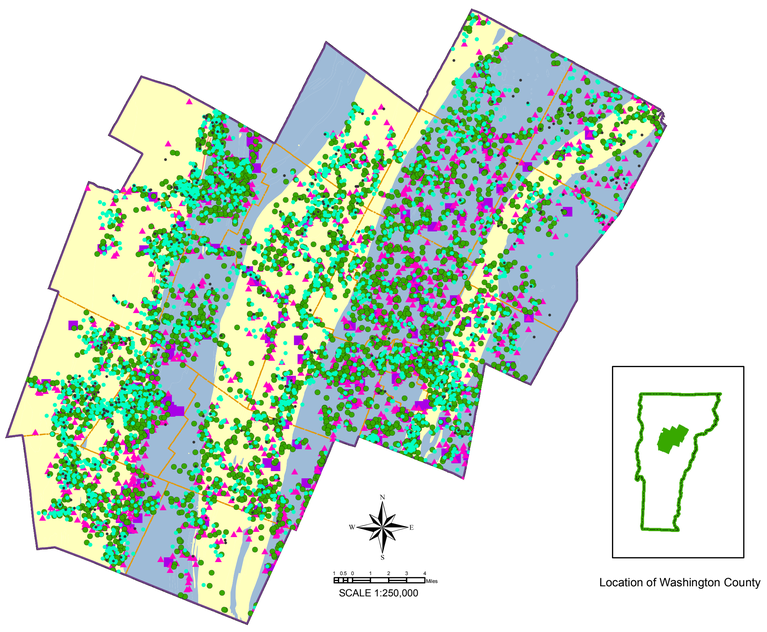


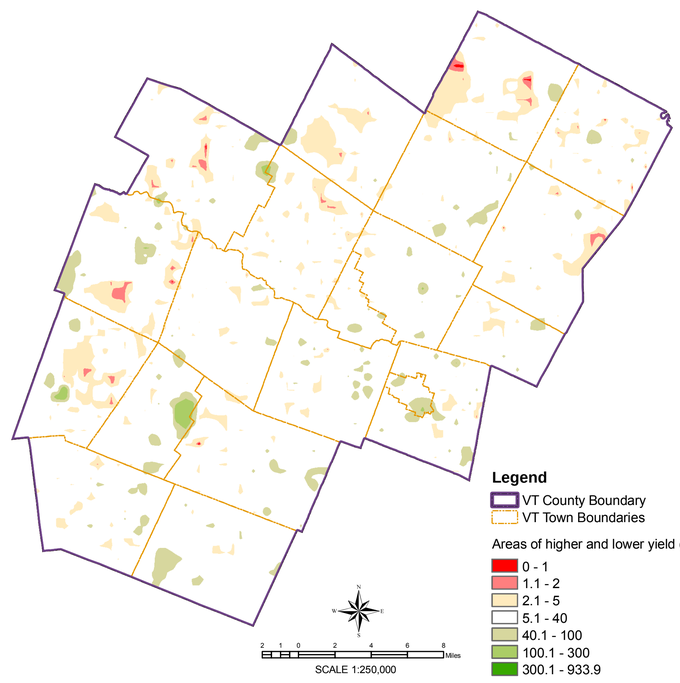
Legend

Reported Yield in GPM
- 0.00 - 0.99
- 1.00 - 4.99
- 5.00 - 19.99
- 20.00 - 99.99
- 100 - 1000

VT County Boundary
VT Town Boundaries

Bedrock units grouped by mean yield (gpm) of wells (see Plate 4 at http://www.anr.state.vt.us/dec/geo/gwaterSTATEinx.htm)
- 2 - 4.99
- 5 - 9.99
- 10 - 14.99
- 15 - 19.99
- 20 - 34.57

Figure 1. All Washingtonr County Bedrock Wells (points) and Bedrock Units Grouped by Yield. The map is the Washington County portion (8,988 wells) of the statewide analyses of 92,315 wells. Map scale is 1:250,000. Refer to the statewide groundwater resource maps on the VGS web site for a discussion of this data and map. Web: http://www.anr.state.vt.us/dec/geo/gwaterSTATEinx.htm



Legend

VT County Boundary
VT Town Boundaries

Areas of higher and lower yield (gpm)
- 0 - 1
- 1.1 - 2
- 2.1 - 5
- 5.1 - 40
- 40.1 - 100
- 100.1 - 300
- 300.1 - 933.9

Figure 2. Areas of higher and lower yield based on an inverse distance weighted analysis of 92,315 well points. See maps at http://www.anr.state.vt.us/dec/geo/gwaterSTATEinx.htm
An inverse distance weighted analysis (IDW) is presented by county. The raster analysis is used to summarize values on the map. The raster statistics summarize attribute values of the well points and assigns a value to each cell in the layer. The IDW raster analysis was set to consider the closest 6 points. The raster shown here may be considered as an approximation of areas for additional study. The raster analysis does not attempt to provide a probabilistic analysis and it is only a presentation of clusters of values. These clusters will change with the addition of more data points.
Errors due to incorrect well locations are less significant at a scale of 1:250,000.

GROUNDWATER RESOURCES BY COUNTY

This county map is part of a map series used to evaluate Vermont's groundwater resources using existing data. The Washington County maps show yield (gallons per minute) data for bedrock wells as reported in the VT DEC Water Supply Division database. A total of 92,315 wells in the State of Vermont were analyzed in the accompanying statewide study. Data were divided into counties for presentation (Figs. 1, 2). Well locations in the database are from well driller descriptions and sketches.

Some wells have been located by GPS or by correlating a well log to an E911 address. In Washington County, 1809 out of 8,988 wells or 20% have an E911 or GPS address (Figure 3). The majority of wells, as shown on Figure 1, have suspect locations although errors due to incorrect well locations are less significant at a scale of 1:250,000.

Well yield (gpm) is generally estimated in the field with a bucket and timer. The time period is usually short and measurements are not meant to be precise. Comparisons of the mean and median values for all wells and the mean and median values for wells in Washington County are shown in Table 1.

Wells are grouped into yield categories on the map presented here. Depth and yield vary due to many factors, including non-geologic factors. For example, a homeowner may drill until the desired yield is obtained. The factors are not indicative of capacity. Moore et. al., 2002*, published "Factors Related to Well Yield in the Fractured-Bedrock Aquifer of the New Hampshire" in which they discussed a number of factors correlated positively or negatively to well yield. Among these factors are year drilled, median household income, drilling method, up gradient drainage area, thickness of overburden, depth drilled, proximity to streams/water bodies, type of bedrock, steepness of slope, elevation, fractures, and geologic structures.

The map presented is designed to be used in conjunction with other data and analyses. Groundwater flow in the crystalline bedrock of Vermont is mainly along planar features such as fractures, cleavage, faults, and bedding. These planar features may be interconnected and groundwater flow within this system is complex.
*Area-specific studies in the county have been completed for the Knox Mountains Marshfield/Plainfield) and the southern Worcester Mountains (Middlesex/Waterbury. These are posted on the web at:
Web: http://www.anr.state.vt.us/dec/geo/grndwaterinx.htm

* 1. Gale, M.H., Kim, J., King, S., Montane, P. and Orsi, C., 2006, Bedrock Geologic Map of the Southern Worcester Mountains, Vermont: Vermont Geological Survey Open File Report 2006-2.
2. Kim, J., Charnock, R., Chow, D. and Springston, G., 2008, Bedrock geologic map of the Knox Mountain pluton area, Marshfield and Peacham, Vermont: Vermont Geological Survey open File Report VG08-3.
3. Kim, J., Springston, G., Gale, M., Dunn, R., and Becker, L., 2006, Geologic Framework for Evaluating Ground Water Resources in the Southern Worcester Mountains, Central Vermont: NEGSA Abstract with programs - poster on line at: http://www.anr.state.vt.us/dec/geo/grndwaterWorc.htm
4. Kim, J., Springston, G., and Charnock, R., 2008, Bedrock Control on Surficial Deposits and Groundwater Issues in Part of the Knox Mountain Granite: NE Vermont: NEGSA Abstract with programs - poster on line at: http://www.anr.state.vt.us/dec/geo/KnoxMtnsPoster.htm
5. Moore, R.B., Schwarz, G.E., Clark, S.F., Jr., Walsh, G.J., and Degnan, J. R., 2002, Factors related to well yield in the fractured-bedrock aquifer of New Hampshire: USGS Professional Paper 1660.
6.Springston, G. and Dunn, R., 2006, Surficial Geologic Map of the Southern Worcester Mountains, Vermont: Vermont Geological Survey Open File Report 2006-3.
7. Springston, G. and Kim, J., 2008, Surficial geologic map of the Knox Mountain area, Marshfield and Peacham, Vermont: Vermont Geological Survey open File Report VG08-4.

TABLE 1

	State of Vermont	Washington County
# of wells	92315	8988
# of located wells	15389	1809
Mean yield, GPM	13.76	15.06
Median yield	6	8
Maximum reported yield	1200	1000
Standard Deviation	22.82	25.35
Mean depth, FT	293.02	248.69
Median depth, FT	260	220
Maximum reported depth	1765	1090
Standard deviation	157.99	126.88
% wells with yield ≤ mean	70%	74%
% wells with yield > mean	30%	26%
% wells with depth ≤ mean	56%	59%
% wells with depth > mean	44%	41%

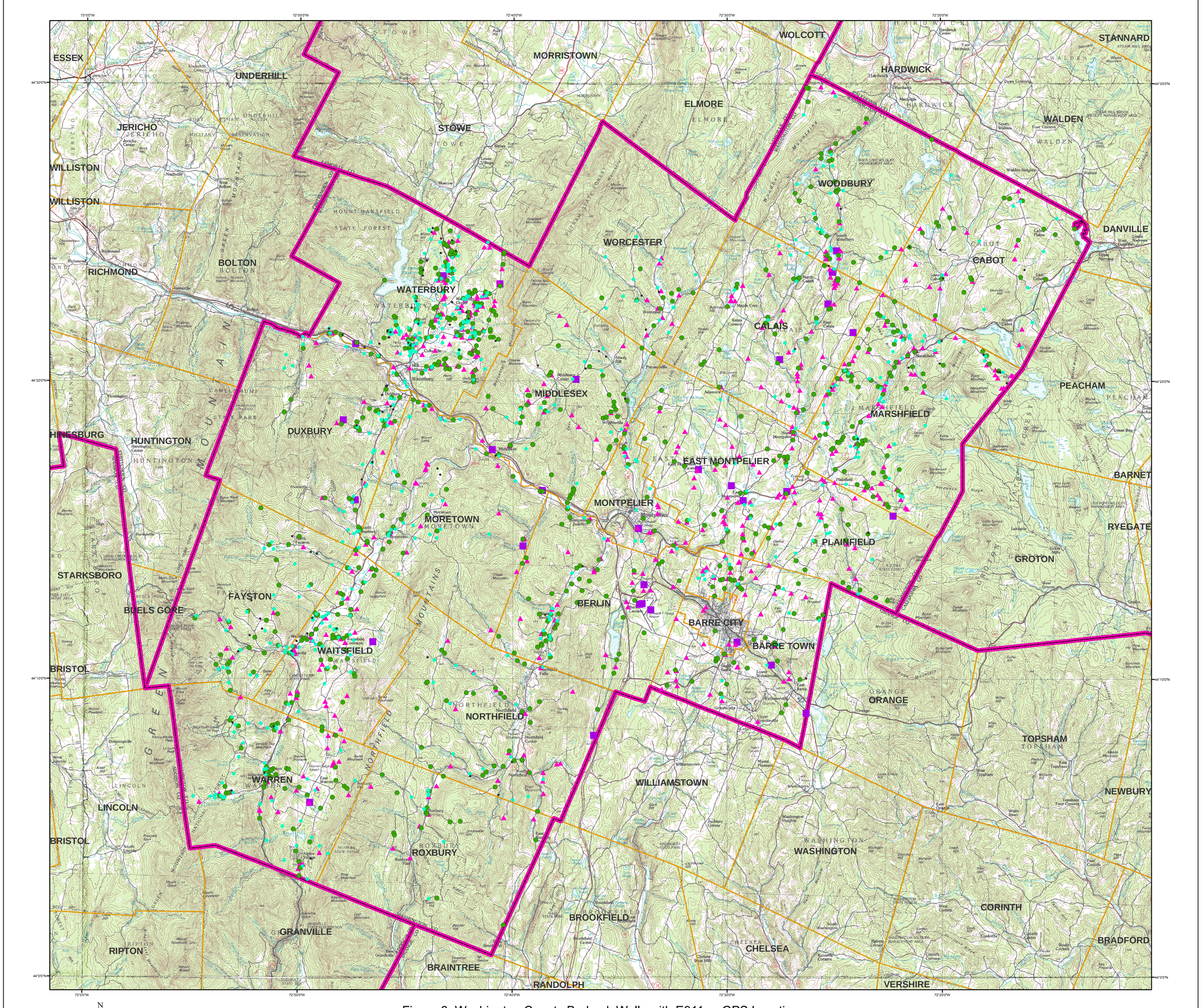


Figure 3. Washington County Bedrock Wells with E911 or GPS Location

Legend

Reported yield in gallons per minute (GPM)
- 0.00 - 0.99
- 1.00 - 4.99
- 5.00 - 19.99
- 20.00 - 99.99
- 100.00 - 435.00

Roads

Water
VT Town Boundaries
VT County Boundary

0 1 2 4 6 8 Miles
SCALE: 1:100,000

Reported Well Yields in Bedrock Wells, Washington County, Vermont

by
Marjorie Gale, George Springston, Ryan Knox and Laurence Becker
2010

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