State Summary for New Hampshire

Information on population density, use of domestic-water supply, land use, and distribution of the 11 selected contaminants (arsenic, atrazine, benzene, deethylatrazine (CIAT), manganese, nitrate (data for nitrate consists of analyses for nitrite plus nitrate, as N, by the laboratory), perchloroethene (PCE), radon, strontium, trichloroethene (TCE), and uranium) for domestic well data for New Hampshire is shown in figures NH1–NH16. The percentage of samples greater than U.S. Environmental Protection Agency (USEPA) human-health benchmarks for National Water-Quality Assessment (NAWQA) Program major-aquifer studies that included New Hampshire is given in table NH1. The areal extent of some NAWQA major-aquifer studies goes beyond the State boundary (fig. NH4). All data associated with a major-aquifer study are provided and are used in contaminant summaries even if the sampled well was located outside the State boundary. The "Selected References" section at the end of this summary lists previous New Hampshire studies that are relevant to the 11 contaminants.

In New Hampshire, the largest areas with the highest population density are located along the southeastern parts of the State (fig. NH1). About 50 percent of the domestic (private) supply and public supply is obtained from ground water. The population (by census-block group for 1990) using a domestic-water supply from ground water was greatest in the southern part of the State (fig. NH2). New Hampshire's population is concentrated in the southern and coastal parts of the State, and contains predominantly forested lands (fig. NH3).

Four NAWQA major-aquifer studies in two principal aquifers (New York/New England crystalline-rock and glacial aquifers) included samples from New Hampshire (fig. NH4). NewYork/New England crystalline rock aquifers in New Hampshire consist mostly of metamorphic and igneous rocks and are mostly confined aquifers (Olcott, 1995). The regolith and fractures in the bedrock serve as the primary areas of storage and well yields are generally only a few gallons per minute, although some well yields may exceed 100 gallons per minute (Olcott, 1995).

Table NH1. Percentage of samples with concentrations greater than U.S. Environmental Protection Agency human-health benchmarks for National Water-Quality Assessment (NAWQA) Program major-aquifer studies that included New Hampshire.

Study-Unit code for NAWQA major-aquifer study	Principal aquifer	Contaminant	Number of samples	Percentage of samples with concentrations greater than human-health benchmark
necbsus1	New York/New England crystalline-rock aquifers	Radon	26	[1]100/15
necbsus2	New York/New England crystalline-rock aquifers	Radon	28	[1]96/46
connsus1	New York/New England crystalline-rock aquifers	Radon	27	[1]96/37
connsus2	Glacial aquifers	Radon	27	[1]81/3.7
necbsus1	New York/New England crystalline-rock aquifers	Arsenic	28	29
necbsus2	New York/New England crystalline-rock aquifers	Arsenic	30	6.7
connsus1	New York/New England crystalline-rock aquifers	Arsenic	26	3.8
necbsus2	New York/New England crystalline-rock aquifers	Uranium	30	10
connsus2	Glacial aquifers	Manganese	28	7.1
necbsus1	New York/New England crystalline-rock aquifers	Manganese	28	7.1
necbsus2	New York/New England crystalline-rock aquifers	Manganese	30	6.7
connsus2	Glacial aquifers	Nitrite plus nitrate	28	3.6

[1]First number is the percentage greater than 300 picocuries per liter (proposed Maximum Contaminant Level), and second number is the percentage greater than 4,000 picocuries per liter (alternate proposed Maximum Contaminant Level).

Several glacial aquifers occur near the land surface throughout New Hampshire, and they consist of aquifers in unconsolidated sand and gravel deposits of Quaternary age. Most of the individual aquifers that comprise the system are not hydraulically connected, and were formed mostly from sediments deposited by continental glaciers or by meltwater from glaciers, or from alluvium in valleys of major streams (Trapp and Horn, 1997). Most of the productive aquifers contain water under mostly unconfined conditions. Well yields are quite variable in the glacial systems because of variable thicknesses, coarseness of material, and the extent of the deposits.

Water-quality data for 11 selected contaminants (table 2) in samples from domestic-water supplies were compiled and summarized. The concentrations relative to USEPA human-health benchmarks (table 2, fig. NH5) and the number of major-aquifer studies with concentrations greater than human-health benchmarks were both considered in evaluating the potential concern to human health. This analysis assumes that current USEPA benchmarks (U.S. Environmental Protection Agency, 2006) are the most relevant and accurate measure of human-health risk.

Radon had the greatest potential human-health concern because it had the largest percentage of samples with concentrations greater than the human-health benchmark of 300 picocuries per liter (pCi/L). Radon concentrations for NAWQA data (fig. NH13) in one major-aquifer study (necbsus1) in the New York/New England crystalline rock aquifers had 100 percent of the samples with concentrations greater than 300 pCi/L, which is the proposed Maximum Contaminant Level (MCL) for radon (table NH1); about 15 percent of the samples had radon concentrations greater than the alternative proposed MCL of 4,000 pCi/L. About 96 percent of samples in the other two major-aquifer studies (necbsus2 and connsus1) in the New York/New England crystalline rock aquifers had radon concentrations greater than the proposed MCL, and about 46 and 37 percent of the samples had radon concentrations greater than the alternative proposed MCL (table NH1). Median radon concentrations in the New York/New England crystalline rock aquifers ranged from 2,000 to 3,500 pCi/L in the three major-aquifer studies conducted in this principal aquifer (fig. NH5). About 81 percent of samples in the glacial aquifers had radon concentrations greater than the proposed MCL, but only about 4 percent (one sample) of samples had concentrations greater than the alternative proposed MCL, and median concentrations were less than 1,000 pCi/L (fig. NH5, table NH1). The U.S. Geological Survey (USGS) State data also showed radon concentrations to be greater than the human-health benchmark of 300 pCi/L in most of the samples collected (fig. NH13). Radon-222 is a decay product of radium-226, and radon concentrations greater than the human-health benchmark are widespread and can be attributed to natural sources in the soil and rock material in New Hampshire.

Arsenic also had some potential concern to human health. About 29 percent (8 samples), 7 percent (2 samples), and 4 percent (1 sample) of the samples from three major-aquifer studies (necbsus1, necbsus2, and connsus1, respectively) in the New York/New England crystalline-rock aquifers had arsenic concentrations greater than the human-health benchmark (MCL of 10 micrograms per liter (µg/L)) (table NH1). Median arsenic concentrations were within an order of magnitude of the human-health benchmark for three of the major-aquifer studies (connsus1, necbsus1, and necbsus2) (fig. NH5). The necbsus1 major-aquifer study was designed to select wells from rock formations known to have arsenic, so the necbsus1 major-aquifer study was biased to look for arsenic (Sarah Flanagan, U.S. Geological Survey, written commun., 2007). NAWQA data for New Hampshire showed arsenic concentrations to be greater than the human-health benchmark in two samples (fig. NH6).

About 7 percent (two samples) of the samples from two major-aquifer studies (necbsus1 and necbsus2) collected from the New York/New England crystalline-rock aquifers had manganese concentrations greater than the USEPA human-health benchmark (Lifetime Health Advisory (HA) of 300 µg/L). Two samples (about 7 percent) from the connsus2 major-aquifer study in the glacial aquifers had manganese concentrations greater than the USEPA human-health benchmark (table NH1). NAWQA data for New Hampshire showed manganese concentrations to be greater than the human-health benchmark in three samples (fig. NH10).

For the entire State of New Hampshire data set, no sample concentrations of atrazine (fig. NH7), benzene (fig. NH8), CIAT (fig. NH9), PCE (fig. NH12), strontium (fig. NH14), and TCE (fig. NH15) were larger than USEPA human-health benchmarks for either NAWQA or USGS State data. Additionally, nitrate (fig. NH11) and uranium (fig. NH16) were not found at concentrations greater than USEPA benchmarks when NAWQA samples and other USGS State data within the State of New Hampshire were considered. CIAT is a degradation product of atrazine and does not have a human-health benchmark; however, for this report, the MCL for atrazine is used as a benchmark for CIAT because their toxicities are considered equivalent.

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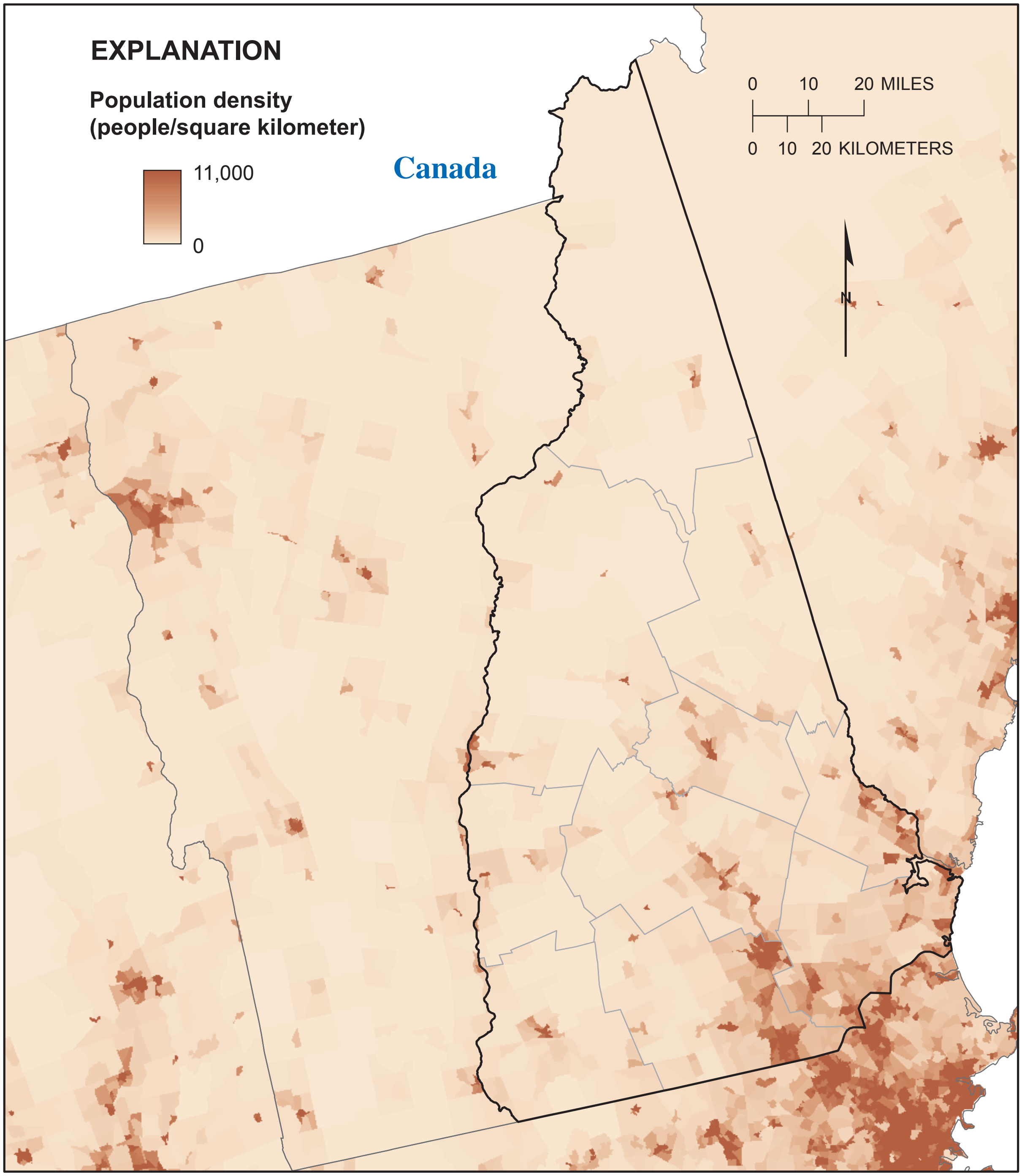
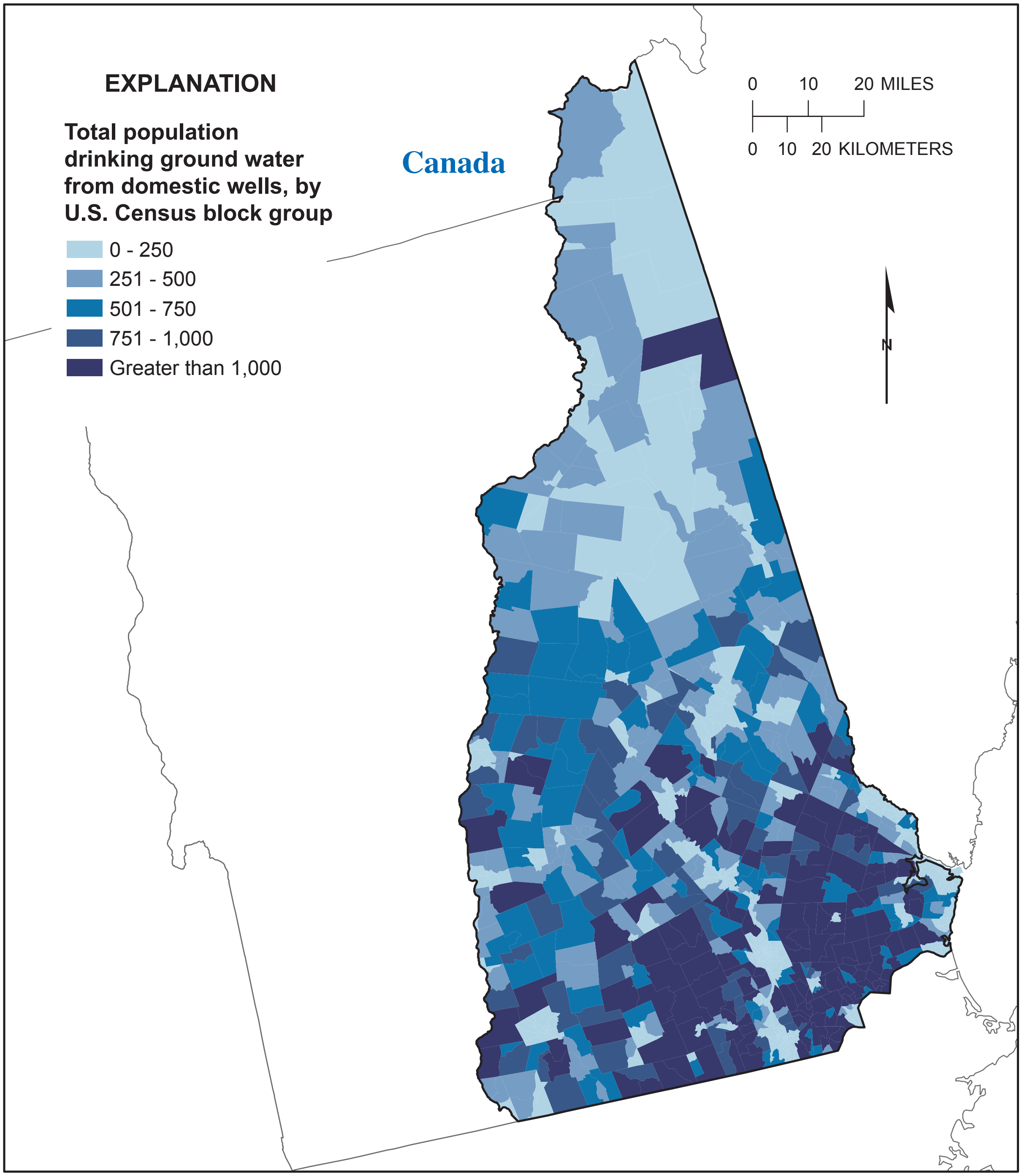


Base information from U.S. Geological Survey digital data, 1:2,000,000
Albers Equal-Area projection
Standard Parallels 29°30' and 45°30', central meridian -96°

Figure NH1. Population density for New Hampshire and nearby States. (Data from Hitt, 2003.)



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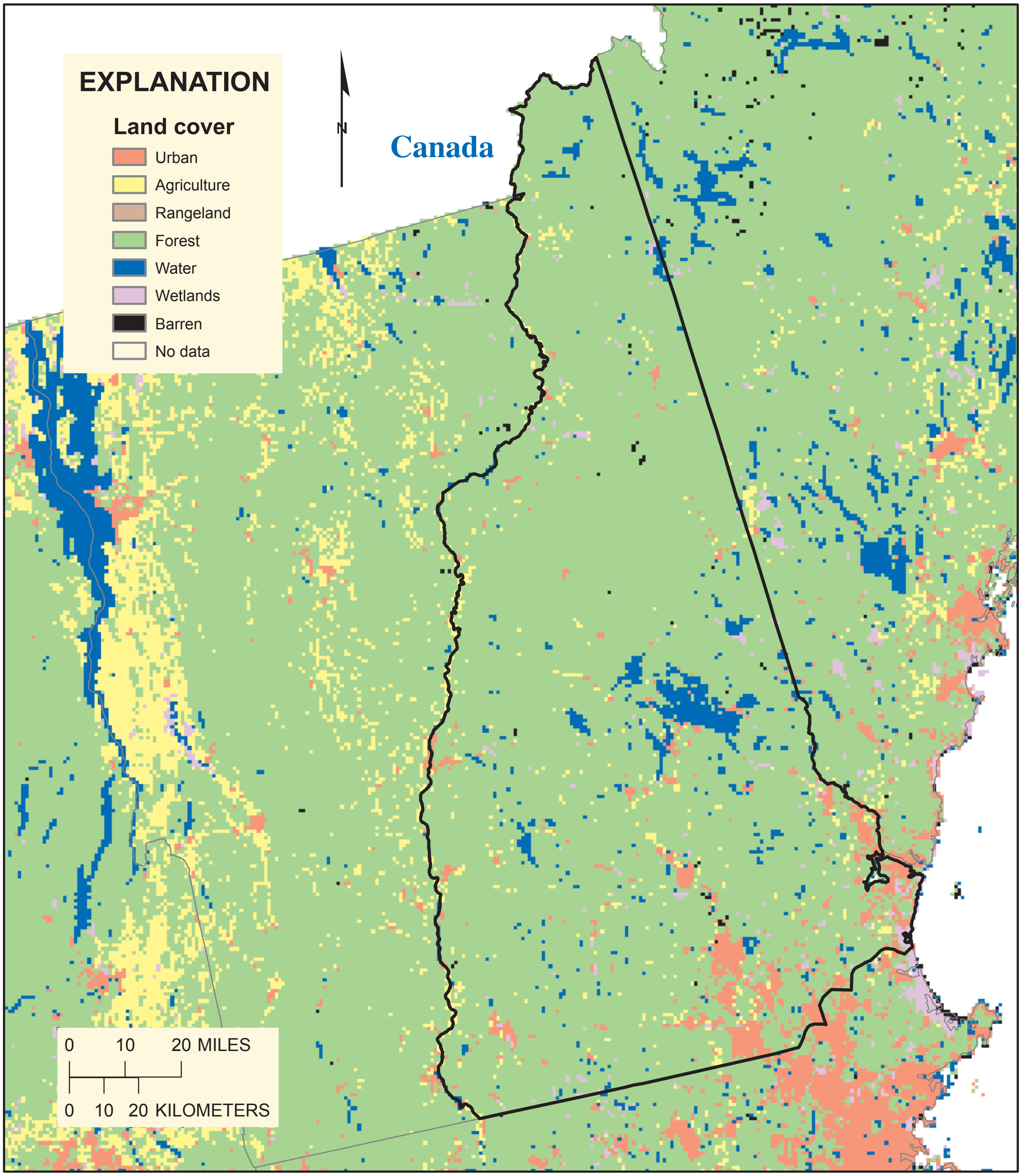
Albers Equal-Area projection
Standard Parallels 29°30' and 45°30', central meridian -96°

Figure NH2. Population using domestic-water supply (from ground water) for New Hampshire. (Data from 1990 U.S. Census block group, Kerie Hitt, U.S. Geological Survey, written commun., 1997.)



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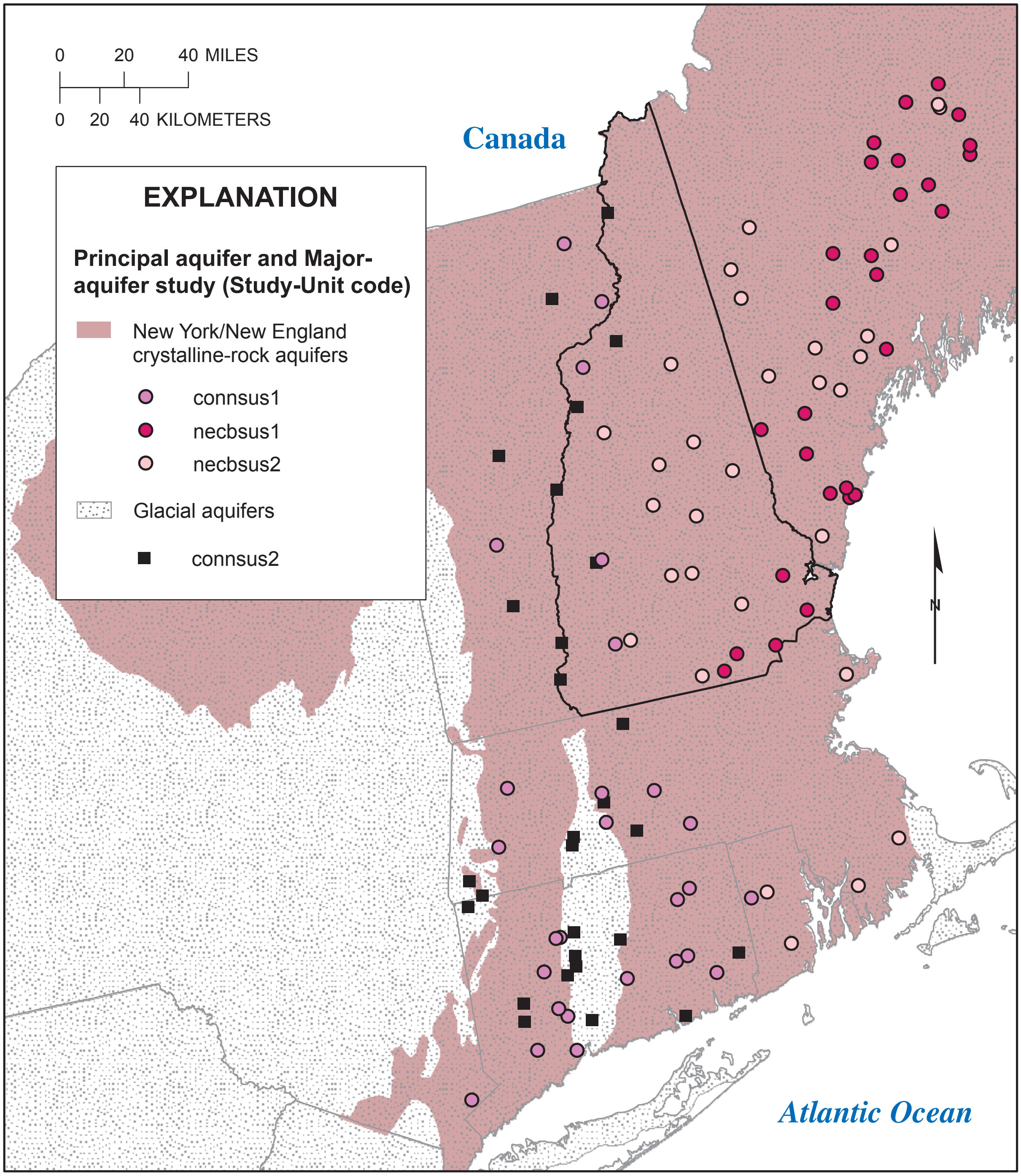
Albers Equal-Area projection
Standard Parallels 29°30' and 45°30', central meridian -96°

Figure NH3. Land use/land cover for New Hampshire and nearby States. (Data from Naomi Nakagaki, U.S. Geological Survey, written commun., 2005.)



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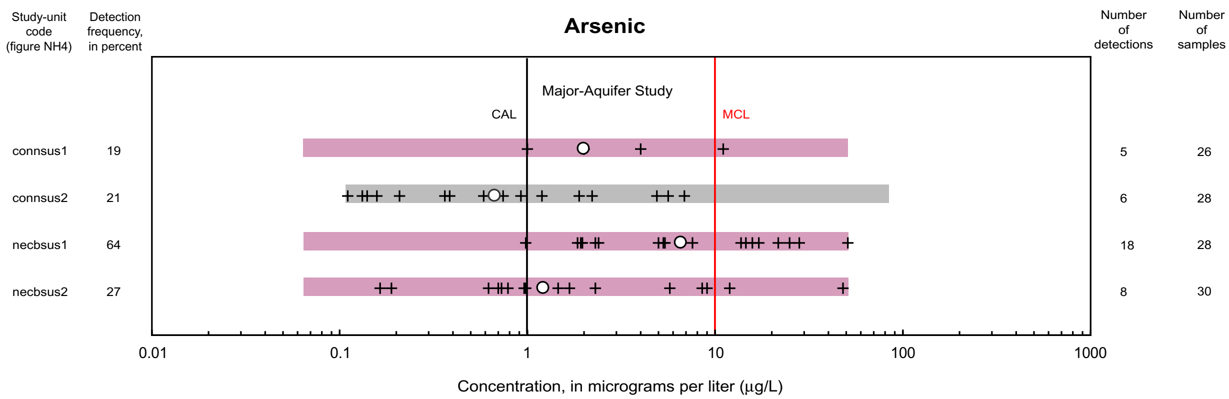
Standard Parallels 29°30' and 45°30', central meridian -96°

Principal aquifer data from U.S. Geological Survey, 2003

Figure NH4. Location of domestic wells sampled for National Water-Quality Assessment (NAWQA) major-aquifer studies that included New Hampshire.



EXPLANATION

Principal Aquifer - Length of shaded bar represents the range of concentrations detected within the entire aquifer including samples collected outside the grantee State

New York/New England crystalline-rock aquifers

Glacial aquifers

+ **Detected Concentration** - Concentrations are shown for all samples collected in major-aquifer study without the application of a common assessment level

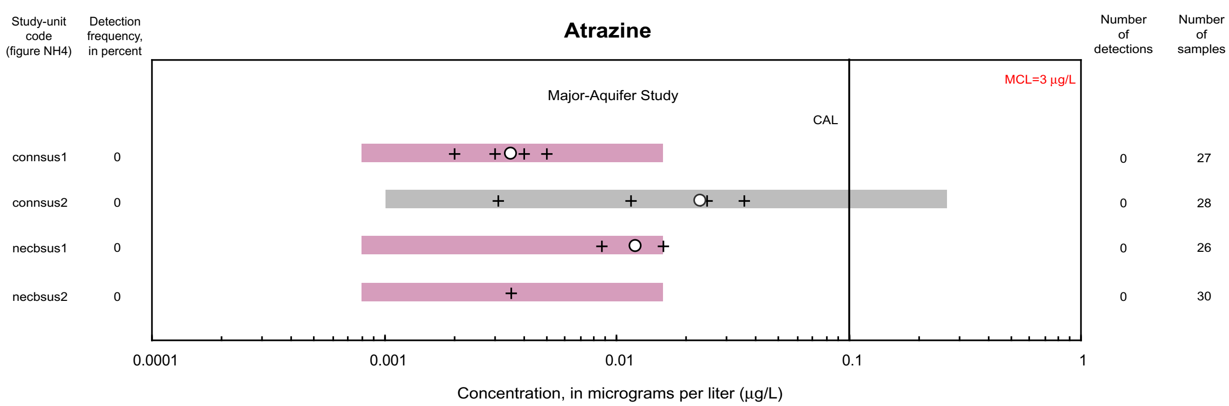
Maximum Contaminant Level (MCL), Lifetime Health Advisory (HA), or proposed MCL

Common assessment level (CAL)

○ Median of all detections - no application of a common assessment level

19 Detection frequency, in percent, at the common assessment level

5 Number of detections at or above the common assessment level



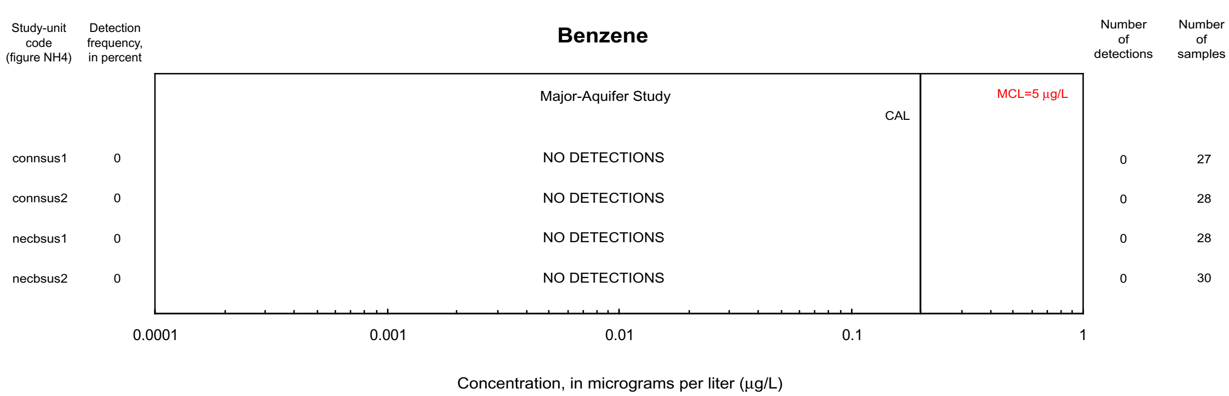


Figure NH5. Statistical summary for 11 selected contaminants by major-aquifer study using domestic-well data from National Water-Quality Assessment (NAWQA) studies for New Hampshire (includes studies for which at least 10 analyses were available).

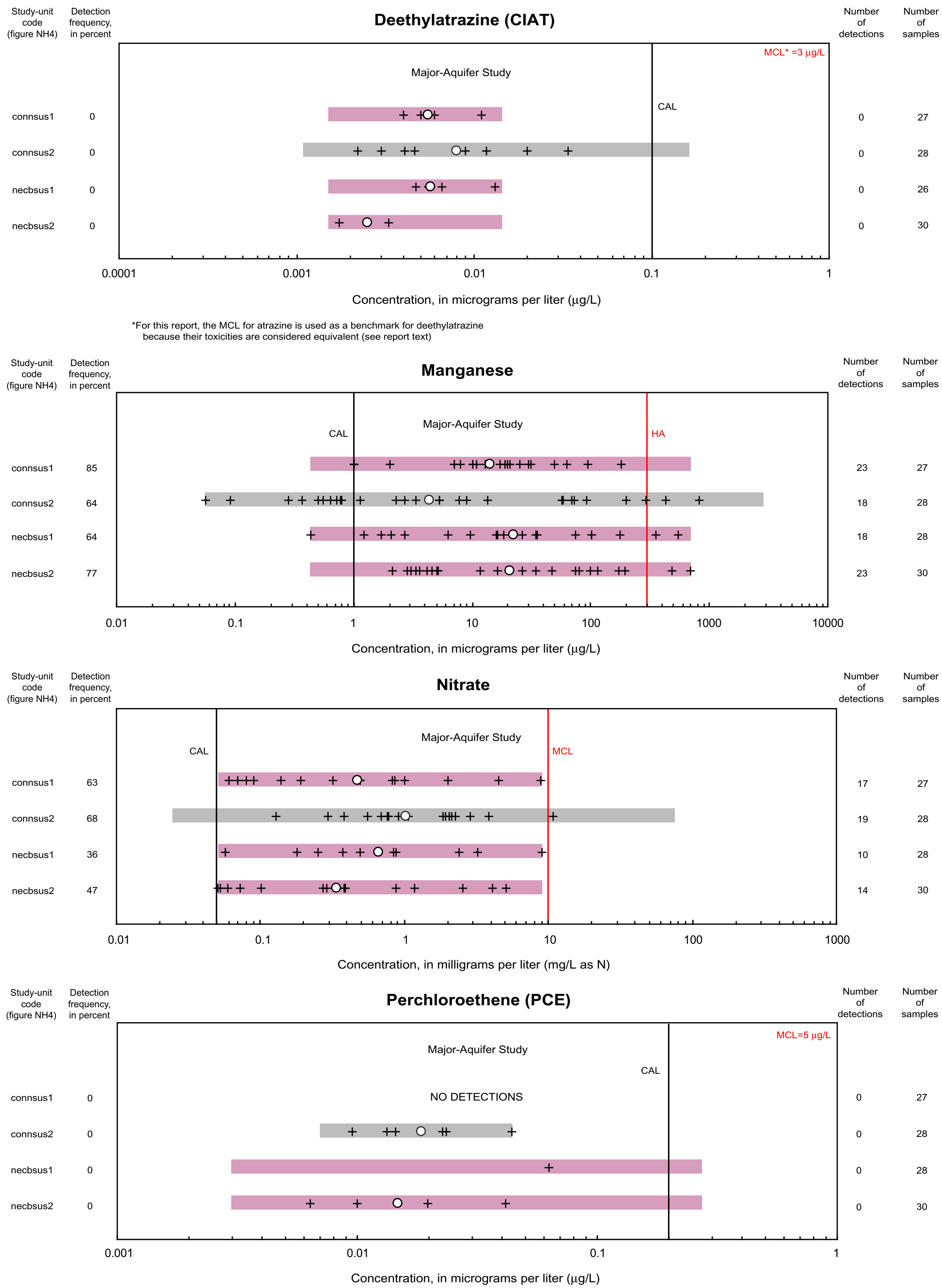
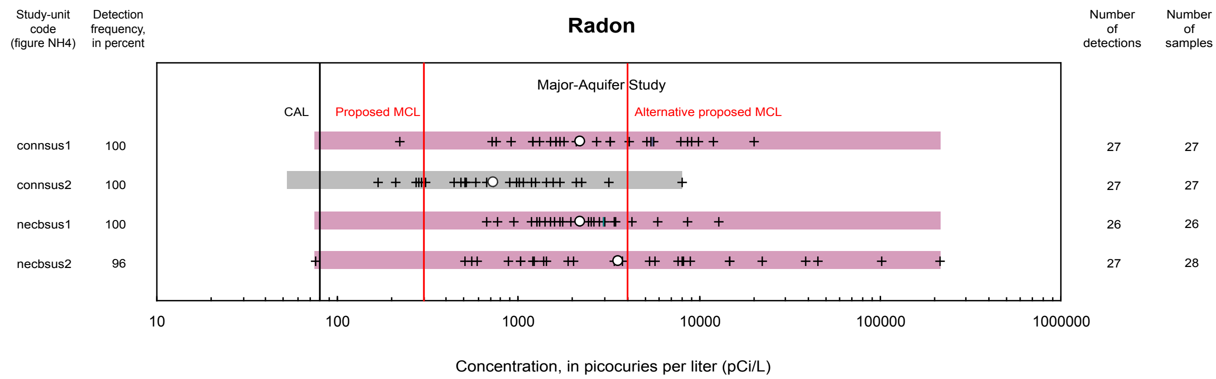
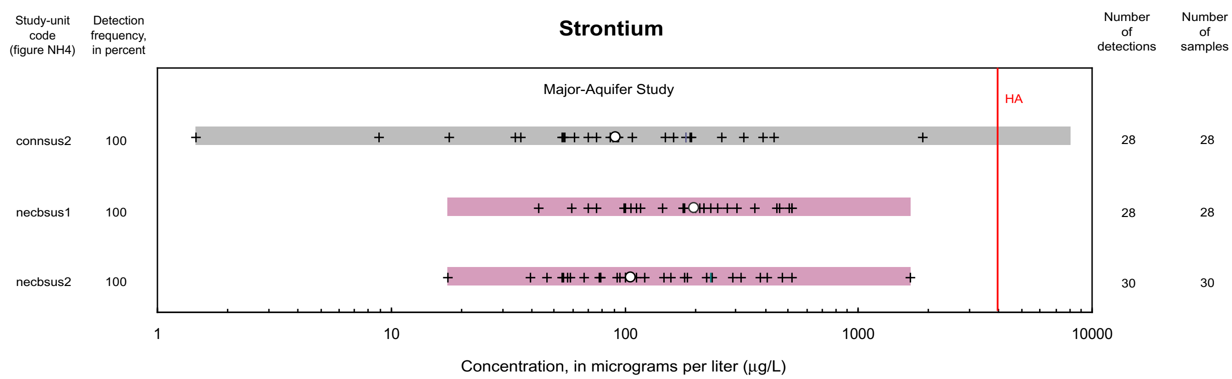
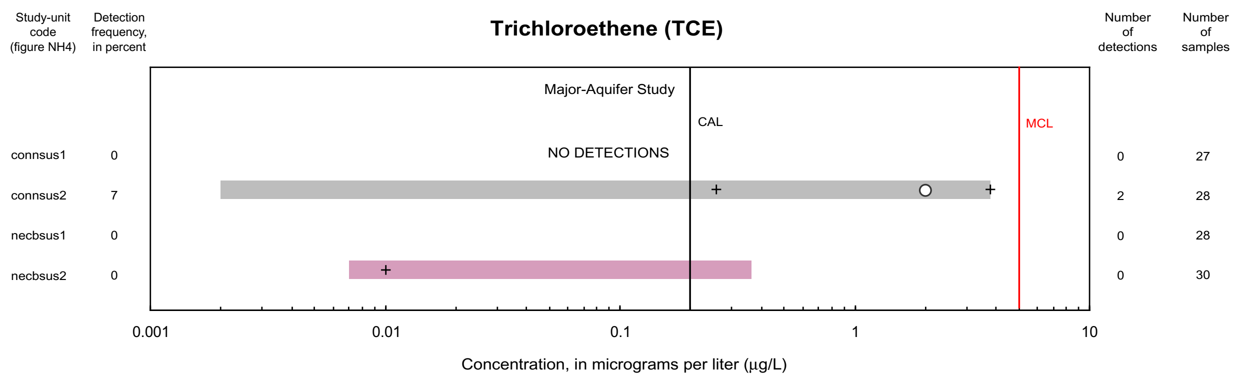


Figure NH5. Statistical summary for 11 selected contaminants by major-aquifer study using domestic-well data from National Water-Quality Assessment (NAWQA) studies for New Hampshire (includes studies for which at least 10 analyses were available).—Continued







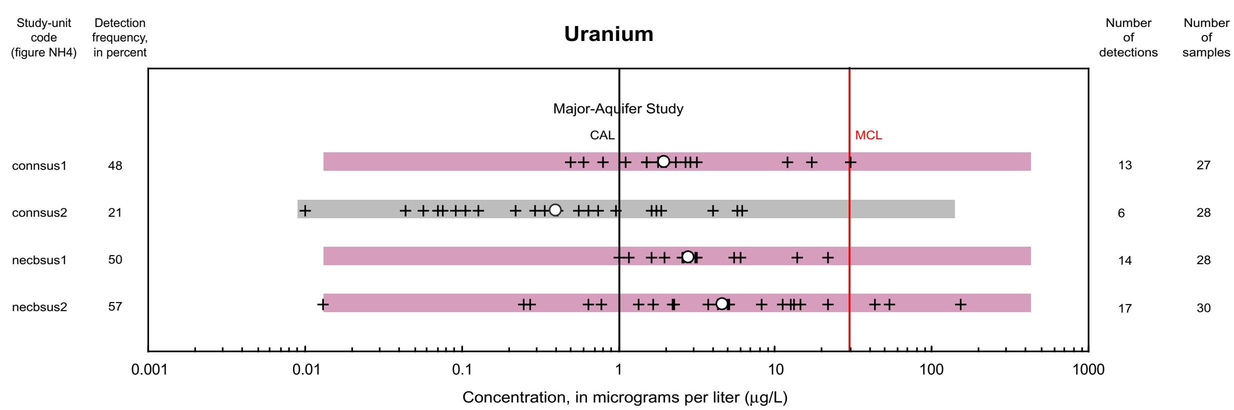
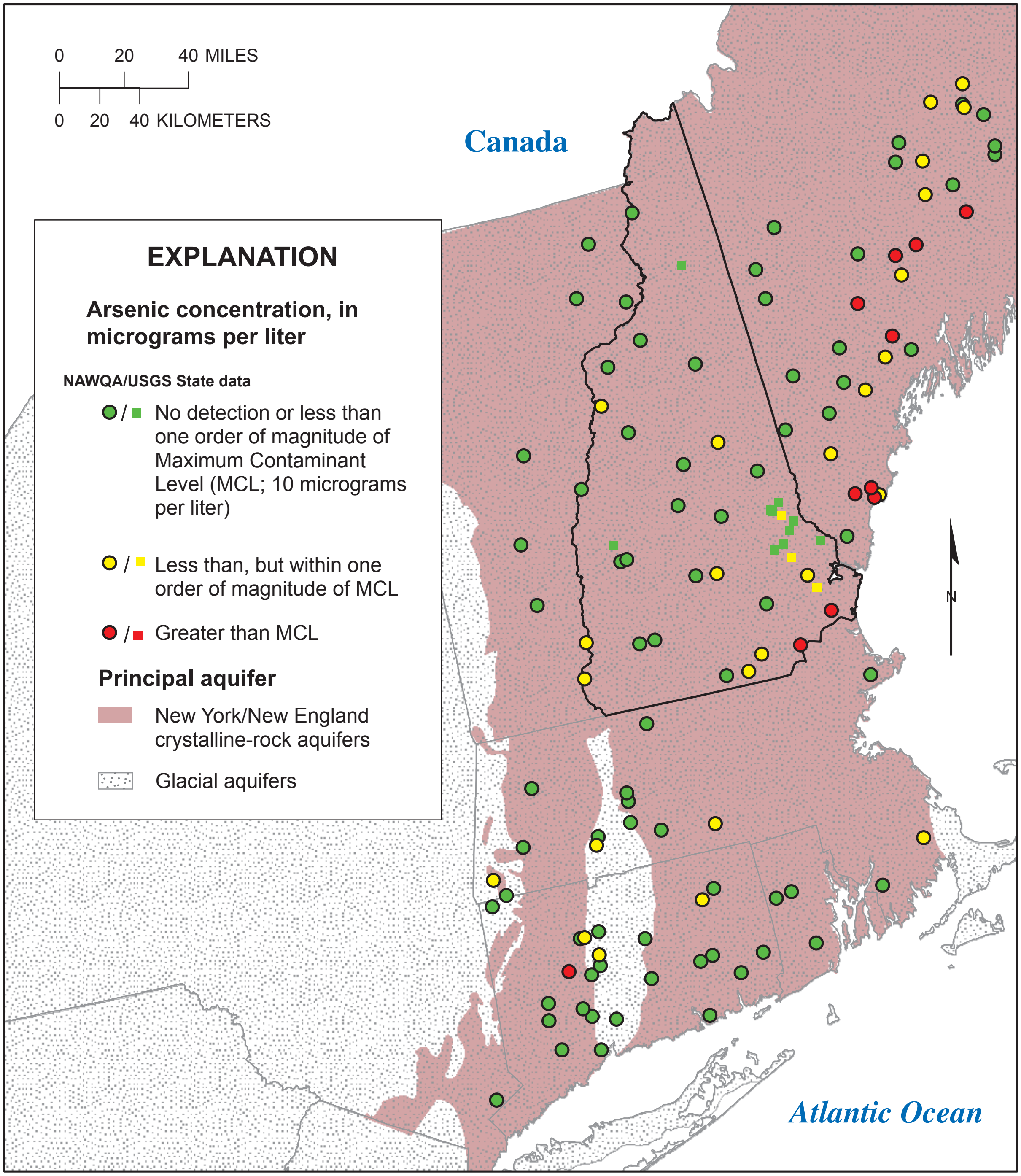


Figure NH5. Statistical summary for 11 selected contaminants by major-aquifer study using domestic-well data from National Water-Quality Assessment (NAWQA) studies for New Hampshire (includes studies for which at least 10 analyses were available).—Continued



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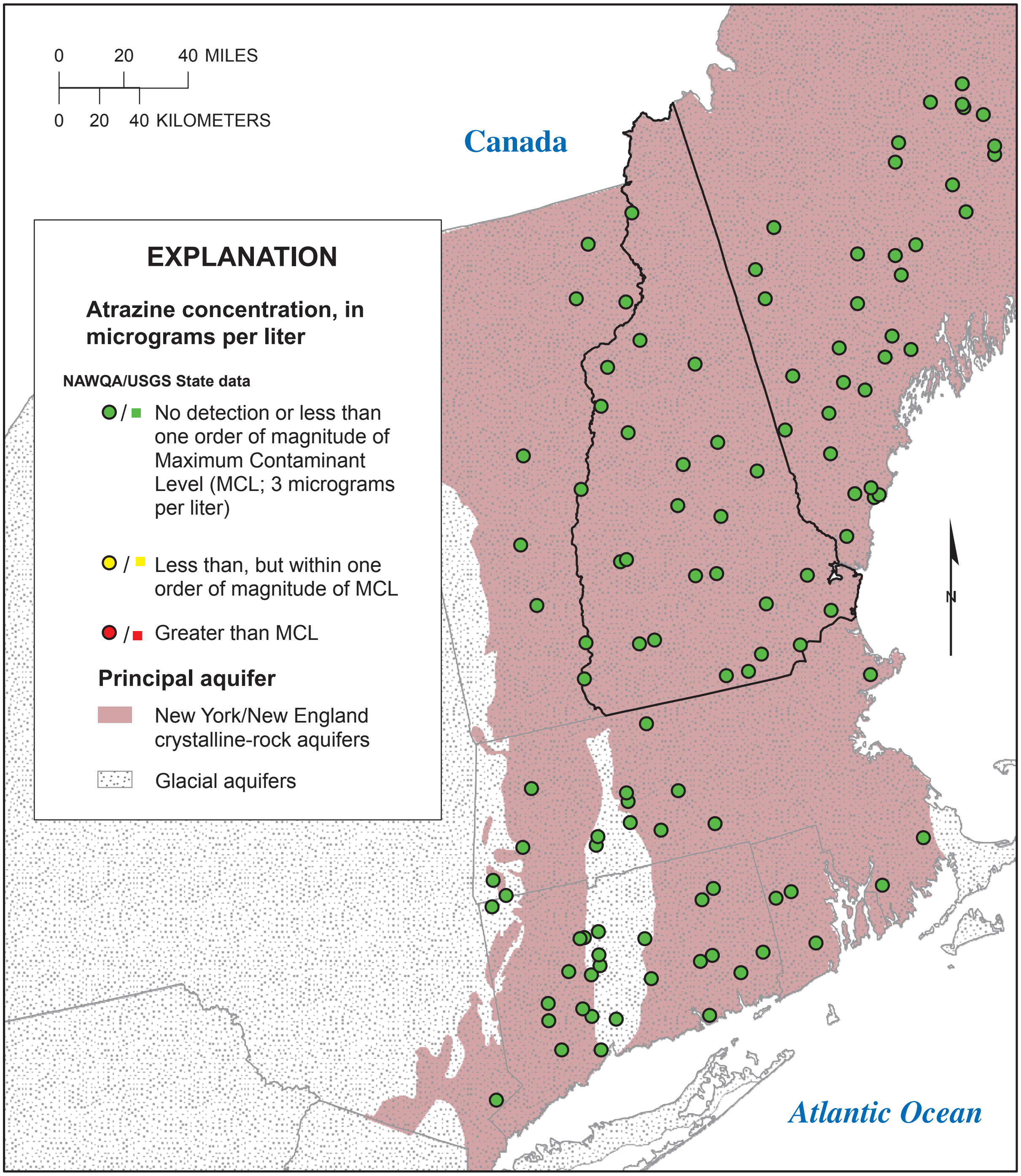
Albers Equal-Area projection
Standard Parallels 29°30' and 45°30', central meridian -96°

Principal aquifer data from U.S. Geological Survey, 2003

Figure NH6. Concentration of arsenic in samples from domestic wells in New Hampshire and nearby States (from National Water-Quality Assessment (NAWQA) studies and U.S. Geological Survey (USGS) State data in the National Water Information System (NWIS)).



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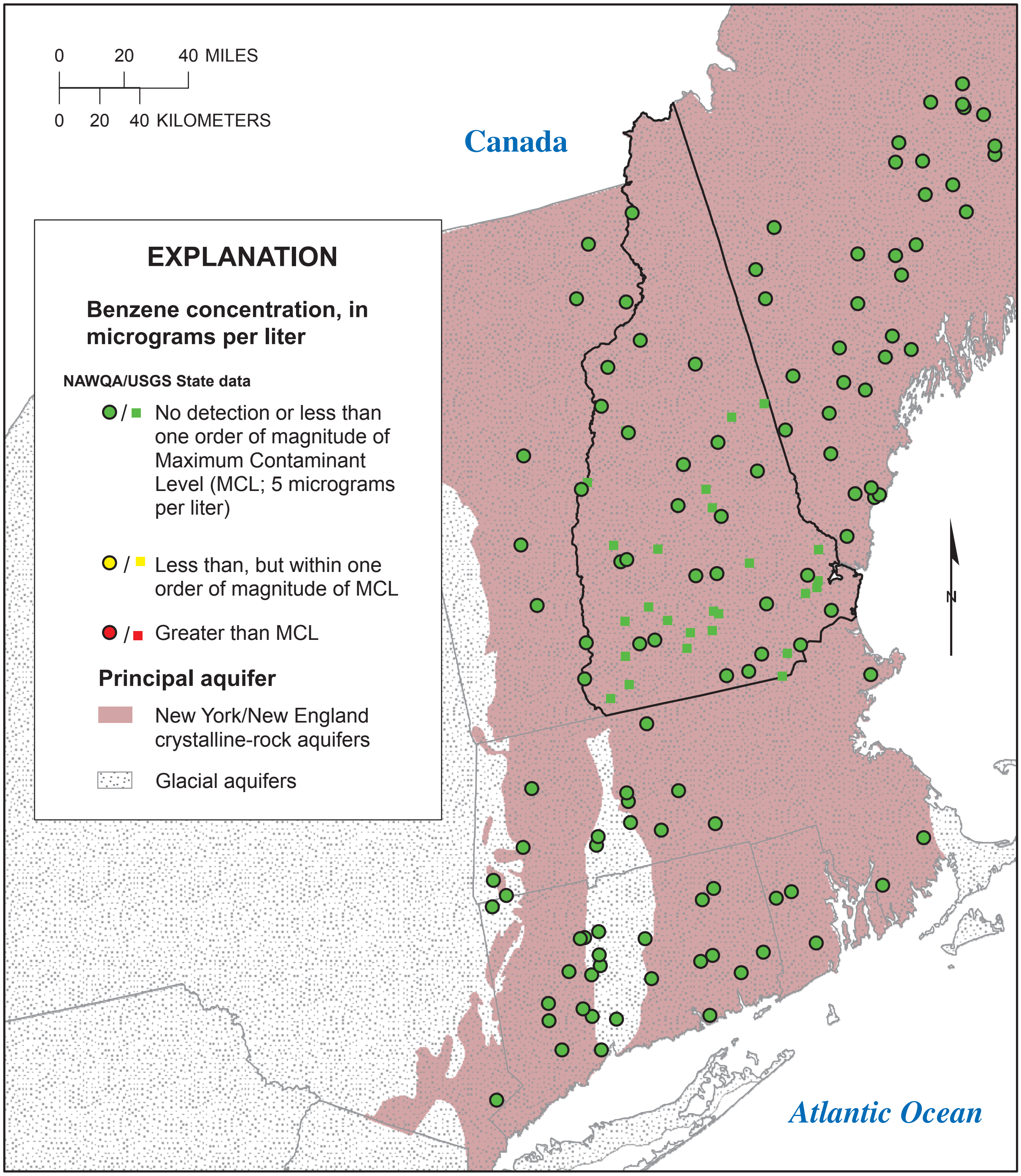
Standard Parallels 29°30' and 45°30', central meridian -96°

Principal aquifer data from U.S. Geological Survey, 2003

Figure NH7. Concentration of atrazine in samples from domestic wells in New Hampshire and nearby States (from National Water-Quality Assessment (NAWQA) studies. No additional data were available from U.S. Geological Survey (USGS) State data in the National Water Information System (NWIS)).



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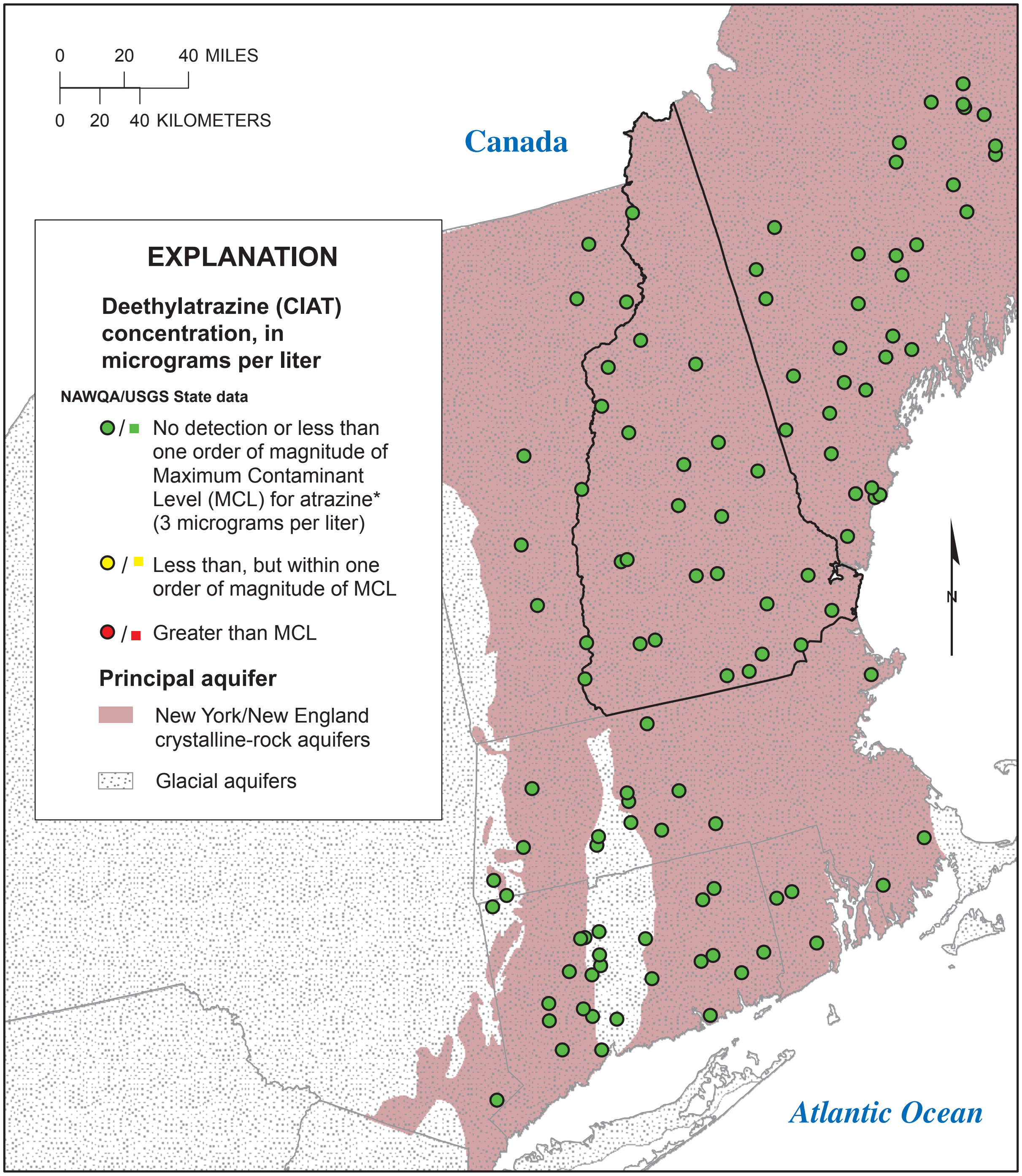
Albers Equal-Area projection
Standard Parallels 29°30' and 45°30', central meridian -96°

Principal aquifer data from U.S. Geological Survey, 2003

Figure NH8. Concentration of benzene in samples from domestic wells in New Hampshire and nearby States (from National Water-Quality Assessment (NAWQA) studies and U.S. Geological Survey (USGS) State data in the National Water Information System (NWIS)).

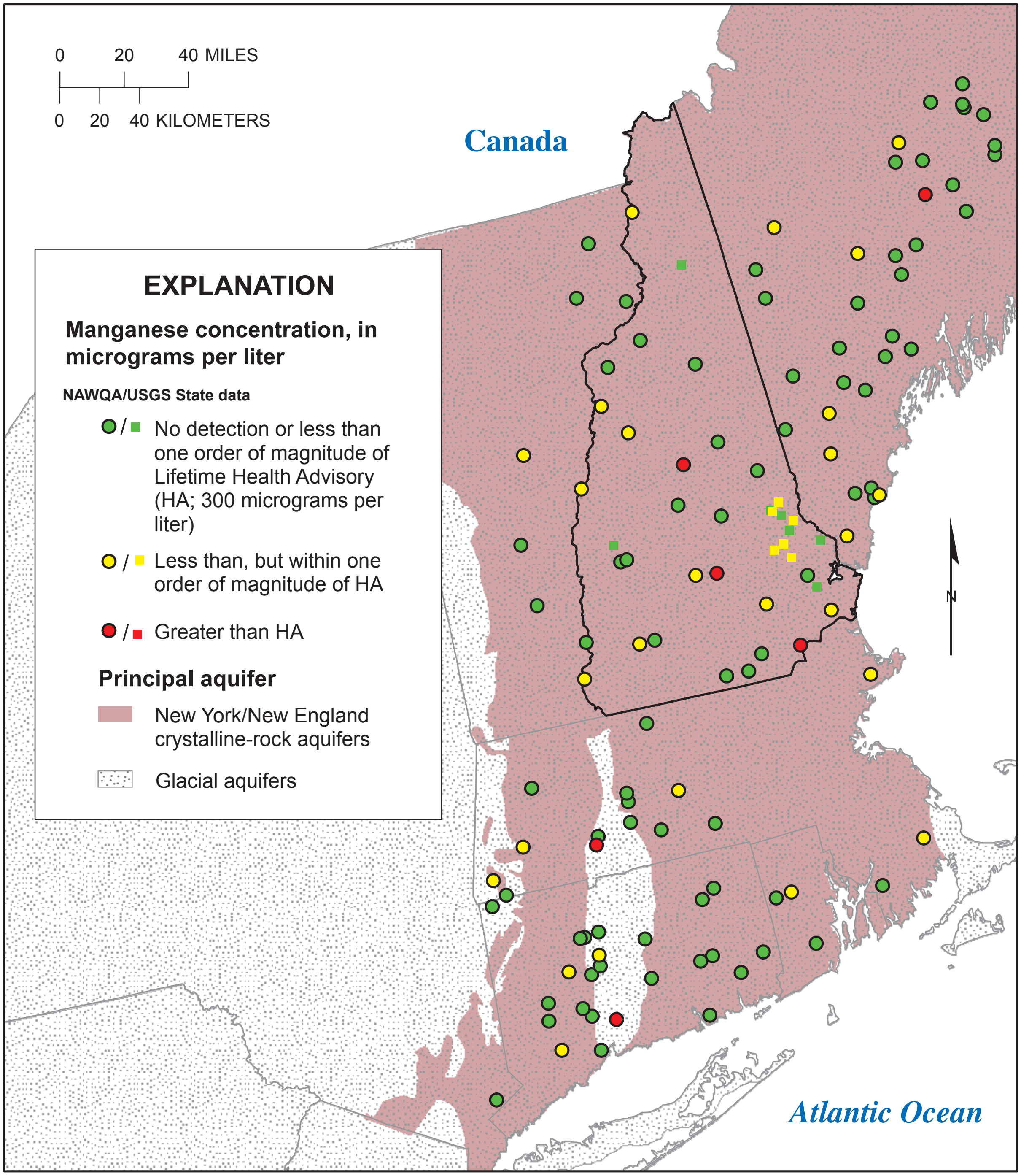


Base information from U.S. Geological Survey digital data, 1:2,000,000
Albers Equal-Area projection
Standard Parallels 29°30' and 45°30', central meridian -96°

Principal aquifer data from U.S. Geological Survey, 2003

* For this report, the MCL for atrazine is used as benchmark for deethylatrazine because their toxicities are considered equivalent (see report text).

Figure NH9. Concentration of deethylatrazine (CIAT) in samples from domestic wells in New Hampshire and nearby States (from National Water-Quality Assessment (NAWQA) studies. No additional data were available from U.S. Geological Survey (USGS) State data in the National Water Information System (NWIS)).



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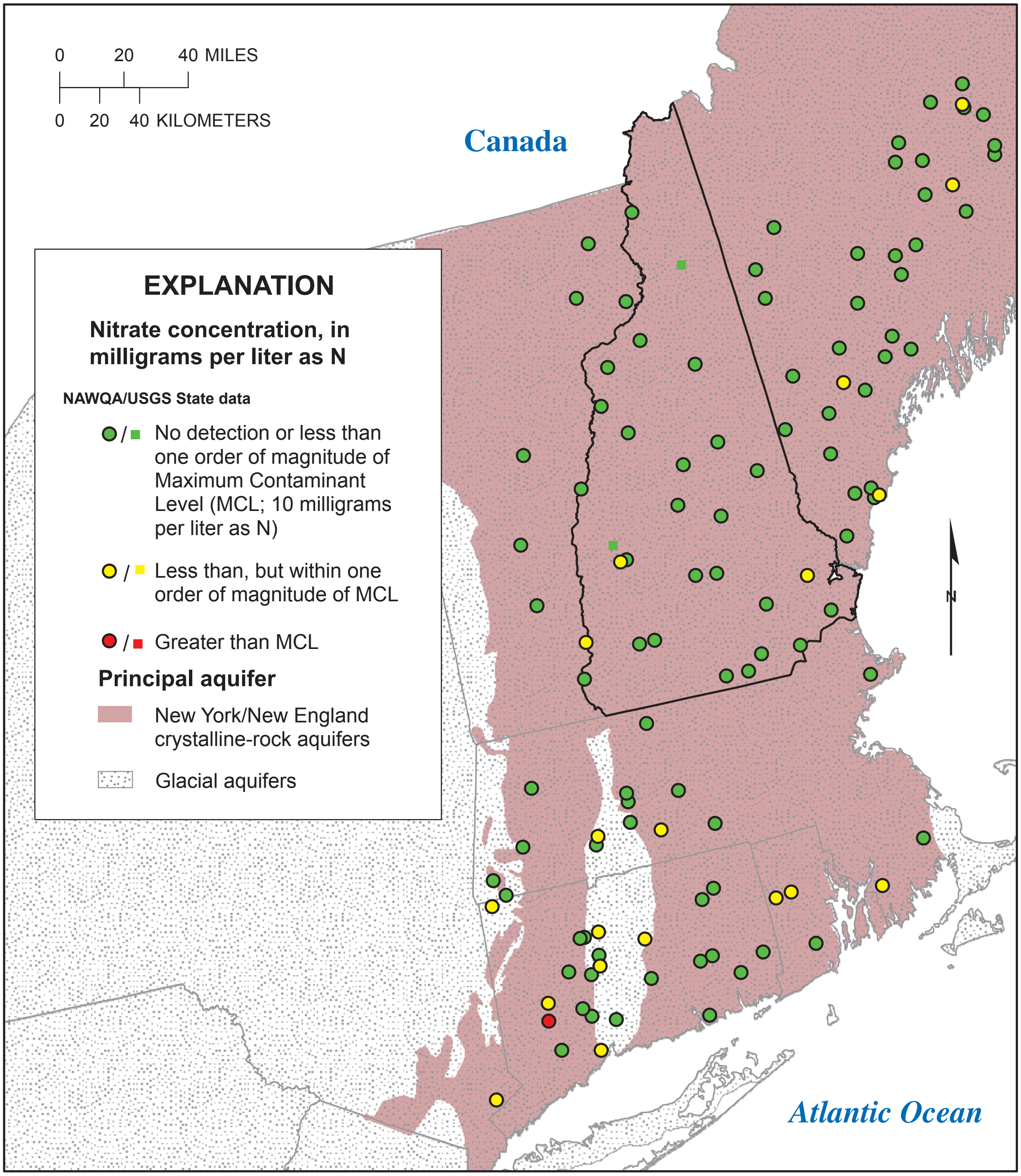
Albers Equal-Area projection
Standard Parallels 29°30' and 45°30', central meridian -96°

Principal aquifer data from U.S. Geological Survey, 2003

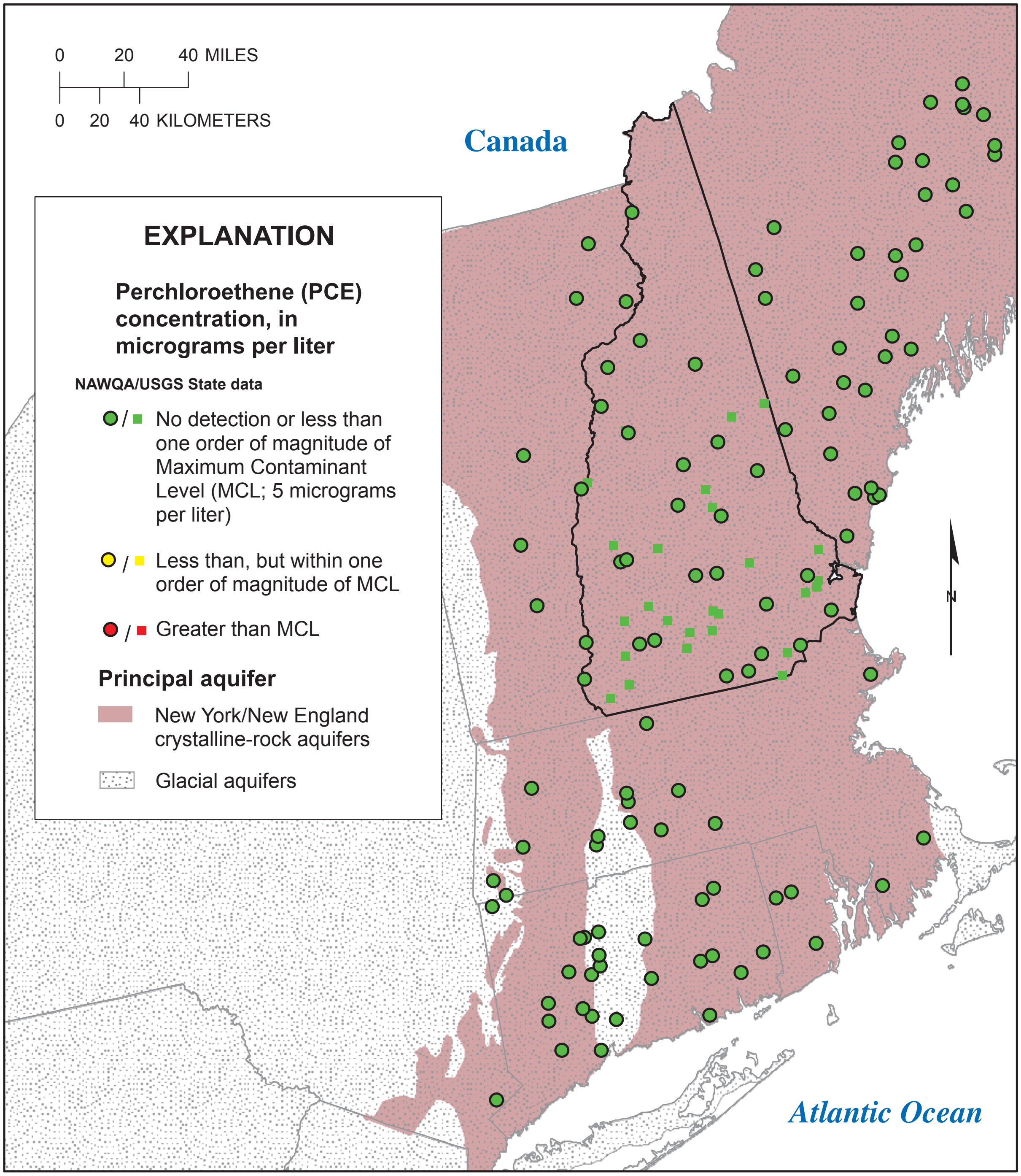
Figure NH10. Concentration of manganese in samples from domestic wells in New Hampshire (from National Water-Quality Assessment (NAWQA) studies and U.S. Geological Survey (USGS) State data in the National Water Information System (NWIS)).



Base information from U.S. Geological Survey digital data, 1:2,000,000
Albers Equal-Area projection
Standard Parallels 29°30' and 45°30', central meridian -96°

Principal aquifer data from U.S. Geological Survey, 2003

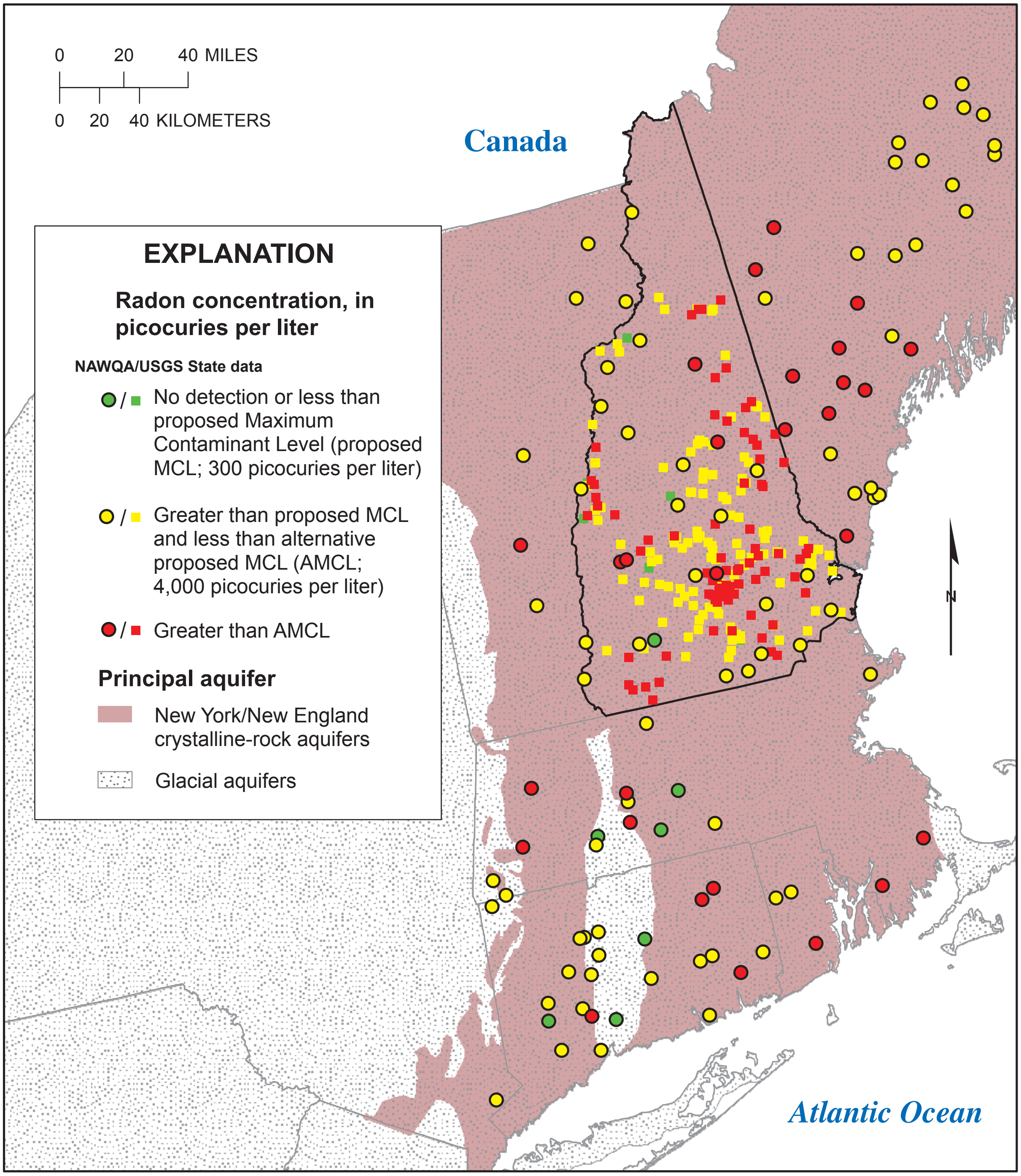
Figure NH11. Concentration of nitrate in samples from domestic wells in New Hampshire and nearby States (from National Water-Quality Assessment (NAWQA) studies and U.S. Geological Survey (USGS) State data in the National Water Information System (NWIS)).



Base information from U.S. Geological Survey digital data, 1:2,000,000
Albers Equal-Area projection
Standard Parallels 29°30' and 45°30', central meridian -96°

Principal aquifer data from U.S. Geological Survey, 2003

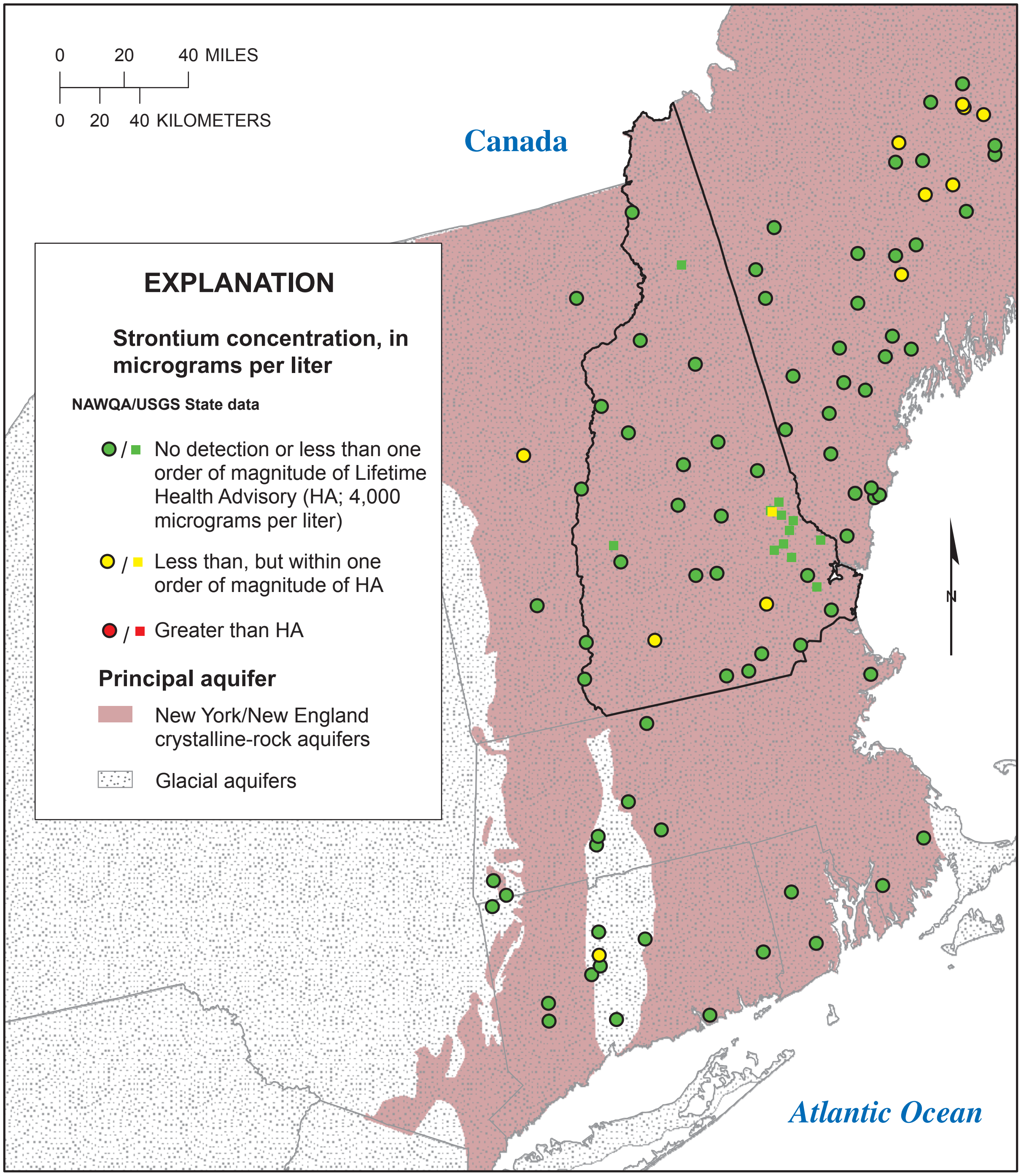
Figure NH12. Concentration of perchloroethene (PCE) in samples from domestic wells in New Hampshire and nearby States (from National Water-Quality Assessment (NAWQA) studies and U.S. Geological Survey (USGS) State data in the National Water Information System (NWIS)).



Base information from U.S. Geological Survey digital data, 1:2,000,000
Albers Equal-Area projection
Standard Parallels 29°30' and 45°30', central meridian -96°

Principal aquifer data from U.S. Geological Survey, 2003

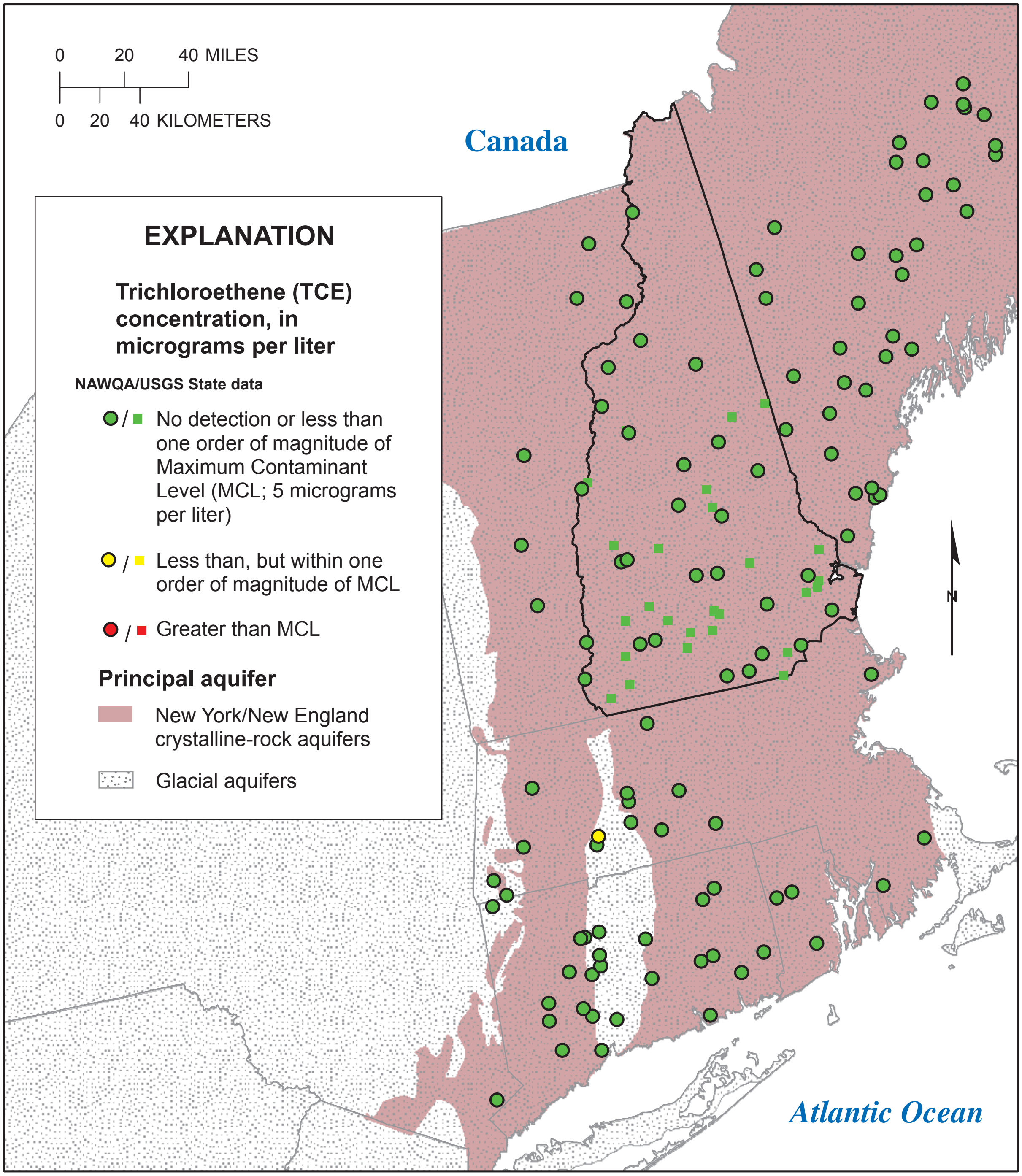
Figure NH13. Concentration of radon in samples from domestic wells in New Hampshire and nearby States (from National Water-Quality Assessment (NAWQA) studies and U.S. Geological Survey (USGS) State data in the National Water Information System (NWIS)).



Base information from U.S. Geological Survey digital data, 1:2,000,000
Albers Equal-Area projection
Standard Parallels 29°30' and 45°30', central meridian -96°

Principal aquifer data from U.S. Geological Survey, 2003

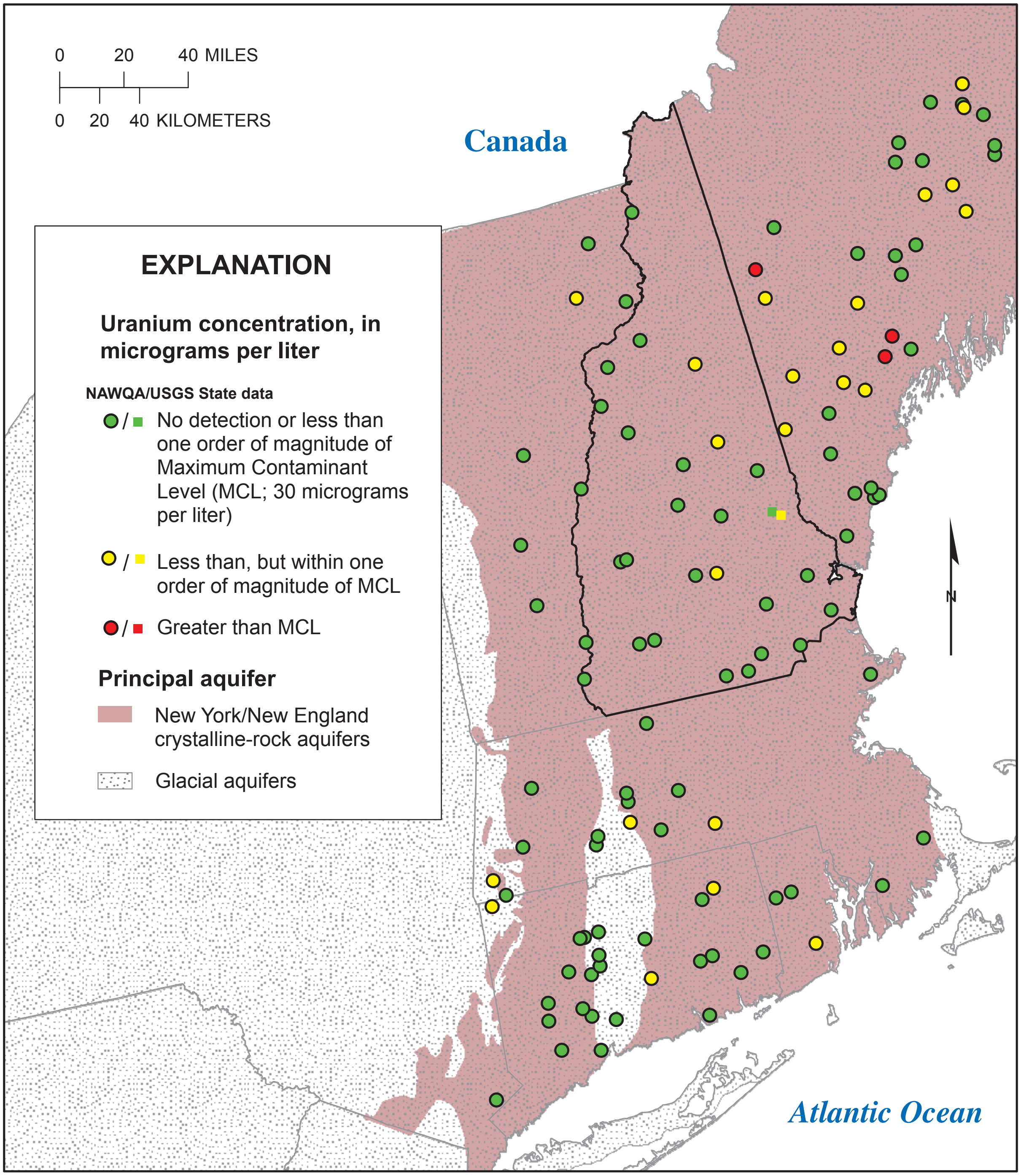
Figure NH14. Concentration of strontium in samples from domestic wells in New Hampshire and nearby States (from National Water-Quality Assessment (NAWQA) studies and U.S. Geological Survey (USGS) State data in the National Water Information System (NWIS)).



Base information from U.S. Geological Survey digital data, 1:2,000,000
Albers Equal-Area projection
Standard Parallels 29°30' and 45°30', central meridian -96°

Principal aquifer data from U.S. Geological Survey, 2003

Figure NH15. Concentration of trichloroethene (TCE) in samples from domestic wells in New Hampshire and nearby States (from National Water-Quality Assessment (NAWQA) studies and U.S. Geological Survey (USGS) State data in the National Water Information System (NWIS)).



Base information from U.S. Geological Survey digital data, 1:2,000,000
Albers Equal-Area projection
Standard Parallels 29°30' and 45°30', central meridian -96°

Principal aquifer data from U.S. Geological Survey, 2003

Figure NH16. Concentration of uranium in samples from domestic wells in New Hampshire and nearby States (from National Water-Quality Assessment (NAWQA) studies and U.S. Geological Survey (USGS) State data in the National Water Information System (NWIS)).