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Jefferson P. Hoffer, PG
Groundwater Availability Studies
Hydrogeologic Site Investigations
Groundwater Supply Development

June 10, 2024

Scott A. Tucker
Wilmington Town Manager
2 East Main Street
Wilmington, VT 05363
via tucker@wilmingtonvt.us

Re: Report on Groundwater Availability Study, Town of Wilmington, Vermont

Dear Mr. Tucker:

Hoffer Consulting Inc. (HCI) is pleased to offer this report on a groundwater availability study conducted for the Town of Wilmington.

We understand the Town plans to extend water and sewer service along Route 9 to the east of the current service area. HCI was retained by the Town to assess the possibility of developing a Town well in the vicinity of the proposed water-line expansion. Figure 1 shows the study area, which includes lands to the east along Route 9 to Shearer Hill Road and south along Route 100 to Dix Road.

We analyzed existing well log data and geologic maps to assess well yields in the study area. Additionally, we reviewed environmental data to identify any current or potential sources of groundwater contamination that could restrict the siting and permitting of a municipal well. Although we conducted a brief windshield survey of the study area, we did not collect any subsurface data or verify the locations of existing water wells.

Conclusions and Recommendations

- The yields of existing bedrock wells in and near the study area indicate that the local bedrock aquifer can sustain a municipal well or wells with a safe yield of 20 to 40 gallons per minute, which would provide 14,400 to 28,800 gallons per day.

- To obtain a source permit for a municipal well, the 200-foot isolation zone around a well must be owned by the Town or controlled through a warranty easement deed.

- Six potential well sites on five different parcels are identified that show the most promise based on their proximity to the proposed service area and accessibility from existing roads. The Town can contact these landowners (and possibly others not identified by HCI) to see if any may be willing to sell land or grant easements to the Town for a municipal well. If willing landowners are identified, we recommend executing purchase and sales agreements prior to initiating the permitting process or drilling a well.

- Geological well siting techniques can then be used to compare possible sites and pinpoint specific well locations. Once the well site(s) have been identified, and purchase and sales agreements with the land owners have been signed, the state permitting process can begin with the submission of a Source Permit Application to the Agency of Natural Resource's Drinking Water and Groundwater Protection Division.

Drinking Water Sources in Vermont

Drinking water sources for municipal water systems include either surface water or groundwater. Surface water sources must be filtered and treated to remove microbiological threats and other contaminants. Groundwater sources typically require less expensive treatment as the water is partially filtered when rain water and snowmelt infiltrate through soil layers to underlying aquifers.

The ideal site for a groundwater source meets the following criteria.

- Favorable aquifer in terms of both quantity and water quality
- Adequate recharge for long-term sustainability
- Remote from potential sources of contamination
- Minimal potential for interference/impact on existing water supplies
- Reasonably close to users and infrastructure (water lines, electricity, etc.)

In Vermont, groundwater is accessible from either stratified-drift (sand and gravel) or fractured-bedrock aquifers. Sand and gravel aquifers are typically found within river valleys and can provide larger volumes of water compared to bedrock aquifers. Municipal wells completed in sand and gravel aquifers often produce over 1,000 gallons per minute (gpm), while 100 gpm is considered a high yield for a bedrock well. Most large communities in Vermont that use groundwater rely on large-diameter wells completed in sand and gravel aquifers.

Although the bedrock aquifer is less productive than most sand and gravel aquifers, it is present throughout all of Vermont. Unlike sand and gravel aquifers where water is stored within the pore spaces between gravel and sand grains, bedrock aquifers store and transmit water through cracks and fractures. The yield of a well drilled into bedrock depends upon the size and number of water-bearing fractures penetrated by the drill hole. Wells drilled into the bedrock in Vermont typically have enough yield to meet the needs of an individual house. Higher yields for commercial and municipal water systems are possible when wells intercept many interconnected fractures and/or larger fracture zones. Many smaller municipal water systems in Vermont rely on bedrock wells.

Potential Aquifers in the Study Area

Figure 2 illustrates the location of the study area on the USGS topographic map for the region. The study area is situated within the Beaver Brook watershed, which drains westward toward its confluence with the North Branch of the Deerfield River.

The mapped surficial geology of the study area is displayed on Figure 3 and includes till, bedrock exposures, and outwash (sand and gravel) deposits along the stream valley of Beaver Brook. These outwash sand and gravel deposits often serve as aquifers capable of supporting high-yielding wells.

Figure 4 illustrates the bedrock geology of the study area, which consists of granites, gneisses and schists. These are ancient igneous and metamorphic rocks that comprise the spine of the Green Mountains in southern Vermont.

Water Well Records

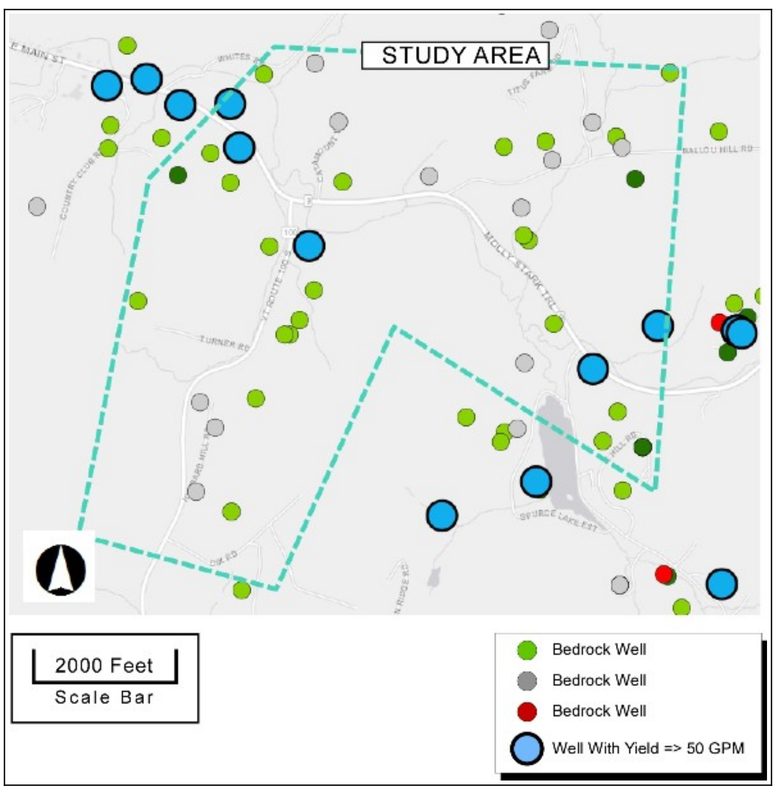
The state of Vermont has maintained a database of private and public wells drilled since 1966, and this data is available on the Vermont Natural Resources Atlas[1] (Atlas). The well logs provide information on the type and thickness of materials penetrated by the well, the well construction details and total depth, and the drillers estimated yield in gpm. The Atlas identifies 40 wells within the study area (see Figure 5), and data for these wells are summarized in Table 1.

Gravel Wells

Even though geologic maps indicate the possible presence of a sand and gravel aquifer in the study area, none of the 40 wells in the study area are completed as gravel wells. Figure 6 shows the location and geologic logs for wells drilled in areas mapped as sand and gravel. While many of the logs show over 50 feet of overburden materials above the bedrock, most of the logs describe the overburden as "hardpan" which indicates till and not outwash sand and gravel deposits. While there may be isolated areas within the study area where gravel wells could be developed, there does not appear to be a continuous or thick sand/gravel aquifer in the study area.

Bedrock Wells

The drillers yield for the 40 bedrock wells in the study area range from zero to 100 gpm. Below is a map of bedrock wells in and near the study area as shown in the Atlas. The larger blue dots are for wells with yields of 50 gpm or greater. There appears to be a cluster of wells with yields of 50 gpm or greater along Route 9 near the northwest extent of the study area.



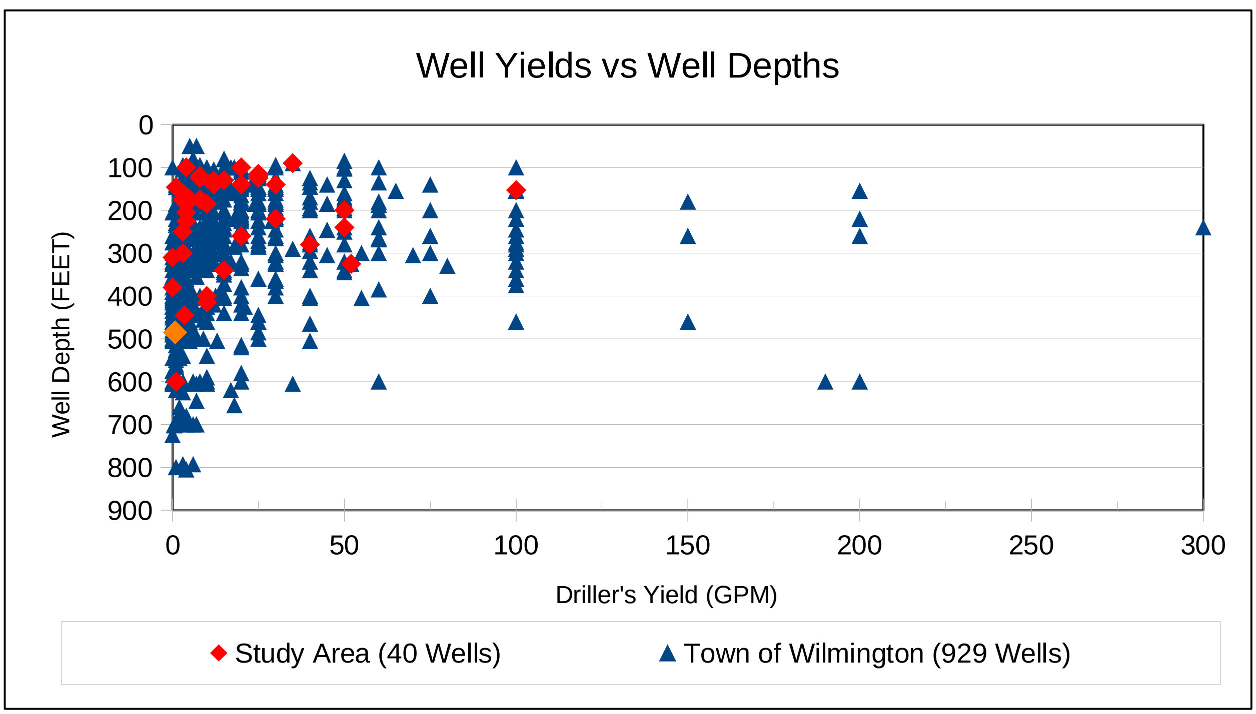
[1]https://anrmaps.vermont.gov/websites/anra5/

Below is a summary of drillers yields and total drilled depths for the 40 study area bedrock wells compared to the entire Town, the county, and all of Vermont.

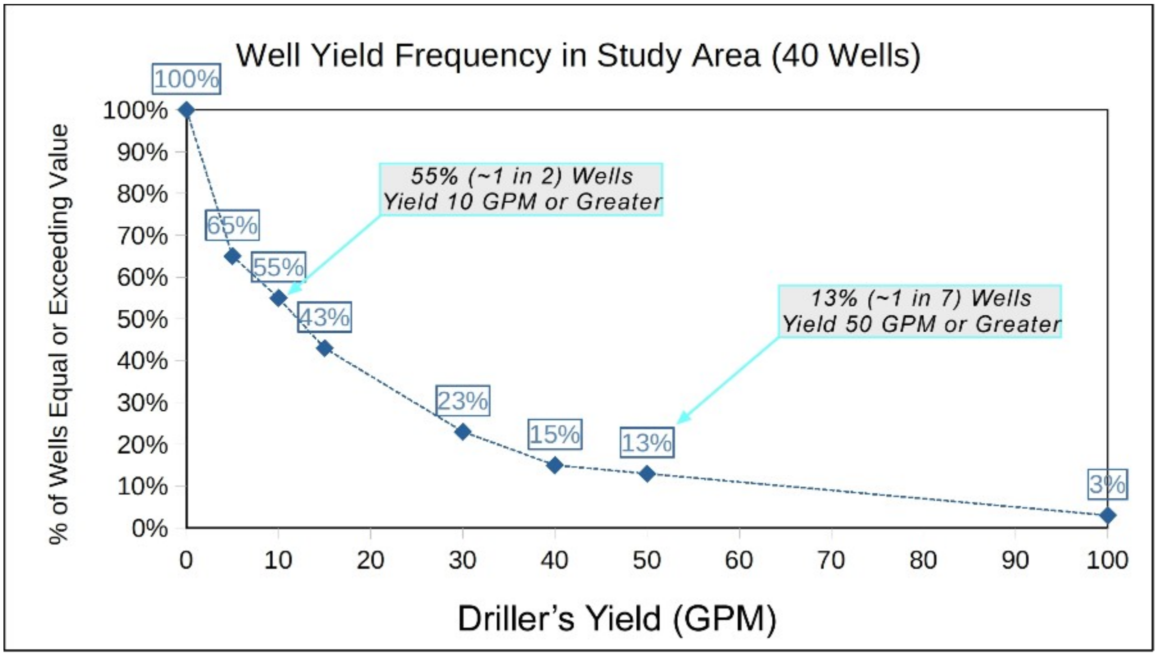
	BEDROCK WELL YIELDS (GPM)			
	Study Area	**Town of Wilmington**	**Windham County**	**State of VT**
N =	40	929	11020	92315
Maximum =	100	300	402	1200
Mean =	17.9	17.7	11.6	13.76
Median =	10	9	5	6

	BEDROCK WELL DEPTHS (FEET)			
	Study Area	**Town of Wilmington**	**Windham County**	**State of VT**
N =	40	947	11020	92315
Minimum =	90	50	-	-
Maximum =	600	805	1600	1765
Mean =	226	303	272	293
Median =	185	280	250	260

This data shows that the average yields for bedrock wells in the study area and the Town of Wilmington exceed county and state-wide averages. On average, the well depths are also shallower in the study area. Below is a chart of well yields versus well depths for the study area (red diamonds) and the Town of Wilmington (blue triangles).



Below is a chart illustrating the frequency of well yields in the study area. It shows that approximately 1 in 2 wells have a drillers yield of 10 gpm or more, and about 1 in 7 wells have a yield of 50 gpm or greater.



These data suggest that the likelihood of drilling a well with a yield of 50 gpm or greater is relatively low, approximately 1 in 7. Most of the wells in the study area were drilled for single family homes or small businesses. Well drillers typically do not drill much deeper than the first water-bearing fracture that has enough water (around 5 gpm) to meet the needs of a typical house or small business. Drilling deeper may increase the chances of hitting additional fracture zones and obtaining an even higher yield.

In addition, the majority of these wells were likely drilled at a location chosen based on prescribed setback distances from a septic system, structure, stream, road, etc. Hydrogeologists use several techniques to choose well-drilling sites that can increase the likelihood of drilling into water-bearing fracture zones. If a large enough area of land is available, these techniques include evaluating fracture patterns in bedrock outcrops, conducting fracture-trace analysis, and performing geophysical surveys.

The well log data indicates that the local bedrock aquifer has the capacity to meet the demands of a municipal water system requiring 14,000 to 28,800 gallons per day (safe well yield of 20 to 40 gpm).

In our experience, the safe yield determined for municipal wells through controlled pumping tests is usually around 50% of the well drillers yield. This means that to achieve a safe yield of 40 gpm, a well with a drillers yield of 80 gpm would be needed. Depending on the size of land available for well placement, and whether geological techniques are utilized to locate drilling targets, it may be necessary to drill more than one well to reach the desired yield.

Water Quality Data

There is limited data available on the water quality of the bedrock aquifer in the study area. There are five regulated water systems in the study area, as listed below, which provide some data on water quality.

WSID	SYSTEM NAME	SYSTEM TYPE	FACILITY NAME	PERMITTED YIELD	WELL TYPE
VT0001944	WHITE HOUSE	NC	WELL #2		Drilled
VT0001944	WHITE HOUSE	NC	WELL #1		Drilled
VT0021180	WILMINGTON HOUSE OF PIZZA (Inactive)	NC	WELL 1		Drilled
VT0020838	DEERFIELD VALLEY HEALTH CENTER	NTNC	DUG WELL	1 GPM	Dug Well
VT0021560	HONORA-WILMINGTON	NP	WELL 1	4 GPM	Drilled

HCI downloaded and reviewed available water quality data for these water systems[2]. Table 2 summarizes parameters that were detected but does not include parameters that were reported as "below detection limits" by the laboratory. The data for the Deerfield Valley Health Center water system provides the most comprehensive data for the study area. The source of water for this water system is reported as a "dug well" but based on our research it is more likely a bedrock well housed in a well pit constructed with concrete well tiles. The source may in fact be the bedrock well drilled for Martin Brown in 1968 with a drillers yield of 100 gpm which is listed on Table 1. This well's location provided in the ANR Atlas is the same as the Deerfield Valley Health Center parcel.

The current water quality data for these water systems does not show any of the typical water quality issues found in Vermont bedrock wells that can require treatment, such as iron, manganese, arsenic, and nitrate. However, there is no data on naturally-occurring radionuclides such as uranium, gross alpha, or radium. The Deerfield Valley Health Center source has been tested twice for per- and polyfluorinated substances (PFAS) and none were found.

In conclusion, the existing water quality data for the bedrock aquifer in the study area is somewhat limited but does not indicate any specific water quality concerns or problems.

Existing and Potential Sources of Contamination

To identify existing sources of groundwater contamination in the study, we used the Waste Management layer of the Atlas to locate landfills, hazardous waste sites, above ground and underground storage tanks, and hazardous waste generators. The database includes a hazardous waste site at the White House Inn, where a 5,000-gallon heating oil tank was removed in 2003 and evidence of soil and groundwater contamination was found. The extent of contamination was investigated and monitored until 2010 when the State designated the site as SMAC'd (site management activity completed). The Deerfield Valley Health Center is identified as a hazardous waste generator, but there is no evidence of any release or impact on the environment.

Other potential sources of groundwater contamination in the area include wastewater disposal systems and roads, which have the potential to impact groundwater from fuel spills or excessive road salting. There do not appear to be any large-scale agricultural lands in the study area that could pose a risk of groundwater contamination from fertilizers, herbicides, or pesticides.

[2]https://anrapp.vermont.gov/dwlibrary/

Potential Well Siting Areas

Ideally, municipal wells are developed in locations that are remote from known or potential sources of contamination, but relatively close to the service area. The minimum required land area for a public community source well is a 200-foot isolation zone, which is a circular area of nearly 3 acres. The study area contains many large parcels where wells could potentially be located. Figure 8 identifies the larger parcels in the study area. While some of these parcels include residences or commercial buildings, the majority of land within these parcels is undeveloped. However, several of these parcels include areas of steep terrain with no existing access roads and are quite far from the proposed service area along Route 9 and Route 100.

To narrow down potential locations for a municipal well, we conducted a map exercise to identify parcels near the proposed service area that could accommodate a 200-foot isolation zone. Figure 9 displays six theoretical well sites on parcels close to the proposed service area, that appear to be easily accessible from main roads. Below is a comparison/ranking of these six sites based on their proximity to the service area, proximity to potential sources of contamination, groundwater favorability based on topographic setting, and the potential for interference on existing water supplies.

HCI Site ID =	A	B	C	D	E	F
Parcel ID # =	2122059	2121095.1	2122063	902004		2122068
Current Owner =	Lopez	Arbor Realty	VT 211	Bezmalinovic		Mack
Proximity to Proposed Water Line	1	3	2	2	3	2
Proximity to Potential Sources Of Contamination	3	1	2	3	3	2
Favorable Topographic Setting (Valley bottom, base of slope?)	1	3	2	2	2	1
Potential for Interference on Existing Water Supplies?	2	1	2	2	2	2
TOTAL	7	8	8	9	10	7

Graded From 1 to 3 (1 is less favorable, 3 is more favorable)

The preliminary ranking indicates that these sites are generally similar, although sites D and E may be slightly more favorable. Below is a discussion of each potential well site.

Site A – This 22.6-acre parcel includes a house at a lower elevation with an upland area of undeveloped but accessible land. The uplands are remote from potential sources of contamination. The site is at a relatively high elevation, which is less favorable from a groundwater supply standpoint.

Site B – This 5.5-acre undeveloped parcel is located near the end of the current water line. It is also close to several high-yielding wells, and in a favorable topographic setting. However, the parcel is not large enough to maintain a 200-foot isolation zone around a well. Therefore, an easement would be required from the adjoining property owner to the east, the White House Inn property. Since Site B is next to Route 9 and Whites Road, and downslope from the White House Inn, it is more susceptible to potential sources of contamination compared to other well sites.

Site C- This 13.1 acre parcel is located off Route 9 with a large commercial building. The uplands above the building consist of undeveloped woodlands. This site is relatively remote from potential sources of contamination, and is relatively near several high-yielding bedrock wells.

Site F and E – Both of these sites are located on an 88-acre undeveloped parcel that includes frontage along Route 9 and access from Route 100. These sites are favorable from a topographic standpoint for groundwater availability, as they are located near the base of steeper slopes, and are close to an existing high-yielding well. Additionally, both these sites are relatively remote from potential sources of contamination.

Site F – This site is on a 15.3 acre parcel with frontage along the northern side of Route 9. The site has a limited amount of area that can support a 200-foot isolation.

Next Steps

If the Town decides to pursue a municipal water source, the initial step is to find landowners who may be willing to sell land or grant easements for a Town well. We recommend starting with the parcels identified as sites A – F. However, the Town may have knowledge of other nearby parcels or landowners that may also be considered.

If one or more willing landowners are identified, the specific sites or land areas available can be evaluated by a hydrogeologist and engineer. If the conditions are favorable, the Town can negotiate a purchase and sales agreement with the landowner prior to starting the permitting process or drilling a well.

If a sufficient land area is available, geological techniques can be implemented to select well sites that have the best potential to drill high yielding wells.

Once a specific drilling site or sites have been identified and an agreement is obtained, the permitting process can be started by submitting a Source Permit Application to the Vermont Drinking Water & Groundwater Protection Division. The permitting process is discussed in detail in the enclosed Appendix A.

Cost Estimate for Source Development

Based on our experience with recent and similar projects, we estimate the cost range to install, test, and permit a bedrock well source to be between $75,000 and $125,000. This range includes drilling of two wells, and testing and permitting one well. Please note that these costs do not cover expenses such as land purchase, road construction, electricity installation, pump house construction, purchase of a permanent pump and controls, treatment, and water lines.

To discuss this report, please e-mail jeffhoffer@charter.net or call me at 802-738-9238.

Sincerely,
HOFFER CONSULTING INC.

Jefferson P. Hoffer, PG
Senior Hydrogeologist

c: Wayne Elliott, PE, Aldrich + Elliott, PC

TABLES

TABLE 1
Well Log Data for the 40 Wells Identified In The Study Area, Wilmington, VT

Well Report #	Well Tag #	Owner First Name	Owner Last Name	Date Drilled	WELL TYPE	YIELD (gpm)	WELL DEPTH (ft)	STATIC WATER LEVEL (ft)	OVERBURDEN THICKNESS (ft)	CASING LENGTH (ft)	Location Method	E911 ADDRESS	LATITUDE	LONGITUDE	Well Reason Code	Driller	Comments	Geologic Log
373		Dorothy	Turner	05/25/1987	Bedrock	0	310	30	5	13	screen digitized		42.8568	-72.85995	Provide additional supply	Lynde		0-5 soil, 5-200 gray granite, 200-260 green schist, 260-285 pink qtz, 285-310 granite
31368	31368	Douglas	Pike	08/23/2005	Bedrock	0	380		hydrofractured	?	E911 Address	56 Hubbard Hill Road	42.85304	-72.8568	Hydrofracture	Green Mtn	Tested for 1/2 hour @ 1 quart per min.	265-380’ gray rock
52988	52988	Kathleen	Brochin	01/16/2017	Bedrock	0.75	485	12	6	40	GPS location	83 East Hill Rd	42.85138	-72.8344	New Supply	Lynde		0-6’ clay, 6-206 gray 206-406’ white, 406-485’ green
5		Peter	Mirasola	09/12/1966	Bedrock	1	146		15	75	screen digitized		42.8561	-72.85178		Carlson & Lundin	Yield test data - 1.5 gpm at 146 ft.	0-15’ clay, 15-146’ soft shale
56020	56020	Tony	Lopez	08/27/2014	Bedrock	1	600		2	40	GPS location	175 VT Route 9	42.86147	-72.85792	New Supply	Frost Well & Pumps		0-12’ sand, 12-20’ hardpan, 20-40’ gray schist, 40-600’ gray and black schist
15		Fred	Hurley	12/10/1966	Bedrock	3	160		?	60	screen digitized		42.85555	-72.85227		Frost In.		0-50’ packed sand/boulders, 50-58’ hardpan, 58-160’ brown & white bedrock
22		Jack	Berkley, Jr.	06/06/1966	Bedrock	3	250		21	21	screen digitized		42.85596	-72.83891		Frost Inc.	Yield test data - 3 gpm at 250 ft.	0-21’ gravel, 21-350’ granite
263		Lilian	Hart	10/21/1983	Bedrock	3	175		11	20	E911 Address		42.85451	-72.84039		Green Mtn	water at 60', water at 115'	0-11’ clay, 11-175’ gray bedrock
5834	37510		Aron & Son Construction	11/10/1997	Bedrock	3	300	20	1	30	screen digitized		42.84899	-72.85521	New Supply	A&W		no log
31736	31736	Bill	Labonte	09/20/2005	Bedrock	3.5	445	20	2	40	E911 Address	19 Titus Farm Lane	42.86342	-72.83694	New Supply	Lynde		0-20’ hardpan, 20-350’ dark brown bedrock, 350-445’ green bedrock
227		JOHN	BOYD	07/15/1981	Bedrock	4	205	20	3	18	screen digitized		42.85905	-72.84017		Lynde	METHOD OF SEALING CASING: OVERSIZE HOLE.	0-3’ topsoil, 3-205’ gray granite & qtz
265		Milton	Sparrow	09/06/1983	Bedrock	4	100		36	50	screen digitized		42.85923	-72.84042		Northeast		
497	208-167-93	Frank	Aldrich	11/19/1993	Bedrock	4	185	18	4	57	screen digitized		42.8652	-72.85357	New Supply	Lynde		0-40’ hardpan, 40-195’ bedrock
2926	255		MIRANDO & MARZELLI	10/11/1996	Bedrock	4	225	15	4	20	screen digitized		42.8516	-72.83641	New Supply	Wrag		0-4’ gravel, 4-225 light/dark bedrock
448	52	Bruce	Wazorko	07/05/1991	Bedrock	5	175	6	9	20	E911 Address		42.86249	-72.83544	New Supply	Lynde	This well not total clear when drilled, will pump.	0-9’ sand/gravel, 9-175’ soft shale
30		John P.	Curry	08/02/1968	Bedrock	8	175		?	50	screen digitized		42.85318	-72.85399		Frost Inc.		0-42’ gravel/hardpan, 42 – 175’gray schist
93		Jan	Hood	07/28/1971	Bedrock	8	125		2	20	screen digitized		42.86119	-72.85528		Wragg		2-20’ dark gray, 20-125’ light gray
385	211	Robert	Hall, c/o Crafts Inn	08/10/1988	Bedrock	8	120		11	20	screen digitized		42.86251	-72.84142	New Supply	Green Mtn	casing length is 20.4'	0-11’ hardpan, 11-30’ brown rock, 30-110’ green, 110-120 white pink granite
179		ROBERT	DORNBERG	06/13/1977	Bedrock	10	185	10	11	20	screen digitized		42.86526	-72.83302		Lynde	PILOT HOLE 9' IN BEDROCK	0-15’ clay, 15-146’ gray granite
455	208-35-92	William	Mack	05/27/1992	Bedrock	10	415	15	3	23	E911 Address		42.86344	-72.8498	New Supply	Lynde	Suggest hydrofracking. Done 05/28/92	0-3’ gravel, 3-415’ bedrock
504	7-673	CATHY	VEGA	09/12/1994	Bedrock	10	400		22	40	screen digitized		42.86228	-72.85627	Replace existing supply	Frost		0-22’ gravel/water, 22 – 400’ gray schist white seam
8		Richard	Cuttings	09/01/1966	Bedrock	12	130	30	3	42	screen digitized		42.85269	-72.83568		Frost	Water level during yield test - 125 ft.	100-130’ gray schist
5720	56G	GARY	HENRY	07/25/1997	Bedrock	12	140		67	80	screen digitized		42.85555	-72.85252	New Supply	Cushing	OVERFLOWS AT 1 GPM.	
62		Paul E.	Vears	06/17/1970	Bedrock	15	130		4	10	screen digitized		42.8572	-72.85105		Frost		0-4’ sand, 4-130 schist
31369	31369	John	Curry	08/24/2005	Bedrock	15	340		hydrofractured	?	E911 Address	11 Hubbard Hill Road	42.84974	-72.85701	Hydrofracture	Green Mtn		170-190’ gray, 190-191’ tan, 191-340’ gray
274		John	Lawson	09/24/1984	Bedrock	20	100		1	30	screen digitized		42.85883	-72.85328		Northeast		0-10’ sand, 10-25’ hardpan, 25-30’ gravel, 30-100’ bedrock
520	111E	BARBARA	WOLFSON	07/24/1995	Bedrock	20	140	8	4	50	screen digitized		42.86121	-72.84958	Replace existing supply	Cushing		0-30’ sand/boulders, 30-40’ hardpan, 40-140’ black granite
26186	26186		Builders Partners	05/17/2004	Bedrock	20	260		?	20	screen digitized	Ballou Hill Road	42.86272	-72.83932	New Supply	Cushing	Big fracture @ 240 ft	0-260’ green granite, frax @ 240’
142		Fred	Skwirut (Builder)	02/01/1975	Bedrock	25	125	5	?	15	screen digitized		42.86289	-72.83573		Lynde	Water level during yield test - 90 ft. , Yield test data - 25 gpm at 100 ft.	10-50’ gray granite, 50-125’ shale & qtz
412	11	Robert L.	Covey	10/15/1988	Bedrock	25	115	8	43	53	E911 Address		42.86142	-72.84522	New Supply	Lynde		0-43’ hardpan, 43-115 gray granite
451	31	Frank & Susan	Merrick	07/26/1991	Bedrock	25	120		12	20	E911 Address		42.86202	-72.83898	New Supply	Green Mtn	casing length is 20' 4"	0-12’ hardpan, 12-100’ gray bedrock, 100-120’ green bedrock
482	35/93	James	Hughes	06/19/1993	Bedrock	30	220		88	101	E911 Address		42.86025	-72.84055	New Supply	Green Mtn		0-88’ gravel and hardpan, 88-188’ green rock, 188-220 gray rock
22683	22683	Gary	Henry	06/10/2003	Bedrock	30	140	10	66	80	E911 Address	Hubbard Hill Rd	42.85211	-72.85605	New Supply	Cushing		0-10’ brown clay till, 10-66’ grey clay till, 66-140 grey granit
57685	57685	Stacy and Robin	Ames	07/28/2020	Bedrock	35	90	4	46	60	GPS location	105 Ballou Hill Road	42.86133	-72.83477	New Supply	Parker		0-46’ brown silt and clay, 46-90’ gabbro
19569	19569	Richard	Seymour	05/22/2006	Bedrock	40	280		63	81	E911 Address	White Road	42.86561	-72.85098	New Supply	Green Mtn		0-63 till, 63-95 gray, 95-140 green, 140-240 gray, 240-245 green, 245-280 gray
444		Ken Boos	Wilmington White House	08/02/1977	Bedrock	50	200	40	110	128	screen digitized		42.8641	-72.85529	Replace existing supply	Lynde	Yield Test: also compressed air	0-110’ hardpan, 110-200 hard gray rock & qtz
11076	11076	SHANON	HEISHMAN	05/22/2000	Bedrock	50	240	2	4	55.6	E911 Address	449 RT 9 E	42.85428	-72.83692	New Supply	Green Mtn		0-40’ sand/gravel, 40-240’ gray bedrock
27710	27710	John	Boyd	11/26/2003	Bedrock	50	240		6	20	E911 Address	58 Ruth Way	42.85587	-72.83364	New Supply	Frost Inc.	pump setting 220'	
31717	31717	Honora	Winery & Vineyard Inc.	07/01/2005	Bedrock	52	325	40	22	40	screen digitized	211 Vt Rte 9 East	42.86248	-72.85483	New Supply	Lynde	LINER – 110’ (4” AB, PV)	0-22’ sand and gravel, 22-325’ bedrock
44		MARTIN	BROWN	10/22/1968	Bedrock	100	153	20	85	88	screen digitized		42.85884	-72.8513		Green Mtn	YIELD TEST: 30 GPM @ 50'.	0-85’ grey hardpan, 85-153’ grey granite ss streaks

	YIELD (gpm)	WELL DEPTH (ft)	STATIC WATER LEVEL (ft)	OVERBURDEN THICKNESS (ft)	CASING LENGTH (ft)
n=	40	40	20	34	38
Min =	0	90	2	1	10
Max =	100	600	40	110	128
Mean =	18.0	226.2	16.7	23.3	43.4
Median =	10	185	15	10	40

TABLE 2

Summary of Water Quality Data for Regulated Water Systems in the Study Area, Wilmington, VT

Date	Deerfield Valley Health Center, Wilmington, VT WSID #20838 Analyte	Concentration	Units	Sample Point	Facility ID	Drinking Water Standard (USEPA MCL)
07/15/08	ALKALINITY, TOTAL	70	MG/L	EP001	WL001	N/A
05/30/07		77	MG/L	EP001	WL001	
05/30/07		70	MG/L	LC001	DS001	
05/30/07		76	MG/L	EP001	WL001	
05/30/07		68	MG/L	LC001	DS001	
10/17/06		63	MG/L	EP001	WL001	
10/17/06		62	MG/L	EP001	WL001	
10/17/06		65	MG/L	LC001	DS001	
10/17/06		62	MG/L	LC001	DS001	
04/18/22	BARIUM	0.076	MG/L	EP002	TP001	2.0 mg/L
05/09/16		0.082	MG/L	EP001	WL001	
05/20/13		0.083	MG/L	EP001	WL001	
05/04/10		0.08	MG/L	EP001	WL001	
04/04/07		0.078	MG/L	EP001	WL001	
04/13/04		0.21	MG/L	EP001	WL001	
06/20/01		0.078	MG/L	EP001	WL001	
07/15/08	CALCIUM	25	MG/L	EP001	WL001	N/A
05/30/07		39	MG/L	EP001	WL001	
05/30/07		29	MG/L	LC001	DS001	
05/30/07		36	MG/L	EP001	WL001	
05/30/07		29	MG/L	LC001	DS001	
10/17/06		24	MG/L	EP001	WL001	
10/17/06		23	MG/L	EP001	WL001	
10/17/06		24	MG/L	LC001	DS001	
10/17/06		24	MG/L	LC001	DS001	
04/04/07	CHROMIUM	0.0015	MG/L	EP001	WL001	0.1 mg/L
07/15/08	COLOR	3	MG/L	EP001	WL001	15 color units
07/15/08	CONDUCTIVITY @ 25 C UMHOS/CM	250	UMHO/ CM	EP001	WL001	N/A
05/30/07		236	UMHO/ CM	EP001	WL001	
05/30/07		212	UMHO/ CM	LC001	DS001	
05/30/07		213	UMHO/ CM	EP001	WL001	
05/30/07		212	UMHO/ CM	LC001	DS001	
10/17/06		234	UMHO/ CM	EP001	WL001	
10/17/06		234	UMHO/ CM	EP001	WL001	
10/17/06		233	UMHO/ CM	LC001	DS001	
10/17/06		233	UMHO/ CM	LC001	DS001	
04/18/22	FLUORIDE	0.19	MG/L	EP002	TP001	4 mg/L
05/06/19		0.23	MG/L	EP001	WL001	
05/09/16		0.25	MG/L	EP001	WL001	
05/04/10		0.2	MG/L	EP001	WL001	
04/04/07		0.23	MG/L	EP001	WL001	
04/13/04		0.17	MG/L	EP001	WL001	
06/20/01		0.205	MG/L	EP001	WL001	
07/15/08	HARDNESS, TOTAL (AS CACO3)	63	MG/L	EP001	WL001	N/A
07/15/08		63	MG/L	EP001	WL001	
05/30/07		96	MG/L	EP001	WL001	
05/30/07		72	MG/L	LC001	DS001	
05/30/07		91	MG/L	EP001	WL001	
05/30/07		72	MG/L	LC001	DS001	
07/15/08	HYDROGEN SULFIDE	0	MG/L	EP001	WL001	N/A
04/18/22	IRON	0.1	MG/L	EP002	TP001	0.3 mg/L
05/09/16		0.04	MG/L	EP001	WL001	
07/15/08		0.13	MG/L	EP001	WL001	
10/17/06	MAGNESIUM	1.9	MG/L	EP001	WL001	N/A
10/17/06		1.9	MG/L	EP001	WL001	
10/17/06		1.9	MG/L	LC001	DS001	
10/17/06		1.9	MG/L	LC001	DS001	
04/04/07	MANGANESE	0.0006	MG/L	EP001	WL001	0.05 mg/L
04/04/07	NICKEL	0.000775	MG/L	EP001	WL001	0.1 (VT Health Advisory)
04/04/23	NITRATE	0.11	MG/L	EP002	TP001	10 mg/L
04/18/22		0.081	MG/L	EP002	TP001	
05/10/21		0.099	MG/L	EP002	TP001	
07/06/20		0.11	MG/L	EP002	TP001	
06/08/20		0.1	MG/L	EP002	TP001	
05/06/19		0.1	MG/L	EP001	WL001	
05/11/15		0.11	MG/L	EP001	WL001	
04/14/14		0.1	MG/L	EP001	WL001	
05/20/13		0.1	MG/L	EP001	WL001	
04/17/12		0.73	MG/L	EP001	WL001	
04/10/06		0.1	MG/L	EP001	WL001	
04/13/04		0.1	MG/L	EP001	WL001	
04/07/03		0.3	MG/L	EP001	WL001	
07/15/08	PH	6.83	SU	EP001	WL001	6.5 to 8.5
07/15/08		6.8	SU	EP001	WL001	
05/30/07		7.32	SU	EP001	WL001	
05/30/07		6.99	SU	LC001	DS001	
05/30/07		7.22	SU	EP001	WL001	
05/30/07		6.95	SU	LC001	DS001	
10/17/06		7.3	SU	EP001	WL001	
10/17/06		7.3	SU	EP001	WL001	
10/17/06		7.3	SU	LC001	DS001	
10/17/06		7.4	SU	LC001	DS001	
04/04/07	SELENIUM	0.001	MG/L	EP001	WL001	0.05 mg/L
07/15/08	TDS	0.3	MG/L	EP001	WL001	500 mg/L
04/04/07	THALLIUM, TOTAL	0.0004	MG/L	EP001	WL001	0.002 mg/L

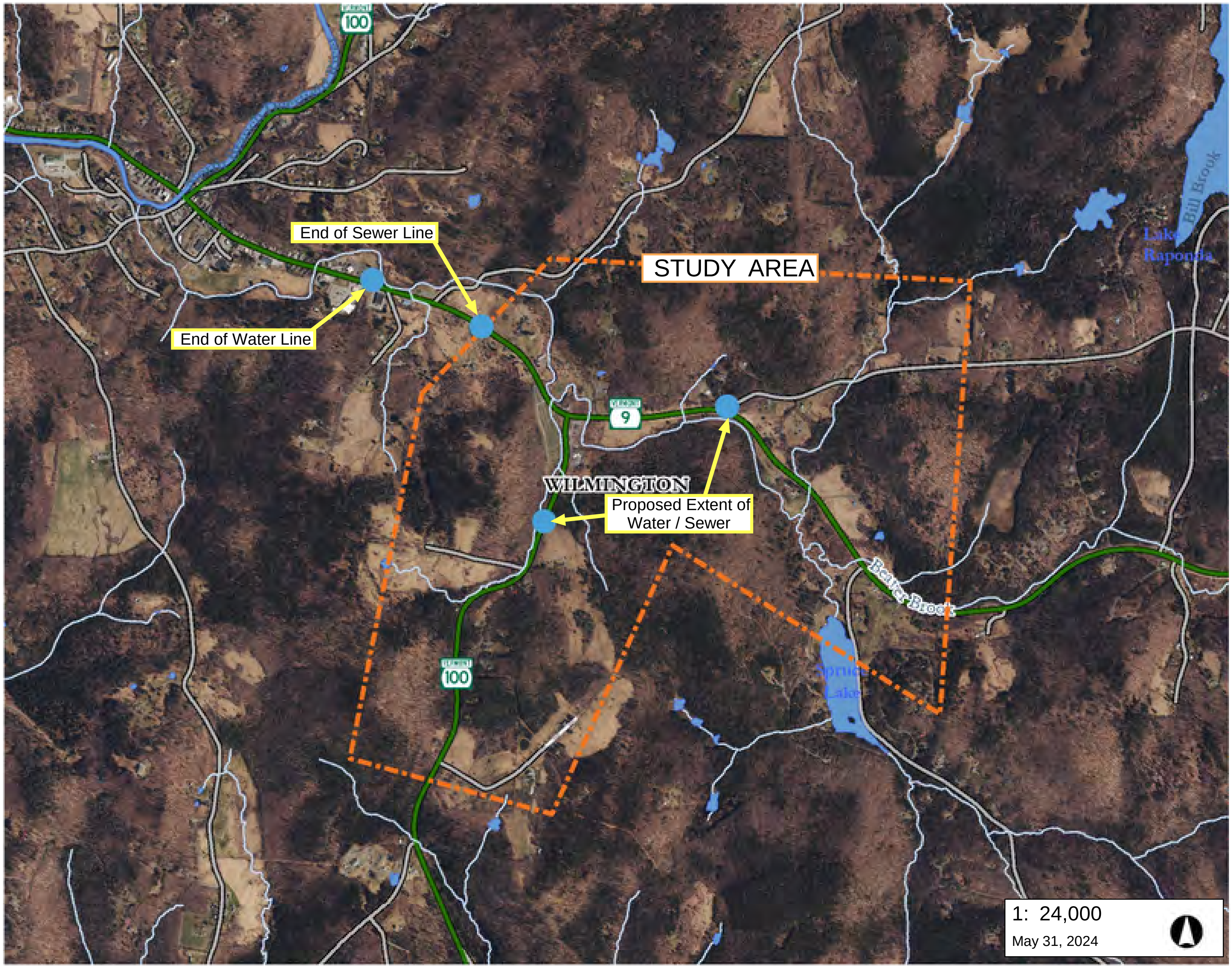
Date	White House, Wilmington, VT WSID #1944 Analyte	Concentration	Units	Sample Point	Facility ID	Drinking Water Standard (USEPA MCL)
9/14/2015	CHLORIDE	7.0	MG/L	EP001	WL001	250 mg/L
9/14/2015		7.0	MG/L	EP001	WL001	
9/14/2015	MANGANESE	0.044	MG/L	EP001	WL001	0.05 mg/L
9/14/2015	PH	8.0	SU	EP001	WL001	6.5 to 8.5
9/14/2015	SODIUM	6.4	MG/L	EP001	WL001	N/A
8/11/2010	NITRATE	0.09	MG/L	EP001	WL001	10.0 mg/L
2/25/2009		0.11	MG/L	EP001	WL001	
12/19/2007		0.06	MG/L	EP001	WL001	
2/22/2005		0.0292	MG/L	EP001	WL001	
2/22/2005		0.0292	MG/L	EP001	WL001	
6/2/2004		0.0385	MG/L	EP001	WL001	
6/2/2004		0.0385	MG/L	EP001	WL001	
3/7/2002		0.81	MG/L	EP001	WL001	

Source: https://anrweb.vt.gov/DEC/DWGWP/SearchWS.aspx

FIGURES

VERMONT

FIGURE 1
Study Area for Groundwater Availability Evaluation
Town of Wilmington, Vermont



LEGEND

- Waterbody
- River Area
- Stream
  - Stream
  - Intermittent Stream
- Roads
  - Interstate
  - US Highway; 1
  - State Highway
  - Town Highway (Class 1)
  - Town Highway (Class 2,3)
  - Town Highway (Class 4)
  - State Forest Trail
  - National Forest Trail
  - Legal Trail
  - Private Road/Driveway
  - Proposed Roads
- Town Boundary

NOTES

Map created using ANR's Natural Resources Atlas by Hoffer Consulting Inc.

1,219.0 0 610.00 1,219.0 Meters

WGS_1984_Web_Mercator_Auxiliary_Sphere 1" = 2000 Ft. 1cm = 240 Meters

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VERMONT

FIGURE 2
Study Area for Groundwater Availability Evaluation
Town of Wilmington, Vermont

LEGEND

NOTES

Map created using ANR's Natural Resources Atlas By Hoffer Consulting Inc.

5,080.0 0 2,540.00 5,080.0 Meters

WGS_1984_Web_Mercator_Auxiliary_Sphere 1" = 8333 Ft. 1cm = 1000 Meters

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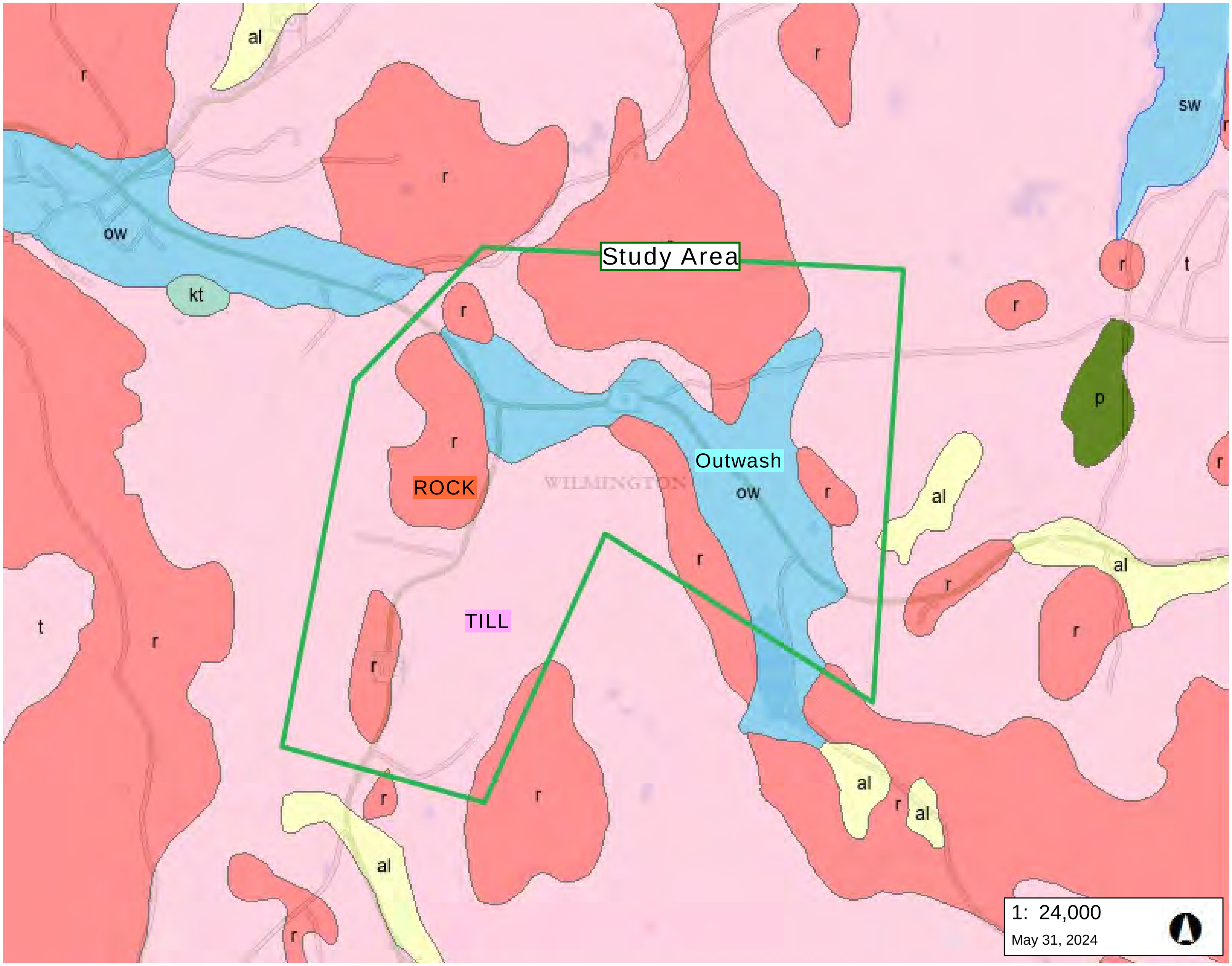
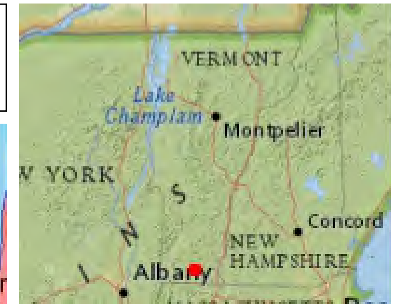
VERMONT

FIGURE 3

Surficial Geology In The Study Area, Town of Wilmington, Vermont





LEGEND

Surficial Geology (Lithology)

- till
- terminal moraine
- moraine
- isolated kame
- kame terrace
- kame moraine
- outwash
- esker
- eolian sand
- lake gravel
- beach gravel
- delta gravel
- delta
- lake sand
- pebbly sand
- boulders in sand
- delta sand
- silt, silty clay, and clay
- varved clay
- boulders in clay
- wave-washed till
- fluvial gravel
- fluvial sand
- alluvium
- marine beach gravel
- marine sand

NOTES

Map created using ANR's Natural Resources Atlas by Hoffer Consulting Inc.

1,219.0 0 610.00 1,219.0 Meters

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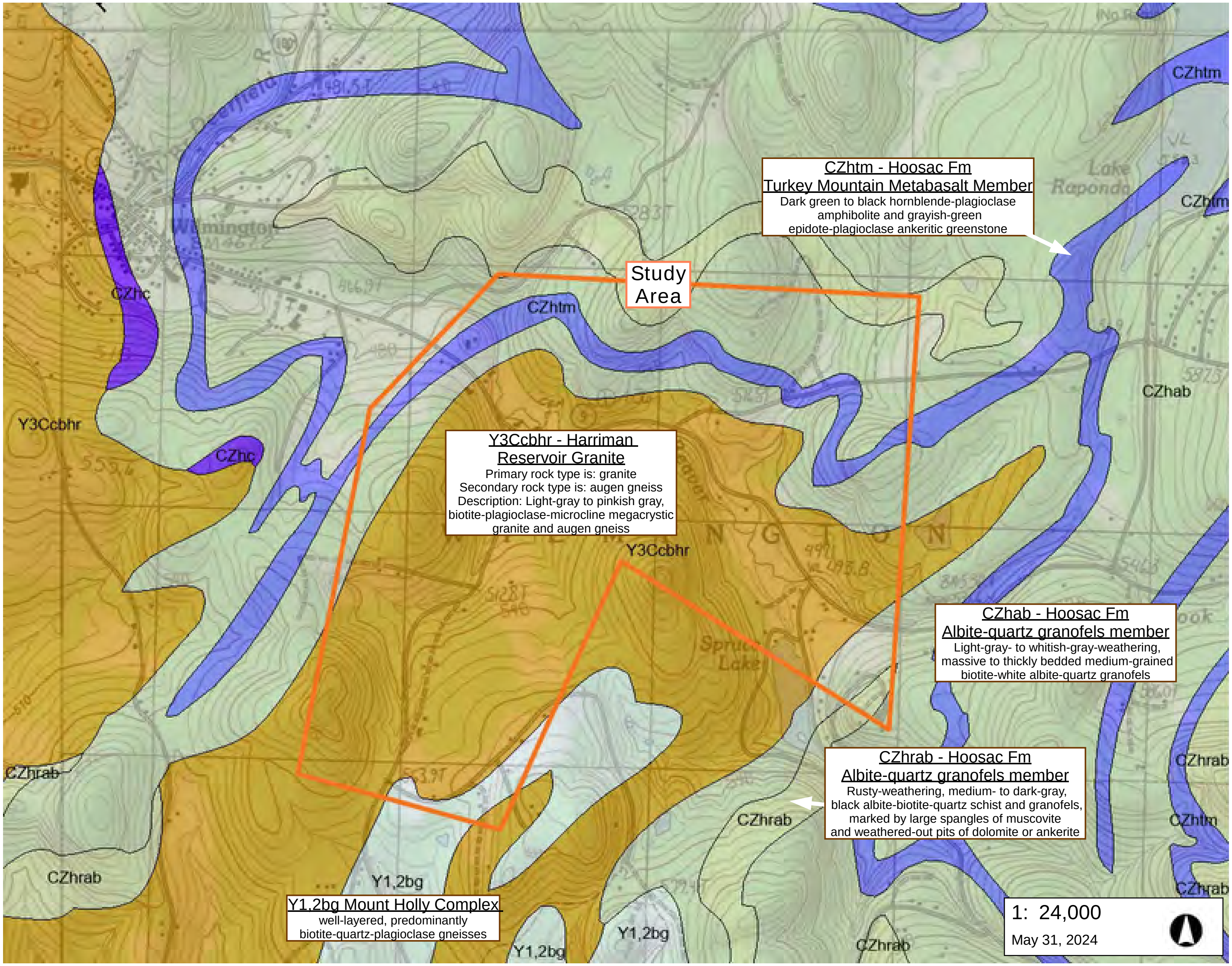
FIGURE 4

Bedrock Geology, Town of Wilmington, Vermont



LEGEND

Bedrock Faults and Contacts

- concealed contact
- contact
- dashed contact
- fault
- fault ?
- high angle fault
- normal fault
- scratch boundary
- strike slip fault
- thrust fault open barb
- thrust fault solid barb
- <all other values>

Bedrock Outcrops (polygon)

- 1:24,000
- 1:62,500

NOTES

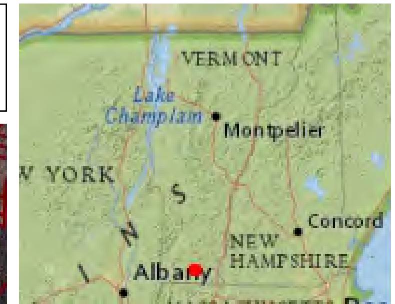
Map created using ANR's Natural Resources Atlas by Hoffer Consulting Inc.

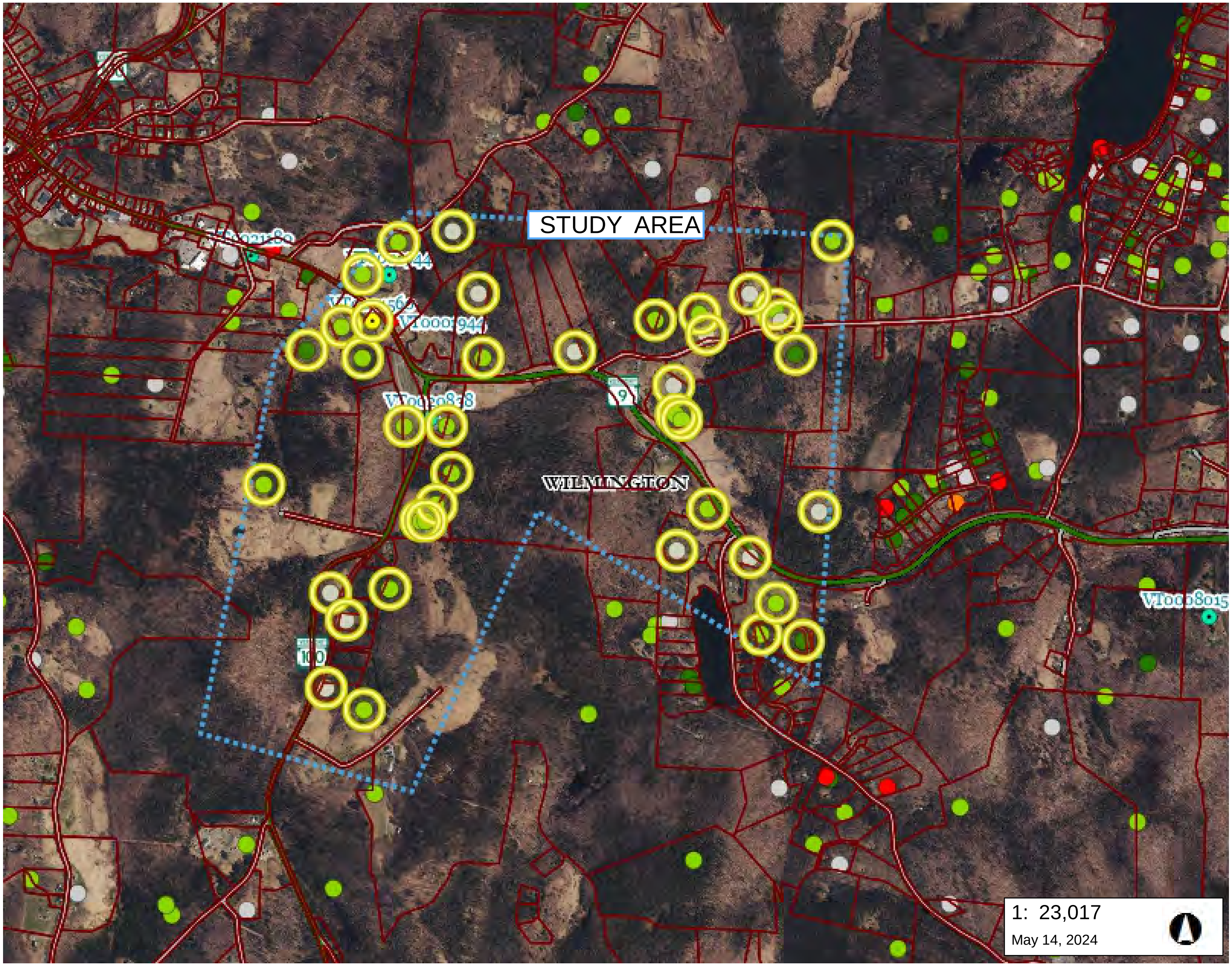
1,219.0 0 610.00 1,219.0 Meters

WGS_1984_Web_Mercator_Auxiliary_Sphere 1" = 2000 Ft. 1cm = 240 Meters

THIS MAP IS NOT TO BE USED FOR NAVIGATION

FIGURE 5
Existing Wells Within The Study Area, Town of Wilmington, Vermont





LEGEND

Public Water Sources
- Active
- Inactive
- Proposed
- Active Non-Public, Previously Perm
- Inactive Non-Public, Previously Per

Private Wells
- GPS Located
- Screen Digitized
- E911 Address Matched
- Welldriller/Clarion
- Unknown Location Method
- Incorrectly Located

Parcels (standardized)

Roads
- Interstate
- US Highway; 1
- State Highway
- Town Highway (Class 1)
- Town Highway (Class 2,3)
- Town Highway (Class 4)
- State Forest Trail
- National Forest Trail
- Legal Trail
- Private Road/Driveway
- Proposed Roads

Town Boundary

1,169.0 0 584.00 1,169.0 Meters

WGS_1984_Web_Mercator_Auxiliary_Sphere 1" = 1918 Ft. 1cm = 230 Meters

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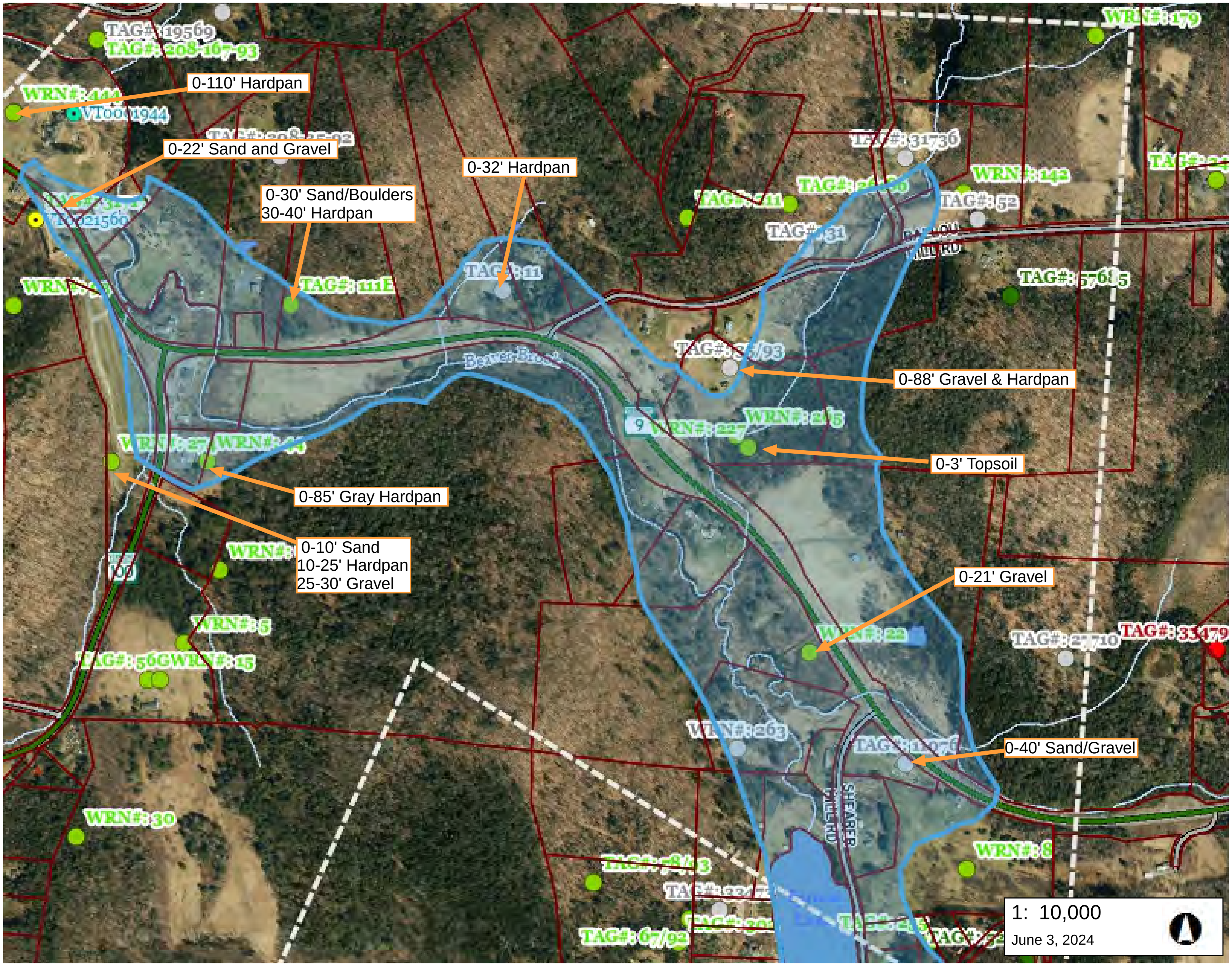
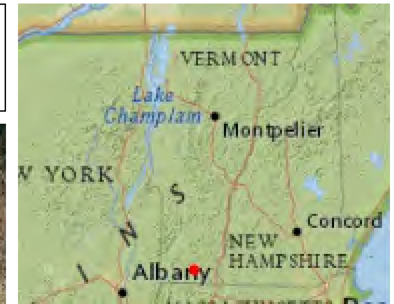
NOTES

Map created using ANR's Natural Resources Atlas by Hoffer Consulting Inc.

FIGURE 6

Description of Overburden Materials for Water Wells Drilled in Areas Mapped as Sand and Gravel, Town of Wilmington, Vermont





LEGEND

Public Water Sources
- Active
- Inactive
- Proposed
- Active Non-Public, Previously Perm
- Inactive Non-Public, Previously Per

Private Wells
- GPS Located
- Screen Digitized
- E911 Address Matched
- Welldriller/Clarion
- Unknown Location Method
- Incorrectly Located

Parcels (standardized)

Waterbody

Stream
- Stream
- Intermittent Stream

0-21' Gravel

Water Well Location and Log of Materials Above Bedrock

NOTES

Map created using ANR's Natural Resources Atlas by Hoffer Consulting Inc.

508.0 0 254.00 508.0 Meters

WGS_1984_Web_Mercator_Auxiliary_Sphere 1" = 833 Ft. 1cm = 100 Meters

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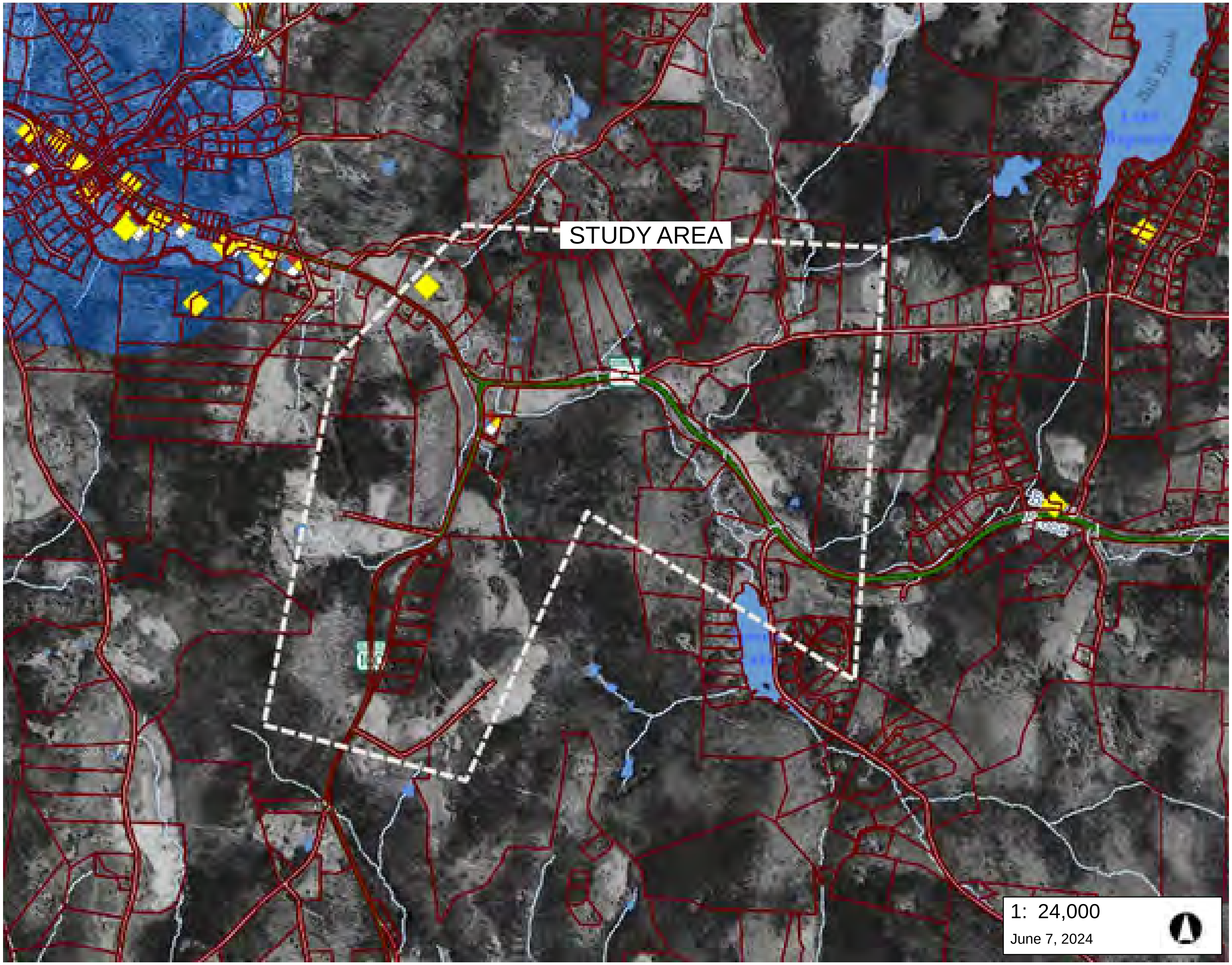
FIGURE 7

Location of Hazardous Waste Sites and Hazardous Waste Generators in the Study Area, Town of Wilmington, Vermont



LEGEND

PFAS Results (Waste Manage

- Hazsite, Non-Detect
- Hazsite, Below Standard
- Hazsite, Detected-No Standards
- Hazsite, Above Standard
- Residuals, Non-Detect
- Residuals, Below Standard
- Residuals, Detected-No Standards
- Residuals, Above Standard
- Solid Waste, Non-Detect
- Solid Waste, Below Standard
- Solid Waste, Detected-No Standard
- Solid Waste, Above Standard
- Waste Water, Non Detect
- Waste Water, Below Standard
- Waste Water, Detected-No Standa
- Waste Water, Above Standard

Landfills

- OPERATING
- CLOSED

- Hazardous Site
- Hazardous Waste Generators
- Aboveground Storage Tank
- Underground Storage Tank (w
- Dry Cleaner
- Urban Soil Background Areas
- Parcels (standardized)

NOTES

Map created using ANR's Natural Resources Atlas by Hoffer Consulting Inc. on June 7, 2024.

1,219.0 0 610.00 1,219.0 Meters

WGS_1984_Web_Mercator_Auxiliary_Sphere 1" = 2000 Ft. 1cm = 240 Meters

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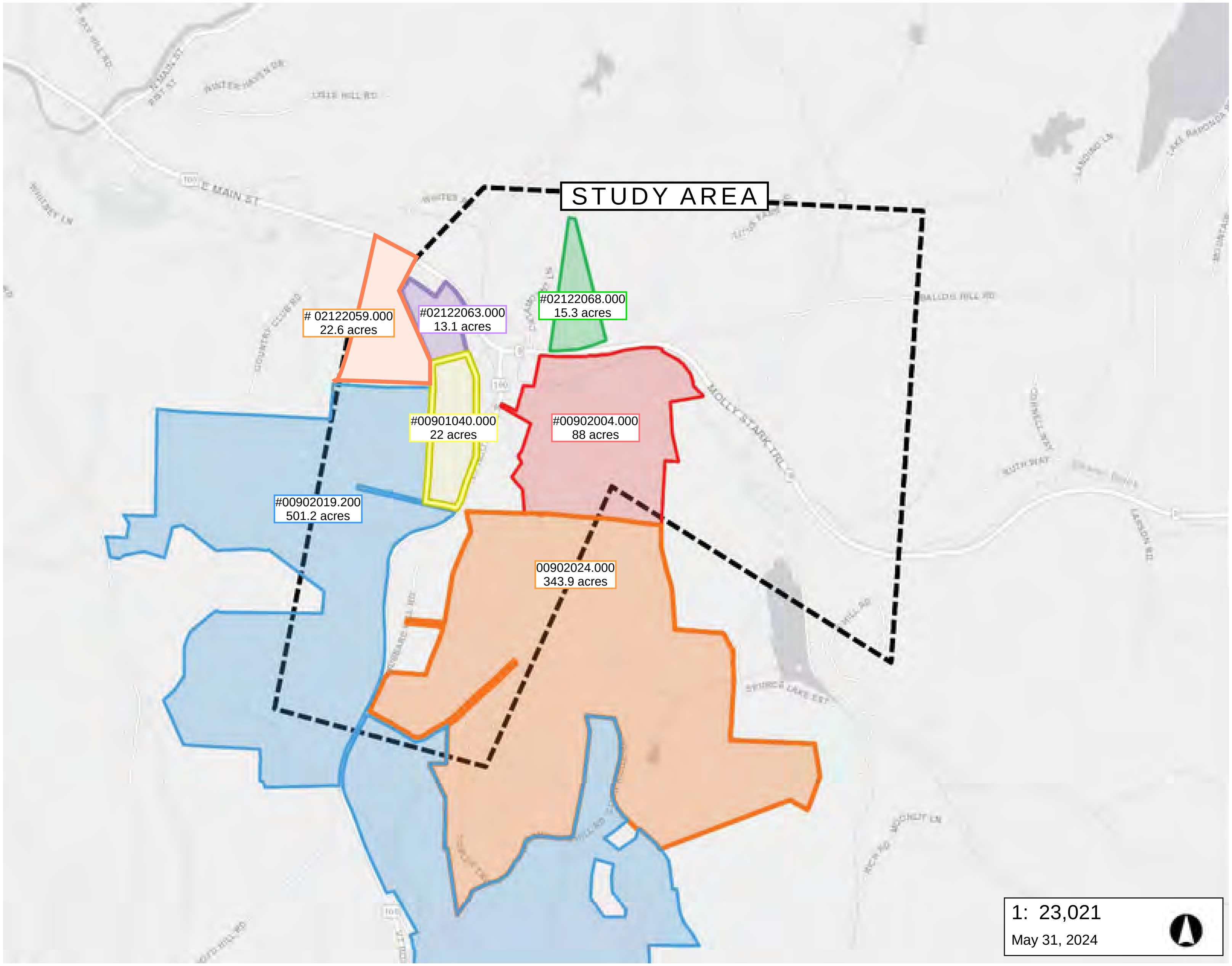
VERMONT

FIGURE 8
Large Parcels in the Study Area,
Town of Wilmington, Vermont



1: 23,021
May 31, 2024

LEGEND

#00902004.000 88 acres = *tax map parcel ID*

NOTES

Map created using ANR's Natural Resources Atlas by Hoffer Consulting Inc.

1,169.0 0 584.00 1,169.0 Meters

WGS_1984_Web_Mercator_Auxiliary_Sphere 1" = 1918 Ft. 1cm = 230 Meters

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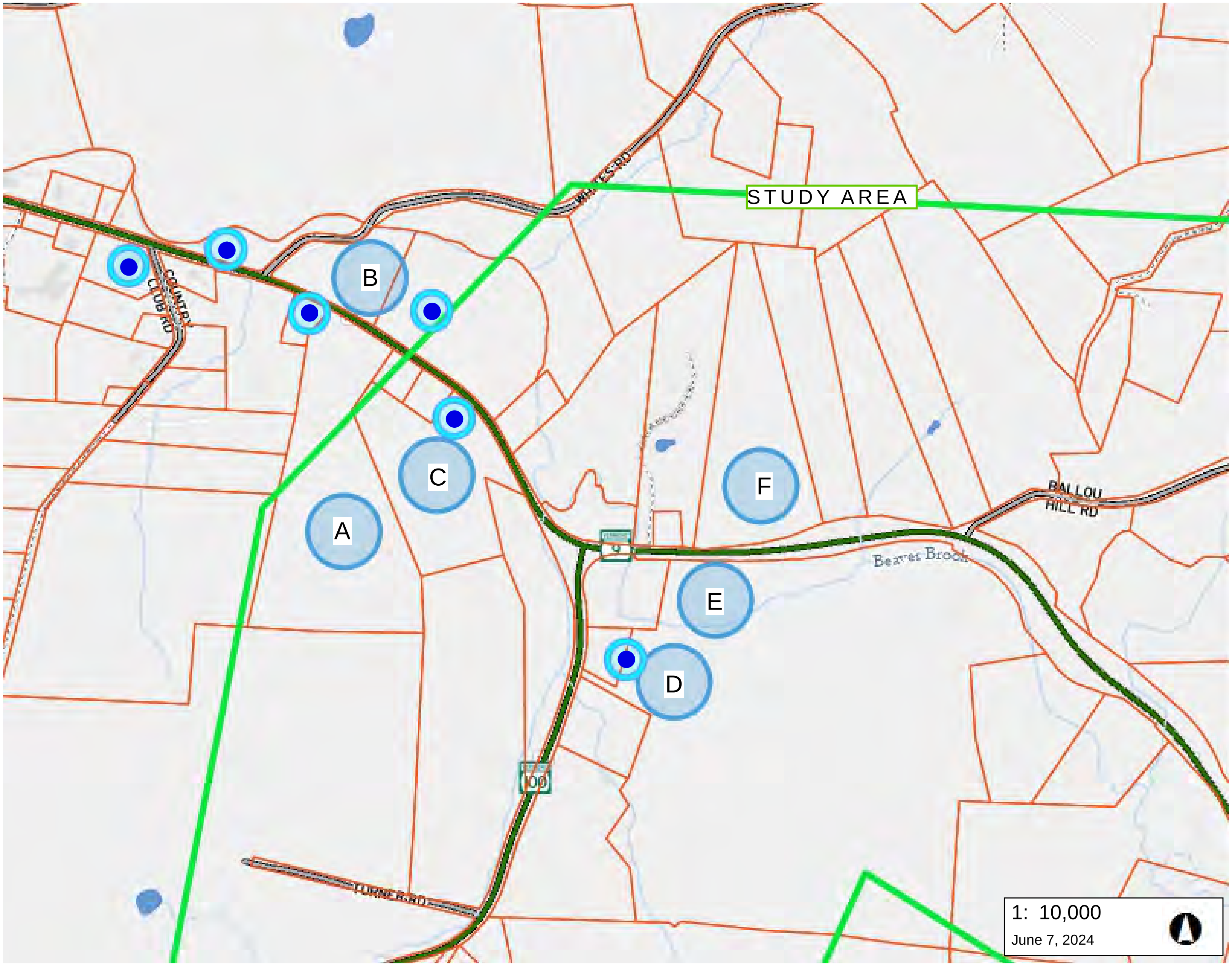
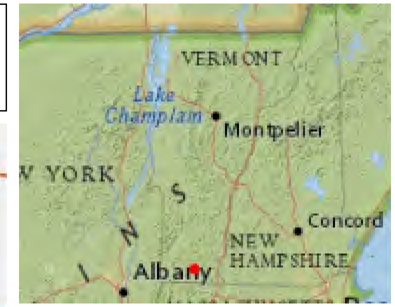
VERMONT

FIGURE 9
Potential Bedrock Well Sites With 200-Foot Isolation Zones
Town of Wilmington, Vermont





LEGEND

Parcels (standardized)

Waterbody

Stream

Stream

E

potential well siting area with 200-foot radius

existing bedrock well with > = 50 gpm driller's yield

508.0 | 0 | 254.00 | 508.0 Meters

WGS_1984_Web_Mercator_Auxiliary_Sphere

1" = 833 Ft. 1cm = 100 Meters

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NOTES

Map created using ANR's Natural Resources Atlas by Hoffer Consulting Inc.

APPENDIX A
Permitting Process for Municipal (Public Community Water System) Wells

Source Permitting Steps for Public Community Water Sources

The permitting and regulatory requirements to develop a well to serve a public community water system are prescribed in the Vermont Water Supply Rule (WSR). Prospective water sources are evaluated against six criteria including the site, source construction, water quantity, water quality, interference on existing water supplies, and source protection issues.

The water system must own or control a 200-foot radius of land around each source, where permissible land uses are limited to source operation and maintenance, playgrounds, ball fields, tennis courts, seasonal light duty roads, conservation zones, controlled usage of potassium and phosphorous fertilizers, and other uses which have the approval of the Secretary of the ANR. Prohibited uses within the 200-foot isolation zone include the application of nitrogen, pesticides, and herbicides, buildings other than those necessary for the water system, parking of motor vehicles, chemical or fuel storage (except chemicals for water treatment or natural gas/propane), swimming pools, salted or paved roads, septic tanks and wastewater disposal systems, sewer lines, and any other activities which may contaminate the water source. Source construction must conform to the WSR well construction standards, which include grouting (sealing) to prevent surface water migration, and the type of materials used in the well materials (casing and well screen).

The water quantity available from a prospective source is evaluated against the WSR's definition of "safe yield", which is defined as follows.

The source shall be capable of 180 days of pumping at the average day demand rate followed by a peak of 3 or 7 days of pumping at the maximum day demand rate without dewatering the source. The 7 day duration of maximum day demand pumping shall be applied to water systems serving developments constructed for the purpose of accessing recreational and resort areas. The 3 day duration of maximum day demand pumping is applied to all other water systems. Peaking duration is evaluated by the Secretary on a case-by-case basis. The maximum safe yield shall not be greater than the pump rate of the constant discharge test, except on a case-by-case basis where a 10% increase may be granted when supported by appropriate documentation.

Potential source interference must be evaluated as part of the yield evaluation for a new public community source. Existing public and private water supplies must remain able to continue to meet their demands with the pumping of the new community source. Alternatives to remedy source interference problems include connecting the affected water supply to the new water source, deepening/replacing the affected water source, or developing additional storage capacity for the affected water source.

Water quality requirements include a lengthy list of microbiological, chemical (naturally occurring and man made), and radiological parameters. In addition, certain sources are subject to evaluate whether or not the source is at risk of being "under the direct influence of surface water" and therefore subject to filtration and disinfection requirements. In the absence of qualifying for an exemption, the Microscopic Particulate Analysis (MPA) must be performed on the source to assess its vulnerability to surface water influence.

Source protection requirements include the delineation of Source Protection Area (SPA) zones of the new source. Zone 1 is a default 200-foot isolation zone around the source. Zone 2 is the area surrounding the well where there will be probable impacts from potential sources of contamination, and is defined by the well's contributing area as determined by hydrogeologic data and WSR numerical standards. Zone 2 is regarded as the remaining drainage or recharge area where contaminants have the potential to reach the source. A two-year time of travel (TYTOT) area must also be defined to provide adequate protection from pathogen threats resulting from onsite disposal of sewage.

A Source Protection Plan (SPP) is required to minimize risks from existing and potential sources of contamination within the defined SPA.

The source approval process begins with the submission of a Source Permit Application from the applicant and their engineer and hydrogeologist. The application initiates the source permitting process and includes a description of the project, details on the proposed source construction and expected yield, identifies adjoining landowners, and identifies potential sources of contamination in the vicinity of the source. The proposed site is visited by VT Drinking Water and Ground Water Protection (DWGWP) personnel, and the DWGWP initiates a public notice of the proposed source to solicit comments and/or a request for a public hearing. Once the applicant receives site approval, the source well(s) can be constructed. Once the new source is constructed, a Source Testing Review Form must be submitted by the applicant's hydrogeologist to the DWGWP. The source testing submittal includes an outline of the proposed pumping tests and other special studies required by the DWGWP. The plan must include for the interference monitoring of all existing water sources in an area defined by the DWGWP on the basis of the proposed pumping test rate. For instance, pumping test rates over 100 gpm require a 120 hour constant-rate test and an interference monitoring radius of 3000 feet. Upon receipt of approval from the DWGWP, the applicant can proceed with the testing.

The results of the source testing are compiled into a Source Evaluation Report, which is reviewed by the DWGWP for completeness and compliance with pertinent regulations. A proposed Source Protection Area must also be submitted for review and approval by the DWGWP. The DWGWP initiates a second public notification period, including a mailing to all landowners within the SPA, to solicit comments and/or a request for a public hearing prior to approving the SPA. After the public notice process, the DWGWP provides the applicant with either a Source Permit containing any required permit conditions or a letter of denial. Once the source is connected to the water system, the source becomes a permitted component of the water system's infrastructure, and is referenced in the water system's Permit to Operate.

Once the Source Permit is obtained, the water system's engineer must obtain a Construction Permit and then an Operating Permit.