Prepared in cooperation with the
New York State Department of Environmental Conservation

Groundwater Quality in the Mohawk River Basin, New York, 2011

Open-File Report 2013–1021

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

Cover. (Clockwise from left) A domestic well in Herkimer County, New York (photograph by Carolyn VanAlstyne); a production well in Schoharie County, New York (photograph by Paul M. Heisig); a U.S. Geological Survey scientist sampling a well in Herkimer County, New York (photograph by Paul M. Heisig).

Prepared in cooperation with the
New York State Department of Environmental Conservation

Groundwater Quality in the Mohawk River Basin, New York, 2011

By Elizabeth A. Nystrom and Tia-Marie Scott

Open-File Report 2013–1021

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

U.S. Department of the Interior
KEN SALAZAR, Secretary

U.S. Geological Survey
Marcia K. McNutt, Director

U.S. Geological Survey, Reston, Virginia: 2013

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

For an overview of USGS information products, including maps, imagery, and publications, visit *http://www.usgs.gov/pubprod*

To order this and other USGS information products, visit *http://store.usgs.gov*

Suggested citation:
Nystrom, E.A., and Scott, T., 2013, Groundwater quality in the Mohawk River Basin, New York, 2011: U.S. Geological Survey Open-File Report 2013-1021, 43 p., at http://pubs.usgs.gov/of/2013/1021/.

Contents

Abstract 1
Introduction 1
Objective and Approach 2
Purpose and Scope 3
Hydrogeologic Setting 3
Methods of Investigation 5
Well Selection 5
Sampling Methods 9
Analytical Methods 10
Quality Control Samples 11
Groundwater Quality 11
Physiochemical Properties 12
Dissolved Gases 13
Major Ions 13
Nutrients and Total Organic Carbon 14
Trace Elements 15
Pesticides 17
Volatile Organic Compounds 17
Radionuclides 17
Bacteria 18
Well sampled in 2002, 2006, and 2011 18
Summary 19
References Cited 19
Appendix: Results of Water-Sample Analyses 24

Figures

Maps showing:
Figure 1. Topography and geography of the Mohawk River Basin, New York. 4
Figure 2. Generalized bedrock geology of the Mohawk River Basin, New York, and locations of wells sampled in 2011. 6
Figure 3. Generalized surficial geology of the Mohawk River Basin, New York, and locations of wells sampled in 2011. 7

Tables

Table 1. Previous groundwater-quality studies and reports. 2
Table 2. Information on wells from which water samples were collected in the Mohawk River Basin, New York, 2011. 8
Table 3. Summary of information on wells from which water samples were collected in the Mohawk River Basin, New York, 2011. 9
Table 4. Drinking-water standards and summary statistics for physiochemical properties of groundwater samples from the Mohawk River Basin, New York, 2011 12
Table 5. Summary statistics for concentrations of dissolved gases in groundwater samples from the Mohawk River Basin, New York, 2011. 13

Table 6. Drinking-water standards and summary statistics for concentrations of major ions in groundwater samples from the Mohawk River Basin, New York, 2011. 14
Table 7. Drinking-water standards and summary statistics for concentrations of nutrients in groundwater samples from the Mohawk River Basin, New York, 2011.......... 15
Table 8. Drinking-water standards and summary statistics for concentrations of trace elements in groundwater samples from the Mohawk River Basin, New York, 2011. 16
Table 9. Drinking-water standards and summary statistics for concentrations of radionuclides in groundwater samples from the Mohawk River Basin, New York, 2011. 18

Appendix 1

Table 1-1. Constituents that were not detected in groundwater samples collected from 21 wells in the Mohawk River Basin, New York, 2011. 25
Table 1–2. Physiochemical properties of groundwater samples collected in the Mohawk River Basin, New York, 2011. 26
Table 1–3. Concentrations of dissolved gases in groundwater samples collected in the Mohawk River Basin, New York, 2011. 27
Table 1–4. Concentrations of major ions in groundwater samples collected in the Mohawk River Basin, New York, 2011. 28
Table 1–5. Concentrations of nutrients and organic carbon in groundwater samples collected in the Mohawk River Basin, New York, 2011. 30
Table 1–6. Concentrations of trace elements in groundwater samples collected in the Mohawk River Basin, New York, 2011. 31
Table 1–7. Concentrations of pesticides detected in groundwater samples collected in the Mohawk River Basin, New York, 2011. 34
Table 1–8. Concentrations of volatile organic compounds detected in groundwater samples collected in the Mohawk River Basin, New York, 2011.......... 35
Table 1–9. Activities of radionuclides in groundwater samples from the Mohawk River Basin, New York, 2011... 36
Table 1–10. Bacteria in groundwater samples collected in the Mohawk River Basin, New York, 2011. 37
Table 1–11. Physiochemical properties and concentrations of nutrients in groundwater samples collected in the Mohawk River Basin, New York, 2002, 2006, and 2011. 38
Table 1–12. Concentrations of major ions in groundwater samples collected in the Mohawk River Basin, New York, 2002, 2006, and 2011. 39
Table 1–13. Concentrations of trace elements and radionuclides in groundwater samples in the Mohawk River Basin, New York, 2002, 2006, and 2011. 40
Table 1–14. Concentrations of pesticides and of volatile organic compounds detected in groundwater samples collected in the Mohawk River Basin, New York, 2002, 2006, and 2011. 42
Table 1–15. Bacteria in groundwater samples collected in the Mohawk River Basin, New York, 2006 and 2011. .. 43

Conversion Factors

Multiply	By	To obtain
	Length	
inch (in.)	2.54	centimeter (cm)
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
	Area	
square mile (mi^2)	259.0	hectare (ha)
square mile (mi^2)	2.590	square kilometer (km^2)
	Volume	
gallon (gal)	3.785	liter (L)
	Flow rate	
gallon per minute (gal/min)	0.06309	liter per second (L/s)
	Pressure	
inch of mercury at 60ºF (in Hg)	3.377	kilopascal (kPa)
	Radioactivity	
picocurie per liter (pCi/L)	0.037	becquerel per liter (Bq/L)

Temperature in degrees Celsius (°C) may be converted to degrees Fahrenheit (°F) as follows:
°F=(1.8×°C)+32
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).
Elevation, as used in this report, refers to distance above the vertical datum.
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).

List of Abbreviations and Acronyms

AMCL	Alternative maximum contaminant level
CFCL	USGS Chlorofluorocarbon Laboratory
CFU	Colony-forming units
cICP-MS	Collision/reaction cell inductively coupled plasma-mass spectrometry
CIAT	2-Chloro-4-isopropylamino-6-amino-*s*-triazine
GC-MS	Gas chromatography-mass spectrometry
GPS	Global positioning system
HPLC-MS	High-performance liquid chromatography-mass spectrometry
ICP-AES	Inductively coupled plasma-atomic emission spectrometry
ICP-MS	Inductively coupled plasma-mass spectrometry
ICP-OES	Inductively coupled plasma-optical emission spectrometry
LRL	Laboratory reporting level
MCL	Maximum contaminant level
MTBE	Methyl *tert*-butyl ether
NAVD 88	North American Vertical Datum of 1988
NWIS	National Water Information System
NWQL	USGS National Water Quality Laboratory
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
PERC	Tetrachloroethene
PVC	Polyvinyl chloride
SDWS	Secondary drinking-water standards
THM	Trihalomethane
USEPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey
VOC	Volatile organic compound

Groundwater Quality in the Mohawk River Basin, New York, 2011

By Elizabeth A. Nystrom and Tia-Marie Scott

Abstract

Water samples were collected from 21 production and domestic wells in the Mohawk River Basin in New York in July 2011 to characterize groundwater quality in the basin. The samples were collected and processed using standard U.S. Geological Survey procedures and were analyzed for 148 physiochemical properties and constituents, including dissolved gases, major ions, nutrients, trace elements, pesticides, volatile organic compounds (VOCs), radionuclides, and indicator bacteria.

The Mohawk River Basin covers 3,500 square miles in New York and is underlain by shale, sandstone, carbonate, and crystalline bedrock. The bedrock is overlain by till in much of the basin, but surficial deposits of saturated sand and gravel are present in some areas. Nine of the wells sampled in the Mohawk River Basin are completed in sand and gravel deposits, and 12 are completed in bedrock. Groundwater in the Mohawk River Basin was typically neutral or slightly basic; the water typically was very hard. Bicarbonate, chloride, calcium, and sodium were the major ions with the greatest median concentrations; the dominant nutrient was nitrate. Methane was detected in 15 samples. Strontium, iron, barium, boron, and manganese were the trace elements with the highest median concentrations. Four pesticides, all herbicides or their degradates, were detected in four samples at trace levels; three VOCs, including chloroform and two solvents, were detected in four samples. The greatest radon-222 activity, 2,300 picocuries per liter, was measured in a sample from a bedrock well, but the median radon activity was higher in samples from sand and gravel wells than in samples from bedrock wells. Coliform bacteria were detected in five samples with a maximum of 92 colony-forming units per 100 milliliters.

Water quality in the Mohawk River Basin is generally good, but concentrations of some constituents equaled or exceeded current or proposed Federal or New York State drinking-water standards. The standards exceeded are color (1 sample), pH (1 sample), sodium (9 samples), chloride (1 sample), sulfate (2 samples), dissolved solids (7 samples), aluminum (3 samples), iron (8 samples), manganese (6 samples), radon-222 (10 samples), and bacteria (5 samples). Fecal coliform bacteria and *Escherichia coli (E. coli)* were each detected in one sample. Concentrations of fluoride, nitrate, nitrite, antimony, arsenic, barium, beryllium, cadmium, chromium, copper, lead, mercury, selenium, silver, thallium, zinc, and uranium, and gross alpha activities, did not exceed existing drinking-water standards in any of the samples collected. Methane concentrations in two samples were greater than 28 milligrams per liter, and the maximum measured concentration was 44.3 milligrams per liter.

Introduction

Groundwater is used as a source of drinking water by approximately one-quarter of the population of New York State (Kenny and others, 2009). In 2002, the U.S. Geological Survey (USGS), in cooperation with the New York State Department of Environmental Conservation (NYSDEC), developed a program to evaluate groundwater quality throughout the major river basins in New York on a rotating basis. The program parallels the NYSDEC Rotating Intensive Basin Study program (http://www.dec.ny.gov/chemical/30951.html), which evaluates surface-water quality on a 5-year cycle by sampling in 2 or 3 of the 14 major river basins in the State each year, and supports NYSDEC's responsibilities under Section 305(b) of the Clean Water Act Amendments of 1977 to report on the chemical quality of groundwater within New York (U.S. Environmental Protection Agency, 1997).

The groundwater-quality program began in 2002 with a pilot study in the Mohawk River Basin and has continued throughout upstate New York since then (table 1). Sampling completed in 2008 represents the conclusion of a first round of groundwater-quality sampling throughout New York State (excluding Long Island, which is monitored through local county programs). Groundwater-quality sampling was conducted in 2011 in the Mohawk River Basin, Niagara and Allegheny River Basins, and Lake Erie and western Lake Ontario tributaries.

Table 1. Previous groundwater-quality studies and reports.

Study area	Year	Report	Reference
Mohawk River Basin	**2002**	**Water-Data Report NY-02-1**	**Butch and others, 2003**
Chemung River Basin	2003	Open-File Report 2004-1329	Hetcher-Aguila, 2005
Lake Champlain Basin	2004	Open-File Report 2006-1088	Nystrom, 2006
Susquehanna River Basin	2004	Open-File Report 2006-1161	Hetcher-Aguila and Eckhardt, 2006
Delaware River Basin	2005	Open-File Report 2007-1098	Nystrom, 2007b
Genesee River Basin	2005	Open-File Report 2007-1093	Eckhardt and others, 2007
St. Lawrence River Basin	2005	Open-File Report 2007-1066	Nystrom, 2007a
Mohawk River Basin	**2006**	**Open-File Report 2008-1086**	**Nystrom, 2008**
Western New York	2006	Open-File Report 2008-1140	Eckhardt and others, 2008
Central New York	2007	Open-File Report 2009-1257	Eckhardt and others, 2009
Upper Hudson River Basin	2007	Open-File Report 2009-1240	Nystrom, 2009
Chemung River Basin	2008	Open-File Report 2011-1112	Risen and Reddy, 2011a
Eastern Lake Ontario Basin	2008	Open-File Report 2011-1074	Risen and Reddy, 2011b
Lower Hudson River Basin	2008	Open-File Report 2010- 1197	Nystrom, 2010
Lake Champlain Basin	2009	Open-File Report 2011- 1180	Nystrom, 2011
Susquehanna River Basin	2009	Open-File Report 2012- 1045	Reddy and Risen, 2012
Delaware River Basin	2010	Open-File Report 2011- 1320	Nystrom, 2012
Genesee River Basin	2010	Open-File Report 2012- 1135	Reddy, 2012
St. Lawrence River Basin	2010	Open-File Report 2011- 1320	Nystrom, 2012

Objective and Approach

The objective of the groundwater-quality monitoring program is to quantify and report on ambient groundwater quality from bedrock and glacial-drift aquifers in upstate New York. Using consistent, standardized methods, groundwater-quality samples were collected from existing domestic and production wells using on-site, permanently installed pumps, then analyzed. Wells were selected to represent an approximately equal number of domestic and production wells, to represent an approximately equal number of bedrock and glacial-drift wells, and to provide a representative geographic distribution of samples with emphasis on areas of greatest groundwater use. As basins were sampled for the second or third time, approximately 20 percent of samples were collected from wells that previously have been sampled as part of the cycle of studies.

Samples were analyzed for a broad suite of constituents, including physiochemical properties and concentrations of dissolved gases, major ions, nutrients, trace elements, pesticides, volatile organic compounds (VOCs), radionuclides, and indicator bacteria. The resulting data set will be used to establish a groundwater-quality baseline for New York State, characterizing naturally occurring and background conditions, and to identify long-term trends. The data are made available through the USGS National Water Information System (NWIS) (http://nwis.waterdata.usgs.gov/ny/nwis/qw) and project reports.

Groundwater-quality samples were collected in the Mohawk River Basin (excluding the Schoharie subbasin) in 2002 and in the complete Mohawk River Basin in 2006 and 2011. In 2011, 21 environmental samples and 3 quality-assurance samples were collected during the month of July. Four of the wells sampled in 2011 were also sampled as part of this cycle of studies in 2002 and 2006 (Butch and others, 2003; and Nystrom, 2008).

Purpose and Scope

This report presents the findings of the 2011 study in the Mohawk River Basin, in which 21 groundwater-quality samples were collected during July 2011. The report (1) describes the hydrogeologic setting, sampled wells, and the methods of site selection, sample collection, and chemical analysis; (2) presents discussions of the analytical results; and (3) presents comparisons of the results of this study with results for selected wells in the Mohawk River Basin that were sampled in 2002 and 2006 (Butch and others, 2003; and Nystrom, 2008).

Hydrogeologic Setting

The Mohawk River Basin encompasses approximately 3,500 square miles (mi^2) in central New York (fig. 1) and all or parts of 14 counties, including all of Montgomery County, most of Schoharie and Schenectady Counties, part of Herkimer, Hamilton, Fulton, Greene, Oneida, Saratoga, and Albany Counties, and small parts of Lewis, Madison, Otsego, and Delaware Counties (fig. 1). The Mohawk River is a major tributary to the Hudson River; the major tributaries to the Mohawk River are the Schoharie and West Canada Creeks (fig. 1). The Mohawk River Basin contains three major reservoirs (fig. 1): the Schoharie Reservoir, which diverts water out of the basin as part of New York City's water-supply system; Hinckley Reservoir, which provides drinking water to the Utica area, and Delta Reservoir.

The highest elevations in the Mohawk River Basin are approximately 4,000 ft above the North American Vertical Datum of 1988 (NAVD 88) along the southern edge of the basin. The Mohawk River Valley runs from west to east along the middle of the basin; the lowest elevation (approximately 10 ft) in the basin is at the confluence of the Mohawk River and the Hudson River north of Troy, N.Y. (fig. 1). The Mohawk River Basin is predominantly forested, especially in upland areas, with urban and agricultural areas mainly in valleys and other low-lying areas (Vogelmann and others, 2001); urban centers and adjacent developed areas in the Mohawk River Basin include Schenectady, Utica, and Amsterdam (fig. 1).

The surficial material (fig. 2) throughout the basin was deposited primarily during the last glaciations of the Pleistocene epoch when the Wisconsin glaciers covered most of the Northeast (Reynolds, 1990). Till mantles the uplands and ice-contact, deltaic, fluvial-, and alluvial sand and gravel and lacustrine silt and clay are present in the valleys. Till and lacustrine silt and clay deposits generally have low yields of water, whereas the well-sorted, coarse-grained deposits form important aquifers in the basin. The valley-fill sand-and-gravel aquifers may produce yields of as much as 500 gallons per minute (gal/min) (Reynolds, 1990).

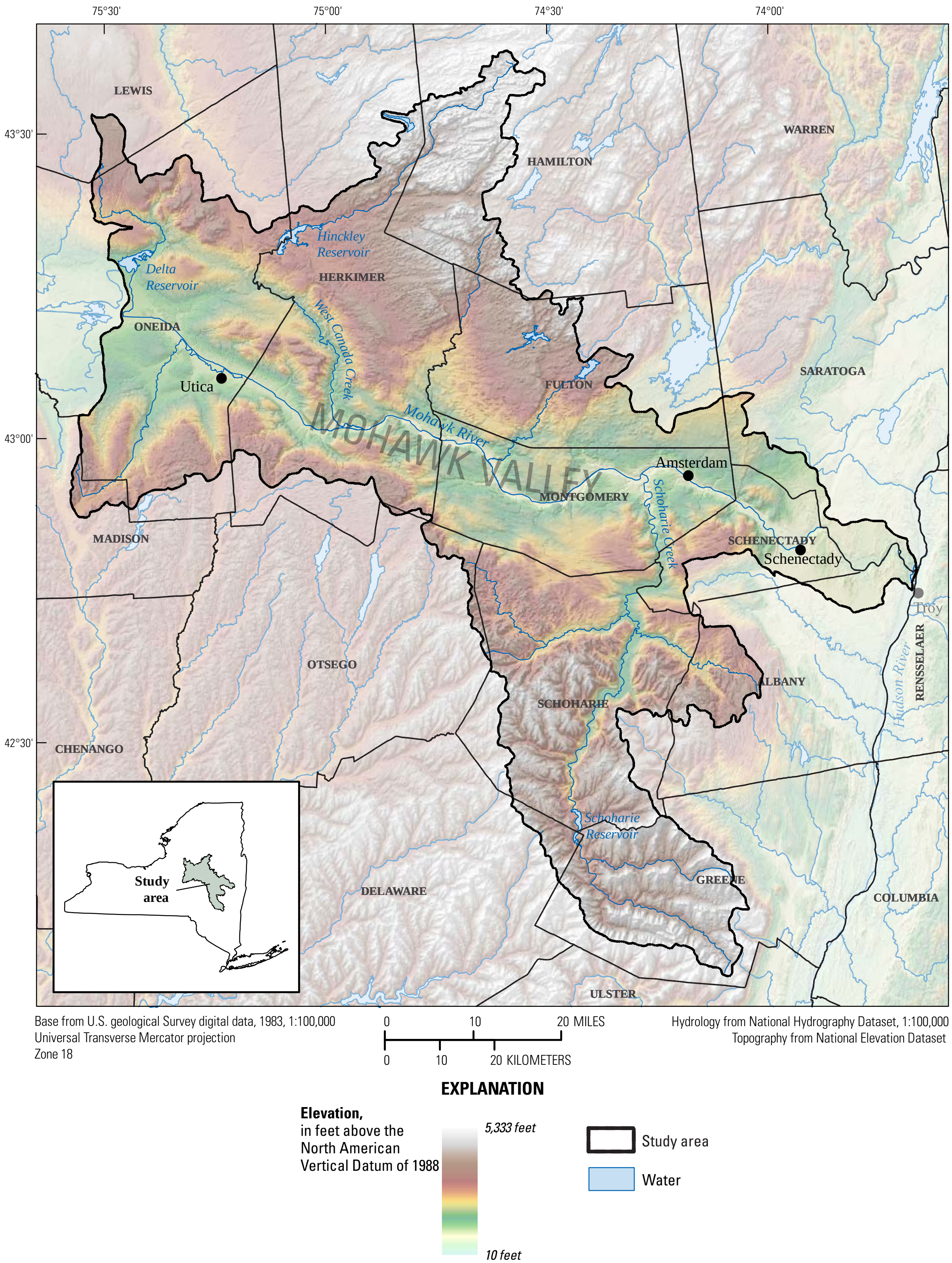

Figure 1. Map showing topography and geography of the Mohawk River Basin, New York.

Bedrock in the Mohawk River Basin (fig. 3) includes shale, sandstone, carbonate, and crystalline rocks. Black shale is present in the Mohawk Valley, with bands of carbonate rock along the edges of the valley. Bedrock in the southern part of the basin consists mainly of shale and sandstone, and bedrock in the northern part of the basin is mainly crystalline metamorphic rock. Of the bedrock aquifers in the basin, carbonate rocks generally produce the highest yields, and the crystalline rocks generally produce the lowest; the clastic rocks generally have low to moderate yields (Hammond and others, 1978).

Methods of Investigation

The methods used in this study, including (1) well-selection criteria, (2) sampling methods, and (3) analytical methods, were designed to maximize data precision, accuracy, and comparability. Groundwater-sample collection and processing followed standard USGS procedures as documented in the National Field Manual for the Collection of Water-Quality Data (U.S. Geological Survey, variously dated). Samples were analyzed by documented methods at the USGS National Water Quality Laboratory (NWQL) in Denver, Colorado, and other laboratories.

Well Selection

The 21 wells selected for sampling (figs. 2 and 3) represent forested, developed, and agricultural areas (table 2). The final selection of each well was based on the availability of well-construction data and hydrogeologic information for the well and its surrounding area. The study did not target specific municipalities, industries, or agricultural practices.

The domestic wells were selected on the basis of information from the NYSDEC Water Well program, which began in 2000. The program requires that licensed well drillers file a report with NYSDEC containing basic information about each well drilled, such as well and casing depth, diameter, yield, and a hydrogeologic log. Inspection of well-completion report data identified several hundred wells as potential sampling sites; well owners were each sent a letter requesting permission to sample the well and a questionnaire about the well. Well owners who granted permission were contacted later by phone to verify well information and to arrange a convenient time for sampling.

Production wells considered for sampling were identified through the U.S. Environmental Protection Agency (USEPA) Safe Drinking Water Information System, the New York State Department of Health (NYSDOH) Drinking Water Protection Program, and the NYSDEC Water Well program. Town officials and (or) water managers were sent letters requesting permission to sample a well, and follow-up phone calls were made to arrange a time for sampling. Well information, such as depth, was provided by water managers if a well-completion report was unavailable. The aquifer type indicated for sampled wells was assigned through inspection of hydrogeologic logs and published geologic maps, including Fisher and others (1970) and Cadwell (1991).

The characteristics of the wells sampled and the type of land cover surrounding each well are listed in table 2. The depths of the wells, the aquifer units from which samples were collected, and the numbers of production and domestic wells are summarized in table 3. Four wells sampled in 2011 (HE 622, OE1460, SA1501, and MT 406) were also sampled in 2002 and 2006 (Butch and others, 2003; Nystrom, 2008).

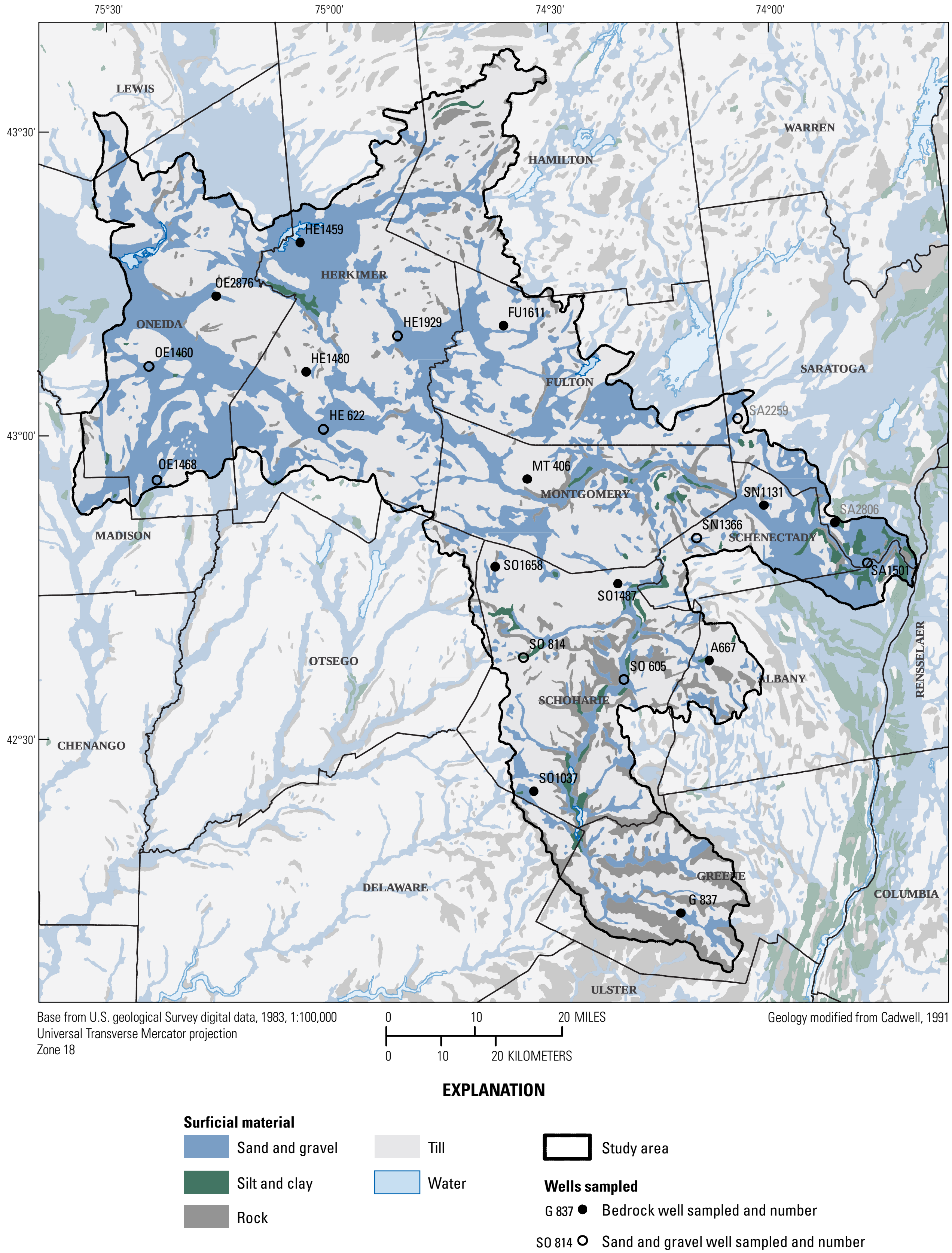

Figure 2. Map showing generalized bedrock geology of the Mohawk River Basin, New York, and locations of wells sampled in 2011.

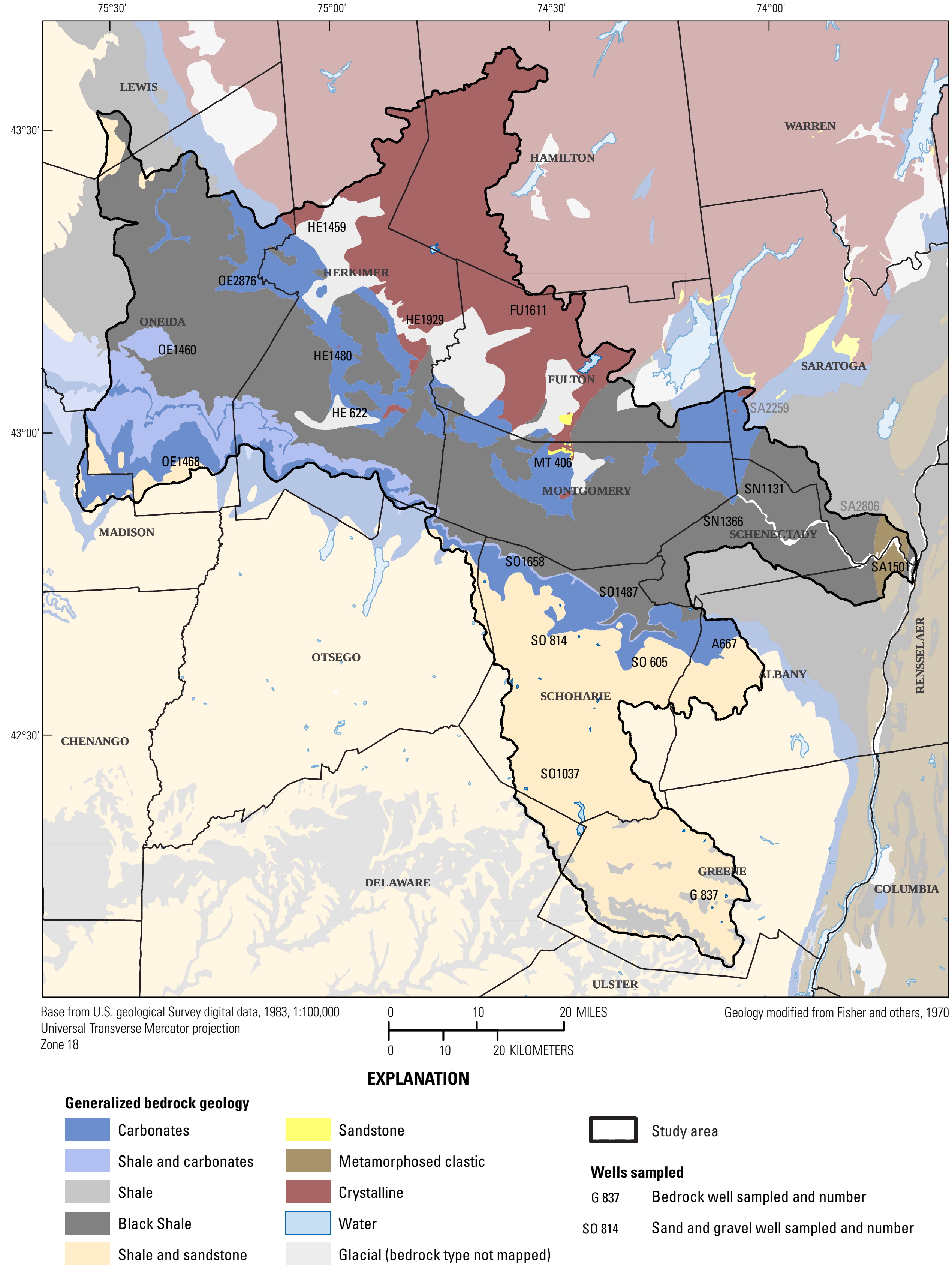

Figure 3. Map showing generalized surficial geology of the Mohawk River Basin, New York, and locations of wells sampled in 2011.

Table 2. Description of wells from which water samples were collected in the Mohawk River Basin, New York, 2011.

[--, unknown; well types: P, production; D, domestic. Land cover categories: D, developed; F, forested; A, agricultural; W, open water; WL, wetlands. Well locations are shown in figures 2 and 3]

Well number[1]	Date sampled	Well depth, feet below land surface	Casing depth, feet below land surface	Well type	Bedrock type	Land cover[2], percent by category, within 0.5-mile radius surrounding the well: D	F	A	W	WL
Sand and gravel wells										
HE 622	7/27/2011	52	--	P		67	5	14	9	5
HE1929	7/12/2011	81	81	D		6	41	5	13	36
OE1460	7/21/2011	28	--	P		16	22	52		9
OE1468	7/21/2011	49	39	P		26	13	59		2
SA1501	7/25/2011	30	--	P		10	10		24	55
SA2259	7/28/2011	40	40	D		4	33		49	14
SN1366	7/18/2011	395	395	D		7	67	12		14
SO 605	7/13/2011	36	32	P		37	5	53	2	2
SO 814	7/19/2011	80	65	P		41	43	16		
Bedrock wells										
A667	7/26/2011	226	179.7	P	Carbonate	10	31	40		19
FU1611	7/12/2011	245	20	D	Crystalline	6	39	1	32	22
G 837	7/26/2011	184	--	P	Shale and sandstone	43	53	1	2	1
HE1459	7/14/2011	279	89.75	D	Carbonate	10	38	7	12	34
HE1480	7/11/2011	160	46	D	Shale		22	74		4
MT 406	7/27/2011	815	--	P	Shale	7		93		1
OE2876	7/14/2011	270	102	D	Shale and carbonate	1	16	76		7
SA2806	7/25/2011	200	47	D	Shale and sandstone	21	16	14		48
SN1131	7/28/2011	120	31	D	Shale	3	91	5		1
SO1037	7/20/2011	190	70	D	Sandstone	4	64	22		9
SO1487	7/20/2011	380	20	D	Shale	10	68	20		3
SO1658	7/19/2011	402	100	P	Carbonate	22	25	33	3	18

[1] A, Albany County; FU, Fulton County; G, Greene County; HE, Herkimer County; MT, Montgomery County; OE, Oneida County; SA, Saratoga County; SN, Schenectady County; SO, Schoharie County.

[2] Determined from the National Land Cover Data set (Vogelmann and others, 2001).

Table 3. Summary of information on wells from which water samples were collected in the Mohawk River Basin, New York, 2011.

[bls, below land surface]

Type of well	Number of wells: Production	Domestic	Total
Wells completed in sand and gravel (depth 28 to 395 feet bls)	6	3	9
Wells completed in bedrock (depth 120 to 815 feet bls)	4	8	12
Carbonate bedrock	2	1	3
Shale and carbonate bedrock	0	1	1
Shale bedrock	1	3	4
Shale and sandstone bedrock	1	1	2
Sandstone bedrock	0	1	1
Crystalline bedrock	0	1	1
Total number of wells	10	11	21

Sampling Methods

Samples were collected and processed in accordance with documented USGS protocols (U.S. Geological Survey, variously dated). The samples were collected before any water-treatment system to be as representative of the aquifer water quality as possible. Most samples from domestic wells were collected from a spigot near the pressure tank; samples from production wells were collected at the spigot or faucet used for collection of raw-water samples by water managers.

At sites with garden-hose type spigots, samples were collected from one or more 10-ft lengths of Teflon tubing attached to the spigot. Domestic wells were purged after the tubing was connected by running to waste for at least 20 minutes at pumping rates ranging from about 2 to 5 gal/min or until at least one well-casing volume of water had passed the sampling point. Wells that had been used recently required removal of less than three well-casing volumes (U.S. Geological Survey, 2006). At least three well-casings of water were pumped from production wells before sampling; several were pumped for 1 hour or more prior to sampling, typically at rates of about 100 gal/min. During well purging, notes about the well and surrounding land and land use were recorded, including a global positioning system (GPS) measurement of latitude and longitude. After the well was purged, field measurements of water temperature, pH, specific conductance, and dissolved oxygen concentration were recorded at regular intervals until these values had stabilized, after which the sample was collected (U.S. Geological Survey, variously dated).

The flow rate for sample collection was adjusted to less than 0.5 gal/min when possible. The Teflon sampling tube was then connected to a sample-collection chamber constructed of a polyvinyl chloride (PVC) frame and a clear plastic chamber bag. The Teflon tubing and spigot-attachment equipment for each sample were pre-cleaned in the laboratory with a dilute phosphate-free detergent solution, followed by rinses with tap water and deionized water. Equipment for filtration of pesticide samples was rinsed with methanol as described in Wilde (2004).

Samples were collected and preserved in the sampling chamber according to standard USGS procedures. Samples for nutrient, major-ion, and some trace-element analyses were filtered through disposable (one-time use) 0.45-micrometer (µm) pore-size polyether sulfone capsule filters that were preconditioned in the laboratory with 3 liters (L) of deionized water the day of sample collection. Samples for pesticide analyses were filtered through baked 0.7-µm pore-size glass fiber filters. Ultra-pure nitric acid preservation was required for trace-element samples, except mercury, which was preserved with hydrochloric acid. Hydrochloric acid was added to VOC samples to kill bacteria that might degrade VOCs; samples for major-cation analysis and some samples for radiochemical analysis were preserved with ultra-pure nitric acid. Acid preservative was added after the collection of other samples to avoid the possibility of cross contamination by the acid preservative; for example, samples preserved with nitric acid were acidified after the collection of samples for nutrient analysis. Samples for bacterial analysis were collected in accordance with NYSDEC and NYSDOH protocols, except that the tap from which each water sample was collected was not flame sterilized. Water samples for radon analysis were collected through a septum chamber with a glass syringe, according to standard USGS procedures. Water samples for the analysis of dissolved gases were filled and sealed while submerged in a beaker of water to prevent exposure to the atmosphere. Water samples analyzed by NYSDOH-certified laboratories were collected in bottles provided by the analyzing laboratory. After collection, all water samples except those for radiochemical analyses were chilled to 4 degrees Celsius (°C) or less and were kept chilled until delivery to the analyzing laboratory. Bacterial samples were hand delivered to the analyzing laboratory within 6 hours of collection; all other samples were shipped by overnight delivery to the designated laboratories.

Most sampling sites had easy access to a garden-hose type spigot; however, some supply wells did not. Wells A667, HE622, OE1460, OE1468, SO605, SO814 were sampled from faucets using adapters to connect the Teflon tubing. Well SA1501 was sampled from a hydrant, and well SO1658 was sampled from a 4-inch discharge pipe at which water-system personnel routinely collect raw-water samples. The syringe for radon-222 sample collection at these sites was inserted directly into the flowing water in the throat of the tap to minimize sample exposure to the atmosphere.

Analytical Methods

Samples were analyzed for 148 physiochemical properties and constituents, including dissolved gases, major ions, nutrients, trace elements, pesticides, pesticide degradates, VOCs, radionuclides, and bacteria. Physiochemical properties such as water temperature, pH, dissolved oxygen concentration, and specific conductance were measured at the sampling site. Major ions, nutrients, total organic carbon, trace elements, radon-222, pesticides, pesticide degradates, and VOCs were analyzed at the USGS NWQL in Denver, Colo. Selected dissolved gases were analyzed at the USGS Chlorofluorocarbon Laboratory (CFCL) in Reston, Virginia. Gross alpha and gross beta radioactivities were analyzed at Eberline Services in Richmond, California. Indicator bacteria were analyzed at the NYSDOH-certified St. Peter's Bender Laboratory in Albany, N.Y.

Anion concentrations were measured by ion-exchange chromatography, and cation concentrations were measured by inductively coupled plasma-atomic emission spectrometry (ICP-AES), as described in Fishman (1993). Nutrients were analyzed by colorimetry, as described by Fishman (1993), and Kjeldahl digestion with photometric finish, as described by Patton and Truitt (2000). Total organic carbon samples were analyzed by high temperature combustion and catalytic oxidation for measurement by infrared detection according to Standard Method 5310 (American Public Health Association, 1998). Mercury concentrations were measured through cold vapor–atomic fluorescence spectrometry according to methods described by Garbarino and Damrau (2001). Arsenic, chromium, and nickel samples were analyzed by use of collision/reaction cell inductively coupled plasma-mass spectrometry (cICP-MS), as described by Garbarino and others (2006). The remaining trace elements were analyzed by ICP-AES (Struzeski and others, 1996), inductively coupled plasma-optical emission spectrometry (ICP-OES), and inductively coupled plasma-mass spectrometry (ICP-MS) (Garbarino and Struzeski, 1998). Procedures for in-bottle digestions for trace-element analyses described by Hoffman and others (1996) were followed. Radon-222 activities were measured through liquid-scintillation counting (ASTM International, 2006). Samples for pesticide analyses were processed as described by Wilde and others (2004) and were analyzed using gas chromatography-mass spectrometry (GC-MS) and high-performance liquid chromatography-mass spectrometry (HPLC-MS), as described by Zaugg and others (1995), Sandstrom and others (2001), and Furlong and others (2001). VOCs were analyzed by GC-MS using methods described by Connor and others (1998).

Gross alpha and gross beta radioactivities were measured through gas flow proportional counting according to USEPA method 900.0 (U.S. Environmental Protection Agency, 1980). Carbon dioxide and methane concentrations were measured through gas chromatography with flame ionization detection; dissolved nitrogen gas and argon concentrations were measured through gas chromatography with thermal conductivity detection. Indicator bacteria samples were tested for total coliform, fecal coliform, and *Escherichia coli (E. coli)* using membrane filtration through Standard Method 9222 (American Public Health Association, 1998); a heterotrophic plate count test (SM 9215 B) also was done.

Quality-Control Samples

In addition to the 21 groundwater samples, 1 field blank sample, 1 replicate sample, and 1 pesticide spike sample were collected for quality assurance. Constituents did not exceed laboratory reporting levels (LRLs) in the blank sample, except for total organic carbon, which was measured at 0.5 milligrams per liter (mg/L). The variability between replicate samples was greatest for unfiltered trace elements, gross alpha radioactivity, and radon-222. No VOCs or pesticides were detected in the replicate samples. The median recovery in the pesticide spike sample, which was collected at site A667, was 79 percent; constituents with 60 to 70 percent recovery include benfluralin, diazinon, dieldrin, fipronil sulfone, malathion, metribuzin, propyzamide, and tebuthiuron. Constituents with less than 50 percent recovery include fonofos (47 percent recovery), phorate (44 percent), terbufos (40 percent), disulfoton (30 percent), 2-chloro-4-isopropylamino-6-amino-*s*-triazine (CIAT, 25 percent), *p,p*'-DDE (23 percent), propargite (20 percent), and *cis*-permethrin (1 percent); of these compounds, disulfoton, CIAT, and propargite are known to have highly variable recovery rates in the analysis method used and are routinely coded as estimated values.

Groundwater Quality

Many of the constituents for which the groundwater samples were analyzed were not detected in any sample. Some concentrations are reported as "estimated." Estimated concentrations are typically reported when the detected value is less than the established LRL or when recovery of a compound has been shown to be highly variable (Childress and others, 1999). Concentrations of some constituents exceeded maximum contaminant levels (MCLs) or secondary drinking-water standards (SDWS) set by the USEPA (U.S. Environmental Protection Agency, 2009) or NYSDOH (New York State Department of Health, 2011). MCLs are enforceable standards for finished water in public water supplies; they are not enforceable for private homeowner wells but are presented here as a standard for evaluation of the water-quality results. SDWS are nonenforceable drinking-water standards that typically relate to aesthetic concerns such as taste, odor, or staining of plumbing fixtures.

The results of analyses of the 21 groundwater samples collected in the Mohawk River Basin during July 2011 are presented in tables 1-1 through 1-10 in appendix 1. Of the 148 constituents and physiochemical properties analyzed for, 82 were not detected at levels greater than the LRLs (appendix table 1–1). Results for the remaining 66 constituents and properties that were detected in the Mohawk River Basin are presented in appendix 1, tables 1–2 through 1–10.

Physiochemical Properties

Most (16) of the samples from the Mohawk River Basin had a color of less than (<) 1 platinum-cobalt (Pt-Co) unit (table 4 and appendix table 1–2); one sample from a bedrock well had a color of 175 Pt-Co units, exceeding the NYSDOH MCL and USEPA SDWS of 15 Pt-Co units. Sample pH was typically near neutral or slightly basic (median 7.5 for all wells) and ranged from 6.5 to 8.9. The pH of one sample from a bedrock well was higher than the USEPA SDWS range for pH (6.5 to 8.5). Specific conductance ranged from 194 to 1,470 microsiemens per centimeter at 25 degrees Celsius (µS/cm at 25°C); the median conductance was 542 µS/cm at 25°C. Water temperature ranged from 9.4 to 16.0°C; the median temperature was 11.5°C. Hydrogen sulfide odor was detected at seven sites, most (six) of which were bedrock wells.

Table 4. Drinking-water standards and summary statistics for physiochemical properties of groundwater samples from the Mohawk River Basin, New York, 2011.

[All concentrations in unfiltered water except as noted; Pt-Co units, platinum-cobalt units; µS/cm at 25ºC, microsiemens per centimeter at 25 degrees Celsius; ºC, degrees Celsius; --, not applicable; <, less than]

	Summary statistics for physical properties								
				Sand and gravel aquifers (9 samples)			Bedrock aquifers (12 samples)		
Constituent	Drinking-water standard	Number of samples exceeding standard	Median (all samples)	Minimum	Median	Maximum	Minimum	Median	Maximum
Color, filtered, Pt-Co units	[1]15	1	<1	<1	<1	5	<1	<1	175
pH	[1]6.5-8.5	1	7.5	6.8	7.3	8.0	6.5	7.6	8.9
Specific conductance, µS/cm at 25ºC	--	--	542	194	835	1,470	286	534	1,450
Temperature, ºC	--	--	11.5	9.6	11.5	15.2	9.4	11.6	16.0

[1] U.S. Environmental Protection Agency Secondary Drinking Water Standard.

Dissolved Gases

Dissolved oxygen concentrations ranged from <0.3 to 6.8 mg/L (table 5 and appendix table 1–3) and typically were greater in samples from sand and gravel wells (median 3.9 mg/L) than in samples from bedrock wells (median <0.3 mg/L). The concentrations of carbon dioxide, argon, dissolved nitrogen gas, and methane were determined twice for each site (table 1–3). The median concentrations of these dissolved gases in the samples were 22.09 mg/L for nitrogen, 17.0 mg/L for carbon dioxide, 0.7546 mg/L for argon, and 0.013 mg/L for methane. Methane was detected in 15 of the 21 samples; concentrations were generally greater in samples from bedrock wells (median 0.573 mg/L) than in samples from sand and gravel wells (median 0.0014 mg/L). The maximum methane concentration measured was 44.3 mg/L in a sample from a well finished in black shale and limestone. Although the USEPA and NYSDOH do not have MCLs for methane, dissolved methane concentrations greater than 28 mg/L (2 samples) can pose explosion hazards as a result of methane accumulation in confined spaces; in addition, the Office of Surface Mining recommends that methane concentrations ranging from 10 to 28 mg/L in water (1 sample) signify an action level where the situation should be closely monitored, and if the concentration increases, the area should be vented to prevent methane gas buildup (Eltschlager and others, 2001).

Table 5. Summary statistics for concentrations of dissolved gases in groundwater samples from Mohawk River Basin, New York, 2011.

[All concentrations in unfiltered water; mg/L, milligrams per liter; <, less than]

	Summary statistics for concentrations of dissolved gases						
		Sand and gravel aquifers (9 samples)			Bedrock aquifers (12 samples)		
Constituent	Median (all samples)	Minimum	Median	Maximum	Minimum	Median	Maximum
Carbon dioxide, mg/L	17.0	1.7	20.2	37.8	0.3	14.7	47.1
Dissolved oxygen, mg/L	<0.3	<0.3	3.9	6.8	<0.3	<0.3	2.2
Argon, mg/L	0.7546	0.6101	0.7331	1.171	0.6387	0.8067	0.9661
Nitrogen gas, mg/L	22.09	16.66	19.85	39.85	16.16	23.29	33.62
Methane, mg/L	0.013	<0.001	.0014	0.143	<0.001	0.573	44.3

Major Ions

The anions detected in the highest concentrations were bicarbonate (median concentration 258 mg/L) and chloride (median concentration 64.9 mg/L) (table 6 and appendix table 1–4). The cations detected in the highest concentrations were calcium (median concentration 63.6 mg/L) and sodium (median concentration 56.6 mg/L). The concentration of sodium in nine samples exceeded the USEPA Drinking Water Advisory Taste Threshold of 60 mg/L; the maximum concentration of sodium detected was 273 mg/L. The concentration of chloride in one sample, 393 mg/L, exceeded the NYSDOH MCL and USEPA SDWS of 250 mg/L. The concentration of sulfate in two samples exceeded the NYSDOH MCL and USEPA SDWS of 250 mg/L; the maximum concentration of sulfate detected in the samples was 453 mg/L. The concentration of fluoride did not exceed established MCLs in any sample (table 6).

Most of the water samples (13 of 21) from the Mohawk River Basin were very hard (greater than 180 mg/L as calcium carbonate, $CaCO_3$; Hem, 1985). The median hardness of the samples was 204 mg/L as $CaCO_3$, and the maximum hardness was 636 mg/L as $CaCO_3$. Of the remaining eight samples, two were soft (0 to 60 mg/L as $CaCO_3$), five were moderately hard (61 to 120 mg/L as $CaCO_3$), and one was hard (121 to 180 mg/L as $CaCO_3$). Alkalinity ranged from 48 to 289 mg/L as $CaCO_3$; the median was 212 mg/L of $CaCO_3$. Dissolved solids concentrations ranged from 125 to 1,090 mg/L with a median of 436 mg/L; dissolved solids concentration in seven samples exceeded, and one sample equaled, the USEPA SDWS for total dissolved solids of 500 mg/L.

Table 6. Drinking-water standards and summary statistics for concentrations of major ions in groundwater samples from the Mohawk River Basin, New York, 2011.

[All concentrations are in milligrams per liter in filtered water; --, not applicable; <, less than; ºC, degrees Celsius; $CaCO_3$, calcium carbonate]

	Constituent	Drinking-water standard	Number of samples exceeding standard	Median (all samples)	Sand and gravel aquifers (9 samples) Minimum	Sand and gravel aquifers Median	Sand and gravel aquifers Maximum	Bedrock aquifers (12 samples) Minimum	Bedrock aquifers Median	Bedrock aquifers Maximum
Cations	Calcium	--	--	63.6	24.2	87.6	120	7.14	38.9	214
Cations	Magnesium	--	--	16.6	2.91	21.1	53.8	0.781	14.3	37.7
Cations	Potassium	--	--	1.91	0.47	1.46	3.40	0.29	2.04	6.68
Cations	Sodium	[4]60	9	56.6	2.51	40.0	150	11.7	64.3	273
Anions	Bicarbonate	--	--	258	59	258	352	95	238	310
Anions	Chloride	[2,3]250	1	64.9	3.01	24.6	188	7.63	77.0	393
Anions	Fluoride	[1]4.0 [2]2.2 [3]2	0	0.36	<0.04	0.06	0.55	0.20	0.42	1.55
Anions	Silica	--	--	8.94	5.10	7.57	13.5	7.38	9.22	17.5
Anions	Sulfate	[2,3]250	2	18.1	5.01	31.9	453	1.31	16.0	388
Hardness as $CaCO_3$		--	--	204	72.5	301	520	21.0	176	636
Alkalinity as $CaCO_3$		--	--	212	48	212	289	78	195	255
Dissolved solids, dried at 180ºC		[3]500	7	436	125	473	1,090	170	378	1,040

[1] U.S. Environmental Protection Agency Maximum Contaminant Level.

[2] New York State Department of Health Maximum Contaminant Level.

[3] U.S. Environmental Protection Agency Secondary Drinking Water Standard.

[4] U.S. Environmental Protection Agency Drinking Water Advisory Taste Threshold.

Nutrients and Total Organic Carbon

The dominant nutrient detected in the Mohawk River Basin was nitrate (table 7 and appendix table 1–5). The concentration of ammonia ranged from <0.010 to 2.07 mg/L as nitrogen (N) and was generally greater in samples from the 12 bedrock wells (median 0.448 mg/L as N) than in samples from the 9 sand and gravel wells (median <0.010 mg/L as N). The concentration of nitrate ranged from <0.013 to 3.48 mg/L as N and was generally greater in samples from sand and gravel wells (median 0.456 mg/L as N) than in samples from bedrock wells (median <0.020 mg/L as N). The concentration of nitrate plus nitrite did not exceed the NYSDOH and USEPA MCL of 10 mg/L as N in any sample. Nitrite was detected in 7 of the 21 samples with a maximum concentration of 0.020 mg/L as N; the concentration of nitrite did not exceed the NYSDOH and USEPA MCL (1 mg/L as N) in any sample. Orthophosphate concentrations ranged from 0.005 to 0.155 mg/L as phosphorus (P). Total organic carbon was detected in 18 of the 21 samples; the maximum concentration was 11.3 mg/L.

Table 7. Drinking-water standards and summary statistics for concentrations of nutrients in groundwater samples from the Mohawk River Basin, New York, 2011.

[All concentrations in milligrams per liter in filtered water except as noted. N, nitrogen; P, phosphorus; --, not applicable; <, less than]

Constituent	Drinking-water standard	Number of samples exceeding standard	Median (all samples)	Sand and gravel aquifers (9 samples)			Bedrock aquifers (12 samples)		
				Minimum	Median	Maximum	Minimum	Median	Maximum
Ammonia plus organic N, as N	--	--	0.23	<0.05	0.07	0.84	<0.05	0.57	2.4
Ammonia (NH_3), as N	--	--	0.100	<0.010	<0.010	0.715	<0.010	0.448	2.07
Nitrate plus nitrite (NO_2 + NO_3), as N	[1,2]10	0	0.04	<0.02	0.46	3.48	<0.02	<0.02	0.55
Nitrate (NO_3), as N	[1,2]10	0	0.038	<0.016	0.456	3.48	<0.013	<0.020	0.550
Nitrite (NO_2), as N	[1,2]1	0	<0.001	<0.001	<0.001	0.004	<0.001	<0.001	0.020
Orthophosphate (PO_4), as P	--	--	0.011	0.005	0.007	0.022	0.007	0.011	0.155
Total organic carbon, unfiltered	--	--	0.7	<0.3	0.7	2.2	<0.3	0.7	11.3

[1] U.S. Environmental Protection Agency Maximum Contaminant Level.

[2] New York State Department of Health Maximum Contaminant Level.

Trace Elements

The trace elements present in the highest median concentrations in the samples were strontium, with a median of 769 micrograms per liter (µg/L), iron (median 132 µg/L in unfiltered water; 12 µg/L in filtered water), barium (median 126 µg/L), boron (median 39 µg/L in filtered water), and manganese (median 15.8 µg/L in unfiltered water; 13.7 µg/L in filtered water) (table 8 and appendix table 1–6). The highest detected concentration of a trace element was 23,400 µg/L of strontium in a sample from a bedrock well. The median concentrations of some trace elements were higher in samples from sand and gravel wells than in samples from bedrock wells, for example, copper and lead; the median concentrations of other trace elements were greater in samples from bedrock wells than in samples from sand and gravel wells, including aluminum, barium, boron, iron, lithium, manganese, and strontium.

The concentration of aluminum in three samples from bedrock wells exceeded the low end of the USEPA SDWS for aluminum of 50 µg/L, but none exceeded the high end of 200 µg/L. The concentration of iron in eight unfiltered and three filtered samples exceeded the NYSDOH MCL and USEPA SDWS of 300 µg/L. Three samples had unfiltered iron concentrations greater than 1,000 µg/L; the maximum iron concentration was 14,400 µg/L in an unfiltered sample from a bedrock well. The concentration of manganese in six unfiltered and four filtered samples exceeded the USEPA SDWS of 50 µg/L; the concentration of manganese in two unfiltered and two filtered samples exceeded the NYSDOH MCL of 300 µg/L. The maximum concentration of manganese, 1,670 µg/L, was in an unfiltered sample from a sand and gravel well. Drinking-water standards for antimony, arsenic, barium, beryllium, cadmium, chromium, copper, lead, mercury, selenium, silver, thallium, zinc, and uranium were not exceeded; additionally, cadmium, mercury and thallium were not detected in any of the 21 samples collected (appendix table 1–1).

Table 8. Drinking-water standards and summary statistics for concentrations of trace elements in groundwater samples from the Mohawk River Basin, New York, 2011.

[All concentrations in micrograms per liter in unfiltered water except as noted. <, less than; --, not applicable]

	Summary statistics for concentrations of trace elements								
				Sand and gravel aquifers (9 samples)			Bedrock aquifers (12 samples)		
Constituent	Drinking-water standard	Number of samples exceeding standard	Median (all samples)	Minimum	Median	Maximum	Minimum	Median	Maximum
Aluminum	[3]50-200	3-0	3	<3	<3	36	<3	10	194
Antimony	[1,2]6	0	<0.2	<0.2	<0.2	0.7	<0.2	<0.2	1.2
Arsenic	[1,2]10	0	0.43	0.14	0.43	4.9	0.15	0.40	6.2
Barium	[1,2]2,000	0	126	6.5	20.1	1,100	7.5	179	968
Beryllium	[1,2]4	0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.02
Boron, filtered	--	--	39	5.8	19	350	1.3	165	907
Cadmium	[1,2]5	0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Chromium	[1,2]100	0	<0.21	<0.21	0.23	0.46	<0.21	<0.21	0.82
Cobalt	--	--	0.03	<0.02	0.03	0.61	<0.02	0.02	11.5
Copper	[3]1,000	0	4.5	<0.70	7.6	52.5	<0.70	<0.81	20.5
Iron, filtered	[2,3]300	3	12	<3	4	7,620	<3	25	14,000
Iron	[2,3]300	8	132	<5	<5	7,700	<5	338	14,400
Lead	[4]15	0	0.22	<0.04	0.41	1.14	<0.04	0.09	4.07
Lithium	--	--	8.5	0.3	6.1	91.2	3.2	60.0	989
Manganese, filtered	[2]300 [3]50	2 4	13.7	<0.2	5.6	1,620	0.3	17.2	1,040
Manganese	[2]300 [3]50	2 6	15.8	<0.4	9.8	1,670	0.4	19.6	995
Mercury	[1,2]2	0	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Molybdenum	--	--	0.4	<0.1	0.3	5.1	0.1	0.6	8.4
Nickel	--	--	0.38	<0.12	0.38	2.4	<0.12	0.33	2.8
Selenium	[1,2]50	0	0.10	<0.05	0.10	0.79	<0.05	0.11	19.8
Silver	[2,3]100	0	<0.01	<0.01	<0.01	0.07	<0.01	<0.01	0.02
Strontium	--	--	769	54.9	229	2,910	78.1	1,410	23,400
Thallium	[1,2]2	0	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06
Zinc	[2,3]5,000	0	7.2	<2.4	8.5	22.3	<2.4	7.0	50.4
Uranium	[1,2]30	0	0.224	0.026	0.224	1.15	<0.014	0.229	3.13

[1] U.S. Environmental Protection Agency Maximum Contaminant Level.

[2] New York State Department of Health Maximum Contaminant Level.

[3] U.S. Environmental Protection Agency Secondary Drinking Water Standard.

[4] U.S. Environmental Protection Agency Treatment Technique.

Pesticides

Four pesticides and pesticide degradates were detected at trace concentrations in four samples from production wells finished in sand and gravel (appendix table 1–7); all were broadleaf herbicides or their degradates. The pesticide detected with the highest (and estimated) concentration (0.034 µg/L) was CIAT (2-chloro-4-isopropylamino-6-amino-*s*-triazine), a degradate of atrazine, which was detected in four samples. Atrazine was detected in two samples with a maximum concentration of 0.027 µg/L. Prometon and simazine were detected in one sample each. One sample had detections of four pesticides, one sample had detections of two pesticides, and two samples had detections of one pesticide each, all from sand and gravel wells. No pesticide concentrations exceeded established drinking-water standards; pesticide degradates currently are not regulated.

Volatile Organic Compounds

VOCs were rarely detected in any of the 21 sampled wells. Three VOCs were detected in samples from two sand and gravel and two bedrock wells (appendix table 1–8). The VOCs detected are a trihalomethane (THM) and two solvents. THMs are byproducts that form when chlorine or bromine are used as disinfectants. Trichloromethane (chloroform) was detected in four samples with a maximum concentration of 4.5 µg/L in a sample from a bedrock well. The concentration of total THMs did not exceed the NYSDOH and USEPA MCLs of 80 µg/L. Tetrachloroethene (PERC), a solvent, was detected in a sample from a sand a gravel well with a concentration of 0.2 µg/L, which did not exceed the NYSDOH and USEPA MCLs of 5 µg/L. Toluene, another solvent, was detected in a sample from a bedrock well with a concentration of 0.1 µg/L, which did not exceed the NYSDOH MCL of 5 µg/L or the USEPA MCL of 1,000 µg/L.

Radionuclides

Gross alpha activity ranged from non-detectable levels to 5.5 picocuries per liter (pCi/L); the median activity was <2 pCi/L (table 9 and appendix table 1–9). The gross alpha activity did not exceed the NYSDOH and USEPA MCLs for gross alpha of 15 pCi/L in any sample. Gross beta activities ranged from non-detectable levels to 5.1 pCi/L. The USEPA and NYSDOH MCLs for gross beta are 4 millirem per year, a dosage determination that requires knowledge of the specific radionuclide sources. The activity units (picocuries per liter) that were used to measure gross beta radioactivity in this study are not comparable to dosage units (millirems per year) without determination of the nuclide sources. Therefore, it is not possible to determine whether any of the samples exceeded the MCL for gross beta radioactivity. Radon-222 activities in the water samples ranged from 22 to 2,320 pCi/L; the median was 141 pCi/L. The highest radon activity was in a sample from a bedrock well finished in sandstone, but the median radon activity in samples from sand and gravel wells (500 pCi/L) was higher than the median activity in samples from bedrock wells (93 pCi/L). Radon is currently (2013) not regulated in drinking water; however, the USEPA has proposed a two-part standard for radon in drinking water: (1) a 300 pCi/L MCL for areas that do not implement an indoor-air radon mitigation program and (2) an alternative MCL (AMCL) of 4,000 pCi/L for areas that do (U.S. Environmental Protection Agency, 1999). Activities in 10 of the samples exceeded the proposed MCL, but none exceeded the proposed AMCL.

Table 9. Drinking-water standards and summary statistics for concentrations of radionuclides in groundwater samples from the Mohawk River Basin, New York, 2011.

[All activities in picocuries per liter in unfiltered water except as noted. mrem/yr, millirem per year; --, not applicable; <, less than]

			Summary statistics for radionuclide activities						
				Sand and gravel aquifers (9 samples)			Bedrock aquifers (12 samples)		
Constituent	Drinking-water standard	Number of samples exceeding standard	Median (all samples)	Minimum	Median	Maximum	Minimum	Median	Maximum
Gross alpha radioactivity	[1,2]15	0	<2	<0.33	<0.87	5.5	<0.92	1.4	4.9
Gross beta radioactivity	[1,2]4 mrem/yr	--	1.6	<0.42	1.4	3.3	<0.62	2.8	5.1
Radon-222	[3]300 [4]4,000	10 0	141	46	500	710	22	93	2,320

[1] U.S. Environmental Protection Agency Maximum Contaminant Level.

[2] New York State Department of Health Maximum Contaminant Level.

[3] U.S. Environmental Protection Agency Proposed Maximum Contaminant Level.

[4] U.S. Environmental Protection Agency Proposed Alternative Maximum Contaminant Level.

Bacteria

Coliform bacteria were detected in five samples, all from bedrock wells (appendix table 1–10), with a maximum of 92 colony-forming units (CFUs) per 100 mL. Coliform bacteria were detected in three of the four wells sampled that are finished in carbonate rocks. The NYSDOH and USEPA MCLs for total coliform bacteria are exceeded when 5 percent of samples of finished water collected in 1 month test positive for total coliform (if 40 or more samples are collected per month) or when two samples test positive for total coliform (if fewer than 40 samples are collected per month). Fecal coliform bacteria were detected in one sample (1 CFU/100mL), and *Escherichia coli (E. coli)* were detected in one sample (2 CFU/100 mL). The heterotrophic plate count ranged from <1 CFU per mL to 998 CFU per mL. The USEPA MCL for the heterotrophic plate count is 500 CFU/mL; this limit was exceeded in one sample from a sand and gravel well.

Well sampled in 2002, 2006, and 2011

Four of the wells sampled in 2011 (wells HE 622, MT 406, OE1460, and SA1501) were sampled previously in 2002 and 2006 as part of this study. Of the 148 constituents and physiochemical properties that samples were analyzed for in 2011, 140 were common to at least 2 years of analyses; the values for the physiochemical properties of the samples and the concentrations of nutrients, major ions, trace elements, radon-222, detected pesticides, pesticide degradates, and VOCs are presented in appendix tables 1-11 through 1-15. Differences between wells were often greater than differences between samples at a single well; however, well MT 406, a bedrock well, showed more variability than other wells. Five pesticides and pesticide degradates were detected in the two of the wells sampled in 2002, 2006, and 2011 (appendix table 1–14); more pesticides were detected in 2006 and 2011 than in 2002. Seven VOCs were detected in three of the wells sampled in 2002, 2006, and 2011, including four THMs—methyl *tert*-butyl ether (MTBE), tetrachloroethene, and toluene. More VOCs were detected in 2002 and 2006 than in 2011. Coliform bacteria were not detected in any of the four resampled wells (appendix table 1–15).

Summary

Groundwater samples were collected during July 2011 from 21 wells in the Mohawk River Basin to characterize the groundwater quality. Sample collection and analysis followed standard USGS procedures and other documented procedures. Samples were analyzed for physical properties and concentrations of dissolved gases, major ions, nutrients, trace elements, pesticides, volatile organic compounds (VOCs), radionuclides, and bacteria. Many of the 148 constituents analyzed for were not detected in any of the samples.

The depths of sand and gravel wells sampled in the Mohawk River Basin range from 28 to 395 ft below land surface; the bedrock wells are 120 to 815 ft deep and typically are completed in shale, sandstone, or carbonate bedrock. Ten of the 21 wells sampled are production wells; 11 are domestic wells. The samples generally indicated good water quality, although properties and concentrations of some constituents—color, pH, sodium, chloride, sulfate, dissolved solids, aluminum, iron, manganese, radon-222, and bacteria—equaled or exceeded primary, secondary, or proposed drinking-water standards. The constituents most frequently detected in concentrations exceeding drinking-water standards were radon-222 (10 samples had concentrations equal to or greater than the U.S. Environmental Protection Agency (USEPA) proposed maximum contaminant level (MCL) of 300 picocuries per liter (pCi/L)), sodium (9 samples had concentrations greater than the USEPA Drinking Water Taste Advisory of 60 milligrams per liter (mg/L)), iron (8 unfiltered samples had concentrations greater than the New York State Department of Health MCL and USEPA secondary drinking-water standard (SDWS) of 300 micrograms per liter (µg/L)), dissolved solids (7 samples had concentrations greater than the USEPA SDWS of 500 mg/L), manganese (6 unfiltered samples had concentrations greater than the USEPA SDWS of 50 µg/L), and coliform bacteria (5 samples had detections).

Sample pH was typically near neutral or slightly basic. Methane was detected in 15 of the 21 samples; 2 samples had methane concentrations greater than 28 mg/L. The water typically was very hard, and the median dissolved solids concentration was 436 mg/L. The ions detected in the highest median concentrations were bicarbonate, chloride, calcium, and sodium. The dominant nutrient was nitrate; concentrations of nitrate and nitrite did not exceed established drinking-water standards. Strontium was the trace element with the highest median concentrations; some samples had moderately high (greater than 10,000 µg/L) concentrations of strontium or iron. Four pesticides and pesticide degradates were detected in four samples from sand and gravel wells; all were trace-level detections of broadleaf herbicides or their degradates. Three VOCs were detected in four samples, including chloroform, tetrachloroethene, and toluene. Radon-222 activities in 10 samples exceeded a proposed MCL, but none exceeded the proposed AMCL. Coliform bacteria were detected in five samples. Fecal coliform and *Escherichia coli* bacteria were detected in one sample each.

References Cited

American Public Health Association, 1998, Standard methods for the examination of water and wastewater (20th ed.): Washington, D.C., American Public Health Association, American Water Works Association, and Water Environment Federation [variously paged].

ASTM International, 2006, D5072-98(2006), Standard test method for radon in drinking water: ASTM International, accessed December 28, 2006, *at* http://www.astm.org.

Butch, G.K., Murray, P.M., Hebert, G.J., and Weigel, J.F., 2003, Water resources data, New York, water year 2002: U.S. Geological Survey Water-Data Report NY-02-1, p. 502–520.

Cadwell, D.H., 1991, Surficial geologic map of New York: New York State Museum Map and Chart Series no. 40, Lower Hudson sheet, scale 1:250,000.

Childress, C.J.O., Foreman, W.T., Connor, B.F., and Maloney, T.J., 1999, New reporting procedures based on long-term method detection levels and some considerations for interpretations of water-quality data provided by the U.S. Geological Survey National Water Quality Laboratory: U.S. Geological Survey Open-File Report 99–193, 19 p.

Connor, B.F., Rose, D.L., Noriega, M.C., Murtagh, L.K., and Abney, S.R., 1998, Methods of analysis by the U.S. Geological Survey National Water Quality Laboratory—Determination of 86 volatile organic compounds in water by gas chromatography/mass spectrometry, including detections less than reporting limits: U.S. Geological Survey Open-File Report 97–829, 78 p., accessed December 9, 2011, *at* http://nwql.usgs.gov/Public/rpt.shtml?OFR-97-829.

Eckhardt, D.A., Reddy, J.E., and Shaw, S.B., 2009, Groundwater quality in central New York, 2007: U.S. Geological Survey Open-File Report 2009–1257, 40 p., accessed August 15, 2011, at http://pubs.usgs.gov/of/2009/1257/.

Eckhardt, D.A., Reddy, J.E., and Tamulonis, K.L., 2007, Ground-water quality in the Genesee River Basin, New York, 2005–06: U.S. Geological Survey Open-File Report 2007–1093, 26 p., accessed August 15, 2011, at http://pubs.usgs.gov/of/2007/1093/.

Eckhardt, D.A., Reddy, J.E., and Tamulonis, K.L., 2008, Ground-water quality in western New York, 2006: U.S. Geological Survey Open-File Report 2008–1140, 36 p., accessed August 15, 2011, at http://pubs.usgs.gov/of/2008/1140/.

Eltschlager, K.K., Hawkins, J.W., Ehler, W.C., and Baldassare, F.B., 2001, Technical measures for the investigation and mitigation of fugitive methane hazards in areas of coal mining: Pittsburgh, Pa., U.S. Department of the Interior, Office of Surface Mining Reclamation and Enforcement, 124 p.

Fisher, D.W., Isachsen, Y.W., and Rickard, L.V., 1970, Geologic map of New York State: New York State Museum Map and Chart Series no. 15, Lower Hudson sheet, scale 1:250,000.

Fishman, M.J., ed., 1993, Methods of analysis by the U.S. Geological Survey National Water Quality Laboratory—Determination of inorganic and organic constituents in water and fluvial sediments: U.S. Geological Survey Open-File Report 93–125, 217 p., December 9, 2011, at http://pubs.usgs.gov/of/1993/0125/report.pdf.

Furlong, E.T., Anderson, B.D., Werner, S.L., Soliven, P.P., Coffey, L.J., and Burkhardt, M.R., 2001, Methods of analysis by the U.S. Geological Survey National Water Quality Laboratory—Determination of pesticides in water by graphitized carbon-based solid-phase extraction and high-performance liquid chromatography/mass spectrometry: U.S. Geological Survey Water-Resources Investigations Report 01–4134, 73 p., accessed December 9, 2011, at http://nwql.usgs.gov/WRIR-01-4134.shtml.

Garbarino, J.R., and Damrau, D.L., 2001, Methods of analysis by the U.S. Geological Survey National Water Quality Laboratory—Determination of organic plus inorganic mercury in filtered and unfiltered natural water with cold vapor-atomic fluorescence spectrometry: U.S. Geological Survey Water-Resources Investigations Report 01–4132, 16 p., accessed December 9, 2011, at http://nwql.usgs.gov/WRIR-01-4132.shtml.

Garbarino, J.R., Kanagy, L.K., and Cree, M.E., 2006, Determination of elements in natural-water, biota, sediment and soil samples using collision/reaction cell inductively coupled plasma-mass spectrometry: U.S. Geological Survey Techniques and Methods, book 5, chap. B1, 88 p., accessed December 9, 2011, at http://pubs.usgs.gov/tm/2006/tm5b1/.

Garbarino, J.R., and Struzeski, T.M., 1998, Methods of analysis by the U.S. Geological Survey National Water Quality Laboratory—Determination of elements in whole-water digests using inductively coupled plasma-optical emission spectrometry and inductively coupled plasma-mass spectrometry:

U.S. Geological Survey Open-File Report 98–165, 101 p., accessed December 9, 2011, at http://nwql.usgs.gov/OFR-98-165.shtml.
Hammond, D.S., Heath, R.C., and Waller, R.M., 1978, Ground-water data on the Hudson River Basin, New York: U. S. Geological Survey Open File Report 78-710, 18 p., accessed December 9, 2011, at http://pubs.usgs.gov/of/1978/0710/report.pdf.
Hem, J.D., 1985, Study and interpretation of the chemical characteristics of natural water (3d ed.): U.S. Geological Survey Water-Supply Paper 2254, 264 p.
Hetcher-Aguila, K.K., 2005, Ground-water quality in the Chemung River Basin, New York, 2003: U.S. Geological Survey Open-File Report 2004–1329, 19 p., accessed August 15, 2011, at http://ny.water.usgs.gov/pubs/of/of041329/.
Hetcher-Aguila, K.K., and Eckhardt, D.A., 2006, Ground-water quality in the upper Susquehanna River Basin, New York, 2004: U.S. Geological Survey Open-File Report 2006–1161, 21 p., accessed August 15, 2011, *at* http://pubs.usgs.gov/of/2006/1161/.
Hoffman, G.L., Fishman, M.J., and Garbarino, J.R., 1996, Methods of analysis by the U.S. Geological Survey National Water Quality Laboratory—In-bottle acid digestion of whole-water samples: U.S. Geological Survey Open-File Report 96–225, 28 p., accessed December 9, 2011, at http://pubs.usgs.gov/of/1996/0225/report.pdf.
Isachsen, Y.W., Landing, E., Lauber, J.M., Rickard, L.V., and Rogers, W.B., eds., 2000, Geology of New York—A simplified account (2d ed.): Albany, N.Y., New York State Museum/Geological Survey, 294 p.
Kenny, J.F., Barber, N.L., Hutson, S.S., Linsey, K.S., Lovelace, J.K., and Maupin, M.A., 2009, Estimated use of water in the United States in 2005: U.S. Geological Survey Circular 1344, 52 p.
New York State Department of Health, 2011, New York State Health Department public water systems regulations: Albany, N.Y. [variously paged], accessed December 9, 2011, at http://www.health.ny.gov/regulations/nycrr/title_10/part_5/subpart_5-1_tables.htm.
Nystrom, E.A., 2006, Ground-water quality in the Lake Champlain Basin, New York, 2004: U.S. Geological Survey Open-File Report 2006–1088, 22 p., accessed August 15, 2011, at http://pubs.usgs.gov/of/2006/1088/.
Nystrom, E.A., 2007a, Ground-water quality in the St. Lawrence River Basin, New York, 2005–06: U.S. Geological Survey Open-File Report 2007–1066, 33 p., accessed August 15, 2011, at http://pubs.usgs.gov/of/2007/1066/.
Nystrom, E.A., 2007b, Ground-water quality in the Delaware River Basin, New York, 2001 & 2005–06: U.S. Geological Survey Open-File Report 2007–1098, 36 p., accessed August 15, 2011, at http://pubs.usgs.gov/of/2007/1098/.
Nystrom, E.A., 2008, Ground-water quality in the Mohawk River Basin, New York, 2006: U.S. Geological Survey Open-File Report 2008–1086, 33 p., accessed August 15, 2011, at http://pubs.usgs.gov/of/2008/1086/.
Nystrom, E.A., 2009, Groundwater quality in the Upper Hudson River Basin, New York, 2007: U.S. Geological Survey Open-File Report 2009–1240, 37 p., accessed August 15, 2011, at http://pubs.usgs.gov/of/2009/1240/.
Nystrom, E.A., 2010, Groundwater quality in the Lower Hudson River Basin, New York, 2008: U.S. Geological Survey Open-File Report 2010–1197, 39 p., accessed August 15, 2011, at http://pubs.usgs.gov/of/2010/1197/.
Nystrom, E.A., 2011, Groundwater quality in the Lake Champlain Basin, New York, 2009: U.S. Geological Survey Open-File Report 2011–1180, 42 p., accessed August15, 2011, at http://pubs.usgs.gov/of/2011/1180/.

Nystrom, E.A., 2012, Groundwater quality in the Delaware and St. Lawrence River Basins, New York, 2010: U.S. Geological Survey Open-File Report 2011–1320, 58 p., accessed January 17, 2012, at http://pubs.usgs.gov/of/2011/1320/.

Patton, C.J., and Truitt, E.P., 2000, Methods of analysis by the U.S. Geological Survey National Water Quality Laboratory—Determination of ammonium plus organic nitrogen by a Kjeldahl digestion method and an automated photometric finish that includes digest cleanup by gas diffusion: U.S. Geological Survey Open-File Report 00–170, 31 p., accessed December 9, 2011, at http://pubs.usgs.gov/of/2000/0170/report.pdf.

Reddy, J.E., and Risen, A.J., 2012, Groundwater quality in the Upper Susquehanna River Basin, 2009: U.S. Geological Survey Open-File Report 2012–1045, 30 p., accessed April 11, 2012, at http://pubs.usgs.gov/of/2012/1045/.

Reddy, J.E., 2012, Groundwater quality in the Genesee River Basin, 2010: U.S. Geological Survey Open-File Report 2012–1135, 29 p., accessed August 7, 2012, at http://pubs.usgs.gov/of/2012/1135/.

Reynolds, 1990, Availability of ground water from unconsolidated deposits in the Mohawk River basin, New York: U.S. Geological Survey Water-Resources Investigations Report 88-4091, 9 plates.

Risen, A.J., and Reddy, J.E., 2011a, Groundwater quality in the Chemung River Basin, 2008: U.S. Geological Survey Open-File Report 2011–1112, 25 p., accessed August 15, 2011, at http://pubs.usgs.gov/of/2011/1112/.

Risen, A.J., and Reddy, J.E., 2011b, Groundwater quality in the Eastern Lake Ontario Basin New York, 2008: U.S. Geological Survey Open-File Report 2011–1074, 32 p., accessed August 15, 2011, at http://pubs.usgs.gov/of/2011/1074/.

Sandstrom, M.W., Stroppel, M.E., Foreman, W.T., and Schroeder, M.P., 2001, Methods of analysis by the U.S. Geological Survey National Water Quality Laboratory—Determination of moderate-use pesticides and selected degradates in water by C-18 solid-phase extraction and gas chromatography/mass spectrometry: U.S. Geological Survey Water-Resources Investigations Report 01–4098, 70 p., accessed December 9, 2011, at http://nwql.usgs.gov/Public/WRIR-01-4098.shtml.

Struzeski, T.M., DeGiacomo, W.J., and Zayhowski, E.J., 1996, Methods of analysis by the U.S. Geological Survey National Water Quality Laboratory—Determination of dissolved aluminum and boron in water by inductively coupled plasma-atomic emission spectrometry: U.S. Geological Survey Open-File Report 96–149, 17 p., accessed December 9, 2011, at http://pubs.usgs.gov/of/1996/0149/report.pdf.

U.S. Environmental Protection Agency, 1980, Prescribed procedures for measurement of radioactivity in drinking water: EPA 600/4-80-032, accessed March 16, 2010, at http://water.epa.gov/scitech/methods/cwa/bioindicators/upload/2007_07_10_methods_method_900_0.pdf.

U.S. Environmental Protection Agency, 1997, Guidelines for preparation of the comprehensive state water quality assessments (305(b) Reports) and electronic updates: Washington, D.C., U.S. Environmental Protection Agency, Office of Water, EPA 841-B-97-002A and EPA 841-B-97-002B, PL95-217, 271 p.

U.S. Environmental Protection Agency, 1999, Proposed radon in drinking water rule: Washington, D.C., U.S. Environmental Protection Agency, Office of Water, EPA 815-F-99-006, 6 p.

U.S. Environmental Protection Agency, 2009, National primary drinking water standards and national secondary drinking water standards: Washington, D.C., U.S. Environmental Protection Agency, Office of Water, EPA 816-F-09-0004, 6 p., accessed March 25, 2009, at http://www.epa.gov/safewater/consumer/pdf/mcl.pdf.

U.S. Geological Survey, variously dated, National field manual for the collection of water-quality data: U.S. Geological Survey Techniques of Water-Resource Investigations, book 9, chaps. A1–A9 [variously paged].

U.S. Geological Survey, 2006, Collection of water samples (ver. 2.0): U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chap. A4, September, accessed March 4, 2010, at http://pubs.water.usgs.gov/twri9A4/.

Vogelmann, J.E., Howard, S.M., Yang, L., Larson, C.R., Wylie, B.K., and Van Driel, J.N., 2001, Completion of the 1990's National Land Cover Data Set for the conterminous United States: Photogrammetric Engineering and Remote Sensing, v. 67, p. 650–662.

Wilde, F.D., ed., 2004, Cleaning of equipment for water sampling (ver. 2.0): U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chap. A3, April, accessed March 4, 2010, at http://pubs.water.usgs.gov/twri9A3/.

Wilde, F.D., Radtke, D.B., Gibs, Jacob, and Iwatsubo, R.T., eds., 2004 with updates through 2009, Processing of water samples (version 2.2): U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chap. A5, April, accessed March 4, 2010, at http://pubs.water.usgs.gov/twri9A5/.

Zaugg, S.D., Sandstrom, M.W., Smith, S.G., and Fehlberg, K.M., 1995, Methods of analysis by the U.S. Geological Survey National Water Quality Laboratory—Determination of pesticides in water by C-18 solid-phase extraction and capillary-column gas chromatography/mass spectrometry with selected-ion monitoring: U.S. Geological Survey Open-File Report 95–181, 60 p., accessed December 9, 2011, at http://pubs.usgs.gov/of/1995/0181/report.pdf.

Appendix: Results of Water-Sample Analyses

The following tables summarize results of the chemical analyses of the 21 samples collected in the Mohawk River Basin in New York during July 2011.

Table 1–1. Constituents that were not detected in groundwater samples collected in the Mohawk River Basin, New York, 2011. 25

Table 1–2. Physiochemical properties of groundwater samples collected in the Mohawk River Basin, New York, 2011. 26

Table 1–3. Concentrations of dissolved gases in groundwater samples collected in the Mohawk River Basin, New York, 2011. 27

Table 1–4. Concentrations of major ions in groundwater samples collected in the Mohawk River Basin, New York, 2011. 28

Table 1–5. Concentrations of nutrients and organic carbon in groundwater samples collected in the Mohawk River Basin, New York, 2011. 30

Table 1–6. Concentrations of trace elements in groundwater samples collected in the Mohawk River Basin, New York, 2011. 31

Table 1–7. Concentrations of pesticides detected in groundwater samples collected in the Mohawk River Basin, New York, 2011. 34

Table 1–8. Concentrations of volatile organic compounds detected in groundwater samples collected in the Mohawk River Basin, New York, 2011. 35

Table 1–9. Activities of radionuclides in groundwater samples from the Mohawk River Basin, New York, 2011. 36

Table 1–10. Bacteria in groundwater samples collected in the Mohawk River Basin, New York, 2011. 37

Table 1–11. Physiochemical properties and concentrations of nutrients in groundwater samples collected in the Mohawk River Basin, New York, 2002, 2006, and 2011. 38

Table 1–12. Concentrations of major ions in groundwater samples collected in the Mohawk River Basin, New York, 2002, 2006, and 2011. 39

Table 1–13. Concentrations of trace elements and radionuclides in groundwater samples in the Mohawk River Basin, New York, 2002, 2006, and 2011. 40

Table 1–14. Concentrations of pesticides and of volatile organic compounds detected in groundwater samples collected in the Mohawk River Basin, New York, 2002, 2006, and 2011. 42

Table 1–15. Bacteria in groundwater samples collected in the Mohawk River Basin, New York, 2006 and 2011. 43

Table 1-1. Constituents that were not detected in groundwater samples collected from 21 wells in the Mohawk River Basin, New York, 2011.

[NWIS, National Water Information System]

U.S. Geological Survey NWIS parameter code	Constituent	Laboratory reporting level
Trace elements in unfiltered water, in micrograms per liter		
01027	Cadmium	0.05
71900	Mercury	0.005
01059	Thallium	0.06
Pesticides in filtered water, in micrograms per liter		
82660	2,6-Diethylaniline	0.006
49260	Acetochlor	0.010
46342	Alachlor	0.008
34253	*alpha*-HCH	0.004
82686	Azinphos-methyl	0.120
82673	Benfluralin	0.014
04028	Butylate	0.004
82680	Carbaryl	0.060
82674	Carbofuran	0.060
38933	Chlorpyrifos	0.004
82687	*cis*-Permethrin	0.010
04041	Cyanazine	0.022
82682	DCPA	0.008
62170	Desulfinylfipronil	0.012
39572	Diazinon	0.006
39381	Dieldrin	0.008
82677	Disulfoton	0.04
82668	EPTC	0.006
82663	Ethalfluralin	0.006
82672	Ethoprop	0.016
62169	Desulfinylfipronil amide	0.029
62167	Fipronil sulfide	0.012
62168	Fipronil sulfone	0.024
62166	Fipronil	0.018
04095	Fonofos	0.005
39341	Lindane	0.004
82666	Linuron	0.060
39532	Malathion	0.016
82667	Methyl parathion	0.008
39415	Metolachlor	0.020
82630	Metribuzin	0.012
82671	Molinate	0.004
82684	Napropamide	0.008
34653	*p,p'*-DDE	0.002
39542	Parathion	0.020
82669	Pebulate	0.016
82683	Pendimethalin	0.012
82664	Phorate	0.020
Pesticides in filtered water, in micrograms per liter--continued		
82676	Propyzamide	0.004
04024	Propachlor	0.006
82679	Propanil	0.010
82685	Propargite	0.02
82670	Tebuthiuron	0.03
82665	Terbacil	0.024
82675	Terbufos	0.02
82681	Thiobencarb	0.016
82678	Triallate	0.005
82661	Trifluralin	0.018
Volatile organic compounds in unfiltered water, in micrograms per liter		
34506	1,1,1-Trichloroethane	0.1
77652	1,1,2-Trichloro-1,2,2-trifluoroethane	0.1
34496	1,1-Dichloroethane	0.1
34501	1,1-Dichloroethene	0.1
34536	1,2-Dichlorobenzene	0.1
32103	1,2-Dichloroethane	0.2
34541	1,2-Dichloropropane	0.1
34566	1,3-Dichlorobenzene	0.1
34571	1,4-Dichlorobenzene	0.1
34030	Benzene	0.1
32101	Bromodichloromethane	0.1
32104	Tribromomethane	0.2
34301	Chlorobenzene	0.1
77093	*cis*-1,2-Dichloroethene	0.1
32105	Dibromochloromethane	0.2
34668	Dichlorodifluoromethane	0.2
34423	Dichloromethane	0.2
81576	Diethyl ether	0.2
81577	Diisopropyl ether	0.2
34371	Ethylbenzene	0.1
50005	Methyl *tert*-pentyl ether	0.2
85795	*m*-Xylene plus *p*-xylene	0.2
77135	*o*-Xylene	0.1
77128	Styrene	0.1
50004	*tert*-Butyl ethyl ether	0.1
78032	Methyl *tert*-butyl ether	0.2
32102	Tetrachloromethane	0.2
34546	*trans*-1,2-Dichloroethene	0.1
39180	Trichloroethene	0.1
34488	Trichlorofluoromethane	0.2
39175	Vinyl chloride	0.2

Table 1-2. Physiochemical properties of groundwater samples collected in the Mohawk River Basin, New York, 2011.

[µS/cm @ 25°C, microsiemens per centimeter at 25 degrees Celsius; (00080), U.S. Geological Survey National Water Information System parameter code; <, less than; U, not detected; M, detected but not quantified. **Bold** values exceed one or more drinking-water standards. Well locations are shown in figures 2 and 3]

Well number[1]	Color, platinum-cobalt units (00080)	pH, field, standard units (00400)	Specific conductance, field, µS/cm @ 25°C (00095)	Water temperature, field, degrees Celsius (00010)	Hydrogen sulfide odor field (71875)
		Sand and gravel wells			
HE 622	<1	7.3	874	11.4	U
HE1929	<1	8.0	207	9.6	U
OE1460	<1	7.2	923	13.6	U
OE1468	<1	7.3	835	9.6	U
SA1501	<1	7.3	353	11.7	U
SA2259	<1	7.2	480	15.2	U
SN1366	5	7.6	1,470	13.3	M
SO 605	<1	6.8	194	11.5	U
SO 814	<1	7.6	1,100	10.6	U
		Bedrock wells			
A667	<1	7.6	590	13.6	M
FU1611	**175**	6.5	286	11.5	U
G 837	<1	**8.9**	309	9.6	M
HE1459	<1	7.3	510	10.7	U
HE1480	<1	8.0	526	11.7	M
MT 406	<1	7.5	961	10.3	M
OE2876	2	8.2	1,260	14.4	M
SA2806	8	7.7	453	15.7	M
SN1131	10	7.5	773	16.0	U
SO1037	<1	8.1	308	11.4	U
SO1487	<1	7.5	542	13.1	U
SO1658	<1	7.5	1,450	9.4	U

[1] A, Albany County; FU, Fulton County; G, Greene County; HE, Herkimer County; MT, Montgomery County; OE, Oneida County; SA, Saratoga County; SN, Schenectady County; SO, Schoharie County.

Table 1-3. Concentrations of dissolved gases in groundwater samples collected in the Mohawk River Basin, New York, 2011.

[mg/L, milligrams per liter; (00300), U.S. Geological Survey National Water Information System parameter code; <, less than. Well locations are shown in figures 2 and 3]

Well number[1]	Dissolved oxygen, field, mg/L (00300)	Carbon dioxide, laboratory, mg/L (00405)		Argon, laboratory, mg/L (82043)		Dissolved nitrogen gas, laboratory, mg/L (00597)		Methane, laboratory, mg/L (85574)	
		Bottle 1	Bottle 2	Bottle 1	Bottle 2	Bottle 1	Bottle 2	Bottle 1	Bottle 2
Sand and gravel wells									
HE 622	4.3	19.6	19.6	0.6990	0.7008	19.06	19.04	<0.001	<0.001
HE1929	6.8	1.7	1.8	0.7332	0.7330	19.63	19.52	0.0013	0.0015
OE1460	5.4	37.8	37.7	0.6949	0.6927	18.36	18.19	0.0088	0.0084
OE1468	4.3	24.9	25.0	0.7348	0.7384	22.00	22.18	<0.001	<0.001
SA1501	3.9	22.2	21.9	0.7033	0.7019	19.87	19.83	0.143	0.067
SA2259	1.6	23.8	23.3	0.7728	0.7859	23.57	24.24	<0.001	<0.001
SN1366	0.2	20.4	19.9	1.171	1.164	39.85	39.49	0.0030	0.0028
SO 605	0.5	17.5	17.5	0.6101	0.6179	16.66	16.95	<0.001	<0.001
SO 814	<0.3	16.4	16.7	0.7598	0.7619	23.35	23.39	0.013	0.013
Bedrock wells									
A667	<0.3	13.9	14.0	0.7407	0.7497	18.81	19.32	35.6	38.3
FU1611	<0.3	47.1	47.0	0.8120	0.8097	23.05	22.95	0.632	0.631
G 837	<0.3	0.3	0.3	0.9605	0.9661	30.22	30.21	8.33	8.25
HE1459	1.0	15.9	16.0	0.7510	0.7443	21.43	21.29	<0.001	0.0014
HE1480	<0.3	6.2	6.2	0.8858	0.8960	26.05	26.48	5.10	5.11
MT 406	<0.3	36.3	35.8	0.9487	0.9521	33.37	33.62	0.021	0.019
OE2876	<0.3	1.7	3.0	0.6700	0.6571	16.81	16.16	42.0	44.3
SA2806	<0.3	9.3	9.3	0.6392	0.6387	17.39	17.51	23.7	24.2
SN1131	<0.3	15.4	15.7	0.8202	0.8256	23.53	23.72	0.515	0.510
SO1037	<0.3	2.6	2.6	0.8148	0.8057	24.69	24.32	0.054	0.052
SO1487	<0.3	17.1	16.9	0.8077	0.8051	23.67	23.65	<0.001	<0.001
SO1658	2.2	29.3	29.8	0.7544	0.7549	21.10	20.98	<0.001	<0.001

[1] A, Albany County; FU, Fulton County; G, Greene County; HE, Herkimer County; MT, Montgomery County; OE, Oneida County; SA, Saratoga County; SN, Schenectady County; SO, Schoharie County.

Table 1-4. Concentrations of major ions in groundwater samples collected in the Mohawk River Basin, New York, 2011.

[mg/L, milligrams per liter; $CaCO_3$, calcium carbonate; (00900), U.S. Geological Survey National Water Information System parameter code; <, less than; °C; degrees Celsius. **Bold** values exceed one or more drinking-water standards. Well locations are shown in figures 2 and 3]

Well number[1]	Hardness, filtered, mg/L as $CaCO_3$ (00900)	Calcium, filtered, mg/L (00915)	Magnesium, filtered, mg/L (00925)	Potassium, filtered, mg/L (00935)	Sodium, filtered, mg/L (00930)	Acid neutralizing capacity, unfiltered, mg/L as $CaCO_3$ (90410)	Alkalinity, filtered, incremental titration, field, mg/L as $CaCO_3$ (39086)
Sand and gravel wells							
HE 622	284	87.6	15.9	3.40	**68.7**	226	212
HE1929	103	27.1	8.57	0.47	2.51	105	94
OE1460	357	98.0	27.4	1.92	56.6	247	269
OE1468	347	97.8	25.1	1.46	40.0	240	230
SA1501	204	63.6	11.0	2.02	15.2	176	160
SA2259	301	73.8	28.3	0.89	10.1	205	243
SN1366	520	119	53.8	2.14	**150**	347	289
SO 605	72.5	24.2	2.91	0.83	9.91	65	48
SO 814	386	120	21.1	1.02	**64.6**	241	211
Bedrock wells							
A667	198	41.1	23.0	2.17	**94.7**	268	243
FU1611	79.6	27.2	2.82	1.01	11.7	80	78
G 837	21.0	7.14	0.781	0.29	**88.5**	122	107
HE1459	260	85.6	11.3	1.28	40.6	130	169
HE1480	75.2	17.9	7.44	6.68	**89.0**	275	157
MT 406	385	113	25.0	4.10	53.3	294	255
OE2876	96.6	18.9	12.0	5.08	**273**	172	159
SA2806	160	36.7	16.6	4.40	57.9	264	224
SN1131	315	63.8	37.7	1.91	**81.5**	274	251
SO1037	53.0	15.2	3.63	0.59	50.4	147	126
SO1487	193	45.9	19.0	3.04	43.3	255	223
SO1658	636	214	24.7	1.19	**70.7**	264	221

[1] A, Albany County; FU, Fulton County; G, Greene County; HE, Herkimer County; MT, Montgomery County; OE, Oneida County; SA, Saratoga County; SN, Schenectady County; SO, Schoharie County.

Table1-4. Concentrations of major ions in groundwater samples collected in the Mohawk River Basin, New York, 2011—Continued

[mg/L, milligrams per liter; $CaCO_3$, calcium carbonate; (00900), U.S. Geological Survey National Water Information System parameter code; <, less than; °C; degrees Celsius. **Bold** values exceed one or more drinking-water standards. Well locations are shown in figures 2 and 3]

Well number[1]	Bicarbonate, filtered, incremental titration, field, mg/L (00453)	Chloride, filtered, mg/L (00940)	Fluoride, filtered, mg/L (00950)	Silica, filtered, mg/L (00955)	Sulfate, filtered, mg/L (00945)	Dissolved solids, dried at 180ºC, filtered, mg/L (70300)
Sand and gravel wells						
HE 622	258	112	0.06	7.34	33.2	500
HE1929	114	3.01	<0.04	6.08	5.01	133
OE1460	327	101	0.05	6.11	18.0	**507**
OE1468	279	89.5	<0.04	7.57	32.1	473
SA1501	194	24.6	0.20	13.0	16.1	302
SA2259	295	21.5	0.05	11.5	32.4	351
SN1366	352	9.83	0.55	13.3	**453**	**1,090**
SO 605	59	13.1	0.43	5.10	12.2	125
SO 814	257	188	0.06	13.5	31.9	**764**
Bedrock wells						
A667	295	92.1	0.53	8.94	18.1	444
FU1611	95	17.8	0.26	13.0	9.15	170
G 837	127	64.9	0.48	7.45	4.36	230
HE1459	205	97.2	0.20	17.1	19.4	436
HE1480	190	10.4	0.79	9.50	1.31	305
MT 406	310	89.0	0.32	7.38	79.8	**577**
OE2876	191	**393**	1.55	7.78	4.81	**843**
SA2806	272	19.9	0.37	13.1	14.0	314
SN1131	305	112	0.60	17.5	35.4	**540**
SO1037	153	7.63	0.36	8.81	11.4	186
SO1487	272	13.3	0.53	10.9	19.2	319
SO1658	270	110	0.36	8.70	**388**	**1,040**

[1] A, Albany County; FU, Fulton County; G, Greene County; HE, Herkimer County; MT, Montgomery County; OE, Oneida County; SA, Saratoga County; SN, Schenectady County; SO, Schoharie County.

Table 1-5. Concentrations of nutrients and organic carbon in groundwater samples collected in the Mohawk River Basin, New York, 2011.

[N, nitrogen; P, phosphorus; mg/L, milligrams per liter; (00623), U.S. Geological Survey National Water Information System parameter code; <, less than. Well locations are shown in figures 2 and 3]

Well number[1]	Ammonia plus organic-N, filtered, mg/L as N (00623)	Ammonia, filtered, mg/L as N (00608)	Nitrate plus nitrite, filtered, mg/L as N (00631)	Nitrate, filtered, mg/L as N (00618)	Nitrite, filtered, mg/L as N (00613)	Ortho-phosphate, filtered, mg/L as P (00671)	Organic carbon, unfiltered, mg/L (00680)
Sand and gravel wells							
HE 622	0.07	<0.010	2.38	2.38	<0.001	0.007	0.6
HE1929	<0.05	<0.010	0.28	0.281	0.001	0.006	0.4
OE1460	<0.05	<0.010	2.41	2.41	<0.001	0.005	0.7
OE1468	<0.05	<0.010	2.39	2.39	<0.001	0.007	<0.3
SA1501	0.25	0.164	0.04	0.038	<0.001	0.011	2.2
SA2259	0.07	<0.010	3.48	3.48	<0.001	0.012	1.4
SN1366	0.84	0.715	<0.02	<0.016	0.004	0.011	0.4
SO 605	<0.05	<0.010	0.46	0.456	0.001	0.007	1.0
SO 814	0.15	0.100	<0.02	<0.020	<0.001	0.022	0.7
Bedrock wells							
A667	1.5	1.29	<0.02	<0.020	<0.001	0.155	0.6
FU1611	0.80	0.556	<0.02	<0.013	0.007	0.007	11.3
G 837	0.05	0.059	<0.02	<0.020	<0.001	0.033	0.5
HE1459	<0.05	<0.010	0.55	0.550	0.002	0.011	0.8
HE1480	2.4	2.07	<0.02	<0.019	0.001	0.010	0.3
MT 406	0.44	0.339	<0.02	<0.020	<0.001	0.008	1.4
OE2876	1.7	1.61	<0.02	<0.020	<0.001	0.011	<0.3
SA2806	0.70	0.612	<0.02	<0.020	<0.001	0.036	0.9
SN1131	0.29	0.243	<0.02	<0.020	<0.001	0.014	1.1
SO1037	<0.05	<0.010	0.05	0.049	<0.001	0.016	<0.3
SO1487	1.2	0.990	0.48	0.477	<0.001	0.008	<0.3
SO1658	0.23	0.011	0.16	0.136	0.020	0.007	1.0

[1] A, Albany County; FU, Fulton County; G, Greene County; HE, Herkimer County; MT, Montgomery County; OE, Oneida County; SA, Saratoga County; SN, Schenectady County; SO, Schoharie County.

Table 1-6. Concentrations of trace elements in groundwater samples collected in the Mohawk River Basin, New York, 2011.

[µg/L, micrograms per liter; (01105), U.S. Geological Survey National Water Information System parameter code; <, less than. **Bold** values exceed one or more drinking-water standards. Well locations are shown in figures 2 and 3]

Well number[1]	Aluminum, unfiltered, µg/L (01105)	Antimony, unfiltered, µg/L (01097)	Arsenic, unfiltered, µg/L (01002)	Barium, unfiltered, µg/L (01007)	Beryllium, unfiltered, µg/L (01012)	Boron, filtered, µg/L (01020)	Chromium, unfiltered, µg/L (01034)	Cobalt, unfiltered, µg/L (01037)
Sand and gravel wells								
HE 622	<3	<0.2	1.0	206	<0.02	25	0.29	0.02
HE1929	14	<0.2	0.14	6.5	<0.02	5.8	<0.21	0.02
OE1460	<3	<0.2	0.37	85.7	<0.02	19	<0.21	0.05
OE1468	<3	<0.2	0.45	205	<0.02	16	<0.21	0.03
SA1501	<3	<0.2	0.43	20.1	<0.02	22	0.46	0.61
SA2259	36	<0.2	0.42	12.2	<0.02	11	0.29	0.31
SN1366	<3	<0.2	2.6	11.0	<0.02	350	0.38	0.10
SO 605	<3	<0.2	0.16	18.4	<0.02	11	<0.21	<0.02
SO 814	<3	0.7	4.9	1,100	<0.02	39	0.23	0.02
Bedrock wells								
A667	18	<0.2	0.25	968	<0.02	376	0.32	<0.02
FU1611	**80**	<0.2	0.18	7.5	<0.02	1.3	0.48	11.5
G 837	7	<0.2	6.2	157	<0.02	99	0.29	<0.02
HE1459	5	<0.2	0.34	48.5	<0.02	28	<0.21	0.02
HE1480	**124**	0.7	0.15	245	0.02	907	<0.21	0.07
MT 406	<3	<0.2	0.80	126	<0.02	121	<0.21	0.03
OE2876	13	0.4	0.47	535	<0.02	564	<0.21	<0.02
SA2806	**194**	<0.2	0.26	694	<0.02	170	0.82	0.05
SN1131	3	<0.2	4.0	110	<0.02	160	<0.21	0.14
SO1037	16	<0.2	4.0	22.0	<0.02	188	<0.21	0.02
SO1487	<3	<0.2	0.23	201	<0.02	319	<0.21	0.02
SO1658	<3	1.2	0.79	215	<0.02	27	0.55	0.05

[1] A, Albany County; FU, Fulton County; G, Greene County; HE, Herkimer County; MT, Montgomery County; OE, Oneida County; SA, Saratoga County; SN, Schenectady County; SO, Schoharie County.

Table1-6. Concentrations of trace elements in groundwater samples collected in the Mohawk River Basin, New York, 2011—Continued

[µg/L, micrograms per liter; (01105), U.S. Geological Survey National Water Information System parameter code; <, less than. **Bold** values exceed one or more drinking-water standards. Well locations are shown in figures 2 and 3]

Well number[1]	Copper, unfiltered, µg/L (01042)	Iron, filtered, µg/L (01046)	Iron, unfiltered, µg/L (01045)	Lead, unfiltered, µg/L (01051)	Lithium, unfiltered, µg/L (01132)	Manganese, filtered, µg/L (01056)	Manganese, unfiltered, µg/L (01055)
Sand and gravel wells							
HE 622	7.7	<3	<5	0.41	6.1	0.4	0.5
HE1929	6.1	6	**738**	1.14	0.3	5.6	9.8
OE1460	9.6	4	<5	0.16	7.6	0.4	0.5
OE1468	7.6	<3	<5	0.58	6.7	<0.2	<0.4
SA1501	1.7	3	<5	1.11	4.3	**1,620**	**1,670**
SA2259	52.5	12	111	0.49	0.8	13.7	15.3
SN1366	<0.70	**7,620**	**7,700**	<0.04	91.2	**268**	**282**
SO 605	4.5	<3	<5	0.09	0.5	<0.2	<0.4
SO 814	11.5	175	195	0.23	75.8	**232**	**246**
Bedrock wells							
A667	<0.70	31	**487**	0.04	360	33.4	35.6
FU1611	20.5	**14,000**	**14,400**	4.07	3.6	**1,040**	**995**
G 837	<0.70	6	22	0.06	40.3	27.4	29.5
HE1459	5.5	11	78	0.25	7.2	0.3	0.4
HE1480	0.81	43	237	0.08	353	13.3	15.8
MT 406	<0.70	102	132	<0.04	10.9	17.1	19.1
OE2876	5.5	271	**440**	<0.04	989	7.7	9.1
SA2806	<0.70	19	**684**	0.10	79.7	45.0	**50.5**
SN1131	5.7	**1,340**	**1,410**	0.35	91.2	45.2	**50.5**
SO1037	2.7	17	**458**	0.33	8.5	17.2	20.2
SO1487	<0.70	<3	<5	0.22	118	4.5	5.0
SO1658	<0.70	9	24	<0.04	3.2	0.5	0.9

[1] A, Albany County; FU, Fulton County; G, Greene County; HE, Herkimer County; MT, Montgomery County; OE, Oneida County; SA, Saratoga County; SN, Schenectady County; SO, Schoharie County.

Table1-6. Concentrations of trace elements in groundwater samples collected in the Mohawk River Basin, New York, 2011—Continued

[µg/L, micrograms per liter; (01105), U.S. Geological Survey National Water Information System parameter code; <, less than. **Bold** values exceed one or more drinking-water standards. Well locations are shown in figures 2 and 3]

Well number[1]	Molybdenum, unfiltered, µg/L (01062)	Nickel, unfiltered, µg/L (01067)	Selenium, unfiltered, µg/L (01147)	Silver, unfiltered, µg/L (01077)	Strontium, unfiltered, µg/L (01082)	Zinc, unfiltered, µg/L (01092)	Uranium, unfiltered, µg/L (28011)
Sand and gravel wells							
HE 622	0.1	0.21	0.79	<0.01	618	<2.4	0.208
HE1929	0.1	<0.12	<0.05	<0.01	79.1	<2.4	0.073
OE1460	<0.1	0.44	0.09	0.07	229	8.5	0.137
OE1468	0.3	0.60	0.12	<0.01	169	15.2	0.423
SA1501	1.2	2.4	0.12	<0.01	235	<2.4	0.224
SA2259	0.3	2.0	0.12	<0.01	205	22.3	0.717
SN1366	5.1	0.12	<0.05	<0.01	2,910	<2.4	1.15
SO 605	0.1	0.18	0.10	<0.01	54.9	11.5	0.026
SO 814	0.6	0.38	<0.05	<0.01	1,330	15.0	0.533
Bedrock wells							
A667	0.1	0.49	9.1	<0.01	4,280	50.4	<0.014
FU1611	0.2	2.8	0.25	<0.01	78.1	6.7	0.074
G 837	1.8	<0.12	3.6	<0.01	152	22.1	<0.014
HE1459	0.4	0.24	0.06	<0.01	824	11.7	0.257
HE1480	0.1	0.22	<0.05	<0.01	1,460	<2.4	0.032
MT 406	2.8	0.50	0.08	<0.01	1,810	10.7	1.48
OE2876	5.9	<0.12	0.05	<0.01	2,730	<2.4	0.165
SA2806	0.2	0.81	19.8	<0.01	1,360	<2.4	0.201
SN1131	7.7	0.42	0.08	<0.01	769	7.2	0.874
SO1037	8.4	<0.12	0.20	<0.01	111	<2.4	3.13
SO1487	0.6	0.18	0.12	<0.01	3,700	<2.4	0.279
SO1658	0.6	0.80	0.10	0.02	23,400	23.0	0.643

[1] A, Albany County; FU, Fulton County; G, Greene County; HE, Herkimer County; MT, Montgomery County; OE, Oneida County; SA, Saratoga County; SN, Schenectady County; SO, Schoharie County.

Table 1-7. Concentrations of pesticides detected in groundwater samples collected in the Mohawk River Basin, New York, 2011.

[µg/L, micrograms per liter; CIAT, 2-chloro-4-isopropylamino-6-amino-*s*-triazine; (04040), U.S. Geological Survey National Water Information System parameter code; <, less than; E, estimated concentration; M, presence verified but not quantified. Well locations are shown in figures 2 and 3]

Well number[1]	CIAT, filtered, µg/L (04040)	Atrazine, filtered, µg/L (39632)	Prometon, filtered, µg/L (04037)	Simazine, filtered, µg/L (04035)
Sand and gravel wells				
HE 622	E0.001	<0.008	<0.01	<0.006
HE1929	<0.006	<0.008	<0.01	<0.006
OE1460	E0.034	0.027	M	0.002
OE1468	E0.005	<0.008	<0.01	<0.006
SA1501	<0.006	<0.008	<0.01	<0.006
SA2259	<0.006	<0.008	<0.01	<0.006
SN1366	<0.006	<0.008	<0.01	<0.006
SO 605	E0.005	0.003	<0.01	<0.006
SO 814	<0.006	<0.008	<0.01	<0.006
Bedrock wells				
A667	<0.006	<0.008	<0.01	<0.006
FU1611	<0.006	<0.008	<0.01	<0.006
G 837	<0.006	<0.008	<0.01	<0.006
HE1459	<0.006	<0.008	<0.01	<0.006
HE1480	<0.006	<0.008	<0.01	<0.006
MT 406	<0.006	<0.008	<0.01	<0.006
OE2876	<0.006	<0.008	<0.01	<0.006
SA2806	<0.006	<0.008	<0.01	<0.006
SN1131	<0.006	<0.008	<0.01	<0.006
SO1037	<0.006	<0.008	<0.01	<0.006
SO1487	<0.006	<0.008	<0.01	<0.006
SO1658	<0.006	<0.008	<0.01	<0.006

[1] A, Albany County; FU, Fulton County; G, Greene County; HE, Herkimer County; MT, Montgomery County; OE, Oneida County; SA, Saratoga County; SN, Schenectady County; SO, Schoharie County.

Table 1-8. Concentrations of volatile organic compounds detected in groundwater samples collected in the Mohawk River Basin, New York, 2011.

[µg/L, micrograms per liter; (34475), U.S. Geological Survey National Water Information System parameter code; <, less than. Well locations are shown in figures 2 and 3]

Well number[1]	Tetra-chloro-ethene, unfiltered, µg/L (34475)	Toluene, unfiltered, µg/L (34010)	Trichloro-methane, unfiltered, µg/L (32106)
Sand and gravel wells			
HE 622	<0.1	<0.1	<0.1
HE1929	<0.1	<0.1	<0.1
OE1460	0.2	<0.1	0.1
OE1468	<0.1	<0.1	<0.1
SA1501	<0.1	<0.1	<0.1
SA2259	<0.1	<0.1	<0.1
SN1366	<0.1	<0.1	<0.1
SO 605	<0.1	<0.1	0.2
SO 814	<0.1	<0.1	<0.1
Bedrock wells			
A667	<0.1	<0.1	<0.1
FU1611	<0.1	0.1	4.5
G 837	<0.1	<0.1	<0.1
HE1459	<0.1	<0.1	<0.1
HE1480	<0.1	<0.1	0.2
MT 406	<0.1	<0.1	<0.1
OE2876	<0.1	<0.1	<0.1
SA2806	<0.1	<0.1	<0.1
SN1131	<0.1	<0.1	<0.1
SO1037	<0.1	<0.1	<0.1
SO1487	<0.1	<0.1	<0.1
SO1658	<0.1	<0.1	<0.1

[1] A, Albany County; FU, Fulton County; G, Greene County; HE, Herkimer County; MT, Montgomery County; OE, Oneida County; SA, Saratoga County; SN, Schenectady County; SO, Schoharie County.

Table 1-9. Activities of radionuclides in groundwater samples from the Mohawk River Basin, New York, 2011.

[pCi/L, picocuries per liter; (01519), USGS National Water Information System parameter code; <, less than. **Bold** values equal or exceed one or more existing or proposed drinking-water standard. Well locations are shown in figures 2 and 3]

Well number[1]	Gross alpha radioactivity, unfiltered, pCi/L (01519)	Gross beta radioactivity, unfiltered, pCi/L (85817)	Radon-222, unfiltered, pCi/L (82303)
Sand and gravel wells			
HE 622	<1.5	3.3	**470**
HE1929	<0.33	<0.42	126
OE1460	<0.87	1.6	**560**
OE1468	<1.4	1.6	**510**
SA1501	<0.75	1.3	**500**
SA2259	<0.83	0.7	**670**
SN1366	5.5	2.0	**400**
SO 605	<0.42	0.6	**710**
SO 814	2.0	1.4	46
Bedrock wells			
A667	4.6	4.8	115
FU1611	1.2	0.8	80
G 837	1.5	<0.62	**300**
HE1459	<0.95	1.0	141
HE1480	<0.92	5.1	22
MT 406	<2	4.0	106
OE2876	3.2	4.3	42
SA2806	2.1	4.5	47
SN1131	<1.4	2.5	74
SO1037	4.9	3.0	**2,320**
SO1487	1.2	2.7	35
SO1658	2.7	<1.3	**300**

[1] A, Albany County; FU, Fulton County; G, Greene County; HE, Herkimer County; MT, Montgomery County; OE, Oneida County; SA, Saratoga County; SN, Schenectady County; SO, Schoharie County.

Table 1-10. Bacteria in groundwater samples collected in the Mohawk River Basin, New York, 2011.

[CFU, colony-forming unit; mL, milliliter; (31691), U.S. Geological Survey National Water Information System parameter code; <, less than. **Bold** values indicate detections of coliform bacteria. Well locations are shown in figures 2 and 3]

Well number[1]	*Escherichia coli,* defined substrate, unfiltered, CFU/100mL (31691)	Fecal coliform, membrane filtration, unfiltered, CFU/100mL (61215)	Heterotrophic plate count, unfiltered, CFU/mL (31692)	Total coliform, membrane filtration, unfiltered, CFU/100mL (61213)
		Sand and gravel wells		
HE 622	<2	<1	<1	<1
HE1929	<2	<1	**998**	<1
OE1460	<2	<1	1	<1
OE1468	<2	<1	<1	<1
SA1501	<2	<1	<1	<1
SA2259	<2	<1	90	<1
SN1366	<2	<1	3	<1
SO 605	<2	<1	2	<1
SO 814	<2	<1	2	<1
		Bedrock wells		
A667	<2	<1	4	<1
FU1611	<2	<1	130	<1
G 837	<2	<1	<1	<1
HE1459	<2	<1	50	**54**
HE1480	<2	<1	209	<1
MT 406	<2	<1	2	<1
OE2876	<2	<1	7	**21**
SA2806	<2	<1	8	<1
SN1131	<2	<1	76	**92**
SO1037	<2	**1**	12	**67**
SO1487	<2	<1	14	<1
SO1658	**2**	<1	<1	**1**

[1] A, Albany County; FU, Fulton County; G, Greene County; HE, Herkimer County; MT, Montgomery County; OE, Oneida County; SA, Saratoga County; SN, Schenectady County; SO, Schoharie County.

Table 1-11. Physiochemical property values and concentrations of nutrients in groundwater samples collected in the Mohawk River Basin, New York, 2002, 2006, and 2011.

[(00080), U.S. Geological Survey National Water Information System parameter code; mg/L, milligrams per liter; µS/cm, microsiemens per centimeter at 25 degrees Celsius; N, nitrogen; P, phosphorus; <, less than; E, estimated concentration; --, not analyzed. **Bold** values exceed one or more drinking-water standards. Well locations are shown in figures 2 and 3]

Well number[1]	Year	Month	Color, platinum-cobalt units (00080)	Dissolved oxygen, mg/L (00300)	pH, field, standard units (00400)	Specific conductance, field, µS/cm (00095)	Water temperature, field, degrees Celsius (00010)	Ammonia plus organic-N, filtered, mg/L as N (00623)	Ammonia, filtered, mg/L as N (00608)	Nitrate plus nitrite, filtered, mg/L as N (00631)	Nitrite, filtered, mg/L as N (00613)	Ortho-phosphate, filtered, mg/L as P (00671)	Organic carbon, unfiltered, mg/L (00680)
Sand and gravel wells													
HE 622	2002	September	--	4.3	7.6	880	12.3	<0.10	<0.04	2.53	<0.008	<0.02	E0.5
	2006	September	2	7.9	7.2	1,040	9.9	E0.08	<0.010	2.60	<0.002	E0.004	1.0
	2011	July	<1	4.3	7.3	874	11.4	0.07	<0.010	2.38	<0.001	0.007	0.6
OE1460	2002	September	--	4.8	7.6	941	13.5	<0.10	<0.04	2.00	<0.008	<0.02	2.6
	2006	September	2	5.6	7.1	910	13.6	<0.10	E0.006	2.04	<0.002	E0.004	1.1
	2011	July	<1	5.4	7.2	923	13.6	<0.05	<0.010	2.41	<0.001	0.005	0.7
SA1501	2002	August	--	--	7.3	507	12.8	0.42	0.32	<0.05	<0.008	<0.02	2.6
	2006	September	2	0.6	7.1	455	12.4	0.48	0.343	E0.04	<0.002	0.007	1.6
	2011	July	<1	3.9	7.3	353	11.7	0.25	0.164	0.04	<0.001	0.011	2.2
Bedrock well													
MT 406	2002	September	--	0.1	**4.8**	1,080	9.4	0.52	0.43	<0.05	<0.008	<0.02	0.8
	2006	August	5	5.6	6.6	1,060	9.4	0.47	0.409	<0.06	<0.002	0.007	<1.0
	2011	July	<1	<.3	7.5	961	10.3	0.44	0.339	<0.02	<0.001	0.008	1.4

[1] HE, Herkimer County; MT, Montgomery County; OE, Oneida County; SA, Saratoga County.

Table 1-12. Concentrations of major ions in groundwater samples collected in the Mohawk River Basin, New York, 2002, 2006, and 2011.

[(00900), U.S. Geological Survey National Water Information System parameter code; mg/L, milligrams per liter; $CaCO_3$, calcium carbonate; <, less than; E, estimated concentration; °C, degrees Celsius; lab, laboratory. **Bold** values exceed one or more drinking-water standards. Well locations are shown in figures 2 and 3]

Well number[1]	Year	Hardness, filtered, mg/L as $CaCO_3$ (00900)	Calcium, filtered, mg/L (00915)	Magnesium, filtered, mg/L (00925)	Potassium, filtered, mg/L (00935)	Sodium, filtered, mg/L (00930)	Acid neutralizing capacity, unfiltered, mg/L as $CaCO_3$ (90410)	Alkalinity, filtered, fixed end point, lab, mg/L as $CaCO_3$ (29801)	Bicarbonate[2], filtered, fixed end point, lab, mg/L (29805)	Chloride, filtered, mg/L (00940)	Fluoride, filtered, mg/L (00950)	Silica, filtered, mg/L (00955)	Sulfate, filtered, mg/L (00945)	Dissolved solids, dried at 180ºC, filtered, mg/L (70300)
Sand and gravel wells														
HE 622	2002	298	92.7	16.2	3.64	62.7	244	237	289	115	E0.07	7.3	39.9	**517**
	2006	314	97.8	17.0	3.60	68.2	242	243	296	130	<0.10	7.22	35.3	**531**
	2011	284	87.6	15.9	3.40	68.7	226	220	268	112	0.06	7.34	33.2	**500**
OE1460	2002	366	95.1	31.2	2.10	60.0	E288	E233	284	105	<0.10	6.0	48.4	**545**
	2006	349	91.5	29.3	2.09	55.1	294	290	354	98.1	E0.08	6.21	30.4	453
	2011	357	98.0	27.4	1.92	56.6	247	251	306	101	0.05	6.11	18.0	**507**
SA1501	2002	230	73.0	11.7	2.35	14.8	196	198	242	26.5	0.21	10.9	34.2	311
	2006	227	72.6	11.2	2.38	15.2	210	212	259	21.9	0.21	11.8	19.5	283
	2011	204	63.6	11.0	2.02	15.2	176	183	223	24.6	0.20	13.0	16.1	302
Bedrock well														
MT 406	2002	502	148	32.4	4.40	41.3	290	289	353	108	0.33	7.7	151	**708**
	2006	424	123	28.5	4.24	51.4	295	293	357	110	0.32	7.15	101	**634**
	2011	385	113	25.0	4.10	53.3	294	194	237	89.0	0.32	7.38	79.8	**577**

[1] HE, Herkimer County; MT, Montgomery County; OE, Oneida County; SA, Saratoga County.

[2] Bicarbonate concentrations calculated from laboratory alkalinity values.

Table 1-13. Concentrations of trace elements and radionuclides in groundwater samples in the Mohawk River Basin, New York, 2002, 2006, and 2011.

[(01105), U.S. Geological Survey National Water Information System parameter code; µg/L, micrograms per liter; pCi/L, picocuries per liter; <, less than; E, estimated concentration. **Bold** values exceed one or more existing or proposed drinking-water standards. Well locations are shown in figures 2 and 3]

Well number[1]	Year	Aluminum, unfiltered, µg/L (01105)	Antimony, unfiltered, µg/L (01097)	Arsenic, unfiltered, µg/L (01002)	Barium, unfiltered, µg/L (01007)	Beryllium, unfiltered, µg/L (01012)	Boron, filtered, µg/L (01020)	Cadmium, unfiltered, µg/L (01027)	Chromium, unfiltered, µg/L (01034)	Cobalt, unfiltered, µg/L (01037)	Copper, unfiltered, µg/L (01042)	Iron, filtered, µg/L (01046)	Iron, unfiltered, µg/L (01045)	Lead, unfiltered, µg/L (01051)
Sand and gravel wells														
HE 622	2002	<2	<0.9	E1	203	<0.06	26	<0.04	<0.8	<1.00	2.3	<10	46	<1.00
	2006	<2	<0.2	0.60	200	<0.06	27	E0.03	0.23	0.183	3.6	<6	E6	0.15
	2011	<3	<0.2	1.0	206	<0.02	25	<0.05	0.29	0.02	7.7	<3	<5	0.41
OE1460	2002	<2	<0.9	<2	94.7	<0.06	31	<0.04	<0.8	<1.00	3.5	<10	<12	<1.00
	2006	<2	<0.2	0.21	97.3	<0.06	28	<0.04	0.05	0.235	1.0	<6	E3	E0.06
	2011	<3	<0.2	0.37	85.7	<0.02	19	<0.05	<0.21	0.05	9.6	4	<5	0.16
SA1501	2002	<2	<0.9	<2	22.6	<0.06	28	0.04	<0.8	<1.00	2.8	<10	E7	<1.00
	2006	<2	<0.2	0.38	19.8	<0.06	24	0.05	0.45	0.742	1.2	E4	7	0.07
	2011	<3	<0.2	0.43	20.1	<0.02	22	<0.05	0.46	0.61	1.7	3	<5	1.11
Bedrock well														
MT 406	2002	<2	<0.9	E1	114	<0.06	178	<0.04	<0.8	<1.00	1.6	169	236	<1.00
	2006	<2	<0.2	0.91	105	<0.06	139	<0.04	0.16	0.260	3.0	154	143	<0.06
	2011	<3	<0.2	0.80	126	<0.02	121	<0.05	<0.21	0.03	<0.70	102	132	<0.04

Table 1–13. Concentrations of trace elements and radionuclides in groundwater samples in the Mohawk River Basin, New York, 2002, 2006, and 2011—Continued

[(01105), U.S. Geological Survey National Water Information System parameter code; µg/L, micrograms per liter; pCi/L, picocuries per liter; <, less than; E, estimated concentration. **Bold** values exceed one or more existing or proposed drinking-water standards. Well locations are shown in figures 2 and 3]

Well number[1]	Year	Lithium, unfiltered, µg/L (01132)	Manganese, filtered, µg/L (01056)	Manganese, unfiltered, µg/L (01055)	Mercury, unfiltered, µg/L (71900)	Molybdenum, unfiltered, µg/L (01062)	Nickel, unfiltered, µg/L (01067)	Selenium, unfiltered, µg/L (01147)	Silver, unfiltered, µg/L (01077)	Strontium, unfiltered, µg/L (01082)	Thallium, unfiltered, µg/L (01059)	Zinc, unfiltered, µg/L (01092)	Radon-222, unfiltered, pCi/L (82303)	Uranium, unfiltered, µg/L (28011)
Sand and gravel wells														
HE 622	2002	6.2	<2.0	<2.4	<0.011	<0.2	4.04	0.9	<0.05	616	<0.90	3	**490**	0.221
	2006	5.7	E0.5	<0.6	<0.010	E0.1	1.96	0.71	<0.16	651	<0.18	9	**450**	0.221
	2011	6.1	0.4	0.5	<0.005	0.1	0.21	0.79	<0.01	618	<0.06	<2.4	**470**	0.208
OE1460	2002	9.7	<2.0	<2.4	0.030	<0.2	4.04	E0.2	<0.05	407	<0.90	4	**590**	0.149
	2006	10.4	<0.6	<0.6	<0.010	<0.2	1.01	E0.06	<0.16	369	<0.18	E2	**480**	0.151
	2011	7.6	0.4	0.5	<0.005	<0.1	0.44	0.09	0.07	229	<0.06	8.5	**560**	0.137
SA1501	2002	4.0	**1,930**	**1,910**	<0.011	1.1	1.72	<0.4	<0.05	233	<0.90	4	**530**	0.284
	2006	4.7	**1,960**	**2,020**	<0.010	1.0	2.29	<0.08	<0.16	237	<0.18	<2	**500**	0.236
	2011	4.3	**1,620**	**1,670**	<0.005	1.2	2.4	0.12	<0.01	235	<0.06	<2.4	**500**	0.224
Bedrock well														
MT 406	2002	18.4	27.6	27.6	0.020	2.4	6.35	E0.2	<0.05	2,420	<0.90	2	170	1.95
	2006	14.5	19.9	18.3	<0.010	2.7	1.84	<0.08	<0.16	2,090	<0.18	7	150	1.80
	2011	10.9	17.1	19.1	<0.005	2.8	0.50	0.08	<0.01	1,810	<0.06	10.7	106	1.48

[1] HE, Herkimer County; MT, Montgomery County; OE, Oneida County; SA, Saratoga County.

Table 1-14. Concentrations of pesticides and of volatile organic compounds detected in groundwater samples collected in the Mohawk River Basin, New York, 2002, 2006, and 2011.

[(04040), U.S. Geological Survey National Water Information System parameter code; CIAT, 2-chloro-4-isopropylamino-6-amino-*s*-triazine; µg/L, micrograms per liter; <, less than; E, estimated concentration; M, presence verified but not quantified. **Bold** values indicate detected concentrations. Well locations are shown in figures 2 and 3]

Well number[1]	Year	CIAT, filtered, µg/L (04040)	Atrazine, filtered, µg/L (39632)	Metolachlor, filtered, µg/L (39415)	Prometon, filtered, µg/L (04037)	Simazine, filtered, µg/L (04035)	Bromo-dichloro-methane, unfiltered, µg/L (32101)	Tribromo-methane, unfiltered, µg/L (32104)	Dibromo-chloro-methane, unfiltered, µg/L (32105)	Methyl *tert*-butyl ether, unfiltered, µg/L (78032)	Tetra-chloro-ethene, unfiltered, µg/L (34475)	Toluene, unfiltered, µg/L (34010)	Trichloro-methane, unfiltered, µg/L (32106)
Sand and gravel wells													
HE 622	2002	<0.006	<0.007	<0.013	<0.01	<0.005	<0.1	<0.2	<0.2	**0.2**	<0.1	<0.1	<0.1
	2006	<0.014	<0.007	<0.006	<0.01	<0.005	**0.3**	**0.8**	**0.7**	<0.2	<0.1	<0.1	**0.2**
	2011	**E0.001**	<0.008	<0.020	<0.01	<0.006	<0.1	<0.2	<0.2	<0.2	<0.1	<0.1	<0.1
OE1460	2002	**E0.040**	**0.022**	<0.013	<0.01	<0.005	**0.2**	**0.3**	**0.3**	<0.2	**0.3**	<0.1	**0.8**
	2006	**E0.033**	**0.024**	**E0.002**	<0.01	<0.005	**0.1**	**0.5**	**0.3**	<0.2	**0.4**	**0.2**	**0.1**
	2011	**E0.034**	**0.027**	<0.020	**M**	**0.002**	<0.1	<0.2	<0.2	<0.2	**0.2**	<0.1	**0.1**
SA1501	2002	<0.006	<0.007	<0.013	<0.01	<0.005	<0.1	<0.2	<0.2	**E0.1**	<0.1	<0.1	<0.1
	2006	<0.014	<0.007	<0.006	<0.01	<0.005	<0.1	<0.2	<0.2	<0.2	<0.1	<0.1	<0.1
	2011	<0.006	<0.008	<0.020	<0.01	<0.006	<0.1	<0.2	<0.2	<0.2	<0.1	<0.1	<0.1
Bedrock well													
MT 406	2002	<0.006	<0.007	<0.013	<0.01	<0.005	<0.1	<0.2	<0.2	<0.2	<0.1	<0.1	<0.1
	2006	<0.014	<0.007	<0.006	<0.01	<0.005	<0.1	<0.2	<0.2	<0.2	<0.1	<0.1	<0.1
	2011	<0.006	<0.008	<0.020	<0.01	<0.006	<0.1	<0.2	<0.2	<0.2	<0.1	<0.1	<0.1

[1] HE, Herkimer County; MT, Montgomery County; OE, Oneida County; SA, Saratoga County.

Table 1-15. Bacteria in groundwater samples collected in the Mohawk River Basin, New York, 2006 and 2011.

[(84385), U.S. Geological Survey National Water Information System parameter code; CFU, colony-forming unit; mL, milliliter; <, less than; U, not detected. Well locations are shown in figures 2 and 3]

Well number[1]	Year	*Escherichia coli*, unfiltered, Presence/ Absence (84385)	Fecal coliform, membrane filtration, unfiltered, CFU/100mL (61215)	Heterotrophic plate count, unfiltered, CFU/mL (31692)	Total coliform, membrane filtration, unfiltered, CFU/100mL (61213)
Sand and gravel wells					
HE622	2006	U	<5	<1	<1
	2011	U	<1	<1	<1
OE1460	2006	U	<5	13	<1
	2011	U	<1	1	<1
SA1501	2006	U	<5	<1	<1
	2011	U	<1	<1	<1
Bedrock well					
MT 406	2006	U	<5	2	<1
	2011	U	<1	2	<1

[1] HE, Herkimer County; MT, Montgomery County; OE, Oneida County; SA, Saratoga County.

Nystrom and Scott—Groundwater Quality in the Mohawk River Basin, New York, 2011— Open-File Report 2013–1021

For more information concerning this report, contact

Director
U.S. Geological Survey
New York Water Science Center
425 Jordan Road
Troy, NY 12180-8349
dc_ny@usgs.gov

or visit our Web site at:
http://ny.water.usgs.gov