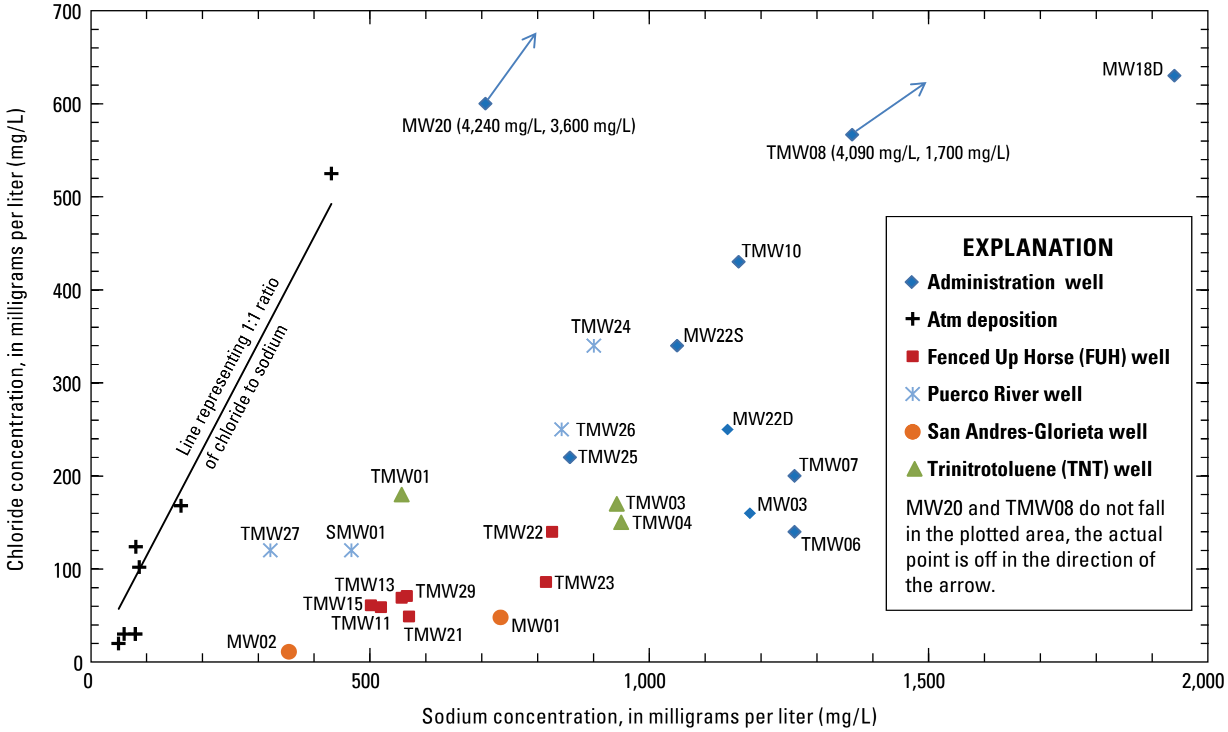
Table 5. Saturation indices for common minerals and partial pressures of dissolved gasses in the alluvial groundwater from Fort Wingate Depot Activity monitoring wells.

[Saturation indices reported as the log of the ratio of the ion activity product and the solubility product; and calculated log of partial pressure of carbon dioxide (pCO2) and oxygen (pO2) in atmospheres (atm). Species listed with name and chemical formula, negative values (undersaturated) denoted by bold, parenthesis; --, no dissolved oxygen data available]

Site designation	Anhydrite (CaSO4)	Gypsum (CaSO4:2H2O)	Calcite ($CaCO_3$)	Dolomite $CaMg(CO_3)_2$	Halite (NaCl)	log pO2 (atm)	log pCO2 (atm)
MW01	**(1.67)**	**(1.43)**	0.16	0.00	**(6.10)**	**(1.22)**	**(1.69)**
MW02	**(0.86)**	**(0.62)**	0.37	0.27	**(7.04)**	**(1.17)**	**(1.18)**
MW03	**(1.13)**	**(0.88)**	0.19	**(0.12)**	**(5.40)**	**(1.51)**	**(1.35)**
MW18D	**(1.22)**	**(1.00)**	0.13	0.07	**(4.65)**	--	**(0.79)**
MW20	**(0.23)**	0.02	0.43	0.42	**(3.59)**	**(1.61)**	**(0.90)**
MW22D	**(1.15)**	**(0.90)**	0.22	**(0.07)**	**(5.21)**	**(1.74)**	**(1.46)**
MW22S	**(1.05)**	**(0.81)**	0.60	0.78	**(5.11)**	**(0.93)**	**(1.45)**
SMW01	**(2.06)**	**(1.80)**	0.10	**(0.11)**	**(5.85)**	**(1.61)**	**(1.99)**
TMW01	**(1.12)**	**(0.87)**	0.45	0.41	**(5.63)**	**(1.22)**	**(2.07)**
TMW03	**(1.45)**	**(1.20)**	0.26	0.14	**(5.45)**	**(1.34)**	**(2.17)**
TMW04	**(1.59)**	**(1.34)**	0.16	**(0.16)**	**(5.50)**	**(1.29)**	**(2.37)**
TMW06	**(1.39)**	**(1.14)**	0.35	0.35	**(5.43)**	**(1.47)**	**(1.51)**
TMW07	**(1.16)**	**(0.91)**	0.49	0.50	**(5.28)**	**(1.11)**	**(2.00)**
TMW08	**(0.44)**	**(0.20)**	0.48	0.65	**(3.93)**	**(1.56)**	**(1.56)**
TMW10	**(1.44)**	**(1.19)**	0.23	0.19	**(4.97)**	**(2.91)**	**(1.86)**
TMW11	**(2.36)**	**(2.12)**	0.40	0.37	**(6.15)**	**(1.25)**	**(2.00)**
TMW13	**(1.97)**	**(1.72)**	0.11	**(0.31)**	**(6.03)**	**(1.48)**	**(1.61)**
TMW15	**(2.31)**	**(2.06)**	0.01	**(0.43)**	**(6.12)**	**(1.44)**	**(1.68)**
TMW21	**(1.70)**	**(1.45)**	0.33	0.28	**(6.18)**	**(1.78)**	**(1.85)**
TMW22	**(1.16)**	**(0.91)**	0.86	1.36	**(5.58)**	**(2.33)**	**(1.90)**
TMW23	**(1.55)**	**(1.30)**	0.50	0.53	**(5.79)**	**(2.10)**	**(1.93)**
TMW24	**(1.89)**	**(1.65)**	0.52	0.80	**(5.17)**	**(1.32)**	**(1.84)**
TMW25	**(1.39)**	**(1.17)**	**(0.05)**	**(0.42)**	**(5.40)**	--	**(1.04)**
TMW26	**(2.01)**	**(1.76)**	0.28	0.39	**(5.31)**	**(1.69)**	**(2.07)**
TMW27	**(2.33)**	**(2.08)**	0.23	0.09	**(6.00)**	**(1.66)**	**(2.04)**
TMW29	**(1.50)**	**(1.24)**	0.73	1.08	**(6.01)**	**(1.06)**	**(2.03)**

the groundwater system from the FUH recharge area than from the TNT recharge area. This requirement is considered reasonable given that the TNT flow path receives local hill-front recharge from a small area (approximately 165 acres, based on a polygon constructed in a geospatial software package to delineate the watershed), and the FUH flow path has a similar area for focused recharge but includes an arroyo draining approximately 7,360 acres and contains several small diversion ditches.

Groundwater from many of the wells in and around the main buildings in the Administration Area do not appear to have identifiable chemical or isotopic trends with any one of the four general flow paths (and corresponding recharge areas) defined in the “Hydrogeology” section. The Administration (Admin) wells had the highest sodium concentrations, and many had the highest chloride concentrations (fig. 10). While the isotopic signatures of five wells (MW01, MW02, MW03, MW22D, and TMW10) (table 4) in the vicinity of the production well demonstrated a large SA-G component, the major ion concentrations in only the two wells closest to the cistern (MW01 and MW02) were easily distinguished as having been substantially influenced by the SA-G source



Atm deposition, Atmospheric Deposition - the percent weight ratio per unit wet and dry deposition from the Clean Air Status and Trends Network (CASTNET) and the National Atmospheric Deposition Program (NADP) network stations: Grand Canyon National Park-Hopi Point, Arizona; Canyonlands National Park, Utah; Petrified Forest National Park, Arizona; and Mesa Verde National Park, Colorado.

Figure 10. Sodium and chloride relations in the Fort Wingate Depot Activity alluvial aquifer, October 2009.

(fig. 10). This is likely because of the large differences in DS concentrations between the Admin wells and the SA-G groundwater. Two Admin wells (MW20 and TMW08) are classified as saline, with DS concentrations greater than 10,000 mg/L (Freeze and Cherry, 1979), and the rest of the Admin wells (except TMW25) are considered brackish, with DS concentrations between 3,000 and 10,000 mg/L (fig. 9). Based on the regional use of the San Andres-Glorieta aquifer as a drinking-water supply and the DS concentration of MW02 (a well with substantial influence by the SA-G source) (1,800 mg/L), it is reasonable to assume that the San Andres-Glorieta water would be classified as fresh with DS concentrations under 1,000 mg/L. A possible explanation for the high ion concentrations in the Admin wells is that groundwater was discharged near this area through transpiration. Transpiration by phreatophytes would remove groundwater while leaving most of the solutes in the aquifer. This discharge mechanism does not affect the fractionation of stable isotopes thus preserving their predischarge ratios. While the administration area is not heavily vegetated, there are some large trees for landscaping, and riparian phreatophytes are present just north toward the South Fork of the Puerco River. The depths to water in many of the Admin wells are around 40 ft and decrease to the north near the South Fork of the Puerco River. For example, groundwater in MW18D was 40.98 ft bls, TMW10 was 34.91 ft bls, and TMW26 was 24.02 ft bls in October 2009. These depths make the resource available to both upland vegetation and riparian phreatophytes.

The sodium and chloride concentrations from wells considered to be in the Puerco flow path, as identified by the hydrogeology and isotopes, suggest that TMW24 and TMW26 also may have a major ion transpiration signal as suggested for the Admin wells above. It does not appear that the wells west of the Admin wells (TMW27 and SMW01) have the same magnitude of influence.

Sulfate and bicarbonate were the dominant anions in the alluvial groundwater in October 2009 (fig. 7). Sulfate concentrations trend linearly (linear r^2 equals 0.87, p less than 0.0001) with DS concentrations between wells and as such, aqueous sulfate concentrations may, along with sodium, reflect the relative position of a well along a groundwater flow path. Decreases in sulfate concentrations along a flow path are considered to result from dilution through mixing with groundwater having lower sulfate concentrations. Other mechanisms for decreases in sulfate concentrations were considered, such as the loss of sulfate through precipitation reactions or reduction to hydrogen sulfide (H_2S). However, the minerals anhydrite and gypsum were calculated to be undersaturated in all but one well (MW20) (table 5), indicating that sulfate is unlikely to be lost from solution through mineral precipitation. Additionally, the concentrations of redox-sensitive species (table 6) do not indicate that sulfur reducing conditions were present in the alluvial aquifer to suggest the loss of sulfate to hydrogen sulfide. There was also no indication of a hydrogen sulfide aroma from the alluvial wells during the sampling event.

The acid neutralizing capacity in the alluvial groundwater was high in October 2009. All wells except for the three wells in the TNT flow path (TMW01, TMW03, and TMW04) had an ANC (milligrams per liter as $CaCO_3$) greater than 500 mg/L, and five wells (MW22S, TMW24, TMW06, MW20, and MW18D) had an ANC of 1,000 mg/L

Table 6. Reduction-Oxidation Species in the alluvial groundwater from Fort Wingate Depot Activity monitoring wells.

[mg/L, milligrams per liter; E, estimated; NS, not sampled; ND, not detected; NR, not recorded; bold entries are above threshold concentrations (O_2 greater than or equal to [≥] 0.5 mg/L, $Fe^{2+} \geq 0.1$ mg/L, $Mn^{2+} \geq 0.05$ mg/L, NO_3^- - N ≥ 0.5 mg/L) indicating groundwater redox process (McMahon and Chapelle, 2008)]

Redox process	Site designation	Oxygen (O_2) (mg/L)	Iron (Fe^{2+}) (mg/L)	Manganese (Mn^{2+}) (mg/L)	Nitrate as nitrogen (NO_3^- - N) (mg/L)
		Anoxic			
Mn(IV) reduction	TMW28	0.08	E0.09	**E0.22**	NS
Mixed	TMW22	0.24	E0.08	**E0.057**	**7.5**
	TMW23	0.40	**E0.22**	E0.023	**39**
		Suboxic			
Undefined	TMW10	0.06	ND	E0.0014	E0.08
		Oxic			
O_2 reduction	SMW01	**1.28**	ND	0.047	ND
	MW03	**1.52**	ND	0.042	**14**
	TMW06	**1.61**	E0.03	E0.041	**26**
	TMW13	**1.62**	ND	ND	2.2
	TMW15	**1.85**	ND	0.0019	1
	TMW04	**2.58**	ND	E 0.0029	51
	TMW11	**2.62**	ND	0.02	E0.25
	MW01	**2.99**	ND	ND	**8.2**
	TMW29	**4.41**	E0.02	0.01	**4.7**
Mixed	TMW21	**0.83**	ND	**0.13**	**9.1**
	MW22D	**0.90**	ND	**0.09**	**18**
	TMW26	**1.01**	E0.02	**E0.094**	E0.05
	TMW27	**1.10**	ND	**0.54**	NS
	MW20	**1.14**	ND	**2.7**	**30**
	TMW08	**1.28**	E0.04	**E0.38**	E0.42
	TMW24	**2.12**	ND	**E0.14**	ND
	TMW03	**2.26**	E0.02	**E0.057**	**170**
	TMW01	**2.91**	**E0.12**	E0.006	**9.1**
	MW02	**3.34**	ND	**0.52**	**0.55**
	TMW07	**3.93**	ND	**0.25**	E0.18
	MW22S	**5.66**	E0.02	**E0.07**	**18**
	TMW25[1]	NR	ND	**0.1**	**0.89**
	MW18D[1]	NR	ND	**0.74**	E0.23

[1] Assumption of oxic water based on historical data.

or greater (table 1–5 in appendix 1). One consequence of cation exchange is a decrease in possible bicarbonate losses to mineral precipitation through the "common ion effect" (Langmuir, 1997). Because cation exchange binds the aqueous calcium that is produced from carbonate dissolution to the clay minerals, calcium is not available to bind with bicarbonate and precipitate out of solution, thus preserving high alkalinity. Over all, the ANC varied relatively little from well to well (17 out of 26 wells were between 700 and 1,000 mg/L), especially within designated flow paths. Unlike chloride, the relatively constant ANC along flow paths appears to be the result of the equilibrium condition between calcite and the aqueous species. According to the saturation indices (table 5), groundwater from all the wells is near equilibrium or slightly oversaturated with respect to calcite.

While bicarbonate was the most prevalent anion (as moles per liter) in most of the wells in October 2009, sulfate was responsible for the majority of negative charge balance in the groundwater samples (as milliequivalents per liter). A linear trend is evident between the molar ratio of sulfate to the ANC (as moles of HCO_3) and the moles of sodium (fig. 11). In general, this trend is observed because of increasing sulfate (from gypsum dissolution) and sodium concentrations (from cation exchange) along the flow path and relatively stable ANC values. Water from several wells that deviated from this trend typically had anomalous ANC values compared to most of the groundwater sampled in the study area. MW18D had the highest ANC among the groundwater samples, followed closely by MW20 (fig. 11). MW18D and MW20 are located near the former gas station and maintenance buildings in the Administration Area, and these wells regularly have organic compounds detected in groundwater samples. This source of carbon may be responsible for the particularly high ANC values. (The final product of the biodegradation of many organic materials is carbon dioxide and methane.) Groundwater from wells with high molar SO_4:HCO_3 ratios include TMW07 and the three TNT wells (TMW01, TMW03, and TMW04). TMW07 typically displays anomalous chemical behavior, and the hydraulic head fluctuates more between quarterly measurements than in nearby wells and, thus, no conclusions are drawn from the observed ion concentrations. The three TNT flow-path wells (TMW01, TMW03, and TMW04) have low ANC relative to the other wells screened in the alluvium. One possible influence is the evaporative effect suggested by the isotopic data, where bicarbonate may be lost preferentially to calcite precipitation as water is evaporated. MW02, which has a high molar SO_4:HCO_3 ratio relative to the sodium concentration, is located near the production well, and groundwater from this well likely has relatively small sodium concentrations as a result of a large calcium input from San Andres-Glorieta water.

The groundwater major ion compositions and relations support and further delineate the flow-path designations. They also suggest areas where flow paths mix and converge as well as highlight the heterogeneity of the alluvial matrix. The Admin wells, those in and around the main buildings of the Administration Area, have chemical signatures that are difficult to associate with any one flow path defined in the "Hydrogeology" section. The hydraulic gradients and high DS concentrations in groundwater samples from the Admin wells suggest that the flow paths may converge in that area, and there is likely a partial withdrawal of water through transpiration.

An important consideration regarding the observed distribution of chemical constituents in groundwater of the Depot area is that the 2009 potentiometric surface does not reflect the influence of recharge from the explosive washout operations described in "Description of the Study Area." It is likely that some of the TNT leachate recharged the aquifer, affecting local hydraulic gradients and extending the hydrologic influence of the TNT flow path far beyond the area of influence implied by recent observations. As such, some of the constituents in the October 2009 groundwater samples may be relicts of this earlier flow regime, and the potentiometric surface may still be adjusting to the loss of this temporary TNT leachate recharge.

Geochemical Evidence for the Fate and Transport of Constituents of Concern

The fate and transport of the constituents of concern found in groundwater in the alluvial aquifer are dependent on the nature and properties of the constituent, the location of the source of the constituent with respect to the groundwater flow paths, the mixing of groundwater along these flow paths, and the pH and redox conditions present. This section introduces the nature and properties of the constituents and the locations of their suspected source(s) with respect to flow paths and then describes the conditions in the aquifer that may or may not support degradation.

Constituent Source and Transport

Explosives

Explosive compounds, primarily RDX and TNT, are reported to have been released to the environment from the washout operations at the TNT leaching beds (fig. 2) (PMC Environmental, 2001). These explosive compounds and their degradation products have been detected primarily in the wells associated with the TNT flow path and closest to the TNT leaching beds, but the concentrations and spatial distribution of the species vary because of differences in their chemical nature.

TNT was not detected in any of the alluvial wells sampled in October 2009 (table 1–6 in appendix 1). Historically, TNT has only been detected in TNT flow-path wells TMW03 and TMW04 and in the downgradient FUH

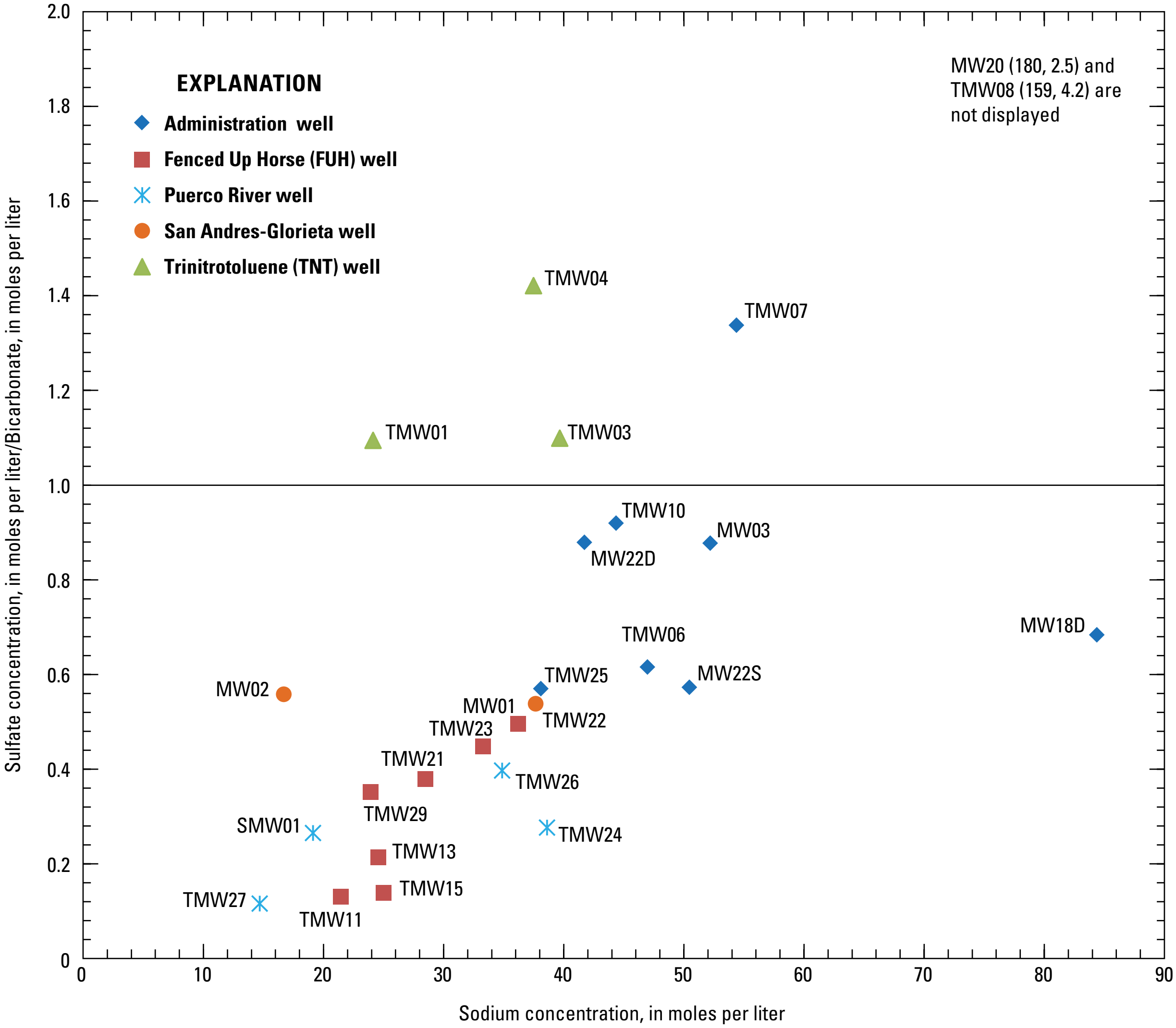


Figure 11. The molar relations of sulfate to bicarbonate with sodium in the Fort Wingate Depot Activity alluvial aquifer, October 2009.

well TMW23 at concentrations below the regulatory standards (U.S. Army Corps of Engineers, 2009, 2010, 2011c). TNT is the most common military nitroaromatic. Nitroaromatics are compounds with at least one nitro group attached to an aromatic ring. Studies have shown that photolysis and volatilization rapidly remove nitroaromatic compounds from surface soils and waters, so that TNT compounds generally do not persist in surface environments (McGrath, 1995). Given the design and construction of the TNT leaching beds to enhance evaporation, photolysis and volatilization may have been important processes contributing to the loss of TNT prior to the compound reaching groundwater.

The major environmental processes affecting the fate and transport of TNT in the subsurface are degradation and sorption (Townsend and Myers, 1996). The reduction of TNT nitro groups to amino products such as 2-Amino-4,6-Dinitrotoluene (2A-DNT), 4-Amino-2,6-Dinitrotoluene (4A-DNT), 2,4-Diamino-6-nitrotoluene (2,4-DANT), and 2,6-Diamino-4-nitrotoluene (2,6-DANT), and finally to the highly unstable 2,4,6-triaminotoluene (TAT) has been demonstrated through aerobic, anaerobic, and combined microbial degradations (Townsend and Myers, 1996; Brannon and Myers, 1997; Comfort, 2005). The few intermediate degradation products for which analyses were done in October 2009 were detected only in the wells TMW03 and TMW04, adjacent to the TNT leaching beds. Typically, TNT is adsorbed to clay surfaces preferentially to these aromatic amines, and all are prone to bind irreversibly to organic soils (Brannon and Myers, 1997; Comfort, 2005).

RDX has been a widely used military explosive since its large-scale production began in the 1940s. In October 2009, RDX was the most prevalent explosive compound detected in groundwater samples collected from the alluvial aquifer (table 1–6 in appendix 1). RDX was detected above the laboratory reporting level in groundwater from the monitoring wells TMW03, TMW04, and TMW23; historically, RDX has been found consistently in these three wells (U.S. Army Corps of Engineers, 2009, 2010, 2011c). In October 2009, RDX concentrations in groundwater from well TMW03 were larger (370 μg/L) than in groundwater from wells TMW04 and TMW23 (2.3 μg/L and 12 μg/L, respectively). This high concentration is consistent with previous sampling data and suggests that RDX has limited mobility (because of slow groundwater flow) or is being attenuated downgradient from well TMW03 (U.S. Army Corps of Engineers, 2009, 2010, 2011c). No explosives were detected in the well TMW22 in October 2009, which is located both spatially and hydrologically between TMW03 and TMW23. The lack of detectable concentrations of explosive compounds in TMW22, along with the interpretations made from the isotope and major ion concentrations, suggests that it may receive a significant portion of hill-front recharge from the outcrop along the eastern margin of the study area that is diluting those concentrations. This recharge may also be influencing concentrations in well TMW23.

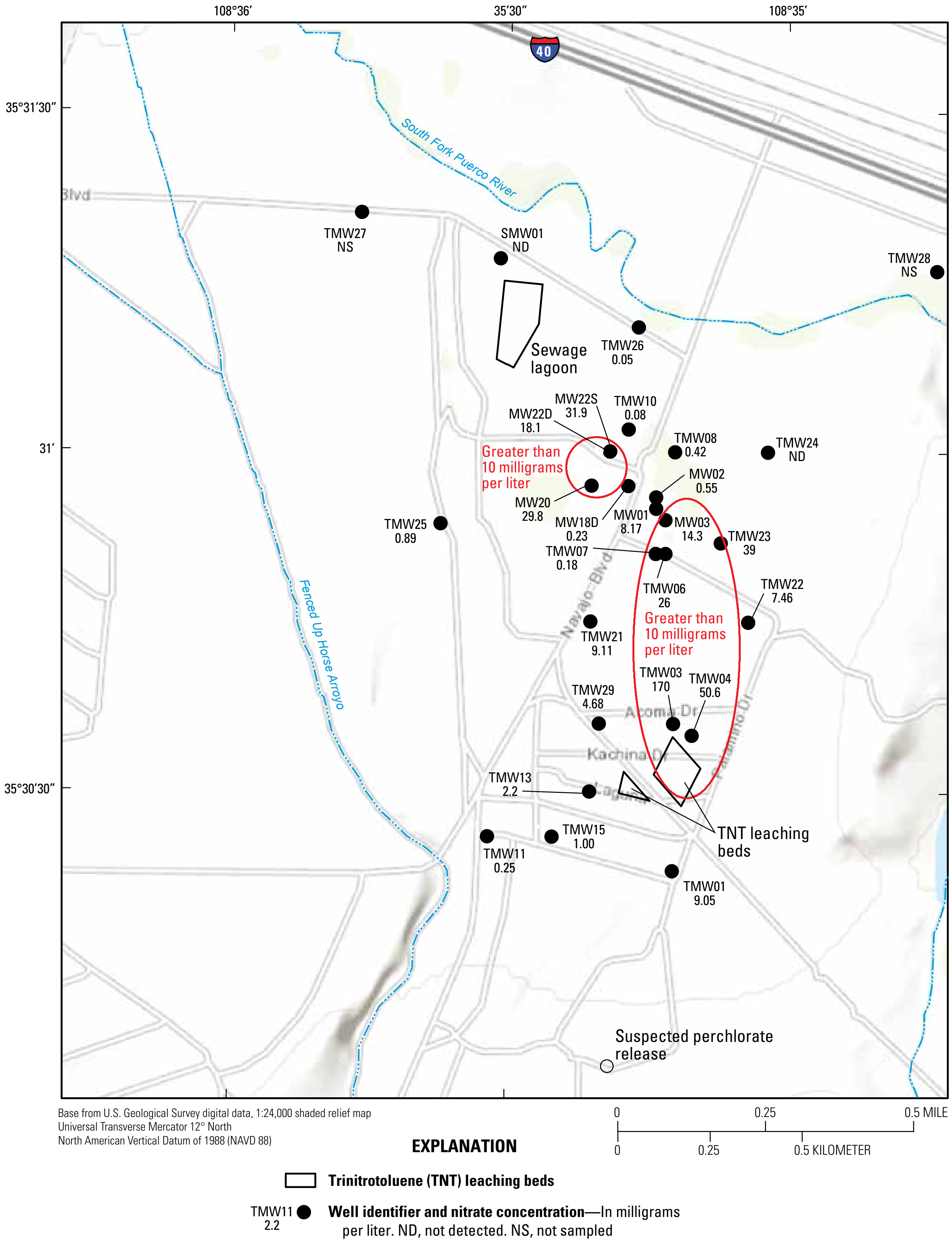
RDX is a highly energetic cyclic nitramine (an anime having a nitro group instead of a hydrogen atom). The nitramines (primarily RDX and octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine [HMX]) are less soluble than nitroaromatic compounds, but generally considered more mobile because they are less sorptive to soils (Douglas and others, 2009). Degradation of RDX typically produces nitroso rather than amino products in groundwater and primarily occurs by anaerobic biodegradation (Crocker, 2006). Proposed biodegradation mechanisms, as summarized by Crocker (2006), may include: two-electron reduction, single electron reduction/denitration, and direct enzymatic cleavage of bonds. The intermediate degrative products (for example, hexahydro-1-nitroso-3,5-dinitro-1,3,5-triazine [MNX], hexahydro-1,3-dinitroso-5-nitro-1,3,5-triazine [DMX], and hexahydro-1,3,5-trinitroso-1,3,5-triazine [TMX]) generally are considered unstable and spontaneously degrade to nitrate and small carbon alkanes and alcohols (Crocker, 2006). Chemical similarities of RDX and HMX result in similar biodegradation mechanisms. Electron donors and acceptors that support RDX biodegradation also support the biodegradation of HMX, and several microorganisms have been shown to cometabolize both compounds (Crocker, 2006). Samples from the October 2009 sampling event were not analyzed for RDX derivatives, but previous samples historically have yielded low concentrations (less than 10 μg/L).

The chemical characteristics and environmental behavior of the two explosive groups have resulted in RDX being more widespread and persistent than TNT in groundwater at the Depot and at many other sites where both compounds have been released (Comfort, 2005; Langman and others, 2008). The spatial extent of explosives in the alluvial aquifer is consistent with the extent of the TNT flow path delineated in the previous sections. The presence of explosive concentrations in the downgradient FUH well TMW23 indicates that groundwater is mixing with the TNT flow path, as suggested by the major ion and isotopic data. One important consequence of the influence of FUH flow-path water in well TMW23 is the limited effect constituents associated with the TNT flow path currently have on water quality in the rest of the aquifer. During the period of active TNT processing, recharging TNT leachate may have had a more extensive effect on the aquifer water quality.

Nitrate

Nitrate was prevalent in the alluvial aquifer in October 2009, with 9 of 29 monitoring wells having groundwater with nitrate concentrations above the regulatory standard of 10 mg/L (nitrate as nitrogen) (U.S. Environmental Protection Agency, 2009b). Only two wells had no detectable concentrations. Nitrate concentrations ranged from below the laboratory reporting level of 0.5 mg/L (the lowest estimated concentration was 0.02 mg/L) to 170 mg/L (table 1–7 in appendix 1) (fig. 12).

Given the relatively high concentrations of nitrate (39 to 165 mg/L; fig. 12) in wells with correspondingly high RDX concentrations, it is likely that some of the nitrate being detected in groundwater was derived from the degradation of explosive compounds. Nitrate is considered very mobile in an oxygenated, aqueous environment because of its high solubility and low sorption to soils (Hem, 1985). For this reason, it has been considered that Admin wells (MW20, MW22S, and MW22D) with high nitrate concentrations (greater than 10 mg/L) may also be associated with the TNT leaching operations. However, this flow model would require that the TNT flow path make an abrupt turn to the west without a strong hydraulic potential (fig. 5). In addition, there is not a well with a nitrate concentration equal to or greater than 10 mg/L between the two well groupings depicted in figure 12. A second source of nitrate in the Administration Area would honor the geochemical flow-path interpretations and would explain the nitrate distribution. One possible source of nitrate to the groundwater in the Administration Area is the aging sewer lines. Utility maps of the Depot show most buildings are serviced with 6- to 8-inch vitrified clay sewer pipes. The sewage effluent is routed from the buildings to the sewage lagoon located in the northwestern part of the Depot adjacent to SMW01 (fig. 2). One additional possibility is that the nitrate concentrations found outside the recent influence of the TNT flow path may be a relic of former hydrologic conditions that, through artificial recharge from the TNT leaching beds, increased the spatial influence of the TNT flow path.



Base from U.S. Geological Survey digital data, 1:24,000 shaded relief map
Universal Transverse Mercator 12° North
North American Vertical Datum of 1988 (NAVD 88)

Figure 12. Nitrate concentrations in October 2009 in the alluvial aquifer.

In addition to anthropogenic inputs (such as fertilizers and sewage effluent), natural sources can introduce nitrate to groundwater. In particular, soils may contain nitrate deposited during geologic times that can mobilize when water percolates through the soils (Jury and others, 1991). Nitrate concentrations, up to 5 mg/L or more in areas unlikely to be substantially affected by anthropogenic sources (outside the Admin and TNT flow paths), could reasonably be of natural origin based on conclusions drawn by Plummer and others (2004) in the study of the Middle Rio Grande Basin of central New Mexico. Hem (1985) reported high nitrate levels (68 mg/L) in a well located in an undeveloped part of the Sonoran Desert and speculated that the source may have been nitrogen-fixing desert legumes or accumulation from atmospheric deposition. Later work by Walvoord and others (2003) estimated that nitrate has been accumulating in desert soils throughout the Holocene Epoch.

Other Constituents

Perchlorate

Perchlorate is a strong oxidizer used in a variety of products, including fireworks, ordnance, and flares (Brown and Gu, 2006). Perchlorate is thought to have been introduced to the groundwater through the accidental release of photoflash (a pyrotechnic material containing potassium perchlorate) following base closure (U.S. Army Corps of Engineers, 2011b). The release reportedly occurred around 1997 south of the study area (figs. 2 and 12, south of TMW01). Based on the topography, if the contents of the photoflash release were to dissolve and be entrained in overland flow, the chemical components could enter the alluvial groundwater system in the area of recharge to the TNT flow path near TMW01. Perchlorate concentrations in the alluvial aquifer were highest in groundwater from TMW01 (260 µg/L), supporting that hypothesis. Only two other alluvial wells (TMW03 and TMW04) located near the TNT leaching beds (figs. 2 and 12) produced groundwater with perchlorate concentrations detected above the laboratory reporting level (1.0 and 0.85 µg/L, respectively) (table 1–8 in appendix 1).

Perchlorate is highly soluble in water (maximum concentration of 185 µg/L) and generally will not adsorb to soil material (Urbansky and Brown, 2003). Therefore, perchlorate is considered very mobile and persistent in oxic groundwater, as is primarily found in the alluvial aquifer at the Depot. However, many anaerobic bacteria in aqueous environments can use perchlorate as a reducing compound to oxidize other compounds, leading to its degradation (Van Ginkel and others, 1996; Coates, 2004; Sturchio, 2007). The limited distribution of perchlorate in the alluvial aquifer supports the limited extent of influence of the TNT flow path. In addition, despite its high solubility and mobility, perchlorate concentrations immediately downgradient from TMW01 are low, suggesting that the TNT flow path likely has slow groundwater velocities.

Organics

Several VOCs, thought to be associated with past fueling and maintenance activities, were detected above the laboratory reporting level in groundwater from wells located near the former gas station and maintenance buildings. In October 2009, VOCs were detected in wells MW01, MW02 MW18D, MW20, and MW22S (table 1–9 in appendix 1). The only concentrations exceeding regulatory limits were found in MW18D and MW20 (U.S. Environmental Protection Agency, 2009b). In addition to the individual organic compounds, gasoline range organics (GRO) and diesel range organics (DRO) also were detected in MW18D and MW20, and DRO was detected in MW22S and MW22D. The presence of VOCs in the listed wells suggests that there may be another source of groundwater recharge local to the Administration Area. This source could be responsible for the anomalous chemistry of some of these wells (particularly for wells MW18D and MW20, which have the largest concentrations of organic contaminants). Each of these wells is an Admin well and located in the part of the aquifer that has undifferentiated groundwater flow paths. As discussed above, the discharge point of groundwater in this area is not definitely determined and, as such, the movement of these constituents is not certain.

Attenuation of Constituents of Concern

Attenuation of chemical species in groundwater can occur as the result of many processes, including dilution, dispersion, sorption, and degradation. Dilution and dispersion are a function of recharge, groundwater flow, and flow-path interaction (mixing); sorption is a function of the nature of the alluvial matrix and the chemical species; and degradation (including biodegradation) is a function of the aqueous environment and the aqueous species.

The pH of most natural groundwater ranges from 6.0 to 8.5 (Hem, 1985). The pH of the groundwater in the alluvial aquifer in October 2009 generally was between 7.0 and 8.0 standard units (fig. 13; table 1–10 in appendix 1). The narrow range of pH values suggests a highly buffered system that has resulted from the high ANC in the alluvial wells. The effect of pH on the fate of anthropogenic constituents is considered minimal, given the narrow range of values.

Many of the constituents of concern identified in the alluvial aquifer are sensitive to redox conditions. Redox reactions are microbial-mediated processes that preferentially pair the most efficient electron donors to the most efficient electron acceptors (McMahon and Chapelle, 2008). With the exception of the nitroaromatics and organic compounds, which may degrade in a wide range of redox potentials, most of the constituents of concern degraded in anoxic conditions, such as the reductions of the nitro groups to nitroso groups in nitramines.

Organic carbon is the most common electron donor in groundwater systems. While no total or dissolved organic carbon data are available, the number of oxic wells (dissolved

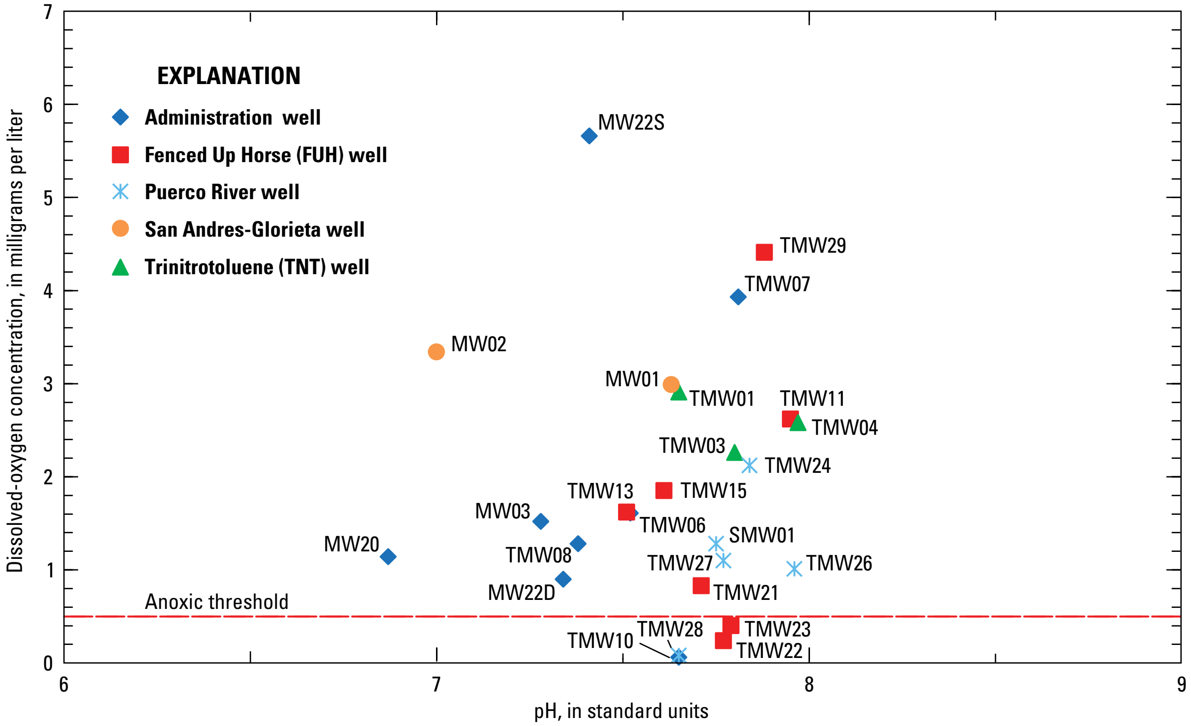


Figure 13. Dissolved oxygen concentrations and pH values for groundwater samples collected in October 2009.

oxygen concentration greater than 0.5 mg/L; fig. 13 and table 6) in the study area suggests the presence of only limited carbon sources that can be utilized in microbial processes. Known anthropogenic sources of organic carbon within the alluvial aquifer include the degrative products from the nitroaromatic and nitramine explosive compounds released from TNT washout operations and petroleum and organic carbon products from maintenance buildings and a former fuel station in the Administration Area. An additional source may be waste products from aging clay sewage pipes servicing many of the structures in the Administration Area.

Dissolved oxygen (DO) is commonly available and is the most energetically favorable electron acceptor. However, when groundwater is isolated from the atmosphere, DO may be consumed and unavailable further from the point of recharge (Freeze and Cherry, 1979). In the absence of oxygen, other electron-accepting species may be used in an ecological succession of decreasingly favorable species. This succession often is referred to as the redox ladder. The next most energetically favorable electron acceptor after oxygen is nitrate, followed by manganese (Mn [IV]), ferric iron (Fe [III]), sulfate, and carbon dioxide. Concentrations of these electron accepting species (or their reduced form) can help determine the position on the redox ladder of water from a well in the groundwater system (McMahon and Chapelle, 2008; Chapelle and others, 2009) The concentrations that are used to determine the primary electron-accepting species are subject to certain limitations, such as the type of microbial species that are present and the type and availability of electron donors (McMahon and Chapelle, 2008).

Groundwater from 16 of the 27 wells sampled was classified as being mixed with respect to redox processes (that is, criteria for more than one redox process were met) (table 6), and all but four wells (TMW10, TMW22, TMW23, and TMW28) produced at least some fraction of groundwater that was oxic, based on dissolved-oxygen measurements taken in the field.

A review of historical dissolved-oxygen measurements shows that between sampling events a few wells produce groundwater that alternates between oxic and anoxic conditions, as determined by dissolved-oxygen measurements made in the field (U.S. Army Corps of Engineers, 2009, 2010, 2011c). These disparate conditions suggest that most of the aquifer lacks a consistent source of electrons, in the form of dissolved carbon, to sustain reducing conditions.

The presence of relatively high concentrations of iron and manganese (above threshold concentrations used for redox classification) in several dissolved samples may be derived from solid-phase sediments and colloids that passed through the filter used for sample collection. At neutral to slightly alkaline pH and in the presence of dissolved oxygen above 0.5 mg/L, as found in the majority of alluvial wells, aqueous iron and manganese concentrations typically are low. The high concentrations may not represent the dissolved concentrations of these elements but may instead represent the release of iron and manganese to solution as a result of acid preservation of the sample or during the analytical metals extraction method, which could leach these cations out of sediments and colloids. If the laboratory results for iron and manganese do not represent true concentrations for groundwater in the aquifer, then groundwater from nearly all sampled wells would be classified with respect to redox as solely oxic (rather than mixed), suggesting that little organic carbon is available in the aquifer for utilization in microbial processes.

The anoxic conditions present in groundwater from wells TMW22 and TMW23 in October 2009 may be enhancing the degradation of explosives and nitrate; however, these conditions appear to be spatially and temporally limited. Dissolved-oxygen concentrations indicate that oxic groundwater is widespread in the alluvial aquifer of the Depot; therefore, nitramines, nitrate, and perchlorate likely are not prone to degradation across large areas. Given the apparent lack of widespread reducing conditions, the distribution and concentrations of explosives and nitrate and the flow-path interpretations, the dominant process for decreasing the concentrations of these constituents is likely to be dispersion and dilution by local hill-front recharge and flow-path mixing.

Summary

The alluvial aquifer underlying the Administration and Workshop Areas of the Fort Wingate Depot Activity (Depot) receives multiple sources of groundwater recharge that influence flow paths across the area. The fine-grained nature of the alluvial matrix creates a highly heterogeneous environment that adds to the difficulty of precisely determining the flow directions of groundwater and aqueous constituents based solely on the potentiometric surface. This geochemical investigation adds evidence for defining the fine-scale groundwater and constituent flow paths and adds support for determining the dominant attenuation processes for constituents of concern.

The hydrogeologic framework provides important constraints on the geochemical interpretations. The clay and mudstones of the Painted Desert Member of the Petrified Forest Formation that compose the underlying bedrock restrict cross-formational groundwater exchange between the lower confined units and the alluvial aquifer. The barriers to cross-formational flow limit the sources of recharge to the alluvial aquifer, influence the direction of groundwater flow, and affect the fate of groundwater and dissolved constituents. In addition, the erosion and subsequent deposition of these fine-grained materials in the alluvial basin create low hydraulic conductivities and groundwater velocities in the aquifer.

The October 2009 potentiometric surface of the alluvial aquifer beneath the Depot's Administration and Workshop Areas indicates that groundwater generally follows the surface topography. In the southern part of the Depot, the general flow direction is northward, although the influence of the South Fork of the Puerco River groundwater basin causes groundwater to flow southwestward in the northernmost part of the study area. The center of the Administration Area appears to be an area where multiple flow paths merge, and flow directions are highly variable. Three possible flow paths originating at the aquifer margins were identified as (1) the TNT flow path, which originates near the southeastern boundary and moves northward under the TNT leaching beds; (2) the FUH flow path, which originates at the southwestern boundary of the study area near the Fenced Up Horse (FUH) arroyo; and (3) the Puerco flow path, which flows southwest from the alluvial deposits underlying the South Fork of the Puerco River. A fourth recharge source with a spatially-limited area of apparent influence, referred to as the SA-G flow path, is identified near the cistern used for collecting water produced from the Depot's production well screened in the San Andres-Glorieta (SA-G) aquifer.

The mineralogy of the Painted Desert clays and resulting erosional deposits of the alluvium includes aluminosilicate montmorillonite clays, anhydrite and gypsum, and calcite. The montmorillonite clays have a strong cation exchange potential that preferentially bind divalent cations such as calcium over monovalent cations such as sodium, resulting in sodium-dominated groundwater in the alluvial aquifer. This cation exchange allows for further dissolution of calcium carbonates and sulfate minerals while limiting calcium availability for mineral precipitation and reducing the "common ion effect." The large clay component of the aquifer matrix results in the nonconservative behavior of sodium, whereas, chloride behavior is conservative; concentrations of both constituents aid in interpreting flow paths and groundwater mixing.

The deuterium and oxygen-18 (δ^2H and δ^{18}O relative to Vienna Standard Mean Ocean Water [VSMOW]) isotopic ratios of sampled groundwater provide evidence for the contribution of San Andres-Glorieta water to the alluvial aquifer in areas near the cistern containing water from the Depot's production well. Mixing ratios calculated from isotopic end-members (the production well and the median composition of groundwater in the Administration Area believed to be unaffected by cistern leakage) suggests a substantial contribution (between 46 and 84 percent) of San Andres-Glorieta water to the alluvial system in a localized area, while highlighting the heterogeneity of the alluvium by not being apparent in all downgradient wells at similar distances from the cistern source. Wells located near other sources of groundwater recharge did not have sufficiently different isotopic compositions to allow for similar end-member contribution calculations. However, qualitative observations of the isotopic compositions support flow-path designations and further geochemical interpretations. Slight variations in the isotopic compositions among wells of a given flow path are thought to result primarily from the seasonal fractionation of precipitation.

Given the geologic, potentiometric, and mineral constraints, flow paths were further delineated by major ion concentrations and their relations to each other. As groundwater moves through the alluvial aquifer, calcium from the dissolution of gypsum and calcite is removed from solution and replaced by sodium through cation exchange. Based on the October 2009 sampling event, sodium concentrations increase linearly with dissolved solids along groundwater flow paths. Sulfate concentrations also increase along flow paths, suggesting that both ions reflect the extent of mineral weathering (though as the result of different geochemical processes). Therefore, the two species offer evidence of a well's relative position along a flow path. Chloride is shown to be derived from precipitation and to behave conservatively in the aqueous environment. As such, changes in the chloride concentrations along a flow path indicate the mixing of flow paths or the addition of local groundwater recharge. The high ion concentrations in the Admin wells suggest that a mechanism of discharge from the study area is through transpiration. Transpiration would not affect the fractionation of stable isotopes and is therefore supported by the isotope ratios.

Water levels in wells TMW22 and TMW23 indicate that they are downgradient from all wells in the TNT and FUH flow paths. In addition, groundwater from TMW23 historically has had explosive and explosive degradate concentrations that suggests a connection with wells in the TNT flow path. However, the lower sodium (and chloride) concentrations in TMW22 and TMW23 than the upgradient TNT flow path wells (TMW03 and TMW04) require that these concentrations are being substantially diluted by an alternate recharge source along the TNT flow path or that these wells belong to a separate flow path. The ion concentrations in these wells therefore indicate the extent of the TNT flow paths.

The acid neutralizing capacity (ANC) in the alluvial aquifer, like chloride, generally did not increase in downgradient wells. For groundwater from most wells, concentrations of bicarbonate (the major component of alkalinity) were found to be controlled partly by equilibrium with the mineral calcite and the aqueous species. Overall, the ANC concentrations were fairly similar across the aquifer and deviations from the expected values helped to associate individual wells with certain flow paths.

Explosives, consisting primarily of 1,3,5-trinitroperhydro-1,3,5-triazine (RDX) and a few degrative products, released from the TNT leaching beds, are found primarily along the TNT flow path. In October 2009, RDX was detected in the wells closest to the leaching beds (TMW03 and TMW04) and in the downgradient well (TMW23) of the FUH flow path. Given the limited influence of the TNT flow path and the lack of explosives in nearby wells, TMW23 reflects the most downgradient location of detection of explosives during October 2009. Dissolved concentrations of the nitroaromatics are presumed to decrease through the combination of irreversible sorption and degradation, while concentrations of nitramines are thought to primarily decrease through dilution with groundwater from the FUH flow path. The downgradient mixing of the TNT and FUH flow paths around TMW23 is supported with other geochemical data. One important consequence of the designated flow paths is the limited effect that constituents associated with the TNT flow path have on water quality in the rest of the aquifer. This appears to be the case with the nitroaromatic and nitramine explosives released from the TNT leaching beds and would apply to perchlorate suspected of being released at the far southeastern margins of the aquifer. In October 2009, the only perchlorate concentrations in the alluvium above the laboratory reporting level were found in wells associated with the TNT flow path.

Nitrate was ubiquitous in the alluvial groundwater in October 2009. Given the geochemical evidence for the alluvial flow regime and distribution of nitrate concentrations, there is evidence to suggest two anthropogenic sources for the nitrate. Nitrate in wells associated with the TNT flow path is thought to be the degrative product of explosive compounds. The decrease in nitrate concentrations in wells downgradient from the TNT flow path suggests attenuation primarily through dilution, similar to that of RDX. The wide range and inconsistent distribution of nitrate concentrations in groundwater from wells located among the structures of the Administration Area (Admin wells) likely reflect the heterogeneity of the alluvial aquifer and the mixing of several flow paths. The cause of elevated nitrate concentrations in the Admin wells is uncertain but may have resulted from leakage from aging clay sewage pipes that service most of the structures within the Administration Area or reflect relics of a former hydrologic regime in which groundwater of the TNT flow path (from washout operations) migrated across a broader area.

The lack of data to identify a discharge point for the groundwater in this area also implies that the fate and transport of nitrate and the petroleum and organic products associated with these wells is also unknown. The majority of the alluvial aquifer was oxic and therefore does not support the degradation of most of the constituents of concern.

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Appendix 1—Groundwater Analytical Results

Table 1–1. Dissolved solids analyzed according to the U.S. Environmental Protection Agency's Methods for Chemical Analysis of Water and Wastes (MCAWW), EPA Method 160.1.

[mg/L, milligrams per liter]

Site designation	Collection date	Analyte	Result (mg/L)	Laboratory reporting level (mg/L)	Laboratory detection limit (mg/L)
MW01	10/22/2009	Dissolved solids	2,700	40	19
MW02	10/22/2009	Dissolved solids	1,800	40	19
MW03	10/23/2009	Dissolved solids	3,500	20	9.4
MW18D	10/23/2009	Dissolved solids	5,500	20	9.4
MW20	10/23/2009	Dissolved solids	14,000	40	19
MW22D	10/21/2009	Dissolved solids	3,400	20	9.4
MW22S	10/23/2009	Dissolved solids	3,500	20	9.4
SMW01	10/24/2009	Dissolved solids	1,300	10	4.7
TMW01	10/14/2009	Dissolved solids	1,900	10	4.7
TMW03	10/14/2009	Dissolved solids	3,000	20	9.4
TMW04	10/14/2009	Dissolved solids	2,700	20	9.4
TMW06	10/17/2009	Dissolved solids	3,400	20	9.4
TMW07	10/20/2009	Dissolved solids	3,700	20	9.4
TMW08	10/17/2009	Dissolved solids	12,000	40	19
TMW10	10/19/2009	Dissolved solids	3,100	20	9.4
TMW11	10/20/2009	Dissolved solids	1,300	10	4.7
TMW13	10/22/2009	Dissolved solids	1,500	10	4.7
TMW15	10/26/2009	Dissolved solids	1,400	10	4.7
TMW21	10/24/2009	Dissolved solids	1,600	10	4.7
TMW22	10/19/2009	Dissolved solids	2,500	20	9.4
TMW23	10/19/2009	Dissolved solids	2,300	40	19
TMW24	10/19/2009	Dissolved solids	2,300	20	9.4
TMW25	10/22/2009	Dissolved solids	2,600	20	9.4
TMW26	10/17/2009	Dissolved solids	2,100	20	9.4
TMW27	10/24/2009	Dissolved solids	920	10	4.7
TMW29	10/20/2009	Dissolved solids	1,700	40	19

Table 1–2. Dissolved cations and mercury analyzed according to the U.S. Environmental Protection Agency's methods SW846 6010B/6020 and SW846 7471, respectively.

[CAS, Chemical Abstract Services; mg/L, milligrams per liter; U, undetected; —, unqualified result; E, estimated concentration]

Site designation	Collection date	Analyte	CAS number[1]	Result (mg/L)	Qualifier	Laboratory reporting level (mg/L)	Laboratory detection limit (mg/L)
MW01	10/22/2009	Aluminum	7429-90-5	0.016	U	0.050	0.016
MW01	10/22/2009	Antimony	7440-36-0	0.0034	U	0.0060	0.0034
MW01	10/22/2009	Arsenic	7440-38-2	0.0044	U	0.0050	0.0044
MW01	10/22/2009	Barium	7440-39-3	0.014	—	0.0030	0.00024
MW01	10/22/2009	Beryllium	7440-41-7	0.00005	U	0.0010	0.00005
MW01	10/22/2009	Cadmium	7440-43-9	0.00043	U	0.0050	0.00043
MW01	10/22/2009	Calcium	7440-70-2	26	—	5.0	0.090
MW01	10/22/2009	Chromium	7440-47-3	0.00050	U	0.0020	0.00050
MW01	10/22/2009	Cobalt	7440-48-4	0.00025	U	0.0050	0.00025
MW01	10/22/2009	Copper	7440-50-8	0.0027	E	0.020	0.0021
MW01	10/22/2009	Iron	7439-89-6	0.0097	U	0.30	0.0097
MW01	10/22/2009	Lead	7439-92-1	0.0018	U	0.0050	0.0018
MW01	10/22/2009	Magnesium	7439-95-4	6.7	—	0.50	0.0085
MW01	10/22/2009	Manganese	7439-96-5	0.00034	U	0.0010	0.00034
MW01	10/22/2009	Mercury	7439-97-6	0.000050	U	0.00020	0.000050
MW01	10/22/2009	Nickel	7440-02-0	0.00071	U	0.0020	0.00071
MW01	10/22/2009	Potassium	7440-09-7	0.28	E	0.50	0.056
MW01	10/22/2009	Selenium	7782-49-2	0.021	—	0.010	0.0056
MW01	10/22/2009	Silver	7440-22-4	0.00072	U	0.0050	0.00072
MW01	10/22/2009	Sodium	7440-23-5	870	—	50	6.2
MW01	10/22/2009	Thallium	7440-28-0	0.0026	U	0.0050	0.0026
MW01	10/22/2009	Vanadium	7440-62-2	0.0078	—	0.0050	0.0011
MW01	10/22/2009	Zinc	7440-66-6	0.022	—	0.010	0.0012
MW02	10/22/2009	Aluminum	7429-90-5	0.016	U	0.050	0.016
MW02	10/22/2009	Antimony	7440-36-0	0.0034	U	0.0060	0.0034
MW02	10/22/2009	Arsenic	7440-38-2	0.0044	U	0.0050	0.0044
MW02	10/22/2009	Barium	7440-39-3	0.025	—	0.0030	0.00024
MW02	10/22/2009	Beryllium	7440-41-7	0.00005	U	0.0010	0.00005
MW02	10/22/2009	Cadmium	7440-43-9	0.00043	U	0.0050	0.00043
MW02	10/22/2009	Calcium	7440-70-2	170	—	50	0.90
MW02	10/22/2009	Chromium	7440-47-3	0.0016	E	0.0020	0.00050
MW02	10/22/2009	Cobalt	7440-48-4	0.00025	U	0.0050	0.00025
MW02	10/22/2009	Copper	7440-50-8	0.0021	U	0.020	0.0021
MW02	10/22/2009	Iron	7439-89-6	0.0097	U	0.30	0.0097
MW02	10/22/2009	Lead	7439-92-1	0.0018	U	0.0050	0.0018
MW02	10/22/2009	Magnesium	7439-95-4	41	—	5.0	0.085
MW02	10/22/2009	Manganese	7439-96-5	0.52	—	0.010	0.0034
MW02	10/22/2009	Mercury	7439-97-6	0.000050	U	0.00020	0.000050
MW02	10/22/2009	Nickel	7440-02-0	0.0033	—	0.0020	0.00071
MW02	10/22/2009	Potassium	7440-09-7	0.41	E	0.50	0.056
MW02	10/22/2009	Selenium	7782-49-2	0.0056	U	0.010	0.0056
MW02	10/22/2009	Silver	7440-22-4	0.00072	U	0.0050	0.00072

Table 1–2. Dissolved cations and mercury analyzed according to the U.S. Environmental Protection Agency's methods SW846 6010B/6020 and SW846 7471, respectively.—Continued

[CAS, Chemical Abstract Services; mg/L, milligrams per liter; U, undetected; —, unqualified result; E, estimated concentration]

Site designation	Collection date	Analyte	CAS number[1]	Result (mg/L)	Qualifier	Laboratory reporting level (mg/L)	Laboratory detection limit (mg/L)
MW02	10/22/2009	Sodium	7440-23-5	380	—	50	6.2
MW02	10/22/2009	Thallium	7440-28-0	0.0026	U	0.0050	0.0026
MW02	10/22/2009	Vanadium	7440-62-2	0.0085	—	0.0050	0.0011
MW02	10/22/2009	Zinc	7440-66-6	0.12	—	0.010	0.0012
MW03	10/23/2009	Aluminum	7429-90-5	0.016	U	0.050	0.016
MW03	10/23/2009	Antimony	7440-36-0	0.0044	E	0.0060	0.0034
MW03	10/23/2009	Arsenic	7440-38-2	0.0044	U	0.0050	0.0044
MW03	10/23/2009	Barium	7440-39-3	0.0092	—	0.0030	0.00024
MW03	10/23/2009	Beryllium	7440-41-7	0.00005	U	0.0010	0.00005
MW03	10/23/2009	Cadmium	7440-43-9	0.00043	U	0.0050	0.00043
MW03	10/23/2009	Calcium	7440-70-2	77	—	5.0	0.090
MW03	10/23/2009	Chromium	7440-47-3	0.00050	U	0.0020	0.00050
MW03	10/23/2009	Cobalt	7440-48-4	0.00025	U	0.0050	0.00025
MW03	10/23/2009	Copper	7440-50-8	0.0021	U	0.020	0.0021
MW03	10/23/2009	Iron	7439-89-6	0.0097	U	0.30	0.0097
MW03	10/23/2009	Lead	7439-92-1	0.0018	U	0.0050	0.0018
MW03	10/23/2009	Magnesium	7439-95-4	16	E	5.0	0.085
MW03	10/23/2009	Manganese	7439-96-5	0.042	—	0.0010	0.00034
MW03	10/23/2009	Mercury	7439-97-6	0.000050	U	0.00020	0.000050
MW03	10/23/2009	Nickel	7440-02-0	0.00071	U	0.0020	0.00071
MW03	10/23/2009	Potassium	7440-09-7	0.51	—	0.50	0.056
MW03	10/23/2009	Selenium	7782-49-2	0.0094	E	0.010	0.0056
MW03	10/23/2009	Silver	7440-22-4	0.00072	U	0.0050	0.00072
MW03	10/23/2009	Sodium	7440-23-5	1,200	—	500	62
MW03	10/23/2009	Thallium	7440-28-0	0.0026	U	0.0050	0.0026
MW03	10/23/2009	Vanadium	7440-62-2	0.0098	—	0.0050	0.0011
MW03	10/23/2009	Zinc	7440-66-6	0.029	—	0.010	0.0012
MW18D	10/23/2009	Aluminum	7429-90-5	0.016	U	0.050	0.016
MW18D	10/23/2009	Antimony	7440-36-0	0.0034	U	0.0060	0.0034
MW18D	10/23/2009	Arsenic	7440-38-2	0.0044	U	0.0050	0.0044
MW18D	10/23/2009	Barium	7440-39-3	0.017	—	0.0030	0.00024
MW18D	10/23/2009	Beryllium	7440-41-7	0.00005	U	0.0010	0.00005
MW18D	10/23/2009	Cadmium	7440-43-9	0.00043	U	0.0050	0.00043
MW18D	10/23/2009	Calcium	7440-70-2	74	—	5.0	0.090
MW18D	10/23/2009	Chromium	7440-47-3	0.002	—	0.0020	0.00050
MW18D	10/23/2009	Cobalt	7440-48-4	0.00025	U	0.0050	0.00025
MW18D	10/23/2009	Copper	7440-50-8	0.0021	U	0.020	0.0021
MW18D	10/23/2009	Iron	7439-89-6	0.0097	U	0.30	0.0097
MW18D	10/23/2009	Lead	7439-92-1	0.0018	U	0.0050	0.0018
MW18D	10/23/2009	Magnesium	7439-95-4	20	E	5.0	0.085
MW18D	10/23/2009	Manganese	7439-96-5	0.74	—	0.010	0.0034
MW18D	10/23/2009	Mercury	7439-97-6	0.000050	U	0.00020	0.000050

Table 1–2. Dissolved cations and mercury analyzed according to the U.S. Environmental Protection Agency's methods SW846 6010B/6020 and SW846 7471, respectively.—Continued

[CAS, Chemical Abstract Services; mg/L, milligrams per liter; U, undetected; —, unqualified result; E, estimated concentration]

Site designation	Collection date	Analyte	CAS number[1]	Result (mg/L)	Qualifier	Laboratory reporting level (mg/L)	Laboratory detection limit (mg/L)
MW18D	10/23/2009	Nickel	7440-02-0	0.0053	—	0.0020	0.00071
MW18D	10/23/2009	Potassium	7440-09-7	0.93	—	0.50	0.056
MW18D	10/23/2009	Selenium	7782-49-2	0.0056	U	0.010	0.0056
MW18D	10/23/2009	Silver	7440-22-4	0.00087	E	0.0050	0.00072
MW18D	10/23/2009	Sodium	7440-23-5	1,900	—	500	62
MW18D	10/23/2009	Thallium	7440-28-0	0.0026	U	0.0050	0.0026
MW18D	10/23/2009	Vanadium	7440-62-2	0.012	—	0.0050	0.0011
MW18D	10/23/2009	Zinc	7440-66-6	0.0059	E	0.010	0.0012
MW20	10/23/2009	Aluminum	7429-90-5	0.016	U	0.050	0.016
MW20	10/23/2009	Antimony	7440-36-0	0.0051	E	0.0060	0.0034
MW20	10/23/2009	Arsenic	7440-38-2	0.0044	U	0.0050	0.0044
MW20	10/23/2009	Barium	7440-39-3	0.014	—	0.0030	0.00024
MW20	10/23/2009	Beryllium	7440-41-7	0.00005	U	0.0010	0.00005
MW20	10/23/2009	Cadmium	7440-43-9	0.00043	U	0.0050	0.00043
MW20	10/23/2009	Calcium	7440-70-2	480	—	50	0.90
MW20	10/23/2009	Chromium	7440-47-3	0.0015	E	0.0020	0.00050
MW20	10/23/2009	Cobalt	7440-48-4	0.00025	U	0.0050	0.00025
MW20	10/23/2009	Copper	7440-50-8	0.0031	E	0.020	0.0021
MW20	10/23/2009	Iron	7439-89-6	0.0097	U	0.30	0.0097
MW20	10/23/2009	Lead	7439-92-1	0.0091	—	0.0050	0.0018
MW20	10/23/2009	Magnesium	7439-95-4	110	E	50	0.85
MW20	10/23/2009	Manganese	7439-96-5	2.7	—	0.10	0.034
MW20	10/23/2009	Mercury	7439-97-6	0.000050	U	0.00020	0.000050
MW20	10/23/2009	Nickel	7440-02-0	0.0071	—	0.0020	0.00071
MW20	10/23/2009	Potassium	7440-09-7	2.6	—	0.50	0.056
MW20	10/23/2009	Selenium	7782-49-2	0.28	—	0.10	0.056
MW20	10/23/2009	Silver	7440-22-4	0.00072	U	0.0050	0.00072
MW20	10/23/2009	Sodium	7440-23-5	4,100	—	500	62
MW20	10/23/2009	Thallium	7440-28-0	0.0026	U	0.0050	0.0026
MW20	10/23/2009	Vanadium	7440-62-2	0.0011	U	0.0050	0.0011
MW20	10/23/2009	Zinc	7440-66-6	0.32	—	0.10	0.012
MW22D	10/21/2009	Aluminum	7429-90-5	0.016	U	0.050	0.016
MW22D	10/21/2009	Antimony	7440-36-0	0.0042	E	0.0060	0.0034
MW22D	10/21/2009	Arsenic	7440-38-2	0.0048	E	0.0050	0.0044
MW22D	10/21/2009	Barium	7440-39-3	0.008	—	0.0030	0.00024
MW22D	10/21/2009	Beryllium	7440-41-7	0.00005	U	0.0010	0.00005
MW22D	10/21/2009	Cadmium	7440-43-9	0.00043	U	0.0050	0.00043
MW22D	10/21/2009	Calcium	7440-70-2	69	—	5.0	0.090
MW22D	10/21/2009	Chromium	7440-47-3	0.00050	U	0.0020	0.00050
MW22D	10/21/2009	Cobalt	7440-48-4	0.00025	U	0.0050	0.00025
MW22D	10/21/2009	Copper	7440-50-8	0.0021	U	0.020	0.0021
MW22D	10/21/2009	Iron	7439-89-6	0.0097	U	0.30	0.0097

Table 1–2. Dissolved cations and mercury analyzed according to the U.S. Environmental Protection Agency's methods SW846 6010B/6020 and SW846 7471, respectively.—Continued

[CAS, Chemical Abstract Services; mg/L, milligrams per liter; U, undetected; —, unqualified result; E, estimated concentration]

Site designation	Collection date	Analyte	CAS number[1]	Result (mg/L)	Qualifier	Laboratory reporting level (mg/L)	Laboratory detection limit (mg/L)
MW22D	10/21/2009	Lead	7439-92-1	0.0018	U	0.0050	0.0018
MW22D	10/21/2009	Magnesium	7439-95-4	15	—	5.0	0.085
MW22D	10/21/2009	Manganese	7439-96-5	0.09	—	0.0010	0.00034
MW22D	10/21/2009	Mercury	7439-97-6	0.000050	U	0.00020	0.000050
MW22D	10/21/2009	Nickel	7440-02-0	0.0022	—	0.0020	0.00071
MW22D	10/21/2009	Potassium	7440-09-7	0.61	—	0.50	0.056
MW22D	10/21/2009	Selenium	7782-49-2	0.05	—	0.010	0.0056
MW22D	10/21/2009	Silver	7440-22-4	0.00096	E	0.0050	0.00072
MW22D	10/21/2009	Sodium	7440-23-5	1,200	—	500	62
MW22D	10/21/2009	Thallium	7440-28-0	0.0026	U	0.0050	0.0026
MW22D	10/21/2009	Vanadium	7440-62-2	0.0091	—	0.0050	0.0011
MW22D	10/21/2009	Zinc	7440-66-6	0.049	—	0.010	0.0012
MW22S	10/20/2009	Aluminum	7429-90-5	0.054	—	0.050	0.016
MW22S	10/20/2009	Antimony	7440-36-0	0.0034	U	0.0060	0.0034
MW22S	10/20/2009	Arsenic	7440-38-2	0.0044	U	0.0050	0.0044
MW22S	10/20/2009	Barium	7440-39-3	0.019	—	0.0030	0.00024
MW22S	10/20/2009	Beryllium	7440-41-7	0.00005	U	0.0010	0.00005
MW22S	10/20/2009	Cadmium	7440-43-9	0.00043	U	0.0050	0.00043
MW22S	10/20/2009	Calcium	7440-70-2	77	—	5.0	0.090
MW22S	10/20/2009	Chromium	7440-47-3	0.0025	—	0.0020	0.00050
MW22S	10/20/2009	Cobalt	7440-48-4	0.00025	U	0.0050	0.00025
MW22S	10/20/2009	Copper	7440-50-8	0.0021	U	0.020	0.0021
MW22S	10/20/2009	Iron	7439-89-6	0.021	E	0.30	0.0097
MW22S	10/20/2009	Lead	7439-92-1	0.0018	U	0.0050	0.0018
MW22S	10/20/2009	Magnesium	7439-95-4	24	—	5.0	0.085
MW22S	10/20/2009	Manganese	7439-96-5	0.070	E	0.0010	0.00034
MW22S	10/20/2009	Mercury	7439-97-6	0.000050	U	0.00020	0.000050
MW22S	10/20/2009	Nickel	7440-02-0	0.0031	—	0.0020	0.00071
MW22S	10/20/2009	Potassium	7440-09-7	0.52	—	0.50	0.056
MW22S	10/20/2009	Selenium	7782-49-2	0.057	—	0.010	0.0056
MW22S	10/20/2009	Silver	7440-22-4	0.00072	U	0.0050	0.00072
MW22S	10/20/2009	Sodium	7440-23-5	960	—	50	6.2
MW22S	10/20/2009	Thallium	7440-28-0	0.0026	U	0.0050	0.0026
MW22S	10/20/2009	Vanadium	7440-62-2	0.010	—	0.0050	0.0011
MW22S	10/20/2009	Zinc	7440-66-6	0.0057	E	0.010	0.0012
SMW01	10/24/2009	Aluminum	7429-90-5	0.016	U	0.050	0.016
SMW01	10/24/2009	Antimony	7440-36-0	0.0034	U	0.0060	0.0034
SMW01	10/24/2009	Arsenic	7440-38-2	0.0044	U	0.0050	0.0044
SMW01	10/24/2009	Barium	7440-39-3	0.015	—	0.0030	0.00024
SMW01	10/24/2009	Beryllium	7440-41-7	0.00005	U	0.0010	0.00005
SMW01	10/24/2009	Cadmium	7440-43-9	0.00081	E	0.0050	0.00043
SMW01	10/24/2009	Calcium	7440-70-2	23	—	5.0	0.090

Table 1–2. Dissolved cations and mercury analyzed according to the U.S. Environmental Protection Agency's methods SW846 6010B/6020 and SW846 7471, respectively.—Continued

[CAS, Chemical Abstract Services; mg/L, milligrams per liter; U, undetected; —, unqualified result; E, estimated concentration]

Site designation	Collection date	Analyte	CAS number[1]	Result (mg/L)	Qualifier	Laboratory reporting level (mg/L)	Laboratory detection limit (mg/L)
SMW01	10/24/2009	Chromium	7440-47-3	0.00050	U	0.0020	0.00050
SMW01	10/24/2009	Cobalt	7440-48-4	0.00025	U	0.0050	0.00025
SMW01	10/24/2009	Copper	7440-50-8	0.0021	U	0.020	0.0021
SMW01	10/24/2009	Iron	7439-89-6	0.0097	U	0.30	0.0097
SMW01	10/24/2009	Lead	7439-92-1	0.0018	U	0.0050	0.0018
SMW01	10/24/2009	Magnesium	7439-95-4	7.2	E	0.50	0.0085
SMW01	10/24/2009	Manganese	7439-96-5	0.047	—	0.0010	0.00034
SMW01	10/24/2009	Mercury	7439-97-6	0.000050	U	0.00020	0.000050
SMW01	10/24/2009	Nickel	7440-02-0	0.00071	U	0.0020	0.00071
SMW01	10/24/2009	Potassium	7440-09-7	0.078	E	0.50	0.056
SMW01	10/24/2009	Selenium	7782-49-2	0.0056	U	0.010	0.0056
SMW01	10/24/2009	Silver	7440-22-4	0.00072	U	0.0050	0.00072
SMW01	10/24/2009	Sodium	7440-23-5	440	—	50	6.2
SMW01	10/24/2009	Thallium	7440-28-0	0.0026	U	0.0050	0.0026
SMW01	10/24/2009	Vanadium	7440-62-2	0.0074	—	0.0050	0.0011
SMW01	10/24/2009	Zinc	7440-66-6	0.0038	E	0.010	0.0012
TMW01	10/14/2009	Aluminum	7429-90-5	0.016	E	0.050	0.016
TMW01	10/14/2009	Antimony	7440-36-0	0.0034	U	0.0060	0.0034
TMW01	10/14/2009	Arsenic	7440-38-2	0.012	—	0.0050	0.0044
TMW01	10/14/2009	Barium	7440-39-3	0.011	—	0.0030	0.00024
TMW01	10/14/2009	Beryllium	7440-41-7	0.00005	U	0.0010	0.00005
TMW01	10/14/2009	Cadmium	7440-43-9	0.00043	U	0.0050	0.00043
TMW01	10/14/2009	Calcium	7440-70-2	98	—	50	0.90
TMW01	10/14/2009	Chromium	7440-47-3	0.00076	E	0.0020	0.00050
TMW01	10/14/2009	Cobalt	7440-48-4	0.00025	U	0.0050	0.00025
TMW01	10/14/2009	Copper	7440-50-8	0.01	E	0.020	0.0021
TMW01	10/14/2009	Iron	7439-89-6	0.12	E	0.30	0.0097
TMW01	10/14/2009	Lead	7439-92-1	0.0018	U	0.0050	0.0018
TMW01	10/14/2009	Magnesium	7439-95-4	19	—	5.0	0.085
TMW01	10/14/2009	Manganese	7439-96-5	0.0064	E	0.0010	0.00034
TMW01	10/14/2009	Mercury	7439-97-6	0.000050	U	0.00020	0.000050
TMW01	10/14/2009	Nickel	7440-02-0	0.0089	—	0.0020	0.00071
TMW01	10/14/2009	Potassium	7440-09-7	0.47	E	0.50	0.056
TMW01	10/14/2009	Selenium	7782-49-2	0.0088	E	0.010	0.0056
TMW01	10/14/2009	Silver	7440-22-4	0.00072	U	0.0050	0.00072
TMW01	10/14/2009	Sodium	7440-23-5	560	—	50	6.2
TMW01	10/14/2009	Thallium	7440-28-0	0.0026	U	0.0050	0.0026
TMW01	10/14/2009	Vanadium	7440-62-2	0.02	—	0.0050	0.0011
TMW01	10/14/2009	Zinc	7440-66-6	0.0044	E	0.010	0.0012
TMW03	10/14/2009	Aluminum	7429-90-5	0.016	U	0.050	0.016
TMW03	10/14/2009	Antimony	7440-36-0	0.0034	U	0.0060	0.0034
TMW03	10/14/2009	Arsenic	7440-38-2	0.0083	—	0.0050	0.0044

Table 1–2. Dissolved cations and mercury analyzed according to the U.S. Environmental Protection Agency's methods SW846 6010B/6020 and SW846 7471, respectively.—Continued

[CAS, Chemical Abstract Services; mg/L, milligrams per liter; U, undetected; —, unqualified result; E, estimated concentration]

Site designation	Collection date	Analyte	CAS number[1]	Result (mg/L)	Qualifier	Laboratory reporting level (mg/L)	Laboratory detection limit (mg/L)
TMW03	10/14/2009	Barium	7440-39-3	0.014	—	0.0030	0.00024
TMW03	10/14/2009	Beryllium	7440-41-7	0.00005	U	0.0010	0.00005
TMW03	10/14/2009	Cadmium	7440-43-9	0.00043	U	0.0050	0.00043
TMW03	10/14/2009	Calcium	7440-70-2	45	—	5.0	0.090
TMW03	10/14/2009	Chromium	7440-47-3	0.00050	U	0.0020	0.00050
TMW03	10/14/2009	Cobalt	7440-48-4	0.00025	U	0.0050	0.00025
TMW03	10/14/2009	Copper	7440-50-8	0.0021	U	0.020	0.0021
TMW03	10/14/2009	Iron	7439-89-6	0.016	E	0.30	0.0097
TMW03	10/14/2009	Lead	7439-92-1	0.0018	U	0.0050	0.0018
TMW03	10/14/2009	Magnesium	7439-95-4	11	—	5.0	0.085
TMW03	10/14/2009	Manganese	7439-96-5	0.057	E	0.0010	0.00034
TMW03	10/14/2009	Mercury	7439-97-6	0.000050	U	0.00020	0.000050
TMW03	10/14/2009	Nickel	7440-02-0	0.00071	U	0.0020	0.00071
TMW03	10/14/2009	Potassium	7440-09-7	0.53	—	0.50	0.056
TMW03	10/14/2009	Selenium	7782-49-2	0.073	—	0.010	0.0056
TMW03	10/14/2009	Silver	7440-22-4	0.00072	U	0.0050	0.00072
TMW03	10/14/2009	Sodium	7440-23-5	910	—	50	6.2
TMW03	10/14/2009	Thallium	7440-28-0	0.0034	E	0.0050	0.0026
TMW03	10/14/2009	Vanadium	7440-62-2	0.0086	—	0.0050	0.0011
TMW03	10/14/2009	Zinc	7440-66-6	0.036	—	0.010	0.0012
TMW04	10/14/2009	Aluminum	7429-90-5	0.018	E	0.050	0.016
TMW04	10/14/2009	Antimony	7440-36-0	0.0034	U	0.0060	0.0034
TMW04	10/14/2009	Arsenic	7440-38-2	0.0087	—	0.0050	0.0044
TMW04	10/14/2009	Barium	7440-39-3	0.0067	—	0.0030	0.00024
TMW04	10/14/2009	Beryllium	7440-41-7	0.00005	U	0.0010	0.00005
TMW04	10/14/2009	Cadmium	7440-43-9	0.00043	U	0.0050	0.00043
TMW04	10/14/2009	Calcium	7440-70-2	27	—	5.0	0.090
TMW04	10/14/2009	Chromium	7440-47-3	0.00071	E	0.0020	0.00050
TMW04	10/14/2009	Cobalt	7440-48-4	0.00025	U	0.0050	0.00025
TMW04	10/14/2009	Copper	7440-50-8	0.0021	U	0.020	0.0021
TMW04	10/14/2009	Iron	7439-89-6	0.0097	U	0.30	0.0097
TMW04	10/14/2009	Lead	7439-92-1	0.0018	U	0.0050	0.0018
TMW04	10/14/2009	Magnesium	7439-95-4	6	—	0.50	0.0085
TMW04	10/14/2009	Manganese	7439-96-5	0.0029	E	0.0010	0.00034
TMW04	10/14/2009	Mercury	7439-97-6	0.000050	U	0.00020	0.000050
TMW04	10/14/2009	Nickel	7440-02-0	0.00071	U	0.0020	0.00071
TMW04	10/14/2009	Potassium	7440-09-7	0.85	—	0.50	0.056
TMW04	10/14/2009	Selenium	7782-49-2	0.1	—	0.010	0.0056
TMW04	10/14/2009	Silver	7440-22-4	0.00072	U	0.0050	0.00072
TMW04	10/14/2009	Sodium	7440-23-5	860	—	50	6.2
TMW04	10/14/2009	Thallium	7440-28-0	0.0026	U	0.0050	0.0026
TMW04	10/14/2009	Vanadium	7440-62-2	0.021	—	0.0050	0.0011

Table 1–2. Dissolved cations and mercury analyzed according to the U.S. Environmental Protection Agency's methods SW846 6010B/6020 and SW846 7471, respectively.—Continued

[CAS, Chemical Abstract Services; mg/L, milligrams per liter; U, undetected; —, unqualified result; E, estimated concentration]

Site designation	Collection date	Analyte	CAS number[1]	Result (mg/L)	Qualifier	Laboratory reporting level (mg/L)	Laboratory detection limit (mg/L)
TMW04	10/14/2009	Zinc	7440-66-6	0.0062	E	0.010	0.0012
TMW06	10/17/2009	Aluminum	7429-90-5	0.016	U	0.050	0.016
TMW06	10/17/2009	Antimony	7440-36-0	0.0034	U	0.0060	0.0034
TMW06	10/17/2009	Arsenic	7440-38-2	0.0044	U	0.0050	0.0044
TMW06	10/17/2009	Barium	7440-39-3	0.02	—	0.0030	0.00024
TMW06	10/17/2009	Beryllium	7440-41-7	0.00005	U	0.0010	0.00005
TMW06	10/17/2009	Cadmium	7440-43-9	0.00043	U	0.0050	0.00043
TMW06	10/17/2009	Calcium	7440-70-2	52	—	5.0	0.090
TMW06	10/17/2009	Chromium	7440-47-3	0.00050	U	0.0020	0.00050
TMW06	10/17/2009	Cobalt	7440-48-4	0.00025	U	0.0050	0.00025
TMW06	10/17/2009	Copper	7440-50-8	0.013	E	0.020	0.0021
TMW06	10/17/2009	Iron	7439-89-6	0.034	E	0.30	0.0097
TMW06	10/17/2009	Lead	7439-92-1	0.0018	U	0.0050	0.0018
TMW06	10/17/2009	Magnesium	7439-95-4	14	—	5.0	0.085
TMW06	10/17/2009	Manganese	7439-96-5	0.041	E	0.0010	0.00034
TMW06	10/17/2009	Mercury	7439-97-6	0.000050	U	0.00020	0.000050
TMW06	10/17/2009	Nickel	7440-02-0	0.0039	—	0.0020	0.00071
TMW06	10/17/2009	Potassium	7440-09-7	0.51	—	0.50	0.056
TMW06	10/17/2009	Selenium	7782-49-2	0.015	—	0.010	0.0056
TMW06	10/17/2009	Silver	7440-22-4	0.00072	U	0.0050	0.00072
TMW06	10/17/2009	Sodium	7440-23-5	1,100	—	500	62
TMW06	10/17/2009	Thallium	7440-28-0	0.0026	U	0.0050	0.0026
TMW06	10/17/2009	Vanadium	7440-62-2	0.01	—	0.0050	0.0011
TMW06	10/17/2009	Zinc	7440-66-6	0.0041	E	0.010	0.0012
TMW07	10/20/2009	Aluminum	7429-90-5	0.018	E	0.050	0.016
TMW07	10/20/2009	Antimony	7440-36-0	0.0034	U	0.0060	0.0034
TMW07	10/20/2009	Arsenic	7440-38-2	0.0082	—	0.0050	0.0044
TMW07	10/20/2009	Barium	7440-39-3	0.014	—	0.0030	0.00024
TMW07	10/20/2009	Beryllium	7440-41-7	0.00005	U	0.0010	0.00005
TMW07	10/20/2009	Cadmium	7440-43-9	0.00084	E	0.0050	0.00043
TMW07	10/20/2009	Calcium	7440-70-2	55	—	5.0	0.090
TMW07	10/20/2009	Chromium	7440-47-3	0.0006	E	0.0020	0.00050
TMW07	10/20/2009	Cobalt	7440-48-4	0.00025	U	0.0050	0.00025
TMW07	10/20/2009	Copper	7440-50-8	0.0028	E	0.020	0.0021
TMW07	10/20/2009	Iron	7439-89-6	0.0097	U	0.30	0.0097
TMW07	10/20/2009	Lead	7439-92-1	0.0018	U	0.0050	0.0018
TMW07	10/20/2009	Magnesium	7439-95-4	11	—	0.50	0.0085
TMW07	10/20/2009	Manganese	7439-96-5	0.25	—	0.0010	0.00034
TMW07	10/20/2009	Mercury	7439-97-6	0.000050	U	0.00020	0.000050
TMW07	10/20/2009	Nickel	7440-02-0	0.0026	—	0.0020	0.00071
TMW07	10/20/2009	Potassium	7440-09-7	3	—	0.50	0.056
TMW07	10/20/2009	Selenium	7782-49-2	0.0056	U	0.010	0.0056

Table 1–2. Dissolved cations and mercury analyzed according to the U.S. Environmental Protection Agency's methods SW846 6010B/6020 and SW846 7471, respectively.—Continued

[CAS, Chemical Abstract Services; mg/L, milligrams per liter; U, undetected; —, unqualified result; E, estimated concentration]

Site designation	Collection date	Analyte	CAS number[1]	Result (mg/L)	Qualifier	Laboratory reporting level (mg/L)	Laboratory detection limit (mg/L)
TMW07	10/20/2009	Silver	7440-22-4	0.00072	U	0.0050	0.00072
TMW07	10/20/2009	Sodium	7440-23-5	1,300	—	500	62
TMW07	10/20/2009	Thallium	7440-28-0	0.0026	U	0.0050	0.0026
TMW07	10/20/2009	Vanadium	7440-62-2	0.012	—	0.0050	0.0011
TMW07	10/20/2009	Zinc	7440-66-6	0.0053	E	0.010	0.0012
TMW08	10/17/2009	Aluminum	7429-90-5	0.016	U	0.050	0.016
TMW08	10/17/2009	Antimony	7440-36-0	0.0034	U	0.0060	0.0034
TMW08	10/17/2009	Arsenic	7440-38-2	0.0044	U	0.0050	0.0044
TMW08	10/17/2009	Barium	7440-39-3	0.0077	—	0.0030	0.00024
TMW08	10/17/2009	Beryllium	7440-41-7	0.00005	U	0.0010	0.00005
TMW08	10/17/2009	Cadmium	7440-43-9	0.00043	U	0.0050	0.00043
TMW08	10/17/2009	Calcium	7440-70-2	280	—	50	0.90
TMW08	10/17/2009	Chromium	7440-47-3	0.0013	E	0.0020	0.00050
TMW08	10/17/2009	Cobalt	7440-48-4	0.00025	U	0.0050	0.00025
TMW08	10/17/2009	Copper	7440-50-8	0.0021	U	0.020	0.0021
TMW08	10/17/2009	Iron	7439-89-6	0.038	E	0.30	0.0097
TMW08	10/17/2009	Lead	7439-92-1	0.0044	E	0.0050	0.0018
TMW08	10/17/2009	Magnesium	7439-95-4	85	—	5.0	0.085
TMW08	10/17/2009	Manganese	7439-96-5	0.38	E	0.010	0.0034
TMW08	10/17/2009	Mercury	7439-97-6	0.000050	U	0.00020	0.000050
TMW08	10/17/2009	Nickel	7440-02-0	0.0038	—	0.0020	0.00071
TMW08	10/17/2009	Potassium	7440-09-7	3.5	—	0.50	0.056
TMW08	10/17/2009	Selenium	7782-49-2	0.028	—	0.010	0.0056
TMW08	10/17/2009	Silver	7440-22-4	0.00072	U	0.0050	0.00072
TMW08	10/17/2009	Sodium	7440-23-5	3,700	—	500	62
TMW08	10/17/2009	Thallium	7440-28-0	0.0026	U	0.0050	0.0026
TMW08	10/17/2009	Vanadium	7440-62-2	0.0011	U	0.0050	0.0011
TMW08	10/17/2009	Zinc	7440-66-6	0.013	—	0.010	0.0012
TMW10	10/19/2009	Aluminum	7429-90-5	0.016	E	0.050	0.016
TMW10	10/19/2009	Antimony	7440-36-0	0.0034	U	0.0060	0.0034
TMW10	10/19/2009	Arsenic	7440-38-2	0.0044	U	0.0050	0.0044
TMW10	10/19/2009	Barium	7440-39-3	0.013	—	0.0030	0.00024
TMW10	10/19/2009	Beryllium	7440-41-7	0.00005	U	0.0010	0.00005
TMW10	10/19/2009	Cadmium	7440-43-9	0.00043	U	0.0050	0.00043
TMW10	10/19/2009	Calcium	7440-70-2	46	—	5.0	0.090
TMW10	10/19/2009	Chromium	7440-47-3	0.00056	E	0.0020	0.00050
TMW10	10/19/2009	Cobalt	7440-48-4	0.00025	U	0.0050	0.00025
TMW10	10/19/2009	Copper	7440-50-8	0.015	E	0.020	0.0021
TMW10	10/19/2009	Iron	7439-89-6	0.0097	U	0.30	0.0097
TMW10	10/19/2009	Lead	7439-92-1	0.0018	U	0.0050	0.0018
TMW10	10/19/2009	Magnesium	7439-95-4	14	—	5.0	0.085
TMW10	10/19/2009	Manganese	7439-96-5	0.0014	E	0.0010	0.00034

Table 1–2. Dissolved cations and mercury analyzed according to the U.S. Environmental Protection Agency's methods SW846 6010B/6020 and SW846 7471, respectively.—Continued

[CAS, Chemical Abstract Services; mg/L, milligrams per liter; U, undetected; —, unqualified result; E, estimated concentration]

Site designation	Collection date	Analyte	CAS number[1]	Result (mg/L)	Qualifier	Laboratory reporting level (mg/L)	Laboratory detection limit (mg/L)
TMW10	10/19/2009	Mercury	7439-97-6	0.000050	U	0.00020	0.000050
TMW10	10/19/2009	Nickel	7440-02-0	0.00071	U	0.0020	0.00071
TMW10	10/19/2009	Potassium	7440-09-7	0.56	—	0.50	0.056
TMW10	10/19/2009	Selenium	7782-49-2	0.0093	E	0.010	0.0056
TMW10	10/19/2009	Silver	7440-22-4	0.00072	U	0.0050	0.00072
TMW10	10/19/2009	Sodium	7440-23-5	1,000	—	500	62
TMW10	10/19/2009	Thallium	7440-28-0	0.0026	U	0.0050	0.0026
TMW10	10/19/2009	Vanadium	7440-62-2	0.0089	—	0.0050	0.0011
TMW10	10/19/2009	Zinc	7440-66-6	0.0028	E	0.010	0.0012
TMW11	10/20/2009	Aluminum	7429-90-5	0.016	U	0.050	0.016
TMW11	10/20/2009	Antimony	7440-36-0	0.0034	U	0.0060	0.0034
TMW11	10/20/2009	Arsenic	7440-38-2	0.0044	U	0.0050	0.0044
TMW11	10/20/2009	Barium	7440-39-3	0.016	—	0.0030	0.00024
TMW11	10/20/2009	Beryllium	7440-41-7	0.00005	U	0.0010	0.00005
TMW11	10/20/2009	Cadmium	7440-43-9	0.00043	U	0.0050	0.00043
TMW11	10/20/2009	Calcium	7440-70-2	15	—	5.0	0.090
TMW11	10/20/2009	Chromium	7440-47-3	0.00050	U	0.0020	0.00050
TMW11	10/20/2009	Cobalt	7440-48-4	0.00025	U	0.0050	0.00025
TMW11	10/20/2009	Copper	7440-50-8	0.0021	U	0.020	0.0021
TMW11	10/20/2009	Iron	7439-89-6	0.0097	U	0.30	0.0097
TMW11	10/20/2009	Lead	7439-92-1	0.0018	U	0.0050	0.0018
TMW11	10/20/2009	Magnesium	7439-95-4	3	—	0.50	0.0085
TMW11	10/20/2009	Manganese	7439-96-5	0.02	—	0.0010	0.00034
TMW11	10/20/2009	Mercury	7439-97-6	0.000050	U	0.00020	0.000050
TMW11	10/20/2009	Nickel	7440-02-0	0.00071	U	0.0020	0.00071
TMW11	10/20/2009	Potassium	7440-09-7	0.52	—	0.50	0.056
TMW11	10/20/2009	Selenium	7782-49-2	0.018	—	0.010	0.0056
TMW11	10/20/2009	Silver	7440-22-4	0.00072	U	0.0050	0.00072
TMW11	10/20/2009	Sodium	7440-23-5	490	—	50	6.2
TMW11	10/20/2009	Thallium	7440-28-0	0.0026	U	0.0050	0.0026
TMW11	10/20/2009	Vanadium	7440-62-2	0.0056	—	0.0050	0.0011
TMW11	10/20/2009	Zinc	7440-66-6	0.0026	E	0.010	0.0012
TMW13	10/22/2009	Aluminum	7429-90-5	0.016	U	0.050	0.016
TMW13	10/22/2009	Antimony	7440-36-0	0.0034	U	0.0060	0.0034
TMW13	10/22/2009	Arsenic	7440-38-2	0.0067	—	0.0050	0.0044
TMW13	10/22/2009	Barium	7440-39-3	0.015	—	0.0030	0.00024
TMW13	10/22/2009	Beryllium	7440-41-7	0.00005	U	0.0010	0.00005
TMW13	10/22/2009	Cadmium	7440-43-9	0.0012	E	0.0050	0.00043
TMW13	10/22/2009	Calcium	7440-70-2	27	—	5.0	0.090
TMW13	10/22/2009	Chromium	7440-47-3	0.00075	E	0.0020	0.00050
TMW13	10/22/2009	Cobalt	7440-48-4	0.00025	U	0.0050	0.00025
TMW13	10/22/2009	Copper	7440-50-8	0.0029	E	0.020	0.0021

Table 1–2. Dissolved cations and mercury analyzed according to the U.S. Environmental Protection Agency's methods SW846 6010B/6020 and SW846 7471, respectively.—Continued

[CAS, Chemical Abstract Services; mg/L, milligrams per liter; U, undetected; —, unqualified result; E, estimated concentration]

Site designation	Collection date	Analyte	CAS number[1]	Result (mg/L)	Qualifier	Laboratory reporting level (mg/L)	Laboratory detection limit (mg/L)
TMW13	10/22/2009	Iron	7439-89-6	0.0097	U	0.30	0.0097
TMW13	10/22/2009	Lead	7439-92-1	0.0018	U	0.0050	0.0018
TMW13	10/22/2009	Magnesium	7439-95-4	5.2	—	0.50	0.0085
TMW13	10/22/2009	Manganese	7439-96-5	0.00034	U	0.0010	0.00034
TMW13	10/22/2009	Mercury	7439-97-6	0.000050	U	0.00020	0.000050
TMW13	10/22/2009	Nickel	7440-02-0	0.00071	U	0.0020	0.00071
TMW13	10/22/2009	Potassium	7440-09-7	0.43	E	0.50	0.056
TMW13	10/22/2009	Selenium	7782-49-2	0.0089	E	0.010	0.0056
TMW13	10/22/2009	Silver	7440-22-4	0.00072	U	0.0050	0.00072
TMW13	10/22/2009	Sodium	7440-23-5	570	—	50	6.2
TMW13	10/22/2009	Thallium	7440-28-0	0.0027	E	0.0050	0.0026
TMW13	10/22/2009	Vanadium	7440-62-2	0.0083	—	0.0050	0.0011
TMW13	10/22/2009	Zinc	7440-66-6	0.0021	E	0.010	0.0012
TMW15	10/26/2009	Aluminum	7429-90-5	0.016	U	0.050	0.016
TMW15	10/26/2009	Antimony	7440-36-0	0.0034	U	0.0060	0.0034
TMW15	10/26/2009	Arsenic	7440-38-2	0.0044	U	0.0050	0.0044
TMW15	10/26/2009	Barium	7440-39-3	0.019	—	0.0030	0.00024
TMW15	10/26/2009	Beryllium	7440-41-7	0.00005	U	0.0010	0.00005
TMW15	10/26/2009	Cadmium	7440-43-9	0.00043	U	0.0050	0.00043
TMW15	10/26/2009	Calcium	7440-70-2	18	—	5.0	0.090
TMW15	10/26/2009	Chromium	7440-47-3	0.00050	U	0.0020	0.00050
TMW15	10/26/2009	Cobalt	7440-48-4	0.00025	U	0.0050	0.00025
TMW15	10/26/2009	Copper	7440-50-8	0.0021	U	0.020	0.0021
TMW15	10/26/2009	Iron	7439-89-6	0.0097	U	0.30	0.0097
TMW15	10/26/2009	Lead	7439-92-1	0.0018	U	0.0050	0.0018
TMW15	10/26/2009	Magnesium	7439-95-4	3.3	E	0.50	0.0085
TMW15	10/26/2009	Manganese	7439-96-5	0.0019	—	0.0010	0.00034
TMW15	10/26/2009	Mercury	7439-97-6	0.000050	U	0.00020	0.000050
TMW15	10/26/2009	Nickel	7440-02-0	0.00071	U	0.0020	0.00071
TMW15	10/26/2009	Potassium	7440-09-7	0.44	E	0.50	0.056
TMW15	10/26/2009	Selenium	7782-49-2	0.0078	E	0.010	0.0056
TMW15	10/26/2009	Silver	7440-22-4	0.00072	U	0.0050	0.00072
TMW15	10/26/2009	Sodium	7440-23-5	580	—	50	6.2
TMW15	10/26/2009	Thallium	7440-28-0	0.0026	U	0.0050	0.0026
TMW15	10/26/2009	Vanadium	7440-62-2	0.0061	—	0.0050	0.0011
TMW15	10/26/2009	Zinc	7440-66-6	0.027	—	0.010	0.0012
TMW21	10/24/2009	Aluminum	7429-90-5	0.016	U	0.050	0.016
TMW21	10/24/2009	Antimony	7440-36-0	0.0034	U	0.0060	0.0034
TMW21	10/24/2009	Arsenic	7440-38-2	0.0044	U	0.0050	0.0044
TMW21	10/24/2009	Barium	7440-39-3	0.02	—	0.0030	0.00024
TMW21	10/24/2009	Beryllium	7440-41-7	0.00005	U	0.0010	0.00005
TMW21	10/24/2009	Cadmium	7440-43-9	0.00043	U	0.0050	0.00043

Table 1–2. Dissolved cations and mercury analyzed according to the U.S. Environmental Protection Agency's methods SW846 6010B/6020 and SW846 7471, respectively.—Continued

[CAS, Chemical Abstract Services; mg/L, milligrams per liter; U, undetected; —, unqualified result; E, estimated concentration]

Site designation	Collection date	Analyte	CAS number[1]	Result (mg/L)	Qualifier	Laboratory reporting level (mg/L)	Laboratory detection limit (mg/L)
TMW21	10/24/2009	Calcium	7440-70-2	33	—	5.0	0.090
TMW21	10/24/2009	Chromium	7440-47-3	0.00050	U	0.0020	0.00050
TMW21	10/24/2009	Cobalt	7440-48-4	0.00025	U	0.0050	0.00025
TMW21	10/24/2009	Copper	7440-50-8	0.021	—	0.020	0.0021
TMW21	10/24/2009	Iron	7439-89-6	0.0097	U	0.30	0.0097
TMW21	10/24/2009	Lead	7439-92-1	0.0018	U	0.0050	0.0018
TMW21	10/24/2009	Magnesium	7439-95-4	7.3	E	0.50	0.0085
TMW21	10/24/2009	Manganese	7439-96-5	0.13	—	0.0010	0.00034
TMW21	10/24/2009	Mercury	7439-97-6	0.000050	U	0.00020	0.000050
TMW21	10/24/2009	Nickel	7440-02-0	0.00071	U	0.0020	0.00071
TMW21	10/24/2009	Potassium	7440-09-7	0.63	—	0.50	0.056
TMW21	10/24/2009	Selenium	7782-49-2	0.0056	U	0.010	0.0056
TMW21	10/24/2009	Silver	7440-22-4	0.00072	U	0.0050	0.00072
TMW21	10/24/2009	Sodium	7440-23-5	660	—	50	6.2
TMW21	10/24/2009	Thallium	7440-28-0	0.0026	U	0.0050	0.0026
TMW21	10/24/2009	Vanadium	7440-62-2	0.009	—	0.0050	0.0011
TMW21	10/24/2009	Zinc	7440-66-6	0.0022	E	0.010	0.0012
TMW22	10/19/2009	Aluminum	7429-90-5	0.17	—	0.050	0.016
TMW22	10/19/2009	Antimony	7440-36-0	0.0034	U	0.0060	0.0034
TMW22	10/19/2009	Arsenic	7440-38-2	0.0049	E	0.0050	0.0044
TMW22	10/19/2009	Barium	7440-39-3	0.02	—	0.0030	0.00024
TMW22	10/19/2009	Beryllium	7440-41-7	0.00005	U	0.0010	0.00005
TMW22	10/19/2009	Cadmium	7440-43-9	0.00043	U	0.0050	0.00043
TMW22	10/19/2009	Calcium	7440-70-2	28	—	5.0	0.090
TMW22	10/19/2009	Chromium	7440-47-3	0.0009	E	0.0020	0.00050
TMW22	10/19/2009	Cobalt	7440-48-4	0.00025	U	0.0050	0.00025
TMW22	10/19/2009	Copper	7440-50-8	0.0021	U	0.020	0.0021
TMW22	10/19/2009	Iron	7439-89-6	0.081	E	0.30	0.0097
TMW22	10/19/2009	Lead	7439-92-1	0.0018	U	0.0050	0.0018
TMW22	10/19/2009	Magnesium	7439-95-4	10	—	5.0	0.085
TMW22	10/19/2009	Manganese	7439-96-5	0.057	E	0.0010	0.00034
TMW22	10/19/2009	Mercury	7439-97-6	0.000050	U	0.00020	0.000050
TMW22	10/19/2009	Nickel	7440-02-0	0.0021	—	0.0020	0.00071
TMW22	10/19/2009	Potassium	7440-09-7	1.0	—	0.50	0.056
TMW22	10/19/2009	Selenium	7782-49-2	0.0056	U	0.010	0.0056
TMW22	10/19/2009	Silver	7440-22-4	0.00072	U	0.0050	0.00072
TMW22	10/19/2009	Sodium	7440-23-5	830	—	50	6.2
TMW22	10/19/2009	Thallium	7440-28-0	0.0026	U	0.0050	0.0026
TMW22	10/19/2009	Vanadium	7440-62-2	0.012	—	0.0050	0.0011
TMW22	10/19/2009	Zinc	7440-66-6	0.0067	E	0.010	0.0012
TMW23	10/19/2009	Aluminum	7429-90-5	0.44	—	0.050	0.016
TMW23	10/19/2009	Antimony	7440-36-0	0.0034	U	0.0060	0.0034

Table 1–2. Dissolved cations and mercury analyzed according to the U.S. Environmental Protection Agency's methods SW846 6010B/6020 and SW846 7471, respectively.—Continued

[CAS, Chemical Abstract Services; mg/L, milligrams per liter; U, undetected; —, unqualified result; E, estimated concentration]

Site designation	Collection date	Analyte	CAS number[1]	Result (mg/L)	Qualifier	Laboratory reporting level (mg/L)	Laboratory detection limit (mg/L)
TMW23	10/19/2009	Arsenic	7440-38-2	0.0044	U	0.0050	0.0044
TMW23	10/19/2009	Barium	7440-39-3	0.024	—	0.0030	0.00024
TMW23	10/19/2009	Beryllium	7440-41-7	0.00005	U	0.0010	0.00005
TMW23	10/19/2009	Cadmium	7440-43-9	0.00043	U	0.0050	0.00043
TMW23	10/19/2009	Calcium	7440-70-2	16	—	5.0	0.090
TMW23	10/19/2009	Chromium	7440-47-3	0.0024	—	0.0020	0.00050
TMW23	10/19/2009	Cobalt	7440-48-4	0.00025	U	0.0050	0.00025
TMW23	10/19/2009	Copper	7440-50-8	0.0021	U	0.020	0.0021
TMW23	10/19/2009	Iron	7439-89-6	0.22	E	0.30	0.0097
TMW23	10/19/2009	Lead	7439-92-1	0.0018	U	0.0050	0.0018
TMW23	10/19/2009	Magnesium	7439-95-4	4.9	—	0.50	0.0085
TMW23	10/19/2009	Manganese	7439-96-5	0.023	E	0.0010	0.00034
TMW23	10/19/2009	Mercury	7439-97-6	0.000050	U	0.00020	0.000050
TMW23	10/19/2009	Nickel	7440-02-0	0.00071	U	0.0020	0.00071
TMW23	10/19/2009	Potassium	7440-09-7	0.53	—	0.50	0.056
TMW23	10/19/2009	Selenium	7782-49-2	0.0056	U	0.010	0.0056
TMW23	10/19/2009	Silver	7440-22-4	0.00072	U	0.0050	0.00072
TMW23	10/19/2009	Sodium	7440-23-5	770	—	50	6.2
TMW23	10/19/2009	Thallium	7440-28-0	0.0026	U	0.0050	0.0026
TMW23	10/19/2009	Vanadium	7440-62-2	0.0094	—	0.0050	0.0011
TMW23	10/19/2009	Zinc	7440-66-6	0.004	E	0.010	0.0012
TMW24	10/19/2009	Aluminum	7429-90-5	0.016	U	0.050	0.016
TMW24	10/19/2009	Antimony	7440-36-0	0.0034	U	0.0060	0.0034
TMW24	10/19/2009	Arsenic	7440-38-2	0.0057	—	0.0050	0.0044
TMW24	10/19/2009	Barium	7440-39-3	0.036	—	0.0030	0.00024
TMW24	10/19/2009	Beryllium	7440-41-7	0.00005	U	0.0010	0.00005
TMW24	10/19/2009	Cadmium	7440-43-9	0.00043	U	0.0050	0.00043
TMW24	10/19/2009	Calcium	7440-70-2	26	—	5.0	0.090
TMW24	10/19/2009	Chromium	7440-47-3	0.0019	E	0.0020	0.00050
TMW24	10/19/2009	Cobalt	7440-48-4	0.00025	U	0.0050	0.00025
TMW24	10/19/2009	Copper	7440-50-8	0.0021	U	0.020	0.0021
TMW24	10/19/2009	Iron	7439-89-6	0.0097	U	0.30	0.0097
TMW24	10/19/2009	Lead	7439-92-1	0.0018	U	0.0050	0.0018
TMW24	10/19/2009	Magnesium	7439-95-4	8.1	—	0.50	0.0085
TMW24	10/19/2009	Manganese	7439-96-5	0.14	E	0.0010	0.00034
TMW24	10/19/2009	Mercury	7439-97-6	0.000050	U	0.00020	0.000050
TMW24	10/19/2009	Nickel	7440-02-0	0.0019	E	0.0020	0.00071
TMW24	10/19/2009	Potassium	7440-09-7	0.46	E	0.50	0.056
TMW24	10/19/2009	Selenium	7782-49-2	0.0056	U	0.010	0.0056
TMW24	10/19/2009	Silver	7440-22-4	0.00072	U	0.0050	0.00072
TMW24	10/19/2009	Sodium	7440-23-5	890	—	50	6.2
TMW24	10/19/2009	Thallium	7440-28-0	0.0026	U	0.0050	0.0026

Table 1–2. Dissolved cations and mercury analyzed according to the U.S. Environmental Protection Agency's methods SW846 6010B/6020 and SW846 7471, respectively.—Continued

[CAS, Chemical Abstract Services; mg/L, milligrams per liter; U, undetected; —, unqualified result; E, estimated concentration]

Site designation	Collection date	Analyte	CAS number[1]	Result (mg/L)	Qualifier	Laboratory reporting level (mg/L)	Laboratory detection limit (mg/L)
TMW24	10/19/2009	Vanadium	7440-62-2	0.0092	—	0.0050	0.0011
TMW24	10/19/2009	Zinc	7440-66-6	0.0037	E	0.010	0.0012
TMW25	10/23/2009	Aluminum	7429-90-5	0.016	U	0.050	0.016
TMW25	10/23/2009	Antimony	7440-36-0	0.0034	U	0.0060	0.0034
TMW25	10/23/2009	Arsenic	7440-38-2	0.0044	U	0.0050	0.0044
TMW25	10/23/2009	Barium	7440-39-3	0.01	—	0.0030	0.00024
TMW25	10/23/2009	Beryllium	7440-41-7	0.00005	U	0.0010	0.00005
TMW25	10/23/2009	Cadmium	7440-43-9	0.00043	U	0.0050	0.00043
TMW25	10/23/2009	Calcium	7440-70-2	58	—	5.0	0.090
TMW25	10/23/2009	Chromium	7440-47-3	0.00052	E	0.0020	0.00050
TMW25	10/23/2009	Cobalt	7440-48-4	0.00025	U	0.0050	0.00025
TMW25	10/23/2009	Copper	7440-50-8	0.0021	U	0.020	0.0021
TMW25	10/23/2009	Iron	7439-89-6	0.0097	U	0.30	0.0097
TMW25	10/23/2009	Lead	7439-92-1	0.0018	U	0.0050	0.0018
TMW25	10/23/2009	Magnesium	7439-95-4	13	E	5.0	0.085
TMW25	10/23/2009	Manganese	7439-96-5	0.098	—	0.0010	0.00034
TMW25	10/23/2009	Mercury	7439-97-6	0.000050	U	0.00020	0.000050
TMW25	10/23/2009	Nickel	7440-02-0	0.00071	U	0.0020	0.00071
TMW25	10/23/2009	Potassium	7440-09-7	0.26	E	0.50	0.056
TMW25	10/23/2009	Selenium	7782-49-2	0.0056	U	0.010	0.0056
TMW25	10/23/2009	Silver	7440-22-4	0.00072	U	0.0050	0.00072
TMW25	10/23/2009	Sodium	7440-23-5	880	—	50	6.2
TMW25	10/23/2009	Thallium	7440-28-0	0.0026	U	0.0050	0.0026
TMW25	10/23/2009	Vanadium	7440-62-2	0.011	—	0.0050	0.0011
TMW25	10/23/2009	Zinc	7440-66-6	0.0091	E	0.010	0.0012
TMW26	10/17/2009	Aluminum	7429-90-5	0.077	—	0.050	0.016
TMW26	10/17/2009	Antimony	7440-36-0	0.0034	U	0.0060	0.0034
TMW26	10/17/2009	Arsenic	7440-38-2	0.0044	U	0.0050	0.0044
TMW26	10/17/2009	Barium	7440-39-3	0.016	—	0.0030	0.00024
TMW26	10/17/2009	Beryllium	7440-41-7	0.00005	U	0.0010	0.00005
TMW26	10/17/2009	Cadmium	7440-43-9	0.00043	U	0.0050	0.00043
TMW26	10/17/2009	Calcium	7440-70-2	16	—	5.0	0.090
TMW26	10/17/2009	Chromium	7440-47-3	0.00050	U	0.0020	0.00050
TMW26	10/17/2009	Cobalt	7440-48-4	0.00025	U	0.0050	0.00025
TMW26	10/17/2009	Copper	7440-50-8	0.0021	E	0.020	0.0021
TMW26	10/17/2009	Iron	7439-89-6	0.022	E	0.30	0.0097
TMW26	10/17/2009	Lead	7439-92-1	0.0018	U	0.0050	0.0018
TMW26	10/17/2009	Magnesium	7439-95-4	7.4	—	0.50	0.0085
TMW26	10/17/2009	Manganese	7439-96-5	0.094	E	0.0010	0.00034
TMW26	10/17/2009	Mercury	7439-97-6	0.000050	U	0.00020	0.000050
TMW26	10/17/2009	Nickel	7440-02-0	0.0037	—	0.0020	0.00071
TMW26	10/17/2009	Potassium	7440-09-7	0.48	E	0.50	0.056

Table 1–2. Dissolved cations and mercury analyzed according to the U.S. Environmental Protection Agency's methods SW846 6010B/6020 and SW846 7471, respectively.—Continued

[CAS, Chemical Abstract Services; mg/L, milligrams per liter; U, undetected; —, unqualified result; E, estimated concentration]

Site designation	Collection date	Analyte	CAS number[1]	Result (mg/L)	Qualifier	Laboratory reporting level (mg/L)	Laboratory detection limit (mg/L)
TMW26	10/17/2009	Selenium	7782-49-2	0.0056	U	0.010	0.0056
TMW26	10/17/2009	Silver	7440-22-4	0.00072	U	0.0050	0.00072
TMW26	10/17/2009	Sodium	7440-23-5	800	—	50	6.2
TMW26	10/17/2009	Thallium	7440-28-0	0.0026	U	0.0050	0.0026
TMW26	10/17/2009	Vanadium	7440-62-2	0.010	—	0.0050	0.0011
TMW26	10/17/2009	Zinc	7440-66-6	0.0078	E	0.010	0.0012
TMW27	10/24/2009	Aluminum	7429-90-5	0.016	U	0.050	0.016
TMW27	10/24/2009	Antimony	7440-36-0	0.0034	U	0.0060	0.0034
TMW27	10/24/2009	Arsenic	7440-38-2	0.019	—	0.0050	0.0044
TMW27	10/24/2009	Barium	7440-39-3	0.1	—	0.0030	0.00024
TMW27	10/24/2009	Beryllium	7440-41-7	0.00005	U	0.0010	0.00005
TMW27	10/24/2009	Cadmium	7440-43-9	0.00043	U	0.0050	0.00043
TMW27	10/24/2009	Calcium	7440-70-2	24	—	5.0	0.090
TMW27	10/24/2009	Chromium	7440-47-3	0.00050	U	0.0020	0.00050
TMW27	10/24/2009	Cobalt	7440-48-4	0.00025	U	0.0050	0.00025
TMW27	10/24/2009	Copper	7440-50-8	0.0021	U	0.020	0.0021
TMW27	10/24/2009	Iron	7439-89-6	0.0097	U	0.30	0.0097
TMW27	10/24/2009	Lead	7439-92-1	0.0018	U	0.0050	0.0018
TMW27	10/24/2009	Magnesium	7439-95-4	6.4	E	0.50	0.0085
TMW27	10/24/2009	Manganese	7439-96-5	0.54	—	0.010	0.0034
TMW27	10/24/2009	Mercury	7439-97-6	0.00014	E	0.00020	0.000050
TMW27	10/24/2009	Nickel	7440-02-0	0.0023	—	0.0020	0.00071
TMW27	10/24/2009	Potassium	7440-09-7	0.46	E	0.50	0.056
TMW27	10/24/2009	Selenium	7782-49-2	0.0056	U	0.010	0.0056
TMW27	10/24/2009	Silver	7440-22-4	0.00072	U	0.0050	0.00072
TMW27	10/24/2009	Sodium	7440-23-5	340	—	50	6.2
TMW27	10/24/2009	Thallium	7440-28-0	0.0026	U	0.0050	0.0026
TMW27	10/24/2009	Vanadium	7440-62-2	0.005	E	0.0050	0.0011
TMW27	10/24/2009	Zinc	7440-66-6	0.0083	E	0.010	0.0012
TMW28	10/19/2009	Aluminum	7429-90-5	0.016	U	0.050	0.016
TMW28	10/19/2009	Antimony	7440-36-0	0.0034	U	0.0060	0.0034
TMW28	10/19/2009	Arsenic	7440-38-2	0.0044	U	0.0050	0.0044
TMW28	10/19/2009	Barium	7440-39-3	0.042	—	0.0030	0.00024
TMW28	10/19/2009	Beryllium	7440-41-7	0.00005	U	0.0010	0.00005
TMW28	10/19/2009	Cadmium	7440-43-9	0.00043	U	0.0050	0.00043
TMW28	10/19/2009	Calcium	7440-70-2	43	—	5.0	0.090
TMW28	10/19/2009	Chromium	7440-47-3	0.00050	U	0.0020	0.00050
TMW28	10/19/2009	Cobalt	7440-48-4	0.00025	U	0.0050	0.00025
TMW28	10/19/2009	Copper	7440-50-8	0.0021	U	0.020	0.0021
TMW28	10/19/2009	Iron	7439-89-6	0.090	U	0.30	0.0097
TMW28	10/19/2009	Lead	7439-92-1	0.0018	U	0.0050	0.0018
TMW28	10/19/2009	Magnesium	7439-95-4	14	—	5.0	0.085

Table 1–2. Dissolved cations and mercury analyzed according to the U.S. Environmental Protection Agency's methods SW846 6010B/6020 and SW846 7471, respectively.—Continued

[CAS, Chemical Abstract Services; mg/L, milligrams per liter; U, undetected; —, unqualified result; E, estimated concentration]

Site designation	Collection date	Analyte	CAS number[1]	Result (mg/L)	Qualifier	Laboratory reporting level (mg/L)	Laboratory detection limit (mg/L)
TMW28	10/19/2009	Manganese	7439-96-5	0.22	E	0.010	0.0034
TMW28	10/19/2009	Mercury	7439-97-6	0.000050	U	0.00020	0.000050
TMW28	10/19/2009	Nickel	7440-02-0	0.00071	U	0.0020	0.00071
TMW28	10/19/2009	Potassium	7440-09-7	1.0	—	0.50	0.056
TMW28	10/19/2009	Selenium	7782-49-2	0.0056	U	0.010	0.0056
TMW28	10/19/2009	Silver	7440-22-4	0.00072	U	0.0050	0.00072
TMW28	10/19/2009	Sodium	7440-23-5	300	—	50	6.2
TMW28	10/19/2009	Thallium	7440-28-0	0.0026	U	0.0050	0.0026
TMW28	10/19/2009	Vanadium	7440-62-2	0.0069	E	0.0050	0.0011
TMW28	10/19/2009	Zinc	7440-66-6	0.0078	E	0.010	0.0012
TMW29	10/20/2009	Aluminum	7429-90-5	0.016	U	0.050	0.016
TMW29	10/20/2009	Antimony	7440-36-0	0.0034	U	0.0060	0.0034
TMW29	10/20/2009	Arsenic	7440-38-2	0.0052	—	0.0050	0.0044
TMW29	10/20/2009	Barium	7440-39-3	0.019	—	0.0030	0.00024
TMW29	10/20/2009	Beryllium	7440-41-7	0.00005	U	0.0010	0.00005
TMW29	10/20/2009	Cadmium	7440-43-9	0.00043	U	0.0050	0.00043
TMW29	10/20/2009	Calcium	7440-70-2	39	—	5.0	0.090
TMW29	10/20/2009	Chromium	7440-47-3	0.00050	U	0.0020	0.00050
TMW29	10/20/2009	Cobalt	7440-48-4	0.00025	U	0.0050	0.00025
TMW29	10/20/2009	Copper	7440-50-8	0.0021	U	0.020	0.0021
TMW29	10/20/2009	Iron	7439-89-6	0.017	E	0.30	0.0097
TMW29	10/20/2009	Lead	7439-92-1	0.0018	U	0.0050	0.0018
TMW29	10/20/2009	Magnesium	7439-95-4	8.5	—	0.50	0.0085
TMW29	10/20/2009	Manganese	7439-96-5	0.01	—	0.0010	0.00034
TMW29	10/20/2009	Mercury	7439-97-6	0.000050	U	0.00020	0.000050
TMW29	10/20/2009	Nickel	7440-02-0	0.00071	U	0.0020	0.00071
TMW29	10/20/2009	Potassium	7440-09-7	1.1	—	0.50	0.056
TMW29	10/20/2009	Selenium	7782-49-2	0.021	—	0.010	0.0056
TMW29	10/20/2009	Silver	7440-22-4	0.00072	U	0.0050	0.00072
TMW29	10/20/2009	Sodium	7440-23-5	550	—	50	6.2
TMW29	10/20/2009	Thallium	7440-28-0	0.0026	U	0.0050	0.0026
TMW29	10/20/2009	Vanadium	7440-62-2	0.012	—	0.0050	0.0011
TMW29	10/20/2009	Zinc	7440-66-6	0.0037	E	0.010	0.0012

[1] CAS Registry Numbers, which is a registered trademark of the American Chemical Society. CAS recommends the verification of the CAS Registry Numbers through CAS Client Services.

Table 1–3. Total cations and mercury analyzed according to the U.S. Environmental Protection Agency's methods SW846 6010B/6020 and SW846 7471, respectively.

[CAS, Chemical Abstract Services; mg/L, milligrams per liter; —, unqualified result; U, undetected; E, estimated concentration]

Site designation	Collection date	Analyte	CAS number[1]	Result (mg/L)	Qualifier	Laboratory reporting level (mg/L)	Laboratory detection limit (mg/L)
MW01	10/22/2009	Aluminum	7429-90-5	4.6	—	0.050	0.016
MW01	10/22/2009	Antimony	7440-36-0	0.0034	U	0.0060	0.0034
MW01	10/22/2009	Arsenic	7440-38-2	0.0044	U	0.0050	0.0044
MW01	10/22/2009	Barium	7440-39-3	0.063	—	0.0030	0.00024
MW01	10/22/2009	Beryllium	7440-41-7	0.000050	U	0.0010	0.000050
MW01	10/22/2009	Cadmium	7440-43-9	0.00086	E	0.0050	0.00043
MW01	10/22/2009	Calcium	7440-70-2	27	—	5.0	0.090
MW01	10/22/2009	Chromium	7440-47-3	0.0045	—	0.0020	0.00050
MW01	10/22/2009	Cobalt	7440-48-4	0.00025	U	0.0050	0.00025
MW01	10/22/2009	Copper	7440-50-8	0.0065	E	0.020	0.0021
MW01	10/22/2009	Iron	7439-89-6	2.8	E	0.30	0.0097
MW01	10/22/2009	Lead	7439-92-1	0.0047	E	0.0050	0.0018
MW01	10/22/2009	Magnesium	7439-95-4	8.2	—	5.0	0.085
MW01	10/22/2009	Manganese	7439-96-5	0.20	—	0.010	0.0034
MW01	10/22/2009	Mercury	7439-97-6	0.000050	U	0.00020	0.000050
MW01	10/22/2009	Nickel	7440-02-0	0.0049	—	0.0020	0.00071
MW01	10/22/2009	Potassium	7440-09-7	1.4	—	0.50	0.056
MW01	10/22/2009	Selenium	7782-49-2	0.024	—	0.010	0.0056
MW01	10/22/2009	Silver	7440-22-4	0.00072	U	0.0050	0.00072
MW01	10/22/2009	Sodium	7440-23-5	730	—	50	6.2
MW01	10/22/2009	Thallium	7440-28-0	0.0026	U	0.0050	0.0026
MW01	10/22/2009	Vanadium	7440-62-2	0.015	—	0.010	0.0011
MW01	10/22/2009	Zinc	7440-66-6	0.11	E	0.10	0.012
MW02	10/22/2009	Aluminum	7429-90-5	14	—	0.50	0.16
MW02	10/22/2009	Antimony	7440-36-0	0.0034	U	0.0060	0.0034
MW02	10/22/2009	Arsenic	7440-38-2	0.0044	U	0.0050	0.0044
MW02	10/22/2009	Barium	7440-39-3	0.21	—	0.030	0.0024
MW02	10/22/2009	Beryllium	7440-41-7	0.00046	E	0.0010	0.000050
MW02	10/22/2009	Cadmium	7440-43-9	0.00087	E	0.0050	0.00043
MW02	10/22/2009	Calcium	7440-70-2	220	—	50	0.90
MW02	10/22/2009	Chromium	7440-47-3	0.011	—	0.0020	0.00050
MW02	10/22/2009	Cobalt	7440-48-4	0.0059	—	0.0050	0.00025
MW02	10/22/2009	Copper	7440-50-8	0.0070	E	0.020	0.0021
MW02	10/22/2009	Iron	7439-89-6	10	E	3.0	0.097
MW02	10/22/2009	Lead	7439-92-1	0.0093	—	0.0050	0.0018
MW02	10/22/2009	Magnesium	7439-95-4	46	—	5.0	0.085
MW02	10/22/2009	Manganese	7439-96-5	0.91	—	0.010	0.0034
MW02	10/22/2009	Mercury	7439-97-6	0.000050	U	0.00020	0.000050
MW02	10/22/2009	Nickel	7440-02-0	0.0091	—	0.0020	0.00071
MW02	10/22/2009	Potassium	7440-09-7	3.0	—	0.50	0.056
MW02	10/22/2009	Selenium	7782-49-2	0.0056	U	0.010	0.0056
MW02	10/22/2009	Silver	7440-22-4	0.00072	U	0.0050	0.00072

Table 1–3. Total cations and mercury analyzed according to the U.S. Environmental Protection Agency's methods SW846 6010B/6020 and SW846 7471, respectively.—Continued

[CAS, Chemical Abstract Services; mg/L, milligrams per liter; —, unqualified result; U, undetected; E, estimated concentration]

Site designation	Collection date	Analyte	CAS number[1]	Result (mg/L)	Qualifier	Laboratory reporting level (mg/L)	Laboratory detection limit (mg/L)
MW02	10/22/2009	Sodium	7440-23-5	360	—	50	6.2
MW02	10/22/2009	Thallium	7440-28-0	0.0026	U	0.0050	0.0026
MW02	10/22/2009	Vanadium	7440-62-2	0.025	—	0.010	0.0011
MW02	10/22/2009	Zinc	7440-66-6	0.98	E	0.10	0.012
MW03	10/23/2009	Aluminum	7429-90-5	0.016	U	0.050	0.016
MW03	10/23/2009	Antimony	7440-36-0	0.0034	U	0.0060	0.0034
MW03	10/23/2009	Arsenic	7440-38-2	0.0044	U	0.0050	0.0044
MW03	10/23/2009	Barium	7440-39-3	0.0093	—	0.0030	0.00024
MW03	10/23/2009	Beryllium	7440-41-7	0.000050	U	0.0010	0.000050
MW03	10/23/2009	Cadmium	7440-43-9	0.00087	E	0.0050	0.00043
MW03	10/23/2009	Calcium	7440-70-2	79	—	5.0	0.090
MW03	10/23/2009	Chromium	7440-47-3	0.00050	U	0.0020	0.00050
MW03	10/23/2009	Cobalt	7440-48-4	0.00025	U	0.0050	0.00025
MW03	10/23/2009	Copper	7440-50-8	0.0034	E	0.020	0.0021
MW03	10/23/2009	Iron	7439-89-6	0.0097	U	0.30	0.0097
MW03	10/23/2009	Lead	7439-92-1	0.0018	U	0.0050	0.0018
MW03	10/23/2009	Magnesium	7439-95-4	16	—	5.0	0.085
MW03	10/23/2009	Manganese	7439-96-5	0.045	—	0.0010	0.00034
MW03	10/23/2009	Mercury	7439-97-6	0.000050	U	0.00020	0.000050
MW03	10/23/2009	Nickel	7440-02-0	0.00071	U	0.0020	0.00071
MW03	10/23/2009	Potassium	7440-09-7	0.55	—	0.50	0.056
MW03	10/23/2009	Selenium	7782-49-2	0.012	—	0.010	0.0056
MW03	10/23/2009	Silver	7440-22-4	0.00072	U	0.0050	0.00072
MW03	10/23/2009	Sodium	7440-23-5	1,200	—	500	62
MW03	10/23/2009	Thallium	7440-28-0	0.0026	U	0.0050	0.0026
MW03	10/23/2009	Vanadium	7440-62-2	0.012	—	0.010	0.0011
MW03	10/23/2009	Zinc	7440-66-6	0.041	—	0.010	0.0012
MW18D	10/23/2009	Aluminum	7429-90-5	0.83	—	0.050	0.016
MW18D	10/23/2009	Antimony	7440-36-0	0.0034	U	0.0060	0.0034
MW18D	10/23/2009	Arsenic	7440-38-2	0.0044	U	0.0050	0.0044
MW18D	10/23/2009	Barium	7440-39-3	0.023	—	0.0030	0.00024
MW18D	10/23/2009	Beryllium	7440-41-7	0.000050	U	0.0010	0.000050
MW18D	10/23/2009	Cadmium	7440-43-9	0.00043	U	0.0050	0.00043
MW18D	10/23/2009	Calcium	7440-70-2	67	—	5.0	0.090
MW18D	10/23/2009	Chromium	7440-47-3	0.0014	E	0.0020	0.00050
MW18D	10/23/2009	Cobalt	7440-48-4	0.00025	U	0.0050	0.00025
MW18D	10/23/2009	Copper	7440-50-8	0.0056	E	0.020	0.0021
MW18D	10/23/2009	Iron	7439-89-6	0.90	—	0.30	0.0097
MW18D	10/23/2009	Lead	7439-92-1	0.0018	U	0.0050	0.0018
MW18D	10/23/2009	Magnesium	7439-95-4	20	—	5.0	0.085
MW18D	10/23/2009	Manganese	7439-96-5	0.77	—	0.010	0.0034
MW18D	10/23/2009	Mercury	7439-97-6	0.000050	U	0.00020	0.000050

Table 1–3. Total cations and mercury analyzed according to the U.S. Environmental Protection Agency’s methods SW846 6010B/6020 and SW846 7471, respectively.—Continued

[CAS, Chemical Abstract Services; mg/L, milligrams per liter; —, unqualified result; U, undetected; E, estimated concentration]

Site designation	Collection date	Analyte	CAS number[1]	Result (mg/L)	Qualifier	Laboratory reporting level (mg/L)	Laboratory detection limit (mg/L)
MW18D	10/23/2009	Nickel	7440-02-0	0.0054	—	0.0020	0.00071
MW18D	10/23/2009	Potassium	7440-09-7	1.0	—	0.50	0.056
MW18D	10/23/2009	Selenium	7782-49-2	0.0056	U	0.010	0.0056
MW18D	10/23/2009	Silver	7440-22-4	0.00072	U	0.0050	0.00072
MW18D	10/23/2009	Sodium	7440-23-5	1,900	—	500	62
MW18D	10/23/2009	Thallium	7440-28-0	0.0026	U	0.0050	0.0026
MW18D	10/23/2009	Vanadium	7440-62-2	0.016	—	0.010	0.0011
MW18D	10/23/2009	Zinc	7440-66-6	0.26	—	0.10	0.012
MW20	10/23/2009	Aluminum	7429-90-5	0.016	U	0.050	0.016
MW20	10/23/2009	Antimony	7440-36-0	0.0034	U	0.0060	0.0034
MW20	10/23/2009	Arsenic	7440-38-2	0.0044	U	0.0050	0.0044
MW20	10/23/2009	Barium	7440-39-3	0.015	—	0.0030	0.00024
MW20	10/23/2009	Beryllium	7440-41-7	0.000050	U	0.0010	0.000050
MW20	10/23/2009	Cadmium	7440-43-9	0.00043	U	0.0050	0.00043
MW20	10/23/2009	Calcium	7440-70-2	510	—	50	0.90
MW20	10/23/2009	Chromium	7440-47-3	0.0015	E	0.0020	0.00050
MW20	10/23/2009	Cobalt	7440-48-4	0.00025	U	0.0050	0.00025
MW20	10/23/2009	Copper	7440-50-8	0.0064	E	0.020	0.0021
MW20	10/23/2009	Iron	7439-89-6	0.67	—	0.30	0.0097
MW20	10/23/2009	Lead	7439-92-1	0.0045	E	0.0050	0.0018
MW20	10/23/2009	Magnesium	7439-95-4	110	—	50	0.85
MW20	10/23/2009	Manganese	7439-96-5	2.8	—	0.10	0.034
MW20	10/23/2009	Mercury	7439-97-6	0.000050	U	0.00020	0.000050
MW20	10/23/2009	Nickel	7440-02-0	0.0085	—	0.0020	0.00071
MW20	10/23/2009	Potassium	7440-09-7	2.2	—	0.50	0.056
MW20	10/23/2009	Selenium	7782-49-2	0.23	—	0.10	0.056
MW20	10/23/2009	Silver	7440-22-4	0.00093	E	0.0050	0.00072
MW20	10/23/2009	Sodium	7440-23-5	4,200	—	500	62
MW20	10/23/2009	Thallium	7440-28-0	0.0026	U	0.0050	0.0026
MW20	10/23/2009	Vanadium	7440-62-2	0.0011	U	0.010	0.0011
MW20	10/23/2009	Zinc	7440-66-6	0.35	—	0.10	0.012
MW22D	10/21/2009	Aluminum	7429-90-5	0.048	UE	0.050	0.016
MW22D	10/21/2009	Antimony	7440-36-0	0.0053	E	0.0060	0.0034
MW22D	10/21/2009	Arsenic	7440-38-2	0.0044	U	0.0050	0.0044
MW22D	10/21/2009	Barium	7440-39-3	0.0094	—	0.0030	0.00024
MW22D	10/21/2009	Beryllium	7440-41-7	0.000050	U	0.0010	0.000050
MW22D	10/21/2009	Cadmium	7440-43-9	0.00043	U	0.0050	0.00043
MW22D	10/21/2009	Calcium	7440-70-2	81	—	5.0	0.090
MW22D	10/21/2009	Chromium	7440-47-3	0.0011	E	0.0020	0.00050
MW22D	10/21/2009	Cobalt	7440-48-4	0.00025	U	0.0050	0.00025
MW22D	10/21/2009	Copper	7440-50-8	0.0024	E	0.020	0.0021
MW22D	10/21/2009	Iron	7439-89-6	0.18	E	0.30	0.0097

Table 1–3. Total cations and mercury analyzed according to the U.S. Environmental Protection Agency's methods SW846 6010B/6020 and SW846 7471, respectively.—Continued

[CAS, Chemical Abstract Services; mg/L, milligrams per liter; —, unqualified result; U, undetected; E, estimated concentration]

Site designation	Collection date	Analyte	CAS number[1]	Result (mg/L)	Qualifier	Laboratory reporting level (mg/L)	Laboratory detection limit (mg/L)
MW22D	10/21/2009	Lead	7439-92-1	0.0018	U	0.0050	0.0018
MW22D	10/21/2009	Magnesium	7439-95-4	15	E	5.0	0.085
MW22D	10/21/2009	Manganese	7439-96-5	0.10	—	0.0010	0.00034
MW22D	10/21/2009	Mercury	7439-97-6	0.000050	U	0.00020	0.000050
MW22D	10/21/2009	Nickel	7440-02-0	0.0030	—	0.0020	0.00071
MW22D	10/21/2009	Potassium	7440-09-7	0.59	—	0.50	0.056
MW22D	10/21/2009	Selenium	7782-49-2	0.051	—	0.010	0.0056
MW22D	10/21/2009	Silver	7440-22-4	0.00075	E	0.0050	0.00072
MW22D	10/21/2009	Sodium	7440-23-5	1,100	—	500	62
MW22D	10/21/2009	Thallium	7440-28-0	0.0026	U	0.0050	0.0026
MW22D	10/21/2009	Vanadium	7440-62-2	0.013	—	0.010	0.0011
MW22D	10/21/2009	Zinc	7440-66-6	0.069	—	0.010	0.0012
MW22S	10/20/2009	Aluminum	7429-90-5	13	—	0.50	0.16
MW22S	10/20/2009	Antimony	7440-36-0	0.0034	U	0.0060	0.0034
MW22S	10/20/2009	Arsenic	7440-38-2	0.0078	—	0.0050	0.0044
MW22S	10/20/2009	Barium	7440-39-3	0.20	—	0.030	0.0024
MW22S	10/20/2009	Beryllium	7440-41-7	0.0012	—	0.0010	0.000050
MW22S	10/20/2009	Cadmium	7440-43-9	0.00043	U	0.0050	0.00043
MW22S	10/20/2009	Calcium	7440-70-2	130	—	50	0.90
MW22S	10/20/2009	Chromium	7440-47-3	0.011	—	0.0020	0.00050
MW22S	10/20/2009	Cobalt	7440-48-4	0.0046	E	0.0050	0.00025
MW22S	10/20/2009	Copper	7440-50-8	0.0090	E	0.020	0.0021
MW22S	10/20/2009	Iron	7439-89-6	8.4	—	0.30	0.0097
MW22S	10/20/2009	Lead	7439-92-1	0.027	—	0.0050	0.0018
MW22S	10/20/2009	Magnesium	7439-95-4	28	—	5.0	0.085
MW22S	10/20/2009	Manganese	7439-96-5	0.40	—	0.010	0.0034
MW22S	10/20/2009	Mercury	7439-97-6	0.000050	U	0.00020	0.000050
MW22S	10/20/2009	Nickel	7440-02-0	0.0076	—	0.0020	0.00071
MW22S	10/20/2009	Potassium	7440-09-7	2.5	—	0.50	0.056
MW22S	10/20/2009	Selenium	7782-49-2	0.057	—	0.010	0.0056
MW22S	10/20/2009	Silver	7440-22-4	0.00072	U	0.0050	0.00072
MW22S	10/20/2009	Sodium	7440-23-5	1,100	—	50	6.2
MW22S	10/20/2009	Thallium	7440-28-0	0.0026	U	0.0050	0.0026
MW22S	10/20/2009	Vanadium	7440-62-2	0.021	—	0.010	0.0011
MW22S	10/20/2009	Zinc	7440-66-6	0.038	—	0.010	0.0012
SMW01	10/24/2009	Aluminum	7429-90-5	0.33	—	0.050	0.016
SMW01	10/24/2009	Antimony	7440-36-0	0.0034	U	0.0060	0.0034
SMW01	10/24/2009	Arsenic	7440-38-2	0.0044	E	0.0050	0.0044
SMW01	10/24/2009	Barium	7440-39-3	0.022	—	0.0030	0.00024
SMW01	10/24/2009	Beryllium	7440-41-7	0.000050	U	0.0010	0.000050
SMW01	10/24/2009	Cadmium	7440-43-9	0.00075	E	0.0050	0.00043
SMW01	10/24/2009	Calcium	7440-70-2	22	—	5.0	0.090

Table 1–3. Total cations and mercury analyzed according to the U.S. Environmental Protection Agency's methods SW846 6010B/6020 and SW846 7471, respectively.—Continued

[CAS, Chemical Abstract Services; mg/L, milligrams per liter; —, unqualified result; U, undetected; E, estimated concentration]

Site designation	Collection date	Analyte	CAS number[1]	Result (mg/L)	Qualifier	Laboratory reporting level (mg/L)	Laboratory detection limit (mg/L)
SMW01	10/24/2009	Chromium	7440-47-3	0.00053	E	0.0020	0.00050
SMW01	10/24/2009	Cobalt	7440-48-4	0.00025	U	0.0050	0.00025
SMW01	10/24/2009	Copper	7440-50-8	0.0026	E	0.020	0.0021
SMW01	10/24/2009	Iron	7439-89-6	0.27	E	0.30	0.0097
SMW01	10/24/2009	Lead	7439-92-1	0.0018	U	0.0050	0.0018
SMW01	10/24/2009	Magnesium	7439-95-4	7.2	—	0.50	0.0085
SMW01	10/24/2009	Manganese	7439-96-5	0.059	—	0.0010	0.00034
SMW01	10/24/2009	Mercury	7439-97-6	0.000050	U	0.00020	0.000050
SMW01	10/24/2009	Nickel	7440-02-0	0.0022	—	0.0020	0.00071
SMW01	10/24/2009	Potassium	7440-09-7	0.21	E	0.50	0.056
SMW01	10/24/2009	Selenium	7782-49-2	0.0056	U	0.010	0.0056
SMW01	10/24/2009	Silver	7440-22-4	0.00072	U	0.0050	0.00072
SMW01	10/24/2009	Sodium	7440-23-5	470	—	50	6.2
SMW01	10/24/2009	Thallium	7440-28-0	0.0026	U	0.0050	0.0026
SMW01	10/24/2009	Vanadium	7440-62-2	0.0095	E	0.010	0.0011
SMW01	10/24/2009	Zinc	7440-66-6	0.0057	E	0.010	0.0012
TMW01	10/14/2009	Aluminum	7429-90-5	0.016	U	0.050	0.016
TMW01	10/14/2009	Antimony	7440-36-0	0.0034	U	0.0060	0.0034
TMW01	10/14/2009	Arsenic	7440-38-2	0.011	—	0.0050	0.0044
TMW01	10/14/2009	Barium	7440-39-3	0.011	—	0.0030	0.00024
TMW01	10/14/2009	Beryllium	7440-41-7	0.000050	U	0.0010	0.000050
TMW01	10/14/2009	Cadmium	7440-43-9	0.00043	U	0.0050	0.00043
TMW01	10/14/2009	Calcium	7440-70-2	100	—	50	0.90
TMW01	10/14/2009	Chromium	7440-47-3	0.00056	E	0.0020	0.00050
TMW01	10/14/2009	Cobalt	7440-48-4	0.00025	U	0.0050	0.00025
TMW01	10/14/2009	Copper	7440-50-8	0.012	E	0.020	0.0021
TMW01	10/14/2009	Iron	7439-89-6	0.0097	U	0.30	0.0097
TMW01	10/14/2009	Lead	7439-92-1	0.0018	U	0.0050	0.0018
TMW01	10/14/2009	Magnesium	7439-95-4	20	—	5.0	0.085
TMW01	10/14/2009	Manganese	7439-96-5	0.0047	—	0.0010	0.00034
TMW01	10/14/2009	Mercury	7439-97-6	0.000050	U	0.00020	0.000050
TMW01	10/14/2009	Nickel	7440-02-0	0.00071	U	0.0020	0.00071
TMW01	10/14/2009	Potassium	7440-09-7	0.54	—	0.50	0.056
TMW01	10/14/2009	Selenium	7782-49-2	0.020	—	0.010	0.0056
TMW01	10/14/2009	Silver	7440-22-4	0.00072	U	0.0050	0.00072
TMW01	10/14/2009	Sodium	7440-23-5	560	—	50	6.2
TMW01	10/14/2009	Thallium	7440-28-0	0.0026	U	0.0050	0.0026
TMW01	10/14/2009	Vanadium	7440-62-2	0.021	—	0.010	0.0011
TMW01	10/14/2009	Zinc	7440-66-6	0.0067	E	0.010	0.0012
TMW03	10/14/2009	Aluminum	7429-90-5	0.016	U	0.050	0.016
TMW03	10/14/2009	Antimony	7440-36-0	0.0034	U	0.0060	0.0034
TMW03	10/14/2009	Arsenic	7440-38-2	0.010	—	0.0050	0.0044

Table 1–3. Total cations and mercury analyzed according to the U.S. Environmental Protection Agency's methods SW846 6010B/6020 and SW846 7471, respectively.—Continued

[CAS, Chemical Abstract Services; mg/L, milligrams per liter; —, unqualified result; U, undetected; E, estimated concentration]

Site designation	Collection date	Analyte	CAS number[1]	Result (mg/L)	Qualifier	Laboratory reporting level (mg/L)	Laboratory detection limit (mg/L)
TMW03	10/14/2009	Barium	7440-39-3	0.015	—	0.0030	0.00024
TMW03	10/14/2009	Beryllium	7440-41-7	0.000050	U	0.0010	0.000050
TMW03	10/14/2009	Cadmium	7440-43-9	0.00043	U	0.0050	0.00043
TMW03	10/14/2009	Calcium	7440-70-2	47	—	5.0	0.090
TMW03	10/14/2009	Chromium	7440-47-3	0.00064	E	0.0020	0.00050
TMW03	10/14/2009	Cobalt	7440-48-4	0.00025	U	0.0050	0.00025
TMW03	10/14/2009	Copper	7440-50-8	0.0021	E	0.020	0.0021
TMW03	10/14/2009	Iron	7439-89-6	0.0097	U	0.30	0.0097
TMW03	10/14/2009	Lead	7439-92-1	0.0018	U	0.0050	0.0018
TMW03	10/14/2009	Magnesium	7439-95-4	12	—	5.0	0.085
TMW03	10/14/2009	Manganese	7439-96-5	0.057	—	0.0010	0.00034
TMW03	10/14/2009	Mercury	7439-97-6	0.000050	U	0.00020	0.000050
TMW03	10/14/2009	Nickel	7440-02-0	0.00071	U	0.0020	0.00071
TMW03	10/14/2009	Potassium	7440-09-7	0.53	—	0.50	0.056
TMW03	10/14/2009	Selenium	7782-49-2	0.083	—	0.010	0.0056
TMW03	10/14/2009	Silver	7440-22-4	0.00072	U	0.0050	0.00072
TMW03	10/14/2009	Sodium	7440-23-5	940	—	50	6.2
TMW03	10/14/2009	Thallium	7440-28-0	0.0033	E	0.0050	0.0026
TMW03	10/14/2009	Vanadium	7440-62-2	0.0089	E	0.010	0.0011
TMW03	10/14/2009	Zinc	7440-66-6	0.047	—	0.010	0.0012
TMW04	10/14/2009	Aluminum	7429-90-5	0.016	U	0.050	0.016
TMW04	10/14/2009	Antimony	7440-36-0	0.0034	U	0.0060	0.0034
TMW04	10/14/2009	Arsenic	7440-38-2	0.0078	—	0.0050	0.0044
TMW04	10/14/2009	Barium	7440-39-3	0.0088	—	0.0030	0.00024
TMW04	10/14/2009	Beryllium	7440-41-7	0.000050	U	0.0010	0.000050
TMW04	10/14/2009	Cadmium	7440-43-9	0.00043	U	0.0050	0.00043
TMW04	10/14/2009	Calcium	7440-70-2	29	—	5.0	0.090
TMW04	10/14/2009	Chromium	7440-47-3	0.0018	E	0.0020	0.00050
TMW04	10/14/2009	Cobalt	7440-48-4	0.00025	U	0.0050	0.00025
TMW04	10/14/2009	Copper	7440-50-8	0.0021	U	0.020	0.0021
TMW04	10/14/2009	Iron	7439-89-6	1.4	—	0.30	0.0097
TMW04	10/14/2009	Lead	7439-92-1	0.0018	U	0.0050	0.0018
TMW04	10/14/2009	Magnesium	7439-95-4	6.1	—	0.50	0.0085
TMW04	10/14/2009	Manganese	7439-96-5	0.0040	—	0.0010	0.00034
TMW04	10/14/2009	Mercury	7439-97-6	0.000050	U	0.00020	0.000050
TMW04	10/14/2009	Nickel	7440-02-0	0.00071	U	0.0020	0.00071
TMW04	10/14/2009	Potassium	7440-09-7	0.89	—	0.50	0.056
TMW04	10/14/2009	Selenium	7782-49-2	0.11	—	0.010	0.0056
TMW04	10/14/2009	Silver	7440-22-4	0.00072	U	0.0050	0.00072
TMW04	10/14/2009	Sodium	7440-23-5	950	—	50	6.2
TMW04	10/14/2009	Thallium	7440-28-0	0.0026	U	0.0050	0.0026
TMW04	10/14/2009	Vanadium	7440-62-2	0.035	—	0.010	0.0011

Table 1–3. Total cations and mercury analyzed according to the U.S. Environmental Protection Agency's methods SW846 6010B/6020 and SW846 7471, respectively.—Continued

[CAS, Chemical Abstract Services; mg/L, milligrams per liter; —, unqualified result; U, undetected; E, estimated concentration]

Site designation	Collection date	Analyte	CAS number[1]	Result (mg/L)	Qualifier	Laboratory reporting level (mg/L)	Laboratory detection limit (mg/L)
TMW04	10/14/2009	Zinc	7440-66-6	0.021	—	0.010	0.0012
TMW06	10/17/2009	Aluminum	7429-90-5	0.016	U	0.050	0.016
TMW06	10/17/2009	Antimony	7440-36-0	0.0034	U	0.0060	0.0034
TMW06	10/17/2009	Arsenic	7440-38-2	0.0044	U	0.0050	0.0044
TMW06	10/17/2009	Barium	7440-39-3	0.020	—	0.0030	0.00024
TMW06	10/17/2009	Beryllium	7440-41-7	0.000050	U	0.0010	0.000050
TMW06	10/17/2009	Cadmium	7440-43-9	0.00079	E	0.0050	0.00043
TMW06	10/17/2009	Calcium	7440-70-2	51	—	5.0	0.090
TMW06	10/17/2009	Chromium	7440-47-3	0.00050	U	0.0020	0.00050
TMW06	10/17/2009	Cobalt	7440-48-4	0.00025	U	0.0050	0.00025
TMW06	10/17/2009	Copper	7440-50-8	0.014	E	0.020	0.0021
TMW06	10/17/2009	Iron	7439-89-6	0.0097	U	0.30	0.0097
TMW06	10/17/2009	Lead	7439-92-1	0.0018	U	0.0050	0.0018
TMW06	10/17/2009	Magnesium	7439-95-4	14	—	5.0	0.085
TMW06	10/17/2009	Manganese	7439-96-5	0.040	—	0.0010	0.00034
TMW06	10/17/2009	Mercury	7439-97-6	0.000050	U	0.00020	0.000050
TMW06	10/17/2009	Nickel	7440-02-0	0.00071	U	0.0020	0.00071
TMW06	10/17/2009	Potassium	7440-09-7	0.61	—	0.50	0.056
TMW06	10/17/2009	Selenium	7782-49-2	0.020	—	0.010	0.0056
TMW06	10/17/2009	Silver	7440-22-4	0.00072	U	0.0050	0.00072
TMW06	10/17/2009	Sodium	7440-23-5	1,300	—	500	62
TMW06	10/17/2009	Thallium	7440-28-0	0.0026	U	0.0050	0.0026
TMW06	10/17/2009	Vanadium	7440-62-2	0.011	—	0.010	0.0011
TMW06	10/17/2009	Zinc	7440-66-6	0.0030	E	0.010	0.0012
TMW07	10/20/2009	Aluminum	7429-90-5	2.5	E	0.050	0.016
TMW07	10/20/2009	Antimony	7440-36-0	0.0034	U	0.0060	0.0034
TMW07	10/20/2009	Arsenic	7440-38-2	0.0078	—	0.0050	0.0044
TMW07	10/20/2009	Barium	7440-39-3	0.043	—	0.0030	0.00024
TMW07	10/20/2009	Beryllium	7440-41-7	0.000050	U	0.0010	0.000050
TMW07	10/20/2009	Cadmium	7440-43-9	0.00043	U	0.0050	0.00043
TMW07	10/20/2009	Calcium	7440-70-2	67	—	5.0	0.090
TMW07	10/20/2009	Chromium	7440-47-3	0.0031	—	0.0020	0.00050
TMW07	10/20/2009	Cobalt	7440-48-4	0.00025	U	0.0050	0.00025
TMW07	10/20/2009	Copper	7440-50-8	0.0033	E	0.020	0.0021
TMW07	10/20/2009	Iron	7439-89-6	1.2	E	0.30	0.0097
TMW07	10/20/2009	Lead	7439-92-1	0.0018	U	0.0050	0.0018
TMW07	10/20/2009	Magnesium	7439-95-4	14	E	5.0	0.085
TMW07	10/20/2009	Manganese	7439-96-5	0.34	—	0.010	0.0034
TMW07	10/20/2009	Mercury	7439-97-6	0.000050	U	0.00020	0.000050
TMW07	10/20/2009	Nickel	7440-02-0	0.0068	—	0.0020	0.00071
TMW07	10/20/2009	Potassium	7440-09-7	3.3	—	0.50	0.056
TMW07	10/20/2009	Selenium	7782-49-2	0.0056	U	0.010	0.0056

Table 1–3. Total cations and mercury analyzed according to the U.S. Environmental Protection Agency’s methods SW846 6010B/6020 and SW846 7471, respectively.—Continued

[CAS, Chemical Abstract Services; mg/L, milligrams per liter; —, unqualified result; U, undetected; E, estimated concentration]

Site designation	Collection date	Analyte	CAS number[1]	Result (mg/L)	Qualifier	Laboratory reporting level (mg/L)	Laboratory detection limit (mg/L)
TMW07	10/20/2009	Silver	7440-22-4	0.00072	U	0.0050	0.00072
TMW07	10/20/2009	Sodium	7440-23-5	1,300	—	500	62
TMW07	10/20/2009	Thallium	7440-28-0	0.0026	U	0.0050	0.0026
TMW07	10/20/2009	Vanadium	7440-62-2	0.015	—	0.010	0.0011
TMW07	10/20/2009	Zinc	7440-66-6	0.029	—	0.010	0.0012
TMW08	10/17/2009	Aluminum	7429-90-5	0.016	U	0.050	0.016
TMW08	10/17/2009	Antimony	7440-36-0	0.0034	U	0.0060	0.0034
TMW08	10/17/2009	Arsenic	7440-38-2	0.0044	U	0.0050	0.0044
TMW08	10/17/2009	Barium	7440-39-3	0.0080	—	0.0030	0.00024
TMW08	10/17/2009	Beryllium	7440-41-7	0.000050	U	0.0010	0.000050
TMW08	10/17/2009	Cadmium	7440-43-9	0.00043	U	0.0050	0.00043
TMW08	10/17/2009	Calcium	7440-70-2	260	—	50	0.90
TMW08	10/17/2009	Chromium	7440-47-3	0.00084	E	0.0020	0.00050
TMW08	10/17/2009	Cobalt	7440-48-4	0.00025	U	0.0050	0.00025
TMW08	10/17/2009	Copper	7440-50-8	0.0021	U	0.020	0.0021
TMW08	10/17/2009	Iron	7439-89-6	2.7	—	0.30	0.0097
TMW08	10/17/2009	Lead	7439-92-1	0.0018	U	0.0050	0.0018
TMW08	10/17/2009	Magnesium	7439-95-4	76	—	5.0	0.085
TMW08	10/17/2009	Manganese	7439-96-5	0.36	—	0.010	0.0034
TMW08	10/17/2009	Mercury	7439-97-6	0.000050	U	0.00020	0.000050
TMW08	10/17/2009	Nickel	7440-02-0	0.0030	—	0.0020	0.00071
TMW08	10/17/2009	Potassium	7440-09-7	3.2	—	0.50	0.056
TMW08	10/17/2009	Selenium	7782-49-2	0.021	—	0.010	0.0056
TMW08	10/17/2009	Silver	7440-22-4	0.00072	U	0.0050	0.00072
TMW08	10/17/2009	Sodium	7440-23-5	4,100	—	500	62
TMW08	10/17/2009	Thallium	7440-28-0	0.0026	U	0.0050	0.0026
TMW08	10/17/2009	Vanadium	7440-62-2	0.0056	E	0.010	0.0011
TMW08	10/17/2009	Zinc	7440-66-6	0.016	—	0.010	0.0012
TMW10	10/19/2009	Aluminum	7429-90-5	0.21	—	0.050	0.016
TMW10	10/19/2009	Antimony	7440-36-0	0.0034	U	0.0060	0.0034
TMW10	10/19/2009	Arsenic	7440-38-2	0.0044	U	0.0050	0.0044
TMW10	10/19/2009	Barium	7440-39-3	0.014	—	0.0030	0.00024
TMW10	10/19/2009	Beryllium	7440-41-7	0.000050	U	0.0010	0.000050
TMW10	10/19/2009	Cadmium	7440-43-9	0.00043	U	0.0050	0.00043
TMW10	10/19/2009	Calcium	7440-70-2	45	—	5.0	0.090
TMW10	10/19/2009	Chromium	7440-47-3	0.0044	—	0.0020	0.00050
TMW10	10/19/2009	Cobalt	7440-48-4	0.00025	U	0.0050	0.00025
TMW10	10/19/2009	Copper	7440-50-8	0.023	—	0.020	0.0021
TMW10	10/19/2009	Iron	7439-89-6	0.34	—	0.30	0.0097
TMW10	10/19/2009	Lead	7439-92-1	0.0018	U	0.0050	0.0018
TMW10	10/19/2009	Magnesium	7439-95-4	15	—	5.0	0.085
TMW10	10/19/2009	Manganese	7439-96-5	0.028	—	0.0010	0.00034

Table 1–3. Total cations and mercury analyzed according to the U.S. Environmental Protection Agency's methods SW846 6010B/6020 and SW846 7471, respectively.—Continued

[CAS, Chemical Abstract Services; mg/L, milligrams per liter; —, unqualified result; U, undetected; E, estimated concentration]

Site designation	Collection date	Analyte	CAS number[1]	Result (mg/L)	Qualifier	Laboratory reporting level (mg/L)	Laboratory detection limit (mg/L)
TMW10	10/19/2009	Mercury	7439-97-6	0.000050	U	0.00020	0.000050
TMW10	10/19/2009	Nickel	7440-02-0	0.0023	—	0.0020	0.00071
TMW10	10/19/2009	Potassium	7440-09-7	0.76	—	0.50	0.056
TMW10	10/19/2009	Selenium	7782-49-2	0.017	—	0.010	0.0056
TMW10	10/19/2009	Silver	7440-22-4	0.00072	U	0.0050	0.00072
TMW10	10/19/2009	Sodium	7440-23-5	1,200	—	500	62
TMW10	10/19/2009	Thallium	7440-28-0	0.0027	E	0.0050	0.0026
TMW10	10/19/2009	Vanadium	7440-62-2	0.010	—	0.010	0.0011
TMW10	10/19/2009	Zinc	7440-66-6	0.0029	E	0.010	0.0012
TMW11	10/20/2009	Aluminum	7429-90-5	0.60	E	0.050	0.016
TMW11	10/20/2009	Antimony	7440-36-0	0.0034	U	0.0060	0.0034
TMW11	10/20/2009	Arsenic	7440-38-2	0.0059	—	0.0050	0.0044
TMW11	10/20/2009	Barium	7440-39-3	0.020	—	0.0030	0.00024
TMW11	10/20/2009	Beryllium	7440-41-7	0.000050	U	0.0010	0.000050
TMW11	10/20/2009	Cadmium	7440-43-9	0.00043	U	0.0050	0.00043
TMW11	10/20/2009	Calcium	7440-70-2	15	—	5.0	0.090
TMW11	10/20/2009	Chromium	7440-47-3	0.00066	E	0.0020	0.00050
TMW11	10/20/2009	Cobalt	7440-48-4	0.00025	U	0.0050	0.00025
TMW11	10/20/2009	Copper	7440-50-8	0.0021	U	0.020	0.0021
TMW11	10/20/2009	Iron	7439-89-6	0.89	E	0.30	0.0097
TMW11	10/20/2009	Lead	7439-92-1	0.0018	U	0.0050	0.0018
TMW11	10/20/2009	Magnesium	7439-95-4	3.2	E	0.50	0.0085
TMW11	10/20/2009	Manganese	7439-96-5	0.024	—	0.0010	0.00034
TMW11	10/20/2009	Mercury	7439-97-6	0.000050	U	0.00020	0.000050
TMW11	10/20/2009	Nickel	7440-02-0	0.00071	U	0.0020	0.00071
TMW11	10/20/2009	Potassium	7440-09-7	0.65	—	0.50	0.056
TMW11	10/20/2009	Selenium	7782-49-2	0.028	—	0.010	0.0056
TMW11	10/20/2009	Silver	7440-22-4	0.00072	U	0.0050	0.00072
TMW11	10/20/2009	Sodium	7440-23-5	520	—	50	6.2
TMW11	10/20/2009	Thallium	7440-28-0	0.0026	U	0.0050	0.0026
TMW11	10/20/2009	Vanadium	7440-62-2	0.0069	E	0.010	0.0011
TMW11	10/20/2009	Zinc	7440-66-6	0.024	—	0.010	0.0012
TMW13	10/22/2009	Aluminum	7429-90-5	0.053	UE	0.050	0.016
TMW13	10/22/2009	Antimony	7440-36-0	0.0034	U	0.0060	0.0034
TMW13	10/22/2009	Arsenic	7440-38-2	0.0069	—	0.0050	0.0044
TMW13	10/22/2009	Barium	7440-39-3	0.016	—	0.0030	0.00024
TMW13	10/22/2009	Beryllium	7440-41-7	0.000050	U	0.0010	0.000050
TMW13	10/22/2009	Cadmium	7440-43-9	0.00043	U	0.0050	0.00043
TMW13	10/22/2009	Calcium	7440-70-2	27	—	5.0	0.090
TMW13	10/22/2009	Chromium	7440-47-3	0.00081	E	0.0020	0.00050
TMW13	10/22/2009	Cobalt	7440-48-4	0.00025	U	0.0050	0.00025
TMW13	10/22/2009	Copper	7440-50-8	0.0035	E	0.020	0.0021

Table 1–3. Total cations and mercury analyzed according to the U.S. Environmental Protection Agency's methods SW846 6010B/6020 and SW846 7471, respectively.—Continued

[CAS, Chemical Abstract Services; mg/L, milligrams per liter; —, unqualified result; U, undetected; E, estimated concentration]

Site designation	Collection date	Analyte	CAS number[1]	Result (mg/L)	Qualifier	Laboratory reporting level (mg/L)	Laboratory detection limit (mg/L)
TMW13	10/22/2009	Iron	7439-89-6	0.051	UE	0.30	0.0097
TMW13	10/22/2009	Lead	7439-92-1	0.0018	U	0.0050	0.0018
TMW13	10/22/2009	Magnesium	7439-95-4	5.0	E	0.50	0.0085
TMW13	10/22/2009	Manganese	7439-96-5	0.00098	E	0.0010	0.00034
TMW13	10/22/2009	Mercury	7439-97-6	0.000050	U	0.00020	0.000050
TMW13	10/22/2009	Nickel	7440-02-0	0.00071	U	0.0020	0.00071
TMW13	10/22/2009	Potassium	7440-09-7	0.44	E	0.50	0.056
TMW13	10/22/2009	Selenium	7782-49-2	0.0099	E	0.010	0.0056
TMW13	10/22/2009	Silver	7440-22-4	0.00086	E	0.0050	0.00072
TMW13	10/22/2009	Sodium	7440-23-5	560	—	50	6.2
TMW13	10/22/2009	Thallium	7440-28-0	0.0026	U	0.0050	0.0026
TMW13	10/22/2009	Vanadium	7440-62-2	0.0094	E	0.010	0.0011
TMW13	10/22/2009	Zinc	7440-66-6	0.0012	U	0.010	0.0012
TMW15	10/26/2009	Aluminum	7429-90-5	0.016	U	0.050	0.016
TMW15	10/26/2009	Antimony	7440-36-0	0.0034	E	0.0060	0.0034
TMW15	10/26/2009	Arsenic	7440-38-2	0.0044	U	0.0050	0.0044
TMW15	10/26/2009	Barium	7440-39-3	0.020	—	0.0030	0.00024
TMW15	10/26/2009	Beryllium	7440-41-7	0.000050	U	0.0010	0.000050
TMW15	10/26/2009	Cadmium	7440-43-9	0.0012	E	0.0050	0.00043
TMW15	10/26/2009	Calcium	7440-70-2	16	—	5.0	0.090
TMW15	10/26/2009	Chromium	7440-47-3	0.0014	E	0.0020	0.00050
TMW15	10/26/2009	Cobalt	7440-48-4	0.00025	U	0.0050	0.00025
TMW15	10/26/2009	Copper	7440-50-8	0.0021	U	0.020	0.0021
TMW15	10/26/2009	Iron	7439-89-6	0.0097	U	0.30	0.0097
TMW15	10/26/2009	Lead	7439-92-1	0.0018	U	0.0050	0.0018
TMW15	10/26/2009	Magnesium	7439-95-4	3.6	—	0.50	0.0085
TMW15	10/26/2009	Manganese	7439-96-5	0.0021	—	0.0010	0.00034
TMW15	10/26/2009	Mercury	7439-97-6	0.000050	U	0.00020	0.000050
TMW15	10/26/2009	Nickel	7440-02-0	0.00071	U	0.0020	0.00071
TMW15	10/26/2009	Potassium	7440-09-7	0.50	E	0.50	0.056
TMW15	10/26/2009	Selenium	7782-49-2	0.014	—	0.010	0.0056
TMW15	10/26/2009	Silver	7440-22-4	0.00072	U	0.0050	0.00072
TMW15	10/26/2009	Sodium	7440-23-5	500	—	50	6.2
TMW15	10/26/2009	Thallium	7440-28-0	0.0026	U	0.0050	0.0026
TMW15	10/26/2009	Vanadium	7440-62-2	0.0075	E	0.010	0.0011
TMW15	10/26/2009	Zinc	7440-66-6	0.037	—	0.010	0.0012
TMW21	10/24/2009	Aluminum	7429-90-5	4.2	—	0.050	0.016
TMW21	10/24/2009	Antimony	7440-36-0	0.0034	U	0.0060	0.0034
TMW21	10/24/2009	Arsenic	7440-38-2	0.0044	U	0.0050	0.0044
TMW21	10/24/2009	Barium	7440-39-3	0.062	—	0.0030	0.00024
TMW21	10/24/2009	Beryllium	7440-41-7	0.000050	U	0.0010	0.000050
TMW21	10/24/2009	Cadmium	7440-43-9	0.00043	U	0.0050	0.00043

Table 1–3. Total cations and mercury analyzed according to the U.S. Environmental Protection Agency's methods SW846 6010B/6020 and SW846 7471, respectively.—Continued

[CAS, Chemical Abstract Services; mg/L, milligrams per liter; —, unqualified result; U, undetected; E, estimated concentration]

Site designation	Collection date	Analyte	CAS number[1]	Result (mg/L)	Qualifier	Laboratory reporting level (mg/L)	Laboratory detection limit (mg/L)
TMW21	10/24/2009	Calcium	7440-70-2	34	—	5.0	0.090
TMW21	10/24/2009	Chromium	7440-47-3	0.0030	—	0.0020	0.00050
TMW21	10/24/2009	Cobalt	7440-48-4	0.00025	U	0.0050	0.00025
TMW21	10/24/2009	Copper	7440-50-8	0.17	—	0.020	0.0021
TMW21	10/24/2009	Iron	7439-89-6	2.6	—	0.30	0.0097
TMW21	10/24/2009	Lead	7439-92-1	0.0018	U	0.0050	0.0018
TMW21	10/24/2009	Magnesium	7439-95-4	8.9	—	0.50	0.0085
TMW21	10/24/2009	Manganese	7439-96-5	0.18	—	0.0010	0.00034
TMW21	10/24/2009	Mercury	7439-97-6	0.000050	U	0.00020	0.000050
TMW21	10/24/2009	Nickel	7440-02-0	0.0067	—	0.0020	0.00071
TMW21	10/24/2009	Potassium	7440-09-7	1.5	—	0.50	0.056
TMW21	10/24/2009	Selenium	7782-49-2	0.0056	U	0.010	0.0056
TMW21	10/24/2009	Silver	7440-22-4	0.0053	—	0.0050	0.00072
TMW21	10/24/2009	Sodium	7440-23-5	570	—	50	6.2
TMW21	10/24/2009	Thallium	7440-28-0	0.0026	U	0.0050	0.0026
TMW21	10/24/2009	Vanadium	7440-62-2	0.015	—	0.010	0.0011
TMW21	10/24/2009	Zinc	7440-66-6	0.021	—	0.010	0.0012
TMW22	10/19/2009	Aluminum	7429-90-5	66	—	0.50	0.16
TMW22	10/19/2009	Antimony	7440-36-0	0.0034	U	0.0060	0.0034
TMW22	10/19/2009	Arsenic	7440-38-2	0.0044	U	0.0050	0.0044
TMW22	10/19/2009	Barium	7440-39-3	1.5	—	0.030	0.0024
TMW22	10/19/2009	Beryllium	7440-41-7	0.0039	—	0.0010	0.000050
TMW22	10/19/2009	Cadmium	7440-43-9	0.0021	E	0.0050	0.00043
TMW22	10/19/2009	Calcium	7440-70-2	110	—	50	0.90
TMW22	10/19/2009	Chromium	7440-47-3	0.043	—	0.0020	0.00050
TMW22	10/19/2009	Cobalt	7440-48-4	0.018	—	0.0050	0.00025
TMW22	10/19/2009	Copper	7440-50-8	0.019	E	0.020	0.0021
TMW22	10/19/2009	Iron	7439-89-6	35	—	3.0	0.097
TMW22	10/19/2009	Lead	7439-92-1	0.017	—	0.0050	0.0018
TMW22	10/19/2009	Magnesium	7439-95-4	33	—	5.0	0.085
TMW22	10/19/2009	Manganese	7439-96-5	1.4	—	0.010	0.0034
TMW22	10/19/2009	Mercury	7439-97-6	0.000050	U	0.00020	0.000050
TMW22	10/19/2009	Nickel	7440-02-0	0.042	—	0.0020	0.00071
TMW22	10/19/2009	Potassium	7440-09-7	9.0	—	5.0	0.56
TMW22	10/19/2009	Selenium	7782-49-2	0.0056	U	0.010	0.0056
TMW22	10/19/2009	Silver	7440-22-4	0.00072	U	0.0050	0.00072
TMW22	10/19/2009	Sodium	7440-23-5	830	—	50	6.2
TMW22	10/19/2009	Thallium	7440-28-0	0.0026	U	0.0050	0.0026
TMW22	10/19/2009	Vanadium	7440-62-2	0.082	—	0.010	0.0011
TMW22	10/19/2009	Zinc	7440-66-6	0.25	—	0.10	0.012
TMW23	10/19/2009	Aluminum	7429-90-5	17	—	0.50	0.16
TMW23	10/19/2009	Antimony	7440-36-0	0.0085	—	0.0060	0.0034

Table 1–3. Total cations and mercury analyzed according to the U.S. Environmental Protection Agency's methods SW846 6010B/6020 and SW846 7471, respectively.—Continued

[CAS, Chemical Abstract Services; mg/L, milligrams per liter; —, unqualified result; U, undetected; E, estimated concentration]

Site designation	Collection date	Analyte	CAS number[1]	Result (mg/L)	Qualifier	Laboratory reporting level (mg/L)	Laboratory detection limit (mg/L)
TMW23	10/19/2009	Arsenic	7440-38-2	0.0044	U	0.0050	0.0044
TMW23	10/19/2009	Barium	7440-39-3	0.34	—	0.030	0.0024
TMW23	10/19/2009	Beryllium	7440-41-7	0.0013	—	0.0010	0.000050
TMW23	10/19/2009	Cadmium	7440-43-9	0.00043	U	0.0050	0.00043
TMW23	10/19/2009	Calcium	7440-70-2	47	—	5.0	0.090
TMW23	10/19/2009	Chromium	7440-47-3	0.016	—	0.0020	0.00050
TMW23	10/19/2009	Cobalt	7440-48-4	0.0072	—	0.0050	0.00025
TMW23	10/19/2009	Copper	7440-50-8	0.010	E	0.020	0.0021
TMW23	10/19/2009	Iron	7439-89-6	11	—	3.0	0.097
TMW23	10/19/2009	Lead	7439-92-1	0.0067	—	0.0050	0.0018
TMW23	10/19/2009	Magnesium	7439-95-4	10	—	5.0	0.085
TMW23	10/19/2009	Manganese	7439-96-5	0.60	—	0.010	0.0034
TMW23	10/19/2009	Mercury	7439-97-6	0.000050	U	0.00020	0.000050
TMW23	10/19/2009	Nickel	7440-02-0	0.015	—	0.0020	0.00071
TMW23	10/19/2009	Potassium	7440-09-7	3.7	—	0.50	0.056
TMW23	10/19/2009	Selenium	7782-49-2	0.0056	U	0.010	0.0056
TMW23	10/19/2009	Silver	7440-22-4	0.00072	U	0.0050	0.00072
TMW23	10/19/2009	Sodium	7440-23-5	820	—	50	6.2
TMW23	10/19/2009	Thallium	7440-28-0	0.0026	U	0.0050	0.0026
TMW23	10/19/2009	Vanadium	7440-62-2	0.035	—	0.010	0.0011
TMW23	10/19/2009	Zinc	7440-66-6	0.047	—	0.010	0.0012
TMW24	10/19/2009	Aluminum	7429-90-5	0.016	U	0.050	0.016
TMW24	10/19/2009	Antimony	7440-36-0	0.0091	—	0.0060	0.0034
TMW24	10/19/2009	Arsenic	7440-38-2	0.0066	—	0.0050	0.0044
TMW24	10/19/2009	Barium	7440-39-3	0.038	—	0.0030	0.00024
TMW24	10/19/2009	Beryllium	7440-41-7	0.000050	U	0.0010	0.000050
TMW24	10/19/2009	Cadmium	7440-43-9	0.00043	U	0.0050	0.00043
TMW24	10/19/2009	Calcium	7440-70-2	28	—	5.0	0.090
TMW24	10/19/2009	Chromium	7440-47-3	0.00050	U	0.0020	0.00050
TMW24	10/19/2009	Cobalt	7440-48-4	0.00025	U	0.0050	0.00025
TMW24	10/19/2009	Copper	7440-50-8	0.0021	U	0.020	0.0021
TMW24	10/19/2009	Iron	7439-89-6	0.0097	U	0.30	0.0097
TMW24	10/19/2009	Lead	7439-92-1	0.0018	U	0.0050	0.0018
TMW24	10/19/2009	Magnesium	7439-95-4	8.2	—	0.50	0.0085
TMW24	10/19/2009	Manganese	7439-96-5	0.15	—	0.0010	0.00034
TMW24	10/19/2009	Mercury	7439-97-6	0.000050	U	0.00020	0.000050
TMW24	10/19/2009	Nickel	7440-02-0	0.0028	—	0.0020	0.00071
TMW24	10/19/2009	Potassium	7440-09-7	0.59	—	0.50	0.056
TMW24	10/19/2009	Selenium	7782-49-2	0.0056	U	0.010	0.0056
TMW24	10/19/2009	Silver	7440-22-4	0.00072	U	0.0050	0.00072
TMW24	10/19/2009	Sodium	7440-23-5	900	—	50	6.2
TMW24	10/19/2009	Thallium	7440-28-0	0.0026	U	0.0050	0.0026

Table 1–3. Total cations and mercury analyzed according to the U.S. Environmental Protection Agency's methods SW846 6010B/6020 and SW846 7471, respectively.—Continued

[CAS, Chemical Abstract Services; mg/L, milligrams per liter; —, unqualified result; U, undetected; E, estimated concentration]

Site designation	Collection date	Analyte	CAS number[1]	Result (mg/L)	Qualifier	Laboratory reporting level (mg/L)	Laboratory detection limit (mg/L)
TMW24	10/19/2009	Vanadium	7440-62-2	0.0099	E	0.010	0.0011
TMW24	10/19/2009	Zinc	7440-66-6	0.0048	E	0.010	0.0012
TMW25	10/23/2009	Aluminum	7429-90-5	0.016	U	0.050	0.016
TMW25	10/23/2009	Antimony	7440-36-0	0.0034	U	0.0060	0.0034
TMW25	10/23/2009	Arsenic	7440-38-2	0.0071	—	0.0050	0.0044
TMW25	10/23/2009	Barium	7440-39-3	0.014	—	0.0030	0.00024
TMW25	10/23/2009	Beryllium	7440-41-7	0.000050	U	0.0010	0.000050
TMW25	10/23/2009	Cadmium	7440-43-9	0.00043	U	0.0050	0.00043
TMW25	10/23/2009	Calcium	7440-70-2	56	—	5.0	0.090
TMW25	10/23/2009	Chromium	7440-47-3	0.00050	U	0.0020	0.00050
TMW25	10/23/2009	Cobalt	7440-48-4	0.00025	U	0.0050	0.00025
TMW25	10/23/2009	Copper	7440-50-8	0.0031	E	0.020	0.0021
TMW25	10/23/2009	Iron	7439-89-6	1.6	—	0.30	0.0097
TMW25	10/23/2009	Lead	7439-92-1	0.0018	U	0.0050	0.0018
TMW25	10/23/2009	Magnesium	7439-95-4	13	—	5.0	0.085
TMW25	10/23/2009	Manganese	7439-96-5	0.23	—	0.010	0.0034
TMW25	10/23/2009	Mercury	7439-97-6	0.000050	U	0.00020	0.000050
TMW25	10/23/2009	Nickel	7440-02-0	0.0029	—	0.0020	0.00071
TMW25	10/23/2009	Potassium	7440-09-7	0.31	E	0.50	0.056
TMW25	10/23/2009	Selenium	7782-49-2	0.0081	E	0.010	0.0056
TMW25	10/23/2009	Silver	7440-22-4	0.00072	U	0.0050	0.00072
TMW25	10/23/2009	Sodium	7440-23-5	860	—	50	6.2
TMW25	10/23/2009	Thallium	7440-28-0	0.0026	U	0.0050	0.0026
TMW25	10/23/2009	Vanadium	7440-62-2	0.017	—	0.010	0.0011
TMW25	10/23/2009	Zinc	7440-66-6	0.038	—	0.010	0.0012
TMW26	10/17/2009	Aluminum	7429-90-5	1.2	—	0.050	0.016
TMW26	10/17/2009	Antimony	7440-36-0	0.011	—	0.0060	0.0034
TMW26	10/17/2009	Arsenic	7440-38-2	0.0061	—	0.0050	0.0044
TMW26	10/17/2009	Barium	7440-39-3	0.037	—	0.0030	0.00024
TMW26	10/17/2009	Beryllium	7440-41-7	0.000050	U	0.0010	0.000050
TMW26	10/17/2009	Cadmium	7440-43-9	0.00043	U	0.0050	0.00043
TMW26	10/17/2009	Calcium	7440-70-2	17	—	5.0	0.090
TMW26	10/17/2009	Chromium	7440-47-3	0.00080	E	0.0020	0.00050
TMW26	10/17/2009	Cobalt	7440-48-4	0.00025	U	0.0050	0.00025
TMW26	10/17/2009	Copper	7440-50-8	0.0039	E	0.020	0.0021
TMW26	10/17/2009	Iron	7439-89-6	0.61	—	0.30	0.0097
TMW26	10/17/2009	Lead	7439-92-1	0.0018	U	0.0050	0.0018
TMW26	10/17/2009	Magnesium	7439-95-4	7.2	—	0.50	0.0085
TMW26	10/17/2009	Manganese	7439-96-5	0.11	—	0.0010	0.00034
TMW26	10/17/2009	Mercury	7439-97-6	0.000050	U	0.00020	0.000050
TMW26	10/17/2009	Nickel	7440-02-0	0.0037	—	0.0020	0.00071
TMW26	10/17/2009	Potassium	7440-09-7	0.71	—	0.50	0.056

Table 1–3. Total cations and mercury analyzed according to the U.S. Environmental Protection Agency's methods SW846 6010B/6020 and SW846 7471, respectively.—Continued

[CAS, Chemical Abstract Services; mg/L, milligrams per liter; —, unqualified result; U, undetected; E, estimated concentration]

Site designation	Collection date	Analyte	CAS number[1]	Result (mg/L)	Qualifier	Laboratory reporting level (mg/L)	Laboratory detection limit (mg/L)
TMW26	10/17/2009	Selenium	7782-49-2	0.0056	U	0.010	0.0056
TMW26	10/17/2009	Silver	7440-22-4	0.00072	U	0.0050	0.00072
TMW26	10/17/2009	Sodium	7440-23-5	840	—	50	6.2
TMW26	10/17/2009	Thallium	7440-28-0	0.0026	U	0.0050	0.0026
TMW26	10/17/2009	Vanadium	7440-62-2	0.012	—	0.010	0.0011
TMW26	10/17/2009	Zinc	7440-66-6	0.012	—	0.010	0.0012
TMW27	10/24/2009	Aluminum	7429-90-5	0.016	U	0.050	0.016
TMW27	10/24/2009	Antimony	7440-36-0	0.0034	U	0.0060	0.0034
TMW27	10/24/2009	Arsenic	7440-38-2	0.029	—	0.0050	0.0044
TMW27	10/24/2009	Barium	7440-39-3	0.13	—	0.0030	0.00024
TMW27	10/24/2009	Beryllium	7440-41-7	0.000050	U	0.0010	0.000050
TMW27	10/24/2009	Cadmium	7440-43-9	0.00043	U	0.0050	0.00043
TMW27	10/24/2009	Calcium	7440-70-2	24	—	5.0	0.090
TMW27	10/24/2009	Chromium	7440-47-3	0.00050	U	0.0020	0.00050
TMW27	10/24/2009	Cobalt	7440-48-4	0.00025	U	0.0050	0.00025
TMW27	10/24/2009	Copper	7440-50-8	0.0021	U	0.020	0.0021
TMW27	10/24/2009	Iron	7439-89-6	0.83	—	0.30	0.0097
TMW27	10/24/2009	Lead	7439-92-1	0.0018	U	0.0050	0.0018
TMW27	10/24/2009	Magnesium	7439-95-4	6.6	—	0.50	0.0085
TMW27	10/24/2009	Manganese	7439-96-5	0.58	—	0.010	0.0034
TMW27	10/24/2009	Mercury	7439-97-6	0.000050	U	0.00020	0.000050
TMW27	10/24/2009	Nickel	7440-02-0	0.00071	U	0.0020	0.00071
TMW27	10/24/2009	Potassium	7440-09-7	0.50	E	0.50	0.056
TMW27	10/24/2009	Selenium	7782-49-2	0.0056	U	0.010	0.0056
TMW27	10/24/2009	Silver	7440-22-4	0.00072	U	0.0050	0.00072
TMW27	10/24/2009	Sodium	7440-23-5	320	—	50	6.2
TMW27	10/24/2009	Thallium	7440-28-0	0.0026	U	0.0050	0.0026
TMW27	10/24/2009	Vanadium	7440-62-2	0.0067	E	0.010	0.0011
TMW27	10/24/2009	Zinc	7440-66-6	0.049	—	0.010	0.0012
TMW28	10/19/2009	Aluminum	7429-90-5	0.26	—	0.050	0.016
TMW28	10/19/2009	Antimony	7440-36-0	0.0040	E	0.0060	0.0034
TMW28	10/19/2009	Arsenic	7440-38-2	0.0069	—	0.0050	0.0044
TMW28	10/19/2009	Barium	7440-39-3	0.053	—	0.0030	0.00024
TMW28	10/19/2009	Beryllium	7440-41-7	0.000050	U	0.0010	0.000050
TMW28	10/19/2009	Cadmium	7440-43-9	0.0016	E	0.0050	0.00043
TMW28	10/19/2009	Calcium	7440-70-2	42	—	5.0	0.090
TMW28	10/19/2009	Chromium	7440-47-3	0.00050	U	0.0020	0.00050
TMW28	10/19/2009	Cobalt	7440-48-4	0.00025	U	0.0050	0.00025
TMW28	10/19/2009	Copper	7440-50-8	0.0021	U	0.020	0.0021
TMW28	10/19/2009	Iron	7439-89-6	1.1	—	0.30	0.0097
TMW28	10/19/2009	Lead	7439-92-1	0.0018	U	0.0050	0.0018
TMW28	10/19/2009	Magnesium	7439-95-4	15	—	5.0	0.085

Table 1–3. Total cations and mercury analyzed according to the U.S. Environmental Protection Agency's methods SW846 6010B/6020 and SW846 7471, respectively.—Continued

[CAS, Chemical Abstract Services; mg/L, milligrams per liter; —, unqualified result; U, undetected; E, estimated concentration]

Site designation	Collection date	Analyte	CAS number[1]	Result (mg/L)	Qualifier	Laboratory reporting level (mg/L)	Laboratory detection limit (mg/L)
TMW28	10/19/2009	Manganese	7439-96-5	0.24	—	0.010	0.0034
TMW28	10/19/2009	Mercury	7439-97-6	0.000050	U	0.00020	0.000050
TMW28	10/19/2009	Nickel	7440-02-0	0.00071	U	0.0020	0.00071
TMW28	10/19/2009	Potassium	7440-09-7	1.2	—	0.50	0.056
TMW28	10/19/2009	Selenium	7782-49-2	0.0056	U	0.010	0.0056
TMW28	10/19/2009	Silver	7440-22-4	0.00072	U	0.0050	0.00072
TMW28	10/19/2009	Sodium	7440-23-5	320	—	50	6.2
TMW28	10/19/2009	Thallium	7440-28-0	0.0026	U	0.0050	0.0026
TMW28	10/19/2009	Vanadium	7440-62-2	0.0081	E	0.010	0.0011
TMW28	10/19/2009	Zinc	7440-66-6	0.92	—	0.10	0.012
TMW29	10/20/2009	Aluminum	7429-90-5	49	E	0.50	0.16
TMW29	10/20/2009	Antimony	7440-36-0	0.0034	U	0.0060	0.0034
TMW29	10/20/2009	Arsenic	7440-38-2	0.0045	E	0.0050	0.0044
TMW29	10/20/2009	Barium	7440-39-3	0.25	—	0.030	0.0024
TMW29	10/20/2009	Beryllium	7440-41-7	0.00093	E	0.0010	0.000050
TMW29	10/20/2009	Cadmium	7440-43-9	0.00043	U	0.0050	0.00043
TMW29	10/20/2009	Calcium	7440-70-2	60	—	5.0	0.090
TMW29	10/20/2009	Chromium	7440-47-3	0.012	—	0.0020	0.00050
TMW29	10/20/2009	Cobalt	7440-48-4	0.0066	—	0.0050	0.00025
TMW29	10/20/2009	Copper	7440-50-8	0.0064	E	0.020	0.0021
TMW29	10/20/2009	Iron	7439-89-6	8.5	E	0.30	0.0097
TMW29	10/20/2009	Lead	7439-92-1	0.0038	E	0.0050	0.0018
TMW29	10/20/2009	Magnesium	7439-95-4	17	E	5.0	0.085
TMW29	10/20/2009	Manganese	7439-96-5	0.35	—	0.010	0.0034
TMW29	10/20/2009	Mercury	7439-97-6	0.000050	U	0.00020	0.000050
TMW29	10/20/2009	Nickel	7440-02-0	0.016	—	0.0020	0.00071
TMW29	10/20/2009	Potassium	7440-09-7	3.7	—	0.50	0.056
TMW29	10/20/2009	Selenium	7782-49-2	0.019	—	0.010	0.0056
TMW29	10/20/2009	Silver	7440-22-4	0.00072	U	0.0050	0.00072
TMW29	10/20/2009	Sodium	7440-23-5	570	—	50	6.2
TMW29	10/20/2009	Thallium	7440-28-0	0.0026	U	0.0050	0.0026
TMW29	10/20/2009	Vanadium	7440-62-2	0.034	—	0.010	0.0011
TMW29	10/20/2009	Zinc	7440-66-6	0.041	—	0.010	0.0012

[1] CAS Registry Numbers, which is a registered trademark of the American Chemical Society. CAS recommends the verification of the CAS Registry Numbers through CAS Client Services.

Table 1–4. Total anions analyzed according to the U.S. Environmental Protection Agency's method SW-846 9056A.

[CAS, Chemical Abstract Services; mg/L, milligrams per liter; U, undetected; —, unqualified result; E, estimated concentration]

Site designation	Collection date	Analyte	CAS number[1]	Result (mg/L)	Qualifier	Laboratory reporting level (mg/L)	Laboratory detection limit (mg/L)
MW01	10/22/2009	Bromide	7726-95-6	0.23	U	0.40	0.23
MW01	10/22/2009	Chloride	16887-00-6	48	—	6.0	0.51
MW01	10/22/2009	Fluoride	7782-41-4	0.70	E	1.0	0.12
MW01	10/22/2009	Sulfate	18785-72-3	950	—	100	4.6
MW02	10/22/2009	Bromide	7726-95-6	0.21	—	0.20	0.11
MW02	10/22/2009	Chloride	16887-00-6	11	—	3.0	0.25
MW02	10/22/2009	Fluoride	7782-41-4	0.25	E	0.50	0.060
MW02	10/22/2009	Sulfate	18785-72-3	750	—	100	4.6
MW03	10/23/2009	Bromide	7726-95-6	0.38	E	0.40	0.23
MW03	10/23/2009	Chloride	16887-00-6	160	—	15	1.3
MW03	10/23/2009	Fluoride	7782-41-4	0.45	E	1.0	0.12
MW03	10/23/2009	Sulfate	18785-72-3	1,600	—	250	12
MW18D	10/23/2009	Bromide	7726-95-6	1.4	—	1.0	0.56
MW18D	10/23/2009	Chloride	16887-00-6	630	—	150	13
MW18D	10/23/2009	Fluoride	7782-41-4	0.56	E	2.5	0.30
MW18D	10/23/2009	Sulfate	18785-72-3	2,100	—	250	12
MW20	10/23/2009	Bromide	7726-95-6	5.7	—	4.0	2.3
MW20	10/23/2009	Chloride	16887-00-6	3,600	—	600	51
MW20	10/23/2009	Fluoride	7782-41-4	1.2	U	10	1.2
MW20	10/23/2009	Sulfate	18785-72-3	5,700	—	1000	46
MW22D	10/21/2009	Bromide	7726-95-6	0.53	—	0.40	0.23
MW22D	10/21/2009	Chloride	16887-00-6	250	—	30	2.5
MW22D	10/21/2009	Fluoride	7782-41-4	0.41	E	1.0	0.12
MW22D	10/21/2009	Sulfate	18785-72-3	1,400	—	250	12
MW22S	10/23/2009	Bromide	7726-95-6	2.1	—	0.40	0.23
MW22S	10/23/2009	Chloride	16887-00-6	340	—	30	2.5
MW22S	10/23/2009	Fluoride	7782-41-4	0.27	E	1.0	0.12
MW22S	10/23/2009	Sulfate	18785-72-3	1,100	—	250	12
SMW01	10/24/2009	Bromide	7726-95-6	0.20	—	0.20	0.11
SMW01	10/24/2009	Chloride	16887-00-6	120	—	30	2.5
SMW01	10/24/2009	Fluoride	7782-41-4	0.82	—	0.50	0.060
SMW01	10/24/2009	Sulfate	18785-72-3	310	—	50	2.3
TMW01	10/14/2009	Bromide	7726-95-6	1.7	—	0.20	0.11
TMW01	10/14/2009	Chloride	16887-00-6	180	—	15	1.3
TMW01	10/14/2009	Fluoride	7782-41-4	0.44	E	0.50	0.060
TMW01	10/14/2009	Sulfate	18785-72-3	840	—	250	12
TMW03	10/14/2009	Bromide	7726-95-6	0.23	U	0.40	0.23
TMW03	10/14/2009	Chloride	16887-00-6	170	—	30	2.5
TMW03	10/14/2009	Fluoride	7782-41-4	0.98	E	1.0	0.12
TMW03	10/14/2009	Sulfate	18785-72-3	970	—	250	12
TMW04	10/14/2009	Bromide	7726-95-6	0.80	—	0.40	0.23
TMW04	10/14/2009	Chloride	16887-00-6	150	—	15	1.3

Table 1–4. Total anions analyzed according to the U.S. Environmental Protection Agency's method SW-846 9056A.—Continued

[CAS, Chemical Abstract Services; mg/L, milligrams per liter; U, undetected; —, unqualified result; E, estimated concentration]

Site designation	Collection date	Analyte	CAS number[1]	Result (mg/L)	Qualifier	Laboratory reporting level (mg/L)	Laboratory detection limit (mg/L)
TMW04	10/14/2009	Fluoride	7782-41-4	1.1	—	1.0	0.12
TMW04	10/14/2009	Sulfate	18785-72-3	1,200	—	250	12
TMW06	10/17/2009	Bromide	7726-95-6	0.42	—	0.40	0.23
TMW06	10/17/2009	Chloride	16887-00-6	140	—	15	1.3
TMW06	10/17/2009	Fluoride	7782-41-4	0.53	E	1.0	0.12
TMW06	10/17/2009	Sulfate	18785-72-3	1,300	—	250	12
TMW07	10/20/2009	Bromide	7726-95-6	0.40	—	0.40	0.23
TMW07	10/20/2009	Chloride	16887-00-6	200	—	15	1.3
TMW07	10/20/2009	Fluoride	7782-41-4	0.43	E	1.0	0.12
TMW07	10/20/2009	Sulfate	18785-72-3	1,900	—	250	12
TMW08	10/17/2009	Bromide	7726-95-6	4.2	—	2.0	1.1
TMW08	10/17/2009	Chloride	16887-00-6	1,700	—	150	13
TMW08	10/17/2009	Fluoride	7782-41-4	0.60	U	5.0	0.60
TMW08	10/17/2009	Sulfate	18785-72-3	6,700	—	1000	46
TMW10	10/19/2009	Bromide	7726-95-6	0.27	E	0.40	0.23
TMW10	10/19/2009	Chloride	16887-00-6	430	—	60	5.1
TMW10	10/19/2009	Fluoride	7782-41-4	0.57	E	1.0	0.12
TMW10	10/19/2009	Sulfate	18785-72-3	1,200	—	250	12
TMW11	10/20/2009	Bromide	7726-95-6	0.58	—	0.20	0.11
TMW11	10/20/2009	Chloride	16887-00-6	59	—	15	1.3
TMW11	10/20/2009	Fluoride	7782-41-4	1.9	—	0.50	0.060
TMW11	10/20/2009	Sulfate	18785-72-3	220	—	25	1.2
TMW13	10/22/2009	Bromide	7726-95-6	0.56	—	0.20	0.11
TMW13	10/22/2009	Chloride	16887-00-6	69	—	15	1.3
TMW13	10/22/2009	Fluoride	7782-41-4	1.7	—	0.50	0.060
TMW13	10/22/2009	Sulfate	18785-72-3	340	—	50	2.3
TMW15	10/26/2009	Bromide	7726-95-6	0.49	—	0.20	0.11
TMW15	10/26/2009	Chloride	16887-00-6	61	—	15	1.3
TMW15	10/26/2009	Fluoride	7782-41-4	1.7	—	0.50	0.060
TMW15	10/26/2009	Sulfate	18785-72-3	240	—	25	1.2
TMW21	10/24/2009	Bromide	7726-95-6	0.39	—	0.20	0.11
TMW21	10/24/2009	Chloride	16887-00-6	49	—	3.0	0.25
TMW21	10/24/2009	Fluoride	7782-41-4	0.98	—	0.50	0.060
TMW21	10/24/2009	Sulfate	18785-72-3	560	—	100	4.6
TMW22	10/19/2009	Bromide	7726-95-6	0.58	—	0.40	0.23
TMW22	10/19/2009	Chloride	16887-00-6	140	—	15	1.3
TMW22	10/19/2009	Fluoride	7782-41-4	0.92	E	1.0	0.12
TMW22	10/19/2009	Sulfate	18785-72-3	780	—	100	4.6
TMW23	10/19/2009	Bromide	7726-95-6	0.40	—	0.40	0.23
TMW23	10/19/2009	Chloride	16887-00-6	86	—	15	1.3
TMW23	10/19/2009	Fluoride	7782-41-4	0.79	E	1.0	0.12
TMW23	10/19/2009	Sulfate	18785-72-3	680	—	100	4.6

Table 1–4. Total anions analyzed according to the U.S. Environmental Protection Agency's method SW-846 9056A.—Continued

[CAS, Chemical Abstract Services; mg/L, milligrams per liter; U, undetected; —, unqualified result; E, estimated concentration]

Site designation	Collection date	Analyte	CAS number[1]	Result (mg/L)	Qualifier	Laboratory reporting level (mg/L)	Laboratory detection limit (mg/L)
TMW24	10/19/2009	Bromide	7726-95-6	1.3	—	0.40	0.23
TMW24	10/19/2009	Chloride	16887-00-6	340	—	60	5.1
TMW24	10/19/2009	Fluoride	7782-41-4	0.98	E	1.0	0.12
TMW24	10/19/2009	Sulfate	18785-72-3	530	—	100	4.6
TMW25	10/22/2009	Bromide	7726-95-6	1.0	—	0.40	0.23
TMW25	10/22/2009	Chloride	16887-00-6	220	—	30	2.5
TMW25	10/22/2009	Fluoride	7782-41-4	0.60	E	1.0	0.12
TMW25	10/22/2009	Sulfate	18785-72-3	930	—	250	12
TMW26	10/17/2009	Bromide	7726-95-6	0.96	—	0.40	0.23
TMW26	10/17/2009	Chloride	16887-00-6	250	—	60	5.1
TMW26	10/17/2009	Fluoride	7782-41-4	1.8	—	1.0	0.12
TMW26	10/17/2009	Sulfate	18785-72-3	640	—	100	4.6
TMW27	10/24/2009	Bromide	7726-95-6	0.39	—	0.20	0.11
TMW27	10/24/2009	Chloride	16887-00-6	120	—	15	1.3
TMW27	10/24/2009	Fluoride	7782-41-4	0.99	—	0.50	0.060
TMW27	10/24/2009	Sulfate	18785-72-3	120	—	25	1.2
TMW29	10/20/2009	Bromide	7726-95-6	0.56	—	0.20	0.11
TMW29	10/20/2009	Chloride	16887-00-6	71	—	15	1.3
TMW29	10/20/2009	Fluoride	7782-41-4	0.91	—	0.50	0.060
TMW29	10/20/2009	Sulfate	18785-72-3	520	—	100	4.6

[1] CAS Registry Numbers, which is a registered trademark of the American Chemical Society. CAS recommends the verification of the CAS Registry Numbers through CAS Client Services.

Table 1–5. Acid neutralizing capacity analyzed according to the U.S. Environmental Protection Agency's Methods for Chemical Analysis of Water and Wastes (MCAWW) 310.1.

[mg/L, milligrams per liter; —, unqualified result; U, undetected; E, estimated concentration]

Site designation	Collection date	Analyte	Result (mg/L)	Qualifier	Laboratory reporting level (mg/L)	Laboratory detection limit (mg/L)
MW01	10/22/2009	Bicarbonate, as calcium carbonate	920	—	5.0	1.1
MW01	10/22/2009	Carbonate, as calcium carbonate	1.1	U	5.0	1.1
MW01	10/22/2009	Hydroxide, as calcium carbonate	1.1	U	5.0	1.1
MW01	10/22/2009	Total acid neutralizing capacity, as calcium carbonate	920	—	5.0	1.1
MW02	10/22/2009	Bicarbonate, as calcium carbonate	700	—	5.0	1.1
MW02	10/22/2009	Carbonate, as calcium carbonate	1.1	U	5.0	1.1
MW02	10/22/2009	Hydroxide, as calcium carbonate	1.1	U	5.0	1.1
MW02	10/22/2009	Total acid neutralizing capacity, as calcium carbonate	700	—	5.0	1.1
MW03	10/23/2009	Bicarbonate, as calcium carbonate	950	—	5.0	1.1
MW03	10/23/2009	Carbonate, as calcium carbonate	1.1	U	5.0	1.1
MW03	10/23/2009	Hydroxide, as calcium carbonate	1.1	U	5.0	1.1
MW03	10/23/2009	Total acid neutralizing capacity, as calcium carbonate	950	—	5.0	1.1
MW18D	10/23/2009	Bicarbonate, as calcium carbonate	1,600	—	5.0	1.1
MW18D	10/23/2009	Carbonate, as calcium carbonate	1.1	U	5.0	1.1
MW18D	10/23/2009	Hydroxide, as calcium carbonate	1.1	U	5.0	1.1
MW18D	10/23/2009	Total acid neutralizing capacity, as calcium carbonate	1,600	—	5.0	1.1
MW20	10/23/2009	Bicarbonate, as calcium carbonate	1,200	—	5.0	1.1
MW20	10/23/2009	Carbonate, as calcium carbonate	1.1	U	5.0	1.1
MW20	10/23/2009	Hydroxide, as calcium carbonate	1.1	U	5.0	1.1
MW20	10/23/2009	Total acid neutralizing capacity, as calcium carbonate	1,200	—	5.0	1.1
MW22D	10/21/2009	Bicarbonate, as calcium carbonate	830	—	5.0	1.1
MW22D	10/21/2009	Carbonate, as calcium carbonate	1.1	U	5.0	1.1
MW22D	10/21/2009	Hydroxide, as calcium carbonate	1.1	U	5.0	1.1
MW22D	10/21/2009	Total acid neutralizing capacity, as calcium carbonate	830	—	5.0	1.1
MW22S	10/23/2009	Bicarbonate, as calcium carbonate	1,000	—	5.0	1.1
MW22S	10/23/2009	Carbonate, as calcium carbonate	1.1	U	5.0	1.1
MW22S	10/23/2009	Hydroxide, as calcium carbonate	1.1	U	5.0	1.1
MW22S	10/23/2009	Total acid neutralizing capacity, as calcium carbonate	1,000	—	5.0	1.1
SMW01	10/24/2009	Bicarbonate, as calcium carbonate	610	—	5.0	1.1
SMW01	10/24/2009	Carbonate, as calcium carbonate	2.0	E	5.0	1.1
SMW01	10/24/2009	Hydroxide, as calcium carbonate	1.1	U	5.0	1.1
SMW01	10/24/2009	Total acid neutralizing capacity, as calcium carbonate	610	—	5.0	1.1
TMW01	10/14/2009	Bicarbonate, as calcium carbonate	400	—	5.0	1.1
TMW01	10/14/2009	Carbonate, as calcium carbonate	1.1	U	5.0	1.1
TMW01	10/14/2009	Hydroxide, as calcium carbonate	1.1	U	5.0	1.1

Table 1–5. Acid neutralizing capacity analyzed according to the U.S. Environmental Protection Agency's Methods for Chemical Analysis of Water and Wastes (MCAWW) 310.1.—Continued

[mg/L, milligrams per liter; —, unqualified result; U, undetected; E, estimated concentration]

Site designation	Collection date	Analyte	Result (mg/L)	Qualifier	Laboratory reporting level (mg/L)	Laboratory detection limit (mg/L)
TMW01	10/14/2009	Total acid neutralizing capacity, as calcium carbonate	400	—	5.0	1.1
TMW03	10/14/2009	Bicarbonate, as calcium carbonate	460	—	5.0	1.1
TMW03	10/14/2009	Carbonate, as calcium carbonate	1.1	U	5.0	1.1
TMW03	10/14/2009	Hydroxide, as calcium carbonate	1.1	U	5.0	1.1
TMW03	10/14/2009	Total acid neutralizing capacity, as calcium carbonate	460	—	5.0	1.1
TMW04	10/14/2009	Bicarbonate, as calcium carbonate	440	—	5.0	1.1
TMW04	10/14/2009	Carbonate, as calcium carbonate	1.1	U	5.0	1.1
TMW04	10/14/2009	Hydroxide, as calcium carbonate	1.1	U	5.0	1.1
TMW04	10/14/2009	Total acid neutralizing capacity, as calcium carbonate	440	—	5.0	1.1
TMW06	10/17/2009	Bicarbonate, as calcium carbonate	1,100	—	5.0	1.1
TMW06	10/17/2009	Carbonate, as calcium carbonate	1.1	U	5.0	1.1
TMW06	10/17/2009	Hydroxide, as calcium carbonate	1.1	U	5.0	1.1
TMW06	10/17/2009	Total acid neutralizing capacity, as calcium carbonate	1,100	—	5.0	1.1
TMW07	10/20/2009	Bicarbonate, as calcium carbonate	740	—	5.0	1.1
TMW07	10/20/2009	Carbonate, as calcium carbonate	1.1	U	5.0	1.1
TMW07	10/20/2009	Hydroxide, as calcium carbonate	1.1	U	5.0	1.1
TMW07	10/20/2009	Total acid neutralizing capacity, as calcium carbonate	740	—	5.0	1.1
TMW08	10/17/2009	Bicarbonate, as calcium carbonate	830	—	5.0	1.1
TMW08	10/17/2009	Carbonate, as calcium carbonate	1.1	U	5.0	1.1
TMW08	10/17/2009	Hydroxide, as calcium carbonate	1.1	U	5.0	1.1
TMW08	10/17/2009	Total acid neutralizing capacity, as calcium carbonate	830	—	5.0	1.1
TMW10	10/19/2009	Bicarbonate, as calcium carbonate	680	—	5.0	1.1
TMW10	10/19/2009	Carbonate, as calcium carbonate	1.1	U	5.0	1.1
TMW10	10/19/2009	Hydroxide, as calcium carbonate	1.1	U	5.0	1.1
TMW10	10/19/2009	Total acid neutralizing capacity, as calcium carbonate	680	—	5.0	1.1
TMW11	10/20/2009	Bicarbonate, as calcium carbonate	880	—	5.0	1.1
TMW11	10/20/2009	Carbonate, as calcium carbonate	1.1	U	5.0	1.1
TMW11	10/20/2009	Hydroxide, as calcium carbonate	1.1	U	5.0	1.1
TMW11	10/20/2009	Total acid neutralizing capacity, as calcium carbonate	880	—	5.0	1.1
TMW13	10/22/2009	Bicarbonate, as calcium carbonate	830	—	5.0	1.1
TMW13	10/22/2009	Carbonate, as calcium carbonate	1.1	U	5.0	1.1
TMW13	10/22/2009	Hydroxide, as calcium carbonate	1.1	U	5.0	1.1
TMW13	10/22/2009	Total acid neutralizing capacity, as calcium carbonate	830	—	5.0	1.1
TMW15	10/26/2009	Bicarbonate, as calcium carbonate	900	—	5.0	1.1
TMW15	10/26/2009	Carbonate, as calcium carbonate	1.1	U	5.0	1.1

Table 1–5. Acid neutralizing capacity analyzed according to the U.S. Environmental Protection Agency's Methods for Chemical Analysis of Water and Wastes (MCAWW) 310.1.—Continued

[mg/L, milligrams per liter; —, unqualified result; U, undetected; E, estimated concentration]

Site designation	Collection date	Analyte	Result (mg/L)	Qualifier	Laboratory reporting level (mg/L)	Laboratory detection limit (mg/L)
TMW15	10/26/2009	Hydroxide, as calcium carbonate	1.1	U	5.0	1.1
TMW15	10/26/2009	Total acid neutralizing capacity, as calcium carbonate	900	—	5.0	1.1
TMW21	10/24/2009	Bicarbonate, as calcium carbonate	770	—	5.0	1.1
TMW21	10/24/2009	Carbonate, as calcium carbonate	1.1	U	5.0	1.1
TMW21	10/24/2009	Hydroxide, as calcium carbonate	1.1	U	5.0	1.1
TMW21	10/24/2009	Total acid neutralizing capacity, as calcium carbonate	770	—	5.0	1.1
TMW22	10/19/2009	Bicarbonate, as calcium carbonate	820	—	5.0	1.1
TMW22	10/19/2009	Carbonate, as calcium carbonate	1.1	U	5.0	1.1
TMW22	10/19/2009	Hydroxide, as calcium carbonate	1.1	U	5.0	1.1
TMW22	10/19/2009	Total acid neutralizing capacity, as calcium carbonate	820	—	5.0	1.1
TMW23	10/19/2009	Bicarbonate, as calcium carbonate	790	—	5.0	1.1
TMW23	10/19/2009	Carbonate, as calcium carbonate	1.1	U	5.0	1.1
TMW23	10/19/2009	Hydroxide, as calcium carbonate	1.1	U	5.0	1.1
TMW23	10/19/2009	Total acid neutralizing capacity, as calcium carbonate	790	—	5.0	1.1
TMW24	10/19/2009	Bicarbonate, as calcium carbonate	1,000	—	5.0	1.1
TMW24	10/19/2009	Carbonate, as calcium carbonate	1.1	U	5.0	1.1
TMW24	10/19/2009	Hydroxide, as calcium carbonate	1.1	U	5.0	1.1
TMW24	10/19/2009	Total acid neutralizing capacity, as calcium carbonate	1,000	—	5.0	1.1
TMW25	10/22/2009	Bicarbonate, as calcium carbonate	850	—	5.0	1.1
TMW25	10/22/2009	Carbonate, as calcium carbonate	1.1	U	5.0	1.1
TMW25	10/22/2009	Hydroxide, as calcium carbonate	1.1	U	5.0	1.1
TMW25	10/22/2009	Total Acid Neutralizing Capacity, as calcium carbonate	850	—	5.0	1.1
TMW26	10/17/2009	Bicarbonate, as calcium carbonate	830	—	5.0	1.1
TMW26	10/17/2009	Carbonate, as calcium carbonate	8.5	—	5.0	1.1
TMW26	10/17/2009	Hydroxide, as calcium carbonate	1.1	U	5.0	1.1
TMW26	10/17/2009	Total Acid Neutralizing Capacity, as calcium carbonate	840	—	5.0	1.1
TMW27	10/24/2009	Bicarbonate, as calcium carbonate	540	—	5.0	1.1
TMW27	10/24/2009	Carbonate, as calcium carbonate	1.1	U	5.0	1.1
TMW27	10/24/2009	Hydroxide, as calcium carbonate	1.1	U	5.0	1.1
TMW27	10/24/2009	Total Acid Neutralizing Capacity, as calcium carbonate	540	—	5.0	1.1
TMW29	10/20/2009	Bicarbonate, as calcium carbonate	770	—	5.0	1.1
TMW29	10/20/2009	Carbonate, as calcium carbonate	1.1	U	5.0	1.1
TMW29	10/20/2009	Hydroxide, as calcium carbonate	1.1	U	5.0	1.1
TMW29	10/20/2009	Total Acid Neutralizing Capacity, as calcium carbonate	770	—	5.0	1.1

Table 1–6. Explosives analyzed according to the U.S. Environmental Protection Agency's method SW-846 8330B.

[CAS, Chemical Abstract Services; µg/L, micrograms per liter; U, undetected; E, estimated concentration; UE,undetected but detection limit estimated, —, unqualified result]

Site designation	Collection date	Analyte	CAS number[1]	Result (µg/L)	Qualifier	Laboratory reporting level (µg/L)	Laboratory detection limit (µg/L)
MW01	10/22/2009	Dinitrobenzene, 1,3-	99-65-0	0.12	U	0.50	0.12
MW01	10/22/2009	Dinitrotoluene, 2,4-	121-14-2	0.20	U	0.50	0.20
MW01	10/22/2009	Dinitrotoluene, 2,6-	606-20-2	0.24	U	0.50	0.24
MW01	10/22/2009	Dinitrotoluene, 2-Amino-4,6-	35572-78-2	0.12	U	0.50	0.12
MW01	10/22/2009	Dinitrotoluene, 4-Amino-2,6-	19406-51-0	0.26	U	0.50	0.26
MW01	10/22/2009	Hexahydro-1,3,5-Trinitro-1,3,5-Triazine (RDX)	121-82-4	0.28	U	0.50	0.28
MW01	10/22/2009	Nitrobenzene	98-95-3	0.22	U	0.50	0.22
MW01	10/22/2009	Nitrotoluene, m-	99-08-1	0.26	U	0.50	0.26
MW01	10/22/2009	Nitrotoluene, o-	88-72-2	0.16	U	0.50	0.16
MW01	10/22/2009	Nitrotoluene, p-	99-99-0	0.30	U	0.50	0.30
MW01	10/22/2009	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	2691-41-0	0.18	UE	0.99	0.18
MW01	10/22/2009	Tetryl (Trinitrophenylmethylnitramine)	479-45-8	0.18	U	0.50	0.18
MW01	10/22/2009	Trinitrobenzene, 1,3,5-	99-35-4	0.20	U	0.50	0.20
MW01	10/22/2009	Trinitrotoluene, 2,4,6-	118-96-7	0.28	U	0.50	0.28
MW02	10/22/2009	Dinitrobenzene, 1,3-	99-65-0	0.070	U	0.29	0.070
MW02	10/22/2009	Dinitrotoluene, 2,4-	121-14-2	0.12	U	0.29	0.12
MW02	10/22/2009	Dinitrotoluene, 2,6-	606-20-2	0.14	U	0.29	0.14
MW02	10/22/2009	Dinitrotoluene, 2-Amino-4,6-	35572-78-2	0.070	U	0.29	0.070
MW02	10/22/2009	Dinitrotoluene, 4-Amino-2,6-	19406-51-0	0.15	U	0.29	0.15
MW02	10/22/2009	Hexahydro-1,3,5-Trinitro-1,3,5-Triazine (RDX)	121-82-4	0.16	U	0.29	0.16
MW02	10/22/2009	Nitrobenzene	98-95-3	0.13	U	0.29	0.13
MW02	10/22/2009	Nitrotoluene, m-	99-08-1	0.15	U	0.29	0.15
MW02	10/22/2009	Nitrotoluene, o-	88-72-2	0.090	U	0.29	0.090
MW02	10/22/2009	Nitrotoluene, p-	99-99-0	0.17	U	0.29	0.17
MW02	10/22/2009	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	2691-41-0	0.10	UE	0.58	0.10
MW02	10/22/2009	Tetryl (Trinitrophenylmethylnitramine)	479-45-8	0.10	U	0.29	0.10
MW02	10/22/2009	Trinitrobenzene, 1,3,5-	99-35-4	0.12	U	0.29	0.12
MW02	10/22/2009	Trinitrotoluene, 2,4,6-	118-96-7	0.16	U	0.29	0.16
MW03	10/23/2009	Dinitrobenzene, 1,3-	99-65-0	0.11	U	0.46	0.11
MW03	10/23/2009	Dinitrotoluene, 2,4-	121-14-2	0.18	U	0.46	0.18
MW03	10/23/2009	Dinitrotoluene, 2,6-	606-20-2	0.22	U	0.46	0.22
MW03	10/23/2009	Dinitrotoluene, 2-Amino-4,6-	35572-78-2	0.11	U	0.46	0.11
MW03	10/23/2009	Dinitrotoluene, 4-Amino-2,6-	19406-51-0	0.24	U	0.46	0.24
MW03	10/23/2009	Hexahydro-1,3,5-Trinitro-1,3,5-Triazine (RDX)	121-82-4	0.25	U	0.46	0.25
MW03	10/23/2009	Nitrobenzene	98-95-3	0.20	U	0.46	0.20
MW03	10/23/2009	Nitrotoluene, m-	99-08-1	0.24	U	0.46	0.24
MW03	10/23/2009	Nitrotoluene, o-	88-72-2	0.14	U	0.46	0.14
MW03	10/23/2009	Nitrotoluene, p-	99-99-0	0.27	U	0.46	0.27

Table 1–6. Explosives analyzed according to the U.S. Environmental Protection Agency's method SW-846 8330B.—Continued

[CAS, Chemical Abstract Services; µg/L, micrograms per liter; U, undetected; E, estimated concentration; UE,undetected but detection limit estimated, —, unqualified result]

Site designation	Collection date	Analyte	CAS number[1]	Result (µg/L)	Qualifier	Laboratory reporting level (µg/L)	Laboratory detection limit (µg/L)
MW03	10/23/2009	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	2691-41-0	0.16	U	0.91	0.16
MW03	10/23/2009	Tetryl (Trinitrophenylmethylnitramine)	479-45-8	0.16	U	0.46	0.16
MW03	10/23/2009	Trinitrobenzene, 1,3,5-	99-35-4	0.18	U	0.46	0.18
MW03	10/23/2009	Trinitrotoluene, 2,4,6-	118-96-7	0.25	U	0.46	0.25
MW18D	10/23/2009	Dinitrobenzene, 1,3-	99-65-0	0.12	U	0.48	0.12
MW18D	10/23/2009	Dinitrotoluene, 2,4-	121-14-2	0.19	U	0.48	0.19
MW18D	10/23/2009	Dinitrotoluene, 2,6-	606-20-2	0.23	U	0.48	0.23
MW18D	10/23/2009	Dinitrotoluene, 2-Amino-4,6-	35572-78-2	0.12	U	0.48	0.12
MW18D	10/23/2009	Dinitrotoluene, 4-Amino-2,6-	19406-51-0	0.25	U	0.48	0.25
MW18D	10/23/2009	Hexahydro-1,3,5-Trinitro-1,3,5-Triazine (RDX)	121-82-4	0.27	U	0.48	0.27
MW18D	10/23/2009	Nitrobenzene	98-95-3	0.21	U	0.48	0.21
MW18D	10/23/2009	Nitrotoluene, m-	99-08-1	0.25	U	0.48	0.25
MW18D	10/23/2009	Nitrotoluene, o-	88-72-2	0.16	U	0.48	0.16
MW18D	10/23/2009	Nitrotoluene, p-	99-99-0	0.29	U	0.48	0.29
MW18D	10/23/2009	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	2691-41-0	0.17	U	0.97	0.17
MW18D	10/23/2009	Tetryl (Trinitrophenylmethylnitramine)	479-45-8	0.17	U	0.48	0.17
MW18D	10/23/2009	Trinitrobenzene, 1,3,5-	99-35-4	0.19	U	0.48	0.19
MW18D	10/23/2009	Trinitrotoluene, 2,4,6-	118-96-7	0.27	U	0.48	0.27
MW20	10/23/2009	Dinitrobenzene, 1,3-	99-65-0	0.12	UE	0.50	0.12
MW20	10/23/2009	Dinitrotoluene, 2,4-	121-14-2	0.20	UE	0.50	0.20
MW20	10/23/2009	Dinitrotoluene, 2,6-	606-20-2	0.24	UE	0.50	0.24
MW20	10/23/2009	Dinitrotoluene, 2-Amino-4,6-	35572-78-2	0.12	UE	0.50	0.12
MW20	10/23/2009	Dinitrotoluene, 4-Amino-2,6-	19406-51-0	0.26	UE	0.50	0.26
MW20	10/23/2009	Hexahydro-1,3,5-Trinitro-1,3,5-Triazine (RDX)	121-82-4	0.28	UE	0.50	0.28
MW20	10/23/2009	Nitrobenzene	98-95-3	0.22	UE	0.50	0.22
MW20	10/23/2009	Nitrotoluene, m-	99-08-1	0.26	UE	0.50	0.26
MW20	10/23/2009	Nitrotoluene, o-	88-72-2	0.16	UE	0.50	0.16
MW20	10/23/2009	Nitrotoluene, p-	99-99-0	0.30	UE	0.50	0.30
MW20	10/23/2009	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	2691-41-0	0.18	UE	0.99	0.18
MW20	10/23/2009	Tetryl (Trinitrophenylmethylnitramine)	479-45-8	0.18	UE	0.50	0.18
MW20	10/23/2009	Trinitrobenzene, 1,3,5-	99-35-4	0.20	UE	0.50	0.20
MW20	10/23/2009	Trinitrotoluene, 2,4,6-	118-96-7	0.28	UE	0.50	0.28
MW22D	10/21/2009	Dinitrobenzene, 1,3-	99-65-0	0.11	U	0.46	0.11
MW22D	10/21/2009	Dinitrotoluene, 2,4-	121-14-2	0.19	U	0.46	0.19
MW22D	10/21/2009	Dinitrotoluene, 2,6-	606-20-2	0.22	U	0.46	0.22
MW22D	10/21/2009	Dinitrotoluene, 2-Amino-4,6-	35572-78-2	0.11	U	0.46	0.11
MW22D	10/21/2009	Dinitrotoluene, 4-Amino-2,6-	19406-51-0	0.24	U	0.46	0.24

Table 1–6. Explosives analyzed according to the U.S. Environmental Protection Agency's method SW-846 8330B.—Continued

[CAS, Chemical Abstract Services; µg/L, micrograms per liter; U, undetected; E, estimated concentration; UE,undetected but detection limit estimated, —, unqualified result]

Site designation	Collection date	Analyte	CAS number[1]	Result (µg/L)	Qualifier	Laboratory reporting level (µg/L)	Laboratory detection limit (µg/L)
MW22D	10/21/2009	Hexahydro-1,3,5-Trinitro-1,3,5-Triazine (RDX)	121-82-4	0.26	U	0.46	0.26
MW22D	10/21/2009	Nitrobenzene	98-95-3	0.20	UE	0.46	0.20
MW22D	10/21/2009	Nitrotoluene, m-	99-08-1	0.24	U	0.46	0.24
MW22D	10/21/2009	Nitrotoluene, o-	88-72-2	0.15	U	0.46	0.15
MW22D	10/21/2009	Nitrotoluene, p-	99-99-0	0.28	U	0.46	0.28
MW22D	10/21/2009	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	2691-41-0	0.17	UE	0.93	0.17
MW22D	10/21/2009	Tetryl (Trinitrophenylmethylnitramine)	479-45-8	0.17	UE	0.46	0.17
MW22D	10/21/2009	Trinitrobenzene, 1,3,5-	99-35-4	0.19	U	0.46	0.19
MW22D	10/21/2009	Trinitrotoluene, 2,4,6-	118-96-7	0.26	U	0.46	0.26
MW22S	10/22/2009	Dinitrobenzene, 1,3-	99-65-0	0.11	U	0.46	0.11
MW22S	10/22/2009	Dinitrotoluene, 2,4-	121-14-2	0.19	U	0.46	0.19
MW22S	10/22/2009	Dinitrotoluene, 2,6-	606-20-2	0.22	U	0.46	0.22
MW22S	10/22/2009	Dinitrotoluene, 2-Amino-4,6-	35572-78-2	0.11	U	0.46	0.11
MW22S	10/22/2009	Dinitrotoluene, 4-Amino-2,6-	19406-51-0	0.24	U	0.46	0.24
MW22S	10/22/2009	Hexahydro-1,3,5-Trinitro-1,3,5-Triazine (RDX)	121-82-4	0.26	U	0.46	0.26
MW22S	10/22/2009	Nitrobenzene	98-95-3	0.20	U	0.46	0.20
MW22S	10/22/2009	Nitrotoluene, m-	99-08-1	0.24	U	0.46	0.24
MW22S	10/22/2009	Nitrotoluene, o-	88-72-2	0.15	U	0.46	0.15
MW22S	10/22/2009	Nitrotoluene, p-	99-99-0	0.28	U	0.46	0.28
MW22S	10/22/2009	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	2691-41-0	0.17	UE	0.93	0.17
MW22S	10/22/2009	Tetryl (Trinitrophenylmethylnitramine)	479-45-8	0.17	U	0.46	0.17
MW22S	10/22/2009	Trinitrobenzene, 1,3,5-	99-35-4	0.19	U	0.46	0.19
MW22S	10/22/2009	Trinitrotoluene, 2,4,6-	118-96-7	0.26	U	0.46	0.26
TMW03	10/14/2009	Dinitrobenzene, 1,3-	99-65-0	0.11	U	0.47	0.11
TMW03	10/14/2009	Dinitrotoluene, 2,4-	121-14-2	0.33	E	0.47	0.19
TMW03	10/14/2009	Dinitrotoluene, 2,6-	606-20-2	0.22	U	0.47	0.22
TMW03	10/14/2009	Dinitrotoluene, 2-Amino-4,6-	35572-78-2	1.5	—	0.47	0.11
TMW03	10/14/2009	Dinitrotoluene, 4-Amino-2,6-	19406-51-0	1.3	—	0.47	0.24
TMW03	10/14/2009	Hexahydro-1,3,5-Trinitro-1,3,5-Triazine (RDX)	121-82-4	370	—	47	26
TMW03	10/14/2009	Nitrobenzene	98-95-3	4.1	—	0.47	0.21
TMW03	10/14/2009	Nitrotoluene, m-	99-08-1	0.24	U	0.47	0.24
TMW03	10/14/2009	Nitrotoluene, o-	88-72-2	0.15	U	0.47	0.15
TMW03	10/14/2009	Nitrotoluene, p-	99-99-0	0.28	U	0.47	0.28
TMW03	10/14/2009	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	2691-41-0	0.17	U	0.94	0.17
TMW03	10/14/2009	Tetryl (Trinitrophenylmethylnitramine)	479-45-8	0.17	U	0.47	0.17
TMW03	10/14/2009	Trinitrobenzene, 1,3,5-	99-35-4	2.0	—	0.47	0.19
TMW03	10/14/2009	Trinitrotoluene, 2,4,6-	118-96-7	0.26	U	0.47	0.26

Table 1–6. Explosives analyzed according to the U.S. Environmental Protection Agency's method SW-846 8330B.—Continued

[CAS, Chemical Abstract Services; µg/L, micrograms per liter; U, undetected; E, estimated concentration; UE,undetected but detection limit estimated, —, unqualified result]

Site designation	Collection date	Analyte	CAS number[1]	Result (µg/L)	Qualifier	Laboratory reporting level (µg/L)	Laboratory detection limit (µg/L)
TMW04	10/14/2009	Dinitrobenzene, 1,3-	99-65-0	0.060	U	0.25	0.060
TMW04	10/14/2009	Dinitrotoluene, 2,4-	121-14-2	0.18	E	0.25	0.10
TMW04	10/14/2009	Dinitrotoluene, 2,6-	606-20-2	0.12	U	0.25	0.12
TMW04	10/14/2009	Dinitrotoluene, 2-Amino-4,6-	35572-78-2	2.8	—	0.25	0.060
TMW04	10/14/2009	Dinitrotoluene, 4-Amino-2,6-	19406-51-0	2.4	—	0.25	0.13
TMW04	10/14/2009	Hexahydro-1,3,5-Trinitro-1,3,5-Triazine (RDX)	121-82-4	2.3	—	0.25	0.14
TMW04	10/14/2009	Nitrobenzene	98-95-3	5.4	—	0.25	0.11
TMW04	10/14/2009	Nitrotoluene, m-	99-08-1	0.13	U	0.25	0.13
TMW04	10/14/2009	Nitrotoluene, o-	88-72-2	0.080	U	0.25	0.080
TMW04	10/14/2009	Nitrotoluene, p-	99-99-0	0.15	U	0.25	0.15
TMW04	10/14/2009	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	2691-41-0	0.090	U	0.50	0.090
TMW04	10/14/2009	Tetryl (Trinitrophenylmethylnitramine)	479-45-8	0.090	U	0.25	0.090
TMW04	10/14/2009	Trinitrobenzene, 1,3,5-	99-35-4	5.2	—	0.25	0.10
TMW04	10/14/2009	Trinitrotoluene, 2,4,6-	118-96-7	0.14	U	0.25	0.14
TMW06	10/17/2009	Dinitrobenzene, 1,3-	99-65-0	0.060	UE	0.26	0.060
TMW06	10/17/2009	Dinitrotoluene, 2,4-	121-14-2	0.10	UE	0.26	0.10
TMW06	10/17/2009	Dinitrotoluene, 2,6-	606-20-2	0.12	UE	0.26	0.12
TMW06	10/17/2009	Dinitrotoluene, 2-Amino-4,6-	35572-78-2	0.060	UE	0.26	0.060
TMW06	10/17/2009	Dinitrotoluene, 4-Amino-2,6-	19406-51-0	0.14	UE	0.26	0.14
TMW06	10/17/2009	Hexahydro-1,3,5-Trinitro-1,3,5-Triazine (RDX)	121-82-4	0.14	UE	0.26	0.14
TMW06	10/17/2009	Nitrobenzene	98-95-3	0.11	UE	0.26	0.11
TMW06	10/17/2009	Nitrotoluene, m-	99-08-1	0.14	UE	0.26	0.14
TMW06	10/17/2009	Nitrotoluene, o-	88-72-2	0.080	UE	0.26	0.080
TMW06	10/17/2009	Nitrotoluene, p-	99-99-0	0.16	UE	0.26	0.16
TMW06	10/17/2009	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	2691-41-0	0.090	UE	0.52	0.090
TMW06	10/17/2009	Tetryl (Trinitrophenylmethylnitramine)	479-45-8	0.090	UE	0.26	0.090
TMW06	10/17/2009	Trinitrobenzene, 1,3,5-	99-35-4	0.10	UE	0.26	0.10
TMW06	10/17/2009	Trinitrotoluene, 2,4,6-	118-96-7	0.14	UE	0.26	0.14
TMW07	10/20/2009	Dinitrobenzene, 1,3-	99-65-0	0.12	U	0.50	0.12
TMW07	10/20/2009	Dinitrotoluene, 2,4-	121-14-2	0.20	U	0.50	0.20
TMW07	10/20/2009	Dinitrotoluene, 2,6-	606-20-2	0.24	U	0.50	0.24
TMW07	10/20/2009	Dinitrotoluene, 2-Amino-4,6-	35572-78-2	0.12	U	0.50	0.12
TMW07	10/20/2009	Dinitrotoluene, 4-Amino-2,6-	19406-51-0	0.26	U	0.50	0.26
TMW07	10/20/2009	Hexahydro-1,3,5-Trinitro-1,3,5-Triazine (RDX)	121-82-4	0.28	U	0.50	0.28
TMW07	10/20/2009	Nitrobenzene	98-95-3	0.22	UE	0.50	0.22
TMW07	10/20/2009	Nitrotoluene, m-	99-08-1	0.26	U	0.50	0.26
TMW07	10/20/2009	Nitrotoluene, o-	88-72-2	0.16	U	0.50	0.16
TMW07	10/20/2009	Nitrotoluene, p-	99-99-0	0.30	U	0.50	0.30

Table 1–6. Explosives analyzed according to the U.S. Environmental Protection Agency's method SW-846 8330B.—Continued

[CAS, Chemical Abstract Services; µg/L, micrograms per liter; U, undetected; E, estimated concentration; UE,undetected but detection limit estimated, —, unqualified result]

Site designation	Collection date	Analyte	CAS number[1]	Result (µg/L)	Qualifier	Laboratory reporting level (µg/L)	Laboratory detection limit (µg/L)
TMW07	10/20/2009	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	2691-41-0	0.18	U	1.0	0.18
TMW07	10/20/2009	Tetryl (Trinitrophenylmethylnitramine)	479-45-8	0.18	U	0.50	0.18
TMW07	10/20/2009	Trinitrobenzene, 1,3,5-	99-35-4	0.20	U	0.50	0.20
TMW07	10/20/2009	Trinitrotoluene, 2,4,6-	118-96-7	0.28	U	0.50	0.28
TMW10	10/19/2009	Dinitrobenzene, 1,3-	99-65-0	0.11	U	0.47	0.11
TMW10	10/19/2009	Dinitrotoluene, 2,4-	121-14-2	0.19	U	0.47	0.19
TMW10	10/19/2009	Dinitrotoluene, 2,6-	606-20-2	0.22	U	0.47	0.22
TMW10	10/19/2009	Dinitrotoluene, 2-Amino-4,6-	35572-78-2	0.11	U	0.47	0.11
TMW10	10/19/2009	Dinitrotoluene, 4-Amino-2,6-	19406-51-0	0.24	U	0.47	0.24
TMW10	10/19/2009	Hexahydro-1,3,5-Trinitro-1,3,5-Triazine (RDX)	121-82-4	0.26	U	0.47	0.26
TMW10	10/19/2009	Nitrobenzene	98-95-3	0.21	UE	0.47	0.21
TMW10	10/19/2009	Nitrotoluene, m-	99-08-1	0.24	U	0.47	0.24
TMW10	10/19/2009	Nitrotoluene, o-	88-72-2	0.15	U	0.47	0.15
TMW10	10/19/2009	Nitrotoluene, p-	99-99-0	0.28	U	0.47	0.28
TMW10	10/19/2009	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	2691-41-0	0.17	U	0.94	0.17
TMW10	10/19/2009	Tetryl (Trinitrophenylmethylnitramine)	479-45-8	0.17	U	0.47	0.17
TMW10	10/19/2009	Trinitrobenzene, 1,3,5-	99-35-4	0.19	U	0.47	0.19
TMW10	10/19/2009	Trinitrotoluene, 2,4,6-	118-96-7	0.26	U	0.47	0.26
TMW11	10/20/2009	Dinitrobenzene, 1,3-	99-65-0	0.12	U	0.50	0.12
TMW11	10/20/2009	Dinitrotoluene, 2,4-	121-14-2	0.20	U	0.50	0.20
TMW11	10/20/2009	Dinitrotoluene, 2,6-	606-20-2	0.24	U	0.50	0.24
TMW11	10/20/2009	Dinitrotoluene, 2-Amino-4,6-	35572-78-2	0.12	U	0.50	0.12
TMW11	10/20/2009	Dinitrotoluene, 4-Amino-2,6-	19406-51-0	0.26	U	0.50	0.26
TMW11	10/20/2009	Hexahydro-1,3,5-Trinitro-1,3,5-Triazine (RDX)	121-82-4	0.43	E	0.50	0.28
TMW11	10/20/2009	Nitrobenzene	98-95-3	0.22	UE	0.50	0.22
TMW11	10/20/2009	Nitrotoluene, m-	99-08-1	0.26	U	0.50	0.26
TMW11	10/20/2009	Nitrotoluene, o-	88-72-2	0.16	U	0.50	0.16
TMW11	10/20/2009	Nitrotoluene, p-	99-99-0	0.30	U	0.50	0.30
TMW11	10/20/2009	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	2691-41-0	0.18	U	1.0	0.18
TMW11	10/20/2009	Tetryl (Trinitrophenylmethylnitramine)	479-45-8	0.18	U	0.50	0.18
TMW11	10/20/2009	Trinitrobenzene, 1,3,5-	99-35-4	0.20	U	0.50	0.20
TMW11	10/20/2009	Trinitrotoluene, 2,4,6-	118-96-7	0.28	U	0.50	0.28
TMW15	10/26/2009	Dinitrobenzene, 1,3-	99-65-0	0.080	U	0.34	0.080
TMW15	10/26/2009	Dinitrotoluene, 2,4-	121-14-2	0.13	U	0.34	0.13
TMW15	10/26/2009	Dinitrotoluene, 2,6-	606-20-2	0.16	U	0.34	0.16
TMW15	10/26/2009	Dinitrotoluene, 2-Amino-4,6-	35572-78-2	0.080	U	0.34	0.080
TMW15	10/26/2009	Dinitrotoluene, 4-Amino-2,6-	19406-51-0	0.17	U	0.34	0.17

Table 1–6. Explosives analyzed according to the U.S. Environmental Protection Agency's method SW-846 8330B.—Continued

[CAS, Chemical Abstract Services; µg/L, micrograms per liter; U, undetected; E, estimated concentration; UE,undetected but detection limit estimated, —, unqualified result]

Site designation	Collection date	Analyte	CAS number[1]	Result (µg/L)	Qualifier	Laboratory reporting level (µg/L)	Laboratory detection limit (µg/L)
TMW15	10/26/2009	Hexahydro-1,3,5-Trinitro-1,3,5-Triazine (RDX)	121-82-4	0.19	U	0.34	0.19
TMW15	10/26/2009	Nitrobenzene	98-95-3	0.15	U	0.34	0.15
TMW15	10/26/2009	Nitrotoluene, m-	99-08-1	0.17	U	0.34	0.17
TMW15	10/26/2009	Nitrotoluene, o-	88-72-2	0.11	U	0.34	0.11
TMW15	10/26/2009	Nitrotoluene, p-	99-99-0	0.20	U	0.34	0.20
TMW15	10/26/2009	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	2691-41-0	0.12	U	0.67	0.12
TMW15	10/26/2009	Tetryl (Trinitrophenylmethylnitramine)	479-45-8	0.12	U	0.34	0.12
TMW15	10/26/2009	Trinitrobenzene, 1,3,5-	99-35-4	0.13	U	0.34	0.13
TMW15	10/26/2009	Trinitrotoluene, 2,4,6-	118-96-7	0.19	U	0.34	0.19
TMW21	10/24/2009	Dinitrobenzene, 1,3-	99-65-0	0.12	UE	0.50	0.12
TMW21	10/24/2009	Dinitrotoluene, 2,4-	121-14-2	0.20	UE	0.50	0.20
TMW21	10/24/2009	Dinitrotoluene, 2,6-	606-20-2	0.24	UE	0.50	0.24
TMW21	10/24/2009	Dinitrotoluene, 2-Amino-4,6-	35572-78-2	0.12	UE	0.50	0.12
TMW21	10/24/2009	Dinitrotoluene, 4-Amino-2,6-	19406-51-0	0.26	UE	0.50	0.26
TMW21	10/24/2009	Hexahydro-1,3,5-Trinitro-1,3,5-Triazine (RDX)	121-82-4	0.28	UE	0.50	0.28
TMW21	10/24/2009	Nitrobenzene	98-95-3	0.22	UE	0.50	0.22
TMW21	10/24/2009	Nitrotoluene, m-	99-08-1	0.26	UE	0.50	0.26
TMW21	10/24/2009	Nitrotoluene, o-	88-72-2	0.16	UE	0.50	0.16
TMW21	10/24/2009	Nitrotoluene, p-	99-99-0	0.30	UE	0.50	0.30
TMW21	10/24/2009	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	2691-41-0	0.18	UE	1.0	0.18
TMW21	10/24/2009	Tetryl (Trinitrophenylmethylnitramine)	479-45-8	0.18	UE	0.50	0.18
TMW21	10/24/2009	Trinitrobenzene, 1,3,5-	99-35-4	0.20	UE	0.50	0.20
TMW21	10/24/2009	Trinitrotoluene, 2,4,6-	118-96-7	0.28	UE	0.50	0.28
TMW22	10/19/2009	Dinitrobenzene, 1,3-	99-65-0	0.090	U	0.39	0.090
TMW22	10/19/2009	Dinitrotoluene, 2,4-	121-14-2	0.16	U	0.39	0.16
TMW22	10/19/2009	Dinitrotoluene, 2,6-	606-20-2	0.19	U	0.39	0.19
TMW22	10/19/2009	Dinitrotoluene, 2-Amino-4,6-	35572-78-2	0.090	U	0.39	0.090
TMW22	10/19/2009	Dinitrotoluene, 4-Amino-2,6-	19406-51-0	0.20	U	0.39	0.20
TMW22	10/19/2009	Hexahydro-1,3,5-Trinitro-1,3,5-Triazine (RDX)	121-82-4	0.22	U	0.39	0.22
TMW22	10/19/2009	Nitrobenzene	98-95-3	0.17	UE	0.39	0.17
TMW22	10/19/2009	Nitrotoluene, m-	99-08-1	0.20	U	0.39	0.20
TMW22	10/19/2009	Nitrotoluene, o-	88-72-2	0.12	U	0.39	0.12
TMW22	10/19/2009	Nitrotoluene, p-	99-99-0	0.23	U	0.39	0.23
TMW22	10/19/2009	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	2691-41-0	0.14	U	0.78	0.14
TMW22	10/19/2009	Tetryl (Trinitrophenylmethylnitramine)	479-45-8	0.14	U	0.39	0.14
TMW22	10/19/2009	Trinitrobenzene, 1,3,5-	99-35-4	0.16	U	0.39	0.16
TMW22	10/19/2009	Trinitrotoluene, 2,4,6-	118-96-7	0.22	U	0.39	0.22

Table 1–6. Explosives analyzed according to the U.S. Environmental Protection Agency's method SW-846 8330B.—Continued

[CAS, Chemical Abstract Services; µg/L, micrograms per liter; U, undetected; E, estimated concentration; UE,undetected but detection limit estimated, —, unqualified result]

Site designation	Collection date	Analyte	CAS number[1]	Result (µg/L)	Qualifier	Laboratory reporting level (µg/L)	Laboratory detection limit (µg/L)
TMW23	10/19/2009	Dinitrobenzene, 1,3-	99-65-0	0.10	UE	0.40	0.10
TMW23	10/19/2009	Dinitrotoluene, 2,4-	121-14-2	0.16	UE	0.40	0.16
TMW23	10/19/2009	Dinitrotoluene, 2,6-	606-20-2	0.19	UE	0.40	0.19
TMW23	10/19/2009	Dinitrotoluene, 2-Amino-4,6-	35572-78-2	0.10	UE	0.40	0.10
TMW23	10/19/2009	Dinitrotoluene, 4-Amino-2,6-	19406-51-0	0.21	UE	0.40	0.21
TMW23	10/19/2009	Hexahydro-1,3,5-Trinitro-1,3,5-Triazine (RDX)	121-82-4	12	E	0.40	0.23
TMW23	10/19/2009	Nitrobenzene	98-95-3	0.18	UE	0.40	0.18
TMW23	10/19/2009	Nitrotoluene, m-	99-08-1	0.21	UE	0.40	0.21
TMW23	10/19/2009	Nitrotoluene, o-	88-72-2	0.13	UE	0.40	0.13
TMW23	10/19/2009	Nitrotoluene, p-	99-99-0	0.24	UE	0.40	0.24
TMW23	10/19/2009	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	2691-41-0	0.14	UE	0.81	0.14
TMW23	10/19/2009	Tetryl (Trinitrophenylmethylnitramine)	479-45-8	0.14	UE	0.40	0.14
TMW23	10/19/2009	Trinitrobenzene, 1,3,5-	99-35-4	0.16	UE	0.40	0.16
TMW23	10/19/2009	Trinitrotoluene, 2,4,6-	118-96-7	0.23	UE	0.40	0.23
TMW24	10/19/2009	Dinitrobenzene, 1,3-	99-65-0	0.070	UE	0.28	0.070
TMW24	10/19/2009	Dinitrotoluene, 2,4-	121-14-2	0.11	UE	0.28	0.11
TMW24	10/19/2009	Dinitrotoluene, 2,6-	606-20-2	0.13	UE	0.28	0.13
TMW24	10/19/2009	Dinitrotoluene, 2-Amino-4,6-	35572-78-2	0.070	UE	0.28	0.070
TMW24	10/19/2009	Dinitrotoluene, 4-Amino-2,6-	19406-51-0	0.14	UE	0.28	0.14
TMW24	10/19/2009	Hexahydro-1,3,5-Trinitro-1,3,5-Triazine (RDX)	121-82-4	0.15	UE	0.28	0.15
TMW24	10/19/2009	Nitrobenzene	98-95-3	0.12	UE	0.28	0.12
TMW24	10/19/2009	Nitrotoluene, m-	99-08-1	0.14	UE	0.28	0.14
TMW24	10/19/2009	Nitrotoluene, o-	88-72-2	0.090	UE	0.28	0.090
TMW24	10/19/2009	Nitrotoluene, p-	99-99-0	0.16	UE	0.28	0.16
TMW24	10/19/2009	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	2691-41-0	0.10	UE	0.55	0.10
TMW24	10/19/2009	Tetryl (Trinitrophenylmethylnitramine)	479-45-8	0.10	UE	0.28	0.10
TMW24	10/19/2009	Trinitrobenzene, 1,3,5-	99-35-4	0.11	UE	0.28	0.11
TMW24	10/19/2009	Trinitrotoluene, 2,4,6-	118-96-7	0.15	UE	0.28	0.15

[1] CAS Registry Numbers, which is a registered trademark of the American Chemical Society. CAS recommends the verification of the CAS Registry Numbers through CAS Client Services.

Table 1–7. Nitrate and Nitrite analyzed according to the U.S. Environmental Protection Agency's method 300.1.

[CAS, Chemical Abstract Services; mg/L, milligrams per liter; —, unqualified result; U, undetected; E, estimated concentration]

Site designation	Collection date	Analyte	CAS number[1]	Result (mg/L)	Qualifier	Laboratory reporting level (mg/L)	Laboratory detection limit (mg/L)
MW01	10/22/2009	Nitrate as nitrogen	14797-55-8	8.2	—	0.50	0.017
MW01	10/22/2009	Nitrite as nitrogen	14797-65-0	0.040	E	0.50	0.015
MW02	10/22/2009	Nitrate as nitrogen	14797-55-8	0.55	—	0.50	0.017
MW02	10/22/2009	Nitrite as nitrogen	14797-65-0	0.015	U	0.50	0.015
MW03	10/23/2009	Nitrate as nitrogen	14797-55-8	14	—	0.50	0.017
MW03	10/23/2009	Nitrite as nitrogen	14797-65-0	0.14	E	0.50	0.015
MW18D	10/23/2009	Nitrate as nitrogen	14797-55-8	0.23	E	0.50	0.017
MW18D	10/23/2009	Nitrite as nitrogen	14797-65-0	0.015	U	0.50	0.015
MW20	10/23/2009	Nitrate as nitrogen	14797-55-8	30	—	0.50	0.017
MW20	10/23/2009	Nitrite as nitrogen	14797-65-0	4.4	—	0.50	0.015
MW22D	10/21/2009	Nitrate as nitrogen	14797-55-8	18	—	0.50	0.017
MW22D	10/21/2009	Nitrite as nitrogen	14797-65-0	0.015	U	0.50	0.015
SMW01	10/24/2009	Nitrate as nitrogen	14797-55-8	0.017	U	0.50	0.017
SMW01	10/24/2009	Nitrite as nitrogen	14797-65-0	0.020	E	0.50	0.015
TMW01	10/14/2009	Nitrate as nitrogen	14797-55-8	9.1	—	0.50	0.017
TMW01	10/14/2009	Nitrite as nitrogen	14797-65-0	0.10	E	0.50	0.015
TMW03	10/14/2009	Nitrate as nitrogen	14797-55-8	170	—	5.00	0.170
TMW03	10/14/2009	Nitrite as nitrogen	14797-65-0	0.66	—	0.50	0.015
TMW04	10/14/2009	Nitrate as nitrogen	14797-55-8	51	—	0.50	0.017
TMW04	10/14/2009	Nitrite as nitrogen	14797-65-0	0.20	E	0.50	0.015
TMW06	10/17/2009	Nitrate as nitrogen	14797-55-8	26	E	0.50	0.017
TMW06	10/17/2009	Nitrite as nitrogen	14797-65-0	0.15	E	0.50	0.015
TMW07	10/20/2009	Nitrate as nitrogen	14797-55-8	0.18	E	0.50	0.017
TMW07	10/20/2009	Nitrite as nitrogen	14797-65-0	0.015	U	0.50	0.015
TMW08	10/17/2009	Nitrate as nitrogen	14797-55-8	0.42	E	0.50	0.017
TMW08	10/17/2009	Nitrite as nitrogen	14797-65-0	1.6	E	0.50	0.015
TMW10	10/19/2009	Nitrate as nitrogen	14797-55-8	0.080	E	0.50	0.017
TMW10	10/19/2009	Nitrite as nitrogen	14797-65-0	0.015	U	0.50	0.015
TMW11	10/20/2009	Nitrate as nitrogen	14797-55-8	0.25	E	0.50	0.017
TMW11	10/20/2009	Nitrite as nitrogen	14797-65-0	0.030	E	0.50	0.015
TMW13	10/22/2009	Nitrate as nitrogen	14797-55-8	2.2	—	0.50	0.017
TMW13	10/22/2009	Nitrite as nitrogen	14797-65-0	0.015	U	0.50	0.015
TMW15	10/26/2009	Nitrate as nitrogen	14797-55-8	1.0	—	0.50	0.017
TMW15	10/26/2009	Nitrite as nitrogen	14797-65-0	0.015	U	0.50	0.015
TMW21	10/24/2009	Nitrate as nitrogen	14797-55-8	9.1	—	0.50	0.017
TMW21	10/24/2009	Nitrite as nitrogen	14797-65-0	0.060	E	0.50	0.015
TMW22	10/19/2009	Nitrate as nitrogen	14797-55-8	7.5	—	0.50	0.017
TMW22	10/19/2009	Nitrite as nitrogen	14797-65-0	0.24	E	0.50	0.015
TMW23	10/19/2009	Nitrate as nitrogen	14797-55-8	39	—	0.50	0.017
TMW23	10/19/2009	Nitrite as nitrogen	14797-65-0	0.10	E	0.50	0.015
TMW24	10/19/2009	Nitrate as nitrogen	14797-55-8	0.017	U	0.50	0.017
TMW24	10/19/2009	Nitrite as nitrogen	14797-65-0	0.015	U	0.50	0.015
TMW25	10/23/2009	Nitrate as nitrogen	14797-55-8	0.89	—	0.50	0.017
TMW25	10/23/2009	Nitrite as nitrogen	14797-65-0	0.015	U	0.50	0.015
TMW26	10/17/2009	Nitrate as nitrogen	14797-55-8	0.050	E	0.50	0.017
TMW26	10/17/2009	Nitrite as nitrogen	14797-65-0	0.015	U	0.50	0.015
TMW29	10/20/2009	Nitrate as nitrogen	14797-55-8	4.7	—	0.50	0.017
TMW29	10/20/2009	Nitrite as nitrogen	14797-65-0	0.11	E	0.50	0.015

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[1] CAS Registry Numbers, which is a registered trademark of the American Chemical Society. CAS recommends the verification of the CAS Registry Numbers through CAS Client Services.

Table 1–8. Perchlorate analyzed according to the U.S. Environmental Protection Agency's method SW-846 6860.

[CAS, Chemical Abstract Services; µg/L, micrograms per liter; U, undetected; —, unqualified result; E, estimated concentration]

Site designation	Collection date	Analyte	CAS number[1]	Result (µg/L)	Qualifier	Laboratory reporting level (µg/L)	Laboratory detection limit (µg/L)
MW22D	10/21/2009	Perchlorate	14797-73-0	0.062	U	0.2	0.062
MW22S	10/22/2009	Perchlorate	14797-73-0	0.062	U	0.2	0.062
TMW01	10/14/2009	Perchlorate	14797-73-0	260	—	2.0	0.62
TMW03	10/14/2009	Perchlorate	14797-73-0	1.0	—	0.2	0.062
TMW04	10/14/2009	Perchlorate	14797-73-0	0.85	—	0.2	0.062
TMW10	10/19/2009	Perchlorate	14797-73-0	0.62	U	2.0	0.62
TMW11	10/20/2009	Perchlorate	14797-73-0	0.12	E	0.2	0.062
TMW15	10/26/2009	Perchlorate	14797-73-0	0.062	U	0.2	0.062
TMW16	10/20/2009	Perchlorate	14797-73-0	0.062	U	0.2	0.062
TMW22	10/19/2009	Perchlorate	14797-73-0	0.62	U	2.0	0.62
TMW23	10/19/2009	Perchlorate	14797-73-0	0.062	U	0.2	0.062
TMW24	10/19/2009	Perchlorate	14797-73-0	0.62	U	2.0	0.62
TMW29	10/20/2009	Perchlorate	14797-73-0	0.062	U	0.2	0.062

[1] CAS Registry Numbers, which is a registered trademark of the American Chemical Society. CAS recommends the verification of the CAS Registry Numbers through CAS Client Services

Table 1–9. Detected volatile organic compounds and diesel and gasoline range organics (U.S. Environmental Protection Agency, 2009b).

[CAS, Chemical Abstract Services; µg/L, micrograms per liter; E, estimated concentration; —, unqualified result; *, exceeds the U.S. Environmental Protection Agency's Maximum Contaminant Limit of 5.0 µg/L for 1,2-dichloroethane.]

Site designation	Collection date	Analyte	CAS number[1]	Result (µg/L)	Qualifier	Laboratory reporting level (µg/L)	Laboratory detection limit (µg/L)
Detected volatile organic compounds analyzed according to the U.S. Environmental Protection Agency's method SW-846 8260C							
MW01	10/22/2009	Dichloroethane, 1,2-	107-06-2	1.2	E	0.50	0.20
MW02	10/22/2009	Methyl tert-Butyl Ether (MTBE)	1634-04-4	0.40	E	0.50	0.20
MW02	10/22/2009	Dichloroethane, 1,2-	107-06-2	0.70	—	0.50	0.20
MW18D	10/23/2009	Carbon Disulfide	75-15-0	1.2	—	0.50	0.10
MW18D	10/23/2009	Dichloroethane, 1,2-	107-06-2	120*	—	0.50	0.20
MW20	10/23/2009	Bromomethane	74-83-9	1.2	E	0.50	0.10
MW20	10/23/2009	Dichloroethane, 1,1-	75-34-3	0.20	E	0.50	0.10
MW20	10/23/2009	Dichloroethane, 1,2-	107-06-2	10*	E	0.50	0.20
MW20	10/23/2009	Chlormethane	74-87-3	0.40	E	0.50	0.10
MW20	10/23/2009	Toluene	108-88-3	0.20	E	0.50	0.20
MW22S	10/19/2009	Dichloroethane, 1,1-	75-34-3	0.60	—	0.50	0.20
MW22S	10/19/2009	Dichloroethane, 1,2-	107-06-2	0.70	—	0.50	0.20
MW22S	10/19/2009	Trichloroethane, 1,1,1-	75-09-2	3.40	—	0.50	0.10
Diesel and gasoline range organics analyzed according to the U.S. Environmental Protection Agency's method SW-846 8015B							
MW18D	10/23/2009	Diesel Range Organics	none	58	—	53	36
MW20	10/23/2009	Diesel Range Organics	none	61	—	50	34
MW22S	10/19/2009	Diesel Range Organics	none	58	—	50	34
MW22D	10/21/2009	Diesel Range Organics	none	70	—	50	34
MW18D	10/23/2009	Gasoline Range Organics	none	12	E	1,000	10
MW20	10/23/2009	Gasoline Range Organics	none	15	E	1,000	10

[1] CAS Registry Numbers, which is a registered trademark of the American Chemical Society. CAS recommends the verification of the CAS Registry Numbers through CAS Client Services.

Table 1–10. Field parameters.

[µS/cm, microsiemens per centimeter at 25 degrees Celsius; mg/L, milligrams per liter; NTU, Nephelometric turbidity units]

Site designation	Collection date	Field parameter	Result	Units
MW01	10/13/2009	Conductivity	3,560	µS/cm
MW01	10/13/2009	Dissolved oxygen	2.99	mg/L
MW01	10/13/2009	pH	7.63	Standard units
MW01	10/13/2009	Temperature	14.58	Degrees Celsius
MW01	10/13/2009	Turbidity	366.80	NTU
MW02	10/13/2009	Conductivity	2,450	µS/cm
MW02	10/13/2009	Dissolved oxygen	3.34	mg/L
MW02	10/13/2009	pH	7.00	Standard units
MW02	10/13/2009	Temperature	14.80	Degrees Celsius
MW03	10/23/2009	Conductivity	5,380	µS/cm
MW03	10/23/2009	Dissolved oxygen	1.52	mg/L
MW03	10/23/2009	pH	7.28	Standard units
MW03	10/23/2009	Temperature	14.38	Degrees Celsius
MW03	10/23/2009	Turbidity	0.61	NTU
MW20	10/23/2009	Conductivity	1,900	µS/cm
MW20	10/23/2009	Dissolved oxygen	1.14	mg/L
MW20	10/23/2009	pH	6.87	Standard units
MW20	10/23/2009	Temperature	13.81	Degrees Celsius
MW20	10/23/2009	Turbidity	4.30	NTU
MW22D	10/21/2009	Conductivity	5,330	µS/cm
MW22D	10/21/2009	Dissolved oxygen	0.90	mg/L
MW22D	10/21/2009	pH	7.34	Standard units
MW22D	10/21/2009	Temperature	14.12	Degrees Celsius
MW22D	10/21/2009	Turbidity	0.64	NTU
MW22S	10/19/2009	Conductivity	4,640	µS/cm
MW22S	10/19/2009	Dissolved oxygen	5.66	mg/L
MW22S	10/19/2009	pH	7.41	Standard units
MW22S	10/19/2009	Temperature	15.17	Degrees Celsius
MW22S	10/19/2009	Turbidity	137.10	NTU
SMW01	10/24/2009	Conductivity	2,050	µS/cm
SMW01	10/24/2009	Dissolved oxygen	1.28	mg/L
SMW01	10/24/2009	pH	7.75	Standard units
SMW01	10/24/2009	Temperature	11.62	Degrees Celsius
SMW01	10/24/2009	Turbidity	7.07	NTU
TMW01	10/14/2009	Conductivity	2,810	µS/cm
TMW01	10/14/2009	Dissolved oxygen	2.91	mg/L
TMW01	10/14/2009	pH	7.65	Standard units
TMW01	10/14/2009	Temperature	15.91	Degrees Celsius
TMW01	10/14/2009	Turbidity	4.87	NTU
TMW03	10/14/2009	Conductivity	4,320	µS/cm
TMW03	10/14/2009	Dissolved oxygen	2.26	mg/L

Table 1–10. Field parameters.—Continued

[µS/cm, microsiemens per centimeter at 25 degrees Celsius; mg/L, milligrams per liter; NTU, Nephelometric turbidity units]

Site designation	Collection date	Field parameter	Result	Units
TMW03	10/14/2009	pH	7.80	Standard units
TMW03	10/14/2009	Temperature	14.54	Degrees Celsius
TMW03	10/14/2009	Turbidity	13.85	NTU
TMW04	10/14/2009	Conductivity	3,940	µS/cm
TMW04	10/14/2009	Dissolved oxygen	2.58	mg/L
TMW04	10/14/2009	pH	7.97	Standard units
TMW04	10/14/2009	Temperature	13.74	Degrees Celsius
TMW04	10/14/2009	Turbidity	246.90	NTU
TMW06	10/17/2009	Conductivity	4,950	µS/cm
TMW06	10/17/2009	Dissolved oxygen	1.61	mg/L
TMW06	10/17/2009	pH	7.52	Standard units
TMW06	10/17/2009	Temperature	15.92	Degrees Celsius
TMW06	10/17/2009	Turbidity	1.20	NTU
TMW07	10/19/2009	Conductivity	5,340	µS/cm
TMW07	10/19/2009	Dissolved oxygen	3.93	mg/L
TMW07	10/19/2009	pH	7.81	Standard units
TMW07	10/19/2009	Temperature	13.20	Degrees Celsius
TMW07	10/19/2009	Turbidity	459.00	NTU
TMW08	10/17/2009	Conductivity	1,640	µS/cm
TMW08	10/17/2009	Dissolved oxygen	1.28	mg/L
TMW08	10/17/2009	pH	7.38	Standard units
TMW08	10/17/2009	Temperature	14.82	Degrees Celsius
TMW08	10/17/2009	Turbidity	78.42	NTU
TMW10	10/19/2009	Conductivity	6,740	µS/cm
TMW10	10/19/2009	Dissolved oxygen	0.06	mg/L
TMW10	10/19/2009	pH	7.65	Standard Units
TMW10	10/19/2009	Temperature	15.20	Degrees Celsius
TMW10	10/19/2009	Turbidity	7.09	NTU
TMW11	10/20/2009	Conductivity	2,200	µS/cm
TMW11	10/20/2009	Dissolved oxygen	2.62	mg/L
TMW11	10/20/2009	pH	7.95	Standard Units
TMW11	10/20/2009	Temperature	18.05	Degrees Celsius
TMW11	10/20/2009	Turbidity	49.05	NTU
TMW13	10/22/2009	Conductivity	2,350	µS/cm
TMW13	10/22/2009	Dissolved oxygen	1.62	mg/L
TMW13	10/22/2009	pH	7.51	Standard Units
TMW13	10/22/2009	Temperature	14.45	Degrees Celsius
TMW13	10/22/2009	Turbidity	0.33	NTU
TMW15	10/26/2009	Conductivity	2,300	µS/cm
TMW15	10/26/2009	Dissolved oxygen	1.85	mg/L
TMW15	10/26/2009	pH	7.61	Standard Units

Table 1–10. Field parameters.—Continued

[µS/cm, microsiemens per centimeter at 25 degrees Celsius; mg/L, milligrams per liter; NTU, Nephelometric turbidity units]

Site designation	Collection date	Field parameter	Result	Units
TMW15	10/26/2009	Temperature	13.07	Degrees Celsius
TMW15	10/26/2009	Turbidity	1.55	NTU
TMW21	10/24/2009	Conductivity	2,640	µS/cm
TMW21	10/24/2009	Dissolved oxygen	0.83	mg/L
TMW21	10/24/2009	pH	7.71	Standard Units
TMW21	10/24/2009	Temperature	14.28	Degrees Celsius
TMW21	10/24/2009	Turbidity	131.10	NTU
TMW22	10/13/2009	Conductivity	3,490	µS/cm
TMW22	10/13/2009	Dissolved oxygen	0.24	mg/L
TMW22	10/13/2009	pH	7.77	Standard Units
TMW22	10/13/2009	Temperature	12.85	Degrees Celsius
TMW23	10/13/2009	Conductivity	3,250	µS/cm
TMW23	10/13/2009	Dissolved oxygen	0.40	mg/L
TMW23	10/13/2009	pH	7.79	Standard Units
TMW23	10/13/2009	Temperature	13.05	Degrees Celsius
TMW23	10/13/2009	Turbidity	110.60	NTU
TMW24	10/19/2009	Conductivity	3,840	µS/cm
TMW24	10/19/2009	Dissolved oxygen	2.12	mg/L
TMW24	10/19/2009	pH	7.84	Standard Units
TMW24	10/19/2009	Temperature	19.97	Degrees Celsius
TMW24	10/19/2009	Turbidity	1.88	NTU
TMW26	10/17/2009	Conductivity	3,590	uS/cm
TMW26	10/17/2009	DO	1.01	mg/L
TMW26	10/17/2009	pH	7.96	Standard Units
TMW26	10/17/2009	Temperature	14.67	Degrees Celsius
TMW26	10/17/2009	Turbidity	39.68	NTU
TMW27	10/24/2009	Conductivity	1,530	uS/cm
TMW27	10/24/2009	DO	1.10	mg/L
TMW27	10/24/2009	pH	7.77	Standard Units
TMW27	10/24/2009	Temperature	14.07	Degrees Celsius
TMW27	10/24/2009	Turbidity	3.10	NTU
TMW28	10/19/2009	Conductivity	1,590	uS/cm
TMW28	10/19/2009	DO	0.08	mg/L
TMW28	10/19/2009	pH	7.65	Standard Units
TMW28	10/19/2009	Temperature	17.38	Degrees Celsius
TMW28	10/19/2009	Turbidity	25.80	NTU
TMW29	10/14/2009	Conductivity	2,520	uS/cm
TMW29	10/14/2009	DO	4.41	mg/L
TMW29	10/14/2009	pH	7.88	Standard Units
TMW29	10/14/2009	Temperature	12.76	Degrees Celsius
TMW29	10/14/2009	Turbidity	705.40	NTU

Table 1–11. Stable isotopes of water.

[‰, per mil; stable isotope ratios for ^{2}Hydrogen(^{2}H)/^{1}Hydrogen (^{1}H) and ^{18}Oxygen(^{18}O)/^{16}Oxygen (^{16}O) are reported in the standard delta notation (δ), the ratio of the heavier isotope to the more common lighter isotope of that element, relative to Vienna Mean Standard Ocean Water]

Site designation	Collection date	Analyte	Result (‰)
MW01	10/22/2009	δ^{2}H	-99.4
MW01	10/22/2009	δ^{18}O	-13.35
MW02	10/22/2009	δ^{2}H	-102.0
MW02	10/22/2009	δ^{18}O	-13.75
MW03	10/23/2009	δ^{2}H	-93.7
MW03	10/23/2009	δ^{18}O	-12.49
MW18D	10/23/2009	δ^{2}H	-79.9
MW18D	10/23/2009	δ^{18}O	-10.38
MW20	10/23/2009	δ^{2}H	-75.0
MW20	10/23/2009	δ^{18}O	-9.55
MW22D	10/21/2009	δ^{2}H	-98.3
MW22D	10/21/2009	δ^{18}O	-13.14
MW22S	10/19/2009	δ^{2}H	-83.1
MW22S	10/19/2009	δ^{18}O	-10.99
Production well	11/9/2009	δ^{2}H	-107.0
Production well	11/9/2009	δ^{18}O	-14.35
SMW01	10/24/2009	δ^{2}H	-78.3
SMW01	10/24/2009	δ^{18}O	-10.56
TMW01	10/14/2009	δ^{2}H	-78.2
TMW01	10/14/2009	δ^{18}O	-10.26
TMW03	10/14/2009	δ^{2}H	-82.0
TMW03	10/14/2009	δ^{18}O	-10.48
TMW04	10/14/2009	δ^{2}H	-84.0
TMW04	10/14/2009	δ^{18}O	-10.64
TMW06	10/17/2009	δ^{2}H	-83.2
TMW06	10/17/2009	δ^{18}O	-11.04
TMW07	10/20/2009	δ^{2}H	-78.5
TMW07	10/20/2009	δ^{18}O	-10.16
TMW08	10/17/2009	δ^{2}H	-82.3
TMW08	10/17/2009	δ^{18}O	-10.73
TMW10	10/19/2009	δ^{2}H	-99.4
TMW10	10/19/2009	δ^{18}O	-13.37
TMW11	10/20/2009	δ^{2}H	-79.2
TMW11	10/20/2009	δ^{18}O	-10.62
TMW13	10/22/2009	δ^{2}H	-83.2
TMW13	10/22/2009	δ^{18}O	-11.11
TMW15	10/26/2009	δ^{2}H	-80.6
TMW15	10/26/2009	δ^{18}O	-10.80
TMW21	10/24/2009	δ^{2}H	-85.6
TMW21	10/24/2009	δ^{18}O	-11.64
TMW22	10/19/2009	δ^{2}H	-79.7
TMW22	10/19/2009	δ^{18}O	-10.53
TMW23	10/19/2009	δ^{2}H	-84.2
TMW23	10/19/2009	δ^{18}O	-11.17
TMW24	10/19/2009	δ^{2}H	-75.8
TMW24	10/19/2009	δ^{18}O	-9.99
TMW25	10/23/2009	δ^{2}H	-79.1
TMW25	10/23/2009	δ^{18}O	-10.33
TMW26	10/17/2009	δ^{2}H	-74.3
TMW26	10/17/2009	δ^{18}O	-9.99
TMW27	10/24/2009	δ^{2}H	-74.1
TMW27	10/24/2009	δ^{18}O	-9.91
TMW29	10/20/2009	δ^{2}H	-83.2
TMW29	10/20/2009	δ^{18}O	-11.20

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