Westmore Energy Profile

Northeastern Vermont Development Association (NVDA) has prepared this document using best available data to help you meet with the requirements of Act 174 and "Enhanced Energy Planning" standards as outlined in 24 V.S.A. §4352. If your municipal plan meets the standards, it will be given an affirmative "determination of energy compliance," and will receive "substantial deference" in the Public Service Board's review of whether an energy project meets the orderly development criterion in the Section 248 process.

Compliance with the enhanced energy standards is **optional**. The Department of Public Service has published detailed standards for municipal plans, in checklist form, which can be found on the DPS's Act 174 web page: http://publicservice.vermont.gov/sites/dps/files/documents/Pubs_Plans_Reports/Act_174/Municipal%20Determination%20Standards_Final.pdf

The data in this profile is a starting point for your municipality in assessing strategies for meeting local, regional, and statewide energy goals, namely **meeting 90% of all energy demand by renewable sources by 2050**. This document identifies sources and assumptions and identifies spreadsheets that are available for you to use in refining your information.

Westmore Statistics:

2015 Population estimates (Census): **340**

Land (in acres) **24,048** Population density: **9.0/square mile**

Total Households (2015 American Community Survey Estimates): **173**

Total owned: **158** Avg. Owner HH Size: **2.06**

Total HHs Renter: **15** Avg. Renter HH Size: **1.87**

Total vacant units for recreational or seasonal use: **436**

Total covered employment, private establishments: **22**

Municipal Guidance Checklist 5A. Does the plan estimate current energy use across transportation, heating, and electric sectors?

Transportation

Total vehicles :	Avg. annual vehicle miles travelled (VMTs) per vehicle:	Total annual VMTs: **
305	14,000	4,270,00

Fossil Fuel:	Ethanol:	Total:
176,623 gallons	17,468 gallons	**22,897 MMBTUs**
21,417 MMBTUs	1,480 MMBTUs	**$436,705**

Registered EVs as of January 2017: 0 (0 MMBTUs annually)

Transportation Assumptions:

This data was developed using the Department of Public Service's worksheet. The total number of vehicles comes from American Community Survey (ACS) 5-Year Estimates. Average annual VMTs is an NVDA estimate, which accounts for longer commutes and incidental trips in the rural region. Total vehicle miles travelled assumes an average fuel economy of 22 miles per gallon. Registered EVs was determined by the Vermont Energy Investment Corporation and uses the Dept. of Public Service's of average of 7,000 VMTs per EV annually.

Non-residential heating

Estimated number of commercial buildings, per Vt. Dept. of Labor:	**5**
Average annual heating load per building:	**568 MMBTUs**
Estimated total heat energy consumption:	**2,841 MMBTUs**

Non-residential heating assumptions:

This table uses a worksheet created by the Department of Public Service, which uses data from the Vermont Department of Labor's Economic and Labor Market Information web site: http://www.vtlmi.info. The worksheet is based on assumptions from by the Energy Information Institute's Survey of Commercial Uses and does not include industrial uses.

Residential heating

Percent of Housing Built before 1940:	**19.0% owned, 46.7% rented**
Total Energy Use for Heating Occupied Households:	**** MMBTUs**
Total Cost for Occupied Households:	**$239,453**
Total Energy Use for Heating Seasonal Households (assumes 5% of average occupied housing unit, per unit):	**2,425 MMBTUs**

Occupied Residential heating by fuel source:

Fuel Type: Space Heating	Households	Total avg. Use (Annual)		% Use: (All HHs)	Percent of Use: Owner	Percent of Use: Renter	% of Cost (All HHs)
Tank/LP/etc. Gas	36	31541	gallons	20.8%	20.9%	20.0%	33.5%
Electricity	2	48144	KwH	1.2%	1.3%	0.0%	3.0%
Fuel Oil	76	42718	gallons	43.9%	40.5%	80.0%	39.8%
Wood	56	230	cords	32.4%	35.4%	0.0%	21.8%
Coal/Coke	3	13	tons	1.7%	1.9%	0.0%	1.9%
Other	-	0		0.0%	0.0%	0.0%	0.0%

Residential heating assumptions:

NVDA developed a spreadsheet using ACS 5-Year Estimates for primary heating sources. Average household square footages were developed from ACS estimates as well as American Housing Survey estimates. Our estimate accounted for the age of the housing stock, since pre-1940 housing structures are likely to be "leaky" and poorly insulated. NVDA assumed 80,000 BTUs per square foot for pre-1940 housing stock, 45,000 BTUs for all other. Estimates for seasonal housing units came from Department of Public Service guidelines.

Electricity Usage (Draft data, final data forthcoming)

Total annual usage by sector, in KWh

	2014	2015	2016	Total
Commercial & Industrial	n/a	n/a	n/a	**n/a**
Residential	176,351	186,479	217,873	**580,703**
Total (2014-2016)	**176,351**	**186,479**	**217,873**	**580,703**

Total 2016 Use in MMBTUs: 743

Customer Cost Savings – The estimated financial savings for energy (electrical and/or thermal) and water use realized by a customer over the first year that a measure or measures are installed:

	2014	2015	2016
Gross MWh	1.0	4.4	13.1
Gross MMBTU	(0)	(0)	540
Customer Cost Savings	$156	$727	$7,509

Electricity Usage Assumptions:

This data was compiled on behalf of NVDA by the Vermont Energy Investment Corporation.

Municipal Guidance Checklist 5B. Does the plan establish 2025, 2035, and 2050 targets for thermal and electric efficiency improvements, and use of renewable energy for transportation, heating, and electricity?

5 C. Does the plan evaluate the amount of thermal-sector conservation, efficiency, and conversion to alternative heating fuels needed to achieve these targets?

5D. Does the plan evaluate transportation system changes and land use strategies needed to achieve these targets?

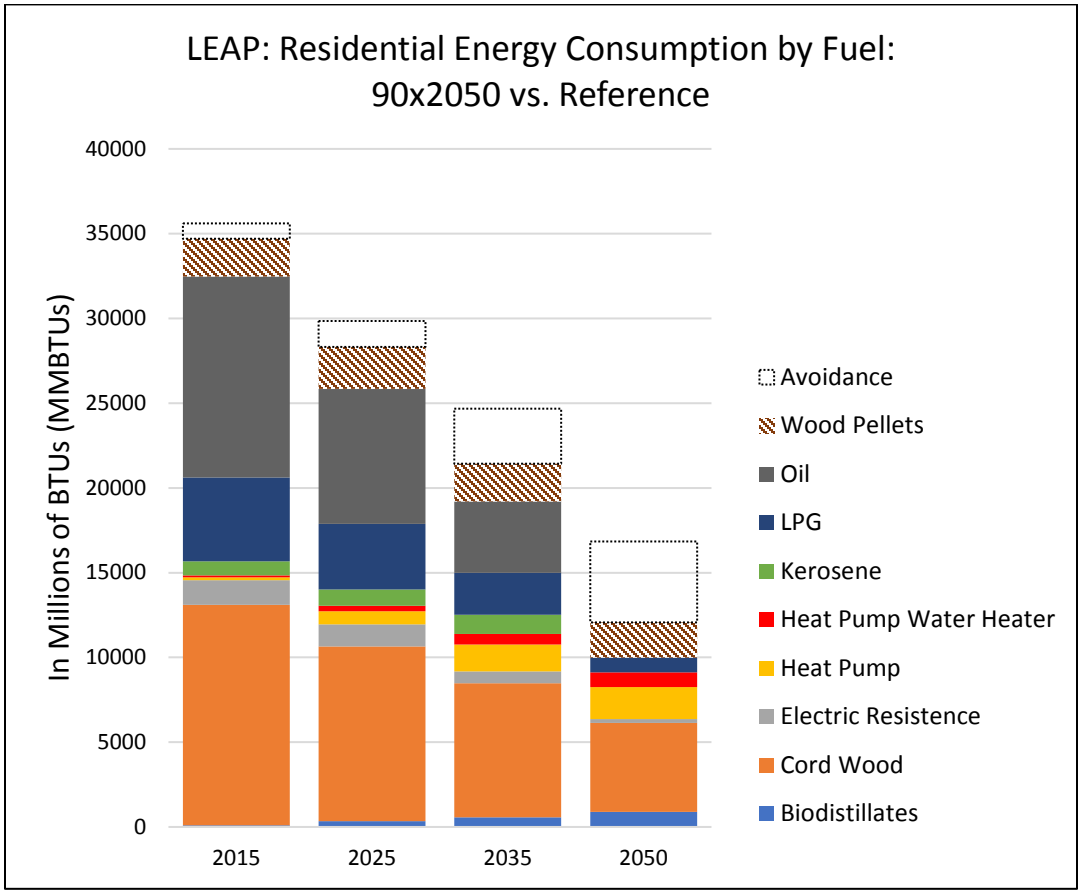
5E. Does the plan evaluate electric-sector conservation and efficiency needed to achieve these targets? (Y/N)

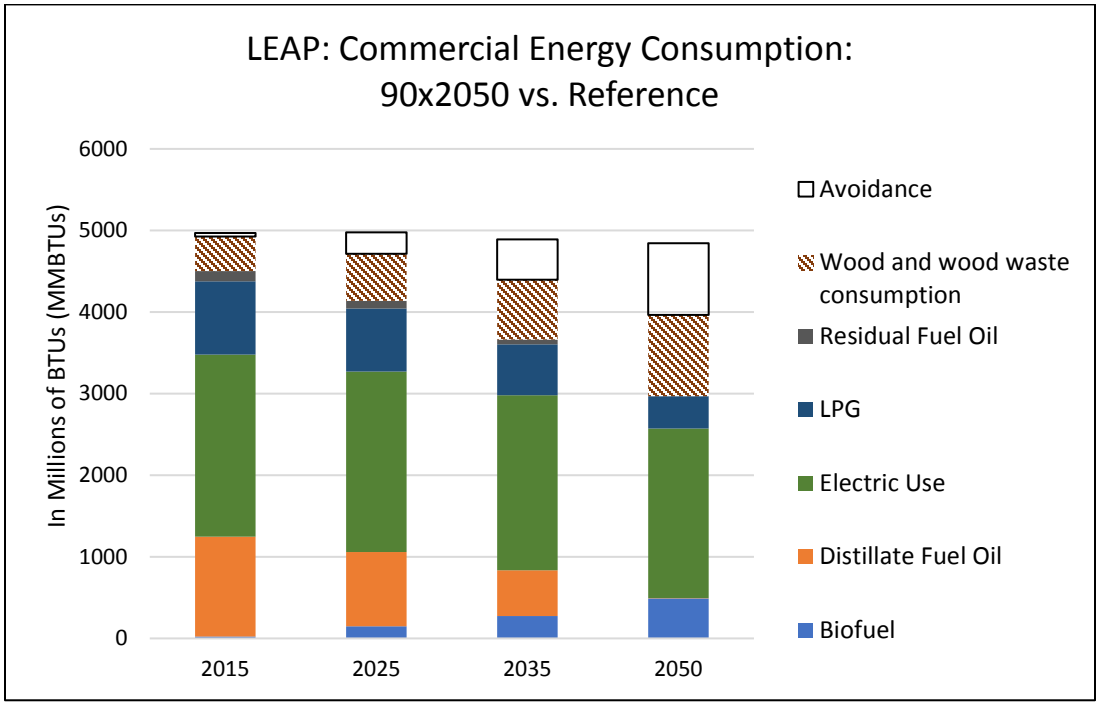
Targets for future energy use and generation were developed by Vermont Energy Investment Corporation using a regional **Long-Range Energy Alternatives Planning (LEAP)** analysis. It should be noted that some of the assumptions NVDA used to calculate *current* energy use for standard 5A are slightly different than the assumptions used in the LEAP analysis. Nevertheless, the LEAP analysis identifies pathways that your municipality can take in order to meet the statewide 90x50 goal.

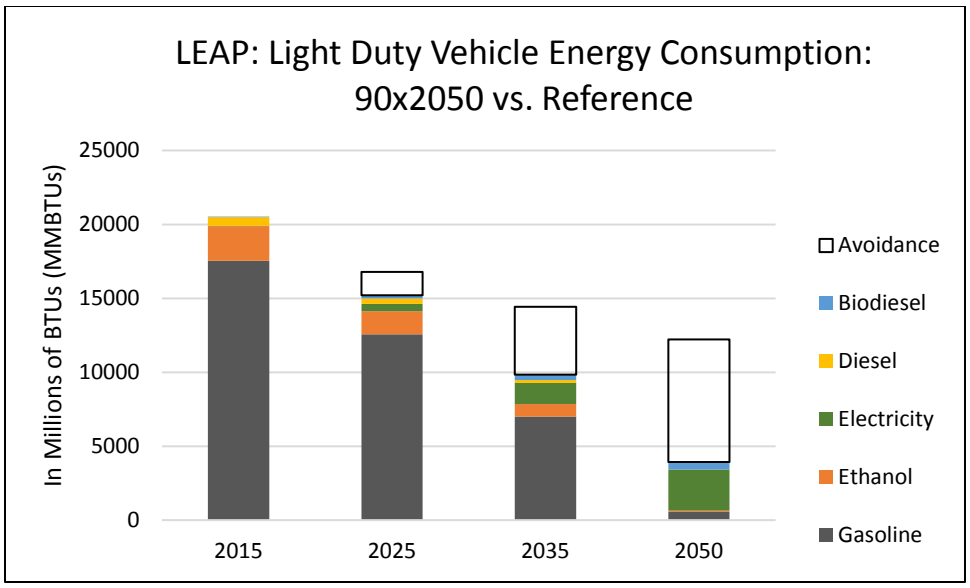
Reduction of heat energy demand (through weatherization) is an absolutely essential component of meeting 90x50 goals. Increased fuel switching (from non-renewables to renewables) will not compensate for lower weatherization targets. On the other hand, more aggressive weatherization strategies will reduce fuel switching targets.

For heating purposes, the primary options for fuel switching are modern, efficient wood heating systems and heat pumps. The charts below show the more efficient 90% x 2050 scenarios. Even if the population and economy grows, energy use actually declines because of efficiency and electrification. Electrification of heating and transportation has a

significant effect on the total demand, because the electric end uses are three to four times more efficient than the combustion versions they replace. This explains why even though wood heating (including cord wood) continues to play an important part in the area's energy use, growth in electric heating reduces overall energy use.







Where the graphs show "Avoided vs. Reference," that is the portion of energy that we do not need to provide because of the efficiencies achieved through aggressive weatherization and efficiency upgrades.

Residential and Commercial Thermal Efficiency Improvements

	2025	2035	2050
Estimated number of households	183	194	206
% of households to be weatherized	23%	38%	39%
# of households to be weatherized	43	74	80
Estimated number of commercial establishments	5	6	6
% of commercial establishments to be weatherized	7%	12%	21%
# of commercial establishments to be weatherized	0	1	1

Thermal Efficiency Assumptions:

These projections estimate a 6% increase in number of housing units/commercial establishments over each period Weatherization projects are assumed to achieve an average of 25% reduction in MMBTUs for residential units and 20% for commercial establishments, although some weatherization projects can achieve deeper savings. *Increasing* the average savings will *decrease* the weatherization targets.

Electricity Efficiency Improvements

	2025	2035	2050
Estimated number of residential customers	725	769	815
% of residential customers to upgrade electrical equipment	9%	13%	19%
# of residential customers to upgrade electrical equipment	66	103	151

Electrical Efficiency Assumptions:

Since there are generally more utility customers than households, this figure multiples projected number of households by 1.5. It can be assumed that the share of commercial businesses with upgraded equipment is comparable.

Thermal Fuel Switching Targets for Residential and Commercial

	2025	2035	2050
New Efficient Wood Heat Systems in Residences	111	91	66
% of households with Wood Heat Systems	60%	47%	32%
New Efficient Wood Heat Systems in Commercial Establishments	1	2	2
% commercial establishments with wood heat systems	22%	27%	35%
New Heat Pumps in Residential Units	33	70	88
% of households with Heat Pumps	18%	36%	43%
Estimated commercial establishments with Heat Pumps	0	1	1
% of commercial establishments with Heat Pumps	9%	15%	21%

Fuel Switching Targets for Transportation

	2025	2035	2050
Projected number of light-duty vehicles in the area, by year	343	386	434
Number of vehicles powered by electricity	38	122	263
% of vehicles powered by electricity	11%	32%	61%
Number of vehicles using bio-fuel blends	261	179	31
% of vehicles using bio-fuel blends	76%	46%	7%

Transportation assumptions:

Projected number of vehicles in the area is estimated to be roughly commensurate with projections of population and households. Estimates assume a gradual increase in EV fuel economy from 3 kwh per mile to 4 kwh per mile by 2050.

9A. Does the plan evaluate (estimates of or actual) generation from existing renewable energy generation in the municipality?

Renewable Type	Capacity in MegaWatts (MW)	Capacity in MegaWatt Hours (MWh)
Solar	.0049	6.0
Wind	0.0	0.0
Hydro	0.0	0.0
Biomass	0.0	0.0
Other	0.0	0.0
Total Generation	**0.0049**	**6.0**

Generation Assumptions:

Data comes from the Renewable Energy Atlas, which can be accessed on the Vermont Community Energy Dashboard. If actual production data is not available, outputs are estimated using the following methodology:

Solar	MWh of energy = (number of MW) * (8,760 hours per year) * (0.14 capacity factor)
Wind	MWh of energy = (number of MW) * (8,760 hours per year) * (0.20 capacity factor for small residential, .35 capacity factor for commercial and larger)
Hydro	MWh of energy = (number of MW) * (8,760 hours per year) * (0.40 capacity factor)

9B. Does the plan analyze generation potential, through the mapping exercise (see attached maps) to determine potential from preferred and potentially suitable areas in the municipality?

Renewable Type	Capacity in MegaWatts (MW)	Capacity in MegaWatt Hours (MWh)
Residential Rooftop solar	.25	307
Small commercial rooftop solar (<40,000 sq. ft.)	0	0
Large commercial rooftop solar (>40, sq. ft.)	0	0
Ground-mounted solar	4.06	4983.1
Wind	.17	292.3
Hydro	0.0	0.0

Biomass and methane	0.0	0.0
Total Potential Generation Capacity	**4.48**	**5582.4**

Potential Generation Assumptions:

This analysis uses maps are produced by NVDA and evaluated only prime areas (no known constraints). Rooftop solar is calculated at 10% of structures (including seasonal residences) and assumes 4kw capacity for residential, 20kW for small commercial, and 200 kW for large commercial. NVDA is not planning for additional utility scale wind, so wind is calculated assuming an average output of 9.5 kW (residential), based on average capacity of existing installations in the region.

This estimate assumes no locally designated restraints, which may reduce generation capacity. Statewide preferred locations include rooftops (and other structures), parking lots, previously developed sites, brownfields, gravel pits, quarries, and Superfund sites. *Locally* preferred locations that are not included in the statewide categories must be not be impractical for developing a technology with regard to the presence of the renewable resource and access to transmission/distribution infrastructure.

9C. Does the plan identify sufficient land in the municipality for renewable energy development to reasonably reach 2050 targets for renewable energy generation, based on population and energy resource potential, accounting for the fact that land may not be available due to private property constraints, site-specific constraints, or grid-related constraints?

New Net Generation Targets	**Sufficient Land for Solar?)**	**Sufficient Land for Wind)**
97 MWh	Y	Y

New Net Generation Assumptions:

The region's target for new net generation in 18,680 MWh. Your generation targets are based on the municipality's share of the region's population. Note: Existing generation identified in Table 9A do not count toward this target.

NVDA's capacity analysis assumes a conservative average of 9.5 kw per every 25 acres of prime residential-scale wind, in order to account for contingencies, such as property owners not interested in leasing their land, interconnection costs that may be too high in some areas, and unsuitability of certain sites after site-specific evaluation. Similarly, this estimate assumes a conservative 60 acres per 1 MW of ground mounted solar to account for similar contingencies.

10. Does your plan contain one or more maps that address 11-13 below, as provided by your Regional Planning Commission or as developed by your municipality?

11. Does the plan identify and map existing electric generation sources?

12. Does the plan identify potential areas for the development and siting of renewable energy resources and the potential generation from such generators in the identified areas, taking into account factors including resource availability, environmental constraints, and the location and capacity of electric grid infrastructure?

13. Does the plan identify areas that are unsuitable for siting renewable energy resources or particular categories or sizes of those resources?

NVDA has prepared the following maps to help you meet the above standards. You may choose to rely on these maps to meet the standards in this section. Alternatively, you may choose to undertake their own mapping, according to the same set of standards as regions. Additionally, municipalities are expected to work collaboratively with their regions and with neighboring municipalities to ensure compatibility between the final products.

The following maps are an indicator of siting potential, but NOT a definitive siting tool.

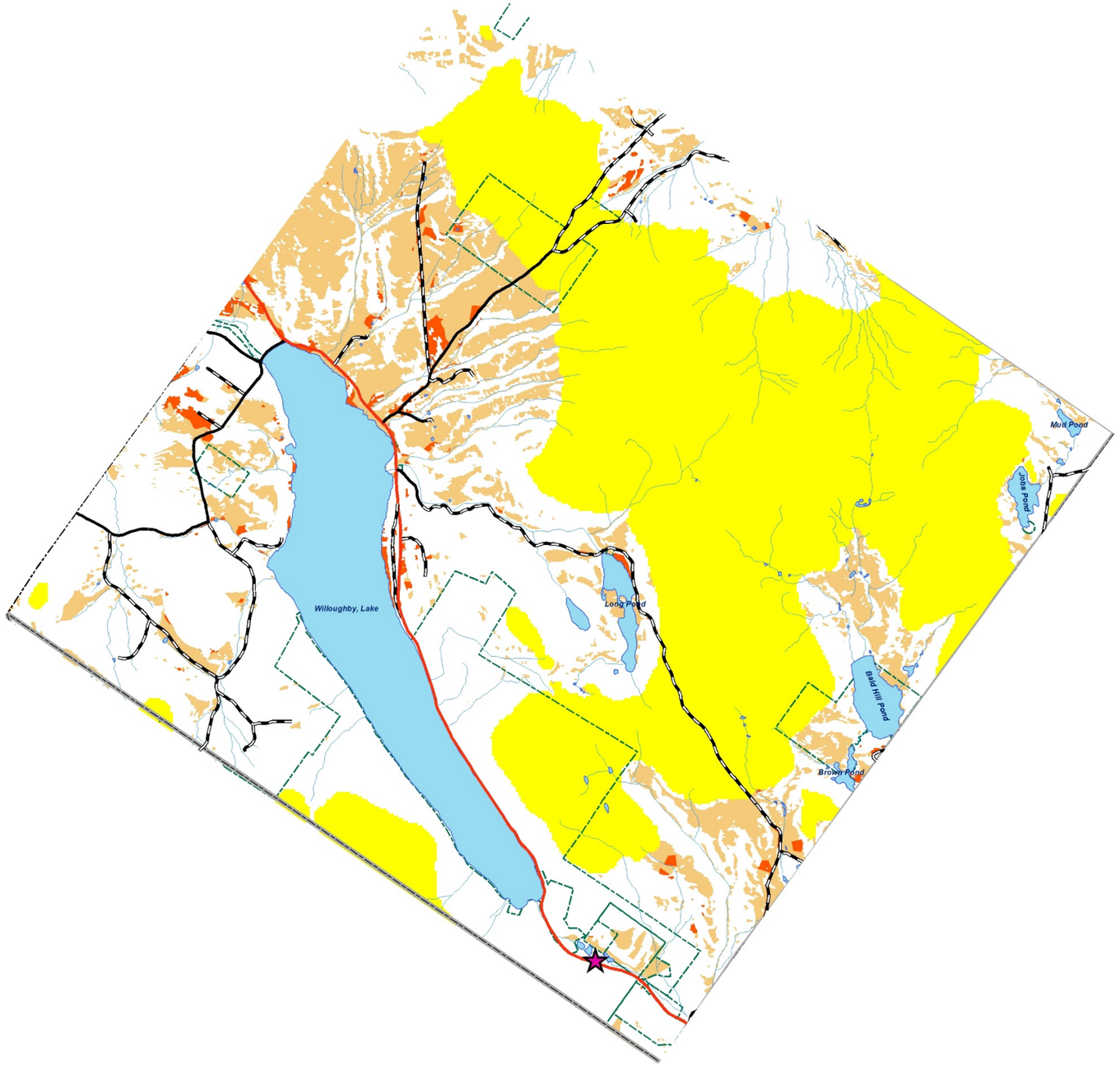
Known constraints are areas not likely to be developed for renewable energy because they contain one or more of the following: vernal pools; river corridors; FEMA floodways; significant natural communities; rare, threatened and endangered species, national wilderness areas, wetlands (Class 1 and Class 2).

Possible constraints are areas that would likely require mitigation because they contain the one or more of the following: agricultural soils; special flood hazard areas (outside of the floodway); protected (conserved) lands; deer wintering areas; Act 250 mitigated agricultural soils; hydric soils, and highest priority forest blocks.

Note: NVDA's Maps assume a potential regional constraint on undisturbed lands with an elevation of 2,000 or higher, which may contain important forest cover (which could, for example, attenuate flood flows), critical habitat, or headwaters. This regional constraint is only proposed because the updated regional plan is still under development.

Westmore, VT
Solar Potential Map

05/01/2017



- Existing Solar Sites
- 3 Phase Power Lines (Not all areas have data available)
- US Interstate Highway
- US & State Highways
- Paved Town Highway
- Unpaved Town Highway
- County Boundary
- Town Boundary
- Streams
- Major electric transmission line
- Lakes, Ponds & Rivers
- Public Lands Boundary
- Areas Over 2000' Elevation (Possible Regional Constraint)

Prime Solar

- No State Constraint
- Possible State Constraint

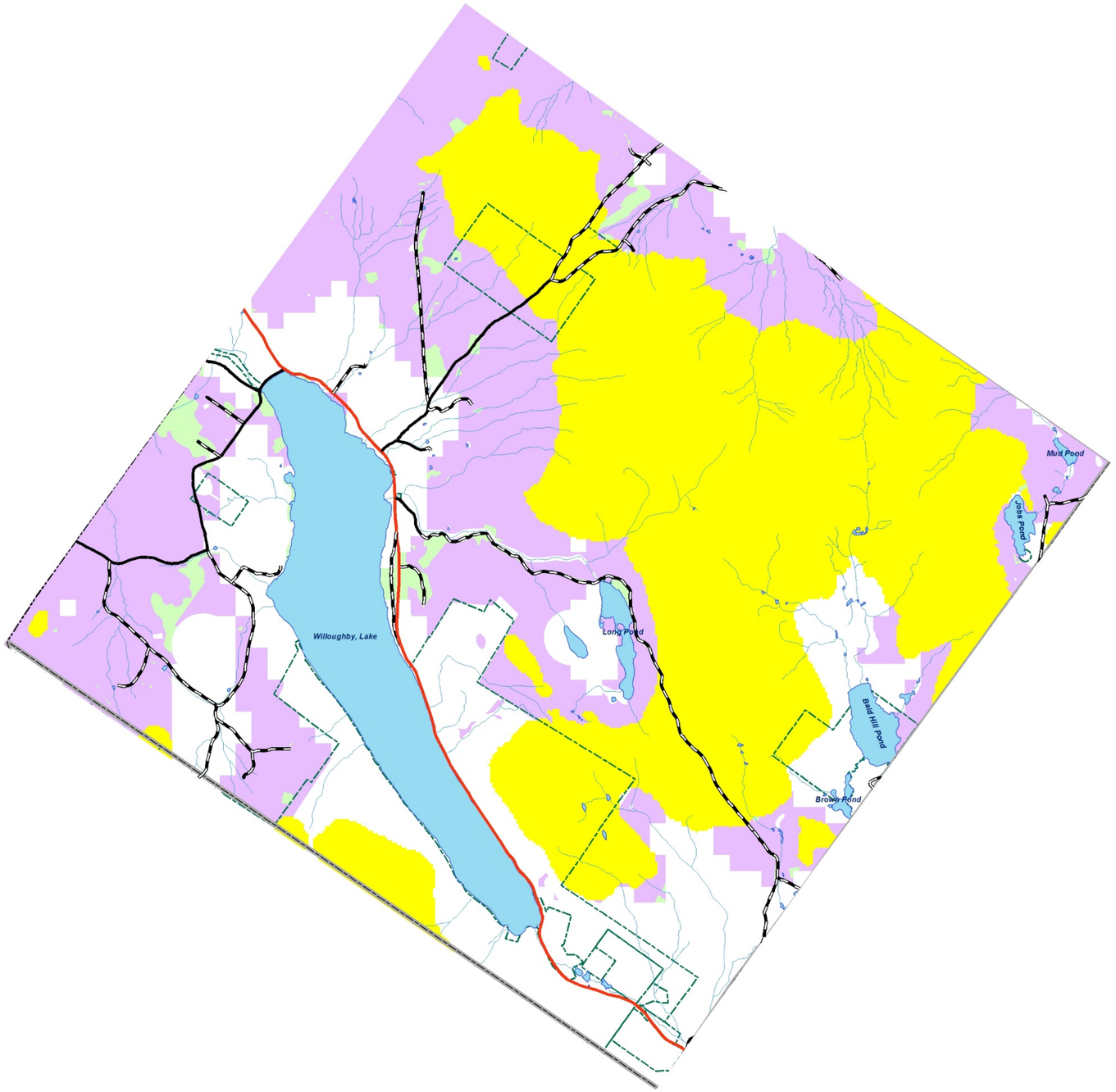
0 1 2 Miles

Warning- This Data is for planning purposes only and does not replace a survey and/or engineering study. Because this map is developed from various scale sources, there may be some discrepancies between data layers.

NVDA
Northeastern Vermont Development Association

Westmore, VT
Wind Potential Map

05/01/2017



- Industrial Wind Towers
- Existing Wind Power Site
- 3 Phase Power Lines (Not all areas have data available)
- US Interstate Highway
- US & State Highways
- Paved Town Highway
- Unpaved Town Highway
- County Boundary
- Town Boundary
- Streams
- Major electric transmission line
- Lakes, Ponds & Rivers
- Public Lands Boundary
- Areas Over 2000' Elevation (Possible Regional Constraint)

Prime Wind Areas

- No Constraint
- Possible Constraint

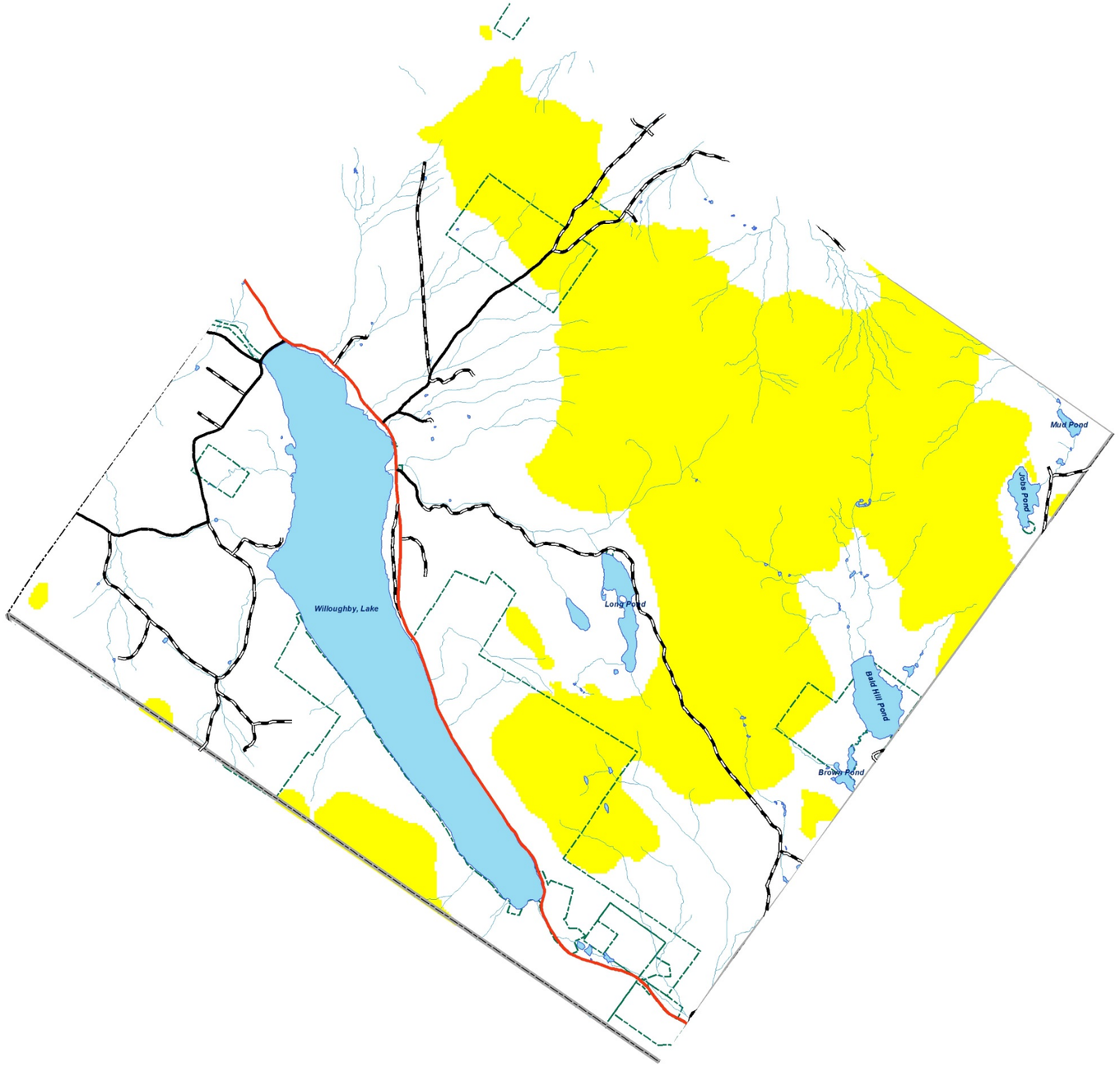
0 1 2 Miles

Warning- This Data is for planning purposes only and does not replace a survey and/or engineering study. Because this map is developed from various scale sources, there may be some discrepancies between data layers.

NVDA
Northeastern Vermont Development Association

Westmore, VT
Hydroelectric Potential Map

05/01/2017



- Existing Hydroelectric Facilities
- Potential Hydroelectric Facilities
- 3 Phase Power Lines (Not all areas have data available)
- US Interstate Highway
- US & State Highways
- Paved Town Highway
- Unpaved Town Highway
- County Boundary
- Town Boundary
- Streams
- Major electric transmission line
- Lakes, Ponds & Rivers
- Public Lands Boundary
- Areas Over 2000' Elevation (Possible Regional Constraint)

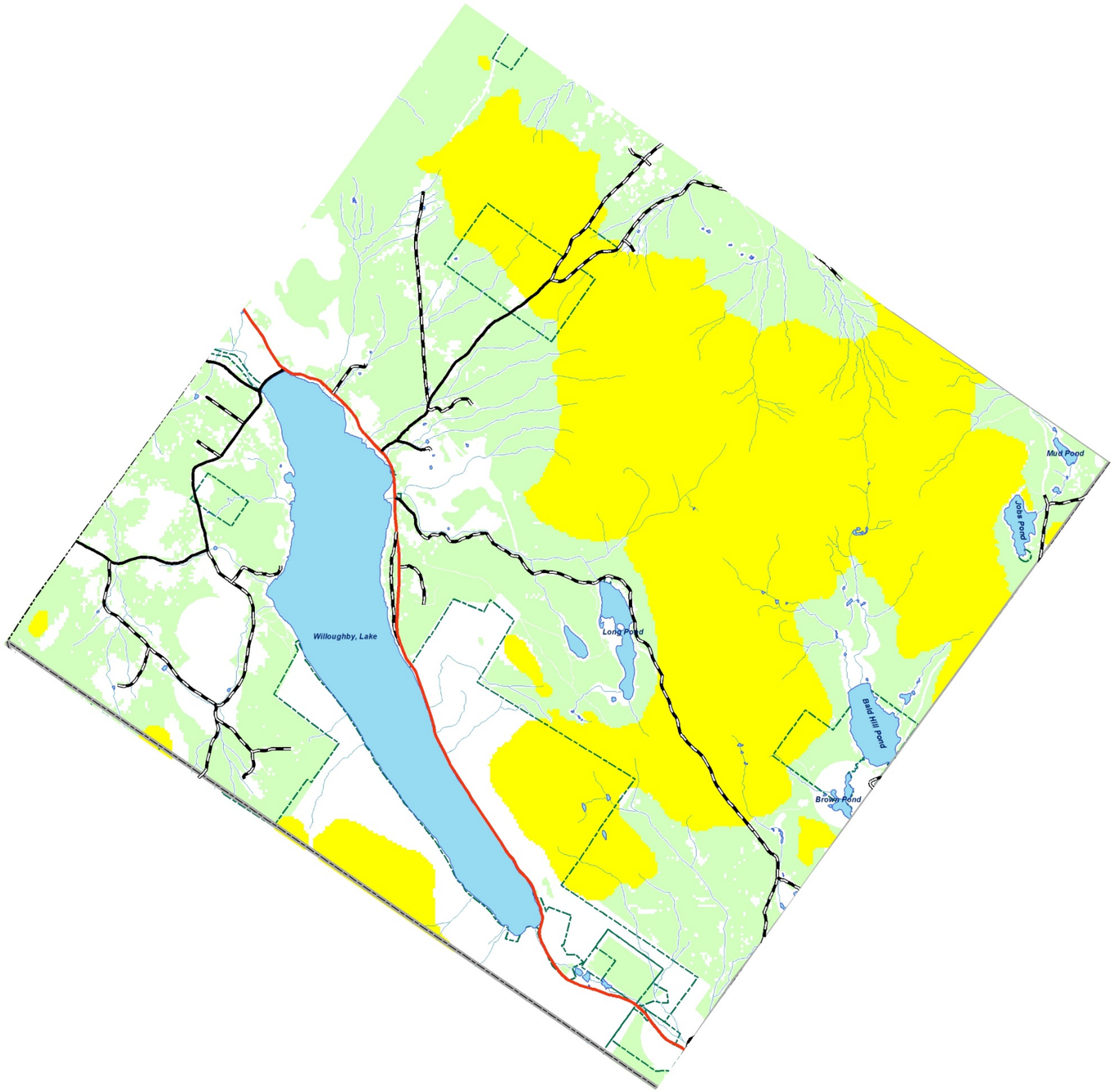
0 1 2 Miles

Warning- This Data is for planning purposes only and does not replace a survey and/or engineering study. Because this map is developed from various scale sources, there may be some discrepancies between data layers.

NVDA
Northeastern Vermont Development Association

Westmore, VT
Woody Biomass Potential Map

05/01/2017



- Existing Woody Biomass Facilities
- 3 Phase Power Lines (Not all areas have data available)
- US Interstate Highway
- US & State Highways
- Paved Town Highway
- Unpaved Town Highway
- County Boundary
- Town Boundary
- Streams
- Major electric transmission line
- Lakes, Ponds & Rivers
- Public Lands Boundary
- Areas Over 2000' Elevation (Possible Regional Constraint)
- Woody Biomass Areas

0 1 2 Miles

Warning- This Data is for planning purposes only and does not replace a survey and/or engineering study. Because this map is developed from various scale sources, there may be some discrepancies between data layers.

NVDA
Northeastern Vermont Development Association