USGS
science for a changing world

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

Groundwater Quality in the Genesee River Basin, New York, 2010

Open-File Report 2012–1135

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

Cover. Middle Falls of the Genesee River, Letchworth State Park, New York. (Photograph by Nancy Reddy, 2001)

Groundwater Quality in the Genesee River Basin, New York, 2010

By James E. Reddy

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

Open-File Report 2012–1135

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: 2012

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

Any use of trade, firm, or product names is for descriptive purposes only and does not imply endorsement by the U.S. Government.

Although this information product, for the most part, is in the public domain, it also may contain copyrighted materials as noted in the text. Permission to reproduce copyrighted items must be secured from the copyright owner.

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

Contents

Figures

Tables

Conversion Factors, Datum, and Abbreviations

Inch/Pound to SI

Multiply	By	To obtain
	Length	
inch (in.)	2.54	centimeter (cm)
foot (ft)	0.3048	meter (m)
	Area	
square mile (mi^2)	2.590	square kilometer (km^2)
	Volume	
million gallons (Mgal)	3,785	cubic meter (m^3)
	Flow rate	
gallon per minute (gal/min)	0.06309	liter per second (L/s)
gallon per day (gal/d)	0.003785	cubic meter per day (m^3/d)
million gallons per day (Mgal/d)	0.04381	cubic meter per second (m^3/s)
inch per year (in/yr)	25.4	millimeter per year (mm/yr)

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 National Geodetic Vertical Datum of 1929 (NGVD 29).

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

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

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

Laboratory reporting level (LRL)—Generally equal to twice the yearly determined long-term method detection level (LT–MDL). The LRL controls false negative error. The probability of falsely reporting a nondetection for a sample that contained an analyte at a concentration equal to or greater than the LRL is predicted to be less than or equal to 1 percent. The value of the LRL will be reported with a "less than" remark code for samples in which the analyte was not detected. The U.S. Geological Survey's National Water Quality Laboratory collects quality-control data from selected analytical methods on a continuing basis to determine LT–MDLs and to establish LRLs. These values are reevaluated annually based on the most current quality-control data, and, therefore, may change (Childress and others, 1999).

Abbreviations

AMCL	Alternative maximum contaminant level
CFCL	USGS Chlorofluorocarbon Laboratory
CFU/mL	Colony forming units per milliliter
LRL	Laboratory reporting level
MCL	Maximum contaminant level
NWQL	USGS National Water Quality Laboratory
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
QC	Quality control
SDWS	Secondary drinking-water standards
THM	Trihalomethane
USEPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey
VOC	Volatile organic compound

Other abbreviations in this report:

µm	micrometer
µg/L	micrograms per liter
mg/L	milligrams per liter
µS/cm	microsiemens per centimeter at 25 degrees Celsius
Pt-Co units	platinum-cobalt units
pCi/L	picocuries per liter

Groundwater Quality in the Genesee River Basin, New York, 2010

By James E. Reddy

Abstract

Water samples collected from eight production wells and eight private residential wells in the Genesee River Basin from September through December 2010 were analyzed to characterize the groundwater quality in the basin. Eight of the wells were completed in sand and gravel aquifers, and eight were finished in bedrock aquifers. Three of the 16 wells were sampled in the first Genesee River Basin study during 2005–2006. Water samples from the 2010 study were analyzed for 147 physiochemical properties and constituents that included major ions, nutrients, trace elements, radionuclides, pesticides, volatile organic compounds (VOCs), and indicator bacteria. Results of the water-quality analyses are presented in tabular form for individual wells, and summary statistics for specific constituents are presented by aquifer type. The results are compared with Federal and New York State drinking-water standards, which typically are identical. The results indicate that groundwater generally is of acceptable quality, although concentrations of the following constituents exceeded current or proposed Federal or New York State drinking-water standards at each of the 16 wells sampled: color (one sample), sodium (three samples), sulfate (three samples), total dissolved solids (four samples), aluminum (one sample), arsenic (two samples), copper (one sample), iron (nine samples), manganese (eight samples), radon-222 (nine samples), and total coliform bacteria (six samples). Existing drinking-water standards for pH, chloride, fluoride, nitrate, nitrite, antimony, barium, beryllium, cadmium, chromium, lead, mercury, selenium, silver, thallium, zinc, gross alpha radioactivity, uranium, fecal coliform, *Escherichia coli*, and heterotrophic bacteria were not exceeded in any of the samples collected. None of the pesticides and VOCs analyzed exceeded existing drinking-water standards.

Introduction

Section 305(b) of the Federal Clean Water Act Amendments of 1977 requires that States monitor and report biennially on the chemical quality of surface water and groundwater within State boundaries (U.S. Environmental Protection Agency, 1997). The U.S. Geological Survey (USGS) in 2002, 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, which evaluates surface-water quality in 2 or 3 of the 14 major river basins in the State each year. 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 represented 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 2010 in the Delaware, St. Lawrence, and Genesee River Basins; these basins also were sampled in 2005–2006 as part of this program. This report presents the results of the 2010 groundwater study in the Genesee River Basin in west-central New York.

Groundwater characteristics are affected by the geology and the land use of the area. Shallow wells that tap sand and gravel aquifers are susceptible to contamination by several kinds of compounds, including deicing chemicals, nutrients, pesticides, and volatile organic compounds (VOCs) from agricultural, industrial, residential areas, and upgradient highways. The movement of these contaminants to the water table through the soils and surficial sand and gravel can be relatively rapid. Bedrock wells that tap into sandstone and shale aquifers in rural upland areas generally are less susceptible to contamination from industrial and urban sources, which are mainly in the valleys; but bedrock wells in lowland areas underlain by carbonate bedrock (limestone and dolostone) may be more vulnerable to contamination from surface runoff because infiltration rates and groundwater flow can be relatively rapid through bedrock solution features. Agricultural land upgradient of wells may be a potential source of contamination from fecal waste, fertilizers, and pesticides, from livestock; lawns and residential septic systems also are a potential source of these contaminants. In addition to anthropogenic contaminants, the aquifers contain naturally derived constituents that may diminish water quality, such as arsenic, chloride, hydrogen sulfide, iron, manganese, methane, radon gases, sodium, and sulfate.

Table 1. Previous groundwater 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
Upper Susquehanna River Basin	2004–2005	Open-File Report 2006–1161	Hetcher-Aguila and Eckhardt, 2006
Delaware River Basin	2005–2006	Open-File Report 2007–1098	Nystrom, 2007b
Genesee River Basin	2005–2006	Open-File Report 2007–1093	Eckhardt and others, 2007
St. Lawrence River Basin	2005–2006	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
Eastern Lake Ontario Basin	2008	Open-File Report 2011–1074	Risen and Reddy, 2011a
Chemung River Basin	2008	Open-File Report 2011–1112	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
Upper Susquehanna River Basin	2009	Open-File Report 2012–1045	Reddy and Risen, 2012
Delaware River Basin	2010	Open-File Report 2011–1320	Nystrom, 2012
St. Lawrence River Basin	2010	Open-File Report 2011–1320	Nystrom, 2012

Purpose and Scope

This report supplements the water-quality study completed in 2005–2006 in the Genesee River Basin (Eckhardt and others, 2007) by resampling 3 of the wells from that study (Wells AG 263, MO 1524, and WO 350), and provides analytical results for 13 new wells (fig. 1). This report briefly describes the study area and the sampling methods, and presents results of the water-quality analyses for the 16 wells sampled in 2010. Summary statistics (number of samples exceeding Federal or State drinking-water standards) and the minimum, median, and maximum concentrations of selected analytes in sand and gravel and bedrock aquifers are provided in tables 2 through 4; information on the sampled wells and detailed analytical results for all analytes are provided in the appendix (tables 1–1 through 1–9).

Study Area

The Genesee River Basin lies mostly in west-central New York and partly in north-central Pennsylvania (fig. 1). A complete description of the study area is included in the first Genesee River Basin report (Eckhardt and others, 2007). The 2,439-square mile (mi^2) study area in New York includes all or parts of nine counties. The central and southern parts of the basin lie within the Appalachian Plateau physiographic province, and the northern part of the basin is in the Lake Ontario Lowlands province (fig. 1). The central and southern parts of the study area are predominantly rural, although there are several large villages [Avon, Dansville, Geneseo, LeRoy, Mount Morris, Warsaw, and Wellsville (fig. 1)] and many small villages and hamlets. Most of the developed area is in the northern part of the basin, including the City of Rochester and its suburbs in Monroe County.

During deglaciation of the region, sand and gravel were deposited by meltwater streams; and clay, silt, and fine sand were deposited in proglacial lakes. The glaciofluvial and glaciolacustrine deposits within the study area are described in detail by Randall (2001) and Coates (1966). The most productive aquifers within the study area are the glaciofluvial deposits of sand and gravel in the valleys. Bedrock aquifers typically are used for water supply in upland areas where sand and gravel aquifers generally are absent. The bedrock aquifers throughout most of the study area are relatively flat-lying, interbedded sedimentary units of shale, siltstone, sandstone, limestone, and dolostone of Silurian and Devonian age (Fisher and others, 1970).

Methods

A total of 16 wells (appendix table 1–1) were selected for sample collection as described by Eckhardt and others (2007)—8 were finished in sand and gravel aquifers and 8

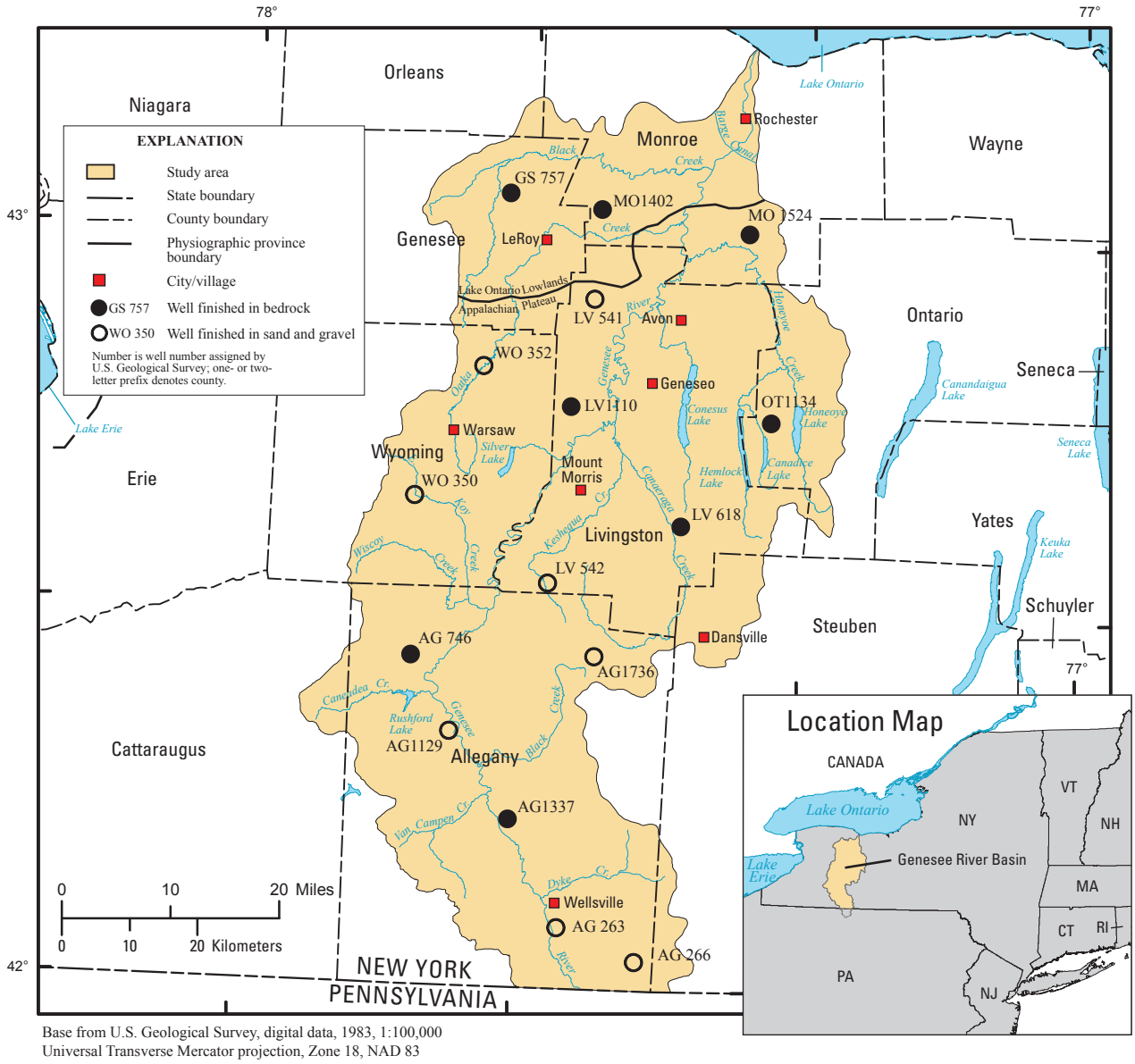

Figure 1. Pertinent geographic features of study area in the Genesee River Basin, New York, and locations of the 16 wells sampled in 2010. (Well data are provided in table 1–1, at end of report.)

were finished in bedrock aquifers. Of the eight wells that tap into sand and gravel aquifers, seven are production wells and one is a private residential well. Of the eight bedrock wells, one is a production well and seven are private residential wells. Samples were collected from September through December 2010. The water samples were analyzed for 147 physiochemical properties and constituents that included major ions, nutrients, trace elements, radionuclides, pesticides, VOCs, and indicator bacteria.

Most of the wells that are finished in sand and gravel were in the valleys and ranged from 25 to 199 ft deep (appendix table 1–1). The wells that are finished in bedrock were generally in the uplands and ranged from 60 to 260 ft deep; all the bedrock wells were finished in sedimentary units of shale, siltstone, and sandstone (appendix table 1–1).

Wells were selected to provide adequate spatial coverage of the study area. The study did not target specific municipalities, industries, or agricultural practices. The private residential wells were selected on the basis of information from the NYSDEC Water Well program, which began in 2000. Production wells were selected using information from the NYSDEC Water Well program and the New York State Department of Health (NYSDOH) Drinking Water Protection program.

In addition to the 16 groundwater samples, one quality control (QC) sample was collected. The 147 physiochemical properties and constituents were divided between a replicate

sample and a blank sample. A concurrent QC replicate sample was collected for radon-222 and the dissolved gases (argon, carbon dioxide, methane, and nitrogen) and a QC blank sample was collected for the remaining 142 physiochemical properties and constituents. The variability between the replicate sample and the corresponding environmental sample was greatest for radon-222, which was detected at a concentration of 750 picocuries per liter (pCi/L) in the replicate sample and 780 pCi/L in the environmental sample—a difference of 3.8 percent. The variability between dissolved gas samples was 1.6 percent or less. Carbon dioxide was the dissolved gas with the greatest variability; the environmental sample had a concentration of 24.6 mg/L and the concentration of the replicate sample was 25.0 mg/L. No constituents exceeded laboratory reporting levels (LRLs) in the blank sample.

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). All samples except those for radionuclide analyses were chilled to 4 degrees Celsius (°C) or less and were kept chilled until delivery to the analyzing laboratory. The samples were delivered directly, or shipped by overnight delivery, to four laboratories: (1) the USGS National Water Quality Laboratory (NWQL) in Denver, Colorado, for analysis of inorganic major ions, nutrients, total organic carbon, inorganic trace elements, radon-222, pesticides and pesticide degradates, and VOCs; (2) the USGS Chlorofluorocarbon Laboratory (CFCL) in Reston, Virginia, for select dissolved gases; (3) a NYSDOH-certified laboratory in Richmond, California, for gross alpha and gross beta radioactivities; and (4) a NYSDOH-certified laboratory in Depew, New York, for bacterial analysis. Physiochemical properties, such as water temperature, pH, dissolved oxygen concentration, and specific conductance, were measured at the sampling site.

Groundwater Quality

Samples from 16 wells were analyzed for 147 physiochemical properties and constituents. Many of these (80) were not detected above the LRLs in any sample (appendix table 1–2). Results for the remaining 67 physiochemical properties and constituents that were detected are presented in appendix tables 1–3 through 1–9. The categories of physiochemical properties and constituents are presented in the appendix tables as follows: physiochemical properties (table 1–3), inorganic constituents (table 1–4), nutrients and total organic carbon (table 1–5), trace elements and radionuclides (table 1–6), pesticides (table 1–7), VOCs (table 1–8), and bacterial water-quality indicators (table 1–9). Some concentrations were reported as "estimated" when the detected value was less than the established LRL, or when recovery of a compound has been documented to be highly variable (Childress and others, 1999).

Analytical results for selected constituents were compared with Federal and New York State drinking-water standards, which are typically identical. The standards include maximum contaminant levels (MCLs) and secondary drinking-water standards (SDWS) established by the U.S. Environmental Protection Agency (USEPA) (U.S. Environmental Protection Agency, 1999; 2002; and 2009) and the NYSDOH (New York State Department of Health, 2007). The MCLs are enforceable standards that specify the highest level of a contaminant that is allowed in public water drinking supplies; they are not enforceable for private residential wells, but are presented here as a guideline for evaluation of the water-quality results. The SDWS are nonenforceable guidelines based on cosmetic and aesthetic criteria, such as taste, odor, or staining of plumbing fixtures.

The quality of the sampled groundwater generally was acceptable, although in samples from each of the 16 wells the concentration of at least 1 constituent exceeded recommended MCLs or SDWS set by the USEPA and the NYSDOH. Exceedances generally involved minerals and chemical elements that occur from natural interactions of water and rock (aluminum, arsenic, copper, iron, manganese, sodium, and sulfate), but also included radon-222, which is generated from the natural decay of uranium, and total coliform bacteria contamination.

Physiochemical Properties

The color of the water samples (appendix table 1–3) ranged from less than 1 platinum-cobalt (Pt-Co) unit (the LRL) to 20 Pt-Co units; the median was less than 5 Pt-Co units for sand and gravel wells and 2 Pt-Co units for bedrock wells. The NYSDOH MCL and USEPA SDWS of 15 Pt-Co units were exceeded in one sample from a sand and gravel well. The pH of the samples ranged from 6.9 to 8.1; the median was pH 7.6 for sand and gravel wells and pH 7.4 for bedrock wells. None of the 16 wells had pH values outside the accepted USEPA SDWS range of pH 6.5 to 8.5 (U.S. Environmental Protection Agency, 2009). Specific conductance of the samples ranged from 293 to 2,510 microsiemens per centimeter (µS/cm) at 25°C; the median was 593 µS/cm at 25°C for sand and gravel wells and 872 µS/cm at 25°C for bedrock wells. The temperature of the water ranged from 9.7°C to 16.9°C; the median was 10.5°C for sand and gravel wells and 13.4°C for bedrock wells.

Dissolved-oxygen concentrations ranged from 0.2 milligrams per liter (mg/L) to 2.7 mg/L; the median was 0.6 mg/L for sand and gravel wells and 0.4 mg/L for bedrock wells. Methane concentrations ranged from less than 0.0005 mg/L (the LRL) to 45.4 mg/L; the median was 0.016 mg/L for sand and gravel wells and 0.005 mg/L for bedrock wells. The odor of hydrogen sulfide gas, which may occur in the absence of oxygen, was noted by field personnel in water from two sand and gravel wells and three bedrock wells.

Major Ions

The cations that were detected in the greatest concentrations were calcium and sodium (table 2 and appendix table 1–4). Calcium concentrations ranged from 22.9 to 544 mg/L; the median was 58.1 mg/L for sand and gravel wells and 102 mg/L for bedrock wells. Magnesium concentrations ranged from 6.03 to 49.5 mg/L; the median was 16.6 mg/L for sand and gravel wells and 38.7 mg/L for bedrock wells. Potassium concentrations ranged from 1.06 to 17.5 mg/L; the median was 1.45 mg/L for sand and gravel wells and 2.78 mg/L for bedrock wells. Sodium concentrations ranged from 6.14 to 118 mg/L; the median was 32.6 mg/L for sand and gravel wells and 28.0 mg/L for bedrock wells. The USEPA nonregulatory drinking-water advisory taste threshold for sodium recommends that sodium concentrations in drinking water not exceed the range of 30 to 60 mg/L (U.S. Environmental Protection Agency, 2002; 2009). The concentration of sodium in samples from one sand and gravel (97.4 mg/L) well and two bedrock wells (61.8 and 118 mg/L) exceeded the upper limit of the USEPA threshold.

The anions that were detected in the greatest concentration were bicarbonate and sulfate (table 2 and appendix table 1–4). Bicarbonate concentrations ranged from 76 to 437 mg/L; the median was 246 mg/L for sand and gravel wells and 344 mg/L for bedrock wells. Chloride concentrations ranged from 8.85 to 94.7 mg/L; the median was 54.2 mg/L for sand and gravel wells and 19.6 mg/L for bedrock wells. Fluoride concentrations ranged from 0.07 to 0.63 mg/L; the median was 0.14 mg/L for sand and gravel wells and 0.27 mg/L for bedrock wells. Silica concentrations ranged from 6.48 to 21.2 mg/L; the median was 9.15 mg/L for sand and gravel wells and 13.5 mg/L for bedrock wells. Sulfate concentrations ranged from <0.09 mg/L (the LRL) to 1,510 mg/L; the median was 15.6 mg/L for sand and gravel wells and 75.0 mg/L for bedrock wells. The NYSDOH MCL and USEPA SDWS of 250 mg/L were exceeded in samples from three bedrock wells.

Calcium and magnesium contribute to water hardness. Water hardness in the basin ranged from 82 to 1,560 mg/L (as $CaCO_3$); the median was 216 mg/L for sand and gravel wells and 415 mg/L for bedrock wells. Three of the samples were soft to moderately hard (120 mg/L as $CaCO_3$ or less) and 13 wells yielded water that was hard to very hard (greater than

Table 2. Drinking-water standards and summary statistics for concentrations of major ions in groundwater samples from the Genesee River Basin, New York, 2010.

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

Constituent		Drinking-water standard	Number of samples exceeding standard	Summary statistics and concentrations					
				Sand and gravel (8 samples)			Bedrock (8 samples)		
				Minimum	Median	Maximum	Minimum	Median	Maximum
Cations	Calcium	--	--	23.7	58.1	120	22.9	102	544
	Magnesium	--	--	6.80	16.6	34.4	6.03	38.7	49.5
	Potassium	--	--	1.06	1.45	2.14	1.84	2.78	17.5
	Sodium	[1]60	3	20.6	32.6	97.4	6.14	28.0	118
Anions	Bicarbonate	--	--	76	246	437	199	344	429
	Chloride	[2,3]250	0	14.1	54.2	94.7	8.85	19.6	88.9
	Fluoride	[4]4.0 [2]2.0 [3]2.2	0	.07	.14	.31	.13	.27	.63
	Silica	--	--	6.48	9.15	21.1	9.77	13.5	21.2
	Sulfate	[2,3]250	3	<.09	15.6	37.4	<.18	75.0	1,510
Hardness as $CaCO_3$		--	--	87	216	440	82	415	1,560
Alkalinity as $CaCO_3$		--	--	62	202	358	163	282	352
Dissolved solids, dried at 180°C		[3]500	4	160	327	539	191	505	2,400

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

[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 Maximum Contaminant Level.

120 mg/L as $CaCO_3$) (Hem, 1985). Wells finished in bedrock were slightly more alkaline (median 282 mg/L as $CaCO_3$) than those finished in sand and gravel (median 202 mg/L as $CaCO_3$). Concentrations of total dissolved solids ranged from 160 to 2,400 mg/L, with a median of 327 mg/L for sand and gravel wells and 505 mg/L for bedrock wells. The USEPA SDWS of 500 mg/L for dissolved solids was exceeded in one sand and gravel well and three bedrock wells.

Nutrients and Organic Carbon

Total organic carbon was the predominant nutrient in the groundwater samples (table 3 and appendix table 1–5). Concentrations of ammonia ranged from <0.010 (the LRL) to 1.50 mg/L as nitrogen (N); the median concentration was 0.138 mg/L as N in samples from sand and gravel wells and 0.394 mg/L as N in samples from bedrock wells. Concentrations of nitrate plus nitrite ranged from <0.02 (the LRL) to 1.31 mg/L as N; the median concentration was <0.02 mg/L as N in samples from sand and gravel wells and <0.04 mg/L as N in samples from bedrock wells. The concentration of nitrate plus nitrite did not exceed the USEPA and NYSDOH MCL of 10 mg/L as N in any sample. Nitrite was detected in four samples with a maximum concentration of 0.004 mg/L as N; the concentration of nitrite did not exceed the MCL (1 mg/L as N) in any sample. Orthophosphate concentrations ranged from 0.006 to 0.111 mg/L as phosphorus (P). Organic carbon was detected in 15 of the 16 samples; the maximum concentration was 2.9 mg/L.

Trace Elements and Radionuclides

The trace elements detected in the greatest concentrations (>100 µg/L) were aluminum, arsenic, barium, boron, copper, iron, manganese, and strontium (table 4 and appendix table 1–6). The largest detected concentration of a trace element, 19,800 µg/L, was of strontium in a sample from a bedrock well. The concentration of aluminum in one sample from a bedrock well, 454 µg/L, exceeded the upper limit of the USEPA SDWS for aluminum of 200 µg/L. The concentration of arsenic in one sample from a sand and gravel well (148 µg/L) and one sample from a bedrock well (13.3 µg/L) exceeded the USEPA and NYSDOH MCL of 10 µg/L. The concentration of copper in one sample from a bedrock well (1,610 µg/L) exceeded the USEPA SDWS of 1,000 µg/L. The concentration of iron in eight filtered samples and nine unfiltered samples exceeded the USEPA SDWS and the NYSDOH MCL of 300 µg/L. The concentration of manganese in seven filtered samples and eight unfiltered samples exceeded the USEPA SDWS of 50 µg/L; the NYSDOH MCL of 300 µg/L was not exceeded in any sample. Drinking-water standards for antimony, barium, beryllium, cadmium, chromium, lead, mercury, selenium, silver, thallium, uranium , and zinc were not exceeded; additionally, mercury and thallium were not detected in any sample (appendix table 1–2).

Three measures of radioactivity were employed (table 4 and appendix table 1–6). Gross alpha activity ranged from less than 0.70 to 2.8 pCi/L. The median activity was <1.2 pCi/L in samples from sand and gravel wells and <1.3 pCi/L in

Table 3. Drinking-water standards and summary statistics for concentrations of nutrients in groundwater samples from the Genesee River Basin, New York, 2010.

[All concentrations in milligrams per liter in filtered water except as noted. N, nitrogen; --, not applicable; <, less than; E, estimated value—constituent was detected in the sample but with low or inconsistent recovery; P, phosphorus]

Constituent	Drinking-water standard	Number of samples exceeding standard	Summary statistics and concentrations					
			Sand and gravel (8 samples)			Bedrock (8 samples)		
			Minimum	Median	Maximum	Minimum	Median	Maximum
Ammonia plus organic N, as N	--	--	<.05	.17	1.5	<.10	.38	1.1
Ammonia, as N	--	--	<.010	.138	1.50	E.011	.394	.999
Nitrate plus nitrite, as N	[1,2]10	0	<.02	<.02	1.31	<.02	<.04	E.03
Nitrite, as N	[1,2]1	0	<.001	<.001	.001	<.001	<.002	.004
Orthophosphate, as P	--	--	.006	.018	.111	.008	.010	.013
Total organic carbon, unfiltered	--	--	.4	.7	2.4	<.3	.8	2.9

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

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

Table 4. Drinking-water standards and summary statistics for concentrations of trace elements and radionuclides in groundwater samples from the Genesee River Basin, New York, 2010.

[All concentrations in micrograms per liter in unfiltered water except as noted. <, less than; E, estimated value—constituent was detected in the sample but with low or inconsistent recovery; --, not applicable; pCi/L, picocuries per liter; mrem/yr, millirem per year]

Constituent	Summary statistics and concentrations							
	Drinking-water standard	Number of samples exceeding standard	Sand and gravel (8 samples)			Bedrock (8 samples)		
			Minimum	Median	Maximum	Minimum	Median	Maximum
Aluminum	[3]50–200	1	<3	<6	34	<3	<6	454
Antimony	[1,2]6	0	<.2	<.2	<.4	<.2	<.4	0.2
Arsenic	[1,2]10	2	.58	1.7	148	.26	3.2	13.3
Barium	[1,2]2,000	0	60.7	192	1,480	7.0	133	644
Beryllium	[1,2]4	0	<.02	<.02	<.04	<.02	<.04	E.02
Boron, filtered	--	--	15	46	144	32	240	2,550
Cadmium	[1,2]5	0	<.04	<.05	<.05	<.04	<.04	E.03
Chromium	[1,2]100	0	<.21	<.21	.21	<.21	<.42	.24
Cobalt	--	--	<.02	.03	.11	<.04	.02	.46
Copper	[3]1,000	1	<.70	1.4	7.6	<.70	E1.1	1,610
Iron, filtered	[2,3]300	8	6	360	2,600	12	398	6,380
Iron	[2,3]300	9	17	388	3,100	32	450	6,180
Lead	[4]15	0	<.04	.50	4.26	<.22	.14	10.4
Lithium	--	--	3.9	7.4	37.4	12.7	30.6	78.3
Manganese, filtered	[2]300	0	.2	39.8	179	13.7	55.8	187
	[3]50	7						
Manganese	[2]300	0	<.4	45.6	191	15.4	72.0	192
	[3]50	8						
Molybdenum	--	--	.1	1.2	12.9	<.1	1.0	4.8
Nickel	--	--	<.12	.21	1.0	<.36	.49	1.5
Selenium	[1,2]50	0	<.05	<.05	.20	<.05	<.10	.14
Silver	[2,3]100	0	<.01	<.01	<.02	<.01	<.01	.11
Strontium	--	--	149	270	859	116	1,144	19,800
Zinc	[2,3]5,000	0	<2.0	6.7	75.0	<2.0	2.8	72.3
Gross alpha radioactivity, pCi/L	[1,2]15	0	<.70	<1.2	2.8	<.88	<1.3	2.0
Gross beta radioactivity, pCi/L	[1,2]4 mrem/yr	--	1.3	1.8	2.7	<.93	3.2	18.4
Radon-222, pCi/L	[5]300	9	235	375	800	175	340	620
	[6]4,000	0						
Uranium	[1,2]30	0	<.014	.024	.376	<.014	.072	.222

[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.

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

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

samples from bedrock wells. The gross alpha activity did not exceed the USEPA and NYSDOH MCLs for gross alpha of 15 pCi/L in any sample. Gross beta activity ranged from less than 0.93 to 18.4 pCi/L. The median activity was 1.8 pCi/L in samples from sand and gravel wells and 3.2 pCi/L in samples from bedrock wells. The USEPA and NYSDOH MCLs for gross beta are expressed as a dose of 4 millirems per year. Radon-222 was detected in every sample, and activity ranged from 175 to 800 pCi/L. The median activity was 375 pCi/L in samples from sand and gravel wells and 340 pCi/L in samples from bedrock wells. Radon currently is not regulated in drinking water; however, the USEPA proposed MCL of 300 pCi/L for radon-222 in drinking water was exceeded in nine samples, but the USEPA proposed Alternate Maximum Contaminant Level (AMCL) of 4,000 pCi/L was not exceeded. The AMCL is the proposed allowable activity of radon in raw-water samples where the State has implemented mitigation programs to address the health risks of radon in indoor air. The proposed MCL and AMCL for radon are under review and have not been adopted (U.S. Environmental Protection Agency, 1980, 1999, 2009).

Pesticides

Four pesticides (two herbicides and two insecticides) were detected in samples from three wells (appendix table 1–7). The pesticides were detected in samples from one sand and gravel well and two bedrock wells. All pesticide concentrations were in hundredths or thousandths of micrograms per liter. The constituent detected with the highest concentration (0.013 µg/L) is the insecticide lindane, which was detected in the sample from the sand and gravel well. The herbicide benfluralin was also detected in the sample from the sand and gravel well at a concentration of 0.003 µg/L. The insecticide disulfoton was detected in one sample from a bedrock well at an estimated concentration of 0.01 µg/L. The presence of the herbicide prometon was verified in one sample from a bedrock well but could not be quantified. None of the pesticides analyzed contained concentrations that exceeded established drinking-water standards.

Volatile Organic Compounds

Four VOCs were detected in samples from three sand and gravel wells and three bedrock wells (appendix table 1–8). Trichloromethane, bromodichloromethane, and dibromochloromethane were detected in samples from two wells. These three compounds are trihalomethanes (THMs), which typically are formed as byproducts when chlorine or bromine is used to disinfect water. Trichloromethane was detected in a sample from a sand and gravel well at a concentration of 0.1 µg/L, and in a sample from a bedrock well at a concentration of 1.3 µg/L. The two other THMs, bromodichloromethane and dibromochloromethane, were also detected in the sample from the bedrock well at concentrations of 0.4 and 0.2 µg/L, respectively. Toluene was detected in samples from three sand and gravel wells and two bedrock wells at concentrations ranging from 0.1 to 0.3 µg/L. None of the VOCs analyzed exceeded established drinking-water standards.

Bacteria

All samples were analyzed for *Escherichia coli*, fecal coliform, heterotrophic bacteria, and total coliform. Total coliform bacteria were detected in six samples (appendix table 1–9)—three from sand and gravel wells and three from bedrock wells. The USEPA and NYSDOH MCL violation for total coliform bacteria occurs when 5 percent of finished water samples collected in 1 month test positive for total coliform (if 40 or more samples are collected per month) or when two samples are positive for total coliform (if fewer than 40 samples are collected per month). Heterotrophic plate counts ranged from 1 to 133 colony-forming units per milliliter (CFU/mL); the USEPA MCL (500 CFU/mL) was not exceeded.

Wells Sampled in 2005–2006 and 2010

Three of the wells sampled in 2010 (Wells AG 263, MO 1524, and WO 350) were sampled previously in 2005–2006 as part of this program. Of the 147 physiochemical properties and constituents that samples were analyzed for in 2010, 136 were common to 2005–2006 (appendix tables 1–10 through 1–13). The difference between 2005–2006 and 2010 results for a single well were typically smaller than those between the results from different wells. In general, there were no detectable trends in constituent concentrations between 2005–2006 and 2010.

Summary

In 2002, the U.S. Geological Survey, in cooperation with the New York State Department of Environmental Conservation (NYSDEC), began an assessment of groundwater quality in bedrock and sand and gravel aquifers throughout New York State. As a part of this assessment, the Genesee River Basin was studied in 2005–2006 and again in 2010. The 2010 study is the subject of this report and includes analysis of 16 water samples collected from 8 production wells and 8 private residential wells from September through December 2010. Water samples were analyzed for 147 physiochemical properties and constituents that included major ions, nutrients, trace elements, radionuclides, pesticides, VOCs, and indicator bacteria. Three wells (AG 263, MO1524, and WO 350) were tested in both studies and a comparison was made of the results. The concentrations of most of the constituents changed little between 2005–2006 and 2010.

The results indicate that groundwater generally is of acceptable quality, although concentrations of the following constituents exceeded current or proposed Federal or New York State drinking-water standards at each of the 16 wells sampled in 2010: color (one sample), sodium (three samples), sulfate (three samples), total dissolved solids (four samples), aluminum (one sample), arsenic (two samples), copper (one sample), iron (nine samples), manganese (eight samples), radon-222 (nine samples), and total coliform bacteria (six samples). Existing drinking-water standards for pH, chloride, fluoride, nitrate, nitrite, antimony, barium, beryllium, cadmium, chromium, lead, mercury, selenium, silver, thallium, zinc, gross alpha radioactivity, uranium, fecal coliform, *Escherichia coli*, and heterotrophic bacteria were not exceeded in any of the samples collected. None of the pesticides and VOCs analyzed exceeded existing drinking-water standards.

References Cited

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.

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.

Coates, D.R., 1966, Glaciated Appalachian Plateau—Till shadows on hills: Science, v. 152, p. 1617–1619.

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., 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., 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., at *http://pubs.usgs.gov/of/2008/1140/*.

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, Finger Lakes and Niagara sheets, scale 1:250,000.

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 04–1329, 19 p., at *http://ny.water.usgs.gov/pubs/of/of041329/*.

Hetcher-Aguila, K.K., and Eckhardt, D.A., 2006, Groundwater quality in the Upper Susquehanna River Basin, New York, 2004–05: U.S. Geological Survey Open-File Report 06–1161, 20 p., at *http://pubs.usgs.gov/of/2006/1161/*.

New York State Department of Health, 2007, New York State Health Department public water systems regulations: Albany, N.Y. [variously paged], accessed January 2009, at *http://www.health.state.ny.us/environmental/water/drinking/part5/tables.htm.*

Nystrom, E.A., 2006, Ground-water quality in the Lake Champlain Basin, New York, 2004: U.S. Geological Survey Open-File Report 06–1088, 22 p., at *http://pubs.usgs.gov/of/2006/1088/*.

Nystrom, E.A., 2007a, Ground-water quality in the St. Lawrence River Basin, New York, 2005–2006: U.S. Geological Survey Open-File Report 2007–1066, 33 p., at *http://pubs.usgs.gov/of/2007/1066/*.

Nystrom, E.A., 2007b, Ground-water quality in the Delaware River Basin, New York, 2001 and 2005–2006: U.S. Geological Survey Open-File Report 2007–1098, 36 p., 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., at *http://pubs.usgs.gov/of/2008/1086/*.

Nystrom, E.A., 2009, Ground-water quality in the Upper Hudson River Basin, New York, 2007: U.S. Geological Survey Open-File Report 2009–1240, 37 p., 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., 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., 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., at *http://pubs.usgs.gov/of/2011/1320/*.

Randall, A.D., 2001, Hydrogeologic framework of stratified-drift aquifers in the glaciated Northeastern United States: U.S. Geological Survey Professional Paper 1415–B, 179 p.

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

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

U.S. Environmental Protection Agency, 1980, Prescribed procedures for measurement of radioactivity in drinking water: EPA 600/4–80–032. (Also available at *http://www.epa.gov/ogwdw000/methods/pdfs/methods/methods_radionuclides.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., Office of Water, EPA 841–B–97–002A and EPA 841–B–97–002B, PL 95–217, 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, 2002, Drinking-water advisory—Consumer acceptability advice and health effects analysis on sodium: Washington, D.C., Office of Water, EPA 822–R–02–032, 34 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. (Also available 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-Resources Investigations, book 9, chap. A1–A9, available at *http://pubs.water.usgs.gov/twri9A*.

Appendix 1.

Tables 1–1 through 1–13

Table 1–1. Information on wells sampled in the Genesee River Basin, New York, 2010.

[Well locations are shown in figure 1. --, information not available; well types: P, production; D, domestic]

Well number[1]	U.S. Geological Survey site identifier	Date sampled	Well depth, feet below land surface	Casing depth, feet below land surface	Well type	Bedrock type
Sand and gravel wells						
AG 263	421210077921001	10/6/2010	160	--	P	--
AG 266	420219077462301	11/16/2010	78	--	P	--
AG1129	422018078071901	11/17/2010	199	198	P	--
AG1736	422635077515701	12/1/2010	154	154	D	--
LV 541	425505077531001	10/5/2010	69	68	P	--
LV 542	423219077571701	11/18/2010	52	--	P	--
WO 350	426400078130001	9/8/2010	150	150	P	--
WO 352	424924078045901	11/2/2010	25	--	P	--
Bedrock wells						
AG 746	422616078114401	9/29/2010	80	31.5	D	Shale/siltstone/sandstone
AG1337	421321078004001	9/15/2010	108	19	D	Shale/siltstone/sandstone
GS 757	430330078023901	9/14/2010	75	50	D	Shale/siltstone/sandstone
LV 618	423712077423401	11/10/2010	60	37.5	D	Shale/siltstone/sandstone
LV1110	424629077552101	9/28/2010	72	66	D	Shale/siltstone/sandstone
MO 1402	430221077524001	11/3/2010	73	45.5	D	Shale/siltstone/sandstone
MO 1524	430049077362701	9/23/2010	260	216	D	Shale/siltstone/sandstone
OT1134	424536077331601	10/26/2010	154	--	P	Shale/siltstone/sandstone

[1]Prefix denotes county: AG, Allegany; GS, Genesee; LV, Livingston; MO, Monroe; OT, Ontario; WO, Wyoming; number is local well-identification number assigned by U.S. Geological Survey.

Table 1–2. Compounds for which groundwater samples from the Genesee River Basin, New York, were analyzed but not detected, 2010.

U.S. Geological Survey parameter code	Constituent	Laboratory reporting level, micrograms per liter[1]
	Trace elements in unfiltered water	
71900	Mercury	0.01
01059	Thallium	.12
	Pesticides in filtered water	
82660	2,6-Diethylaniline	.006
04040	CIAT	.006–.014
49260	Acetochlor	.01
46342	Alachlor	.008
34253	alpha-HCH	.004–.008
39632	Atrazine	.007–.008
82686	Azinphos-methyl	.120
04028	Butylate	.002–.004
82680	Carbaryl	.06–.2
82674	Carbofuran	.060
38933	Chlorpyrifos	.010
82687	cis-Permethrin	.014
04041	Cyanazine	.022–.040
82682	DCPA	.006–.008
62170	Desulfinyl fipronil	.012
62169	Desulfinylfipronil amide	.029
39572	Diazinon	.005
39381	Dieldrin	.009
82668	EPTC	.002
82663	Ethalfluralin	.006–.009
82672	Ethoprop	.016
62167	Fipronil sulfide	.013
62168	Fipronil sulfone	.024
62166	Fipronil	.018–.040
04095	Fonofos	.004–.010
82666	Linuron	.06
39532	Malathion	.016–.020
82667	Methyl parathion	.008
39415	Metolachlor	.014
82630	Metribuzin	.012–.016
82671	Molinate	.002–.003
82684	Napropamide	.008–.018
34653	p,p’-DDE	.002–.003
39542	Parathion	.020
82669	Pebulate	.016
82683	Pendimethalin	.012
82664	Phorate	.020
04024	Propachlor	.006–.012
82679	Propanil	.010–.014
82685	Propargite	.02
82676	Propyzamide	.004
04035	Simazine	.006
82670	Tebuthiron	.02–.03
82665	Terbacil	.024–.040
82675	Terbufos	.02
82681	Thiobencarb	.016
82678	Triallate	.006
82661	Trifluralin	.012–.018
	Volatile organic compounds in unfiltered water	
34506	1,1,1-Trichloroethane	.1
77652	1,1,1-Trichloro-1,2,2-trifluoroethane	.1
34496	1,1-Dichloroethane	.1
34501	1,1-Dichloroethene	.1
34536	1,2-Dichlorobenzene	.1
32103	1,2-Dichloroethane	.2
34541	1,2-Dichloropropane	.1
34566	1,3-Dichlorobenzene	.1
34571	1,4-Dichlorobenzene	.1
34030	Benzene	.1
34301	Chlorobenzene	.1
77093	cis-1,2-Dichloroethene	.1
34668	Dichlorodifluoromethane	.2
34423	Dichloromethane	.2
81576	Diethyl ether	.2
81577	Diisopropyl ether	.2
34371	Ethylbenzene	.1
78032	Methyl tert-butyl ether	.2

[1]Constituents with two laboratory reporting levels (LRL) are analytes for which the LRL changed during the course of the sampling.

Table 1–2. Compounds for which groundwater samples from the Genesee River Basin, New York, were analyzed but not detected, 2010.—Continued

U.S. Geological Survey parameter code	Constituent	Laboratory reporting level, micrograms per liter[1]
Volatile organic compounds in unfiltered water		
50005	Methyl tert-pentyl ether	.2
85795	m + p-Xylene	.2
77135	o-Xylene	.1
77128	Styrene	.1
50004	tert-Butyl ethyl ether	.1
34475	Tetrachloroethene	.1
32102	Tetrachloromethane	.2
34546	trans-1,2-Dichloroethene	.1
32104	Tribromomethane	.2
39180	Trichloroethene	.1
34488	Trichlorofluoromethane	.2
39175	Vinyl Choride	.2

[1]Constituents with two laboratory reporting levels (LRL) are analytes for which the LRL changed during the course of the sampling.

Table 1–3. Physiochemical properties of groundwater samples from the Genesee River Basin, New York, 2010.

[Well locations are shown in figure 1. (00080), National Water Information System (NWIS) parameter code; µS/cm @ 25°C, microsiemens per centimeter at 25 degrees Celsius; mg/L, milligrams per liter; <, less than. **Bold** values exceed one or more drinking-water standard]

Well number[1]	Water color, filtered, platinum cobalt units (00080)	pH, field, standard units (00400)	Specific conductance, field, µS/cm @ 25°C (00095)	Water temperature, degrees Celsius (00010)	Dissolved-oxygen unfiltered, field, mg/L (00300)	Dissolved nitrogen gas unfiltered mg/L (00597)	Carbon dioxide unfiltered, mg/L (00405)	Methane unfiltered, mg/L (85574)	Argon unfiltered, mg/L (82043)	Hydrogen sulfide odor field, (71875)
Sand and gravel wells										
AG 263	<1	8.1	415	9.7	0.5	23.95	3.3	<0.0005	0.8053	Absent
AG 266	<1	6.9	293	10.0	1.5	19.08	26.1	<.0005	.6914	Absent
AG1129	10	7.9	825	10.3	.2	12.87	5.8	45.4	.6318	Absent
AG1736	**20**	8.1	425	10.5	.7	17.98	2.3	14.2	.7426	Present
LV 541	<1	7.3	979	12.3	.5	13.95	54.5	20.7	.5251	Absent
LV 542	5	7.6	661	14.2	2.2	22.93	7.5	.003	.7193	Absent
WO 350	8	7.6	525	10.5	.5	24.19	9.4	.030	.7949	Present
WO 352	<1	7.4	716	11.6	.6	21.78	24.6	.001	.7683	Absent
Bedrock wells										
AG 746	<1	7.6	364	13.6	2.7	21.02	10.0	<.0005	.7404	Absent
AG1337	2	7.8	655	11.4	.3	17.74	16.5	14.6	.7495	Absent
GS 757	2	7.1	1,650	13.6	.5	26.12	41.2	.001	.7374	Absent
LV 618	2	7.3	795	11.5	.3	28.40	38.2	.003	.8225	Absent
LV1110	<1	7.3	948	16.9	1.6	22.62	32.0	1.43	.7593	Present
MO 1402	2	7.4	2,330	13.2	.4	28.27	37.0	.004	.7858	Present
MO 1524	10	7.1	2,510	16.4	.3	24.55	29.5	.006	.8483	Absent
OT1134	<1	7.6	599	12.3	2.3	19.60	21.2	9.26	.7752	Present

Table 1–4. Concentrations of major ions in groundwater samples from the Genesee River Basin, New York, 2010.

[Well locations are shown in figure 1. mg/L, milligrams per liter; $CaCO_3$, calcium carbonate; (00900), USGS National Water Information System (NWIS) parameter code. **Bold** values exceed one or more drinking-water standard]

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, fixed endpoint, laboratory, mg/L as $CaCO_3$ (29801)
Sand and gravel wells							
AG 263	98	27.4	7.09	2.13	48.7	167	165
AG 266	87	23.7	6.80	1.39	20.6	62	62
AG1129	214	56.7	17.5	1.62	**97.4**	330	328
AG1736	150	45.6	8.66	1.33	33.1	194	199
LV 541	440	120	34.4	1.51	32.0	372	358
LV 542	268	76.6	18.7	1.17	25.1	171	171
WO 350	218	59.5	16.9	1.06	21.8	195	204
WO 352	278	84.5	16.2	2.14	35.6	234	245
Bedrock wells							
AG 746	172	48.1	12.5	1.84	6.14	162	163
AG1337	82	22.9	6.03	3.16	**118**	351	352
GS 757	976	316	45.5	2.64	12.8	260	260
LV 618	402	102	35.7	2.22	11.0	304	303
LV1110	428	103	41.7	2.92	21.5	315	316
MO 1402	1,470	505	49.5	17.5	51.1	237	244
MO 1524	1,560	544	49.1	5.62	34.6	162	171
OT1134	181	50.3	13.6	1.91	**61.8**	309	316

[1]Prefix denotes county: AG, Allegany; GS, Genesee; LV, Livingston; MO, Monroe; OT, Ontario; WO, Wyoming; number is local well-identification number assigned by U.S. Geological Survey.

[2]Calculated from alkalinity.

Table 1–4. Concentrations of major ions in groundwater samples from the Genesee River Basin, New York, 2010.—Continued

[Well locations are shown in figure 1. mg/L, milligrams per liter; $CaCO_3$, calcium carbonate; (29805), USGS National Water Information System (NWIS) parameter code; <, less than. **Bold** values exceed one or more drinking-water standard]

Well number[1]	Bicarbonate,[2] filtered, 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 180° Celsius, filtered, mg/L (70300)
Sand and gravel wells						
AG 263	201	14.1	0.31	9.67	26.7	231
AG 266	76	40.9	.08	6.48	11.7	160
AG1129	400	73.6	.20	8.46	<.09	451
AG1736	243	17.6	.23	8.63	<.09	240
LV 541	437	94.7	.20	21.1	3.68	**539**
LV 542	209	83.0	.08	11.0	37.4	370
WO 350	249	34.9	.09	12.7	19.4	284
WO 352	299	67.4	.07	7.19	28.2	386
Bedrock wells						
AG 746	199	12.9	.21	13.4	10.6	191
AG1337	429	9.07	.23	9.77	<.18	369
GS 757	317	28.9	.31	12.1	**727**	**1,370**
LV 618	370	26.3	.13	16.3	98.1	481
LV1110	386	88.9	.22	21.2	51.8	529
MO 1402	298	45.3	.36	12.9	**1,290**	**2,240**
MO 1524	209	10.2	.63	13.8	**1,510**	**2,400**
OT1134	386	8.85	.32	13.6	11.8	364

[1]Prefix denotes county: AG, Allegany; GS, Genesee; LV, Livingston; MO, Monroe; OT, Ontario; WO, Wyoming; number is local well-identification number assigned by U.S. Geological Survey.

[2]Calculated from alkalinity.

Table 1–5. Concentrations of nutrients and total organic carbon in groundwater samples from the Genesee River Basin, New York, 2010.

[Well locations are shown in figure 1. mg/L, milligrams per liter; N, nitrogen; (00623), National Water Information System (NWIS) parameter code; P, phosphorus; <, less than; E, estimated value—constituent was detected in the sample but with low or inconsistent recovery]

Well number[1]	Ammonia plus organic nitrogen, 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)	Orthophosphate, filtered, mg/L as P (00671)	Total organic carbon, unfiltered, mg/L (00680)
Sand and gravel wells						
AG 263	0.22	0.175	<.02	<.001	0.010	0.5
AG 266	<.05	<.010	1.23	<.001	.025	.4
AG1129	1.5	1.50	<.02	<.001	.111	2.4
AG1736	.19	.174	<.02	.001	.082	.7
LV 541	.21	.161	<.02	<.001	.017	1.1
LV 542	.12	.055	<.02	<.001	.015	.7
WO 350	.15	.114	<.04	<.002	.019	.7
WO 352	.09	<.010	1.31	.001	.006	.9
Bedrock wells						
AG 746	<.10	E.011	E.03	<.002	.008	.6
AG1337	.74	.737	<.04	<.002	.010	.6
GS 757	E.10	.038	<.04	<.002	.011	1.0
LV 618	.08	.052	<.02	<.001	.012	.8
LV1110	.57	.577	<.04	<.002	.013	2.9
MO 1402	1.1	.999	<.02	.002	.010	.7
MO 1524	.20	.212	<.04	.004	.011	.8
OT1134	.79	.737	<.02	<.001	.010	<.3

[1]Prefix denotes county: AG, Allegany; GS, Genesee; LV, Livingston; MO, Monroe; OT, Ontario; WO, Wyoming; number is local well-identification number assigned by U.S. Geological Survey.

Table 1–6. Concentrations of trace elements and radionuclides in groundwater samples from the Genesee River Basin, New York, 2010.

[Well locations are shown in figure 1. µg/L, micrograms per liter; (01105), USGS National Water Information System (NWIS) parameter code; <, less than; E, estimated value—constituent was detected in the sample but with low or inconsistent recovery. **Bold** values exceed one or more drinking-water standard]

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)	Cadmium, unfiltered, µg/L (01027)	Chromium, unfiltered, µg/L (01034)	Cobalt, unfiltered, µg/L (01037)
Sand and gravel wells									
AG 263	4	<.2	0.89	79.3	<.02	144	<.05	<.21	<.02
AG 266	<3	<.2	.58	142	<.02	19	<.05	<.21	.02
AG1129	<3	<.2	**148**	240	<.02	91	<.05	.21	.11
AG1736	4	<.2	9.4	609	<.02	71	<.05	<.21	.02
LV 541	34	<.2	1.6	1,480	<.02	62	<.05	<.21	.04
LV 542	<3	<.2	1.5	306	<.02	15	<.05	<.21	.02
WO 350	<6	<.4	9.8	145	<.04	25	<.04	<.42	.09
WO 352	<3	<.2	1.8	60.7	<.02	29	<.05	<.21	.04
Bedrock wells									
AG 746	12	<.4	1.1	331	<.04	32	<.04	<.42	E.02
AG1337	<6	<.4	.26	539	<.04	364	<.04	<.42	<.04
GS 757	<6	E.2	4.7	9.2	<.04	117	<.04	<.42	.10
LV 618	<3	<.2	4.5	31.2	<.02	62	<.05	<.21	.02
LV1110	**454**	<.4	1.8	234	E.02	100	E.03	<.42	.46
MO 1402	<17	<1.1	**13.3**	12.6	<.12	2,550	<.30	<1.3	<.12
MO 1524	<6	<.4	9.9	7.0	<.04	552	<.04	<.42	.08
OT1134	<3	.2	1.1	644	<.02	433	<.05	.24	.02

[1]Prefix denotes county: AG, Allegany; GS, Genesee; LV, Livingston; MO, Monroe; OT, Ontario; WO, Wyoming; number is local well-identification number assigned by U.S. Geological Survey.

Table 1–6. Concentrations of trace elements and radionuclides in groundwater samples from the Genesee River Basin, New York, 2010.—Continued

[Well locations are shown in figure 1. pCi/L, picocuries per liter; (01042), USGS National Water Information System (NWIS) parameter code; µg/L, micrograms per liter; <, less than; E, estimated value—constituent was detected in the sample but with low or inconsistent recovery; **Bold** values exceed one or more drinking-water standard]

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)	Molybdenum, unfiltered, µg/L (01062)	Nickel, unfiltered, µg/L (01067)
Sand and gravel wells									
AG 263	3.9	10	125	4.26	37.4	17.9	20.3	0.5	<.12
AG 266	5.0	6	17	.46	3.9	.2	<.4	.1	.17
AG1129	<.70	**1,700**	**1,740**	<.04	6.0	43.4	48.3	12.9	.25
AG1736	<.70	**2,600**	**2,900**	.64	12.2	**179**	**191**	5.1	.14
LV 541	.95	**2,400**	**3,100**	.51	23.5	36.3	43.0	.1	1.0
LV 542	7.6	227	288	.73	7.8	**93.4**	**95.4**	2.0	.29
WO 350	E.70	**493**	**487**	<.06	7.1	**76.0**	**81.8**	3.0	<.36
WO 352	1.9	22	25	.48	4.1	.7	.8	.4	.99
Bedrock wells									
AG 746	E.77	12	81	E.04	12.7	**81.5**	**110**	.9	<.36
AG1337	3.5	94	119	.21	69.5	13.8	15.4	<.1	E.27
GS 757	<1.4	261	**302**	.18	20.8	13.7	16.1	4.8	.56
LV 618	.86	**535**	**597**	.28	23.8	**187**	**192**	1.4	.31
LV1110	**1,610**	**1,850**	**3,710**	10.4	23.0	47.6	**71.8**	.3	1.5
MO 1402	4.3	**6,380**	**6,180**	<.22	55.2	**69.1**	**72.1**	1.0	1.2
MO 1524	E1.3	**1,120**	**2,130**	.10	37.5	**63.9**	**81.5**	1.5	.82
OT1134	<.70	28	32	.08	78.3	45.4	44.5	.1	.42

[1]Prefix denotes county: AG, Allegany; GS, Genesee; LV, Livingston; MO, Monroe; OT, Ontario; WO, Wyoming; number is local well-identification number assigned by U.S. Geological Survey.

Table 1–6. Concentrations of trace elements and radionuclides in groundwater samples from the Genesee River Basin, New York, 2010.—Continued

[Well locations are shown in figure 1. µg/L, micrograms per liter; (01147), USGS National Water Information System (NWIS) parameter code; pCi/L, picocuries per liter; <, less than; E, estimated value—constituent was detected in the sample but with low or inconsistent recovery. **Bold** values exceed one or more drinking-water standard]

Well number[1]	Selenium, unfiltered, µg/L (01147)	Silver, unfiltered, µg/L (01077)	Strontium, unfiltered, µg/L (01082)	Zinc, unfiltered, µg/L (01092)	Gross alpha radioactivity pCi/L (01519)	Gross beta radioactivity pCi/L (85817)	Radon-222, unfiltered, pCi/L (82303)	Uranium, unfiltered, µg/L (28011)
Sand and gravel wells								
AG 263	<.05	<.01	423	19.1	<0.99	2.5	300	0.032
AG 266	<.05	<.01	178	3.2	<.91	2.3	**800**	.015
AG1129	<.05	<.01	503	<2.4	<1.2	1.9	**580**	<.014
AG1736	<.05	<.01	290	<2.4	2.0	2.7	**370**	<.014
LV 541	<.05	<.01	859	28.8	<1.2	1.4	235	<.014
LV 542	<.05	<.01	151	10.2	<.70	1.3	300	.285
WO 350	<.10	<.02	249	<2.0	2.8	1.5	**380**	.275
WO 352	.20	<.01	149	75.0	<1.2	1.7	**780**	.376
Bedrock wells								
AG 746	<.10	E.01	116	2.4	2.0	<0.93	**380**	.044
AG1337	<.10	<.02	202	3.6	<1.1	3.2	238	<.028
GS 757	.14	.02	19,800	<2.0	<1.8	3.1	175	.204
LV 618	<.05	<.01	249	72.3	<.88	2.3	**620**	.099
LV1110	<.10	.11	1,310	71.3	<1.5	3.5	236	.040
MO 1402	<.30	<.09	12,200	<14.4	<3.4	18.4	**380**	.112
MO 1524	E.07	E.01	10,600	3.1	<3.3	4.8	**490**	.222
OT1134	<.05	<.01	978	<2.4	1.3	2.8	300	<.014

[1]Prefix denotes county: AG, Allegany; GS, Genesee; LV, Livingston; MO, Monroe; OT, Ontario; WO, Wyoming; number is local well-identification number assigned by U.S. Geological Survey.

Table 1–7. Concentrations of pesticides detected in groundwater samples from the Genesee River Basin, New York, 2010.

[Well locations are shown in figure 1. µg/L, micrograms per liter; (82673), USGS National Water Information System (NWIS) parameter code; <, less than; M, measured but not quantified; E, estimated value—constituent was detected in the sample but with low or inconsistent recovery]

Well number[1]	Benfluralin, filtered, µg/L (82673)	Disulfoton, filtered, µg/L (82677)	Lindane, filtered, µg/L (39341)	Prometon, filtered, µg/L (04037)
Sand and gravel wells				
AG 263	<.014	<.04	<.004	<.01
AG 266	<.014	<.04	<.004	<.01
AG1129	.003	<.04	.013	<.01
AG1736	<.014	<.04	<.004	<.01
LV 541	<.014	<.04	<.004	<.01
LV 542	<.014	<.04	<.004	<.01
WO 350	<.014	<.04	<.004	<.01
WO 352	<.014	<.04	<.004	<.01
Bedrock wells				
AG 746	<.014	<.04	<.004	M
AG1337	<.014	E.01	<.004	<.01
GS 757	<.014	<.04	<.004	<.01
LV 618	<.014	<.04	<.004	<.01
LV1110	<.014	<.04	<.004	<.01
MO 1402	<.014	<.04	<.004	<.01
MO 1524	<.014	<.04	<.004	<.01
OT1134	<.014	<.04	<.004	<.01

[1]Prefix denotes county: AG, Allegany; GS, Genesee; LV, Livingston; MO, Monroe; OT, Ontario; WO, Wyoming; number is local well-identification number assigned by U.S. Geological Survey.

Table 1–8. Concentrations of volatile organic compounds in groundwater samples from the Genesee River Basin, New York, 2010.

[Well locations are shown in figure 1. µg/L, micrograms per liter; (32106), USGS National Water Information System parameter code; <, less than]

Well number[1]	Trichloromethane, unfiltered, µg/L (32106)	Bromodichloromethane, unfiltered, µg/L (32101)	Dibromochloromethane, unfiltered, µg/L (32105)	Toluene, unfiltered, µg/L (34010)
Sand and gravel wells				
AG 263	<.1	<.1	<.2	0.3
AG 266	<.1	<.1	<.2	<.1
AG1129	<.1	<.1	<.2	<.1
AG1736	<.1	<.1	<.2	.3
LV 541	.1	<.1	<.2	.2
LV 542	<.1	<.1	<.2	<.1
WO 350	<.1	<.1	<.2	<.1
WO 352	<.1	<.1	<.2	<.1
Bedrock wells				
AG 746	<.1	<.1	<.2	<.1
AG1337	<.1	<.1	<.2	<.1
GS 757	<.1	<.1	<.2	<.1
LV 618	<.1	<.1	<.2	<.1
LV1110	<.1	<.1	<.2	<.1
MO 1402	<.1	<.1	<.2	.1
MO 1524	1.3	.4	.2	<.1
OT1134	<.1	<.1	<.2	.3

[1]Prefix denotes county: AG, Allegany; GS, Genesee; LV, Livingston; MO, Monroe; OT, Ontario; WO, Wyoming; number is local well-identification number assigned by U.S. Geological Survey.

Table 1–9. Concentrations of bacteria in unfiltered groundwater samples from the Genesee River Basin, New York, 2010.

[Well locations are shown in figure 1. mL, milliliter; (61213), National Water Information System (NWIS) parameter code; CFU, colony-forming unit; <, less than; >, greater than. **Bold** values indicate detections of coliform bacteria]

Well number[1]	Total coliform colonies per 100 mL (61213)	Fecal coliform colonies per 100 mL (61215)	Escherichia coli, colonies per 100 mL (31691)	Heterotrophic plate count, CFUs per mL (31692)
Sand and gravel wells				
AG 263	**1**	<1	<1	23
AG 266	<1	<1	<1	7
AG1129	<1	<1	<1	3
AG1736	**4**	<1	<1	6
LV 541	<1	<1	<1	133
LV 542	<1	<1	<1	9
WO 350	**250**	<1	<1	3
WO 352	<1	<1	<1	3
Bedrock wells				
AG 746	**6**	<1	<1	10
AG1337	<1	<1	<1	20
GS 757	<1	<1	<1	36
LV 618	<1	<1	<1	7
LV1110	<1	<1	<1	9
MO 1402	**4**	<1	<1	48
MO 1524	<1	<1	<1	1
OT1134	**34**	<1	<1	1

[1]Prefix denotes county: AG, Allegany; GS, Genesee; LV, Livingston; MO, Monroe; OT, Ontario; WO, Wyoming; number is local well-identification number assigned by U.S. Geological Survey.

Table 1–10. Physiochemical properties of and concentrations of major ions, nutrients and total organic carbon, and bacteria in groundwater samples collected in the Genesee River Basin, New York, 2005–2006 and 2010.

[Well locations are shown in figure 1. NWIS, National Water Information System; <, less than; mg/L, milligrams per liter; µS/cm @ 25°C, microsiemens per centimeter at 25 degrees Celsius; microsiemens per centimeter at 25 degrees Celsius; $CaCO_3$, calcium carbonate; °C, degrees Celcius; N, nitrogen; U, not detected; P, phosphorus; E, estimated value—constituent was detected in the sample but with low or inconsistent recovery; CFU, colony-forming unit; mL, milliliter. **Bold** values exceed one or more drinking-water standard]

U.S. Geological Survey NWIS parameter code	Constituent	AG 263[1]		MO 1524[1]		WO 350[1]	
		2005–2006	2010	2005–2006	2010	2005–2006	2010
00080	Color, filtered, platinum-cobalt units	2	<1	8	10	8	8
00300	Dissolved oxygen, unfiltered, mg/L	13.8	.5	.3	.3	.49	.5
00400	pH, unfiltered	7.8	8.1	7.0	7.1	7.4	7.6
00095	Specific conductance, unfiltered, µS/cm @ 25°C	404	415	2,501	2,510	397	525
00010	Temperature, unfiltered, degrees Celsius	9.3	9.7	8.9	16.4	9.8	10.5
00900	Hardness, filtered, mg/L as $CaCO_3$	92	98	1,500	1,560	240	218
00915	Calcium, filtered, mg/L	26.4	27.4	531	544	64.0	59.5
00925	Magnesium, filtered, mg/L	6.39	7.09	51.8	49.1	19.0	16.9
00935	Potassium, filtered, mg/L	2.19	2.13	5.32	5.62	1.11	1.06
00930	Sodium, filtered, mg/L	53.0	48.7	32.5	34.6	21.3	21.8
90410	Acid neutralizing capacity, unfiltered, fixed end point, lab, mg/L as $CaCO_3$	172	167	164	162	185	195
29801	Alkalinity, filtered, fixed end point, laboratory, mg/L as $CaCO_3$	172	165	164	171	190	204
29805	Bicarbonate, filtered, fixed endpoint, laboratory, mg/L	208	201	198	209	230	249
00940	Chloride, filtered, mg/L	10.0	14.1	6.32	10.2	37.1	34.9
00950	Fluoride, filtered, mg/L	.3	.31	.7	.63	.1	.09
00955	Silica, filtered, mg/L	9.99	9.67	14.3	13.8	12.7	12.7
00945	Sulfate, filtered, mg/L	28.1	26.7	**1,470**	**1,510**	25.5	19.4
70300	Residue on evaporation at 180°C, filtered, mg/L	231	231	**2,460**	**2,400**	310	284
00623	Ammonia + organic-N, filtered, mg/L as N	.12	.22	.28	.2	.13	.15
00608	Ammonia, filtered, mg/L as N	.12	.175	.27	.212	.1	.114
00613	Nitrite, filtered, mg/L as N	U	<.001	U	.004	U	<002
00671	Orthophosphate, filtered, mg/L as P	<.02	.01	<0.02	.011	E.01	.019
00680	Total organic carbon, unfiltered, mg/L	<1.0	.5	<1.0	.8	<1.0	.7
31691	Escherichia coli, unfiltered, CFU per 100 mL	<1	<1	<1	<1	<1	<1
61215	Fecal coliform, unfiltered, CFU per 100 mL	<5	<1	<5	<1	<5	<1
31692	Heterotrophic plate count, unfiltered, CFU per ml	2	23	2	1	2	3
61213	Total coliform, unfiltered, CFU per 100 mL	<1	**1**	<1	<1	**1**	**250**

[1]Prefix denotes county: AG, Allegany; MO, Monroe; WO, Wyoming; number is local well-identification number assigned by U.S. Geological Survey.

Table 1–11. Concentrations of trace elements and radionuclides in groundwater samples collected in the Genesee River Basin, New York, 2005–2006 and 2010.

[Well locations are shown in figure 1. All concentrations in micrograms per liter except as noted. NWIS, National Water Information System; E, estimated value—constituent was detected in the sample but with low or inconsistent recovery; <, less than; U, not detected; pCi/L, picocuries per liter. **Bold** values exceed one or more drinking-water standard]

U.S. Geological Survey NWIS parameter code	Constituent	AG 263[1]		MO 1524[1]		WO 350[1]	
		2005–2006	2010	2005–2006	2010	2005–2006	2010
01105	Aluminum, unfiltered	3	4	E1	<6	E2	<6
01097	Antimony, unfiltered	<.2	<.2	E.1	<.4	<.2	<.4
01002	Arsenic, unfiltered	.31	.89	.88	9.9	8.8	9.8
01007	Barium, unfiltered	70	79.3	7	7	164	145
01020	Boron, filtered	145	144	529	552	24	25
01027	Cadmium, unfiltered	<.04	<.05	<.04	<.04	<.04	<.04
01034	Chromium, unfiltered	.05	<.21	.17	<.42	.2	<.42
01037	Cobalt, unfiltered	.057	<.02	1.33	.08	.366	.09
01042	Copper, unfiltered	.8	3.9	8.5	E1.3	2.4	E.70
01046	Iron, filtered	28	10	**2,010**	**1,120**	**422**	**493**
01045	Iron, unfiltered	40	125	**2,190**	**2,130**	**397**	**487**
01051	Lead, unfiltered	.13	4.26	.08	.1	<.06	<.06
01132	Lithium, unfiltered	29.6	37.4	42.0	37.5	7.7	7.1
01056	Manganese, filtered	13.4	17.9	**73.2**	**63.9**	**83.5**	**76**
01055	Manganese, unfiltered	13.8	20.3	**72.0**	**81.5**	**81.8**	**81.8**
01062	Molybdenum, unfiltered	0.5	.5	1.6	1.5	2.7	3
01067	Nickel, unfiltered	E.13	<.12	9.21	.82	1.68	<.36
01147	Selenium, unfiltered	<.08	<.05	.16	E.07	E.05	<.10
01077	Silver, unfiltered	U	<.01	U	E.01	U	<.02
01082	Strontium, unfiltered	377	423	10,700	10,600	280	249
01092	Zinc, unfiltered	20	19.1	7	3.1	<2	<2.0
82303	Radon-222, unfiltered, pCi/L	280	300	**520**	**490**	**470**	**380**
28011	Uranium, unfiltered	.032	.032	.239	.222	.405	.275

[1]Prefix denotes county: AG, Allegany; MO, Monroe; WO, Wyoming; number is local well-identification number assigned by U.S. Geological Survey.

Table 1–12. Concentrations of pesticides in groundwater samples collected in the Genesee River Basin, New York, 2005–2006 and 2010.

[Well locations are shown in figure 1. All concentrations in micrograms per liter in filtered water. NWIS, National Water Information System; <, less than]

U.S. Geological Survey NWIS parameter code	Constituent	AG 263[1]		MO 1524[1]		WO 350[1]	
		2005–2006	2010	2005–2006	2010	2005–2006	2010
82660	2,6-Diethylaniline	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
04040	2-Chloro-4-isopropylamino-6-amino-s-triazine (CIAT)	<.006	<.006	<.006	<.014	<.006	<.014
49260	Acetochlor	<.006	<.010	<.006	<.010	<.006	<.010
46342	Alachlor	<.005	<.008	<.005	<.008	<.005	<.008
34253	alpha-HCH	<.005	<.004	<.005	<.004	<.005	<.004
39632	Atrazine	<.007	<.008	<.007	<.007	<.007	<.007
82686	Azinphos-methyl	<.050	<.120	<.050	<.120	<.050	<.120
82673	Benfluralin	<.010	<.014	<.010	<.014	<.010	<.014
04028	Butylate	<.004	<.004	<.004	<.004	<.004	<.004
82680	Carbaryl	<.041	<.060	<.041	<.060	<.041	<.060
82674	Carbofuran	<.020	<.060	<.020	<.060	<.020	<.060
38933	Chlorpyrifos	<.005	<.004	<.005	<.010	<.005	<.010
82687	cis-Permethrin	<.006	<.010	<.006	<.014	<.006	<.014
04041	Cyanazine	<.018	<.022	<.018	<.022	<.018	<.022
82682	DCPA	<.003	<.008	<.003	<.008	<.003	<.008
62170	Desulfinylfipronil	<.012	<.012	<.012	<.012	<.012	<.012
39572	Diazinon	<.005	<.006	<.005	<.005	<.005	<.005
39381	Dieldrin	<.009	<.008	<.009	<.009	<.009	<.009
82677	Disulfoton	<.02	<.04	<.02	<.04	<.02	<.04
82668	EPTC	<.004	<.006	<.004	<.002	<.004	<.002
82663	Ethalfluralin	<.009	<.006	<.009	<.006	<.009	<.006
82672	Ethoprop	<.005	<.016	<.005	<.016	<.005	<.016
62169	Desulfinylfipronil amide	<.029	<.029	<.029	<.029	<.029	<.029
62167	Fipronil sulfide	<.013	<.012	<.013	<.013	<.013	<.013
62168	Fipronil sulfone	<.024	<.024	<.024	<.024	<.024	<.024
62166	Fipronil	<.016	<.018	<.016	<.018	<.016	<.018
04095	Fonofos	<.003	<.005	<.003	<.004	<.003	<.004
39341	Lindane	<.004	<.004	<.004	<.004	<.004	<.004
82666	Linuron	<.035	<.060	<.035	<.060	<.035	<.060
39532	Malathion	<.027	<.016	<.027	<.016	<.027	<.016
82667	Methyl parathion	<.015	<.008	<.015	<.008	<.015	<.008
39415	Metolachlor	<.006	<.014	<.006	<.014	<.006	<.014
82630	Metribuzin	<.006	<.012	<.006	<.012	<.006	<.012
82671	Molinate	<.003	<.004	<.003	<.003	<.003	<.003
82684	Napropamide	<.007	<.008	<.007	<.008	<.007	<.008
34653	p,p’-DDE	<.003	<.002	<.003	<.002	<.003	<.002
39542	Parathion	<.010	<.020	<.010	<.020	<.010	<.020
82669	Pebulate	<.004	<.016	<.004	<.016	<.004	<.016
82683	Pendimethalin	<.022	<.012	<.022	<.012	<.022	<.012
82664	Phorate	<.011	<.020	<.011	<.020	<.011	<.020

Table 1–12. Concentrations of pesticides in groundwater samples collected in the Genesee River Basin, New York, 2005–2006 and 2010.—Continued.

[Well locations are shown in figure 1. All concentrations in micrograms per liter in filtered water. NWIS, National Water Information System; <, less than]

04037	Prometon	<.01	<.01	<.01	<.01	<.01	<.01
82676	Propyzamide	<.004	<.004	<.004	<.004	<.004	<.004
04024	Propachlor	<.025	<.006	<.025	<.006	<.025	<.006
82679	Propanil	<.011	<.010	<.011	<.010	<.011	<.010
82685	Propargite	<.02	<.02	<.02	<.02	<.02	<.02
04035	Simazine	<.005	<.006	<.005	<.006	<.005	<.006
82670	Tebuthiuron	<.02	<.03	<.02	<.03	<.02	<.03
82665	Terbacil	<.034	<.024	<.034	<.024	<.034	<.024
82675	Terbufos	<.02	<.02	<.02	<.02	<.02	<.02
82681	Thiobencarb	<.010	<.016	<.010	<.016	<.010	<.016
82678	Triallate	<.006	<.005	<.006	<.006	<.006	<.006
82661	Trifluralin	<.009	<.018	<.009	<.018	<.009	<.018

[1]Prefix denotes county: AG, Allegany; MO, Monroe; WO, Wyoming; number is local well-identification number assigned by U.S. Geological Survey.

Table 1–13. Concentrations of volatile organic compounds in groundwater samples collected in the Genesee River Basin, New York, 2005–2006 and 2010.

[Well locations are shown in figure 1. All concentrations in micrograms per liter in unfiltered water. NWIS, National Water Information System; <, less than. **Bold** values indicate detections]

U.S. Geological Survey NWIS parameter code	Constituent	AG 2631		MO 15241		WO 3501	
		2005–2006	2010	2005–2006	2010	2005–2006	2010
34506	1,1,1-Trichloroethane	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
77652	1,1,2-Trichloro-1,2,2-trifluoro-ethane (CFC-113)	< .1	<.1	< .1	<.1	< .1	<.1
34496	1,1-Dichloroethane	< .1	<.1	< .1	<.1	< .1	<.1
34501	1,1-Dichloroethene	< .1	<.1	< .1	<.1	< .1	<.1
34536	1,2-Dichlorobenzene	< .1	<.1	< .1	<.1	< .1	<.1
32103	1,2-Dichloroethane	< .2	<.2	< .2	<.2	< .2	<.2
34541	1,2-Dichloropropane	< .1	<.1	< .1	<.1	< .1	<.1
34566	1,3-Dichlorobenzene	< .1	<.1	< .1	<.1	< .1	<.1
34571	1,4-Dichlorobenzene	< .1	<.1	< .1	<.1	< .1	<.1
34030	Benzene	< .1	<.1	< .1	<.1	< .1	<.1
32101	Bromodichloromethane	< .1	<.1	< .1	**.4**	< .1	<.1
32104	Tribromomethane	< .2	<.2	< .2	<.2	< .2	<.2
34301	Chlorobenzene	< .1	<.1	< .1	<.1	< .1	<.1
77093	cis-1,2-Dichloroethene	< .2	<.1	< .2	<.1	< .2	<.1
32105	Dibromochloromethane	< .2	<.2	< .2	**.2**	< .2	<.2
34668	Dichlorodifluoromethane	< .2	<.2	< .2	<.2	< .2	<.2
34423	Dichloromethane	< .2	<.2	< .2	<.2	< .2	<.2
81576	Diethyl ether	< .2	<.2	< .2	<.2	< .2	<.2
81577	Diisopropyl ether	< .2	<.2	< .2	<.2	< .2	<.2
34371	Ethylbenzene	< .1	<.1	< .1	<.1	< .1	<.1
50005	Methyl tert-pentyl ether	< .2	<.2	< .2	<.2	< .2	<.2
85795	m- + p-Xylene	< .2	<.2	< .2	<.2	< .2	<.2
77135	o-Xylene	< .1	<.1	< .1	<.1	< .1	<.1
77128	Styrene	< .1	<.1	< .1	<.1	< .1	<.1
50004	tert-Butyl ethyl ether	< .2	<.1	< .2	<.1	< .2	<.1
78032	Methyl tert-butyl ether (MTBE)	< .2	<.2	< .2	<.2	< .2	<.2
34475	Tetrachloroethene	< .1	<.1	< .1	<.1	< .1	<.1
32102	Tetrachloromethane	< .1	<.2	< .1	<.2	< .1	<.2
34010	Toluene	< .1	**.3**	< .1	<.1	< .1	<.1
34546	trans-1,2-Dichloroethene	< .1	<.1	< .1	<.1	< .1	<.1
39180	Trichloroethene	< .1	<.1	< .1	<.1	< .1	<.1
34488	Trichlorofluoromethane (CFC-11)	< .1	<.2	< .1	<.2	< .1	<.2
32106	Trichloromethane	< .1	<.1	< .1	**1.3**	< .1	<.1
39175	Vinyl chloride	< .2	<.2	< .2	<.2	< .2	<.2

[1]Prefix denotes county: AG, Allegany; MO, Monroe; WO, Wyoming; number is local well-identification number assigned by U.S. Geological Survey.

This page has been left blank intentionally.

Prepared by the Pembroke and Reston Publishing Service Centers

For additional information write to:
New York Water Science Center
U.S. Geological Survey
30 Brown Rd.
Ithaca, NY 14850

Information requests:
(518) 285-5602
or visit our Web site at:
http://ny.water.usgs.gov