APPENDIX

A

APPENDIX A - SUMMARY RESULTS AND METHODOLOGY

Summary Results and Methodology

Introduction

This document supplements the regional energy plans created by each Regional Planning Commission (RPC). It was developed by Vermont Energy Investment Corporation (VEIC) as documentation to modeling work performed for the RPCs. An award from the Department of Energy's SunShot Solar Market Pathways program funded the creation of a detailed statewide total energy supply and demand model. The VEIC team used the statewide energy model as a foundation for the region-specific modeling efforts. More detailed methodology is included at the end of this report.

Statewide Approach

Historic information was primarily drawn from the Public Service Department's Utility Facts 2013[1] and EIA data. Projections came from the Total Energy Study (TES)[2], the utilities' Committed Supply[3], and stakeholder input.

Demand Drivers

Each sector has a unit that is used to measure activity in the sector. That unit is the "demand driver" because in the model it is multiplied by the energy intensity of the activity to calculate energy demand.

The population change for each region is calculated from town data in *Vermont Population Projections 2010-2030*.[4] Growth rates are assumed constant through 2050.

RPC	Annual Growth
Addison	0.00%
Bennington	0.02%
Central VT	0.12%
Chittenden	0.48%
Lamoille	1.46%
Northwest	0.87%
NVDA	0.21%
Rutland	-0.27%
Southern Windsor	0.24%
Two Rivers	0.29%

[1] Vermont Public Service Department, *Utility Facts 2013*, http://publicservice.vermont.gov/sites/dps/files/documents/Pubs_Plans_Reports/Utility_Facts/Utility%20Facts%202013.pdf

[2] Vermont Public Service Department, *Total Energy Study: Final Report on a Total Energy Approach to Meeting the State's Greenhouse Gas and Renewable Energy Goals.* December 8, 2014. http://publicservice.vermont.gov/sites/psd/files/Pubs_Plans_Reports/TES/TES%20FINAL%20Report%2020141208.pdf.

[3] Vermont Public Service Department provided the data behind the graph on the bottom half of page E.7 in *Utility Facts 2013.* It is compiled from utility Integrated Resource Plans

[4] Jones, Ken, and Lilly Schwarz, *Vermont Population Projections-2010-2030*, August, 2013. http://dail.vermont.gov/dail-publications/publications-general-reports/vt-population-projections-2010-2030.

Windham	0.34%

People per house are assumed to decrease from 2.4 in 2010 to 2.17 in 2050. This gives the number of households, the basic unit and demand driver in the model for **residential energy** consumption.

Projected change in the **energy demand from the commercial sector** was based on commercial sector data in the TES. The demand driver for the commercial sector is commercial building square feet which grow almost 17% from 2010 to 2050.

The team entered total **industrial consumption** by fuel from the TES directly into the model. It grows from 1.1 TBtu in 2010 to 1.4 TBtu in 2050.

Transportation energy use is based on projections of vehicle miles traveled (VMT). VMT peaked in 2006 and has since declined slightly.[5] Given this, and Vermont's efforts to concentrate development and to support alternatives to single occupant vehicles, VMT per capita is assumed to remain flat at 12,000.

The regional models use two scenarios. The **reference scenario** assumes a continuation of today's energy use patterns, but does not reflect the Vermont's renewable portfolio standard or renewable energy or greenhouse gas emissions goals. The main changes over time in the reference scenario are more fuel efficient cars because of CAFE standards and the expansion of natural gas infrastructure. The **90% x 2050 $_{\text{VEIC}}$ scenario** is designed to achieve the goal of meeting 90% of Vermont's total energy demand with renewable sources. It is adapted from the TES TREES Local scenarios. It is a hybrid of the high and low biofuel cost scenarios, with biodiesel or renewable diesel replacing petroleum diesel in heavy duty vehicles and electricity replacing gasoline in light duty vehicles. Despite a growing population and economy, energy use declines because of efficiency and electrification. Electrification of heating and transportation has a large effect on the total demand because the electric end uses are three to four times more efficient than the combustion versions they replace.

Regionalization Approach

The demand in the statewide model was broken into the state's planning regions. Residential demand was distributed according to housing units using data from the American Community Survey. Commercial and industrial demand was allocated to the regions by service-providing and goods-producing NAICS codes respectively. Fuel use in these sectors was allocated based on existing natural gas infrastructure. In the commercial sector, it was assumed that commercial fuel use per employee has the same average energy intensity across the state. All commercial natural gas use was allocated to the regions currently served by natural gas infrastructure, and the rest of the fuel was allocated to create equal consumption by employee.

[5] Jonathan Dowds et al., "Vermont Transportation Energy Profile," October 2015, http://vtrans.vermont.gov/sites/aot/files/planning/documents/planning/Vermont%20Transportation%20Energy%20Profile%202015.pdf.

The industrial sector was assumed to be more diverse in its energy consumption. In the industrial sector, natural gas was allocated among the regions currently served by natural gas based on the number of industrial employees in each region. Other non-electric fuels were distributed among regions without access to natural gas, as it was assumed that other non-electric fuels were primarily used for combustion purposes, and that purpose could likely be served more cheaply with gas. Transportation demand was primarily regionalized through population. The passenger rail sector of transportation demand was regionalized using Amtrak boarding and alighting data to create percentages of rail miles activity by region.[6] The freight rail sector of transportation was regionalized using the following approach: in regions with freight rail infrastructure, activity level was regionalized by share of employees in goods-producing NAICS code sectors. Regions without freight rail infrastructure were determined using a Vermont Rail System map and then assigned an activity level of zero.[7] A weighting factor was applied to regions with freight rail infrastructure to bring the total activity level back up to the calculated statewide total of freight rail short-ton miles in Vermont. Each region's share of state activity and energy use is held constant throughout the analysis period as a simplifying assumption.

Results

The numbers below show the results of the scenarios in "final units," sometimes referred to as "site" energy. This is the energy households and businesses see on their bills and pay for. Energy analysis is sometimes done at the "source" level, which accounts for inefficiency in power plants and losses from transmission and distribution power lines. The model accounts for those losses when calculating supply, but all results provided here are on the demand side, so do not show them.

The graphs below show the more efficient 90% x 2050 VEIC scenario, which is one path to reduce demand enough to make 90% renewable supply possible. This scenario makes use of wood energy, but there is more growth in electric heating and transportation to lower total energy demand. Where the graphs show "Avoided vs. Reference," that is the portion of energy that we do not need to provide because of the efficiency in this scenario compared to the less efficient Reference scenario.

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[6] National Association of Railroad Passengers, "Fact Sheet: Amtrak in Vermont," 2016, https://www.narprail.org/site/assets/files/1038/states_2015.pdf.

[7] Streamlined Design, "Green Mountain Railroad Map" (Vermont Rail System, 2014), http://www.vermontrailway.com/maps/regional_map.html.

Statewide Total Energy Consumption

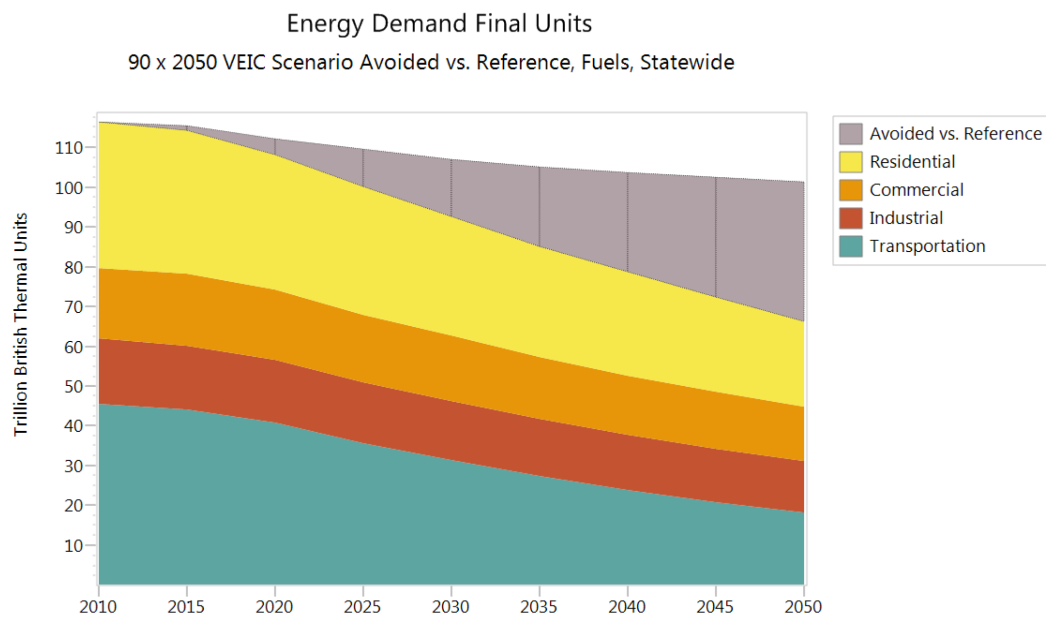

Figure 1 - Statewide energy consumption by sector, 90% x 2050 VEIC scenario compared to the reference scenario

Regional Total Energy Consumption

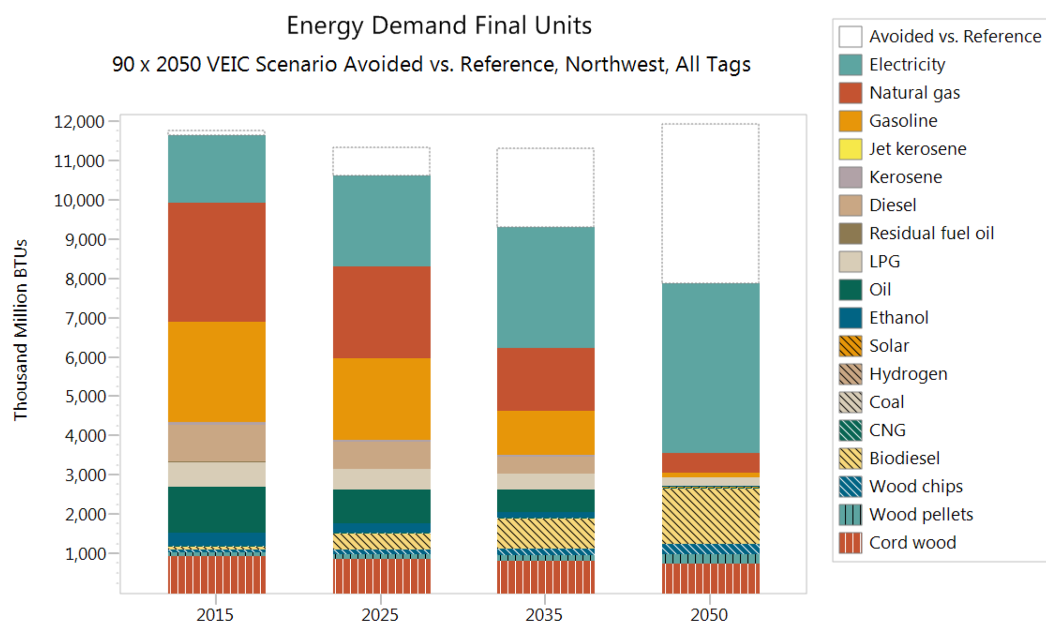

Figure 2: Regional energy consumption by fuel

Regional Energy Consumption by Sector

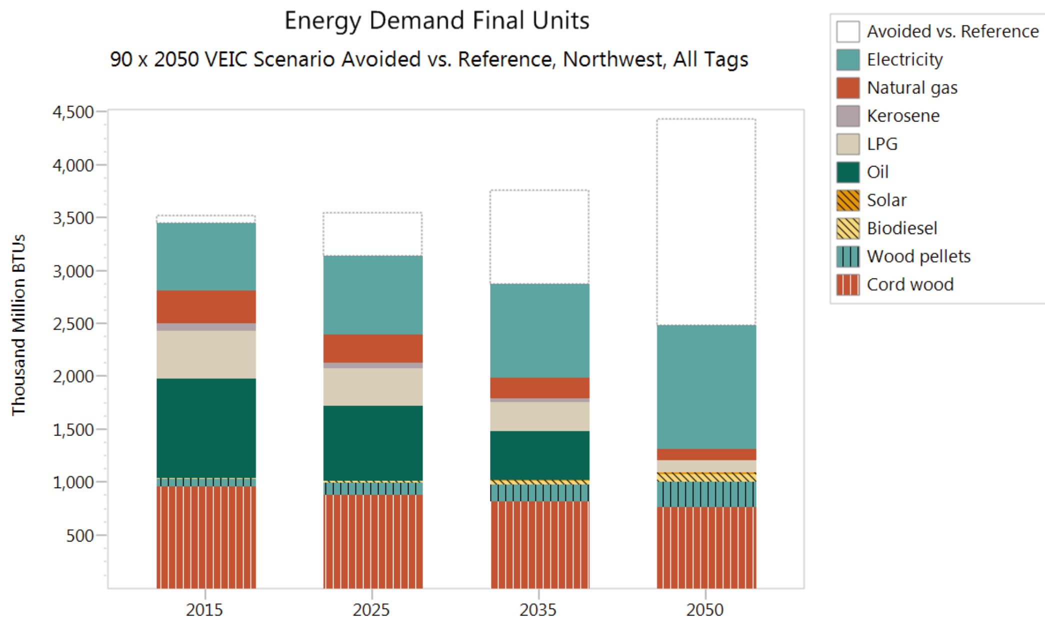

Figure 3: Regional residential energy consumption by fuel

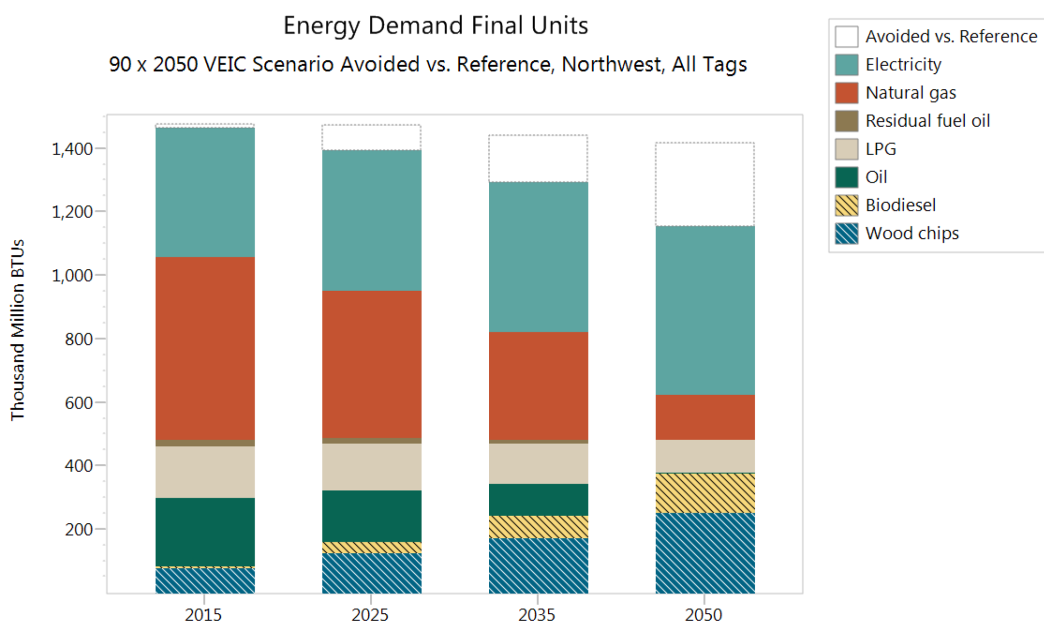

Figure 4: Regional commercial energy consumption by fuel

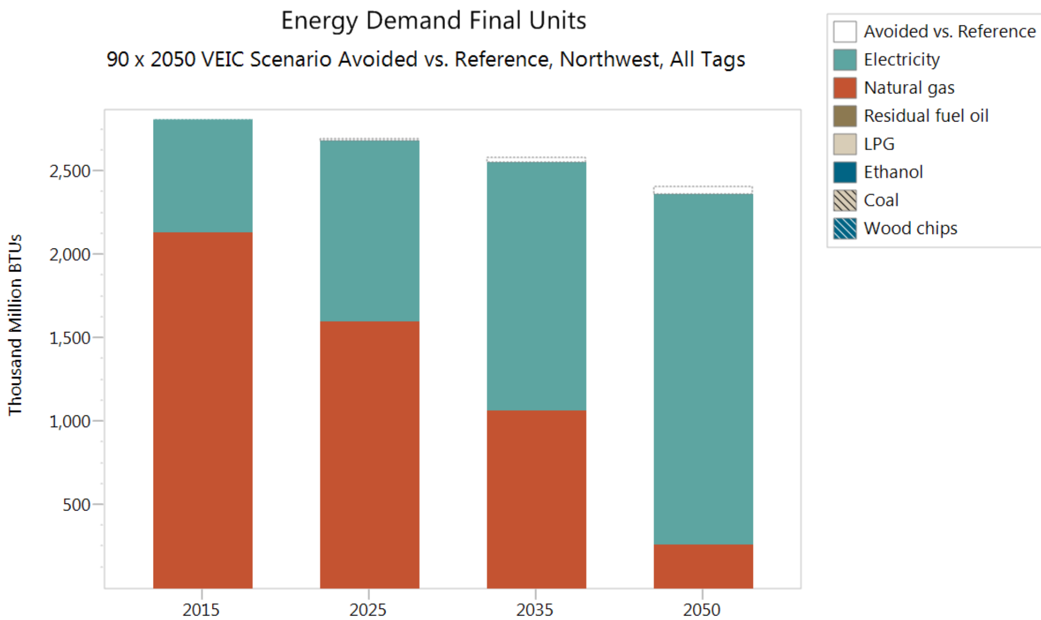

Figure 5: Regional industrial energy consumption by fuel

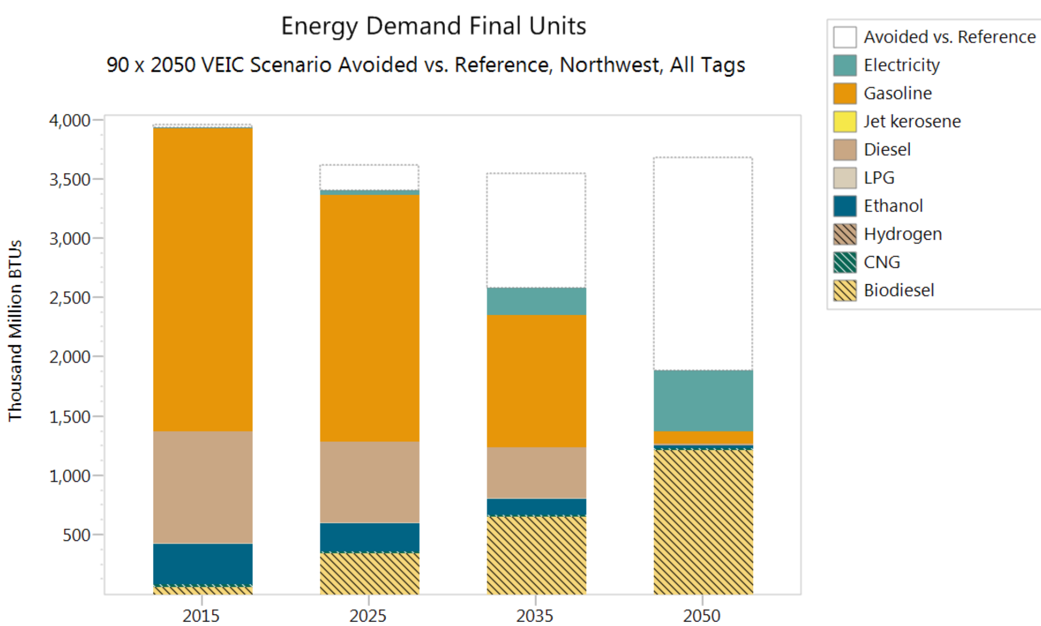

Figure 6: Regional transportation energy consumption by fuel

Detailed Sources and Assumptions

Residential

The TES provides total fuels used by sector. We used a combination of industry data and professional judgement to determine demand inputs at a sufficiently fine level of detail to allow for analysis at many levels, including end use (heating, water heating, appliances, etc.), device (boiler, furnace, heat pump) or home-type (single family, multi-family, seasonal, mobile). Assumptions for each are detailed below. All assumptions for residential demand are at a per-home level.

Space Heating

The team determined per home consumption by fuel type and home type. EIA data on Vermont home heating provides the percent share of homes using each type of fuel. 2009 Residential energy consumption survey (RECS) data provided information on heating fuels used by mobile homes. Current heat pumps consumption estimates were found in a 2013 report prepared for Green Mountain Power by Steve LeTendre entitled *Hyper Efficient Devices: Assessing the Fuel Displacement Potential in Vermont of Plug-In Vehicles and Heat Pump Technology*. Future projections of heat pump efficiency were provided by Efficiency Vermont Efficient Products and Heat Pump program experts.

Additional information came from the following data sources:

- 2010 Housing Needs Assessment[8]
- EIA Vermont State Energy Profile[9]
- 2007-2008 VT Residential Fuel Assessment[10]
- EIA Adjusted Distillate Fuel Oil and Kerosene Sales by End Use[11]

The analyst team made the following assumptions for each home type:

- Multi-family units use 60% of the heating fuel used by single family homes, on average, due to assumed reduced size of multi-family units compared to single-family units. Additionally, where natural gas is available, the team assumed a slightly higher percentage of multi-family homes use natural gas as compared to single family homes, given the high number of multi-family units located in the Burlington area, which is served by the natural gas pipeline. The team also assumed that few multi-family homes rely on cordwood as a primary heating source.

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[8] Vermont Housing and Finance Agency, "2010 Vermont Housing Needs Assessment," December 2009 http://www.vtaffordablehousing.org/documents/resources/623_1.8_Appendix_6_2010_Vermont_Housing_Needs_Assessment.pdf.
[9] U.S. Energy Information Administration, "Vermont Energy Consumption Estimates, 2004," https://www.eia.gov/state/print.cfm?sid=VT
[10] Frederick P. Vermont Residential Fuel Assessment: for the 2007-2008 heating season. Vermont Department of Forest, Parks and Recreation. 2011.
[11] U.S. Energy Information Administration, "Adjusted Distillate Fuel Oil and Kerosene Sales by End Use," December 2015, https://www.eia.gov/dnav/pet/pet_cons_821usea_dcu_nus_a.htm.

- Unoccupied/Seasonal Units: On average, seasonal or unoccupied homes were expected to use 10% of the heating fuel used by single family homes. For cord wood, we expected unoccupied or seasonal homes to use 5% of heating fuel, assuming any seasonal or unoccupied home dependent on cord wood are small in number and may typically be homes unoccupied for most of the winter months (deer camps, summer camps, etc.)
- Mobile homes—we had great mobile home data from 2009 RECS. As heat pumps were not widely deployed in mobile homes in 2009 and did not appear in the RECs data, we applied the ratio of oil consumed between single family homes and mobile homes to estimated single family heat pump use to estimate mobile home heat pump use.
- The reference scenario heating demand projections were developed in line with the TES reference scenario. This included the following: assumed an increase in the number of homes using natural gas, increase in the number of homes using heat pumps as a primary heating source (up to 37% in some home types), an increase in home heated with wood pellets, and drastic decline in homes heating with heating oil. Heating system efficiency and shell efficiency were modeled together and, together, were estimated to increase 5-10% depending on the fuel type. However, heat pumps are expected to continue to rapidly increase in efficiency (becoming 45% more efficient, when combined with shell upgrades, by 2050). We also reflect some trends increasing home sizes.
- In the 90% x 2050 $_{\text{VEIC}}$ scenario, scenario heating demand projections were developed in line with the TES TREES Local scenarios, a hybrid of the high and low biofuel cost scenarios. This included the following: assumed increase in the number of homes using heat pumps as a primary heating source (up to 70% in some home types), an increase in home heated with wood pellets, a drastic decline in homes heating with heating oil and propane, and moderate decline in home heating with natural gas. Heating system efficiency and shell efficiency were modeled together and were estimated to increase 10%-20% depending on the fuel type. However, heat pumps are expected to continue to rapidly increase in efficiency (becoming 50% more efficient, when combined with shell upgrades by 2050). We also reflect some trends increasing home sizes.

Lighting

Lighting efficiency predictions were estimated by Efficiency Vermont products experts.

Water Heating

Water heating estimates were derived from the Efficiency Vermont Technical Reference Manual.[12]

Appliances and Other Household Energy Use:

EnergyStar appliance estimates and the Efficiency Vermont Electric Usage Chart[13] provided estimates for appliance and other extraneous household energy uses.

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[12] Efficiency Vermont, "Technical Reference User Manual (TRM): Measure Savings Algorithms and Cost Assumptions, No. 2014-87," March 2015, http://psb.vermont.gov/sites/psb/files/docketsandprojects/electric/majorpendingproceedings/TRM%20User%20Manual%20No.%202015-87C.pdf.

Using the sources and assumptions listed above, the team created a model that aligned with the residential fuel consumption values in the TES.

Commercial

Commercial energy use estimates are entered in to the model as energy consumed per square foot of commercial space, on average. This was calculated using data from the TES.

Industrial

Industrial use was entered directly from the results of the TES data.

Transportation

The transportation branch focused on aligning with values from the Total Energy Study (TES) Framework for Analysis of Climate-Energy-Technology Systems (FACETS) data in the transportation sector in the Business as Usual (BAU) scenario. The VEIC 90% x 2050 scenario was predominantly aligned with a blend of the Total Renewable Energy and Efficiency Standard (TREES) Local High and Low Bio scenarios in the transportation sector of FACETS data. There were slight deviations from the FACETS data, which are discussed in further detail below.

Light Duty Vehicles

Light Duty Vehicle (LDV) efficiency is based on a number of assumptions: gasoline and ethanol efficiency were derived from the Vermont Transportation Energy Profile.[14] Diesel LDV efficiency was obtained from underlying transportation data used in the Business as Usual scenario for the Total Energy Study, which is referred to as TES Transportation Data below. Biodiesel LDV efficiency was assumed to be 10% less efficient than LDV diesel efficiency.[15] Electric vehicle (EV) efficiency was derived from an Excel worksheet from Drive Electric Vermont. The worksheet calculated EV efficiency using the number of registered EVs in Vermont, EV efficiency associated with each model type, percentage driven in electric mode by model type (if a plugin hybrid vehicle), and the Vermont average annual vehicle miles traveled. LDV electric vehicle efficiency was assumed to increase at a rate of .6%. This was a calculated weighted average of 100-mile electric vehicles, 200-mile electric vehicles, plug-in 10 gasoline hybrid and plug-in 40 gasoline hybrid vehicles from the Energy Information Administration Annual Energy Outlook.[16]

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[13] Efficiency Vermont, "Electric Usage Chart Tool," https://www.efficiencyvermont.com/tips-tools/tools/electric-usage-chart-tool.

[14] Jonathan Dowds et al., "Vermont Transportation Energy Profile," October 2015, http://vtrans.vermont.gov/sites/aot/files/planning/documents/planning/Vermont%20Transportation%20Energy%20Profile%202015.pdf.

[15] U.S. Environmental Protection Agency: Office of Transportation & Air Quality, "Biodiesel," *Www.fueleconomy.gov*, accessed August 19, 2016, https://www.fueleconomy.gov/feg/biodiesel.shtml.

[16] U.S. Energy Information Administration, "Light-Duty Vehicle Miles per Gallon by Technology Type," *Annual Energy Outlook 2015*, 2015, https://www.eia.gov/forecasts/aeo/data/browser/#/?id=50-AEO2016&cases=ref2016~ref_no_cpp&sourcekey=0.

Miles per LDV was calculated using the following assumptions: data from the Vermont Agency of Transportation provided values for statewide vehicles per capita and annual miles traveled.[17] The total number of LDVs in Vermont was sourced TES Transportation Data. The calculated LDV miles per capita was multiplied by the population of Vermont and divided by the number of LDVs to calculate miles per LDV.

The number of EVs were sourced directly from Drive Electric Vermont, which provided a worksheet of actual EV registrations by make and model. This worksheet was used to calculate an estimate of the number of electric vehicles using the percentage driven in electric mode by vehicle type to devalue the count of plug-in hybrid vehicles. Drive Electric Vermont also provided the number of EVs in the 90% x 2050 $_{\text{VEIC}}$ scenario.

Heavy Duty Vehicles

Similar to the LDV vehicle efficiency methods above, HDV efficiency values contained a variety of assumptions from different sources. A weighted average of HDV diesel efficiency was calculated using registration and fuel economy values from the Transportation Energy Data Book.[18] The vehicle efficiency values for diesel and compressed natural gas (CNG) were all assumed to be equal.[19] Diesel efficiency was reduced by 10% to represent biodiesel efficiency.[20] Propane efficiency was calculated using a weighted average from the Energy Information Administration Annual Energy Outlook table for Freight Transportation Energy Use.[21]

In the 90% x 2050 $_{\text{VEIC}}$ scenario, it was assumed HDVs will switch entirely from diesel to biodiesel or renewable diesel by 2050. This assumption is backed by recent advances with biofuel. Cities such as Oakland and San Francisco are integrating a relatively new product called renewable diesel into their municipal fleets that does not gel in colder temperatures and has a much lower overall emissions factor.[22] Historically, gelling in cold temperatures has prevented higher percentages of plant-based diesel replacement products.

Although there has been some progress toward electrifying HDVs, the VEIC 90% x 2050 scenario does not include electric HDVs. An electric transit bus toured the area and gave employees of BED, GMTA, and VEIC a nearly silent ride around Burlington. The bus is able to fast charge using an immense amount of power that few places on the grid can currently support. The California Air Resources Board indicated

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[17] Jonathan Dowds et al., "Vermont Transportation Energy Profile."
[18] Ibid.
[19] "Natural Gas Fuel Basics," *Alternative Fuels Data Center*, accessed August 19, 2016, http://www.afdc.energy.gov/fuels/natural_gas_basics.html.
[20] U.S. Environmental Protection Agency: Office of Transportation & Air Quality, "Biodiesel."
[21] US Energy Information Administration (EIA), "Freight Transportation Energy Use, Reference Case," *Annual Energy Outlook 2015*, 2015, http://www.eia.gov/forecasts/aeo/data/browser/#/?id=58-AEO2015&region=0-0&cases=ref2015&start=2012&end=2040&f=A&linechart=ref2015-d021915a.6-58-AEO2015&sourcekey=0.
[22] Oregon Department of Transportation and U.S. Department of Transportation Federal Highway Administration, "Primer on Renewable Diesel," accessed August 29, 2016, http://altfueltoolkit.org/wp-content/uploads/2004/05/Renewable-Diesel-Fact-Sheet.pdf.

a very limited number of electric HDVs are in use within the state.[23] Anecdotally, Tesla communicated it is working on developing an electric semi-tractor that will reduce the costs of freight transport.[24]

The total number of HDVs was calculated using the difference between the total number of HDVs and LDVs in 2010 in the Vermont Transportation Energy Profile and the total number of LDVs from TES Transportation Data.[25] HDV miles per capita was calculated using the ratio of total HDV miles traveled from the 2012 Transportation Energy Data Book and the 2012 American Community Survey U.S. population estimate.[26,27] The total number of HDVs and HDV miles per capita were combined with the population assumptions outlined above to calculate miles per HDV.

Rail

The rail sector of the transportation branch consists of two types: freight and passenger. Currently in Vermont, freight and passenger rail use diesel fuel.[28,29] The energy intensity (Btu/short ton-mile) of freight rail was obtained from the U.S Department of Transportation Bureau of Transportation Statistics.[30] A 10-year average energy intensity of passenger rail (Btu/passenger mile) was also obtained from the U.S Department of Transportation Bureau of Transportation Statistics.[31] Passenger miles were calculated using two sets of information. First, distance between Vermont Amtrak stations and the appropriate Vermont border location were estimated using Google Maps data. Second, 2013 passenger data was obtained from the National Association of Railroad Passengers.[32] Combined, these two components created total Vermont passenger miles. We used a compound growth rate of 3% for forecast future passenger rail demand in the 90% x 2050 $_{\text{VEIC}}$ scenario, consistent with the historical growth rates of rail

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23 California Environmental Protection Agency Air Resources Board, "Draft Technology Assessment: Medium- and Heavy-Duty Battery Electric Trucks and Buses," October 2015, https://www.arb.ca.gov/msprog/tech/techreport/bev_tech_report.pdf.

24 Elon Musk, "Master Plan, Part Deux," *Tesla*, July 20, 2016, https://www.tesla.com/blog/master-plan-part-deux.

25 Jonathan Dowds et al., "Vermont Transportation Energy Profile."

26 "Transportation Energy Data Book: Edition 33" (Oak Ridge National Laboratory, n.d.), accessed August 18, 2016.

27 U. S. Census Bureau, "Total Population, Universe: Total Population, 2012 American Community Survey 1-Year Estimates," *American Fact Finder*, 2012, http://factfinder.census.gov/bkmk/table/1.0/en/ACS/12_1YR/B01003/0100000US.

28 US Energy Information Administration (EIA), "Freight Transportation Energy Use, Reference Case."

29 Vermont Agency of Transportation Operations Division - Rail Section, "Passenger Rail Equipment Options for the Amtrak Vermonter and Ethan Allen Express: A Report to the Vermont Legislature," January 2010, http://www.leg.state.vt.us/reports/2010ExternalReports/253921.pdf.

30 U.S. Department of Transportation: Office of the Assistant Secretary for Research and Technology Bureau of Transportation Statistics, "Table 4-25: Energy Intensity of Class I Railroad Freight Service," accessed August 26, 2016, http://www.rita.dot.gov/bts/sites/rita.dot.gov.bts/files/publications/national_transportation_statistics/html/table_04_25.html.

31 U.S. Department of Transportation: Office of the Assistant Secretary for Research and Technology Bureau of Transportation Statistics, "Table 4-26: Energy Intensity of Amtrak Services," accessed August 26, 2016, http://www.rita.dot.gov/bts/sites/rita.dot.gov.bts/files/publications/national_transportation_statistics/html/table_04_26.html.

32 National Association of Railroad Passengers, "Fact Sheet: Amtrak in Vermont," 2016, https://www.narprail.org/site/assets/files/1038/states_2015.pdf.

passenger miles in Vermont.[33] Passenger rail is assumed to completely transform to electric locomotion. Freight rail is assumed to transform to biodiesel or renewable diesel.

Air

The total energy of air sector used appropriate FACETS data values directly. The air sector is expected to continue using Jet Fuel in both scenarios.

[33] Joseph Barr, AICP et al., “Vermont State Rail Plan: Regional Passenger Rail Forecasts.”

APPENDIX B

APPENDIX B - ENERGY RESOURCE MAPPING

APPENDIX B - ENERGY RESOURCE MAPPING

Version 13 – 5/30/2017

The following is a list of the known constraints and possible constraints that have been included on the regional energy generation map in Appendix C (solar, wind, woody biomass, and hydroelectric). The energy generation maps are not intended to be used without the accompanying goals and policies of the NRPC contained in this plan. For more information about how the energy generation maps shall be used, please see Section V of the plan (see: Energy Resources Maps and the Public Service Board, Energy Generation Maps Methodology, and Northwest Regional Energy Generation Maps and Standards).

A. EXPLANATION OF CONSTRAINTS

The following is an explanation of known and possible constraints used by the NRPC to create the regional energy generation maps. This list of constraints shall also be considered by the NPRC during the review of generation project applications (Section 248) in the Northwest Region:

KNOWN CONSTRAINTS

Known constraints are considered high-priority resources and for this reason energy generation facilities shall not be located in areas where known constraints exist. For this planning initiative, known constraints have been removed from the base layer of each applicable type of resource (solar, wind, biomass, hydro).

POSSIBLE CONSTRAINTS

Possible Constraints are lower-priority resources. These resources often impact the siting process for generation facilities. New generation facilities shall not have an undue adverse impact upon possible constraints. Often, site-specific mitigation solutions are possible when possible constraints exist on a parcel. Therefore, possible constraints have been included in the area designated as “base” on the regional energy generation maps (solar, wind, biomass, hydro).

B. SOLAR GENERATION MAPS

STATE KNOWN CONSTRAINTS

- **Confirmed and Unconfirmed Vernal Pools:** There is a 600-foot buffer around confirmed or unconfirmed vernal pools. (*Source: ANR*)
- **State Significant Natural Communities and Rare, Threatened, and Endangered Species:** Rankings S1 through S3 were used as constraints. These include all of the rare and uncommon rankings within the file. For more information on the specific rankings, explore the methodology for the shapefile. (*Source: VCGI*)
- **River Corridors:** Only mapped River Corridors were mapped. Does not include 50 foot buffer for streams with a drainage area less than 2 square miles. (*Source: VCGI*)
- **National Wilderness Areas:** (*Source: VCGI*)
- **FEMA Floodways:** (*Source: VCGI*)
- **Class 1 and Class 2 Wetlands:** (*Source: VCGI*)

REGIONALLY IDENTIFIED CRITICAL RESOURCES (REGIONAL KNOWN CONSTRAINTS)

- **Designated Downtowns, Designated Growth Centers, and Designated Village Centers:** These areas the center of dense, traditional development in the region. This constraint does not apply to roof-mounted solar within such designated areas. The inclusion of this resource as a regional constraint is consistent with goals and policies of the Northwest Regional Plan. (*Source: NRPC*)

- **FEMA Flood Insurance Rate Map (FIRM) Special Flood Hazard Areas:** Special flood hazard areas as digitized by the NRPC were used—just 100-year flood plain (500-year floodplain not mapped). The inclusion of this resource as a regional constraint is consistent with goals and policies of the Northwest Regional Plan. (*Source: NRPC*)
- **Ground and Surface Waters Drinking Protection Areas:** Buffered Source Protection Areas (SPAs) are designated by the Vermont Department of Environmental Conservation (DEC). SPA boundaries are approximate but are conservative enough to capture the areas most susceptible to contamination. The inclusion of this resource as a regional constraint is consistent with goals and policies of the Northwest Regional Plan. (*Source: Vermont Agency of Natural Resources [ANR]*)
- **Vermont Conservation Design Highest Priority Forest Blocks:** The lands and waters identified here are the areas of the state that are of highest priority for maintaining ecological integrity. Together, these lands comprise a connected landscape of large and intact forested habitat, healthy aquatic and riparian systems, and a full range of physical features (bedrock, soils, elevation, slope, and aspect) on which plant and animal natural communities depend. The inclusion of this resource as a regional constraint is consistent with goals and policies of the Northwest Regional Plan. (*Source: ANR*)
- **Public Water Sources:** A 200-foot buffer is used around public drinking water wellheads. The inclusion of this resource as a regional constraint is consistent with goals and policies of the Northwest Regional Plan. (*Source: ANR*)
- **National Natural Landmark – Chazy Fossil Reef:** The Chazy Fossil Reef in Isle La Motte has been designated a National Natural Landmark by the US Department of Interior. (*Source: NRPC*)
- **Municipal Conservation Land Use Areas:** Conservation Land Use Districts, as designated in municipal plans, that include strict language that strongly deters or prohibits development have been included as a regional known constraint. The inclusion of this resource as a regional constraint is consistent with the goals and policies of the Northwest Regional Plan. Specific municipal land use districts included are outlined in Section D.

STATE POSSIBLE CONSTRAINTS

- **Protected Lands:** This constraint includes public lands held by agencies with conservation or natural resource oriented missions, municipal natural resource holdings (ex. Town forests), public boating and fishing access areas, public and private educational institution holdings with natural resource uses and protections, publicly owned rights on private lands, parcels owned in fee by non profit organizations dedicated to conserving land or resources, and private parcels with conservation easements held by non profit organizations. (*Source: VCGI*)
- **Deer Wintering Areas:** Deer wintering habitat as identified by the Vermont Agency of Natural Resources. (*Source: VCGI*)
- **Hydric Soils:** Hydric soils as identified by the US Department of Agriculture. (*Source: VCGI*)
- **Agricultural Soils:** Local, statewide, and prime agricultural soils are considered. (*Source: VCGI*)
- **Act 250 Agricultural Soil Mitigation Areas:** Sites conserved as a condition of an Act 250 permit. (*Source: VCGI*)

REGIONALLY IDENTIFIED RESOURCES (REGIONAL POSSIBLE CONSTRAINTS)

- **Class 3 Wetlands:** Class 3 wetlands in the region have been identified have been included as a Regional Possible Constraint. The inclusion of this resource as a regional constraint is consistent with goals and policies of the Northwest Regional Plan (*Source: ANR*)
- **Municipal Conservation Land Use Areas:** Conservation Land Use Districts, as designated in municipal plans, that include strict language that deters, but does not prohibit development, have been included as a regional possible constraint. Specific municipal land use districts included are outlined in Section D.

OTHER MAP FEATURES

- **Three-Phase Distribution Lines:** All available utilities with service in any of the three regions (*Source: Green Mountain Power, Swanton Village Electric Department, Vermont Electric Coop, and Village of Enosburg Falls*) were mapped.
- **Transportation Infrastructure:** These were removed in the initial analysis performed by VCGI. Does not include parking lots. (*Source: VCGI*)
- **VELCO Transmission Lines and Substations:** (*Source: VCGI*)
- **Water Bodies:** Major water bodies (i.e., >1 square kilometer in surface area) are shown on maps as "Lakes/Ponds." (*Source: VCGI*)

C. BIOMASS MAPS

STATE KNOWN CONSTRAINTS

- **Confirmed and Unconfirmed Vernal Pools:** There is a 600-foot buffer around confirmed or unconfirmed vernal pools. (*Source: ANR*)
- **State Significant Natural Communities and Rare, Threatened, and Endangered Species:** Rankings S1 through S3 were used as constraints. These include all of the rare and uncommon rankings within the file. For more information on the specific rankings, explore the methodology for the shapefile. (*Source: VCGI*)
- **River Corridors:** Only mapped River Corridors were mapped. Does not include 50 foot buffer for streams with a drainage area less than 2 square miles. (*Source: VCGI*)
- **National Wilderness Areas:** (*Source: VCGI*)
- **FEMA Floodways:** (*Source: VCGI*)
- **Class 1 and Class 2 Wetlands:** (*Source: VCGI*)

REGIONALLY IDENTIFIED CRITICAL RESOURCES (REGIONAL KNOWN CONSTRAINTS)

- **Designated Downtowns, Designated Growth Centers, and Designated Village Centers:** These areas the center of dense, traditional development in the region. This constraint does not apply to roof-mounted solar within such designated areas. The inclusion of this resource as a regional constraint is consistent with goals and policies of the Northwest Regional Plan. (*Source: NRPC*)
- **FEMA Flood Insurance Rate Map (FIRM) Special Flood Hazard Areas:** Special flood hazard areas as digitized by the NRPC were used—just 100-year flood plain (500-year floodplain not mapped). The inclusion of this resource as a regional constraint is consistent with goals and policies of the Northwest Regional Plan. (*Source: NRPC*)
- **Ground and Surface Waters Drinking Protection Areas:** Buffered Source Protection Areas (SPAs) are designated by the Vermont Department of Environmental Conservation (DEC). SPA boundaries are approximate but are conservative enough to capture the areas most susceptible to contamination. The inclusion of this resource as a regional constraint is consistent with goals and policies of the Northwest Regional Plan. (*Source: Vermont Agency of Natural Resources [ANR]*)
- **Vermont Conservation Design Highest Priority Forest Blocks:** The lands and waters identified here are the areas of the state that are of highest priority for maintaining ecological integrity. Together, these lands comprise a connected landscape of large and intact forested habitat, healthy aquatic and riparian systems, and a full range of physical features (bedrock, soils, elevation, slope, and aspect) on which plant and animal natural communities depend. The inclusion of this resource as a regional constraint is consistent with goals and policies of the Northwest Regional Plan. (*Source: ANR*)
- **Public Water Sources:** A 200-foot buffer is used around public drinking water wellheads. The inclusion of this resource as a regional constraint is consistent with goals and policies of the Northwest Regional Plan. (*Source: ANR*)

- **National Natural Landmark – Chazy Fossil Reef:** The Chazy Fossil Reef in Isle La Motte has been designated a National Natural Landmark by the US Department of Interior. (*Source: NRPC*)
- **Municipal Conservation Land Use Areas:** Conservation Land Use Districts, as designated in municipal plans, that include strict language that strongly deters or prohibits development have been included as a regional known constraint. The inclusion of this resource as a regional constraint is consistent with the goals and policies of the Northwest Regional Plan. Specific municipal land use districts included are outlined in Section D.

STATE POSSIBLE CONSTRAINTS

- **Protected Lands:** This constraint includes public lands held by agencies with conservation or natural resource oriented missions, municipal natural resource holdings (ex. Town forests), public boating and fishing access areas, public and private educational institution holdings with natural resource uses and protections, publicly owned rights on private lands, parcels owned in fee by non profit organizations dedicated to conserving land or resources, and private parcels with conservation easements held by non profit organizations. (*Source: VCGI*)
- **Deer Wintering Areas:** Deer wintering habitat as identified by the Vermont Agency of Natural Resources. (*Source: VCGI*)
- **Hydric Soils:** Hydric soils as identified by the US Department of Agriculture. (*Source: VCGI*)
- **Agricultural Soils:** Local, statewide, and prime agricultural soils are considered. (*Source: VCGI*)
- **Act 250 Agricultural Soil Mitigation Areas:** Sites conserved as a condition of an Act 250 permit. (*Source: VCGI*)

REGIONALLY IDENTIFIED RESOURCES (REGIONAL POSSIBLE CONSTRAINTS)

- **Class 3 Wetlands:** Class 3 wetlands in the region have been identified have been included as a Regional Possible Constraint. The inclusion of this resource as a regional constraint is consistent with goals and policies of the Northwest Regional Plan (*Source: ANR*)
- **Municipal Conservation Land Use Areas:** Conservation Land Use Districts, as designated in municipal plans, that include strict language that deters, but does not prohibit development, have been included as a regional possible constraint. Specific municipal land use districts included are outlined in Section D.

OTHER MAP FEATURES

- **Three-Phase Distribution Lines:** All available utilities with service in any of the three regions (*Source: Green Mountain Power, Swanton Village Electric Department, Vermont Electric Coop, and Village of Enosburg Falls*) were mapped.
- **Transportation Infrastructure:** These were removed in the initial analysis performed by VCGI. Does not include parking lots. (*Source: VCGI*)
- **VELCO Transmission Lines and Substations:** (*Source: VCGI*)
- **Water Bodies:** Major water bodies (i.e., >1 square kilometer in surface area) are shown on maps as "Lakes/Ponds." (*Source: VCGI*)

D. WIND GENERATION MAPS

STATE KNOWN CONSTRAINTS

- **Confirmed and Unconfirmed Vernal Pools:** There is a 600-foot buffer around confirmed or unconfirmed vernal pools. (*Source: ANR*)

- **State Significant Natural Communities and Rare, Threatened, and Endangered Species:** Rankings S1 through S3 were used as constraints. These include all of the rare and uncommon rankings within the file. For more information on the specific rankings, explore the methodology for the shapefile. (*Source: VCGI*)
- **River Corridors:** Only mapped River Corridors were mapped. Does not include 50 foot buffer for streams with a drainage area less than 2 square miles. (*Source: VCGI*)
- **National Wilderness Areas:** (*Source: VCGI*)
- **FEMA Floodways:** (*Source: VCGI*)
- **Class 1 and Class 2 Wetlands:** (*Source: VCGI*)

REGIONALLY IDENTIFIED CRITICAL RESOURCES (REGIONAL KNOWN CONSTRAINTS)

- **Designated Downtowns, Designated Growth Centers, and Designated Village Centers:** These areas the center of dense, traditional development in the region. This constraint does not apply to roof-mounted solar within such designated areas. The inclusion of this resource as a regional constraint is consistent with goals and policies of the Northwest Regional Plan. (*Source: NRPC*)
- **FEMA Flood Insurance Rate Map (FIRM) Special Flood Hazard Areas:** Special flood hazard areas as digitized by the NRPC were used—just 100-year flood plain (500-year floodplain not mapped). The inclusion of this resource as a regional constraint is consistent with goals and policies of the Northwest Regional Plan. (*Source: NRPC*)
- **Ground and Surface Waters Drinking Protection Areas:** Buffered Source Protection Areas (SPAs) are designated by the Vermont Department of Environmental Conservation (DEC). SPA boundaries are approximate but are conservative enough to capture the areas most susceptible to contamination. The inclusion of this resource as a regional constraint is consistent with goals and policies of the Northwest Regional Plan. (*Source: Vermont Agency of Natural Resources [ANR]*)
- **Vermont Conservation Design Highest Priority Forest Blocks:** The lands and waters identified here are the areas of the state that are of highest priority for maintaining ecological integrity. Together, these lands comprise a connected landscape of large and intact forested habitat, healthy aquatic and riparian systems, and a full range of physical features (bedrock, soils, elevation, slope, and aspect) on which plant and animal natural communities depend. The inclusion of this resource as a regional constraint is consistent with goals and policies of the Northwest Regional Plan. (*Source: ANR*)
- **Public Water Sources:** A 200-foot buffer is used around public drinking water wellheads. The inclusion of this resource as a regional constraint is consistent with goals and policies of the Northwest Regional Plan. (*Source: ANR*)
- **National Natural Landmark – Chazy Fossil Reef:** The Chazy Fossil Reef in Isle La Motte has been designated a National Natural Landmark by the US Department of Interior. (*Source: NRPC*)
- **Municipal Conservation Land Use Areas:** Conservation Land Use Districts, as designated in municipal plans, that include strict language that strongly deters or prohibits development have been included as a regional known constraint. The inclusion of this resource as a regional constraint is consistent with the goals and policies of the Northwest Regional Plan. Specific municipal land use districts included are outlined in Section D.

STATE POSSIBLE CONSTRAINTS

- **Protected Lands:** This constraint includes public lands held by agencies with conservation or natural resource oriented missions, municipal natural resource holdings (ex. Town forests), public boating and fishing access areas, public and private educational institution holdings with natural resource uses and protections, publicly owned rights on private lands, parcels owned in fee by non profit organizations dedicated to conserving land or resources, and private parcels with conservation easements held by non profit organizations. (*Source: VCGI*)

- **Deer Wintering Areas:** Deer wintering habitat as identified by the Vermont Agency of Natural Resources. (*Source: VCGI*)
- **Hydric Soils:** Hydric soils as identified by the US Department of Agriculture. (*Source: VCGI*)
- **Agricultural Soils:** Local, statewide, and prime agricultural soils are considered. (*Source: VCGI*)
- **Act 250 Agricultural Soil Mitigation Areas:** Sites conserved as a condition of an Act 250 permit. (*Source: VCGI*)

REGIONALLY IDENTIFIED RESOURCES (REGIONAL POSSIBLE CONSTRAINTS)

- **Class 3 Wetlands:** Class 3 wetlands in the region have been identified have been included as a Regional Possible Constraint. The inclusion of this resource as a regional constraint is consistent with goals and policies of the Northwest Regional Plan (*Source: ANR*)
- **Municipal Conservation Land Use Areas:** Conservation Land Use Districts, as designated in municipal plans, that include strict language that deters, but does not prohibit development, have been included as a regional possible constraint. Specific municipal land use districts included are outlined in Section D.

OTHER MAP FEATURES

- **Three-Phase Distribution Lines:** All available utilities with service in any of the three regions (*Source: Green Mountain Power, Swanton Village Electric Department, Vermont Electric Coop, and Village of Enosburg Falls*) were mapped.
- **Transportation Infrastructure:** These were removed in the initial analysis performed by VCGI. Does not include parking lots. (*Source: VCGI*)
- **VELCO Transmission Lines and Substations:** (*Source: VCGI*)
- **Water Bodies:** Major water bodies (i.e., >1 square kilometer in surface area) are shown on maps as "Lakes/Ponds." (*Source: VCGI*)

E. HYDRO GENERATION MAPS

KNOWN CONSTRAINTS

- None

REGIONALLY IDENTIFIED RESOURCES (REGIONAL POSSIBLE CONSTRAINTS)

- **National Scenic and Recreational Rivers:** Known constraint; Missisquoi and Trout Rivers. This constraint will only be incorporated into the Hydroelectric Resource Map. Dams occurring within an impacted area will be displayed as such on maps. (*Source: Digitized by the BCRC from Upper Missisquoi and Trout Rivers, Wild and Scenic Study Management Plan*)

POSSIBLE CONSTRAINTS

- **"303d" List of Stressed Waters:** Possible constraint. This constraint will only be incorporated into the Hydroelectric Resource Map. Dams occurring within an impacted area will be displayed as such on maps. (*Source: ANR*)
- **Impaired Water:** Possible constraint. This constraint will only be incorporated into the Hydroelectric Resource Map. Dams occurring within an impacted area will be displayed as such on maps. (*Source: ANR*)

- **State Significant Natural Communities and Rare, Threatened, and Endangered Species:** Rankings S1 through S3 were used as constraints. These include all of the rare and uncommon rankings within the file. For more information on the specific rankings, explore the methodology for the shapefile. (*Source: VCGI*)

OTHER MAP FEATURES

- **Three-Phase Distribution Lines:** All available utilities with service in any of the three regions (*Source: Green Mountain Power, Swanton Village Electric Department, Vermont Electric Coop, and Village of Enosburg Falls*) were mapped.
- **Transportation Infrastructure:** These were removed in the initial analysis performed by VCGI. Parking lots are not included. (*Source: VCGI*)
- **VELCO Transmission Lines and Substations:** (*Source: VCGI*)
- **Water Bodies:** Major water bodies (i.e., >1 square kilometer in surface area) are shown on maps as "Lakes/Ponds." (*Source: VCGI*)

F. EXPLANATION OF MUNICIPAL CONSERVATION LAND USE AREAS

The NRPC conducted an analysis of municipal conservation land use area. The analysis reviewed the written descriptions of conservation land use areas from each municipal plan in the region. The intent of the analysis was to see if the conservation land use areas contained language that restricted future development (including the development of renewables). After review, the conservation land use areas from each municipal plan were divided into the following categories:

STRONGLY DETERS

These conservation land uses areas use language that prohibits development or only permits limited, low-density residential development. These areas are included as Regional Known Constraints on the Regional Energy Generation maps. Municipal conservation land use areas that meet this description include:

- Alburgh Town & Village – Conservation Land A
- Enosburgh – Conservation District
- Enosburgh Falls – Conservation District
- Fletcher – Forest District
- Grand Isle – Conservation District
- Montgomery – Conservation District II
- North Hero – Conservation District
- Richford – Recreation/Conservation District and Water Supply District
- St. Albans Town – Conservation District

DETERS

Several conservation land use areas in the region are described in municipal plans as areas where land use shall be restricted to conservation, forestry, and agricultural uses and/or are described as land that is geographically unsuitable for development. These areas are included as Regional Possible Constraints on the Regional Energy Generation maps. Municipal conservation land use areas that meet this description include:

- Alburgh Town and Village – Conservation Land B
- Bakersfield – Conservation District
- Fairfax – Conservation District
- Fairfield – Conservation District
- Fletcher – Conservation District
- Highgate – Forest Reserve District

- Highgate – Protected District
- Montgomery – Conservation District I
- Richford - Forest/Conservation District
- Sheldon – Rural Lands II
- Swanton Town and Village – Conservation District

NEUTRAL
These conservation land use areas may be identified in municipal plans as being geographically or topologically unsuitable for development, yet contain language that allows for some types of development. These areas have not been included on the Regional Energy Generation maps. Municipal conservation land use areas that meet this description include:

- Berkshire – Conservation District
- Georgia – Natural Areas District
- Georgia – Recreation District
- South Hero – Conservation District

DEVELOPMENT MAY OCCUR
These conservation land use areas do not contain language that restricts development. These areas have not been included on the Regional Energy Generation maps. Municipal conservation land use areas that meet this description include:

- Franklin – Conservation District

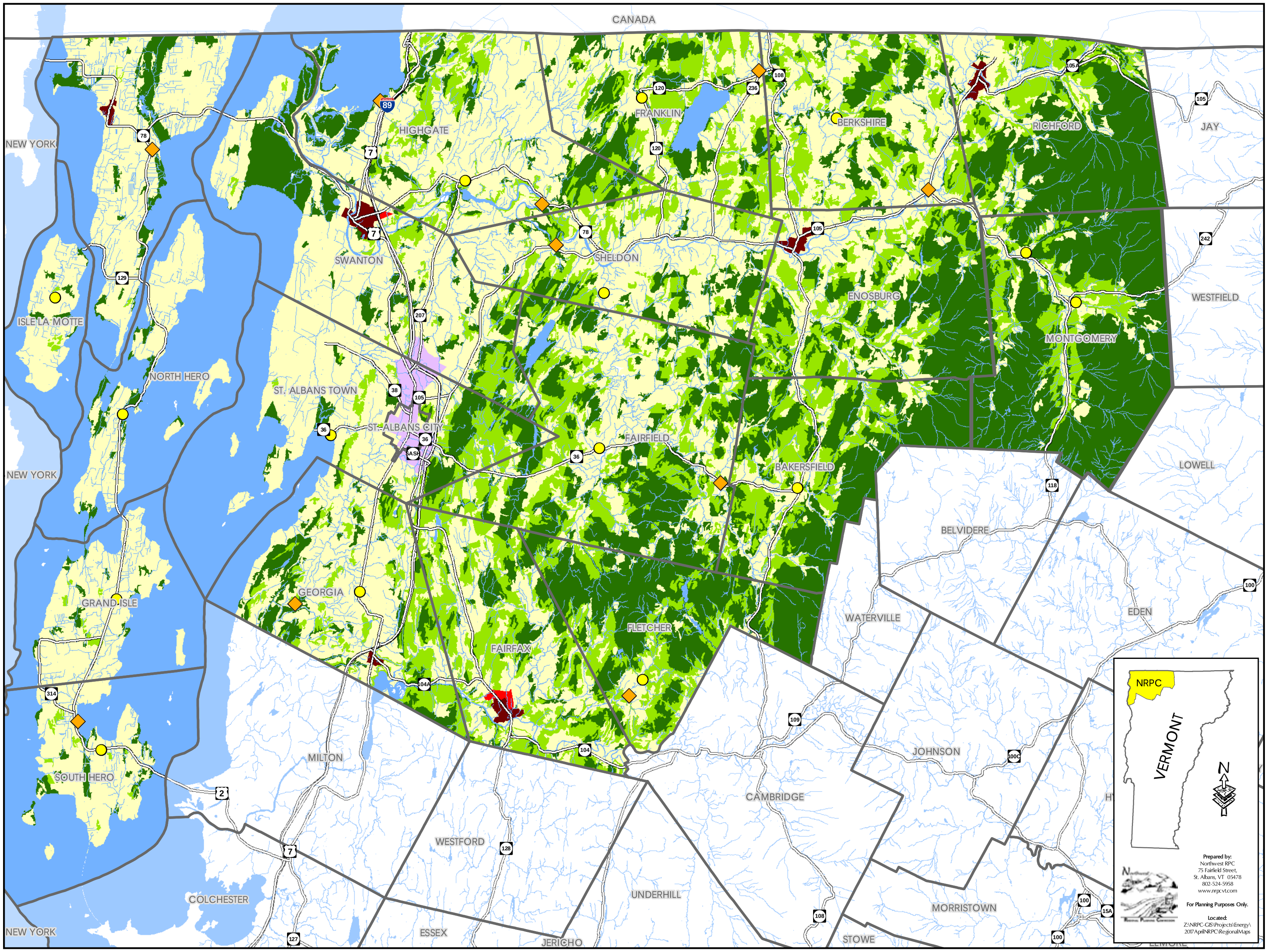
APPENDIX C

APPENDIX C - REGIONAL GENERATION MAPS

Proposed Land Use

Northwest Region, VT
Act 174
Energy Development Improvement Act of 2016

This map and the corresponding data is intended to be used to inform energy planning efforts by municipalities and regions. This may also be used for conceptual planning or initial site identification by those interested in developing renewable energy infrastructure. The maps do NOT take the place of site-specific investigation for a proposed facility and cannot be used of as "siting maps."



Legend

- Village
- Hamlet

Proposed Land Use Features

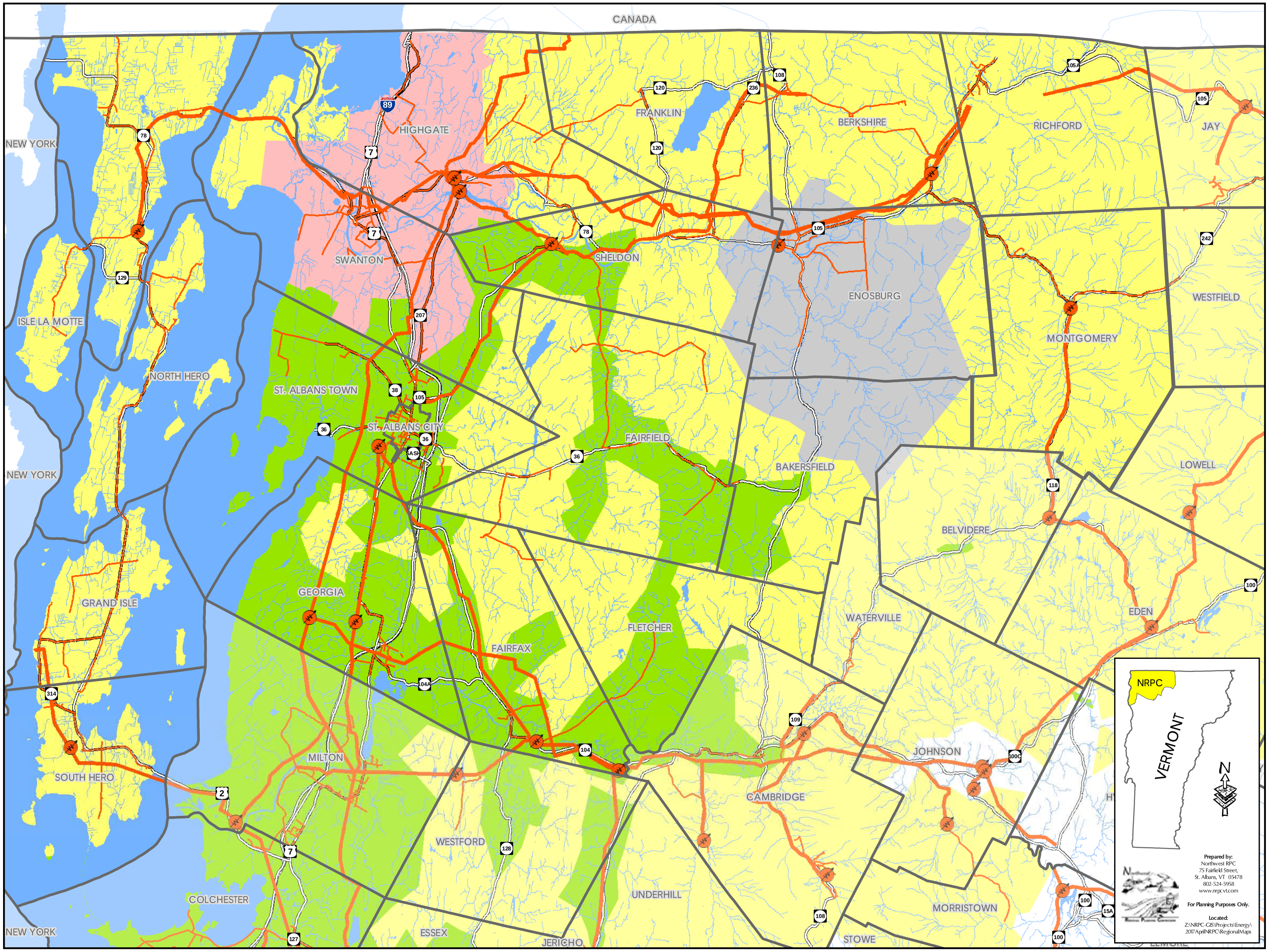
- Regional Growth Area
- Sub-Regional Growth Area
- Transitional Growth Area
- Agricultural Resource Planning Area
- Conservation & Forest Resource Planning Area
- Rural Planning Area

Sources: VCGI
Disclaimer: The accuracy of information presented is determined by its sources. Errors and omissions may exist. The Northwest RPC is not responsible for these. Questions of on-the-ground location can be resolved by site inspections and/or surveys by a registered surveyor. This map is not sufficient for delineation of features on-the-ground. This map identifies the presence of features, and may indicate relationships between features, but is not a replacement for surveyed information or engineering studies.

0 1 2 3 4 Miles

Utility Service Areas

Northwest Region, VT
Act 174
Energy Development Improvement Act of 2016



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Legend

- Substation
- 3 Phase Power Line
- Transmission Line

Utility Service Area Features

- Green Mountain Power
- Swanton Village Electric
- Vermont Electric Co-op
- Enosburg Falls Electric

Sources: VCGI
Disclaimer: The accuracy of information presented is determined by its sources. Errors and omissions may exist. The Northwest RPC is not responsible for these. Questions of on-the-ground location can be resolved by site inspections and/or surveys by a registered surveyor. This map is not sufficient for delineation of features on-the-ground. This map identifies the presence of features, and may indicate relationships between features, but is not a replacement for surveyed information or engineering studies.

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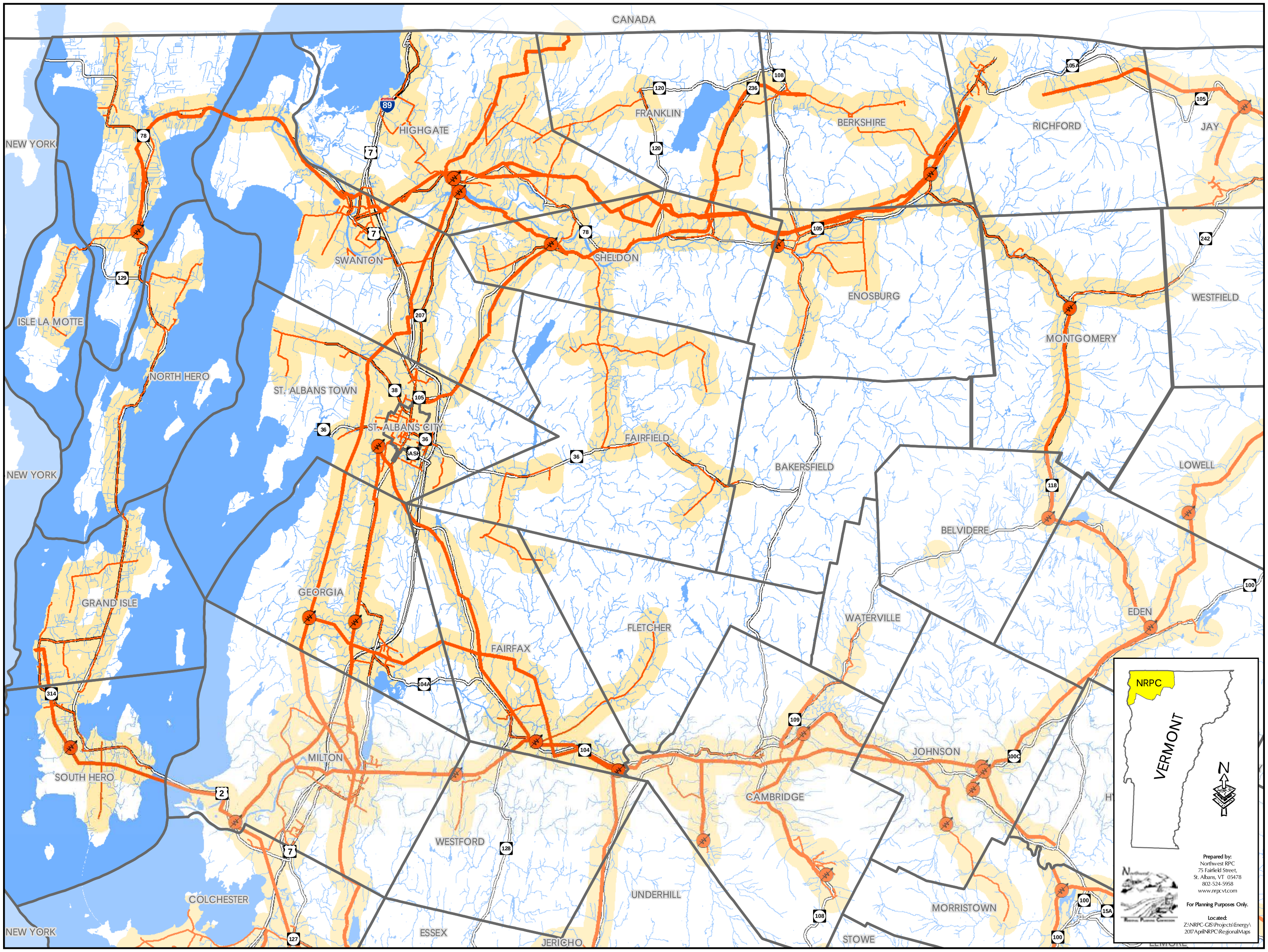

Transmission and 3 Phase Power Infrastructure

Northwest Region, VT
Act 174
Energy Development Improvement Act of 2016

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Legend

- Substation
- 3 Phase Power Line
- Transmission Line
- 1/2 Mile Buffer (3 Phase Power Line & Transmission Line)

Sources: VCGI
Disclaimer: The accuracy of information presented is determined by its sources. Errors and omissions may exist. The Northwest RPC is not responsible for these. Questions of on-the-ground location can be resolved by site inspections and/or surveys by a registered surveyor. This map is not sufficient for delineation of features on-the-ground. This map identifies the presence of features, and may indicate relationships between features, but is not a replacement for surveyed information or engineering studies.

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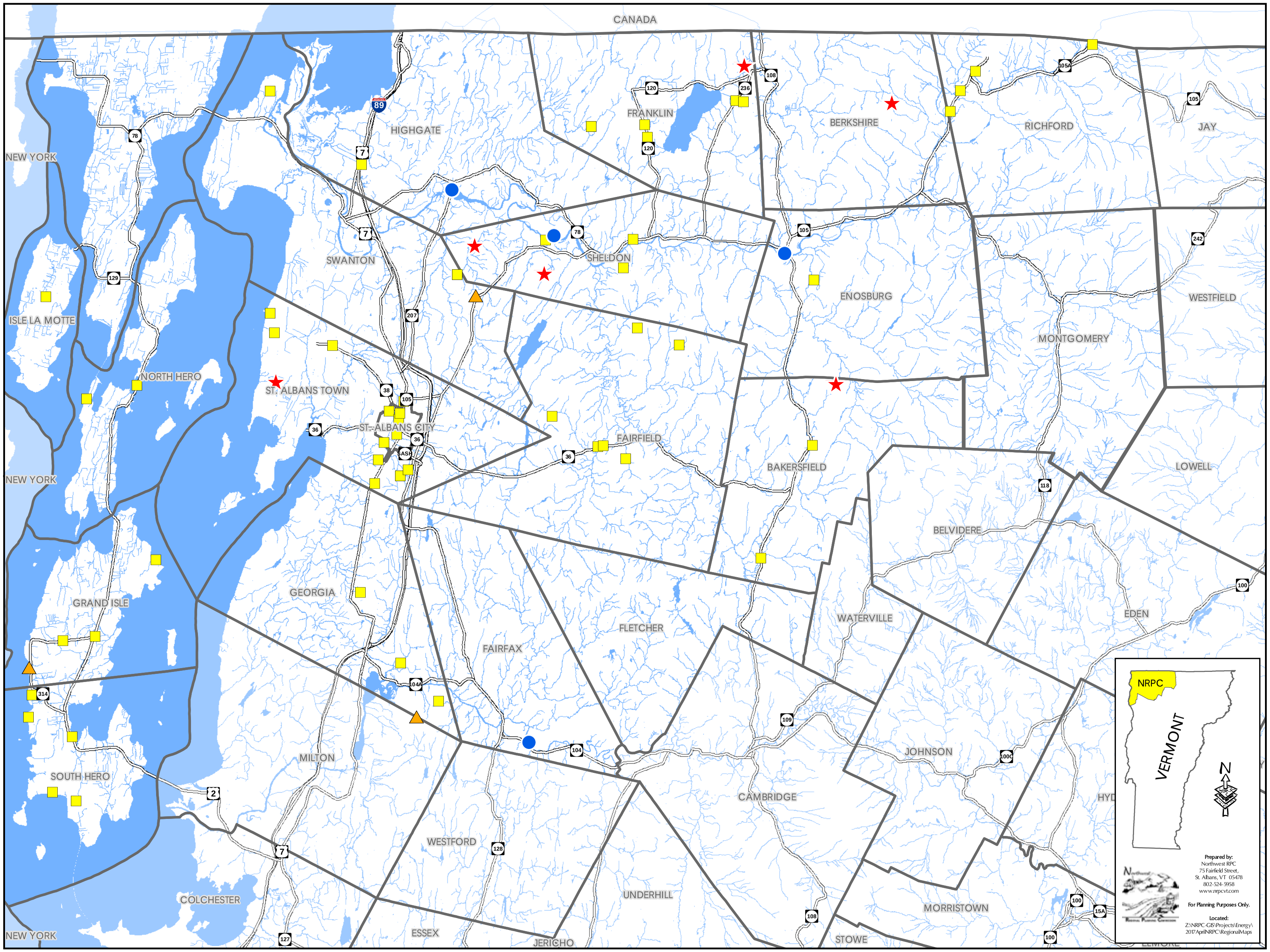

Existing Generation Facilities

Northwest Region, VT
Act 174
Energy Development Improvement
Act of 2016

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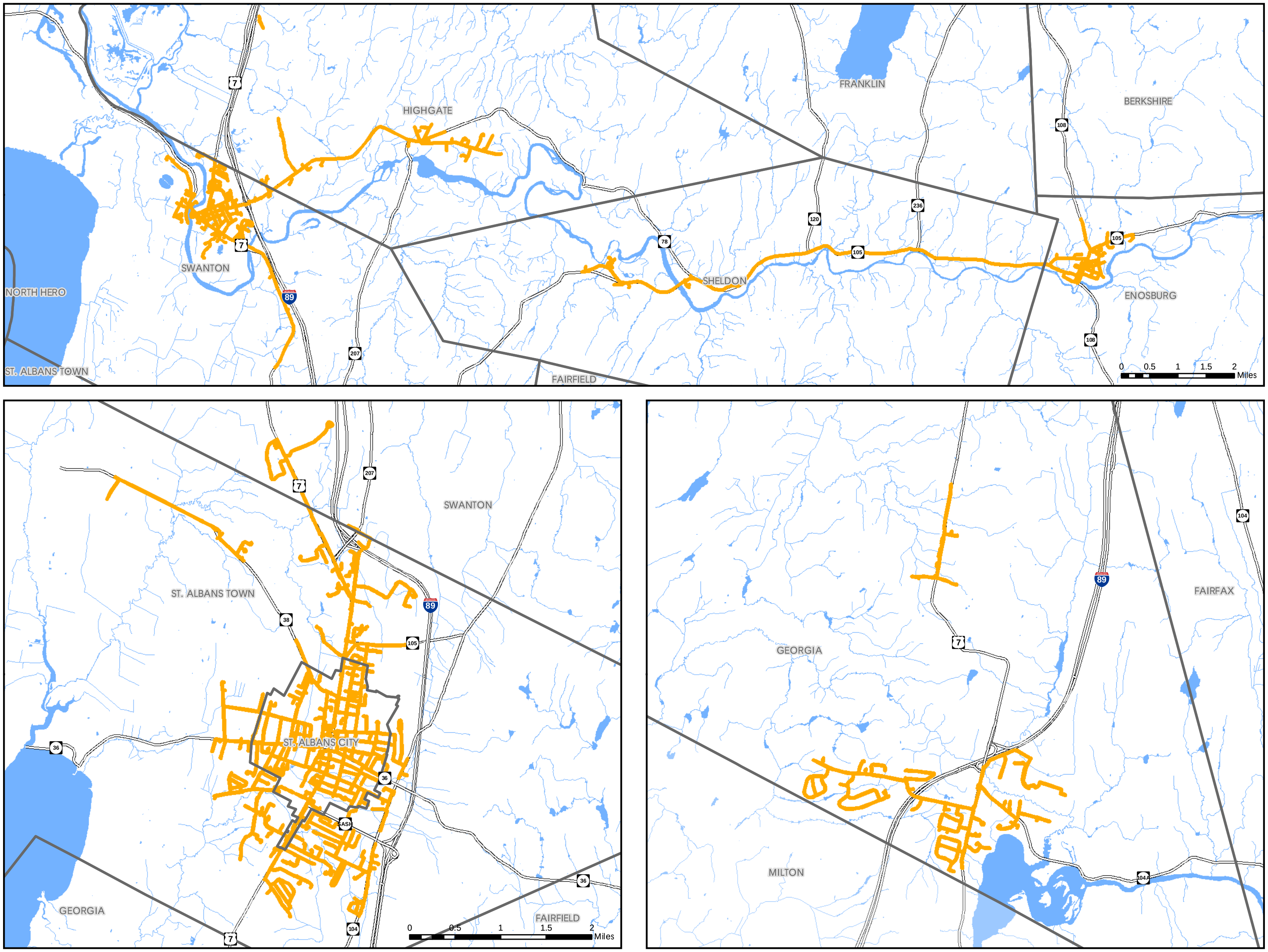
Legend

- Biomass Facility
- Hydro Facility
- Solar Facility
- Wind Facility

Note: Only generators 15kW are shown on the map. A full list of all generators is available.

Sources: VCGI
Disclaimer: The accuracy of information presented is determined by its sources. Errors and omissions may exist. The Northwest RPC is not responsible for these. Questions of on-the-ground location can be resolved by site inspections and/or surveys by a registered surveyor. This map is not sufficient for delineation of features on-the-ground. This map identifies the presence of features, and may indicate relationships between features, but is not a replacement for surveyed information or engineering studies.

0 1 2 3 4 Miles



Natural Gas Lines

Northwest Region, VT
Act 174
Energy Development Improvement Act of 2016

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Legend

Natural Gas Line

Sources: VCGI
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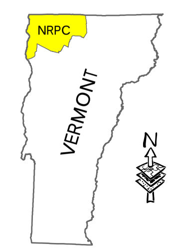

Prepared by:
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802-524-5958
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For Planning Purposes Only.

Located:
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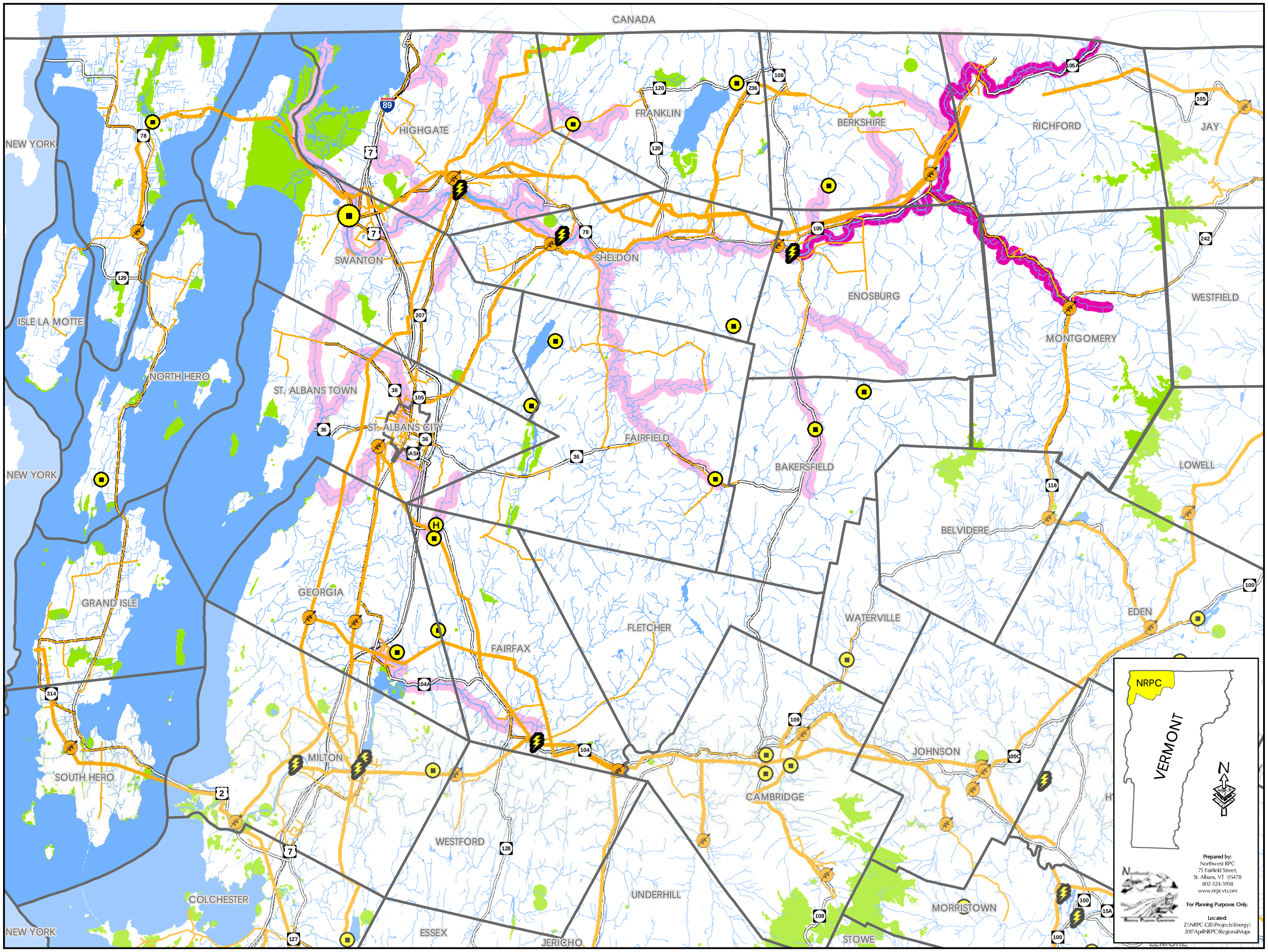

Hydro

Northwest Region, VT
Act 174
Energy Development Improvement Act of 2016

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Legend

- Substation
- 3 Phase Power Line
- Transmission Line
- Designated Outstanding Resource Water
- Known Constraint - Designated National Wild & Scenic River
- Possible Constraint - Stressed or Impaired Water
- Possible Constraint - RINAs

Potential Hydroelectric Facility

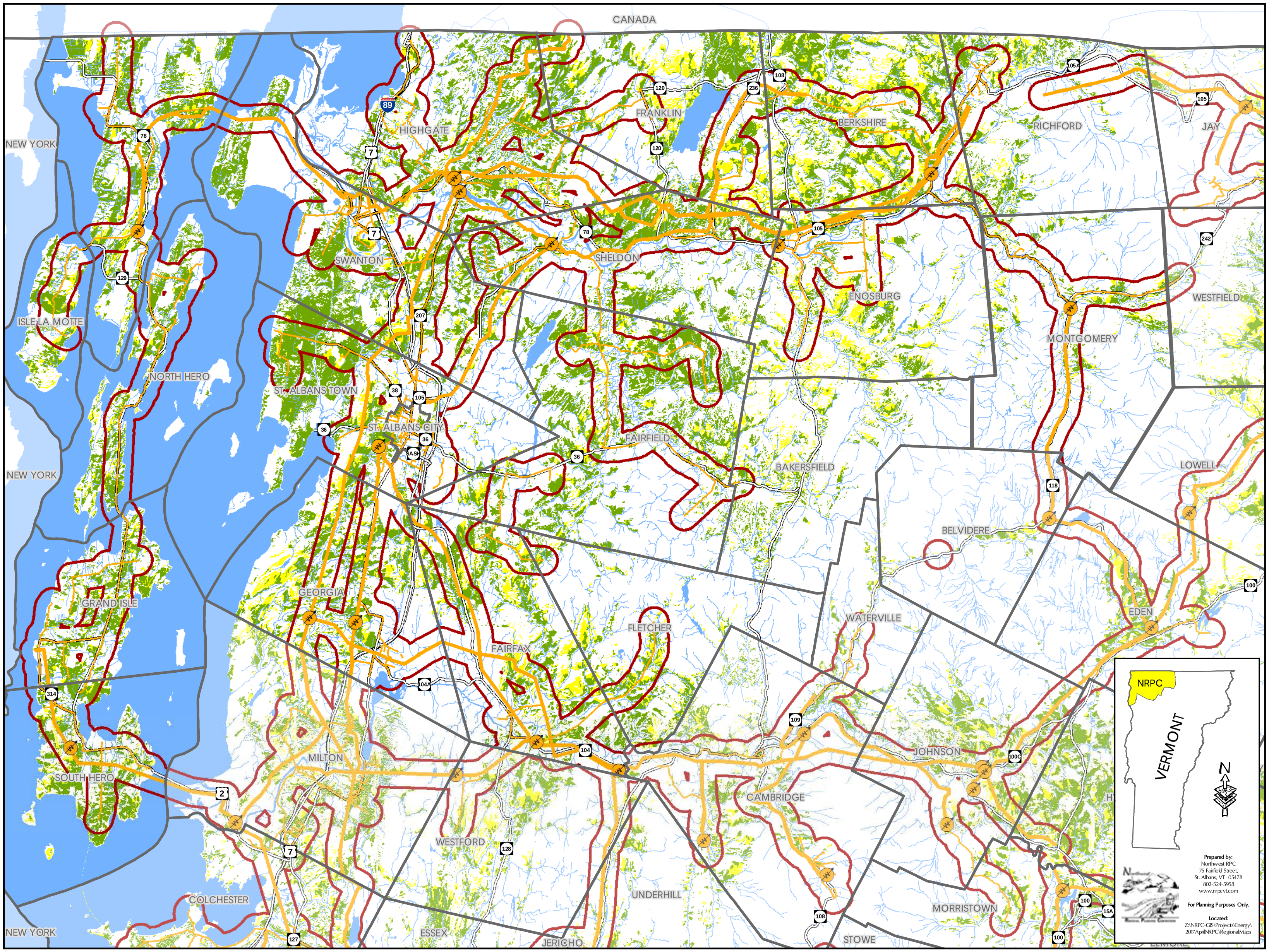
- < 50 kW Capacity
- > 50 kW Capacity
- High Hazard with < 50 kW Capacity
- High Hazard with > 50 kW Capacity

Operating Hydroelectric Facility

- Dam not on National Wild and Scenic River
- Dam on National Wild and Scenic River

Sources: VCGI
Disclaimer: The accuracy of information presented is determined by its sources. Errors and omissions may exist. The Northwest RPC is not responsible for these. Questions of on-the-ground location can be resolved by site inspections and/or surveys by a registered surveyor. This map is not sufficient for delineation of features on-the-ground. This map identifies the presence of features, and may indicate relationships between features, but is not a replacement for surveyed information or engineering studies.

0 1 2 3 4 Miles



Solar

Northwest Region, VT
Act 174
Energy Development
Improvement
Act of 2016

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Legend

- Substation
- 3 Phase Power Line
- Transmission Line
- 1/2 Mile Buffer (3 Phase Power Line & Transmission Line)
- Prime Solar/No Known Constraints
- Base Solar/Possible Constraints

Sources: VCGI
Disclaimer: The accuracy of information presented is determined by its sources. Errors and omissions may exist. The Northwest RPC is not responsible for these. Questions of on-the-ground location can be resolved by site inspections and/or surveys by a registered surveyor. This map is not sufficient for delineation of features on-the-ground. This map identifies the presence of features, and may indicate relationships between features, but is not a replacement for surveyed information or engineering studies.

0 1 2 3 4 Miles

Wind

Northwest Region, VT
Act 174
Energy Development Improvement Act of 2016

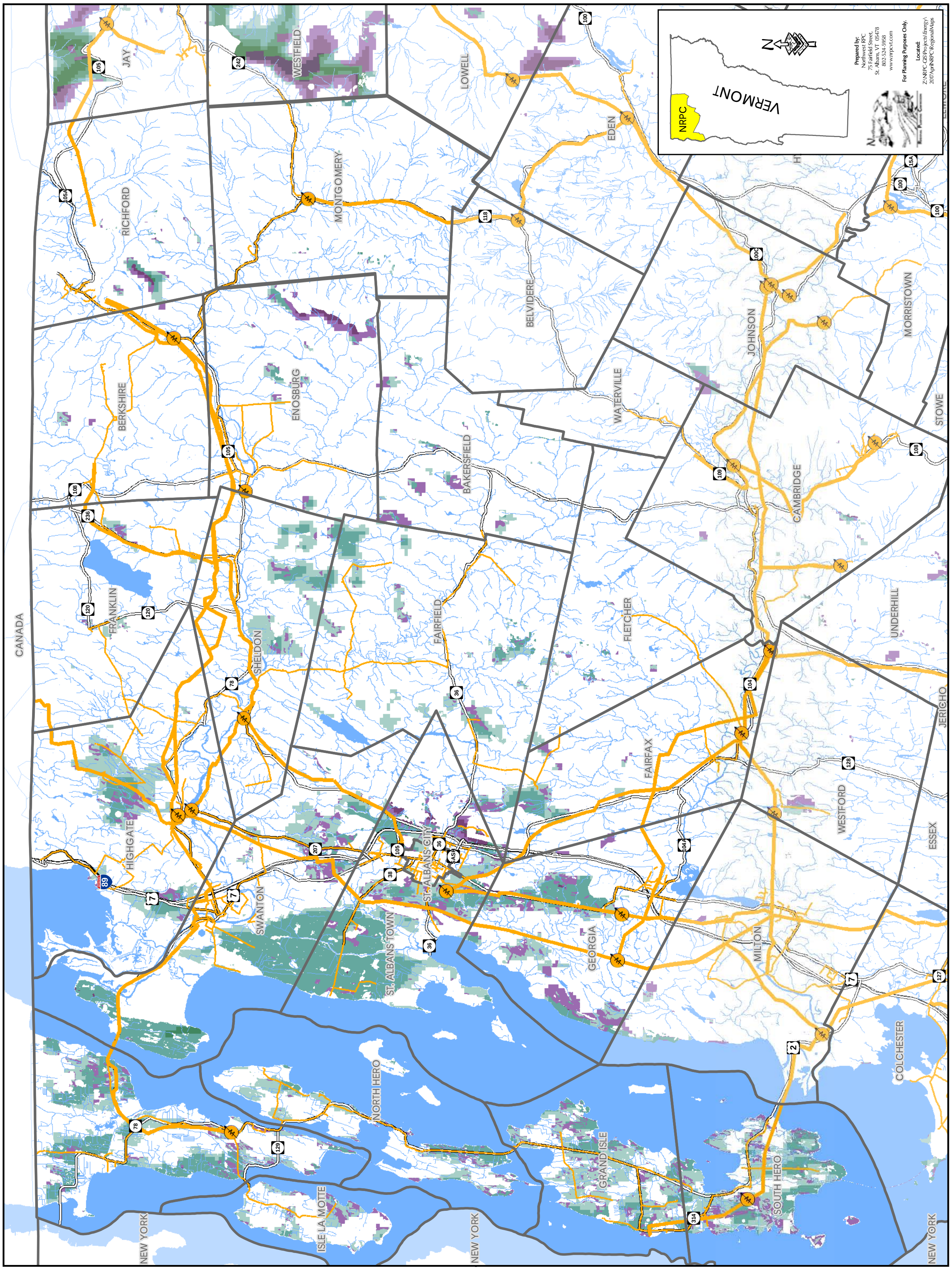
This map and the corresponding data is intended to be used to inform energy planning efforts by municipalities and regions. This may also be used for conceptual planning or initial site identification by those interested in developing renewable energy infrastructure. The maps do NOT take the place of site-specific investigation for a proposed facility and cannot be used of as "siting maps."

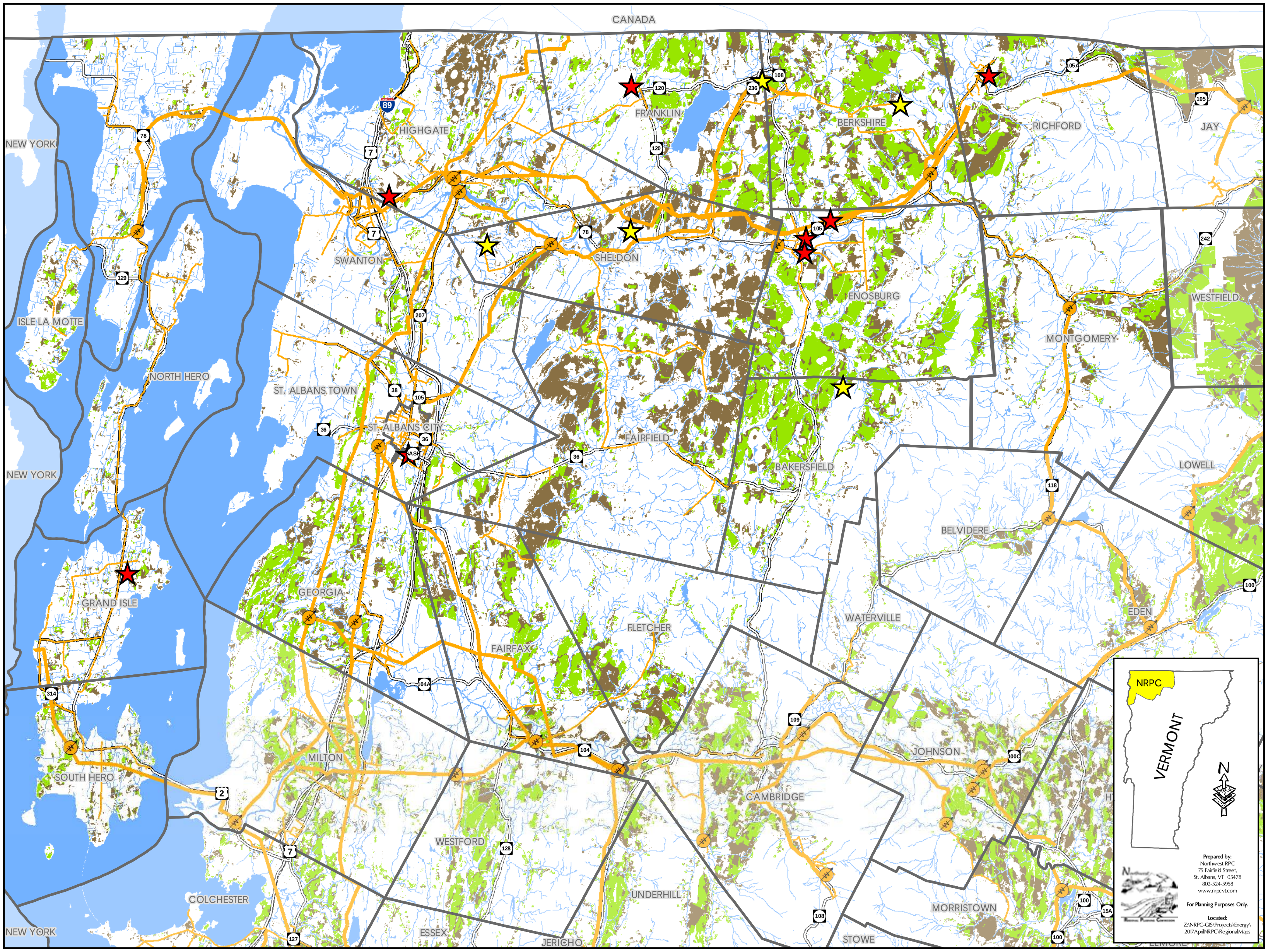
Legend

- Substation
- 3 Phase Power Line
- Transmission Line
- Prime Wind: Areas of high wind potential and no known constraints. Darker areas have higher wind speeds.
- Base Wind: Areas of high wind potential and a presence of possible constraints. Darker areas have higher wind speeds.

Sources: VCGI
Disclaimer: The accuracy of information presented is determined by its sources. Errors and omissions may exist. The Northwest RPC is not responsible for these. Questions of on-the-ground location can be resolved by site inspections and/or surveys by a registered surveyor. This map is not sufficient for delineation of features on-the-ground. This map identifies the presence of features, and may indicate relationships between features, but is not a replacement for surveyed information or engineering studies.

0 1 2 3 4 Miles





Woody Biomass

Northwest Region, VT
Act 174
Energy Development
Improvement
Act of 2016

This map and the corresponding data is intended to be used to inform energy planning efforts by municipalities and regions. This may also be used for conceptual planning or initial site identification by those interested in developing renewable energy infrastructure. The maps do NOT take the place of site-specific investigation for a proposed facility and cannot be used of as "siting maps."

Legend
- Biomass System
- Cow Power
- Substation
- 3 Phase Power Line
- Transmission Line
- Prime Woody Biomass/ No Known Constraints
- Base Woody Biomass/ Possible Constraints

Sources: VCGI
Disclaimer: The accuracy of information presented is determined by its sources. Errors and omissions may exist. The Northwest RPC is not responsible for these. Questions of on-the-ground location can be resolved by site inspections and/or surveys by a registered surveyor. This map is not sufficient for delineation of features on-the-ground. This map identifies the presence of features, and may indicate relationships between features, but is not a replacement for surveyed information or engineering studies.

0 1 2 3 4 Miles

APPENDIX

D

APPENDIX D - SUMMARY OF PLANNING APPROACH AND PROCESS

APPENDIX D - SUMMARY OF PLANNING APPROACH AND PROCESS

This plan is the result of more than two years of work completed by NRPC staff, NRPC commissioners, and various stakeholders throughout the region and the state. This plan builds on previous energy planning efforts in the region and the efforts of the Public Service Department.

During the spring, summer, and fall of 2015, the NRPC worked with two other regional planning commissions—the Bennington County Regional Commission and the Two Rivers-Ottauquechee Regional Commission—to meet with stakeholders and discuss several issues. Meeting topics included the following: mapping and geographic information, thermal efficiency, transportation, and electricity conservation and efficiency. From these stakeholder meetings, many of the strategies in Section IV and Section V were formulated. The NRPC also worked to collect a large amount of the data used in the plan—much of which is cataloged in Section III—during this same time period.

Starting in the summer of 2015, the NRPC formed a Regional Energy Committee. Composed primarily of regional commissioners, the 12 members of the committee met monthly to discuss the development of the plan. Much of the committee's early work consisted of aiding staff in the development of the Regional Energy Generation Maps discussed in Section IV. The committee also provided direction for the development of this plan.

The NRPC held two public meetings in December 2015—one in North Hero and the other in Enosburg Falls—to inform the public about the project and to solicit public input regarding the Renewable Energy Generation Maps. This public input was then analyzed and assessed by the Regional Energy Committee and incorporated into this plan.

A first draft of the plan was reviewed by the NRPC Energy Committee and the Department of Public Service in the summer of 2016. Additional revisions were made, and a draft was released for public comment in October 2016. After releasing the draft plan, the NRPC collected comments from individuals, municipalities, public utilities, and other regional stakeholders. These comments influenced the content—including the strategies and energy generation maps—and the construction of the adopted Regional Energy Plan.

Additional revisions were made to the draft Regional Energy Plan after the release of the "Regional Determination Standards" by the Vermont Department of Public Service in November 2016. The plan then underwent hearings before the Board of Regional Commissioners in May 2017 and June 2017.

The following organizations were integral to the development of the plan through their involvement in the stakeholders process in 2015 or through direct feedback on drafts of the plan released by the NRPC 2016 and 2017:

- Champlain Valley Office of Economic Opportunity
- Chittenden County Regional Planning Commission
- Energy Action Network
- Green Mountain Power
- NeighborWorks of Western Vermont
- Renewable Energy Vermont
- VELCO
- Vermont Agency of Commerce and Community Development
- Vermont Agency of Transportation
- Vermont Center for Geographic Information
- Vermont Energy Investment Corporation and Efficiency Vermont
- Vermont Electric Cooperative
- Vermont Gas
- Vermont Natural Resources Council
- Vermont Public Power Supply Authority
- Vermont Public Transportation Association
- Vermont Public Service Department
- Vermont Sustainable Jobs Fund
- Village of Swanton Electric Department
- Village of Enosburg Falls Electric Department
- Vital Communities

APPENDIX

E

APPENDIX E - LISTS OF ACRONYMS

APPENDIX E - LISTS OF ACRONYMS

- ACCD – Vermont Agency of Commerce and Community Development
- ACS – American Community Survey
- ANR – Vermont Agency of Natural Resources
- BCRC – Bennington County Regional Commission
- BERC – Biomass Energy Resource Center
- BTU – British thermal unit
- CBES – Commercial Building Energy Standards
- CCRPC – Chittenden County Regional Planning Commission
- C.I.D.E.R. - Champlain Islanders Developing Essential Resources
- CNG – compressed natural gas
- CPG – Certificate of Public Good
- CVOEO – Champlain Valley Office of Economic Opportunity
- DC – direct current
- EAN – Energy Action Network
- EIA – Energy Information Administration
- ESP – energy service provider
- EV – electric vehicle
- EVT – Efficiency Vermont
- FCIDC – Franklin County Industrial Development Corporation
- GMP – Green Mountain Power
- GMT – Green Mountain Transit
- GT – green tons
- kW – kilowatts
- LEAP – Long-range Energy Alternatives Planning
- LP(G) – liquefied petroleum gas (propane)
- NAICS - North American Industry Classification System
- NALG – net available low-grade growth (wood)
- NRPC – Northwest Regional Planning Commission
- NYPA – New York Power Authority
- MW – megawatts
- PSB – Public Service Board
- RBES – Residential Building Energy Standards
- REC – Renewable Energy Credit
- RINAs – rare and irreplaceable natural resources
- RPC - regional planning commission
- TES – Total Energy Study
- TPI – Transportation Planning Initiative
- TRORC – Two Rivers-Ottauquechee Regional Commission
- VCGI – Vermont Center for Geographic Information
- VEC – Vermont Electric Cooperative
- VEIC – Vermont Energy Investment Corporation
- VELCO – Vermont Electric Power Company
- VMT – vehicle miles traveled
- VPPSA – Vermont Public Power Supply Authority
- VTrans – Vermont Agency of Transportation
- VY – Vermont Yankee

APPENDIX

F

APPENDIX F - NORTHWEST REGION - EXISTING RENEWABLE GENERATION FACILITY SUMMARY

APPENDIX F - NORTHWEST REGION - EXISTING RENEWABLE GENERATION FACILITY SUMMARY

The following is a summary of all existing renewable generation facilities in the Northwest Region organized by municipality. For maps showing the location of each renewable generation facility in the region, please visit the Energy Action Network's Community Energy Dashboard: http://www.vtenergydashboard.org/.

EXISTING REGIONAL GENERATION

Municipality	Solar Facilities	Solar Generation Capacity (MW)	Wind Facilities	Wind Generation Capacity (MW)	Hydro Facilities	Hydro Generation Capacity (MW)	Anaerobic Digester Sites	Anaerobic Digester Capacity (MW)
Alburgh	15	0.11	0	0.000	0	0	0	0.00
Bakersfield	21	0.14	2	0.012	0	0	1	0.40
Berkshire	8	0.07	1	0.010	0	0	1	0.60
Enosburgh	23	0.29	2	0.003	1	2	0	0.00
Fairfax	73	0.43	1	0.003	1	3.6	0	0.00
Fairfield	38	0.74	3	0.025	0	0	0	0.00
Fletcher	19	0.11	0	0.000	0	0	0	0.00
Franklin	17	0.2	1	0.003	0	0	1	0.18
Georgia	70	0.71	3	5.017	0	0	0	0.00
Grand Isle	34	0.27	5	0.132	0	0	0	0.00
Highgate	13	0.09	0	0.000	1	9.4	0	0.00
Isle La Motte	6	0.08	0	0.000	0	0	0	0.00
Montgomery	11	0.07	0	0.000	0	0	0	0.00
North Hero	13	0.1	0	0.000	0	0	0	0.00
Richford	8	0.13	1	0.010	0	0	0	0.00
St Albans City	44	0.93	0	0.000	0	0	0	0.00
St Albans Town	109	4.33	3		0	0	1	0.30
Sheldon	23	2.5	0	0.000	1	26.38	2	0.83
South Hero	51	0.39	2	0.005	0	0	0	0.00
Swanton	42	0.79	2	0.029	0	0	0	0.00

Source: *EAN Community Energy Dashboard*

APPENDIX G

APPENDIX G - MUNICIPAL ANALYSIS & TARGETS

Municipal Analysis & Targets - Alburgh

The following is an explanation of the municipal energy data compiled by Northwest Regional Planning Commission (NRPC). The intent of the municipal energy data is to provide the municipalities with data required to ensure compliance with the requirements of Act 174 and "Enhanced Energy Planning" (24 V.S.A. 4352). The following tables contain data that estimates current energy use and provides targets for future energy use across all sectors (transportation, heating, and electricity). It also sets targets for renewable energy generation within the municipality.

This data is meant to be a starting point for the municipality to begin planning its energy future and to talk about the changes that may need to occur within the municipality to ensure that local, regional and state energy goals are met. This includes the State of Vermont's goal to have 90% of all energy demand be met from renewable sources by 2050.

Figure 1 - Data Sources

ACS – American Community Survey

DOL –Vermont Department of Labor

DPS – Vermont Department of Public Service

EIA – Energy Information Administration

EVT – Efficiency Vermont

LEAP – Long-Range Energy Alternatives Planning

VEIC – Vermont Energy Investment Corporation

VTrans – Vermont Agency of Transportation

Data Sources

Estimates of current energy use consist primarily of data available from the American Community Survey (ACS), the Vermont Agency of Transportation (VTrans), the Vermont Department of Labor (DOL), and the Vermont Department of Public Service (DPS). Targets for future energy use are reliant upon the Long-range Energy Alternatives Planning (LEAP) analysis for the region completed the Vermont Energy Investment Corporation (VEIC). Targets for future energy generation have come from the regional planning commission and DPS. For more information on LEAP, see the Northwest Regional Energy Plan (www.nrpcvt.com). Targets for both future energy use and energy generation have been generally developed using a "top down" method of disaggregating regional data to the municipal level.

It is possible to develop "bottom up" data. For those municipalities interested in that approach, please see the Department of Public Service's Analysis and Targets Guidance (http://publicservice.vermont.gov/content/act-174-recommendations-and-determination-standards).

Please remember that the targets established by LEAP represent only one way to achieve energy goals. There may several other similar pathways that a municipality may choose to take in order to meet the 90x50 goal.

Below is a worksheet by worksheet explanation of the Municipal Template spreadsheet:

1. Municipal Data Summary

The following tables summarize all data that is required to be in a municipal plan if the plan is to meet the "determination" standards established by the Vermont Department of Public Service.

Table 1A: Current Municipal Transportation Energy Use	
Transportation Data	Municipal Data
Total # of Passenger Vehicles (ACS 2011-2015)	1,398
Average Miles per Vehicle (Vtrans)	11,356
Total Miles Traveled	15,875,688
Realized MPG (2013 - VTrans 2015 Energy Profile)	18.6
Total Gallons Use per Year	853,532
Transportation BTUs (Billion)	103
Average Cost per Gallon of Gasoline (RPC)	2.31
Gasoline Cost per Year	1,971,658

This table uses data from the American Community Survey (ACS) and Vermont Agency of Transportation (VTrans) to calculate current transportation energy use and energy costs in the municipality.

Table 1B: Current Municipal Residential Heating Energy Use				
Fuel Source	Municipal Households (ACS 2011-2015)	% of Municipal Households	Municipal Square Footage Heated	Municipal BTU (in Billions)
Natural Gas	2	0.3%	3,808	0
Propane	77	10.8%	133,936	8
Electricity	0	0.0%	0	0
Fuel Oil	478	67.0%	829,856	50
Coal	0	0.0%	0	0
Wood	146	20.5%	257,568	15
Solar	0	0.0%	0	0
Other	10	1.4%	19,040	1
No Fuel	0	0.0%	0	0
Total	713	100.0%	1,244,208	75

This table displays data from the ACS that estimates current municipal residential heating energy use.

Table 1C: Current Municipal Commercial Energy Use

	Commercial Establishments in Municipality (VT DOL)	Estimated Thermal Energy BTUs per Commercial Establishment (in Billions) (VDPS)	Estimated Thermal Energy BTUs by Commercial Establishments in Municipality (in Billions)
Municipal Commercial Energy Use	38	0.725	28

The table uses data available from the Vermont Department of Labor (VT DOL) and the Vermont Department of Public Service (DPS) to estimate current municipal commercial establishment energy use in the municipality.

Table 1D: Current Electricity Use

Use Sector	Current Electricity Use
Residential (kWh)	6,409,401
Commercial and Industrial (kWh)	9,749,783
Total (kWh)	16,159,184

This table displays current electricity use within the municipality. This data is available from Efficiency Vermont (EVT).

Table 1E: Residential Thermal Efficiency Targets

	2025	2035	2050
"Residential - Increased Efficiency and Conservation (% of municipal households to be weatherized)"	5%	16%	78%

This table displays targets for thermal efficiency of residential structures. The data is based on a methodology developed by DPS using data available from the regional Long-range Energy Alternatives Planning (LEAP) analysis and ACS. The data in this table represents the percentage of municipal households that will need to be weatherized in the target years. The target is cumulative.

Table 1F: Commercial Thermal Efficiency Target

	2025	2035	2050
"Commercial - Increased Efficiency and Conservation (% of commercial establishments to be weatherized)"	25%	25%	73%

This table shows the same information as Table 1E, but sets a target for commercial thermal efficiency and weatherization. Information from the VT DOL is required to complete this target. The target is cumulative.

Table 1G: Thermal Fuel Switching (Residential and Commercial) – Wood Systems

	2025	2035	2050
New Efficient Wood Heat Systems (in units)	0	0	4

This table provides a target for new wood heating systems for residential and commercial structures in the municipality for each target year. This target was calculated using data from LEAP and ACS. The target is cumulative.

Table 1H: Thermal Fuel Switching (Residential and Commercial) – Heat Pumps

	2025	2035	2050
New Heat Pumps (in units)	85	195	365

This table provides a target for new heat pump systems for residential and commercial structures in the municipality for each target year. This target was calculated using data from LEAP and ACS. The target is cumulative.

Table 1I: Electricity Efficiency Targets

	2025	2035	2050
Increase Efficiency and Conservation (BTUs)	25.2%	48.3%	100.7%

Data in this table displays a target for increased electricity efficiency and conservation during the target years. This target will be met through conversions to high efficiency appliances, electric heat pumps, and electric light-duty vehicles. These targets were developed using regional LEAP analysis. The target is cumulative.

Table 1J: Use of Renewables – Transportation

	2025	2035	2050
Renewable Energy Use - Transportation (BTUs)	9.6%	31.2%	90.3%

This data displays targets for the percentage of transportation energy use coming from renewable sources during each target year. This target will be met through conversions to electric light-duty vehicles and biodiesel heavy-duty vehicles. This data was developed using the LEAP analysis. The target is cumulative.

Table 1K: Use of Renewables – Heating

	2025	2035	2050
Renewable Energy Use - Heating (BTUs)	45.1%	58.3%	86.2%

This data displays targets for the percentage of heating energy use coming from renewable sources during each target year. This target will be met through conversions to electric heat pumps and high efficiency wood heating systems. This data was developed using information from the LEAP analysis. The target is cumulative.

Table 1L: Use of Renewables – Electricity

	2025	2035	2050
Renewable Energy Use - Electricity (MWh)	4,371.9	8,743.9	13,248.3

This data displays targets for MWh of electricity generation coming from renewable sources within the municipality during each target year. This data was developed using information from the regional planning commission and DPS. This data is the same as the data in Table 1Q. The target is cumulative.

Table 1M: Transportation Fuel Switching Targets – Electric Vehicles

	2025	2035	2050
Electric Vehicles	122	916	2,179

This tables displays a target for switching from fossil fuel based vehicles (gasoline and diesel) to electric vehicles. This target is calculated using LEAP and ACS data. The target is cumulative.

Table 1N: Transportation Fuel Switching Targets – Biodiesel

	2025	2035	2050
Biodiesel Vehicles	215	427	823

This tables displays a target for switching from fossil fuel based vehicles to biodiesel-powered vehicles. This target is calculated using LEAP and ACS data. The target is cumulative.

Table 1O: Existing Renewable Generation

Renewable Type	MW	MWh
Solar	0.11	134.90
Wind	0.00	0.00
Hydro	0.00	0.00
Biomass	0.00	0.00
Other	0.00	0.00
Total Existing Generation	0.11	134.90

Table 1O shows existing renewable generation in the municipality, in MW and MWh, based on information available from the Vermont Department of Public Service.

Table 1P: Renewable Generation Potential

Renewable Type	MW	MWh
Rooftop Solar	1	1,107
Ground-mounted Solar	837	1,026,653
Wind	1,658	5,084,685
Hydro	0.01	28
Biomass and Methane	0	0
Other	0	0
Total Renewable Generation Potential	2,496	6,112,473

Renewable generation potential is based on mapping completed by the regional planning commission that is based on the Municipal Determination Standards and associated guidance documents developed by DPS. The renewable generation potential is expressed in MW and MWh by the type of renewable resource (solar, wind, hydro, etc.).

Table 1Q: Renewable Generation Targets

	2025	2035	2050
Total Renewable Generation Target (in MWh)	4,371.94	8,743.89	13,248.31

This data displays targets for MWh of electricity generation coming from renewable sources within the municipality during each target year. This data was developed using information from the regional planning commission and DPS. This data is the same as the data in Table 1L.

Table 1R: Sufficient Land?

	Y/N
Solar	Y
Wind	Y

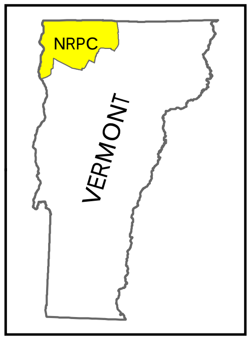
This table shows whether or not there is sufficient land in the municipality to meet the renewable generation targets based on the renewable generation potential in the municipality.

Utility Service Areas

Alburgh, Vermont
Act 174
The Energy Development Improvement Act of 2016

This map and the corresponding data is intended to be used to inform energy planning efforts by municipalities and regions. This may also be used for conceptual planning or initial site identification by those interested in developing renewable energy infrastructure. The maps do NOT take the place of site-specific investigation for a proposed facility and cannot be used of as "siting maps."

N

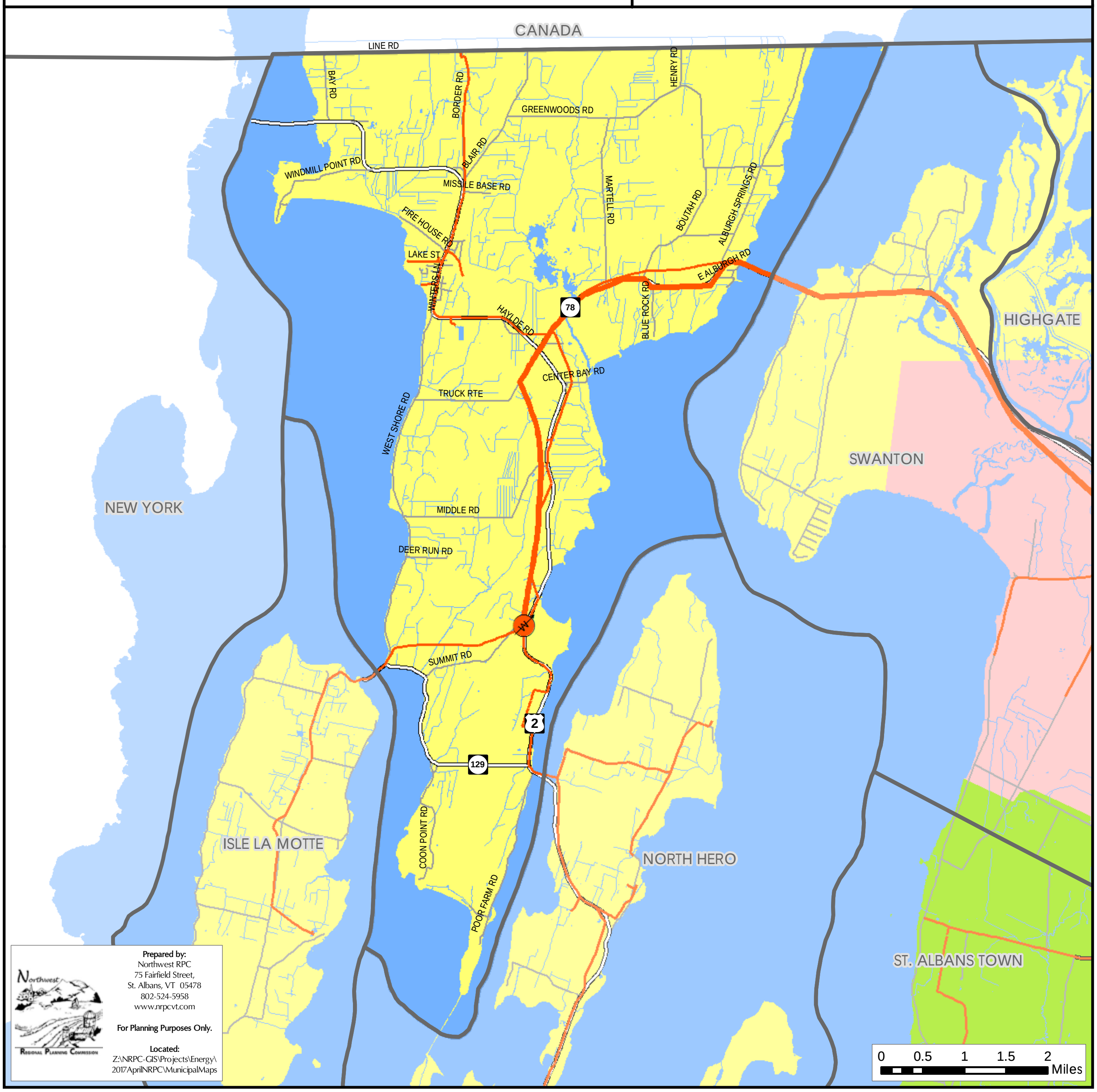


Legend

Utility Service Area Features

- Green Mountain Power
- Swanton Village Electric
- Vermont Electric Co-op
- Enosburg Falls Electric
- Substation
- 3 Phase Power Line
- Transmission Line

Sources: VCGI
Disclaimer: The accuracy of information presented is determined by its sources. Errors and omissions may exist. The Northwest RPC is not responsible for these. Questions of on-the-ground location can be resolved by site inspections and/or surveys by a registered surveyor. This map is not sufficient for delineation of features on-the-ground. This map identifies the presence of features, and may indicate relationships between features, but is not a replacement for surveyed information or engineering studies.



Transmission & 3 Phase Power Infrastructure

Alburgh, Vermont
Act 174
The Energy Development Improvement Act of 2016

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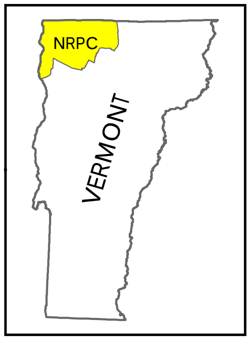

Legend

- Substation
- 3 Phase Power Line
- Transmission Line
- 1/2 Mile Buffer (3 Phase Power Line & Transmission Line)

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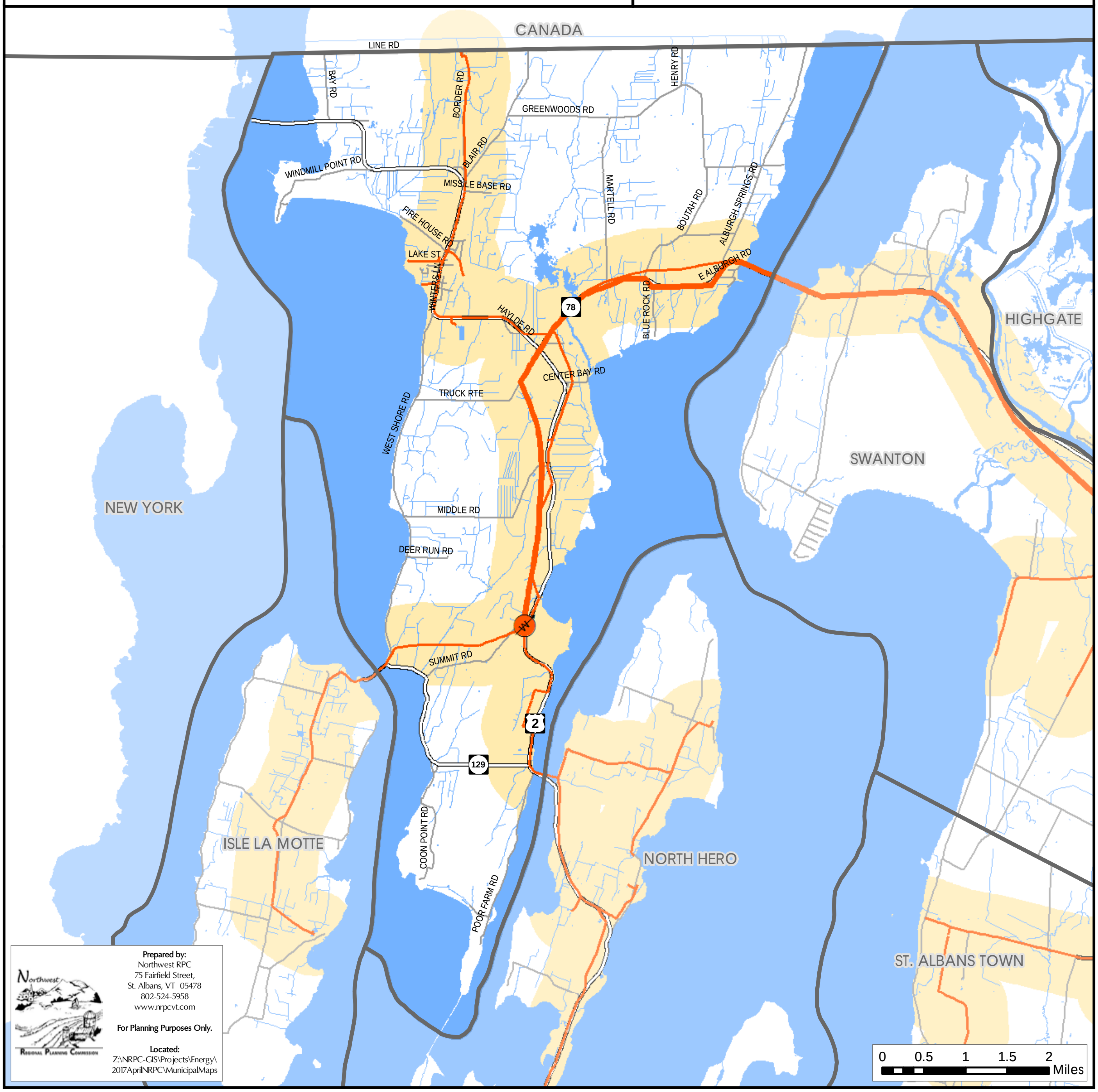

Existing Generation Facilities

Alburgh, Vermont
Act 174
The Energy Development Improvement Act of 2016

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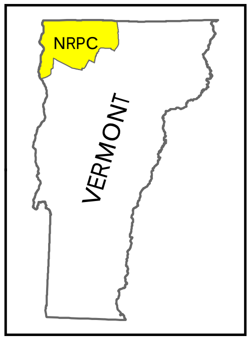

Legend

- Biomass Facility
- Hydro Facility
- Solar Facility
- Wind Facility

Note: Only generators 15kW are shown on the map. A full list of all generators is available.

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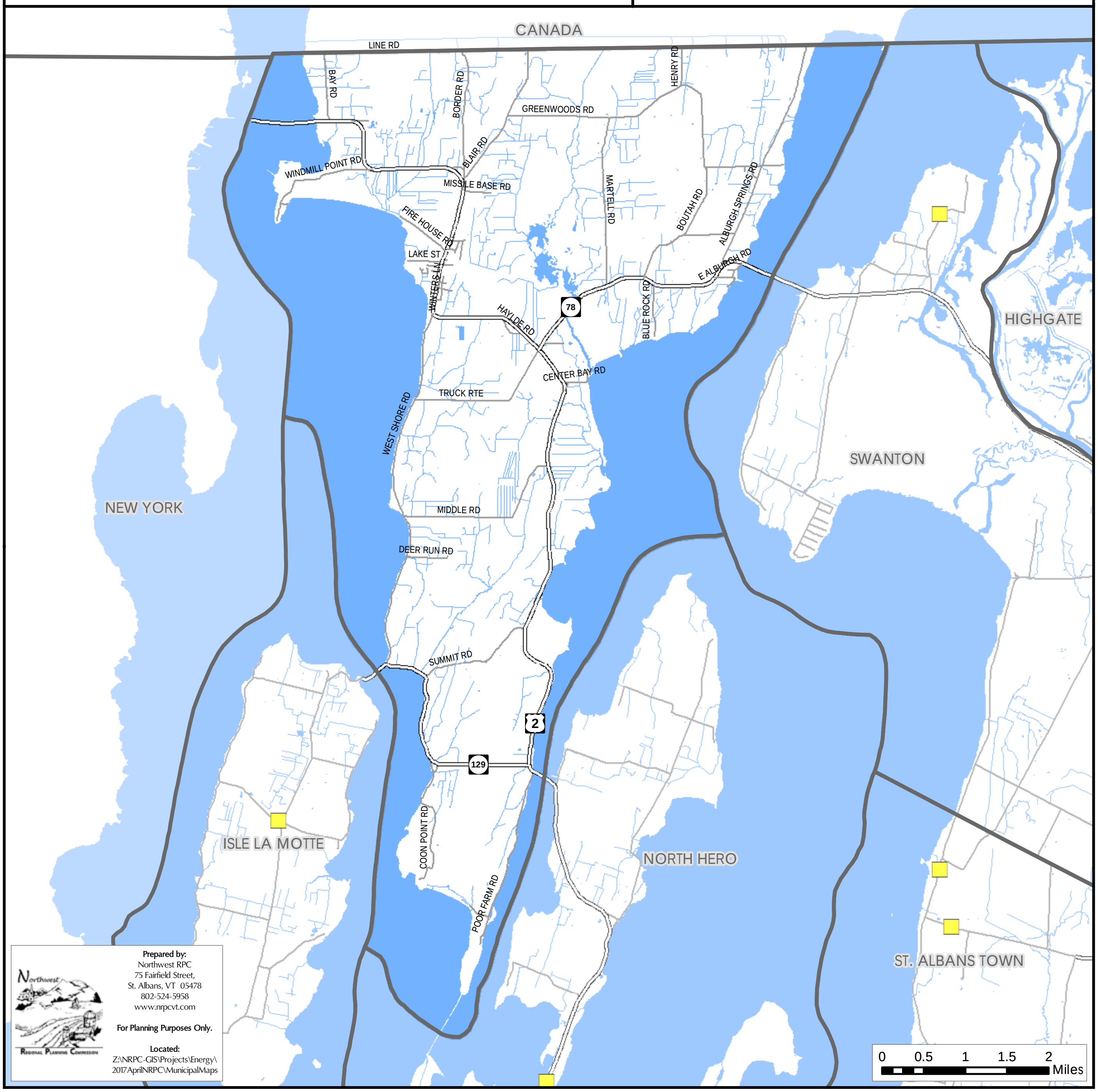

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www.nrpcvt.com

For Planning Purposes Only.

Located:
Z:\NRPC-GIS\Projects\Energy\2017AprilNRPC\MunicipalMaps

Hydro

Alburgh, Vermont
Act 174
The Energy Development Improvement Act of 2016

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N

Legend

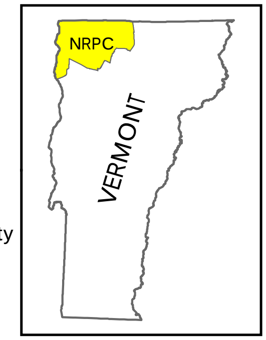
- Substation
- 3 Phase Power Line
- Transmission Line
- Designated Outstanding Resource Water
- Known Constraint - Designated National Wild & Scenic River
- Possible Constraint - Stressed or Impaired Water
- Possible Constraint - RINAs

Potential Hydroelectric Facility

- < 50 kW Capacity
- > 50 kW Capacity
- High Hazard with < 50 kW Capacity
- High Hazard with > 50 kW Capacity

Operating Hydroelectric Facility

- Dam not on National Wild and Scenic River
- Dam on National Wild and Scenic River



Sources: VCGI

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Solar

Alburgh, Vermont
Act 174
The Energy Development Improvement Act of 2016

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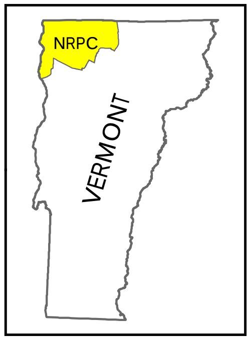
N



Legend

- Substation
- 3 Phase Power Line
- Transmission Line
- 1/2 Mile Buffer (3 Phase Power Line & Transmission Line)
- Prime Solar/No Known Constraints
- Base Solar/Possible Constraints

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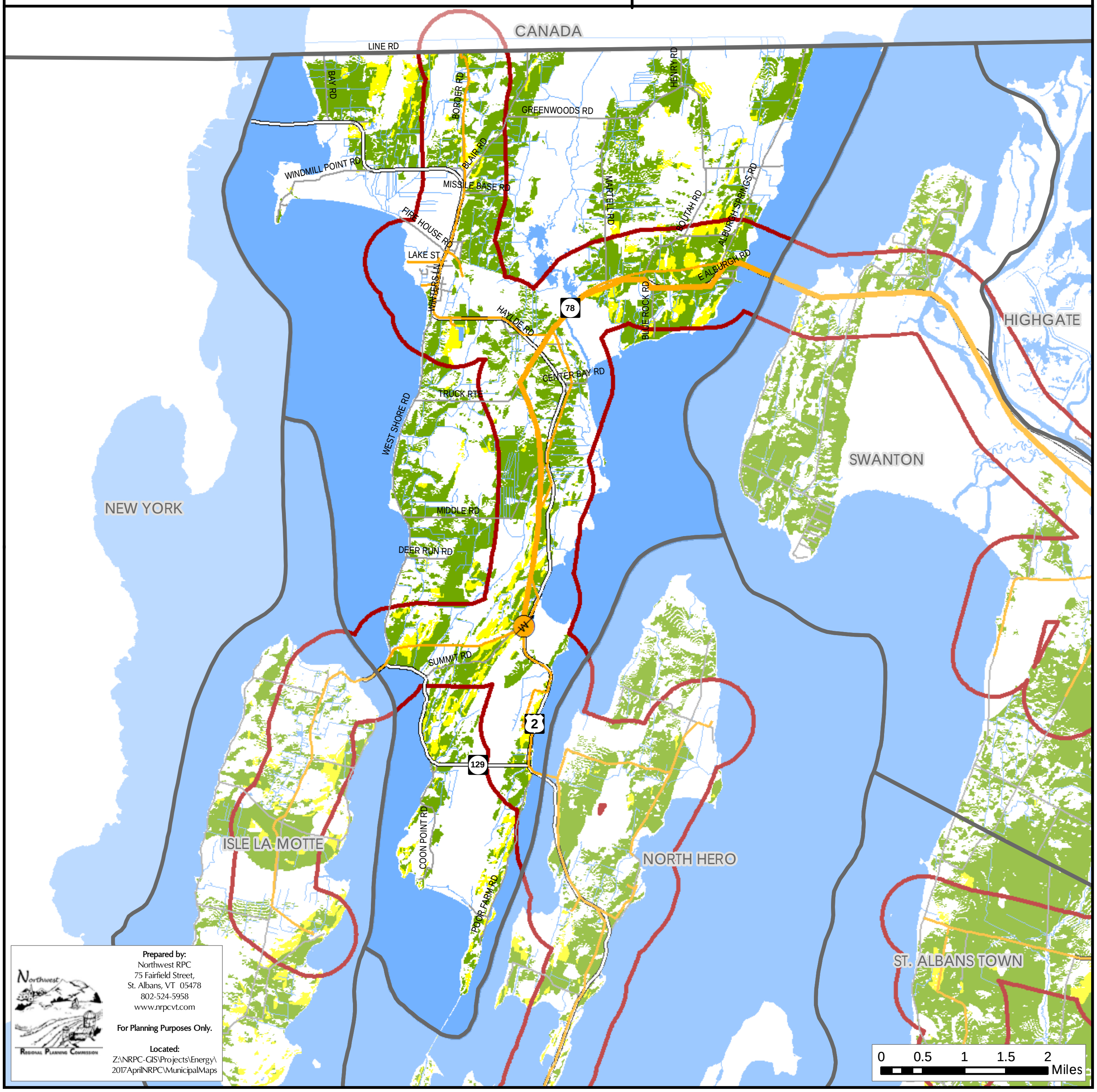

Wind

Alburgh, Vermont
Act 174
The Energy Development Improvement Act of 2016

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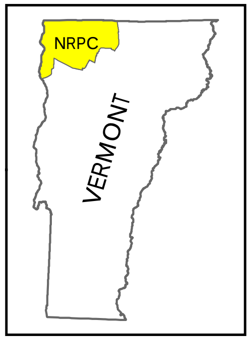

Legend

- Substation
- 3 Phase Power Line
- Transmission Line
- Prime Wind: Areas of high wind potential and no known constraints. Darker areas have higher wind speeds.
- Base Wind: Areas of high wind potential and a presence of possible constraints. Darker areas have higher wind speeds.

Sources: VCGI
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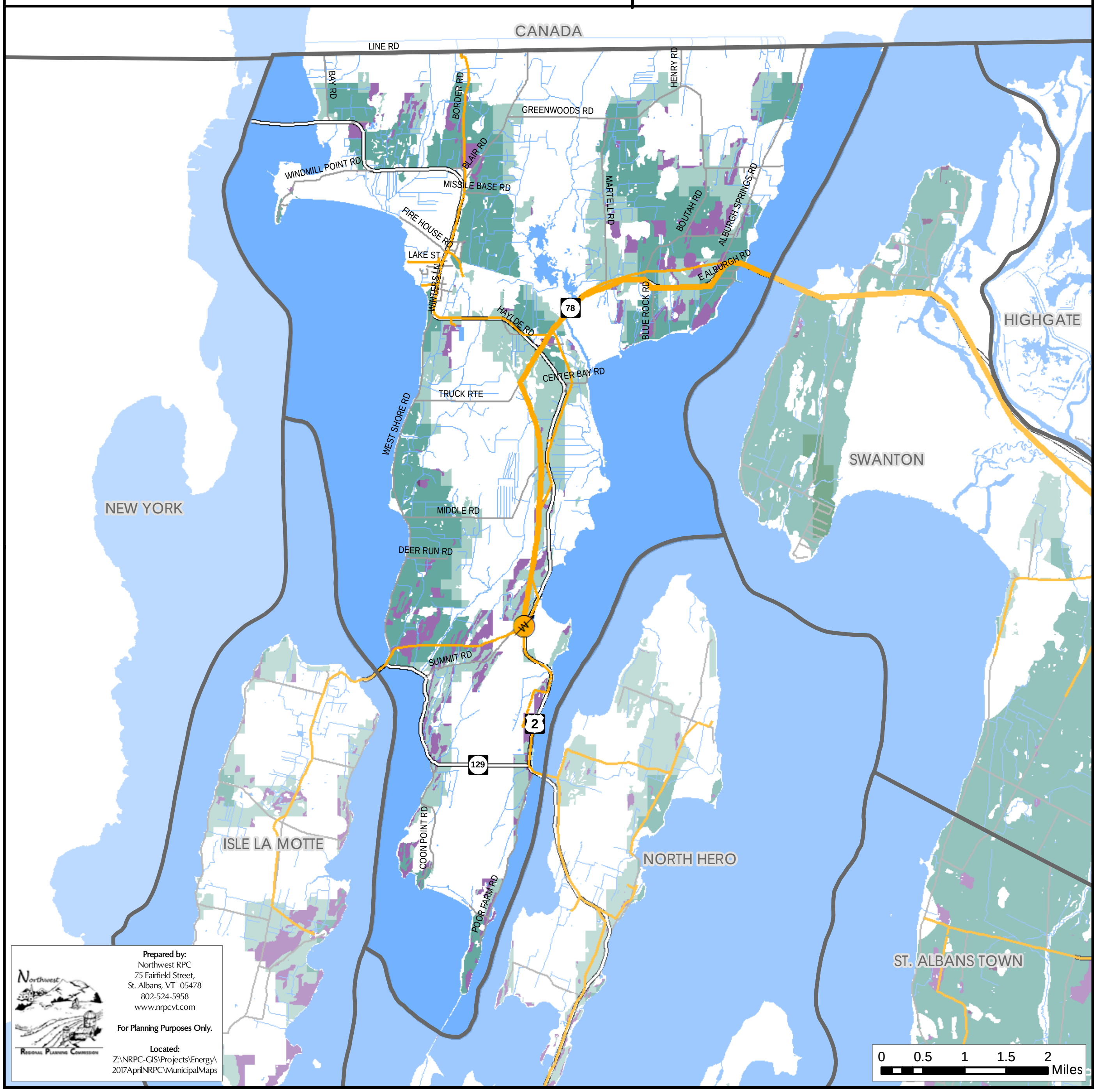

Woody Biomass

Alburgh, Vermont
Act 174
The Energy Development Improvement Act of 2016

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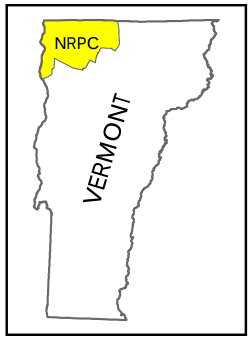
N



Legend

- Biomass System
- Cow Power
- Substation
- 3 Phase Power Line
- Transmission Line
- Prime Woody Biomass/No Known Constraints
- Base Woody Biomass/Possible Constraints

Sources: VCGI

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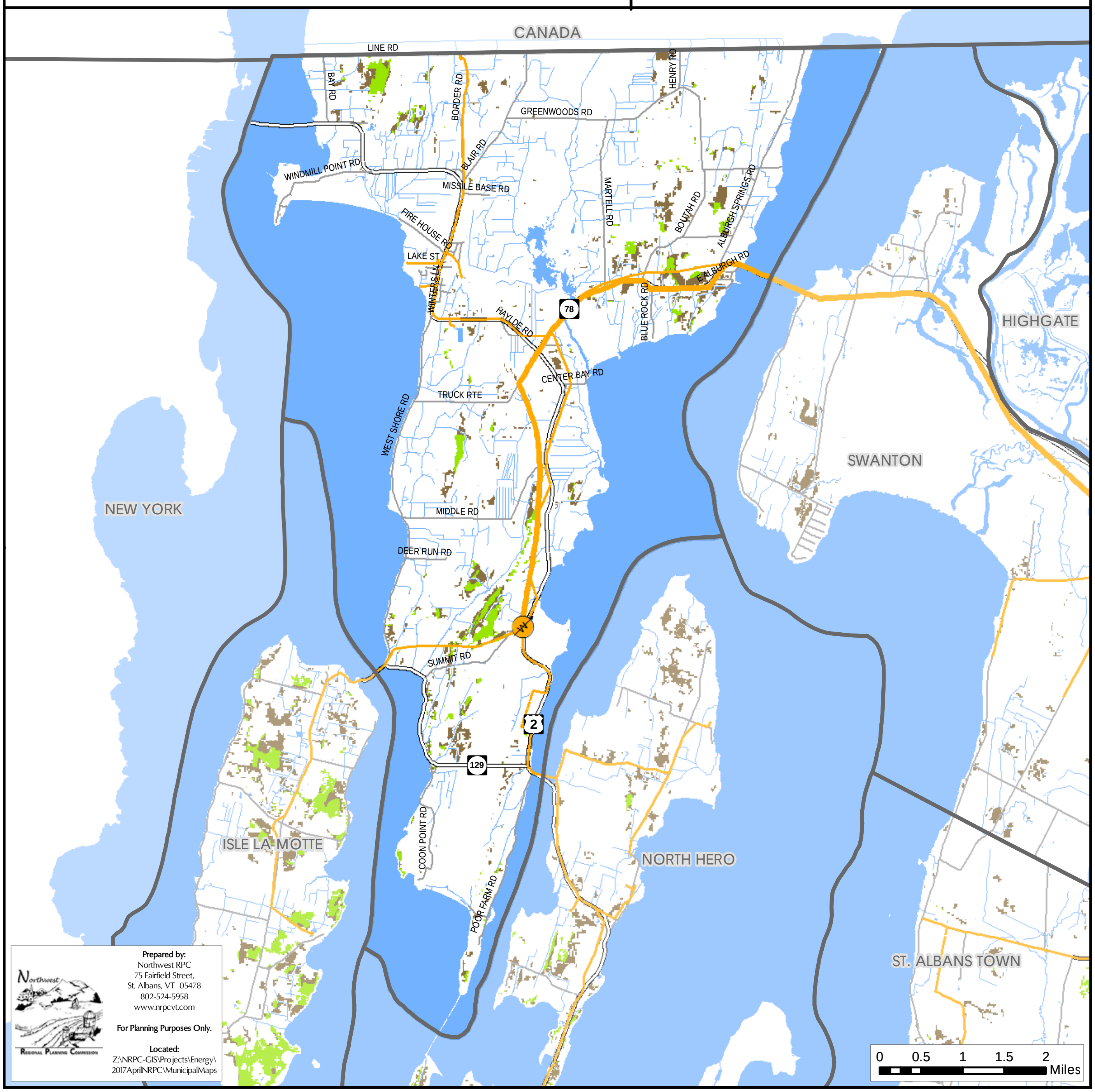

All Generators in Municipality						
Category	Sub - Category	Organization Type	Address	City	CPG Number	Capacity kW
Solar	Ground-mounted PV: Fixed Rack	Residential	44 Bay Rd	Alburgh		12
Solar	Roof-Mounted PV	Residential	70 Bay Road	Alburgh	2760	11.4
Solar	Ground-mounted PV: Tracker	Residential	24 Deer Run	Alburgh	3776	10.3
Solar	Ground-mounted PV: Tracker	Residential	180 US Route 129	Alburgh	2254	10
Solar	Roof-Mounted PV	Residential	669 US Route 2	Alburgh	6063	10
Solar	Roof-Mounted PV	Residential	10 Garcia Lane	Alburgh	7098	9.1
Solar	Ground-mounted PV: Pole	Residential	98 Route 129	Alburgh	6465	7
Solar	Roof-Mounted PV	Residential	88 Route 129	Alburgh		7
Solar	Roof-Mounted PV	Residential	23 West Shore Rd	Alburgh	1697	6.8
Solar	Roof-Mounted PV	Residential	85 Fiske Road	Alburgh	5768	6
Solar	Roof-Mounted PV	Residential	539 US Route 2	Alburgh	7205	6
Solar	Roof-Mounted PV	Residential	26 Baker St	Alburgh	4021	3.8
Solar	Roof-Mounted PV	Residential	325 W Shore Rd	Alburgh	2912	3.7
Solar	Ground-mounted PV: Fixed Rack	Residential	172 Alburg Springs Rd	Alburgh	5462	3.1
Solar	Ground-mounted PV: Fixed Rack	Residential		Alburgh	6876	
Solar	Hot Water	Residential	1A-1B Carle Street	Alburgh		
Solar	Hot Water	Residential	4 North Main Street	Alburgh		
Solar	Hot Water	Residential	5C-5B Carle Street	Alburgh		
Wind	Small Wind	Institution		Alburgh	148	9.5

Municipal Analysis & Targets - Bakersfield

The following is an explanation of the municipal energy data compiled by Northwest Regional Planning Commission (NRPC). The intent of the municipal energy data is to provide the municipalities with data required to ensure compliance with the requirements of Act 174 and "Enhanced Energy Planning" (24 V.S.A. 4352). The following tables contain data that estimates current energy use and provides targets for future energy use across all sectors (transportation, heating, and electricity). It also sets targets for renewable energy generation within the municipality.

This data is meant to be a starting point for the municipality to begin planning its energy future and to talk about the changes that may need to occur within the municipality to ensure that local, regional and state energy goals are met. This includes the State of Vermont's goal to have 90% of all energy demand be met from renewable sources by 2050.

Figure 1 - Data Sources

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It is possible to develop "bottom up" data. For those municipalities interested in that approach, please see the Department of Public Service's Analysis and Targets Guidance (http://publicservice.vermont.gov/content/act-174-recommendations-and-determination-standards).

Please remember that the targets established by LEAP represent only one way to achieve energy goals. There may several other similar pathways that a municipality may choose to take in order to meet the 90x50 goal.

Below is a worksheet by worksheet explanation of the Municipal Template spreadsheet:

1. Municipal Data Summary

The following tables summarize all data that is required to be in a municipal plan if the plan is to meet the "determination" standards established by the Vermont Department of Public Service.

Table 1A: Current Municipal Transportation Energy Use

Transportation Data	Municipal Data
Total # of Passenger Vehicles (ACS 2011-2015)	1,074
Average Miles per Vehicle (Vtrans)	11,356
Total Miles Traveled	12,196,344
Realized MPG (2013 - VTrans 2015 Energy Profile)	18.6
Total Gallons Use per Year	655,717
Transportation BTUs (Billion)	79
Average Cost per Gallon of Gasoline (RPC)	2.31
Gasoline Cost per Year	1,514,707

This table uses data from the American Community Survey (ACS) and Vermont Agency of Transportation (VTrans) to calculate current transportation energy use and energy costs in the municipality.

Table 1B: Current Municipal Residential Heating Energy Use

Fuel Source	Municipal Households (ACS 2011-2015)	% of Municipal Households	Municipal Square Footage Heated	Municipal BTU (in Billions)
Natural Gas	2	0.4%	3,808	0
Propane	49	9.8%	82,736	5
Electricity	0	0.0%	0	0
Fuel Oil	209	41.8%	381,040	23
Coal	0	0.0%	0	0
Wood	232	46.4%	427,648	26
Solar	0	0.0%	0	0
Other	8	1.6%	15,232	1
No Fuel	0	0.0%	0	0
Total	500	100.0%	910,464	55

This table displays data from the ACS that estimates current municipal residential heating energy use.

Table 1C: Current Municipal Commercial Energy Use

	Commercial Establishments in Municipality (VT DOL)	Estimated Thermal Energy BTUs per Commercial Establishment (in Billions) (VDPS)	Estimated Thermal Energy BTUs by Commercial Establishments in Municipality (in Billions)
Municipal Commercial Energy Use	10	0.725	7

The table uses data available from the Vermont Department of Labor (VT DOL) and the Vermont Department of Public Service (DPS) to estimate current municipal commercial establishment energy use in the municipality.

Table 1D: Current Electricity Use

Use Sector	Current Electricity Use
Residential (kWh)	4,494,671
Commercial and Industrial (kWh)	2,565,732
Total (kWh)	7,060,403

This table displays current electricity use within the municipality. This data is available from Efficiency Vermont (EVT).

Table 1E: Residential Thermal Efficiency Targets

	2025	2035	2050
"Residential - Increased Efficiency and Conservation (% of municipal households to be weatherized)"	5%	16%	78%

This table displays targets for thermal efficiency of residential structures. The data is based on a methodology developed by DPS using data available from the regional Long-range Energy Alternatives Planning (LEAP) analysis and ACS. The data in this table represents the percentage of municipal households that will need to be weatherized in the target years. The target is cumulative.

Table 1F: Commercial Thermal Efficiency Target

	2025	2035	2050
"Commercial - Increased Efficiency and Conservation (% of commercial establishments to be weatherized)"	25%	25%	73%

This table shows the same information as Table 1E, but sets a target for commercial thermal efficiency and weatherization. Information from the VT DOL is required to complete this target. The target is cumulative.

Table 1G: Thermal Fuel Switching (Residential and Commercial) – Wood Systems

	2025	2035	2050
New Efficient Wood Heat Systems (in units)	0	0	0

This table provides a target for new wood heating systems for residential and commercial structures in the municipality for each target year. This target was calculated using data from LEAP and ACS. The target is cumulative.

Table 1H: Thermal Fuel Switching (Residential and Commercial) – Heat Pumps

	2025	2035	2050
New Heat Pumps (in units)	60	136	255

This table provides a target for new heat pump systems for residential and commercial structures in the municipality for each target year. This target was calculated using data from LEAP and ACS. The target is cumulative.

Table 1I: Electricity Efficiency Targets

	2025	2035	2050
Increase Efficiency and Conservation (BTUs)	25.2%	48.3%	100.7%

Data in this table displays a target for increased electricity efficiency and conservation during the target years. This target will be met through conversions to high efficiency appliances, electric heat pumps, and electric light-duty vehicles. These targets were developed using regional LEAP analysis. The target is cumulative.

Table 1J: Use of Renewables – Transportation

	2025	2035	2050
Renewable Energy Use - Transportation (BTUs)	5.3%	23.6%	86.9%

This data displays targets for the percentage of transportation energy use coming from renewable sources during each target year. This target will be met through conversions to electric light-duty vehicles and biodiesel heavy-duty vehicles. This data was developed using the LEAP analysis. The target is cumulative.

Table 1K: Use of Renewables – Heating

	2025	2035	2050
Renewable Energy Use - Heating (BTUs)	46.7%	60.4%	88.4%

This data displays targets for the percentage of heating energy use coming from renewable sources during each target year. This target will be met through conversions to electric heat pumps and high efficiency wood heating systems. This data was developed using information from the LEAP analysis. The target is cumulative.

Table 1L: Use of Renewables – Electricity

	2025	2035	2050
Renewable Energy Use - Electricity (MWh)	4,262.5	8,525.0	12,916.6

This data displays targets for MWh of electricity generation coming from renewable sources within the municipality during each target year. This data was developed using information from the regional planning commission and DPS. This data is the same as the data in Table 1Q. The target is cumulative.

Table 1M: Transportation Fuel Switching Targets – Electric Vehicles

	2025	2035	2050
Electric Vehicles	94	704	1,674

This tables displays a target for switching from fossil fuel based vehicles (gasoline and diesel) to electric vehicles. This target is calculated using LEAP and ACS data. The target is cumulative.

Table 1N: Transportation Fuel Switching Targets – Biodiesel

	2025	2035	2050
Biodiesel Vehicles	67	131	247

This tables displays a target for switching from fossil fuel based vehicles to biodiesel-powered vehicles. This target is calculated using LEAP and ACS data. The target is cumulative.

Table 1O: Existing Renewable Generation

Renewable Type	MW	MWh
Solar	0.14	171.70
Wind	0.01	42.92
Hydro	0.00	0.00
Biomass	0.40	1,636.37
Other	0.00	0.00
Total Existing Generation	0.55	1,850.99

Table 1O shows existing renewable generation in the municipality, in MW and MWh, based on information available from the Vermont Department of Public Service.

Table 1P: Renewable Generation Potential

Renewable Type	MW	MWh
Rooftop Solar	1	675
Ground-mounted Solar	288	352,686
Wind	160	490,652
Hydro	0.03	119
Biomass and Methane	0	0
Other	0	0
Total Renewable Generation Potential	448	844,132

Renewable generation potential is based on mapping completed by the regional planning commission that is based on the Municipal Determination Standards and associated guidance documents developed by DPS. The renewable generation potential is expressed in MW and MWh by the type of renewable resource (solar, wind, hydro, etc.).

Table 1Q: Renewable Generation Targets

	2025	2035	2050
Total Renewable Generation Target (in MWh)	4,262.48	8,524.97	12,916.62

This data displays targets for MWh of electricity generation coming from renewable sources within the municipality during each target year. This data was developed using information from the regional planning commission and DPS. This data is the same as the data in Table 1L.

Table 1R: Sufficient Land?

	Y/N
Solar	Y
Wind	Y

This table shows whether or not there is sufficient land in the municipality to meet the renewable generation targets based on the renewable generation potential in the municipality.

Utility Service Areas

Bakersfield, Vermont
Act 174
The Energy Development Improvement Act of 2016

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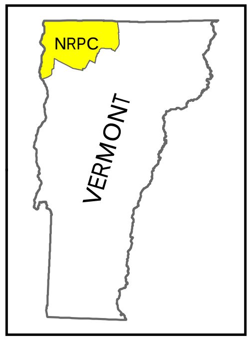
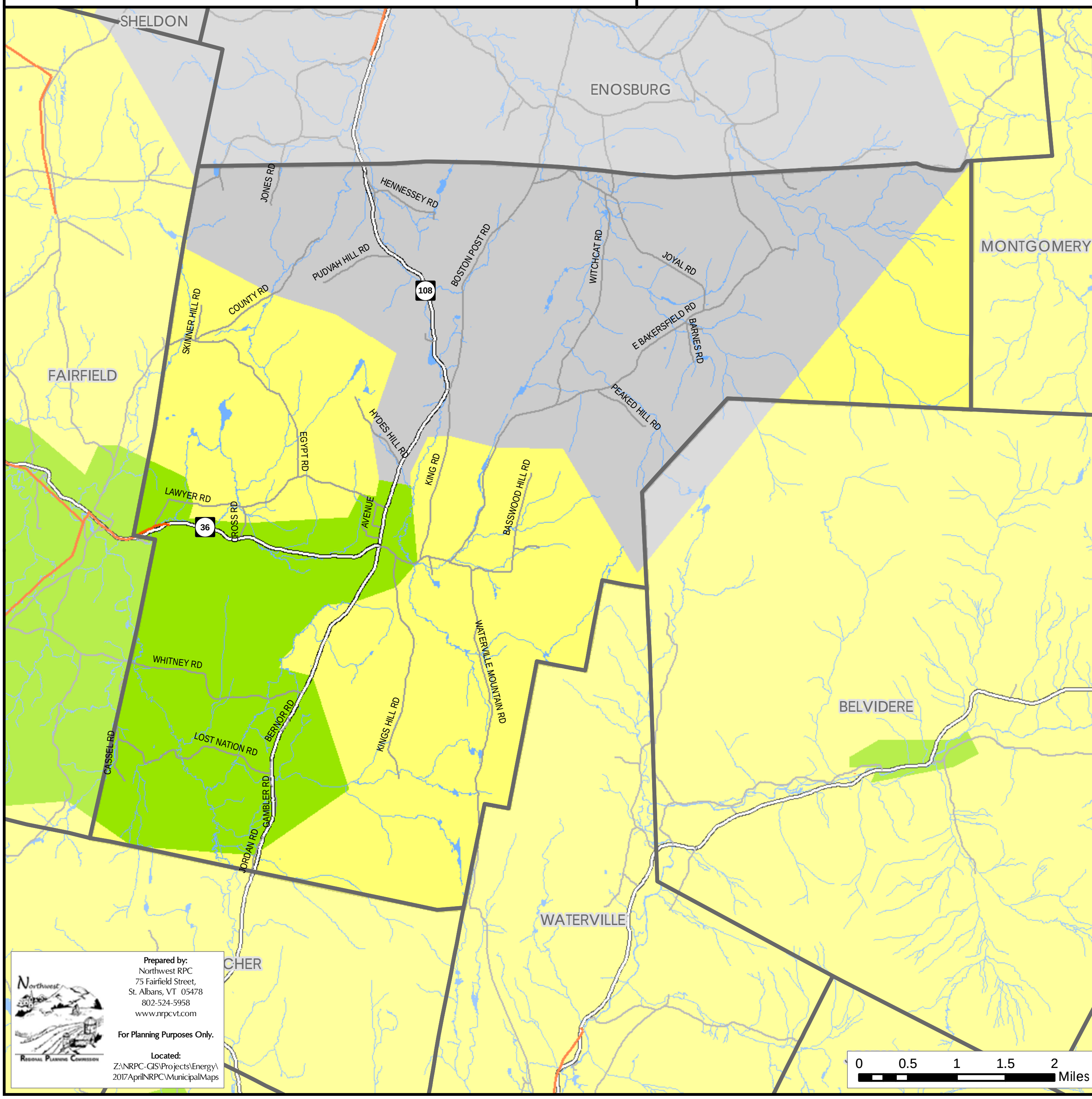


Legend

Utility Service Area Features

- Green Mountain Power
- Swanton Village Electric
- Vermont Electric Co-op
- Enosburg Falls Electric
- Substation
- 3 Phase Power Line
- Transmission Line

Sources: VCGI
Disclaimer: The accuracy of information presented is determined by its sources. Errors and omissions may exist. The Northwest RPC is not responsible for these. Questions of on-the-ground location can be resolved by site inspections and/or surveys by a registered surveyor. This map is not sufficient for delineation of features on-the-ground. This map identifies the presence of features, and may indicate relationships between features, but is not a replacement for surveyed information or engineering studies.



Transmission & 3 Phase Power Infrastructure

Bakersfield, Vermont
Act 174
The Energy Development Improvement Act of 2016

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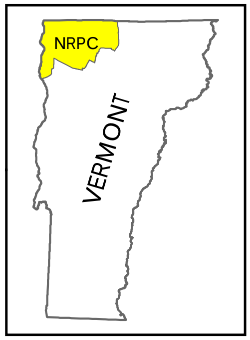
N



Legend

- Substation
- 3 Phase Power Line
- Transmission Line
- 1/2 Mile Buffer (3 Phase Power Line & Transmission Line)

Sources: VCGI
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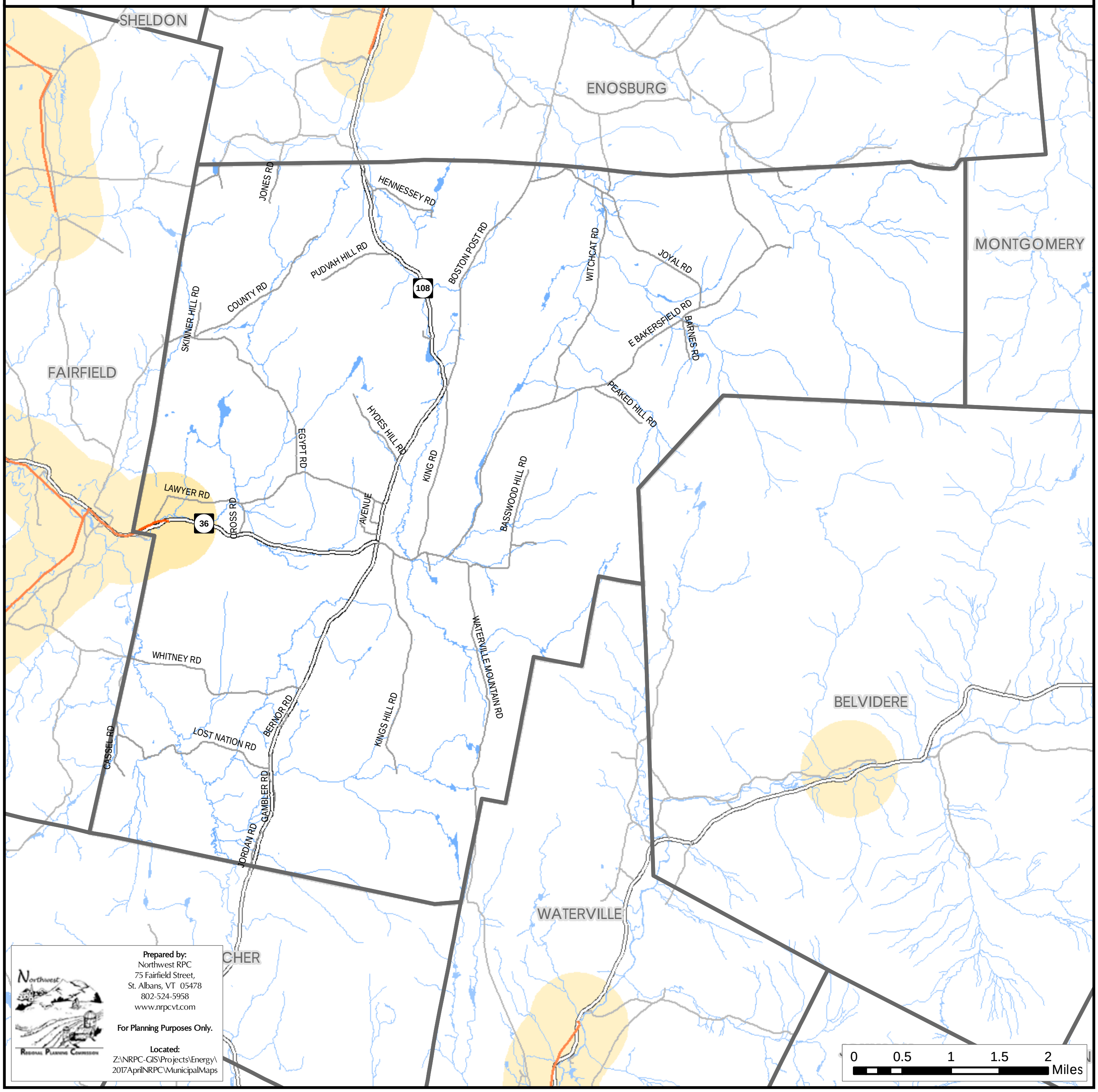

Existing Generation Facilities

Bakersfield, Vermont
Act 174
The Energy Development Improvement Act of 2016

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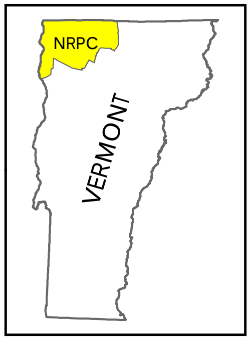
N



Legend

- Biomass Facility
- Hydro Facility
- Solar Facility
- Wind Facility

Note: Only generators 15kW are shown on the map. A full list of all generators is available.

Sources: VCGI
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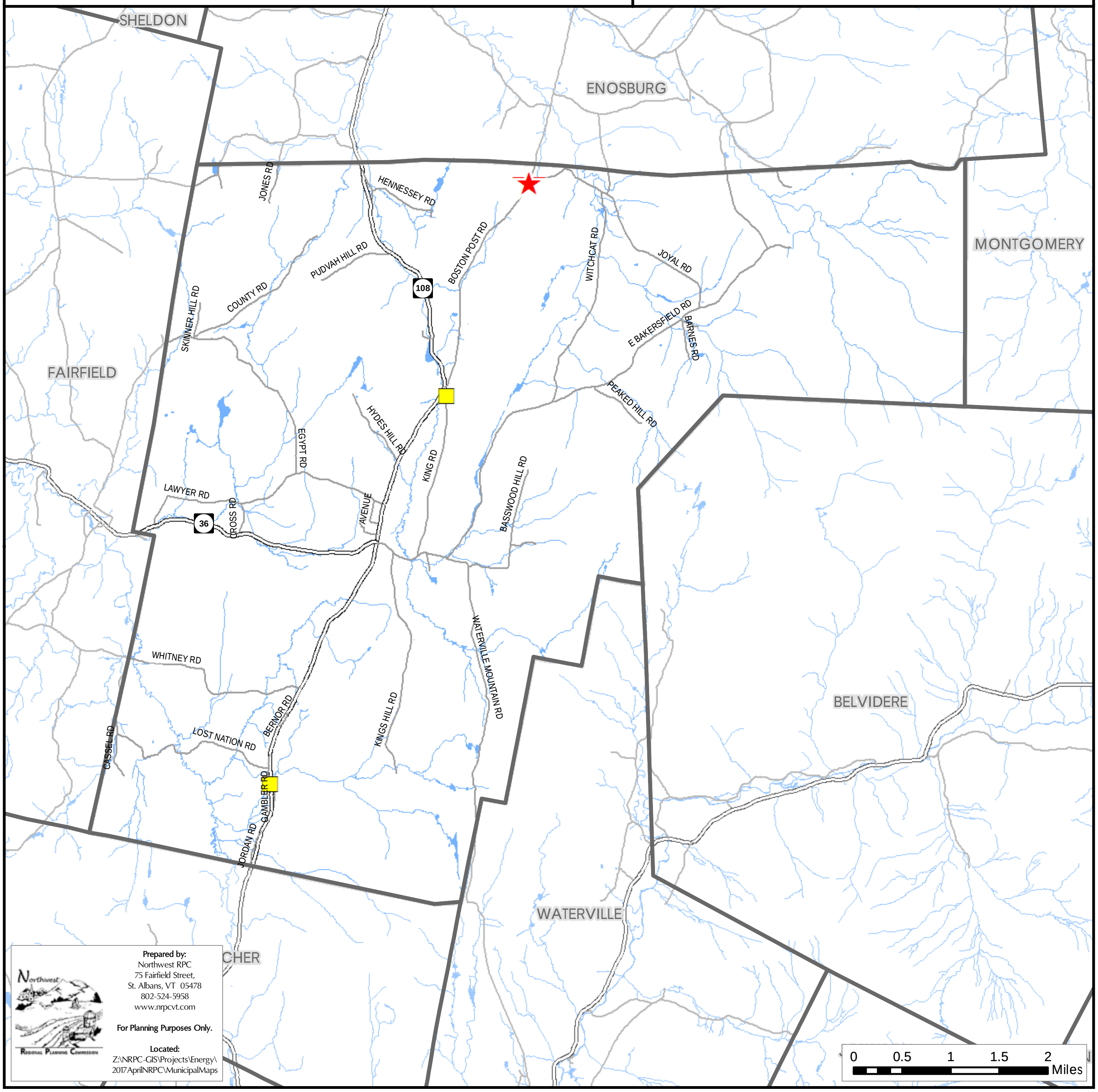

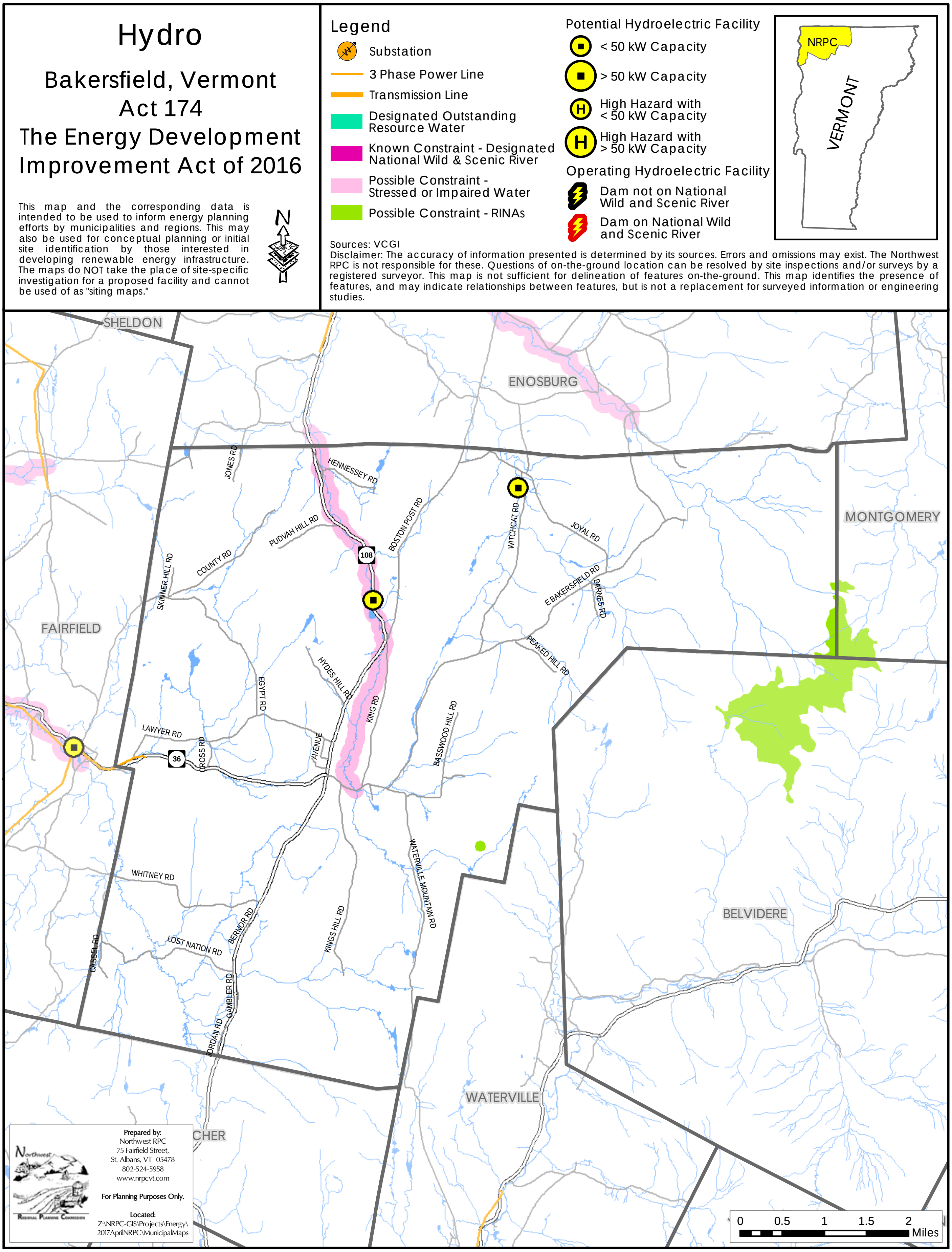

Hydro
Bakersfield, Vermont
Act 174
The Energy Development Improvement Act of 2016
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N
Legend
Substation
3 Phase Power Line
Transmission Line
Designated Outstanding Resource Water
Known Constraint - Designated National Wild & Scenic River
Possible Constraint - Stressed or Impaired Water
Possible Constraint - RINAs
Potential Hydroelectric Facility
< 50 kW Capacity
> 50 kW Capacity
High Hazard with < 50 kW Capacity
High Hazard with > 50 kW Capacity
Operating Hydroelectric Facility
Dam not on National Wild and Scenic River
Dam on National Wild and Scenic River
NRPC
VERMONT
Sources: VCGI
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SHELDON
ENOSBURG
MONTGOMERY
FAIRFIELD
BELVIDERE
WATERVILLE
CHER
JONES RD
HENNESSEY RD
PUDVAH HILL RD
BOSTON POST RD
WITCHCAT RD
JOYAL RD
COUNTY RD
SKINNER HILL RD
108
E BAKERSFIELD RD
BARNES RD
PEAKED HILL RD
HYDES HILL RD
EGYPT RD
KING RD
BASSWOOD HILL RD
LAWYER RD
36
CROSS RD
AVENUE
WATERVILLE MOUNTAIN RD
WHITNEY RD
BERNOR RD
KINGS HILL RD
LOST NATION RD
CASSEL RD
GAMBLER RD
JORDAN RD
Prepared by:
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www.nrpcvt.com
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Located:
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Northwest Regional Planning Commission
0 0.5 1 1.5 2
Miles

Solar

Bakersfield, Vermont
Act 174
The Energy Development Improvement Act of 2016

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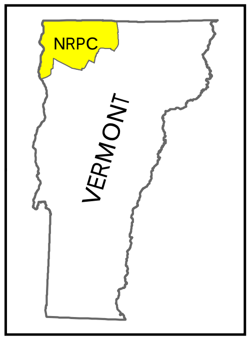

Legend

- Substation
- 3 Phase Power Line
- Transmission Line
- 1/2 Mile Buffer (3 Phase Power Line & Transmission Line)
- Prime Solar/No Known Constraints
- Base Solar/Possible Constraints

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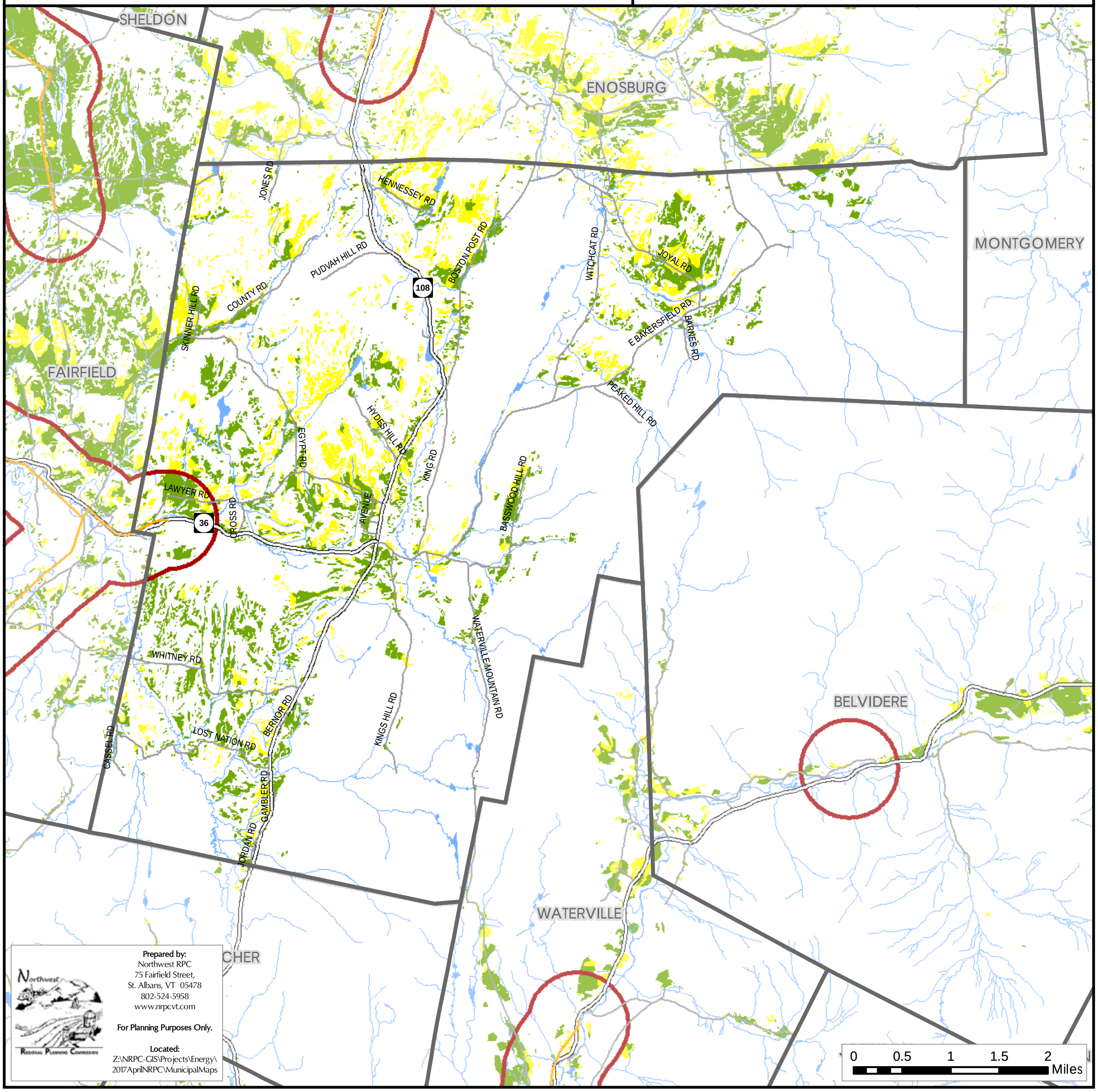

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Wind

Bakersfield, Vermont
Act 174
The Energy Development Improvement Act of 2016

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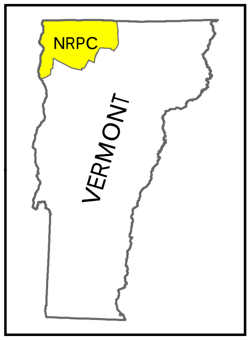

Legend

- Substation
- 3 Phase Power Line
- Transmission Line
- Prime Wind: Areas of high wind potential and no known constraints. Darker areas have higher wind speeds.
- Base Wind: Areas of high wind potential and a presence of possible constraints. Darker areas have higher wind speeds.

Sources: VCGI
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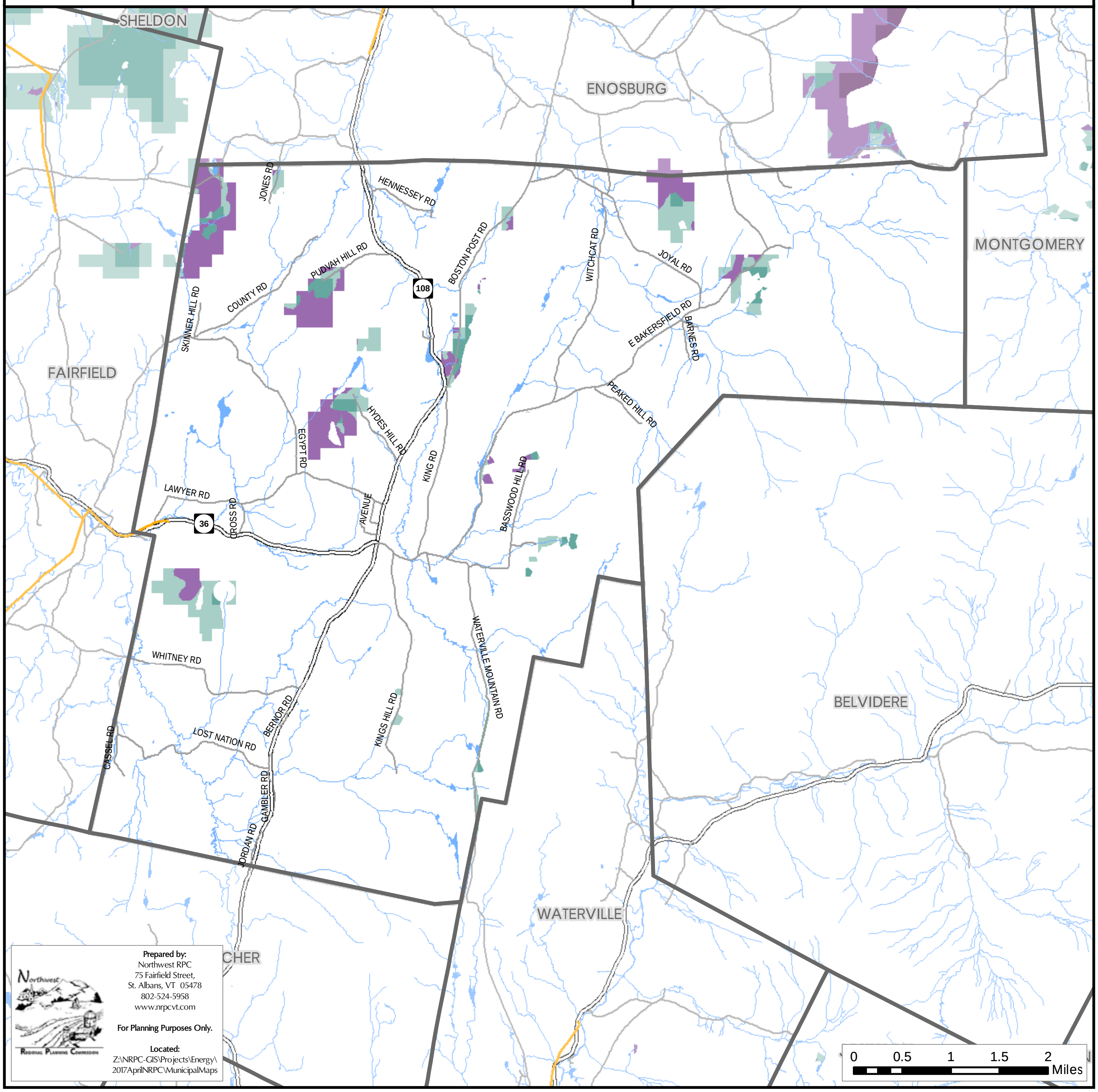

Woody Biomass

Bakersfield, Vermont
Act 174
The Energy Development Improvement Act of 2016

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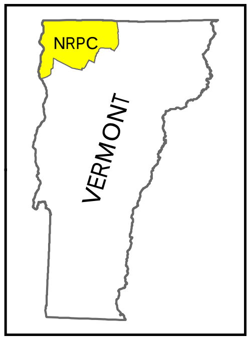

Legend

- Biomass System
- Cow Power
- Substation
- 3 Phase Power Line
- Transmission Line
- Prime Woody Biomass/No Known Constraints
- Base Woody Biomass/Possible Constraints

Sources: VCGI
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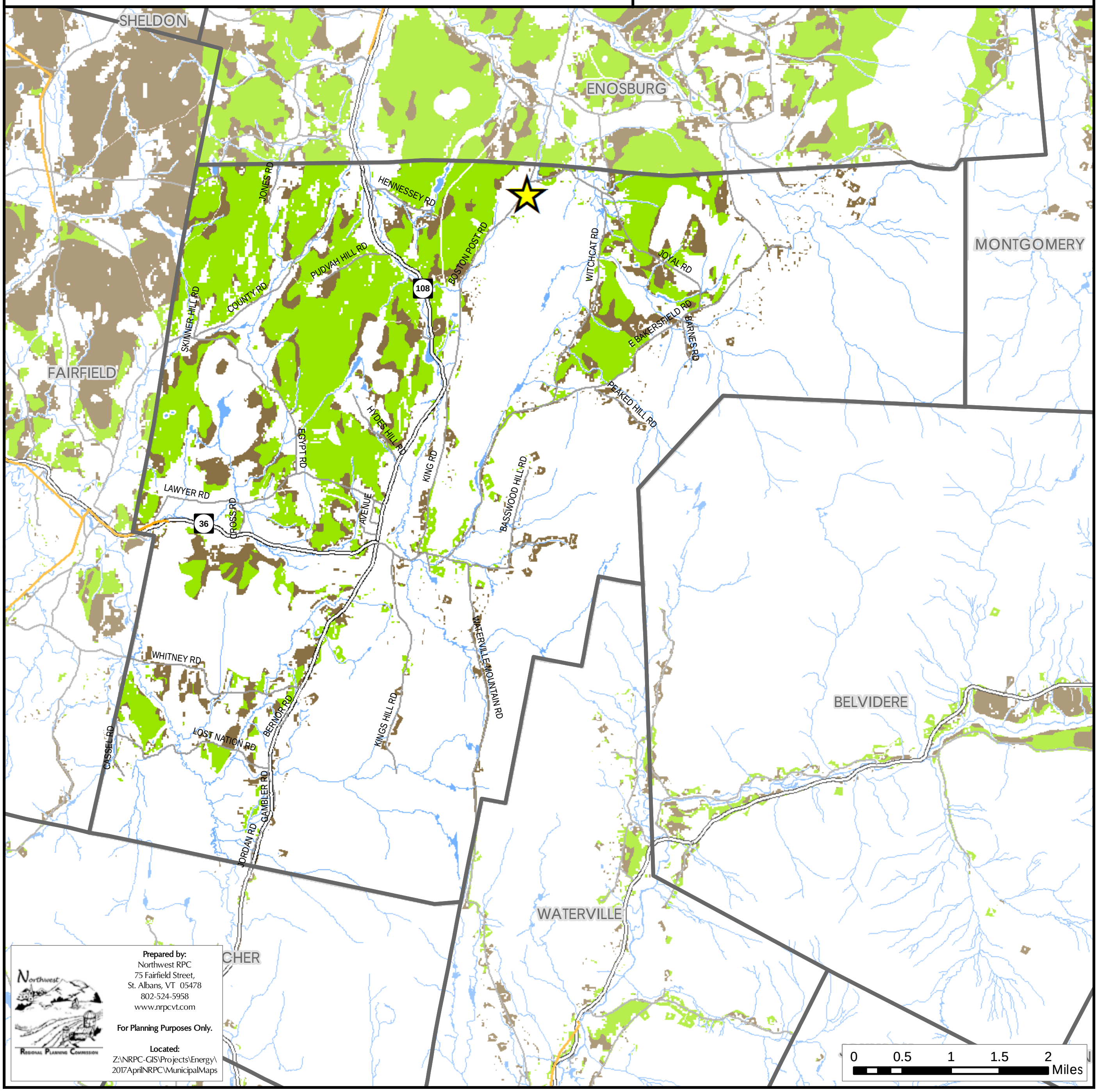

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All Generators in Municipality

Category	Sub - Category	Organization Type	Address	City	CPG Number	Capacity kW
Biomass	Anaerobic Digester	Farm	6001 Boston Post Road	Bakersfield		400
Solar	Ground-mounted PV: Fixed Rack	Farm	1703 Rt 108 S	Bakersfield	2710	8.9
Solar	Ground-mounted PV: Fixed Rack	Residential	2760 Route 108 South	Bakersfield	16-1368	15
Solar	Ground-mounted PV: Fixed Rack	Residential	1710 King Rd	Bakersfield	16-1148	15
Solar	Ground-mounted PV: Fixed Rack	Residential	1408 Witchcat Rd	Enosburg Falls	16-1149	6
Solar	Ground-mounted PV: Pole	Farm	637 Jones Rd	Bakersfield	2742	5.9
Solar	Ground-mounted PV: Pole	Residential	615 Kings Hill Rd	Bakersfield	5029	7
Solar	Ground-mounted PV: Tracker	Residential	2555 Witchcat Rd	Bakersfield	3544	6.8
Solar	Hot Water	Residential	1331 Waterville Mtn. Rd	Bakersfield		
Solar	Roof-Mounted PV	Residential	1331 Waterville Mtn. Rd	Bakersfield	1557	5
Solar	Roof-Mounted PV	Residential	416 Belvidere Mtn Rd	Bakersfield	5027	9.1
Solar	Roof-Mounted PV	Residential	516 Kings Hill Rd	Bakersfield	6063	7
Solar	Roof-Mounted PV	Residential	3322 Main Street North	Bakersfield	3013	5.6
Solar	Roof-Mounted PV	Residential	142 North Main St	Bakersfield	4288	6
Solar	Roof-Mounted PV	Residential	952 Main St N	Bakersfield	3630	6.8
Solar	Roof-Mounted PV	Residential	1456 Basswood Hill Rd	Bakersfield	7227	6
Solar	Roof-Mounted PV	Residential	663 Kings Hill Road	Bakersfield	7242	1.14
Solar	Roof-Mounted PV	Residential	287 Main Street	Bakersfield	16-0151	3.8
Solar	Roof-Mounted PV	Residential	338 Main Street North	Bakersfield	16-0332	6
Solar	Roof-Mounted PV	Residential	1645 King Road	Bakersfield	16-0493	7.25
Solar	Roof-Mounted PV	Residential	180 Avenue Rd	Bakersfield	16-0654	5
Solar	Roof-Mounted PV	Residential	1982 North Main Street	Bakersfield		5
Solar	Roof-Mounted PV	Residential	450 Witchcat Rd	Bakersfield	6974	7.6
Solar	Roof-Mounted PV	Residential	488 Fairfield Road	Bakersfield	16-1731	9.2
Solar	Roof-Mounted PV	Residential	376 E Bakersfield Rd	Bakersfield	16-0982	7.6
Solar	Roof-Mounted PV	Residential	190 Hydes Hill Rd	Bakersfield	5369	5
Wind	Small Wind	Farm	1703 Route 108 South	Bakersfield	222	9.5

All Generators in Municipality

Category	Sub - Category	Organization Type	Address	City	CPG Number	Capacity kW
Wind	Small Wind	Residential	1171 Witchcat Rd	Bakersfield		2

Municipal Analysis & Targets - Berkshire

The following is an explanation of the municipal energy data compiled by Northwest Regional Planning Commission (NRPC). The intent of the municipal energy data is to provide the municipalities with data required to ensure compliance with the requirements of Act 174 and "Enhanced Energy Planning" (24 V.S.A. 4352). The following tables contain data that estimates current energy use and provides targets for future energy use across all sectors (transportation, heating, and electricity). It also sets targets for renewable energy generation within the municipality.

This data is meant to be a starting point for the municipality to begin planning its energy future and to talk about the changes that may need to occur within the municipality to ensure that local, regional and state energy goals are met. This includes the State of Vermont's goal to have 90% of all energy demand be met from renewable sources by 2050.

Figure 1 - Data Sources

ACS – American Community Survey

DOL –Vermont Department of Labor

DPS – Vermont Department of Public Service

EIA – Energy Information Administration

EVT – Efficiency Vermont

LEAP – Long-Range Energy Alternatives Planning

VEIC – Vermont Energy Investment Corporation

VTrans – Vermont Agency of Transportation

Data Sources

Estimates of current energy use consist primarily of data available from the American Community Survey (ACS), the Vermont Agency of Transportation (VTrans), the Vermont Department of Labor (DOL), and the Vermont Department of Public Service (DPS). Targets for future energy use are reliant upon the Long-range Energy Alternatives Planning (LEAP) analysis for the region completed the Vermont Energy Investment Corporation (VEIC). Targets for future energy generation have come from the regional planning commission and DPS. For more information on LEAP, see the Northwest Regional Energy Plan (www.nrpcvt.com). Targets for both future energy use and energy generation have been generally developed using a "top down" method of disaggregating regional data to the municipal level.

It is possible to develop "bottom up" data. For those municipalities interested in that approach, please see the Department of Public Service's Analysis and Targets Guidance (http://publicservice.vermont.gov/content/act-174-recommendations-and-determination-standards).

Please remember that the targets established by LEAP represent only one way to achieve energy goals. There may several other similar pathways that a municipality may choose to take in order to meet the 90x50 goal.

Below is a worksheet by worksheet explanation of the Municipal Template spreadsheet:

1. Municipal Data Summary

The following tables summarize all data that is required to be in a municipal plan if the plan is to meet the "determination" standards established by the Vermont Department of Public Service.

Table 1A: Current Municipal Transportation Energy Use

Transportation Data	Municipal Data
Total # of Passenger Vehicles (ACS 2011-2015)	1,213
Average Miles per Vehicle (Vtrans)	11,356
Total Miles Traveled	13,774,828
Realized MPG (2013 - VTrans 2015 Energy Profile)	18.6
Total Gallons Use per Year	740,582
Transportation BTUs (Billion)	89
Average Cost per Gallon of Gasoline (RPC)	2.31
Gasoline Cost per Year	1,710,745

This table uses data from the American Community Survey (ACS) and Vermont Agency of Transportation (VTrans) to calculate current transportation energy use and energy costs in the municipality.

Table 1B: Current Municipal Residential Heating Energy Use

Fuel Source	Municipal Households (ACS 2011-2015)	% of Municipal Households	Municipal Square Footage Heated	Municipal BTU (in Billions)
Natural Gas	2	0.3%	3,808	0
Propane	46	7.9%	77,728	5
Electricity	0	0.0%	0	0
Fuel Oil	320	55.3%	557,184	33
Coal	0	0.0%	0	0
Wood	192	33.2%	356,416	21
Solar	0	0.0%	0	0
Other	19	3.3%	36,176	2
No Fuel	0	0.0%	0	0
Total	579	100.0%	1,031,312	62

This table displays data from the ACS that estimates current municipal residential heating energy use.

Table 1C: Current Municipal Commercial Energy Use

	Commercial Establishments in Municipality (VT DOL)	Estimated Thermal Energy BTUs per Commercial Establishment (in Billions) (VDPS)	Estimated Thermal Energy BTUs by Commercial Establishments in Municipality (in Billions)
Municipal Commercial Energy Use	8	0.725	6

The table uses data available from the Vermont Department of Labor (VT DOL) and the Vermont Department of Public Service (DPS) to estimate current municipal commercial establishment energy use in the municipality.

Table 1D: Current Electricity Use

Use Sector	Current Electricity Use
Residential (kWh)	5,204,829
Commercial and Industrial (kWh)	2,052,586
Total (kWh)	7,257,415

This table displays current electricity use within the municipality. This data is available from Efficiency Vermont (EVT).

Table 1E: Residential Thermal Efficiency Targets

	2025	2035	2050
"Residential - Increased Efficiency and Conservation (% of municipal households to be weatherized)"	5%	16%	78%

This table displays targets for thermal efficiency of residential structures. The data is based on a methodology developed by DPS using data available from the regional Long-range Energy Alternatives Planning (LEAP) analysis and ACS. The data in this table represents the percentage of municipal households that will need to be weatherized in the target years. The target is cumulative.

Table 1F: Commercial Thermal Efficiency Target

	2025	2035	2050
"Commercial - Increased Efficiency and Conservation (% of commercial establishments to be weatherized)"	25%	25%	73%

This table shows the same information as Table 1E, but sets a target for commercial thermal efficiency and weatherization. Information from the VT DOL is required to complete this target. The target is cumulative.

Table 1G: Thermal Fuel Switching (Residential and Commercial) – Wood Systems

	2025	2035	2050
New Efficient Wood Heat Systems (in units)	0	0	-1

This table provides a target for new wood heating systems for residential and commercial structures in the municipality for each target year. This target was calculated using data from LEAP and ACS. The target is cumulative.

Table 1H: Thermal Fuel Switching (Residential and Commercial) – Heat Pumps

	2025	2035	2050
New Heat Pumps (in units)	69	158	295

This table provides a target for new heat pump systems for residential and commercial structures in the municipality for each target year. This target was calculated using data from LEAP and ACS. The target is cumulative.

Table 1I: Electricity Efficiency Targets

	2025	2035	2050
Increase Efficiency and Conservation (BTUs)	25.2%	48.3%	100.7%

Data in this table displays a target for increased electricity efficiency and conservation during the target years. This target will be met through conversions to high efficiency appliances, electric heat pumps, and electric light-duty vehicles. These targets were developed using regional LEAP analysis. The target is cumulative.

Table 1J: Use of Renewables – Transportation

	2025	2035	2050
Renewable Energy Use - Transportation (BTUs)	5.3%	23.5%	86.8%

This data displays targets for the percentage of transportation energy use coming from renewable sources during each target year. This target will be met through conversions to electric light-duty vehicles and biodiesel heavy-duty vehicles. This data was developed using the LEAP analysis. The target is cumulative.

Table 1K: Use of Renewables – Heating

	2025	2035	2050
Renewable Energy Use - Heating (BTUs)	47.0%	60.8%	88.9%

This data displays targets for the percentage of heating energy use coming from renewable sources during each target year. This target will be met through conversions to electric heat pumps and high efficiency wood heating systems. This data was developed using information from the LEAP analysis. The target is cumulative.

Table 1L: Use of Renewables – Electricity

	2025	2035	2050
Renewable Energy Use - Electricity (MWh)	8,806.2	17,612.4	26,685.4

This data displays targets for MWh of electricity generation coming from renewable sources within the municipality during each target year. This data was developed using information from the regional planning commission and DPS. This data is the same as the data in Table 1Q. The target is cumulative.

Table 1M: Transportation Fuel Switching Targets – Electric Vehicles

	2025	2035	2050
Electric Vehicles	106	795	1,891

This tables displays a target for switching from fossil fuel based vehicles (gasoline and diesel) to electric vehicles. This target is calculated using LEAP and ACS data. The target is cumulative.

Table 1N: Transportation Fuel Switching Targets – Biodiesel

	2025	2035	2050
Biodiesel Vehicles	75	147	278

This tables displays a target for switching from fossil fuel based vehicles to biodiesel-powered vehicles. This target is calculated using LEAP and ACS data. The target is cumulative.

Table 1O: Existing Renewable Generation

Renewable Type	MW	MWh
Solar	0.07	85.85
Wind	0.01	29.13
Hydro	0.00	0.00
Biomass	0.60	2,454.55
Other	0.00	0.00
Total Existing Generation	0.68	2,569.53

Table 1O shows existing renewable generation in the municipality, in MW and MWh, based on information available from the Vermont Department of Public Service.

Table 1P: Renewable Generation Potential

Renewable Type	MW	MWh
Rooftop Solar	1	759
Ground-mounted Solar	1,056	1,294,707
Wind	22	67,567
Hydro	0.004	14
Biomass and Methane	0	0
Other	0	0
Total Renewable Generation Potential	1,078	1,363,047

Renewable generation potential is based on mapping completed by the regional planning commission that is based on the Municipal Determination Standards and associated guidance documents developed by DPS. The renewable generation potential is expressed in MW and MWh by the type of renewable resource (solar, wind, hydro, etc.).

Table 1Q: Renewable Generation Targets

	2025	2035	2050
Total Renewable Generation Target (in MWh)	8,806.19	17,612.39	26,685.43

This data displays targets for MWh of electricity generation coming from renewable sources within the municipality during each target year. This data was developed using information from the regional planning commission and DPS. This data is the same as the data in Table 1L.

Table 1R: Sufficient Land?

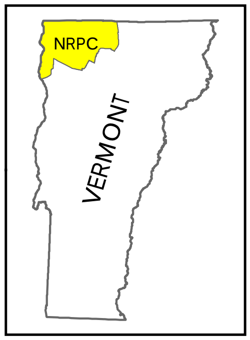
	Y/N
Solar	Y
Wind	Y

This table shows whether or not there is sufficient land in the municipality to meet the renewable generation targets based on the renewable generation potential in the municipality.

Utility Service Areas

Berkshire, Vermont
Act 174
The Energy Development Improvement Act of 2016

This map and the corresponding data is intended to be used to inform energy planning efforts by municipalities and regions. This may also be used for conceptual planning or initial site identification by those interested in developing renewable energy infrastructure. The maps do NOT take the place of site-specific investigation for a proposed facility and cannot be used of as "siting maps."

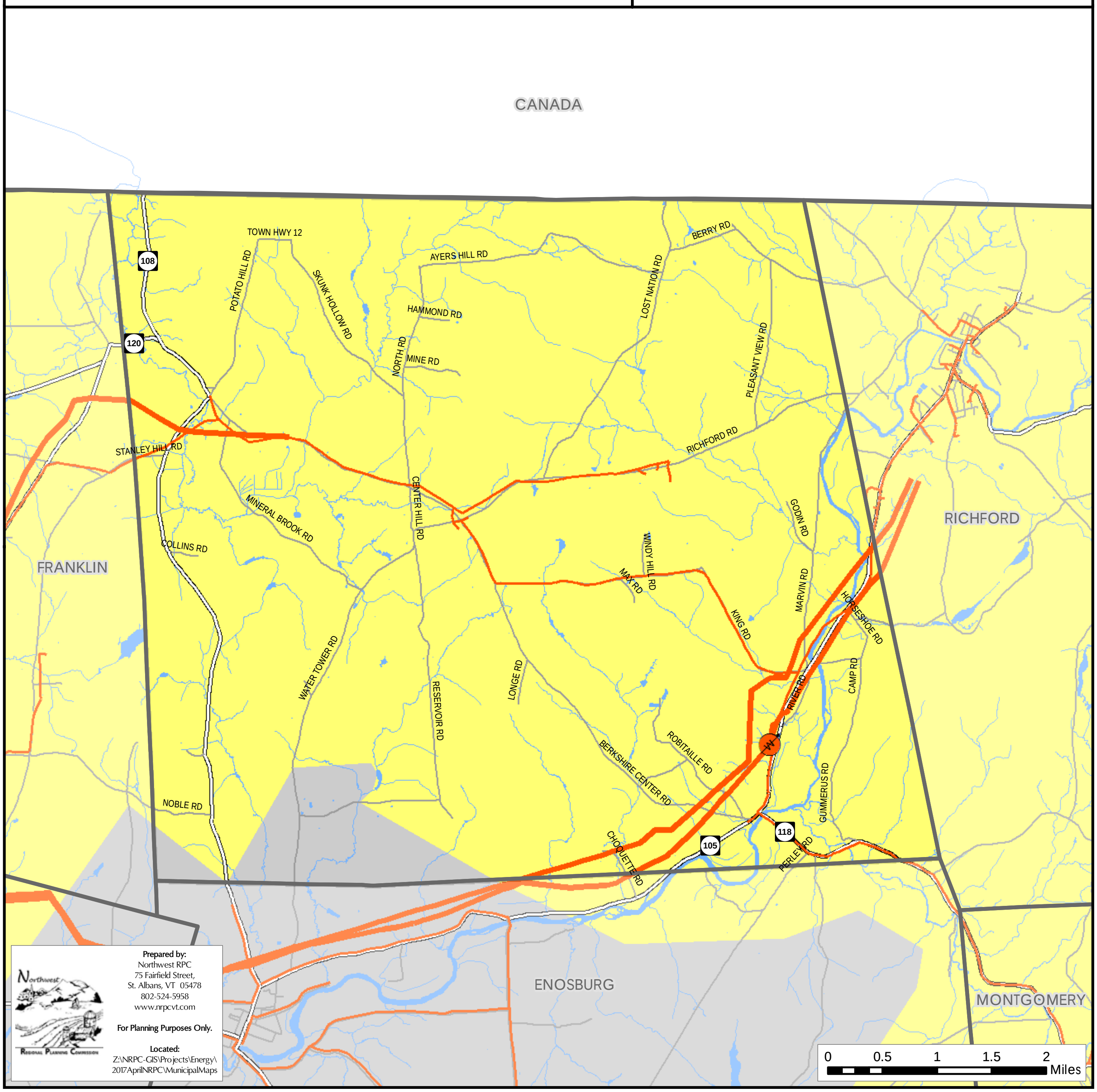


Legend

Utility Service Area Features

- Green Mountain Power
- Swanton Village Electric
- Vermont Electric Co-op
- Enosburg Falls Electric
- Substation
- 3 Phase Power Line
- Transmission Line

Sources: VCGI
Disclaimer: The accuracy of information presented is determined by its sources. Errors and omissions may exist. The Northwest RPC is not responsible for these. Questions of on-the-ground location can be resolved by site inspections and/or surveys by a registered surveyor. This map is not sufficient for delineation of features on-the-ground. This map identifies the presence of features, and may indicate relationships between features, but is not a replacement for surveyed information or engineering studies.



Transmission & 3 Phase Power Infrastructure

Berkshire, Vermont
Act 174
The Energy Development Improvement Act of 2016

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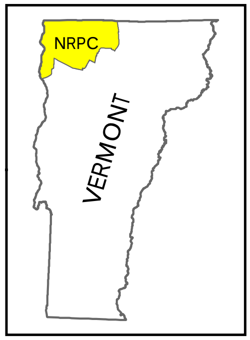
N



Legend

- Substation
- 3 Phase Power Line
- Transmission Line
- 1/2 Mile Buffer (3 Phase Power Line & Transmission Line)

Sources: VCGI
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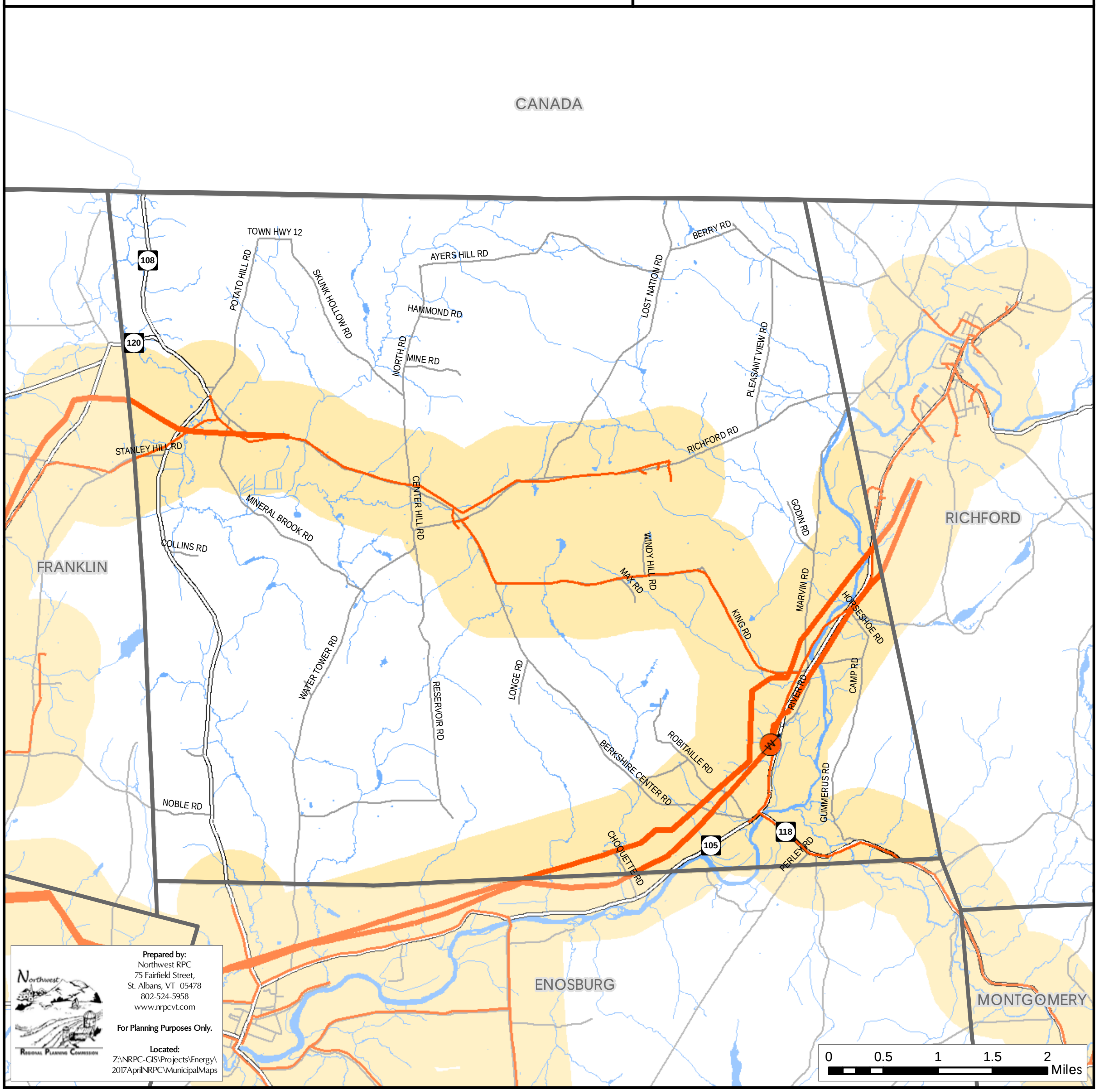

Existing Generation Facilities

Berkshire, Vermont
Act 174
The Energy Development Improvement Act of 2016

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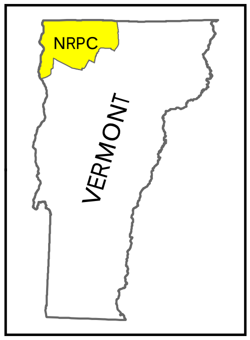

Legend

- Biomass Facility
- Hydro Facility
- Solar Facility
- Wind Facility

Note: Only generators 15kW are shown on the map. A full list of all generators is available.

Sources: VCGI
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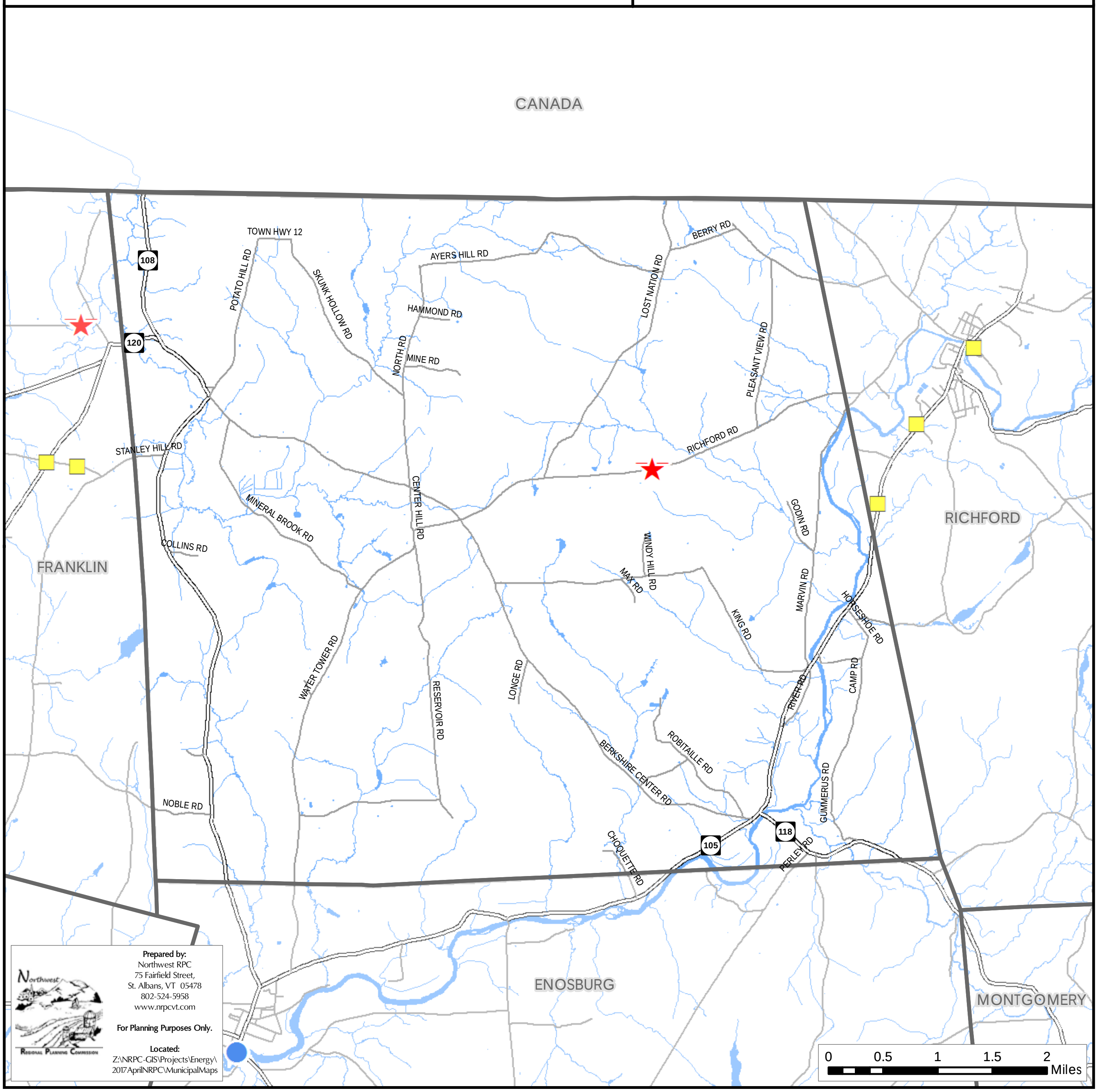

Hydro

Berkshire, Vermont
Act 174
The Energy Development Improvement Act of 2016

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N

Legend

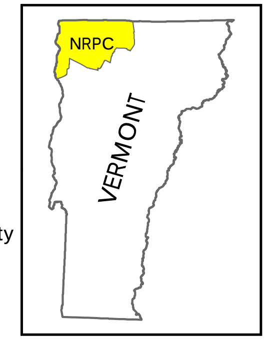
- Substation
- 3 Phase Power Line
- Transmission Line
- Designated Outstanding Resource Water
- Known Constraint - Designated National Wild & Scenic River
- Possible Constraint - Stressed or Impaired Water
- Possible Constraint - RINAs

Potential Hydroelectric Facility

- < 50 kW Capacity
- > 50 kW Capacity
- High Hazard with < 50 kW Capacity
- High Hazard with > 50 kW Capacity

Operating Hydroelectric Facility

- Dam not on National Wild and Scenic River
- Dam on National Wild and Scenic River



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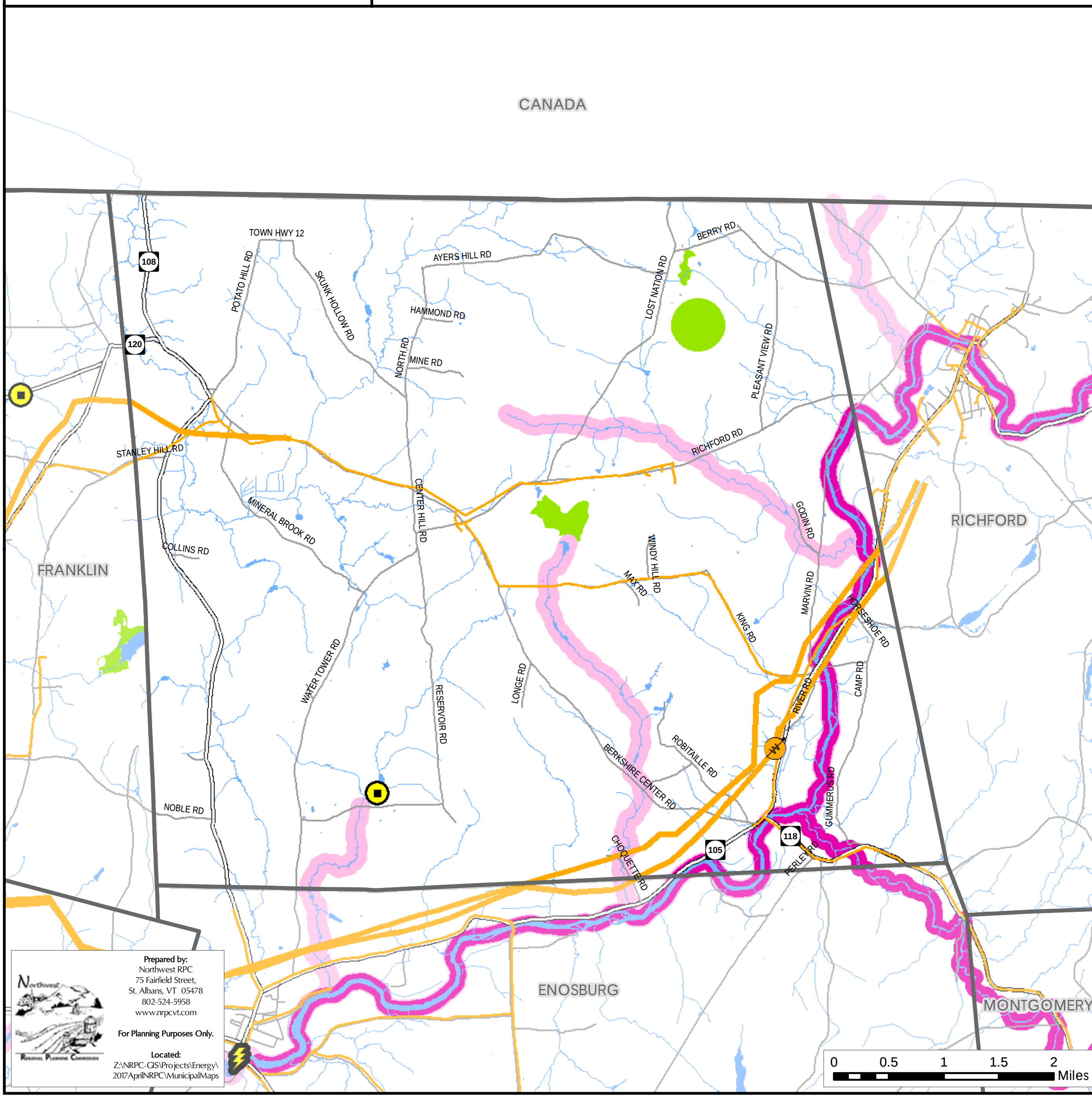

Solar

Berkshire, Vermont
Act 174
The Energy Development Improvement Act of 2016

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Legend

- Substation
- 3 Phase Power Line
- Transmission Line
- 1/2 Mile Buffer (3 Phase Power Line & Transmission Line)
- Prime Solar/No Known Constraints
- Base Solar/Possible Constraints

Sources: VCGI
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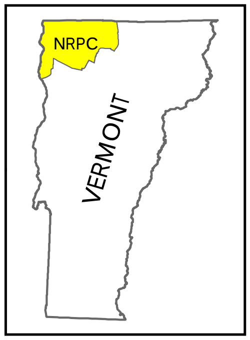

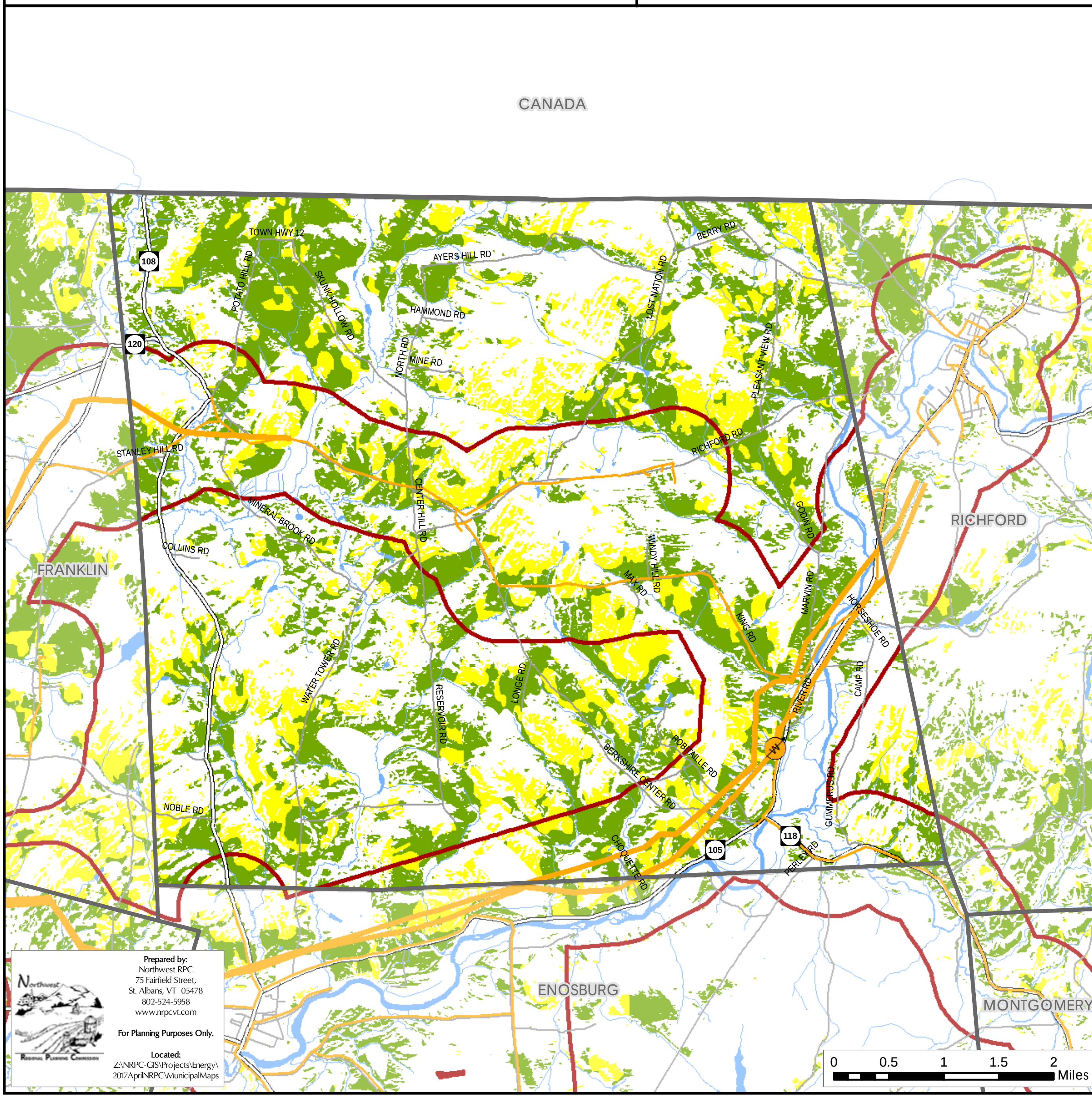

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For Planning Purposes Only.

Located:
Z:\NRPC-GIS\Projects\Energy\2017April\NRPC\MunicipalMaps

Wind

Berkshire, Vermont
Act 174
The Energy Development Improvement Act of 2016

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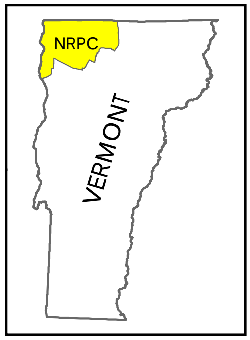

Legend

- Substation
- 3 Phase Power Line
- Transmission Line
- Prime Wind: Areas of high wind potential and no known constraints. Darker areas have higher wind speeds.
- Base Wind: Areas of high wind potential and a presence of possible constraints. Darker areas have higher wind speeds.

Sources: VCGI
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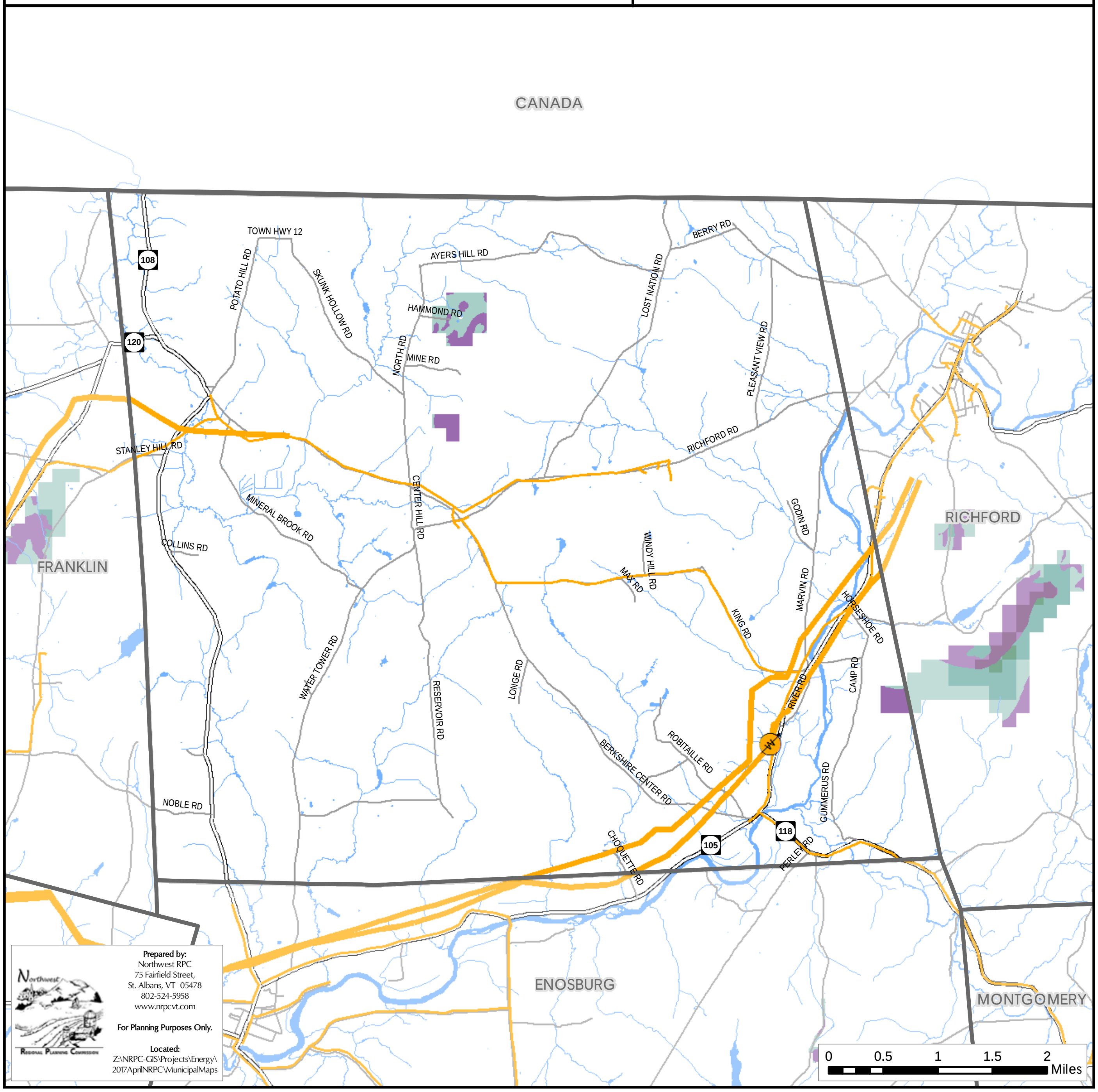

Woody Biomass

Berkshire, Vermont
Act 174
The Energy Development Improvement Act of 2016

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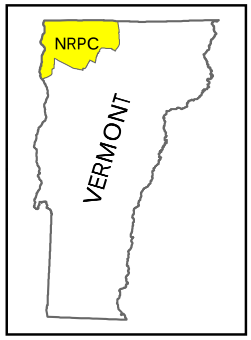


Legend

- Biomass System
- Cow Power
- Substation
- 3 Phase Power Line
- Transmission Line
- Prime Woody Biomass/No Known Constraints
- Base Woody Biomass/Possible Constraints

Sources: VCGI
Disclaimer: The accuracy of information presented is determined by its sources. Errors and omissions may exist. The Northwest RPC is not responsible for these. Questions of on-the-ground location can be resolved by site inspections and/or surveys by a registered surveyor. This map is not sufficient for delineation of features on-the-ground. This map identifies the presence of features, and may indicate relationships between features, but is not a replacement for surveyed information or engineering studies.

All Generators in Municipality

Category	Sub - Category	Organization Type	Address	City	CPG Number	Capacity kW
Biomass	Anaerobic Digester	Farm	1954 Richford Road	Berkshire		600
Solar	Ground-mounted PV: Pole	Residential	3512 Berkshire Ctr. Road	Berkshire	2891	8.5
Solar	Ground-mounted PV: Pole	Residential	1856 Reservoir Rd	Berkshire	3719	7.5
Solar	Hot Water	Residential	1071 Richford Road	Berkshire		
Solar	Roof-Mounted PV	Residential	3440 Water Tower Rd	Berkshire	2687	11.2
Solar	Roof-Mounted PV	Residential	227 Horse Shoe Rd	Berkshire	6206	10
Solar	Roof-Mounted PV	Residential	4730 West Berkshire Rd	Berkshire		8.9
Solar	Roof-Mounted PV	Residential	1179 Mineral Brook Rd	Berkshire	5909	5
Solar	Roof-Mounted PV	Residential	971 King Rd	Berkshire	5033	10
Solar	Roof-Mounted PV	Residential	1376 Bershire Ctr. Road	Berkshire	7295	8.2
Wind	Small Wind	Residential	281 Hammond Road	Berkshire	525	9.5
Wind	Small Wind	Farm	1 Magoon Road	Berkshire	386	9.5

Municipal Analysis & Targets - Enosburgh

The following is an explanation of the municipal energy data compiled by Northwest Regional Planning Commission (NRPC). The intent of the municipal energy data is to provide the municipalities with data required to ensure compliance with the requirements of Act 174 and "Enhanced Energy Planning" (24 V.S.A. 4352). The following tables contain data that estimates current energy use and provides targets for future energy use across all sectors (transportation, heating, and electricity). It also sets targets for renewable energy generation within the municipality.

This data is meant to be a starting point for the municipality to begin planning its energy future and to talk about the changes that may need to occur within the municipality to ensure that local, regional and state energy goals are met. This includes the State of Vermont's goal to have 90% of all energy demand be met from renewable sources by 2050.

Figure 1 - Data Sources

ACS – American Community Survey

DOL –Vermont Department of Labor

DPS – Vermont Department of Public Service

EIA – Energy Information Administration

EVT – Efficiency Vermont

LEAP – Long-Range Energy Alternatives Planning

VEIC – Vermont Energy Investment Corporation

VTrans – Vermont Agency of Transportation

Data Sources

Estimates of current energy use consist primarily of data available from the American Community Survey (ACS), the Vermont Agency of Transportation (VTrans), the Vermont Department of Labor (DOL), and the Vermont Department of Public Service (DPS). Targets for future energy use are reliant upon the Long-range Energy Alternatives Planning (LEAP) analysis for the region completed the Vermont Energy Investment Corporation (VEIC). Targets for future energy generation have come from the regional planning commission and DPS. For more information on LEAP, see the Northwest Regional Energy Plan (www.nrpcvt.com). Targets for both future energy use and energy generation have been generally developed using a "top down" method of disaggregating regional data to the municipal level.

It is possible to develop "bottom up" data. For those municipalities interested in that approach, please see the Department of Public Service's Analysis and Targets Guidance (http://publicservice.vermont.gov/content/act-174-recommendations-and-determination-standards).

Please remember that the targets established by LEAP represent only one way to achieve energy goals. There may several other similar pathways that a municipality may choose to take in order to meet the 90x50 goal.

Below is a worksheet by worksheet explanation of the Municipal Template spreadsheet:

1. Municipal Data Summary

The following tables summarize all data that is required to be in a municipal plan if the plan is to meet the "determination" standards established by the Vermont Department of Public Service.

Table 1A: Current Municipal Transportation Energy Use

Transportation Data	Municipal Data
Total # of Passenger Vehicles (ACS 2011-2015)	2,090
Average Miles per Vehicle (Vtrans)	11,356
Total Miles Traveled	23,734,040
Realized MPG (2013 - VTrans 2015 Energy Profile)	18.6
Total Gallons Use per Year	1,276,024
Transportation BTUs (Billion)	154
Average Cost per Gallon of Gasoline (RPC)	2.31
Gasoline Cost per Year	2,947,615

This table uses data from the American Community Survey (ACS) and Vermont Agency of Transportation (VTrans) to calculate current transportation energy use and energy costs in the municipality.

Table 1B: Current Municipal Residential Heating Energy Use

Fuel Source	Municipal Households (ACS 2011-2015)	% of Municipal Households	Municipal Square Footage Heated	Municipal BTU (in Billions)
Natural Gas	127	10.8%	191,120	11
Propane	128	10.9%	202,176	12
Electricity	16	1.4%	28,352	2
Fuel Oil	557	47.6%	881,008	53
Coal	7	0.6%	8,400	1
Wood	316	27.0%	572,800	34
Solar	0	0.0%	0	0
Other	20	1.7%	31,744	2
No Fuel	0	0.0%	0	0
Total	1,171	100.0%	1,915,600	115

This table displays data from the ACS that estimates current municipal residential heating energy use.

Table 1C: Current Municipal Commercial Energy Use

	Commercial Establishments in Municipality (VT DOL)	Estimated Thermal Energy BTUs per Commercial Establishment (in Billions) (VDPS)	Estimated Thermal Energy BTUs by Commercial Establishments in Municipality (in Billions)
Municipal Commercial Energy Use	89	0.725	65

The table uses data available from the Vermont Department of Labor (VT DOL) and the Vermont Department of Public Service (DPS) to estimate current municipal commercial establishment energy use in the municipality.

Table 1D: Current Electricity Use

Use Sector	Current Electricity Use
Residential (kWh)	10,526,520
Commercial and Industrial (kWh)	22,835,018
Total (kWh)	33,361,538

This table displays current electricity use within the municipality. This data is available from Efficiency Vermont (EVT).

Table 1E: Residential Thermal Efficiency Targets

	2025	2035	2050
"Residential - Increased Efficiency and Conservation (% of municipal households to be weatherized)"	5%	16%	78%

This table displays targets for thermal efficiency of residential structures. The data is based on a methodology developed by DPS using data available from the regional Long-range Energy Alternatives Planning (LEAP) analysis and ACS. The data in this table represents the percentage of municipal households that will need to be weatherized in the target years. The target is cumulative.

Table 1F: Commercial Thermal Efficiency Target

	2025	2035	2050
"Commercial - Increased Efficiency and Conservation (% of commercial establishments to be weatherized)"	25%	25%	73%

This table shows the same information as Table 1E, but sets a target for commercial thermal efficiency and weatherization. Information from the VT DOL is required to complete this target. The target is cumulative.

Table 1G: Thermal Fuel Switching (Residential and Commercial) – Wood Systems

	2025	2035	2050
New Efficient Wood Heat Systems (in units)	6	16	59

This table provides a target for new wood heating systems for residential and commercial structures in the municipality for each target year. This target was calculated using data from LEAP and ACS. The target is cumulative.

Table 1H: Thermal Fuel Switching (Residential and Commercial) – Heat Pumps

	2025	2035	2050
New Heat Pumps (in units)	122	293	578

This table provides a target for new heat pump systems for residential and commercial structures in the municipality for each target year. This target was calculated using data from LEAP and ACS. The target is cumulative.

Table 1I: Electricity Efficiency Targets

	2025	2035	2050
Increase Efficiency and Conservation (BTUs)	25.2%	48.3%	100.7%

Data in this table displays a target for increased electricity efficiency and conservation during the target years. This target will be met through conversions to high efficiency appliances, electric heat pumps, and electric light-duty vehicles. These targets were developed using regional LEAP analysis. The target is cumulative.

Table 1J: Use of Renewables – Transportation

	2025	2035	2050
Renewable Energy Use - Transportation (BTUs)	12.4%	35.7%	91.7%

This data displays targets for the percentage of transportation energy use coming from renewable sources during each target year. This target will be met through conversions to electric light-duty vehicles and biodiesel heavy-duty vehicles. This data was developed using the LEAP analysis. The target is cumulative.

Table 1K: Use of Renewables – Heating

	2025	2035	2050
Renewable Energy Use - Heating (BTUs)	44.3%	57.3%	85.0%

This data displays targets for the percentage of heating energy use coming from renewable sources during each target year. This target will be met through conversions to electric heat pumps and high efficiency wood heating systems. This data was developed using information from the LEAP analysis. The target is cumulative.

Table 1L: Use of Renewables – Electricity

	2025	2035	2050
Renewable Energy Use - Electricity (MWh)	7,188.4	14,376.8	21,783.1

This data displays targets for MWh of electricity generation coming from renewable sources within the municipality during each target year. This data was developed using information from the regional planning commission and DPS. This data is the same as the data in Table 1Q. The target is cumulative.

Table 1M: Transportation Fuel Switching Targets – Electric Vehicles

	2025	2035	2050
Electric Vehicles	183	1,369	3,258

This tables displays a target for switching from fossil fuel based vehicles (gasoline and diesel) to electric vehicles. This target is calculated using LEAP and ACS data. The target is cumulative.

Table 1N: Transportation Fuel Switching Targets – Biodiesel

	2025	2035	2050
Biodiesel Vehicles	493	984	1,906

This tables displays a target for switching from fossil fuel based vehicles to biodiesel-powered vehicles. This target is calculated using LEAP and ACS data. The target is cumulative.

Table 1O: Existing Renewable Generation

Renewable Type	MW	MWh
Solar	0.29	355.66
Wind	0.00	8.58
Hydro	2.00	7,008.00
Biomass	0.00	0.00
Other	0.00	0.00
Total Existing Generation	2.29	7,372.24

Table 1O shows existing renewable generation in the municipality, in MW and MWh, based on information available from the Vermont Department of Public Service.

Table 1P: Renewable Generation Potential

Renewable Type	MW	MWh
Rooftop Solar	2	1,982
Ground-mounted Solar	461	565,299
Wind	176	539,831
Hydro	0.004	14
Biomass and Methane	0	0
Other	0	0
Total Renewable Generation Potential	639	1,107,125

Renewable generation potential is based on mapping completed by the regional planning commission that is based on the Municipal Determination Standards and associated guidance documents developed by DPS. The renewable generation potential is expressed in MW and MWh by the type of renewable resource (solar, wind, hydro, etc.).

Table 1Q: Renewable Generation Targets

	2025	2035	2050
Total Renewable Generation Target (in MWh)	7,188.41	14,376.83	21,783.07

This data displays targets for MWh of electricity generation coming from renewable sources within the municipality during each target year. This data was developed using information from the regional planning commission and DPS. This data is the same as the data in Table 1L.

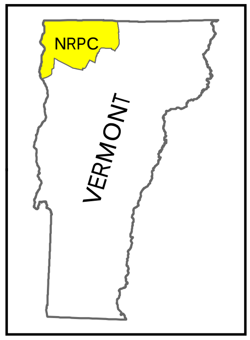
Table 1R: Sufficient Land?

	Y/N
Solar	Y
Wind	Y

This table shows whether or not there is sufficient land in the municipality to meet the renewable generation targets based on the renewable generation potential in the municipality.

Utility Service Areas

Enosburgh, Vermont
Act 174
The Energy Development Improvement Act of 2016



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N

Legend

Utility Service Area Features

- Green Mountain Power
- Swanton Village Electric
- Vermont Electric Co-op
- Enosburg Falls Electric
- Substation
- 3 Phase Power Line
- Transmission Line

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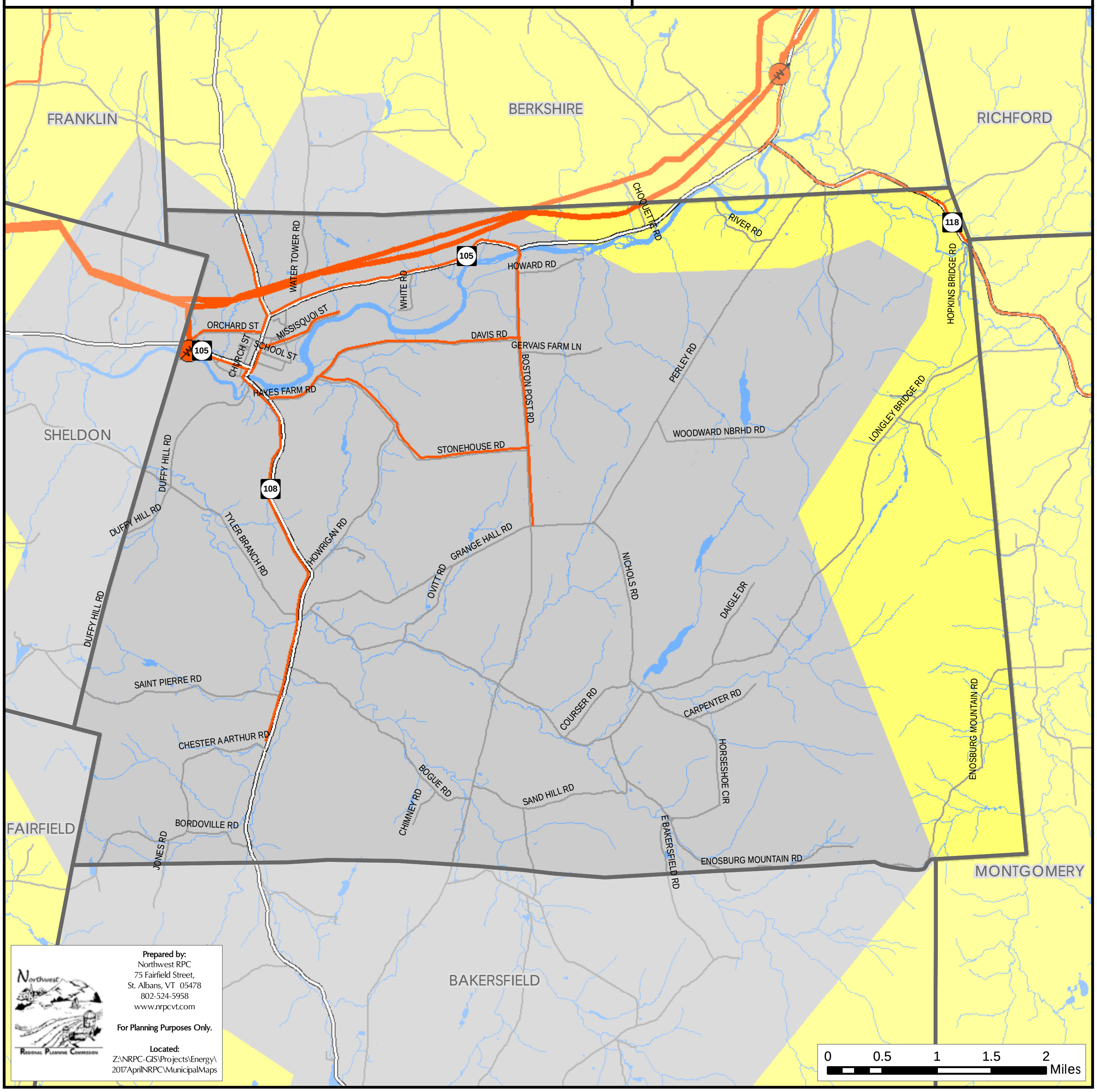

Transmission & 3 Phase Power Infrastructure

Enosburgh, Vermont
Act 174
The Energy Development Improvement Act of 2016

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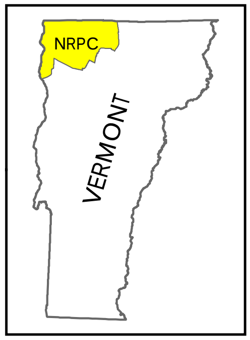

Legend

- Substation
- 3 Phase Power Line
- Transmission Line
- 1/2 Mile Buffer (3 Phase Power Line & Transmission Line)

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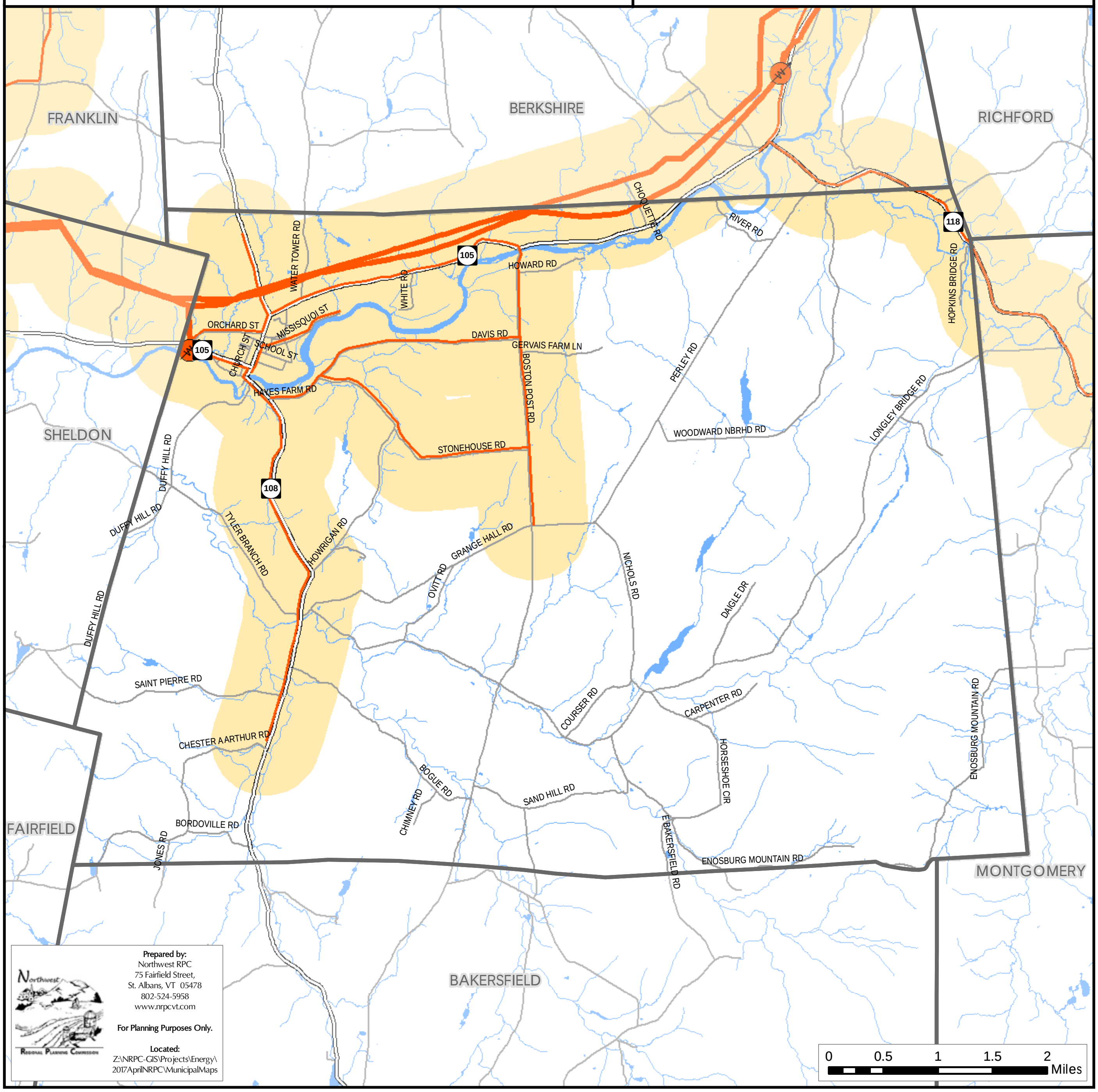

Prepared by:
Northwest RPC
75 Fairfield Street,
St. Albans, VT 05478
802-524-5958
www.nrpcvt.com

For Planning Purposes Only.

Located:
Z:\NRPC-GIS\Projects\Energy\2017AprilNRPC\MunicipalMaps

Existing Generation Facilities

Enosburgh, Vermont
Act 174
The Energy Development Improvement Act of 2016

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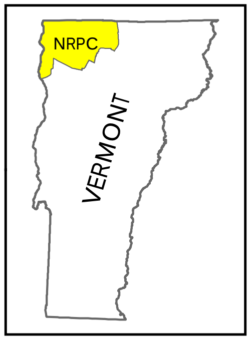

Legend

- Biomass Facility
- Hydro Facility
- Solar Facility
- Wind Facility

Note: Only generators 15kW are shown on the map. A full list of all generators is available.

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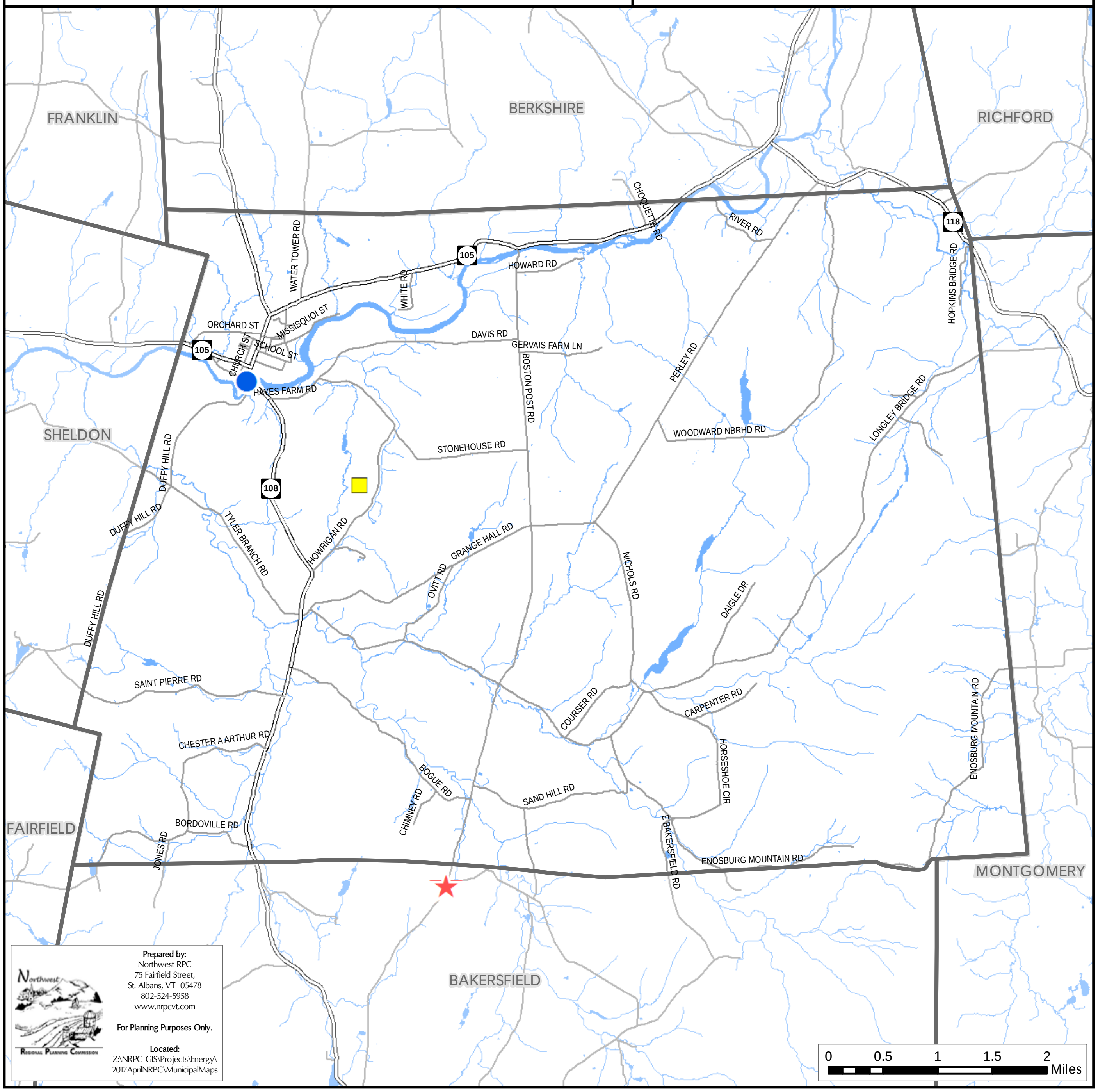

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Natural Gas Lines

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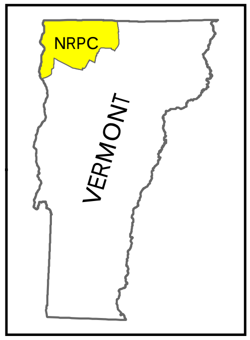

Legend

Natural Gas Line

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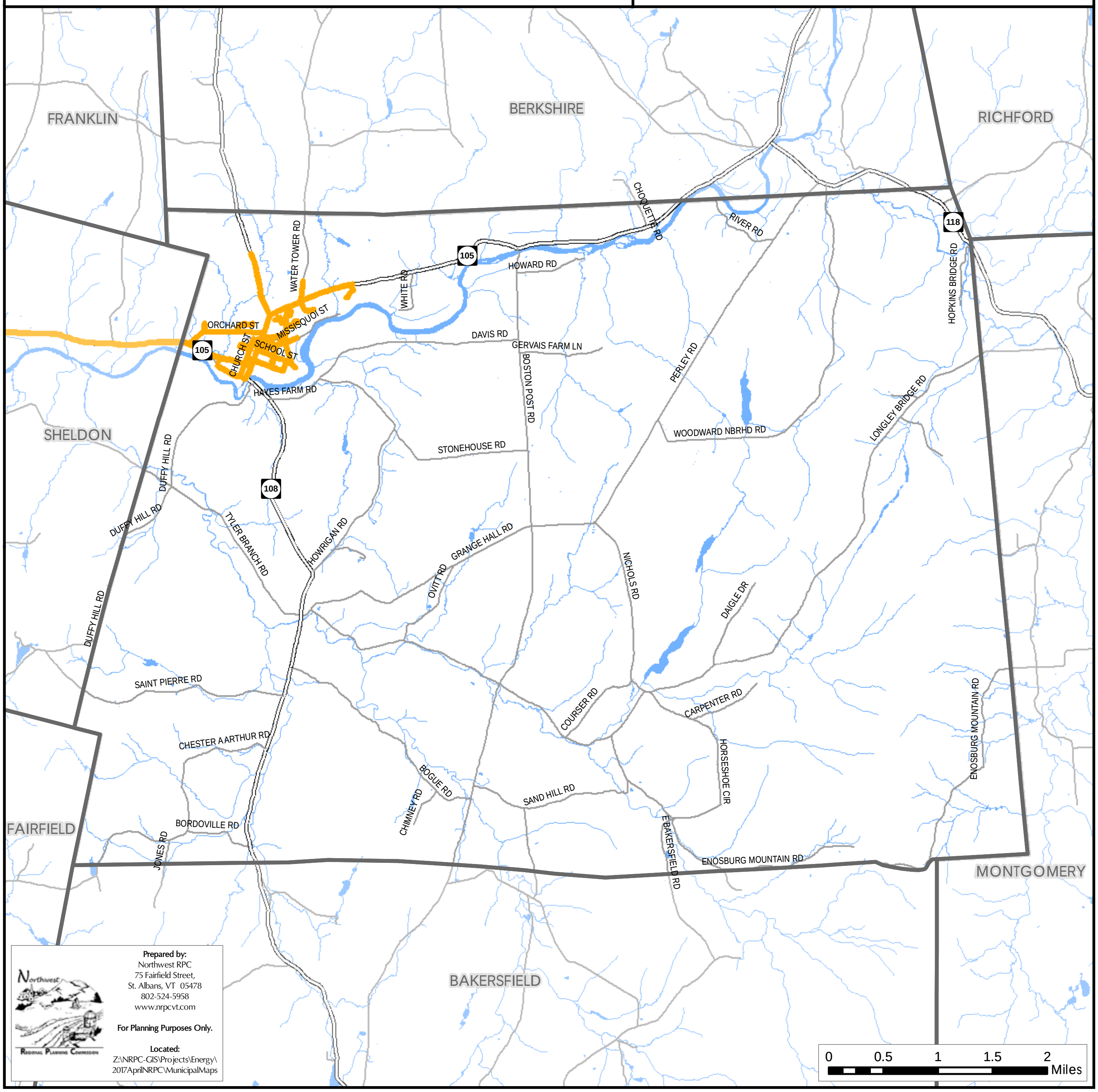

Hydro

Enosburgh, Vermont
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N

Legend

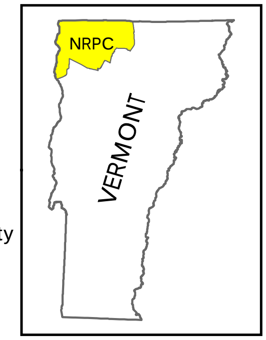
- Substation
- 3 Phase Power Line
- Transmission Line
- Designated Outstanding Resource Water
- Known Constraint - Designated National Wild & Scenic River
- Possible Constraint - Stressed or Impaired Water
- Possible Constraint - RINAs

Potential Hydroelectric Facility

- < 50 kW Capacity
- > 50 kW Capacity
- High Hazard with < 50 kW Capacity
- High Hazard with > 50 kW Capacity

Operating Hydroelectric Facility

- Dam not on National Wild and Scenic River
- Dam on National Wild and Scenic River



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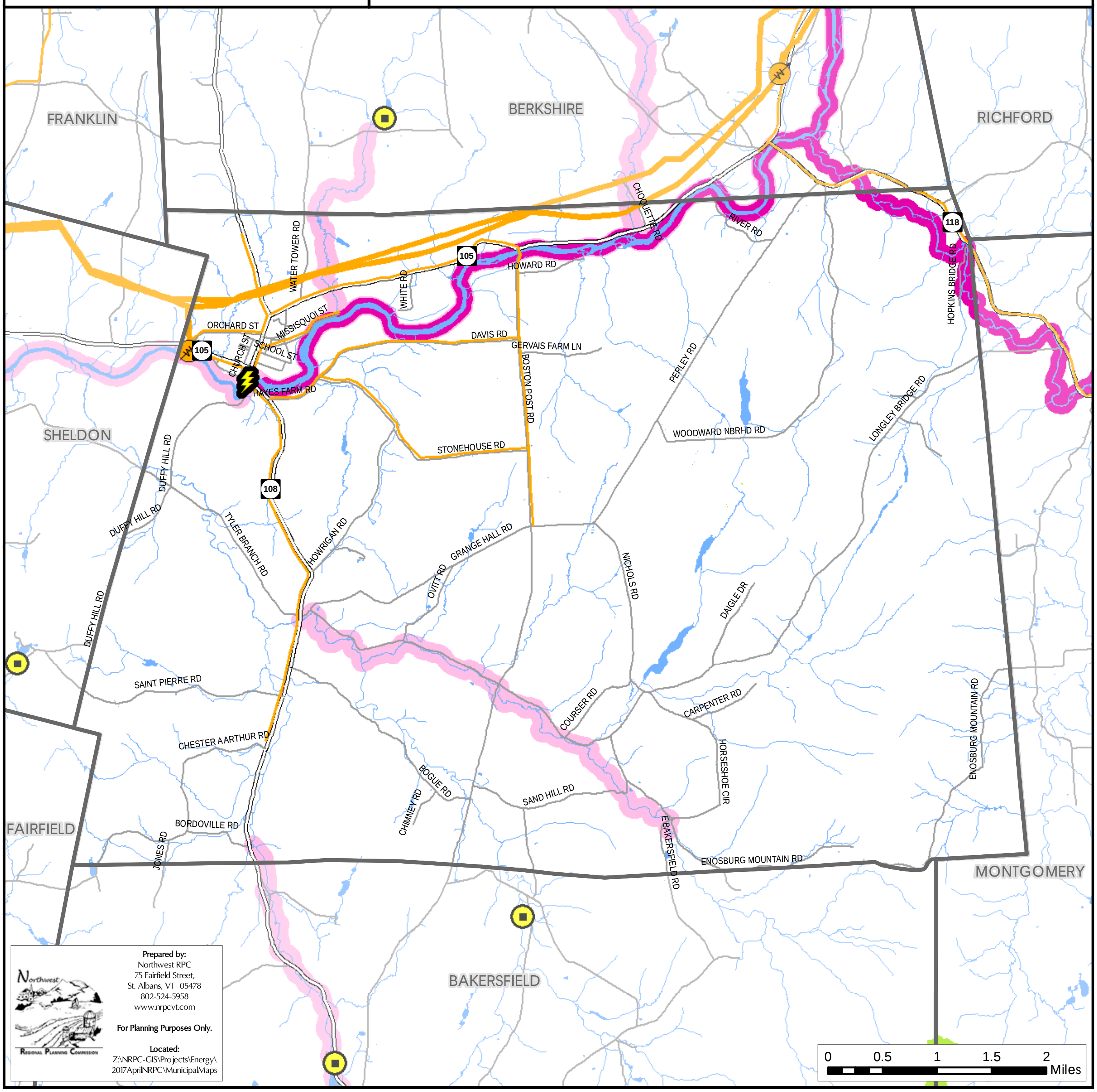

Solar

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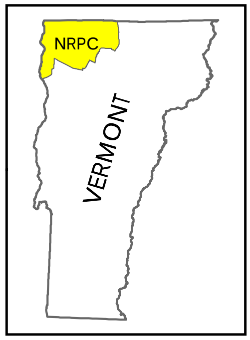

Legend

- Substation
- 3 Phase Power Line
- Transmission Line
- 1/2 Mile Buffer (3 Phase Power Line & Transmission Line)
- Prime Solar/No Known Constraints
- Base Solar/Possible Constraints

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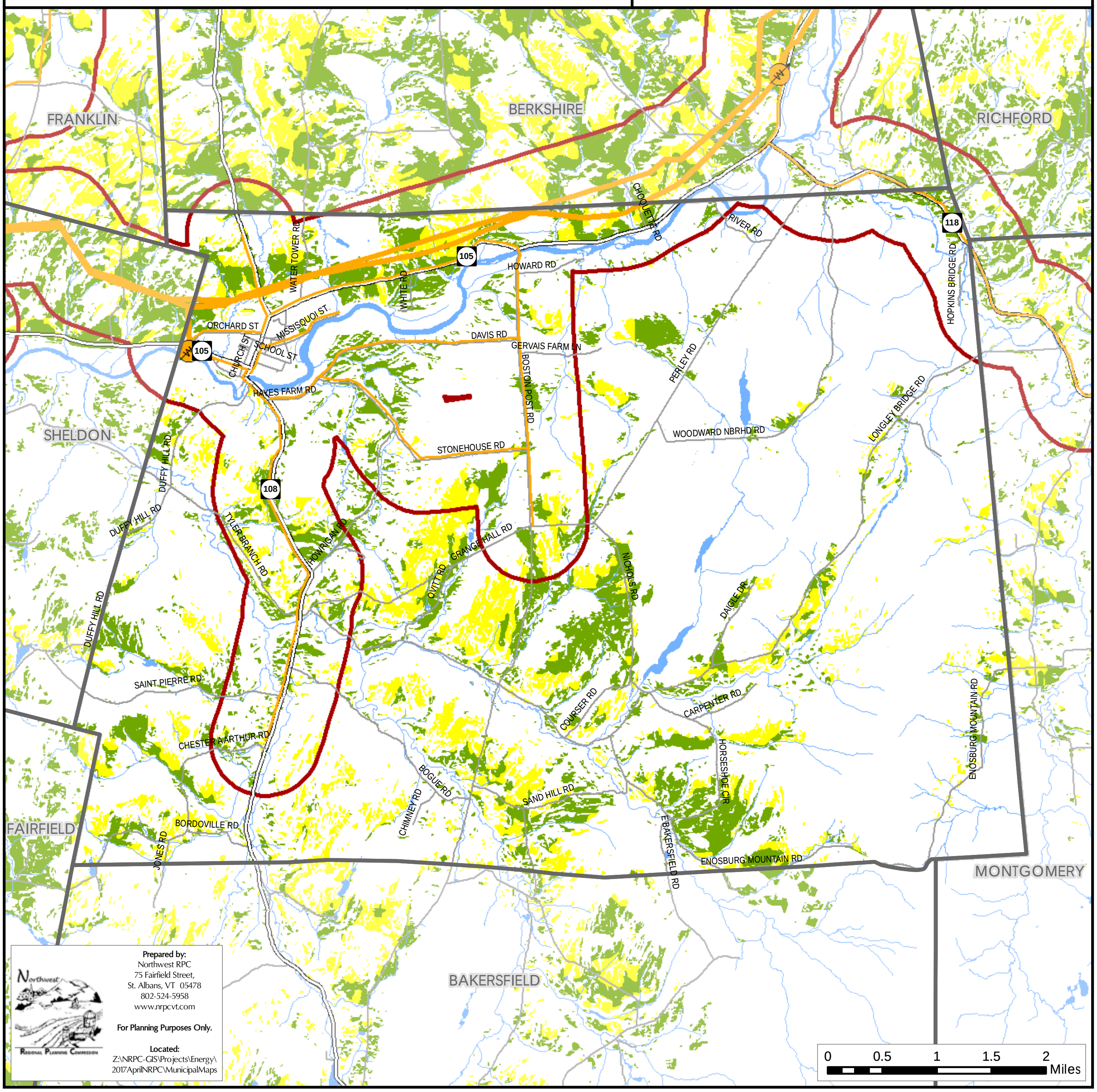

Wind

Enosburgh, Vermont
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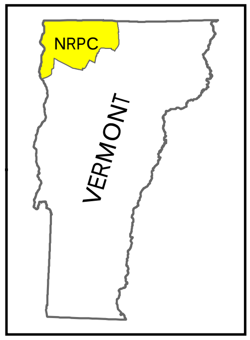

Legend

- Substation
- 3 Phase Power Line
- Transmission Line
- Prime Wind: Areas of high wind potential and no known constraints. Darker areas have higher wind speeds.
- Base Wind: Areas of high wind potential and a presence of possible constraints. Darker areas have higher wind speeds.

Sources: VCGI

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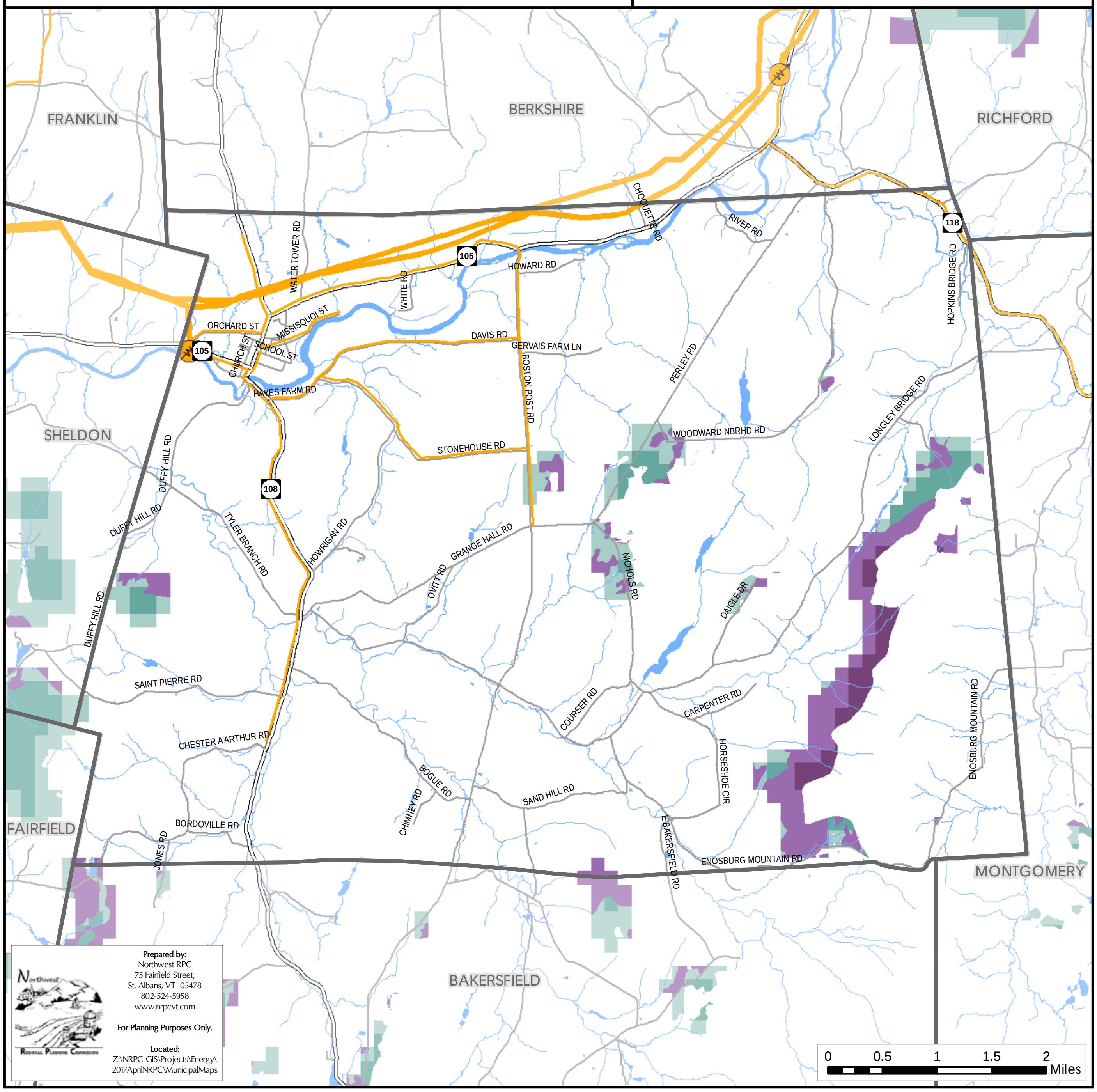

Woody Biomass

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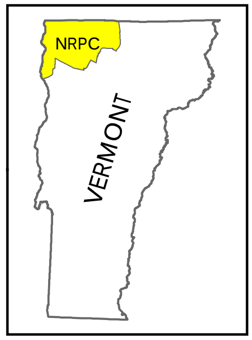

Legend

- Biomass System
- Cow Power
- Substation
- 3 Phase Power Line
- Transmission Line
- Prime Woody Biomass/No Known Constraints
- Base Woody Biomass/Possible Constraints

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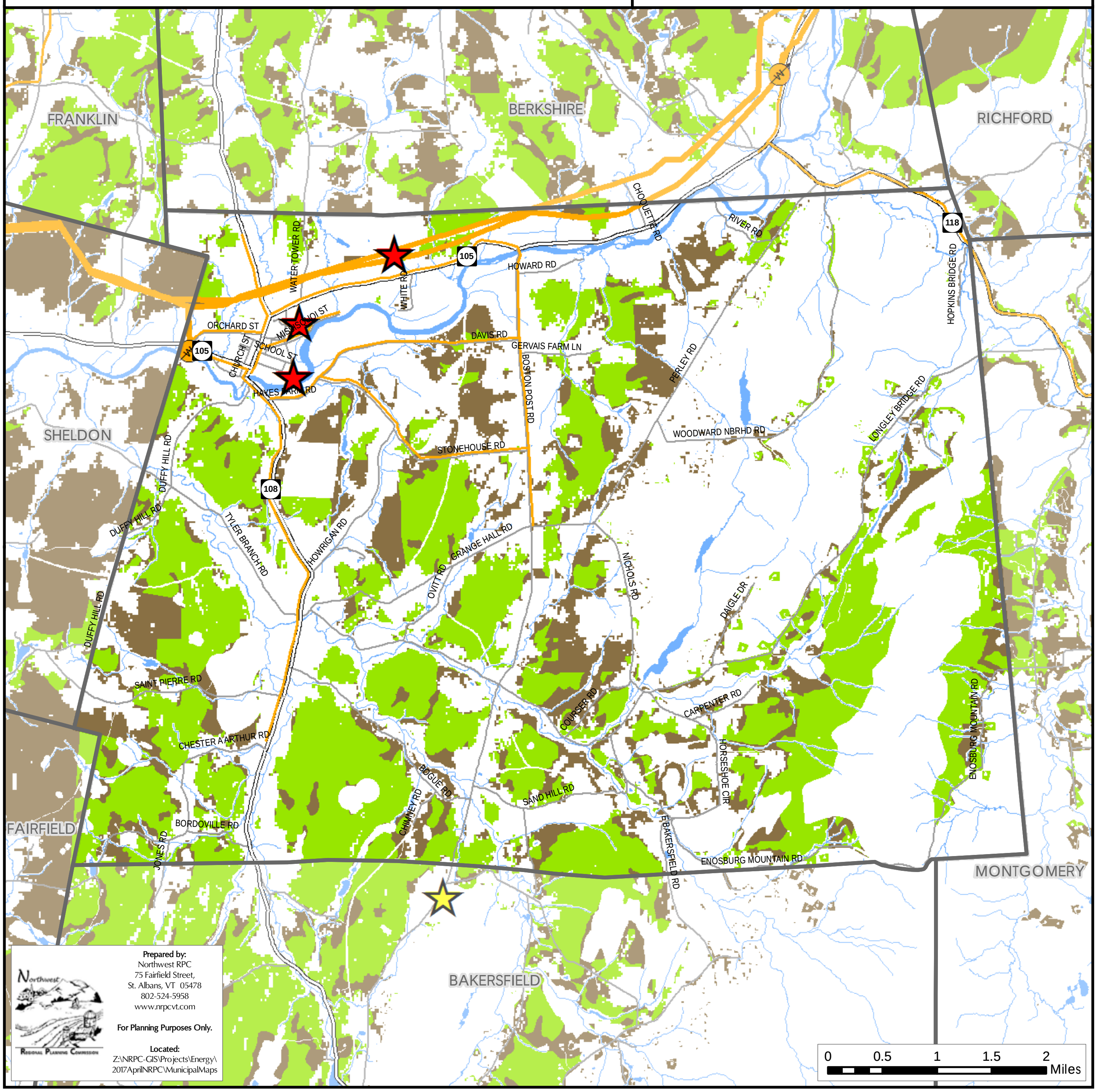

All Generators in Municipality

Category	Sub - Category	Organization Type	Address	City	CPG Number	Capacity kW
Hydro	Hydropower	Business		Enosburg Falls		2000
Solar	Ground-mounted PV: Fixed Rack	Residential	3308 Sampsonville Rd	Enosburg Falls	6313	10
Solar	Ground-mounted PV: Pole	Residential	475 Nichols Rd	Enosburg Falls	6759	6
Solar	Ground-mounted PV: Pole	Residential	8333 Chester A. Arthur Rd	Enosburg Falls	3904	6.4
Solar	Ground-mounted PV: Tracker	Residential	1167 Nichols Rd	Enosburg Falls	1577	8
Solar	Ground-mounted PV: Tracker	Residential	5587 Vermont 105	Enosburg Falls	3227	148.2
Solar	Ground-mounted PV: Tracker	Residential	2319 Longley Bridge Rd	Enosburg Falls	1092	3.8
Solar	Roof-Mounted PV	Residential	300 River Road	Enosburg Falls	1280	1.6
Solar	Roof-Mounted PV	Residential	1391 St. Pierre Road	Enosburg Falls	3441	5.6
Solar	Roof-Mounted PV	Residential	663 Sand Hill Rd	Enosburg Falls	6080	5
Solar	Roof-Mounted PV	Residential	1747 Sampsonville Rd	Enosburg Falls	3858	6
Solar	Roof-Mounted PV	Residential	1889 Davis Rd	Enosburg Falls	6079	5
Solar	Roof-Mounted PV	Residential	279 Howrigan Rd	Enosburg Falls	5801	6
Solar	Roof-Mounted PV	Residential	2852 Duffy Hill Rd	Enosburg Falls	2683	6.1
Solar	Roof-Mounted PV	Residential	4689 Boston Post Rd	Enosburg Falls	5610	10
Solar	Roof-Mounted PV	Residential	3308 Sampsonville Rd	Enosburg Falls		10
Solar	Roof-Mounted PV	Residential	138 Valentine Dr	Enosburg Falls	4190	10
Solar	Roof-Mounted PV	Residential	613 Grange Rd	Enosburg Falls	3680	6
Solar	Roof-Mounted PV	Residential	3954 Boston Post Road	Enosburg Falls	7154	6
Solar	Roof-Mounted PV	Residential	899 Sandhill Rd	Enosburg Falls	16-0304	6.5
Solar	Roof-Mounted PV	Residential	142 Champlain Street	Enosburg Falls	6962	6
Solar	Roof-Mounted PV	Residential	3430 Boston Post Road	Enosburg Falls		3.8
Solar	Roof-Mounted PV	Residential	2035 Tyler Branch Rd	Enosburg Falls	3703	10.3
Wind	Small Wind	Residential	300 River Road	Enosburg Falls	1280	2.8

Municipal Analysis & Targets - Fairfax

The following is an explanation of the municipal energy data compiled by Northwest Regional Planning Commission (NRPC). The intent of the municipal energy data is to provide the municipalities with data required to ensure compliance with the requirements of Act 174 and "Enhanced Energy Planning" (24 V.S.A. 4352). The following tables contain data that estimates current energy use and provides targets for future energy use across all sectors (transportation, heating, and electricity). It also sets targets for renewable energy generation within the municipality.

This data is meant to be a starting point for the municipality to begin planning its energy future and to talk about the changes that may need to occur within the municipality to ensure that local, regional and state energy goals are met. This includes the State of Vermont's goal to have 90% of all energy demand be met from renewable sources by 2050.

Figure 1 - Data Sources

ACS – American Community Survey

DOL –Vermont Department of Labor

DPS – Vermont Department of Public Service

EIA – Energy Information Administration

EVT – Efficiency Vermont

LEAP – Long-Range Energy Alternatives Planning

VEIC – Vermont Energy Investment Corporation

VTrans – Vermont Agency of Transportation

Data Sources

Estimates of current energy use consist primarily of data available from the American Community Survey (ACS), the Vermont Agency of Transportation (VTrans), the Vermont Department of Labor (DOL), and the Vermont Department of Public Service (DPS). Targets for future energy use are reliant upon the Long-range Energy Alternatives Planning (LEAP) analysis for the region completed the Vermont Energy Investment Corporation (VEIC). Targets for future energy generation have come from the regional planning commission and DPS. For more information on LEAP, see the Northwest Regional Energy Plan (www.nrpcvt.com). Targets for both future energy use and energy generation have been generally developed using a "top down" method of disaggregating regional data to the municipal level.

It is possible to develop "bottom up" data. For those municipalities interested in that approach, please see the Department of Public Service's Analysis and Targets Guidance (http://publicservice.vermont.gov/content/act-174-recommendations-and-determination-standards).

Please remember that the targets established by LEAP represent only one way to achieve energy goals. There may several other similar pathways that a municipality may choose to take in order to meet the 90x50 goal.

Below is a worksheet by worksheet explanation of the Municipal Template spreadsheet:

1. Municipal Data Summary

The following tables summarize all data that is required to be in a municipal plan if the plan is to meet the "determination" standards established by the Vermont Department of Public Service.

Table 1A: Current Municipal Transportation Energy Use

Transportation Data	Municipal Data
Total # of Passenger Vehicles (ACS 2011-2015)	3,641
Average Miles per Vehicle (Vtrans)	11,356
Total Miles Traveled	41,347,196
Realized MPG (2013 - VTrans 2015 Energy Profile)	18.6
Total Gallons Use per Year	2,222,968
Transportation BTUs (Billion)	268
Average Cost per Gallon of Gasoline (RPC)	2.31
Gasoline Cost per Year	5,135,055

This table uses data from the American Community Survey (ACS) and Vermont Agency of Transportation (VTrans) to calculate current transportation energy use and energy costs in the municipality.

Table 1B: Current Municipal Residential Heating Energy Use

Fuel Source	Municipal Households (ACS 2011-2015)	% of Municipal Households	Municipal Square Footage Heated	Municipal BTU (in Billions)
Natural Gas	75	4.3%	103,376	6
Propane	414	23.7%	729,824	44
Electricity	19	1.1%	36,176	2
Fuel Oil	859	49.2%	1,451,792	87
Coal	0	0.0%	0	0
Wood	367	21.0%	691,024	41
Solar	0	0.0%	0	0
Other	11	0.6%	20,944	1
No Fuel	0	0.0%	0	0
Total	1,745	100.0%	3,033,136	182

This table displays data from the ACS that estimates current municipal residential heating energy use.

Table 1C: Current Municipal Commercial Energy Use

	Commercial Establishments in Municipality (VT DOL)	Estimated Thermal Energy BTUs per Commercial Establishment (in Billions) (VDPS)	Estimated Thermal Energy BTUs by Commercial Establishments in Municipality (in Billions)
Municipal Commercial Energy Use	66	0.725	48

The table uses data available from the Vermont Department of Labor (VT DOL) and the Vermont Department of Public Service (DPS) to estimate current municipal commercial establishment energy use in the municipality.

Table 1D: Current Electricity Use

Use Sector	Current Electricity Use
Residential (kWh)	15,686,402
Commercial and Industrial (kWh)	16,933,834
Total (kWh)	32,620,236

This table displays current electricity use within the municipality. This data is available from Efficiency Vermont (EVT).

Table 1E: Residential Thermal Efficiency Targets

	2025	2035	2050
"Residential - Increased Efficiency and Conservation (% of municipal households to be weatherized)"	5%	16%	78%

This table displays targets for thermal efficiency of residential structures. The data is based on a methodology developed by DPS using data available from the regional Long-range Energy Alternatives Planning (LEAP) analysis and ACS. The data in this table represents the percentage of municipal households that will need to be weatherized in the target years. The target is cumulative.

Table 1F: Commercial Thermal Efficiency Target

	2025	2035	2050
"Commercial - Increased Efficiency and Conservation (% of commercial establishments to be weatherized)"	25%	25%	73%

This table shows the same information as Table 1E, but sets a target for commercial thermal efficiency and weatherization. Information from the VT DOL is required to complete this target. The target is cumulative.

Table 1G: Thermal Fuel Switching (Residential and Commercial) – Wood Systems

	2025	2035	2050
New Efficient Wood Heat Systems (in units)	0	0	4

This table provides a target for new wood heating systems for residential and commercial structures in the municipality for each target year. This target was calculated using data from LEAP and ACS. The target is cumulative.

Table 1H: Thermal Fuel Switching (Residential and Commercial) – Heat Pumps

	2025	2035	2050
New Heat Pumps (in units)	208	477	891

This table provides a target for new heat pump systems for residential and commercial structures in the municipality for each target year. This target was calculated using data from LEAP and ACS. The target is cumulative.

Table 1I: Electricity Efficiency Targets

	2025	2035	2050
Increase Efficiency and Conservation (BTUs)	25.2%	48.3%	100.7%

Data in this table displays a target for increased electricity efficiency and conservation during the target years. This target will be met through conversions to high efficiency appliances, electric heat pumps, and electric light-duty vehicles. These targets were developed using regional LEAP analysis. The target is cumulative.

Table 1J: Use of Renewables – Transportation

	2025	2035	2050
Renewable Energy Use - Transportation (BTUs)	8.2%	28.9%	89.4%

This data displays targets for the percentage of transportation energy use coming from renewable sources during each target year. This target will be met through conversions to electric light-duty vehicles and biodiesel heavy-duty vehicles. This data was developed using the LEAP analysis. The target is cumulative.

Table 1K: Use of Renewables – Heating

	2025	2035	2050
Renewable Energy Use - Heating (BTUs)	45.7%	59.2%	87.1%

This data displays targets for the percentage of heating energy use coming from renewable sources during each target year. This target will be met through conversions to electric heat pumps and high efficiency wood heating systems. This data was developed using information from the LEAP analysis. The target is cumulative.

Table 1L: Use of Renewables – Electricity

	2025	2035	2050
Renewable Energy Use - Electricity (MWh)	7,931.5	15,862.9	24,034.8

This data displays targets for MWh of electricity generation coming from renewable sources within the municipality during each target year. This data was developed using information from the regional planning commission and DPS. This data is the same as the data in Table 1Q. The target is cumulative.

Table 1M: Transportation Fuel Switching Targets – Electric Vehicles

	2025	2035	2050
Electric Vehicles	319	2,386	5,675

This tables displays a target for switching from fossil fuel based vehicles (gasoline and diesel) to electric vehicles. This target is calculated using LEAP and ACS data. The target is cumulative.

Table 1N: Transportation Fuel Switching Targets – Biodiesel

	2025	2035	2050
Biodiesel Vehicles	437	867	1,665

This tables displays a target for switching from fossil fuel based vehicles to biodiesel-powered vehicles. This target is calculated using LEAP and ACS data. The target is cumulative.

Table 1O: Existing Renewable Generation

Renewable Type	MW	MWh
Solar	0.43	527.35
Wind	0.003	9.20
Hydro	3.60	12614.40
Biomass	0.00	0.00
Other	0.00	0.00
Total Existing Generation	4.03	13,150.95

Table 1O shows existing renewable generation in the municipality, in MW and MWh, based on information available from the Vermont Department of Public Service.

Table 1P: Renewable Generation Potential

Renewable Type	MW	MWh
Rooftop Solar	2	2,545
Ground-mounted Solar	750	920,187
Wind	254	778,319
Hydro	0.012	42
Biomass and Methane	0	0
Other	0	0
Total Renewable Generation Potential	1,006	1,701,093

Renewable generation potential is based on mapping completed by the regional planning commission that is based on the Municipal Determination Standards and associated guidance documents developed by DPS. The renewable generation potential is expressed in MW and MWh by the type of renewable resource (solar, wind, hydro, etc.).

Table 1Q: Renewable Generation Targets

	2025	2035	2050
Total Renewable Generation Target (in MWh)	7,931.47	15,862.95	24,034.77

This data displays targets for MWh of electricity generation coming from renewable sources within the municipality during each target year. This data was developed using information from the regional planning commission and DPS. This data is the same as the data in Table 1L.

Table 1R: Sufficient Land?

	Y/N
Solar	Y
Wind	Y

This table shows whether or not there is sufficient land in the municipality to meet the renewable generation targets based on the renewable generation potential in the municipality.

Utility Service Areas

Fairfax, Vermont
Act 174
The Energy Development Improvement Act of 2016

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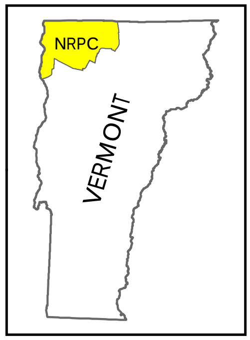

Legend

Utility Service Area Features

- Green Mountain Power
- Swanton Village Electric
- Vermont Electric Co-op
- Enosburg Falls Electric
- Substation
- 3 Phase Power Line
- Transmission Line

Sources: VCGI
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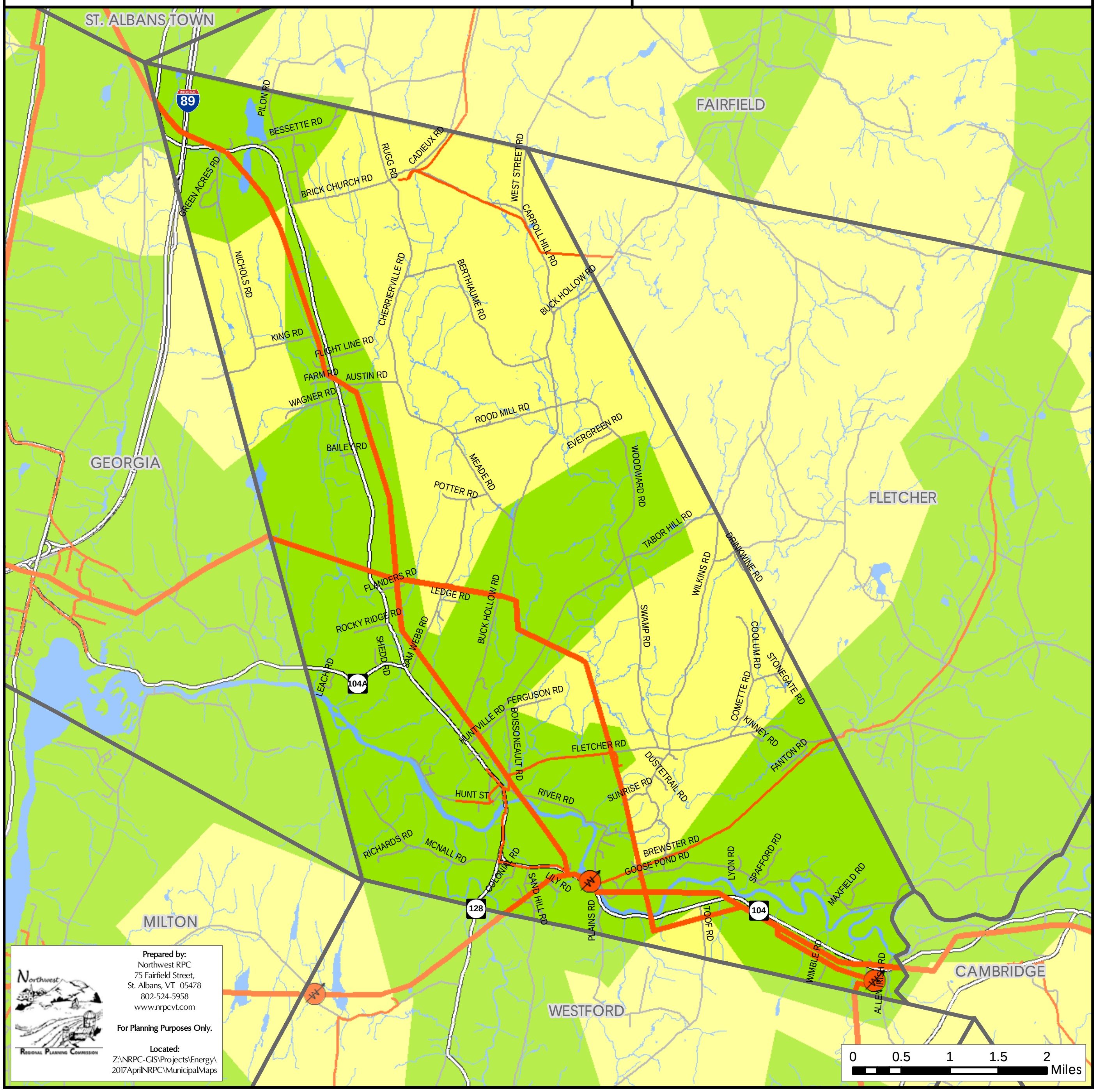

Transmission & 3 Phase Power Infrastructure

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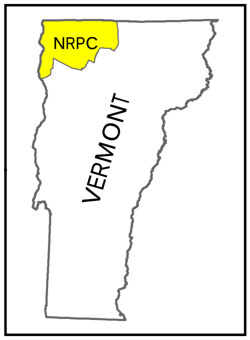

Legend

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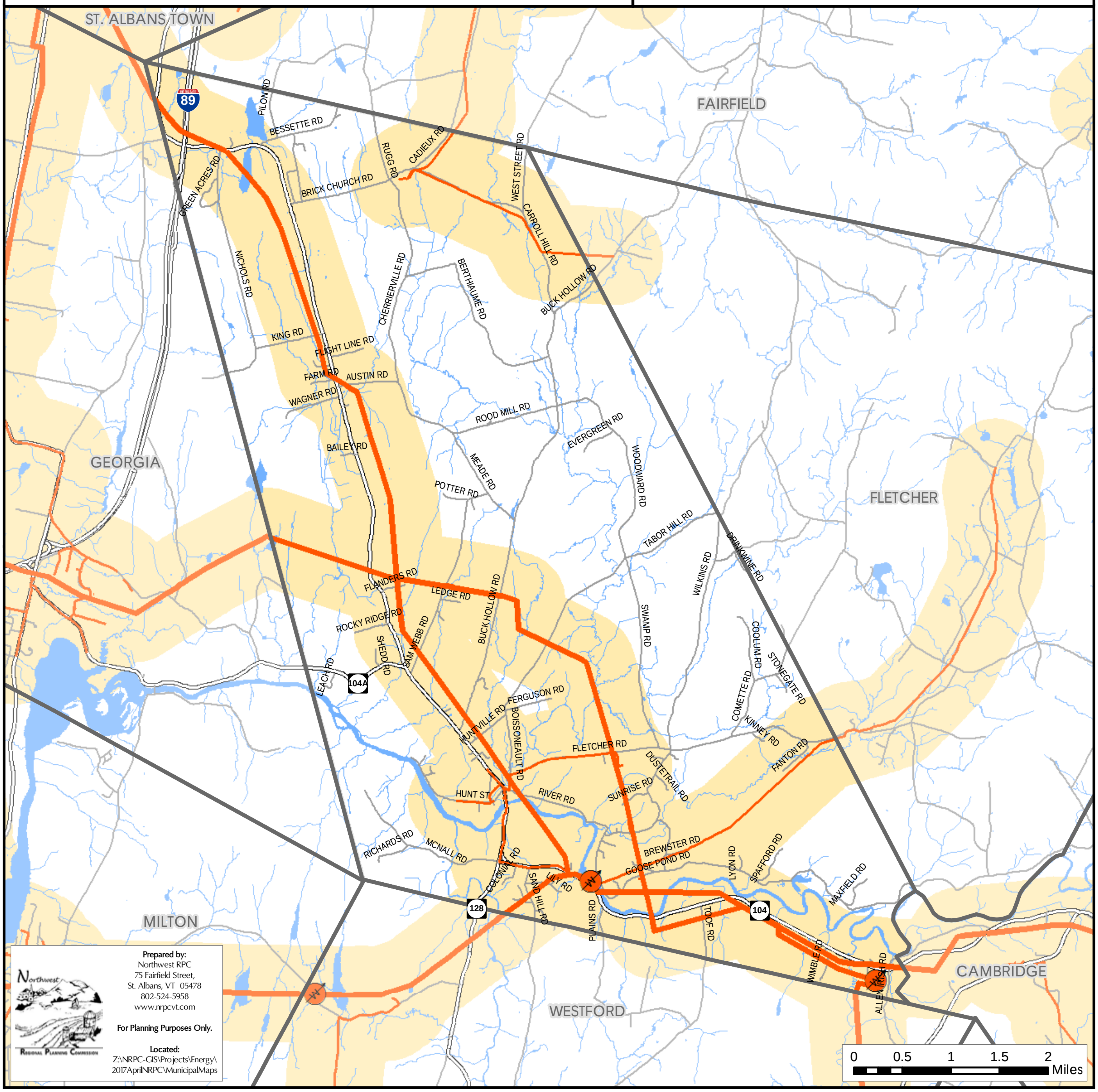

Existing Generation Facilities

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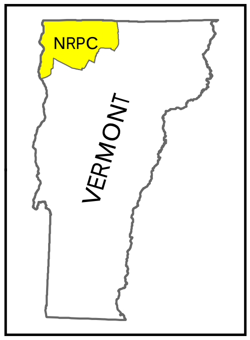

Legend

- Biomass Facility
- Hydro Facility
- Solar Facility
- Wind Facility

Note: Only generators 15kW are shown on the map. A full list of all generators is available.

Sources: VCGI
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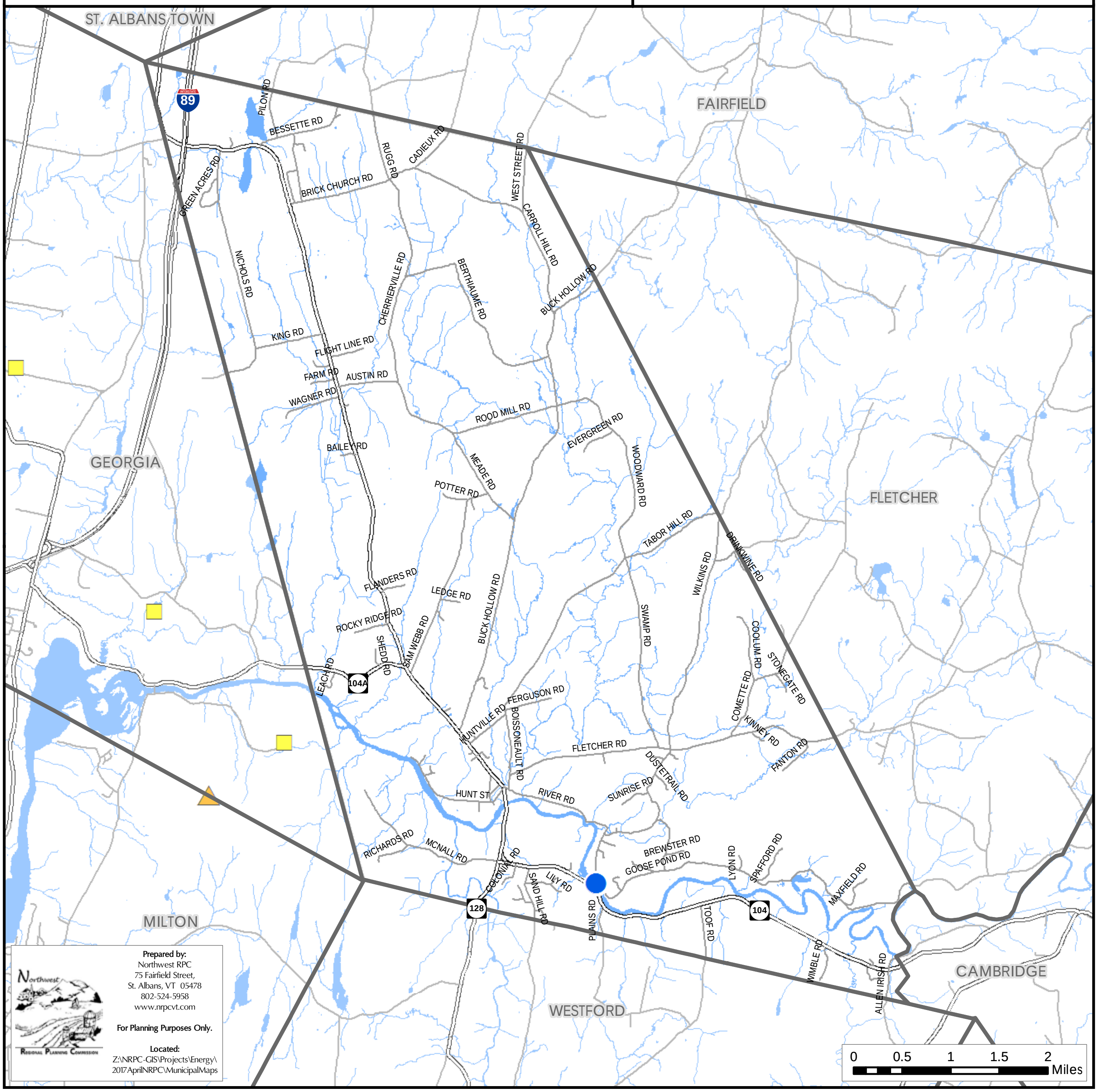

Hydro

Fairfax, Vermont
Act 174
The Energy Development Improvement Act of 2016

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N

Legend

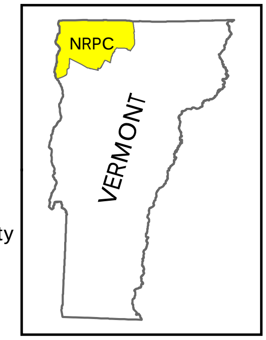
- Substation
- 3 Phase Power Line
- Transmission Line
- Designated Outstanding Resource Water
- Known Constraint - Designated National Wild & Scenic River
- Possible Constraint - Stressed or Impaired Water
- Possible Constraint - RINAs

Potential Hydroelectric Facility

- < 50 kW Capacity
- > 50 kW Capacity
- High Hazard with < 50 kW Capacity
- High Hazard with > 50 kW Capacity

Operating Hydroelectric Facility

- Dam not on National Wild and Scenic River
- Dam on National Wild and Scenic River



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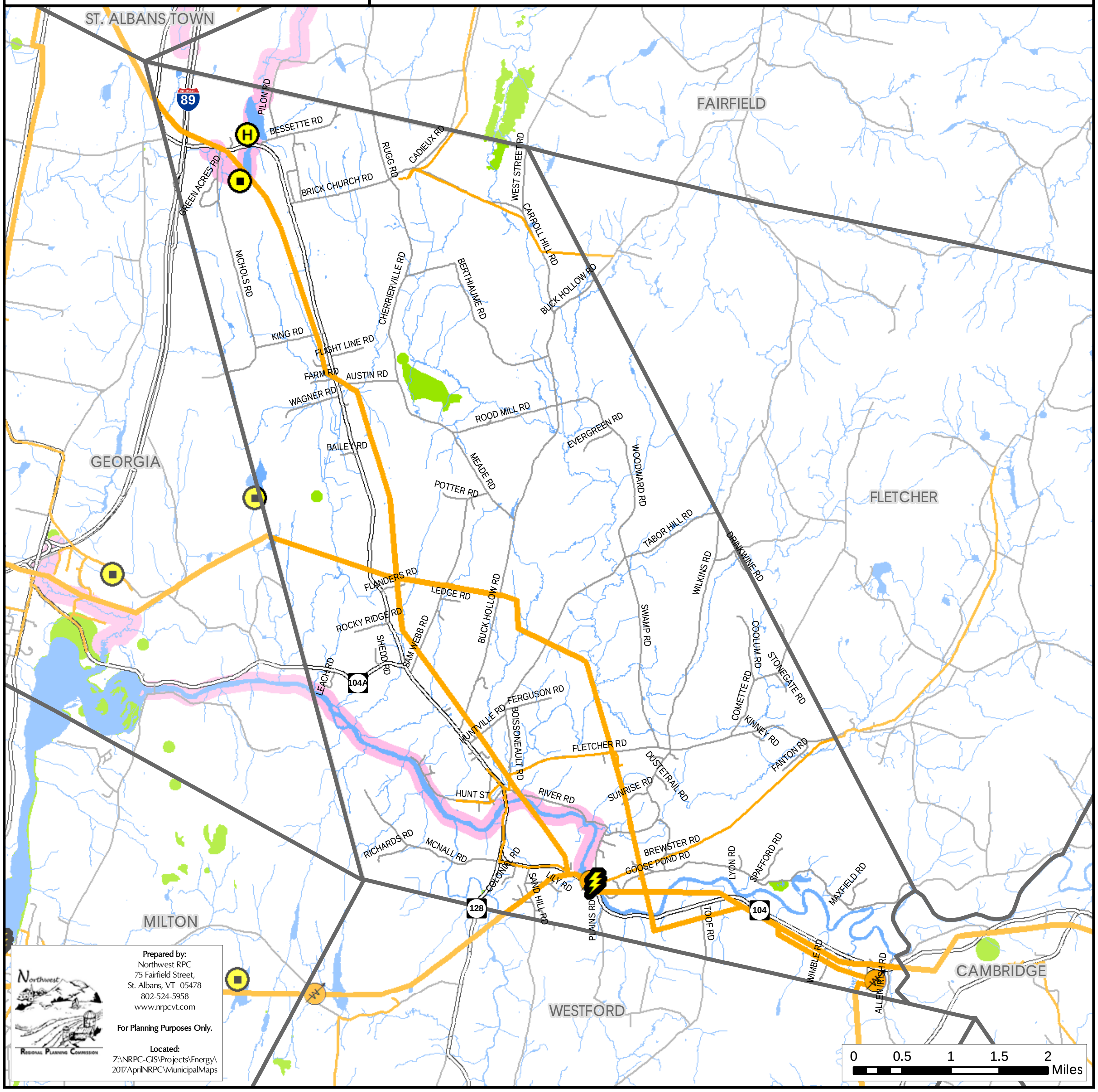

Solar

Fairfax, Vermont
Act 174
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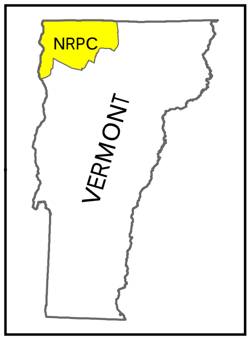

Legend

- Substation
- 3 Phase Power Line
- Transmission Line
- 1/2 Mile Buffer (3 Phase Power Line & Transmission Line)
- Prime Solar/No Known Constraints
- Base Solar/Possible Constraints

Sources: VCGI
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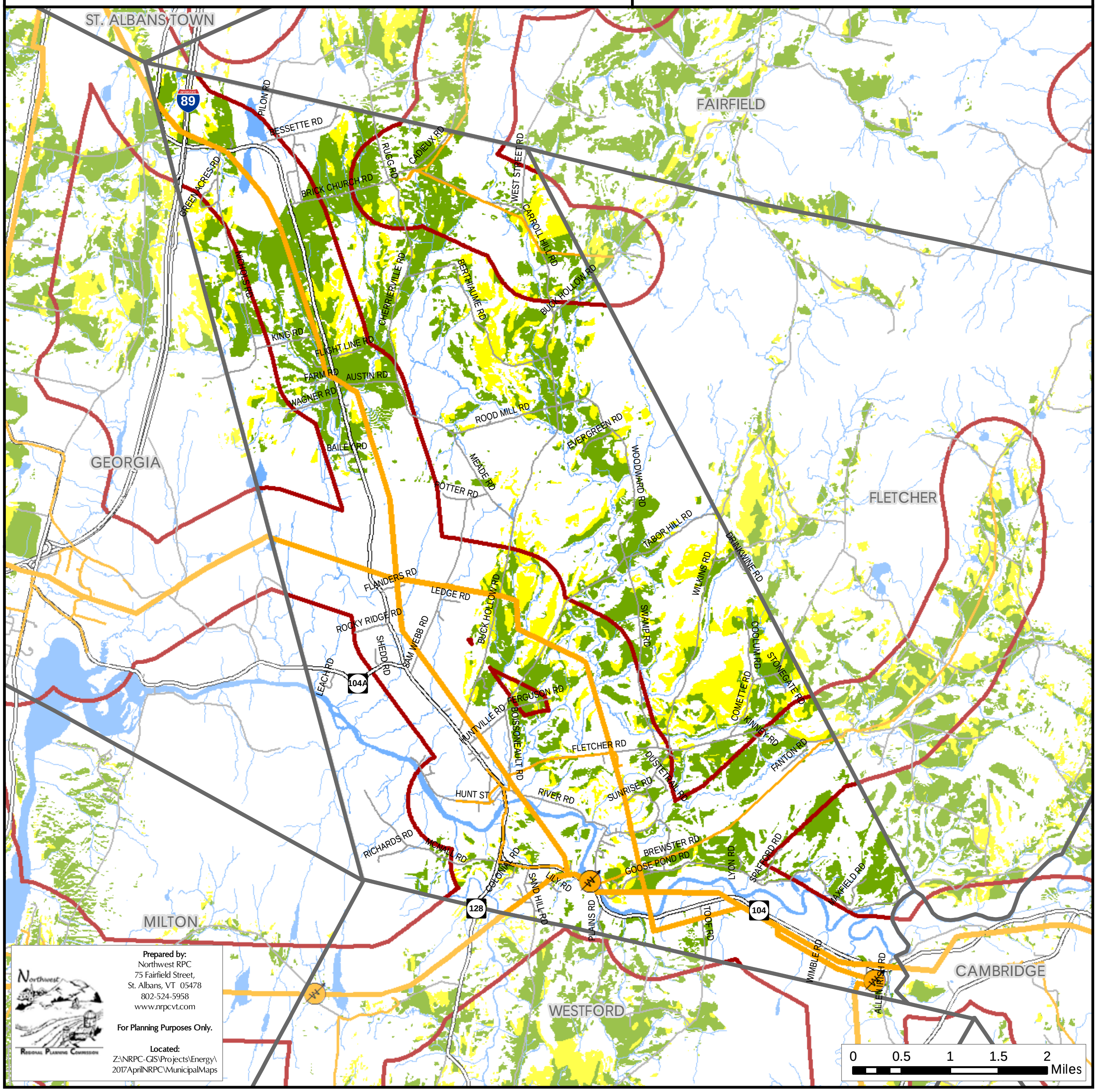

Wind

Fairfax, Vermont
Act 174
The Energy Development Improvement Act of 2016

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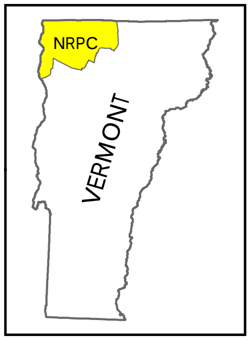

N

Legend

- Substation
- 3 Phase Power Line
- Transmission Line
- Prime Wind: Areas of high wind potential and no known constraints. Darker areas have higher wind speeds.
- Base Wind: Areas of high wind potential and a presence of possible constraints. Darker areas have higher wind speeds.

Sources: VCGI
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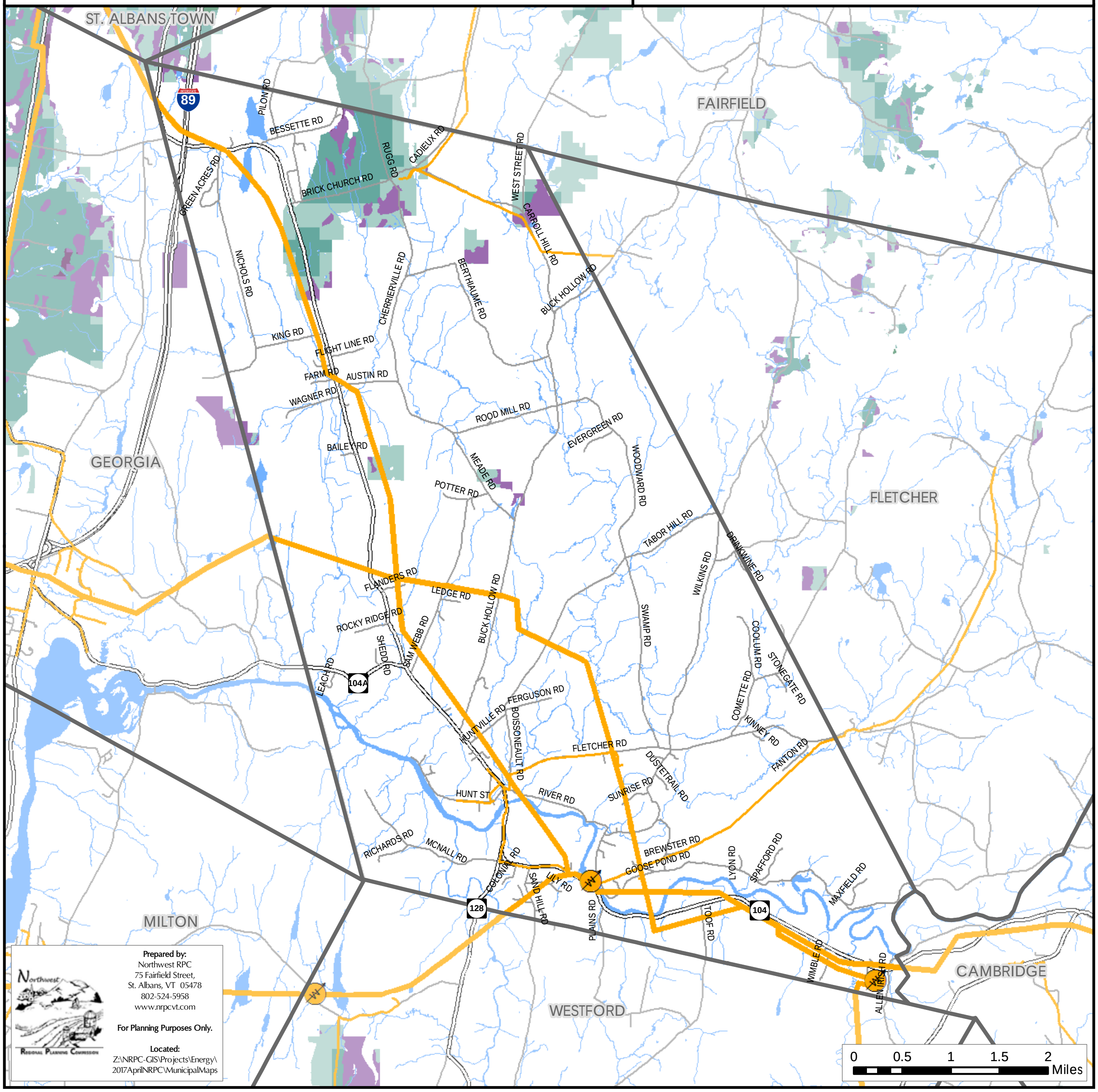

Woody Biomass

Fairfax, Vermont
Act 174
The Energy Development Improvement Act of 2016

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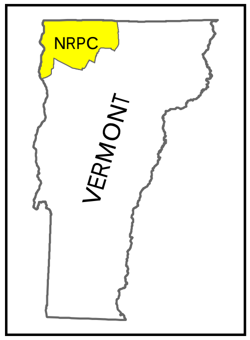

Legend

- Biomass System
- Cow Power
- Substation
- 3 Phase Power Line
- Transmission Line
- Prime Woody Biomass/No Known Constraints
- Base Woody Biomass/Possible Constraints

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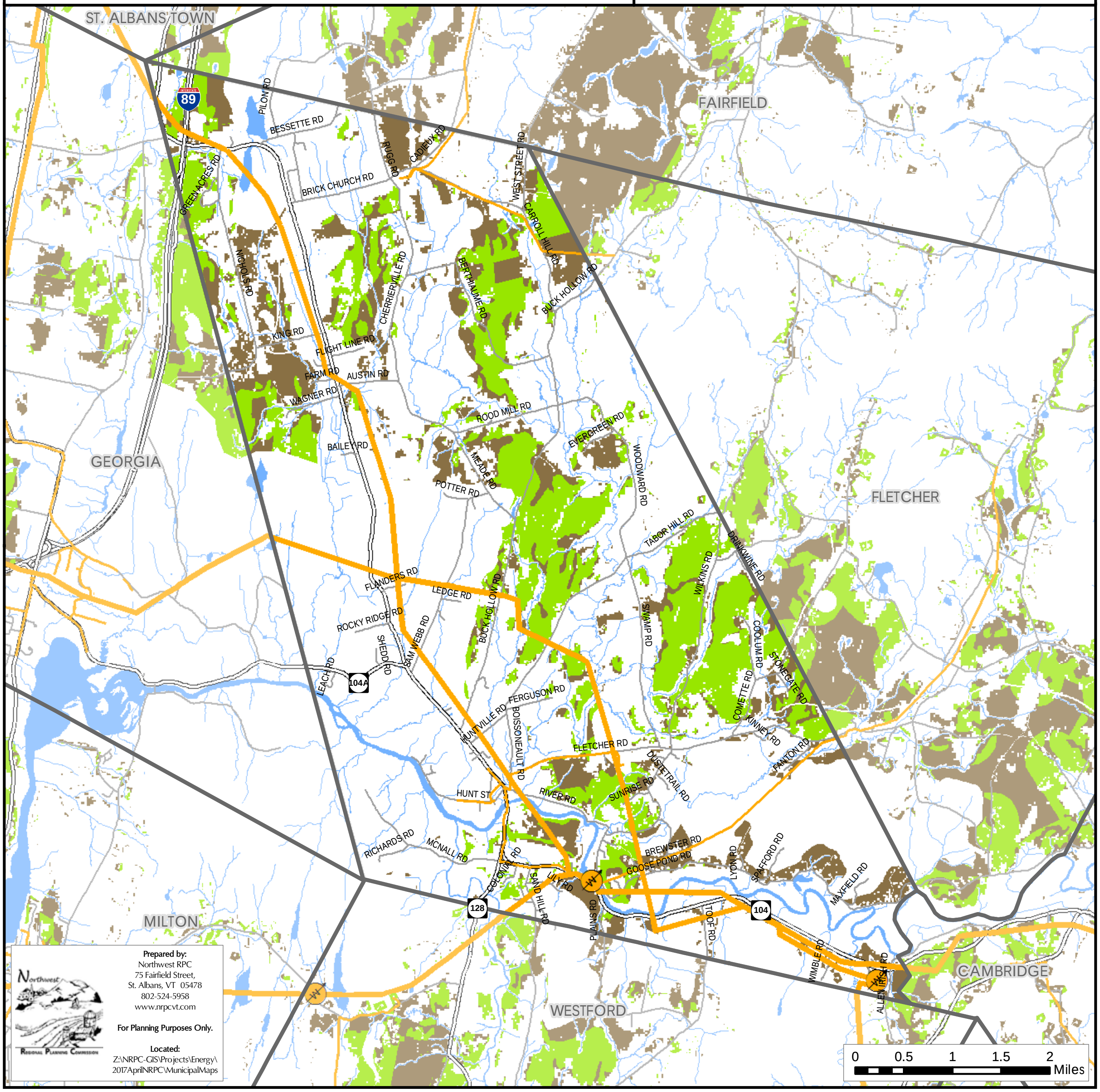

All Generators in Municipality

Category	Sub - Category	Organization Type	Address	City	CPG Number	Capacity kW
Hydro	Hydropower	Business		Fairfax		3600
Solar	Ground-mounted PV: Fixed Rack	Residential	399 Buck Hollow Rd	Fairfax	3111	9.8
Solar	Ground-mounted PV: Fixed Rack	Residential	73 SAM WEBB RD	Fairfax	1560	4.4
Solar	Ground-mounted PV: Fixed Rack	Residential	89 Evergreen Road	Fairfax	772	3.2
Solar	Ground-mounted PV: Pole	Residential	1139 Main St	Fairfax	3406	3.3
Solar	Ground-mounted PV: Pole	Residential	86 Sam Webb Rd	Fairfax	3798	6.4
Solar	Ground-mounted PV: Pole	Residential	5 Benny Rd	Fairfax	4043	7
Solar	Ground-mounted PV: Pole	Residential	83 Ledge Rd	Fairfax	2801	7.5
Solar	Ground-mounted PV: Pole	Residential	6 Bailey Road	Fairfax	16-0489	5
Solar	Ground-mounted PV: Tracker	Residential	86 W Street Rd	Fairfax	2997	6
Solar	Ground-mounted PV: Tracker	Business	1282 Main Street	Fairfax	7001	7
Solar	Hot Water	Residential	1069 Main Street	Fairfax		
Solar	Hot Water	Residential	158 Sam Webb Road	Fairfax		
Solar	Hot Water	Residential	38 Meade Rd	Fairfax		
Solar	Hot Water	Residential	399 Buck Hollow Rd	Fairfax		
Solar	Hot Water	Residential	45 Snowcrest Road	Fairfax		
Solar	Hot Water	Residential	48 Alba Glen Road	Fairfax		
Solar	Hot Water	Residential	501 Carroll Hill Road	Fairfax		
Solar	Hot Water	Residential	609 Cherrierville Road	Fairfax		
Solar	Hot Water	Residential	61 White Pine Road	Fairfax		
Solar	Hot Water	Residential	71 Maxfield Rd	Fairfax		
Solar	Hot Water	Residential	82 Windtop Road	Fairfax		
Solar	Roof-Mounted PV	Residential	758 Fletcher Rd	Fairfax	3497	5.6
Solar	Roof-Mounted PV	Residential	6 Alexzis Rd	Fairfax	3804	5
Solar	Roof-Mounted PV	Residential	2371 Main St	Fairfax	2792	8.9
Solar	Roof-Mounted PV	Residential	287 Buck Hollow Rd	Fairfax	5749	5
Solar	Roof-Mounted PV	Residential	68 Upper Meadow Rd	Fairfax	3815	5

All Generators in Municipality

Category	Sub - Category	Organization Type	Address	City	CPG Number	Capacity kW
Solar	Roof-Mounted PV	Residential	82 WINDTOP RD	Fairfax	2661	5.6
Solar	Roof-Mounted PV	Residential	2227 Main St	Fairfax	2653	3.7
Solar	Roof-Mounted PV	Residential	102 Huntville Rd	Fairfax	3512	7.5
Solar	Roof-Mounted PV	Residential	15 Cherrierville Rd	Fairfax	3748	5
Solar	Roof-Mounted PV	Residential	13 Snowcrest Rd	Fairfax	2622	2.3
Solar	Roof-Mounted PV	Residential	1789 Main St	Fairfax	5311	10
Solar	Roof-Mounted PV	Residential	1235 Main St	Fairfax	2638	4.7
Solar	Roof-Mounted PV	Residential	9 Fletcher Rd	Fairfax	6061	6
Solar	Roof-Mounted PV	Residential	137 West Street Rd	Fairfax	2716	3.7
Solar	Roof-Mounted PV	Residential	41 Maple Hill Rd	Fairfax	3538	9.9
Solar	Roof-Mounted PV	Residential	184 Mead Rd	Fairfax	3698	4.6
Solar	Roof-Mounted PV	Residential	296 Woodward Road	Fairfax		5
Solar	Roof-Mounted PV	Residential	178 Wilkins Rd	Fairfax	4002	8
Solar	Roof-Mounted PV	Residential	14 Hawley Rd	Fairfax	3939	7.7
Solar	Roof-Mounted PV	Residential	17 Michelle Rd	Fairfax	3671	4.6
Solar	Roof-Mounted PV	Residential	20 Delorme Road	Fairfax	5954	3.8
Solar	Roof-Mounted PV	Residential	20 Summit View St	Fairfax	2863	5.6
Solar	Roof-Mounted PV	Residential	16 King Road	Fairfax	3272	5.3
Solar	Roof-Mounted PV	Residential	2855 Main Street	Fairfax	3496	4.3
Solar	Roof-Mounted PV	Residential	32 Audelin Woods Rd	Fairfax	3605	4.6
Solar	Roof-Mounted PV	Residential	281 River Rd	Fairfax	6065	3
Solar	Roof-Mounted PV	Residential	2757 Main St	Fairfax	4156	5
Solar	Roof-Mounted PV	Residential	34 Windtop Rd	Fairfax	5294	7.6
Solar	Roof-Mounted PV	Residential	78 Rood Mill Road	Fairfax	4244	6
Solar	Roof-Mounted PV	Residential	26 Richards Rd	Fairfax	2804	3.7
Solar	Roof-Mounted PV	Residential	34 Dewey Rd	Fairfax	5614	3.8
Solar	Roof-Mounted PV	Residential	26 Summit View St	Fairfax	3508	8

All Generators in Municipality

Category	Sub - Category	Organization Type	Address	City	CPG Number	Capacity kW
Solar	Roof-Mounted PV	Residential	272 Wilkins Rd	Fairfax	3771	5
Solar	Roof-Mounted PV	Residential	23 Summit View St	Fairfax	3645	6.8
Solar	Roof-Mounted PV	Residential	47 Browns River Rd	Fairfax	4217	5.7
Solar	Roof-Mounted PV	Residential	67 White Pine Rd	Fairfax	43	3.8
Solar	Roof-Mounted PV	Residential	36 Craftsfield Rd	Fairfax	16-0261	5
Solar	Roof-Mounted PV	Residential	769 Goose Pond Rd	Fairfax	6446	6
Solar	Roof-Mounted PV	Residential	1979 Main Street	Fairfax	6834	4
Solar	Roof-Mounted PV	Residential	42 Crystal Dr	Fairfax		3.6
Solar	Roof-Mounted PV	Residential	147 Nichols Rd	Fairfax	7031	8
Solar	Roof-Mounted PV	Residential	37 Lochmoor Rd	Fairfax	5253	6
Solar	Roof-Mounted PV	Residential	51 Richards Road	Fairfax	7069	5
Solar	Roof-Mounted PV	Residential	416 Carroll Hill Rd	Fairfax	6708	4
Solar	Roof-Mounted PV	Residential	45 Lochmoor Rd	Fairfax	16-0333	5
Solar	Roof-Mounted PV	Residential	351 Buck Hollow Road	Fairfax	16-0129	7.6
Solar	Roof-Mounted PV	Residential	161 Bessette Road	Fairfax	6396	11
Solar	Roof-Mounted PV	Residential	1209 Main St	Fairfax	16-0389	5
Solar	Roof-Mounted PV	Residential	352 Sam Webb Road	Fairfax	7266	7.6
Solar	Roof-Mounted PV	Residential	28 Old Academy Street	Fairfax	16-0674	3.8
Solar	Roof-Mounted PV	Residential	6 School St	Fairfax		3.6
Solar	Roof-Mounted PV	Residential	58 Upper Meadow Road	Fairfax		3.8
Solar	Roof-Mounted PV	Residential	11 Michelle Rd	Fairfax	16-0686	4.2
Solar	Roof-Mounted PV	Residential	183 Tabor Hill Road	Fairfax	7265	5
Solar	Roof-Mounted PV	Residential	464 Nichols Road	Fairfax	7216	11.4
Solar	Roof-Mounted PV	Residential	10 Nichols Rd	Fairfax		12
Solar	Roof-Mounted PV	Residential	244 Sam Webb Road	Fairfax	7209	7
Solar	Roof-Mounted PV	Residential	28 Rowland Rd	Fairfax	16-0321	5
Solar	Roof-Mounted PV	Residential	3 Hillcrest Road	Fairfax		11.4

All Generators in Municipality

Category	Sub - Category	Organization Type	Address	City	CPG Number	Capacity kW
Solar	Roof-Mounted PV	Residential	74 Windtop Rd	Fairfax	16-1104	4.95
Solar	Roof-Mounted PV	Residential	33 Windtop Rd	Fairfax	16-1447	8.4
Solar	Roof-Mounted PV	Residential	15 Andbron Rd	Fairfax	16-1178	6
Solar	Roof-Mounted PV	Residential	110 Buck Hollow Rd	Fairfax	16-1549	3.6
Solar	Roof-Mounted PV	Residential	31 Hardwood Hill Rd	Fairfax	16-1506	5
Solar	Roof-Mounted PV	Residential	60 Village View Road	Fairfax	16-1495	3
Solar	Roof-Mounted PV	Residential	48 Leach Rd	Fairfax	16-1273	6
Solar	Roof-Mounted PV	Residential	12 Meadows Road	Fairfax	16-1409	4.2
Solar	Roof-Mounted PV	Residential	402 Buck Hollow Road	Fairfax		3
Solar	Roof-Mounted PV	Residential	12 Bentley Rd	Fairfax	16-0852	3.6
Solar	Roof-Mounted PV	Residential	6 King Road	Fairfax	16-1661	3.6
Solar	Roof-Mounted PV	Residential		Fairfax	6800	4.2
Wind	Small Wind	Residential	108 Bessette Road	Fairfax	119	3

Municipal Analysis & Targets - Fairfield

The following is an explanation of the municipal energy data compiled by Northwest Regional Planning Commission (NRPC). The intent of the municipal energy data is to provide the municipalities with data required to ensure compliance with the requirements of Act 174 and "Enhanced Energy Planning" (24 V.S.A. 4352). The following tables contain data that estimates current energy use and provides targets for future energy use across all sectors (transportation, heating, and electricity). It also sets targets for renewable energy generation within the municipality.

This data is meant to be a starting point for the municipality to begin planning its energy future and to talk about the changes that may need to occur within the municipality to ensure that local, regional and state energy goals are met. This includes the State of Vermont's goal to have 90% of all energy demand be met from renewable sources by 2050.

Figure 1 - Data Sources

ACS – American Community Survey

DOL –Vermont Department of Labor

DPS – Vermont Department of Public Service

EIA – Energy Information Administration

EVT – Efficiency Vermont

LEAP – Long-Range Energy Alternatives Planning

VEIC – Vermont Energy Investment Corporation

VTrans – Vermont Agency of Transportation

Data Sources

Estimates of current energy use consist primarily of data available from the American Community Survey (ACS), the Vermont Agency of Transportation (VTrans), the Vermont Department of Labor (DOL), and the Vermont Department of Public Service (DPS). Targets for future energy use are reliant upon the Long-range Energy Alternatives Planning (LEAP) analysis for the region completed the Vermont Energy Investment Corporation (VEIC). Targets for future energy generation have come from the regional planning commission and DPS. For more information on LEAP, see the Northwest Regional Energy Plan (www.nrpcvt.com). Targets for both future energy use and energy generation have been generally developed using a "top down" method of disaggregating regional data to the municipal level.

It is possible to develop "bottom up" data. For those municipalities interested in that approach, please see the Department of Public Service's Analysis and Targets Guidance (http://publicservice.vermont.gov/content/act-174-recommendations-and-determination-standards).

Please remember that the targets established by LEAP represent only one way to achieve energy goals. There may several other similar pathways that a municipality may choose to take in order to meet the 90x50 goal.

Below is a worksheet by worksheet explanation of the Municipal Template spreadsheet:

1. Municipal Data Summary

The following tables summarize all data that is required to be in a municipal plan if the plan is to meet the "determination" standards established by the Vermont Department of Public Service.

Table 1A: Current Municipal Transportation Energy Use

Transportation Data	Municipal Data
Total # of Passenger Vehicles (ACS 2011-2015)	1,397
Average Miles per Vehicle (VTrans)	11,356
Total Miles Traveled	15,864,332
Realized MPG (2013 - VTrans 2015 Energy Profile)	18.6
Total Gallons Use per Year	852,921
Transportation BTUs (Billion)	103
Average Cost per Gallon of Gasoline (RPC)	2.31
Gasoline Cost per Year	1,970,248

This table uses data from the American Community Survey (ACS) and Vermont Agency of Transportation (VTrans) to calculate current transportation energy use and energy costs in the municipality.

Table 1B: Current Municipal Residential Heating Energy Use

Fuel Source	Municipal Households (ACS 2011-2015)	% of Municipal Households	Municipal Square Footage Heated	Municipal BTU (in Billions)
Natural Gas	3	0.5%	5,712	0
Propane	73	11.6%	119,984	7
Electricity	19	3.0%	22,800	1
Fuel Oil	289	45.8%	528,432	32
Coal	0	0.0%	0	0
Wood	219	34.7%	390,224	23
Solar	0	0.0%	0	0
Other	28	4.4%	53,312	3
No Fuel	0	0.0%	0	0
Total	631	100.0%	1,120,464	67

This table displays data from the ACS that estimates current municipal residential heating energy use.

Table 1C: Current Municipal Commercial Energy Use

	Commercial Establishments in Municipality (VT DOL)	Estimated Thermal Energy BTUs per Commercial Establishment (in Billions) (VDPS)	Estimated Thermal Energy BTUs by Commercial Establishments in Municipality (in Billions)
Municipal Commercial Energy Use	21	0.725	15

The table uses data available from the Vermont Department of Labor (VT DOL) and the Vermont Department of Public Service (DPS) to estimate current municipal commercial establishment energy use in the municipality.

Table 1D: Current Electricity Use

Use Sector	Current Electricity Use
Residential (kWh)	5,672,275
Commercial and Industrial (kWh)	5,388,038
Total (kWh)	11,060,313

This table displays current electricity use within the municipality. This data is available from Efficiency Vermont (EVT).

Table 1E: Residential Thermal Efficiency Targets

	2025	2035	2050
"Residential - Increased Efficiency and Conservation (% of municipal households to be weatherized)"	5%	16%	78%

This table displays targets for thermal efficiency of residential structures. The data is based on a methodology developed by DPS using data available from the regional Long-range Energy Alternatives Planning (LEAP) analysis and ACS. The data in this table represents the percentage of municipal households that will need to be weatherized in the target years. The target is cumulative.

Table 1F: Commercial Thermal Efficiency Target

	2025	2035	2050
"Commercial - Increased Efficiency and Conservation (% of commercial establishments to be weatherized)"	25%	25%	73%

This table shows the same information as Table 1E, but sets a target for commercial thermal efficiency and weatherization. Information from the VT DOL is required to complete this target. The target is cumulative.

Table 1G: Thermal Fuel Switching (Residential and Commercial) – Wood Systems

	2025	2035	2050
New Efficient Wood Heat Systems (in units)	0	0	1

This table provides a target for new wood heating systems for residential and commercial structures in the municipality for each target year. This target was calculated using data from LEAP and ACS. The target is cumulative.

Table 1H: Thermal Fuel Switching (Residential and Commercial) – Heat Pumps

	2025	2035	2050
New Heat Pumps (in units)	75	172	322

This table provides a target for new heat pump systems for residential and commercial structures in the municipality for each target year. This target was calculated using data from LEAP and ACS. The target is cumulative.

Table 1I: Electricity Efficiency Targets

	2025	2035	2050
Increase Efficiency and Conservation (BTUs)	25.2%	48.3%	100.7%

Data in this table displays a target for increased electricity efficiency and conservation during the target years. This target will be met through conversions to high efficiency appliances, electric heat pumps, and electric light-duty vehicles. These targets were developed using regional LEAP analysis. The target is cumulative.

Table 1J: Use of Renewables – Transportation

	2025	2035	2050
Renewable Energy Use - Transportation (BTUs)	9.3%	30.8%	90.1%

This data displays targets for the percentage of transportation energy use coming from renewable sources during each target year. This target will be met through conversions to electric light-duty vehicles and biodiesel heavy-duty vehicles. This data was developed using the LEAP analysis. The target is cumulative.

Table 1K: Use of Renewables – Heating

	2025	2035	2050
Renewable Energy Use - Heating (BTUs)	46.0%	59.5%	87.4%

This data displays targets for the percentage of heating energy use coming from renewable sources during each target year. This target will be met through conversions to electric heat pumps and high efficiency wood heating systems. This data was developed using information from the LEAP analysis. The target is cumulative.

Table 1L: Use of Renewables – Electricity

	2025	2035	2050
Renewable Energy Use - Electricity (MWh)	5,035.4	10,070.9	15,258.9

This data displays targets for MWh of electricity generation coming from renewable sources within the municipality during each target year. This data was developed using information from the regional planning commission and DPS. This data is the same as the data in Table 1Q. The target is cumulative.

Table 1M: Transportation Fuel Switching Targets – Electric Vehicles

	2025	2035	2050
Electric Vehicles	122	915	2,177

This tables displays a target for switching from fossil fuel based vehicles (gasoline and diesel) to electric vehicles. This target is calculated using LEAP and ACS data. The target is cumulative.

Table 1N: Transportation Fuel Switching Targets – Biodiesel

	2025	2035	2050
Biodiesel Vehicles	204	407	784

This tables displays a target for switching from fossil fuel based vehicles to biodiesel-powered vehicles. This target is calculated using LEAP and ACS data. The target is cumulative.

Table 1O: Existing Renewable Generation

Renewable Type	MW	MWh
Solar	0.74	907.54
Wind	0.03	77.57
Hydro	0.00	0.00
Biomass	0.00	0.00
Other	0.00	0.00
Total Existing Generation	0.77	985.11

Table 1O shows existing renewable generation in the municipality, in MW and MWh, based on information available from the Vermont Department of Public Service.

Table 1P: Renewable Generation Potential

Renewable Type	MW	MWh
Rooftop Solar	1	903
Ground-mounted Solar	1,437	1,761,767
Wind	997	3,056,794
Hydro	0.064	224
Biomass and Methane	0	0
Other	0	0
Total Renewable Generation Potential	2,434	4,819,689

Renewable generation potential is based on mapping completed by the regional planning commission that is based on the Municipal Determination Standards and associated guidance documents developed by DPS. The renewable generation potential is expressed in MW and MWh by the type of renewable resource (solar, wind, hydro, etc.).

Table 1Q: Renewable Generation Targets

	2025	2035	2050
Total Renewable Generation Target (in MWh)	5,035.44	10,070.87	15,258.90

This data displays targets for MWh of electricity generation coming from renewable sources within the municipality during each target year. This data was developed using information from the regional planning commission and DPS. This data is the same as the data in Table 1L.

Table 1R: Sufficient Land?

	Y/N
Solar	Y
Wind	Y

This table shows whether or not there is sufficient land in the municipality to meet the renewable generation targets based on the renewable generation potential in the municipality.

Utility Service Areas

Fairfield, Vermont
Act 174
The Energy Development Improvement Act of 2016

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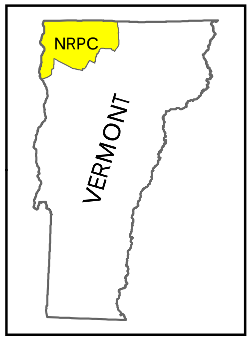

Legend

Utility Service Area Features

- Green Mountain Power
- Swanton Village Electric
- Vermont Electric Co-op
- Enosburg Falls Electric
- Substation
- 3 Phase Power Line
- Transmission Line

Sources: VCGI
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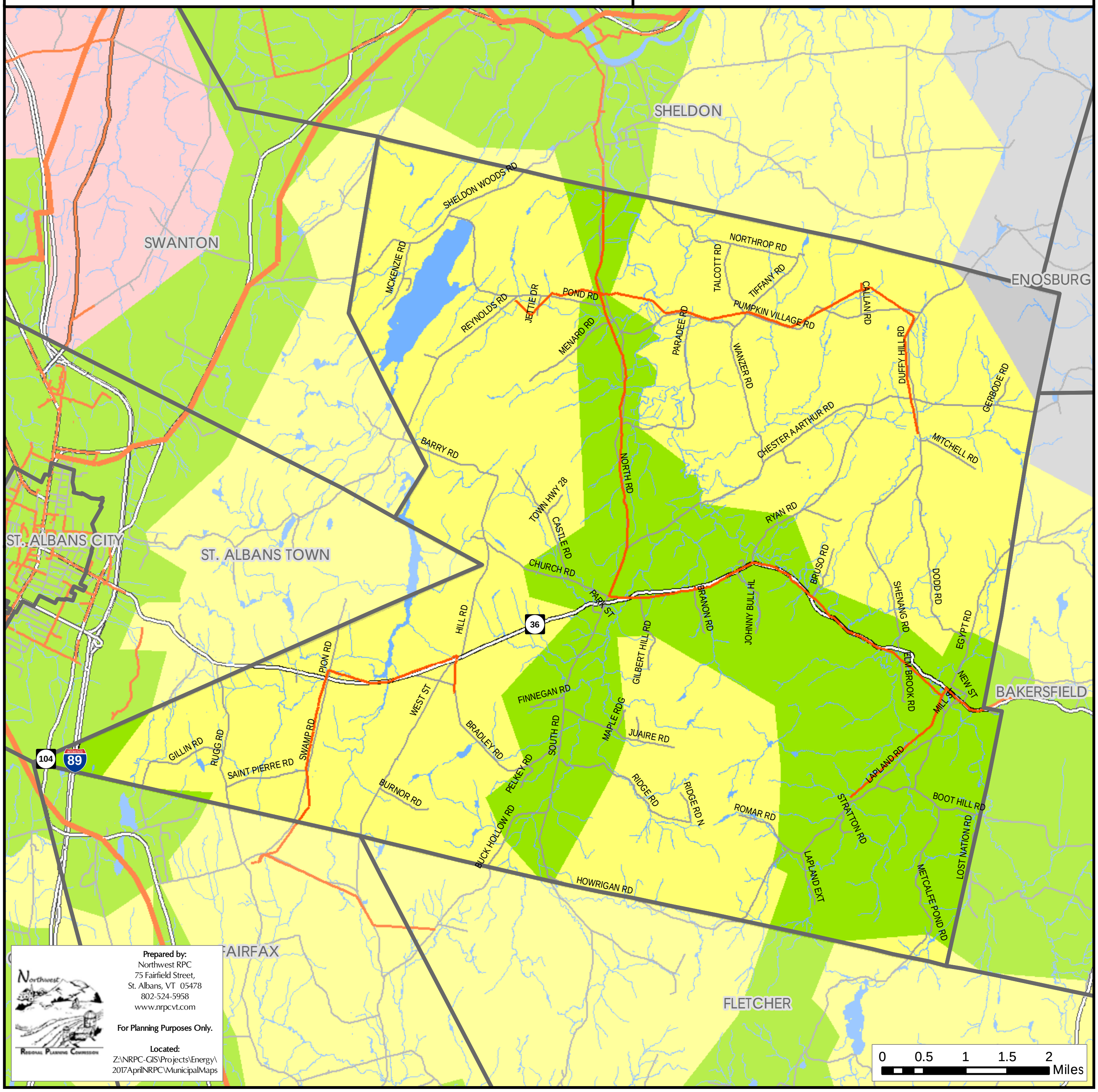
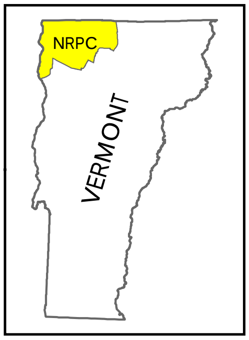


Transmission & 3 Phase Power Infrastructure

Fairfield, Vermont
Act 174
The Energy Development Improvement Act of 2016



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N

Legend

- Substation
- 3 Phase Power Line
- Transmission Line
- 1/2 Mile Buffer (3 Phase Power Line & Transmission Line)

Sources: VCGI

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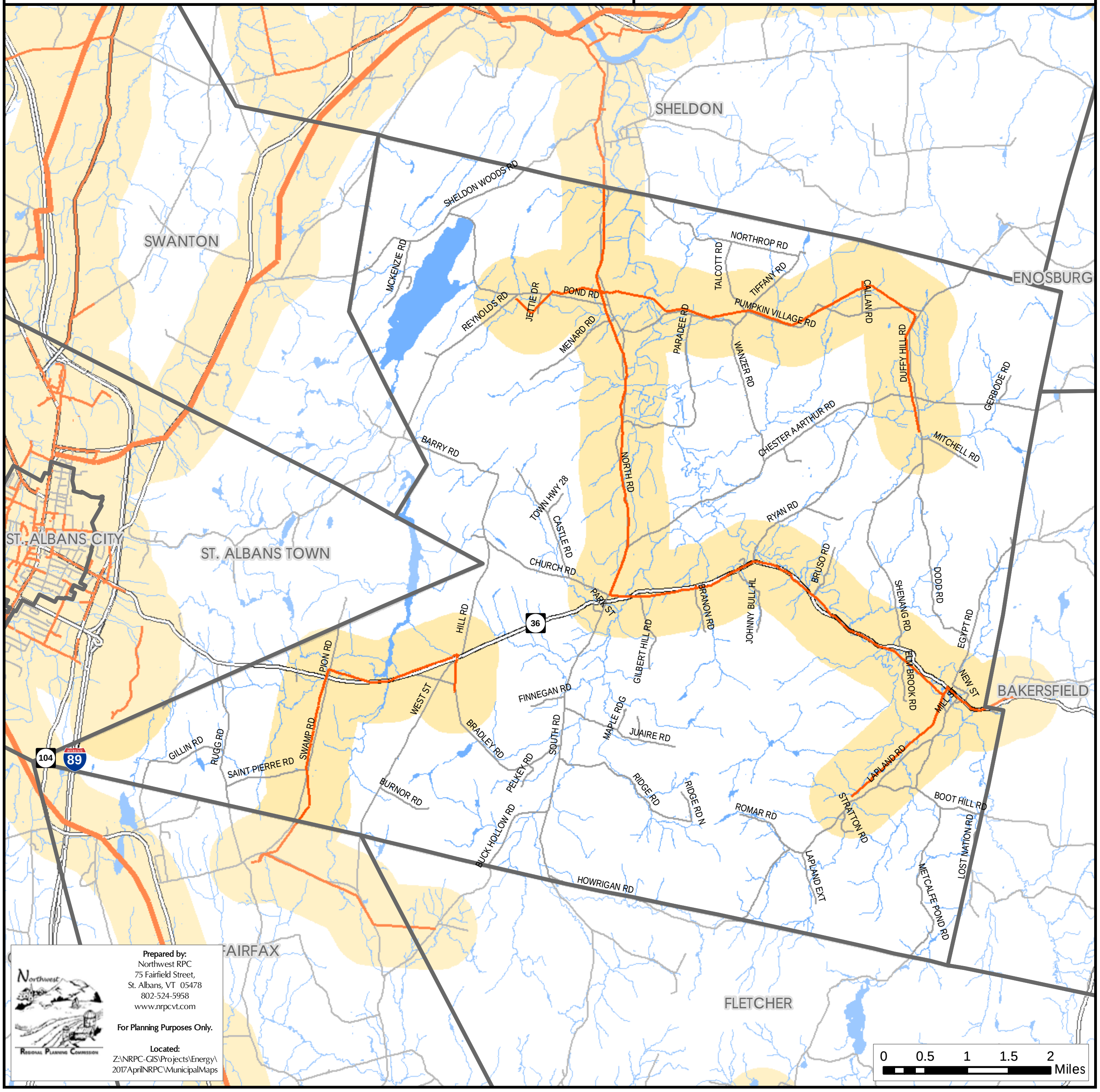

Existing Generation Facilities

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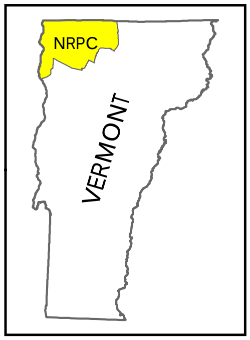

Legend

- Biomass Facility
- Hydro Facility
- Solar Facility
- Wind Facility

Note: Only generators 15kW are shown on the map. A full list of all generators is available.

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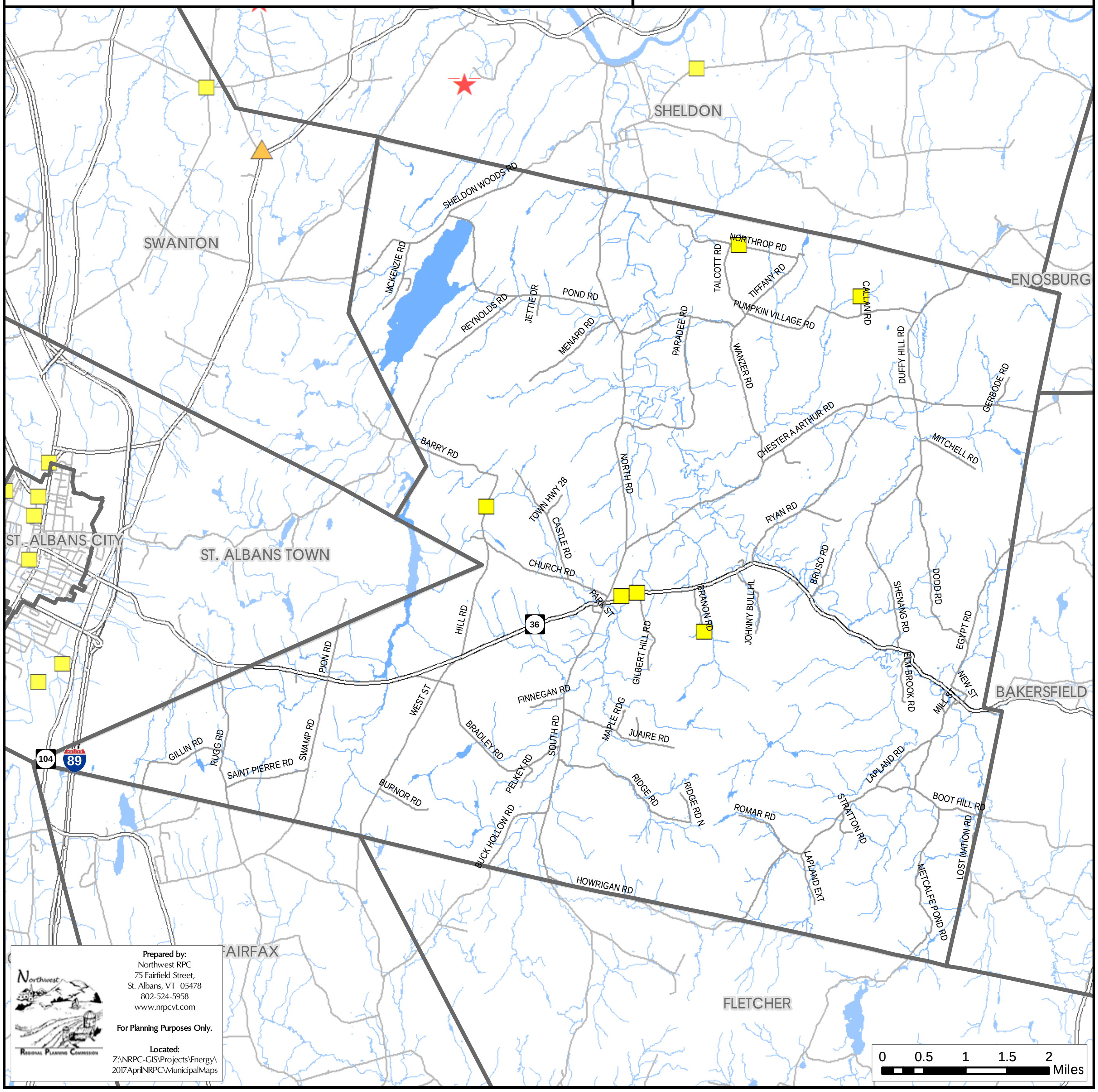

Hydro

Fairfield, Vermont
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The Energy Development Improvement Act of 2016

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N

Legend

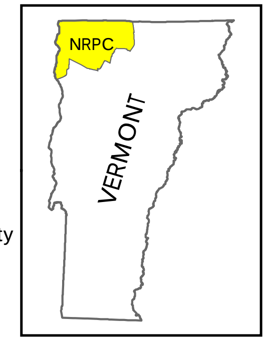
- Substation
- 3 Phase Power Line
- Transmission Line
- Designated Outstanding Resource Water
- Known Constraint - Designated National Wild & Scenic River
- Possible Constraint - Stressed or Impaired Water
- Possible Constraint - RINAs

Potential Hydroelectric Facility

- < 50 kW Capacity
- > 50 kW Capacity
- High Hazard with < 50 kW Capacity
- High Hazard with > 50 kW Capacity

Operating Hydroelectric Facility

- Dam not on National Wild and Scenic River
- Dam on National Wild and Scenic River



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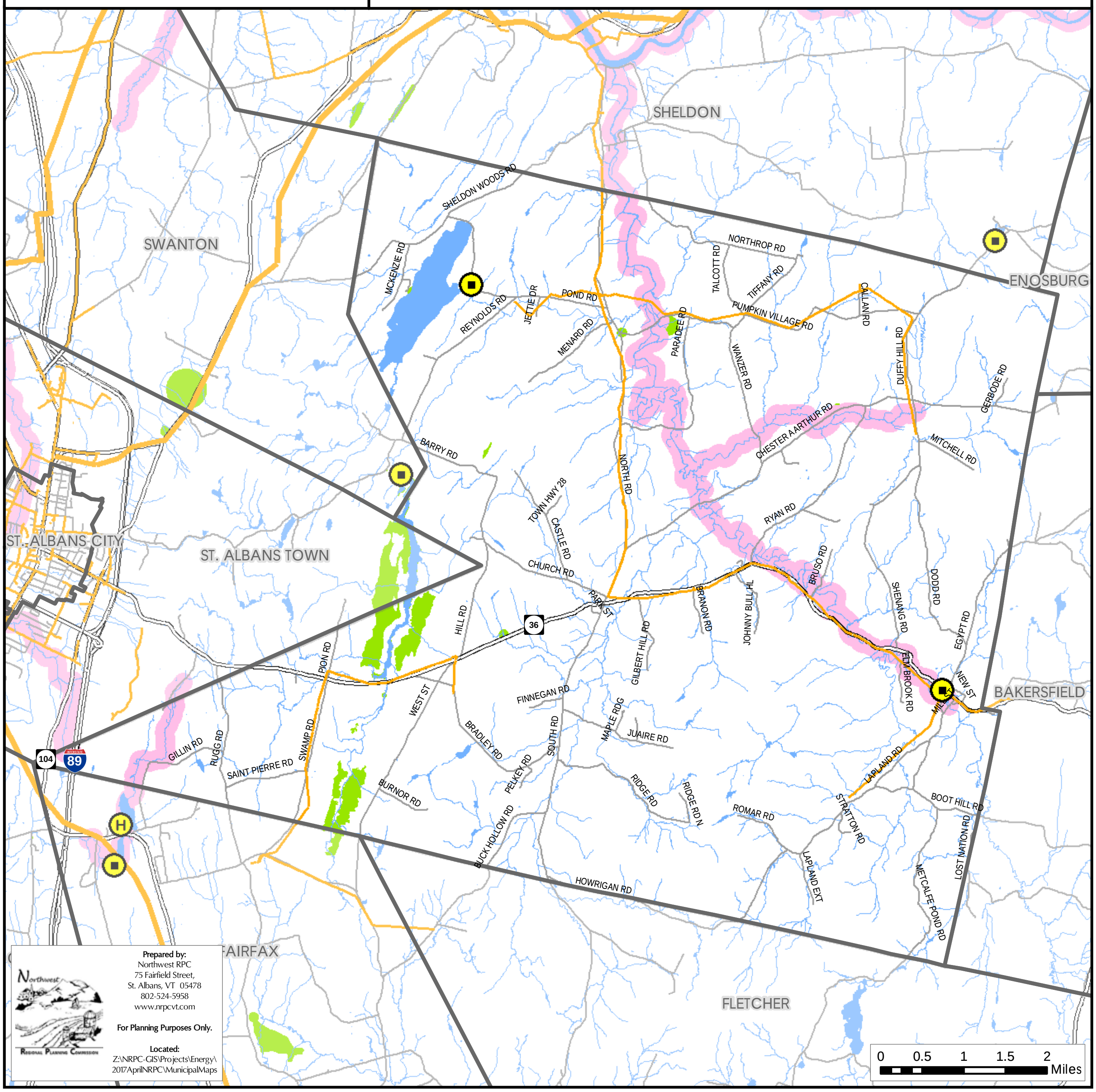

Solar

Fairfield, Vermont
Act 174
The Energy Development Improvement Act of 2016

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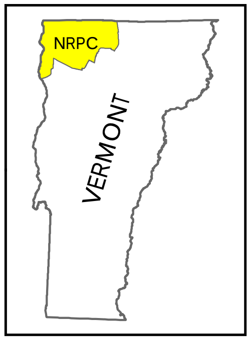

Legend

- Substation
- 3 Phase Power Line
- Transmission Line
- 1/2 Mile Buffer (3 Phase Power Line & Transmission Line)
- Prime Solar/No Known Constraints
- Base Solar/Possible Constraints

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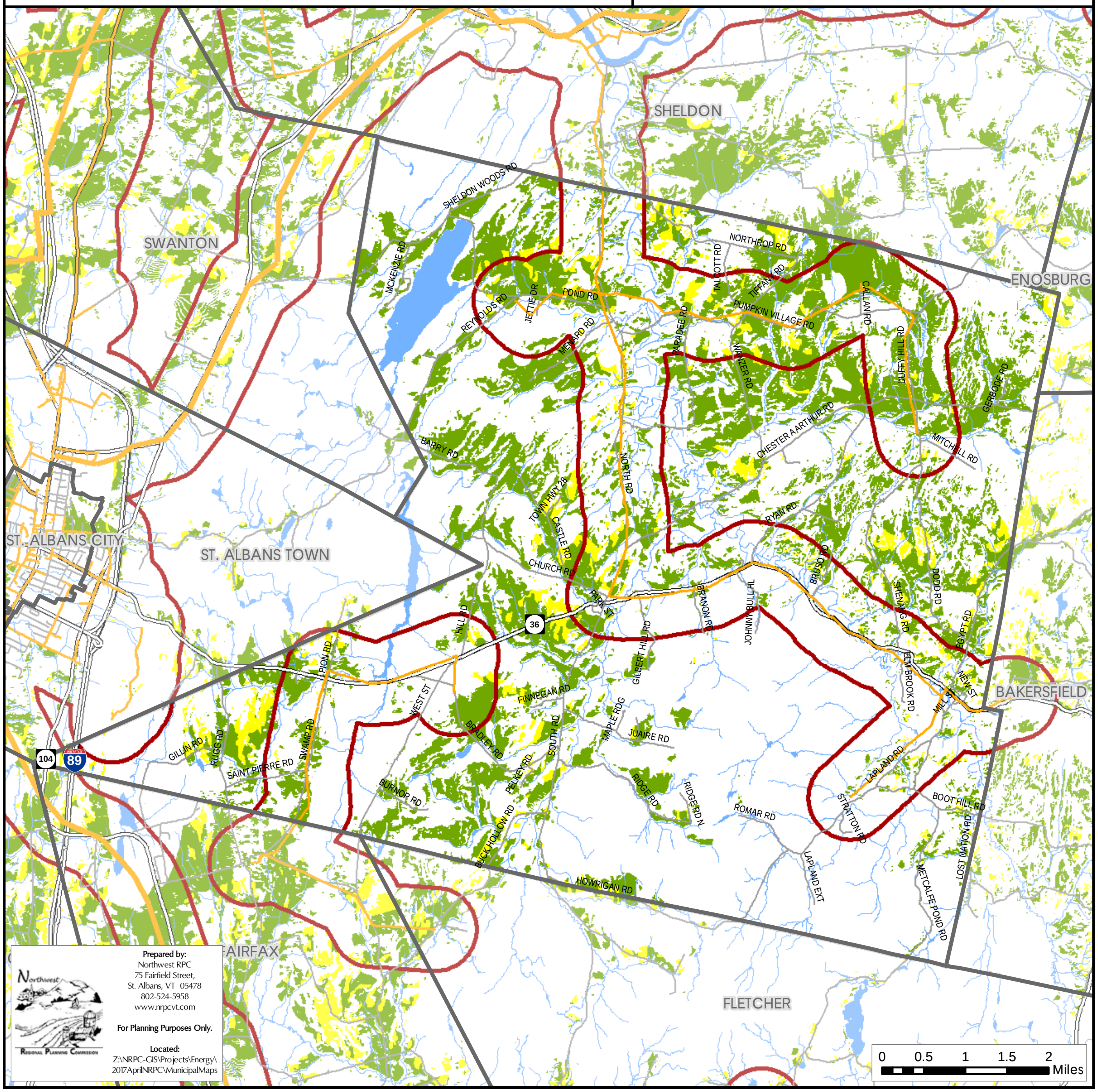

Prepared by:
Northwest RPC
75 Fairfield Street,
St. Albans, VT 05478
802-524-5958
www.nrpcvt.com

Northwest Regional Planning Commission

For Planning Purposes Only.

Located:
Z:\NRPC-GIS\Projects\Energy\2017AprilNRPC\MunicipalMaps

Wind

Fairfield, Vermont
Act 174
The Energy Development Improvement Act of 2016

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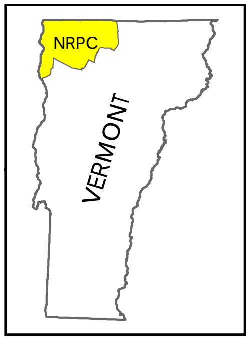

Legend

- Substation
- 3 Phase Power Line
- Transmission Line
- Prime Wind: Areas of high wind potential and no known constraints. Darker areas have higher wind speeds.
- Base Wind: Areas of high wind potential and a presence of possible constraints. Darker areas have higher wind speeds.

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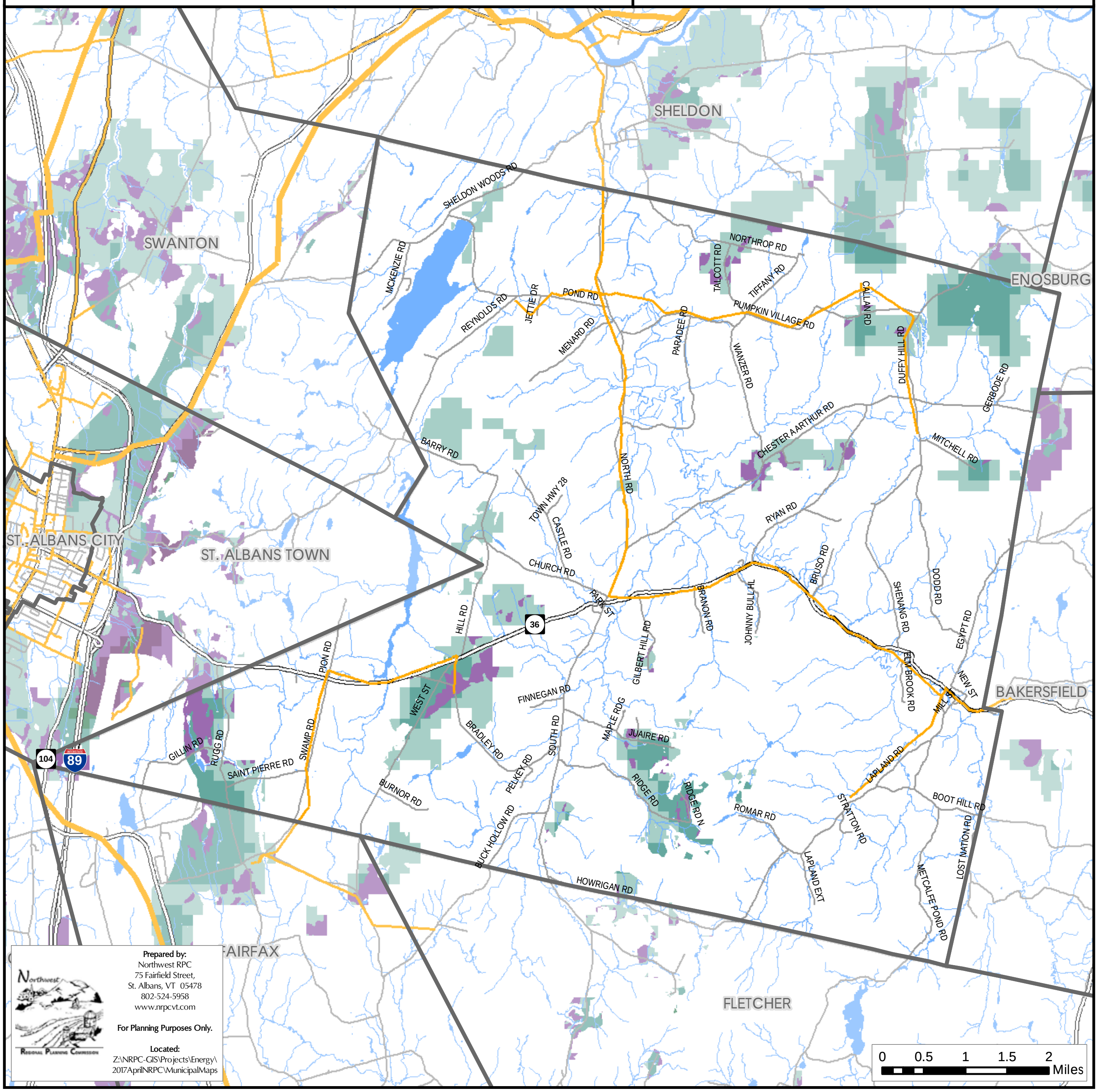

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Woody Biomass

Fairfield, Vermont
Act 174
The Energy Development Improvement Act of 2016

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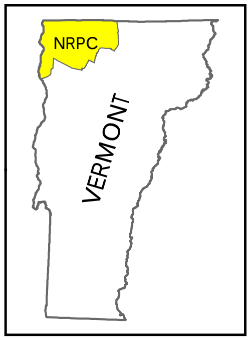

Legend

- Biomass System
- Cow Power
- Substation
- 3 Phase Power Line
- Transmission Line
- Prime Woody Biomass/No Known Constraints
- Base Woody Biomass/Possible Constraints

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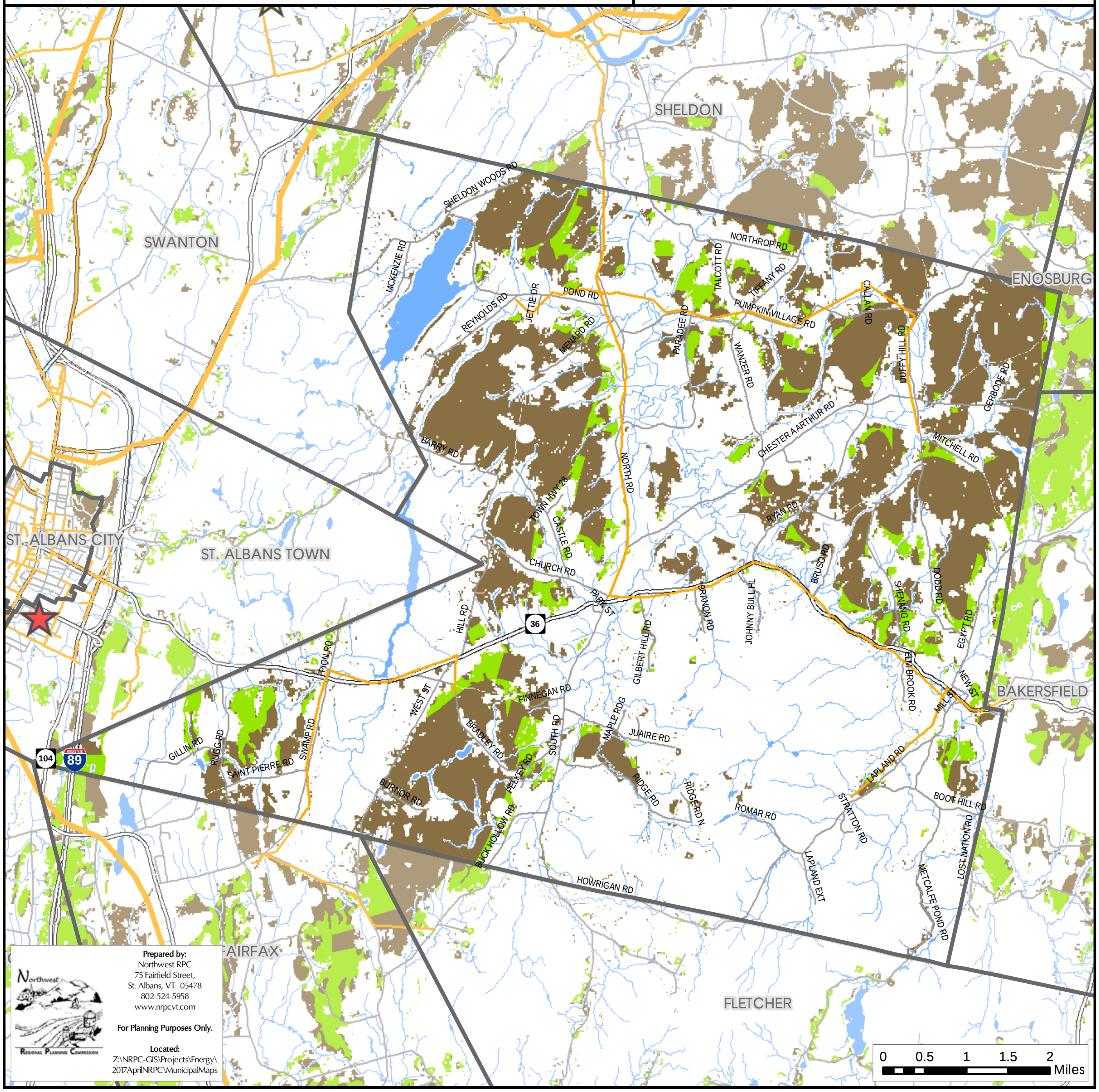

All Generators in Municipality

Category	Sub - Category	Organization Type	Address	City	CPG Number	Capacity kW
Solar	Ground-mounted PV: Fixed Rack	Residential	1963 Sheldon Woods Road	Fairfield	2948	5
Solar	Ground-mounted PV: Fixed Rack	Residential	645 Pumpkin Village Rd	Fairfield	5242	10.8
Solar	Ground-mounted PV: Fixed Rack	Residential	282 Callan Rd	Fairfield	5140	149.7
Solar	Ground-mounted PV: Fixed Rack	Residential	489 Barry Rd	Fairfield	5162	148.2
Solar	Ground-mounted PV: Fixed Rack	Residential	437 Chester Arthur Road	Fairfield	473	3.1
Solar	Ground-mounted PV: Pole	Residential	604 Hill Rd	Fairfield	2753	8.9
Solar	Ground-mounted PV: Pole	Residential	2528 Dodd Rd	Fairfield	3969	1.5
Solar	Ground-mounted PV: Tracker	Farm	539 Branon Road	Fairfield	2646	100.1
Solar	Ground-mounted PV: Tracker	Residential	1364 Castle Rd	Fairfield	5131	7
Solar	Ground-mounted PV: Tracker	Residential	4695 VT Route 36	Fairfield	2840	34.2
Solar	Ground-mounted PV: Tracker	Residential	1513 Lapland Rd	Fairfield	4270	6
Solar	Ground-mounted PV: Tracker	Residential	1941 Ridge Rd North	Fairfield	1482	9.5
Solar	Ground-mounted PV: Tracker	Residential	280 Beaver Meadow Rd	Fairfield	6437	34.2
Solar	Hot Water	Residential	243 Lost Nation Road	Fairfield		
Solar	Hot Water	Residential	437 Chester Arthur Rd	Fairfield		
Solar	Hot Water	Residential	489 Barry Road	Fairfield		
Solar	Roof-Mounted PV	Residential	91 Fischer Dr	Fairfield	5069	8
Solar	Roof-Mounted PV	Residential	1563 Church Road	Fairfield	3814	7
Solar	Roof-Mounted PV	Residential	2261 Pumpkin Village Rd	Fairfield	6284	3.8
Solar	Roof-Mounted PV	Residential	5132 VT Route 36	Fairfield	2148	7.1
Solar	Roof-Mounted PV	Residential	223 Hiram Hill	Fairfield	3977	7.5
Solar	Roof-Mounted PV	Residential	2757 Pumpkin Village Rd	Fairfield	2235	4.3
Solar	Roof-Mounted PV	Residential	1654 Swamp Road	Fairfield	3824	7
Solar	Roof-Mounted PV	Residential	105 South Rd	Fairfield	2879	6.9
Solar	Roof-Mounted PV	Residential	4552 Rt 36	Fairfield	2853	4
Solar	Roof-Mounted PV	Residential	1685 Rugg Rd	Fairfield	4073	10
Solar	Roof-Mounted PV	Farm	4883 VT Route 36	Fairfield	2839	65.2

All Generators in Municipality

Category	Sub - Category	Organization Type	Address	City	CPG Number	Capacity kW
Solar	Roof-Mounted PV	Residential	792 Bruso Rd	Fairfield	5314	7
Solar	Roof-Mounted PV	Residential	313 Hiram Rd	Fairfield	5313	6
Solar	Roof-Mounted PV	Residential	1345 Northrop Rd	Fairfield		15
Solar	Roof-Mounted PV	Residential	90 Pion Rd	Fairfield	5192	6
Solar	Roof-Mounted PV	Residential	2 Vt Rt 36	Fairfield		6
Solar	Roof-Mounted PV	Residential	4112 Pond Rd	Fairfield	2867	6.9
Solar	Roof-Mounted PV	Residential	578 Swamp Rd	Fairfield	2054	4.2
Solar	Roof-Mounted PV	Residential	250 Maple Ridge	Fairfield	16-0230	7.6
Solar	Roof-Mounted PV	Residential	4078 Pond Road	Fairfield	7197	6
Solar	Roof-Mounted PV	Residential	444 Pion Road	Fairfield	7290	5
Solar	Roof-Mounted PV	Residential	394 Route 36	Fairfield	7267	6
Solar	Roof-Mounted PV	Residential	47 Gilbert Hill Rd	Fairfield	6667	10
Solar	Roof-Mounted PV	Residential	6065 Duffy Hill Road	Fairfield	7214	5
Solar	Roof-Mounted PV	Residential	1130 Barry Road	Fairfield		3
Solar	Roof-Mounted PV	Residential	1799 Pond Road	Fairfield	7256	3.1
Wind	Small Wind	Residential	1963 Sheldon Woods Road	Fairfield	460	9.5
Wind	Small Wind	Farm	3971 Pumpkin Village Road	Fairfield	383	6.3
Wind	Small Wind	Residential	336 Emch Drive	Fairfield	445	9.5

Municipal Analysis & Targets - Fletcher

The following is an explanation of the municipal energy data compiled by Northwest Regional Planning Commission (NRPC). The intent of the municipal energy data is to provide the municipalities with data required to ensure compliance with the requirements of Act 174 and "Enhanced Energy Planning" (24 V.S.A. 4352). The following tables contain data that estimates current energy use and provides targets for future energy use across all sectors (transportation, heating, and electricity). It also sets targets for renewable energy generation within the municipality.

This data is meant to be a starting point for the municipality to begin planning its energy future and to talk about the changes that may need to occur within the municipality to ensure that local, regional and state energy goals are met. This includes the State of Vermont's goal to have 90% of all energy demand be met from renewable sources by 2050.

Figure 1 - Data Sources

ACS – American Community Survey

DOL –Vermont Department of Labor

DPS – Vermont Department of Public Service

EIA – Energy Information Administration

EVT – Efficiency Vermont

LEAP – Long-Range Energy Alternatives Planning

VEIC – Vermont Energy Investment Corporation

VTrans – Vermont Agency of Transportation

Data Sources

Estimates of current energy use consist primarily of data available from the American Community Survey (ACS), the Vermont Agency of Transportation (VTrans), the Vermont Department of Labor (DOL), and the Vermont Department of Public Service (DPS). Targets for future energy use are reliant upon the Long-range Energy Alternatives Planning (LEAP) analysis for the region completed the Vermont Energy Investment Corporation (VEIC). Targets for future energy generation have come from the regional planning commission and DPS. For more information on LEAP, see the Northwest Regional Energy Plan (www.nrpcvt.com). Targets for both future energy use and energy generation have been generally developed using a "top down" method of disaggregating regional data to the municipal level.

It is possible to develop "bottom up" data. For those municipalities interested in that approach, please see the Department of Public Service's Analysis and Targets Guidance (http://publicservice.vermont.gov/content/act-174-recommendations-and-determination-standards).

Please remember that the targets established by LEAP represent only one way to achieve energy goals. There may several other similar pathways that a municipality may choose to take in order to meet the 90x50 goal.

Below is a worksheet by worksheet explanation of the Municipal Template spreadsheet:

1. Municipal Data Summary

The following tables summarize all data that is required to be in a municipal plan if the plan is to meet the "determination" standards established by the Vermont Department of Public Service.

Table 1A: Current Municipal Transportation Energy Use

Transportation Data	Municipal Data
Total # of Passenger Vehicles (ACS 2011-2015)	1,216
Average Miles per Vehicle (Vtrans)	11,356
Total Miles Traveled	13,808,896
Realized MPG (2013 - VTrans 2015 Energy Profile)	18.6
Total Gallons Use per Year	742,414
Transportation BTUs (Billion)	89
Average Cost per Gallon of Gasoline (RPC)	2.31
Gasoline Cost per Year	1,714,976

This table uses data from the American Community Survey (ACS) and Vermont Agency of Transportation (VTrans) to calculate current transportation energy use and energy costs in the municipality.

Table 1B: Current Municipal Residential Heating Energy Use

Fuel Source	Municipal Households (ACS 2011-2015)	% of Municipal Households	Municipal Square Footage Heated	Municipal BTU (in Billions)
Natural Gas	0	0.0%	0	0
Propane	85	16.3%	155,504	9
Electricity	8	1.5%	15,232	1
Fuel Oil	195	37.5%	367,056	22
Coal	0	0.0%	0	0
Wood	226	43.5%	422,560	25
Solar	0	0.0%	0	0
Other	6	1.2%	11,424	1
No Fuel	0	0.0%	0	0
Total	520	100.0%	971,776	58

This table displays data from the ACS that estimates current municipal residential heating energy use.

Table 1C: Current Municipal Commercial Energy Use

	Commercial Establishments in Municipality (VT DOL)	Estimated Thermal Energy BTUs per Commercial Establishment (in Billions) (VDPS)	Estimated Thermal Energy BTUs by Commercial Establishments in Municipality (in Billions)
Municipal Commercial Energy Use	5	0.725	4

The table uses data available from the Vermont Department of Labor (VT DOL) and the Vermont Department of Public Service (DPS) to estimate current municipal commercial establishment energy use in the municipality.

Table 1D: Current Electricity Use

Use Sector	Current Electricity Use
Residential (kWh)	4,674,458
Commercial and Industrial (kWh)	1,282,866
Total (kWh)	5,957,324

This table displays current electricity use within the municipality. This data is available from Efficiency Vermont (EVT).

Table 1E: Residential Thermal Efficiency Targets

	2025	2035	2050
"Residential - Increased Efficiency and Conservation (% of municipal households to be weatherized)"	5%	16%	78%

This table displays targets for thermal efficiency of residential structures. The data is based on a methodology developed by DPS using data available from the regional Long-range Energy Alternatives Planning (LEAP) analysis and ACS. The data in this table represents the percentage of municipal households that will need to be weatherized in the target years. The target is cumulative.

Table 1F: Commercial Thermal Efficiency Target

	2025	2035	2050
"Commercial - Increased Efficiency and Conservation (% of commercial establishments to be weatherized)"	25%	25%	73%

This table shows the same information as Table 1E, but sets a target for commercial thermal efficiency and weatherization. Information from the VT DOL is required to complete this target. The target is cumulative.

Table 1G: Thermal Fuel Switching (Residential and Commercial) – Wood Systems

	2025	2035	2050
New Efficient Wood Heat Systems (in units)	0	0	-1

This table provides a target for new wood heating systems for residential and commercial structures in the municipality for each target year. This target was calculated using data from LEAP and ACS. The target is cumulative.

Table 1H: Thermal Fuel Switching (Residential and Commercial) – Heat Pumps

	2025	2035	2050
New Heat Pumps (in units)	62	142	265

This table provides a target for new heat pump systems for residential and commercial structures in the municipality for each target year. This target was calculated using data from LEAP and ACS. The target is cumulative.

Table 1I: Electricity Efficiency Targets

	2025	2035	2050
Increase Efficiency and Conservation (BTUs)	25.2%	48.3%	100.7%

Data in this table displays a target for increased electricity efficiency and conservation during the target years. This target will be met through conversions to high efficiency appliances, electric heat pumps, and electric light-duty vehicles. These targets were developed using regional LEAP analysis. The target is cumulative.

Table 1J: Use of Renewables – Transportation

	2025	2035	2050
Renewable Energy Use - Transportation (BTUs)	4.5%	21.9%	85.9%

This data displays targets for the percentage of transportation energy use coming from renewable sources during each target year. This target will be met through conversions to electric light-duty vehicles and biodiesel heavy-duty vehicles. This data was developed using the LEAP analysis. The target is cumulative.

Table 1K: Use of Renewables – Heating			
	2025	2035	2050
Renewable Energy Use - Heating (BTUs)	47.3%	61.2%	89.2%

This data displays targets for the percentage of heating energy use coming from renewable sources during each target year. This target will be met through conversions to electric heat pumps and high efficiency wood heating systems. This data was developed using information from the LEAP analysis. The target is cumulative.

Table 1L: Use of Renewables – Electricity			
	2025	2035	2050
Renewable Energy Use - Electricity (MWh)	4,008.6	8,017.1	12,147.2

This data displays targets for MWh of electricity generation coming from renewable sources within the municipality during each target year. This data was developed using information from the regional planning commission and DPS. This data is the same as the data in Table 1Q. The target is cumulative.

Table 1M: Transportation Fuel Switching Targets – Electric Vehicles			
	2025	2035	2050
Electric Vehicles	106	797	1,895

This tables displays a target for switching from fossil fuel based vehicles (gasoline and diesel) to electric vehicles. This target is calculated using LEAP and ACS data. The target is cumulative.

Table 1N: Transportation Fuel Switching Targets – Biodiesel			
	2025	2035	2050
Biodiesel Vehicles	58	113	211

This tables displays a target for switching from fossil fuel based vehicles to biodiesel-powered vehicles. This target is calculated using LEAP and ACS data. The target is cumulative.

Table 1O: Existing Renewable Generation

Renewable Type	MW	MWh
Solar	0.11	134.90
Wind	0.00	0.00
Hydro	0.00	0.00
Biomass	0.00	0.00
Other	0.00	0.00
Total Existing Generation	0.11	134.90

Table 1O shows existing renewable generation in the municipality, in MW and MWh, based on information available from the Vermont Department of Public Service.

Table 1P: Renewable Generation Potential

Renewable Type	MW	MWh
Rooftop Solar	1	668
Ground-mounted Solar	320	392,168
Wind	69	211,937
Hydro	0	0
Biomass and Methane	0	0
Other	0	0
Total Renewable Generation Potential	389	604,773

Renewable generation potential is based on mapping completed by the regional planning commission that is based on the Municipal Determination Standards and associated guidance documents developed by DPS. The renewable generation potential is expressed in MW and MWh by the type of renewable resource (solar, wind, hydro, etc.).

Table 1Q: Renewable Generation Targets

	2025	2035	2050
Total Renewable Generation Target (in MWh)	4,008.57	8,017.13	12,147.17

This data displays targets for MWh of electricity generation coming from renewable sources within the municipality during each target year. This data was developed using information from the regional planning commission and DPS. This data is the same as the data in Table 1L.

Table 1R: Sufficient Land?

	Y/N
Solar	Y
Wind	Y

This table shows whether or not there is sufficient land in the municipality to meet the renewable generation targets based on the renewable generation potential in the municipality.

Utility Service Areas

Fletcher, Vermont
Act 174
The Energy Development Improvement Act of 2016

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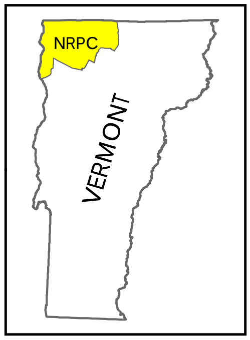
N



Legend

Utility Service Area Features

- Green Mountain Power
- Swanton Village Electric
- Vermont Electric Co-op
- Enosburg Falls Electric
- Substation
- 3 Phase Power Line
- Transmission Line

Sources: VCGI
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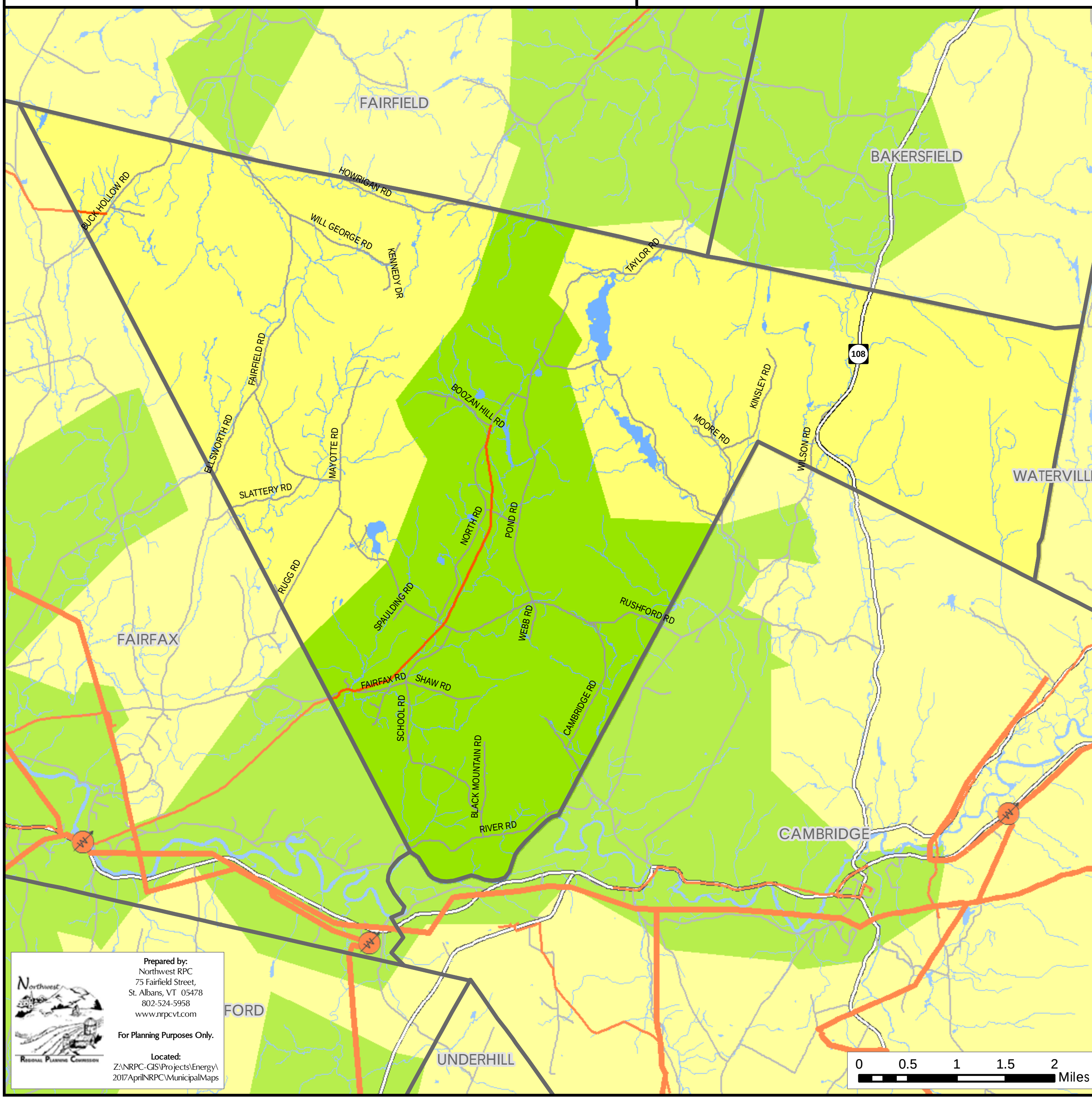

Transmission & 3 Phase Power Infrastructure

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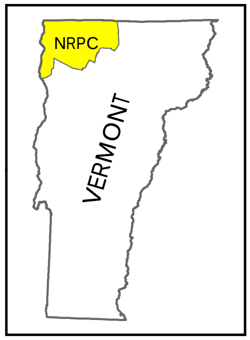

Legend

- Substation
- 3 Phase Power Line
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- 1/2 Mile Buffer (3 Phase Power Line & Transmission Line)

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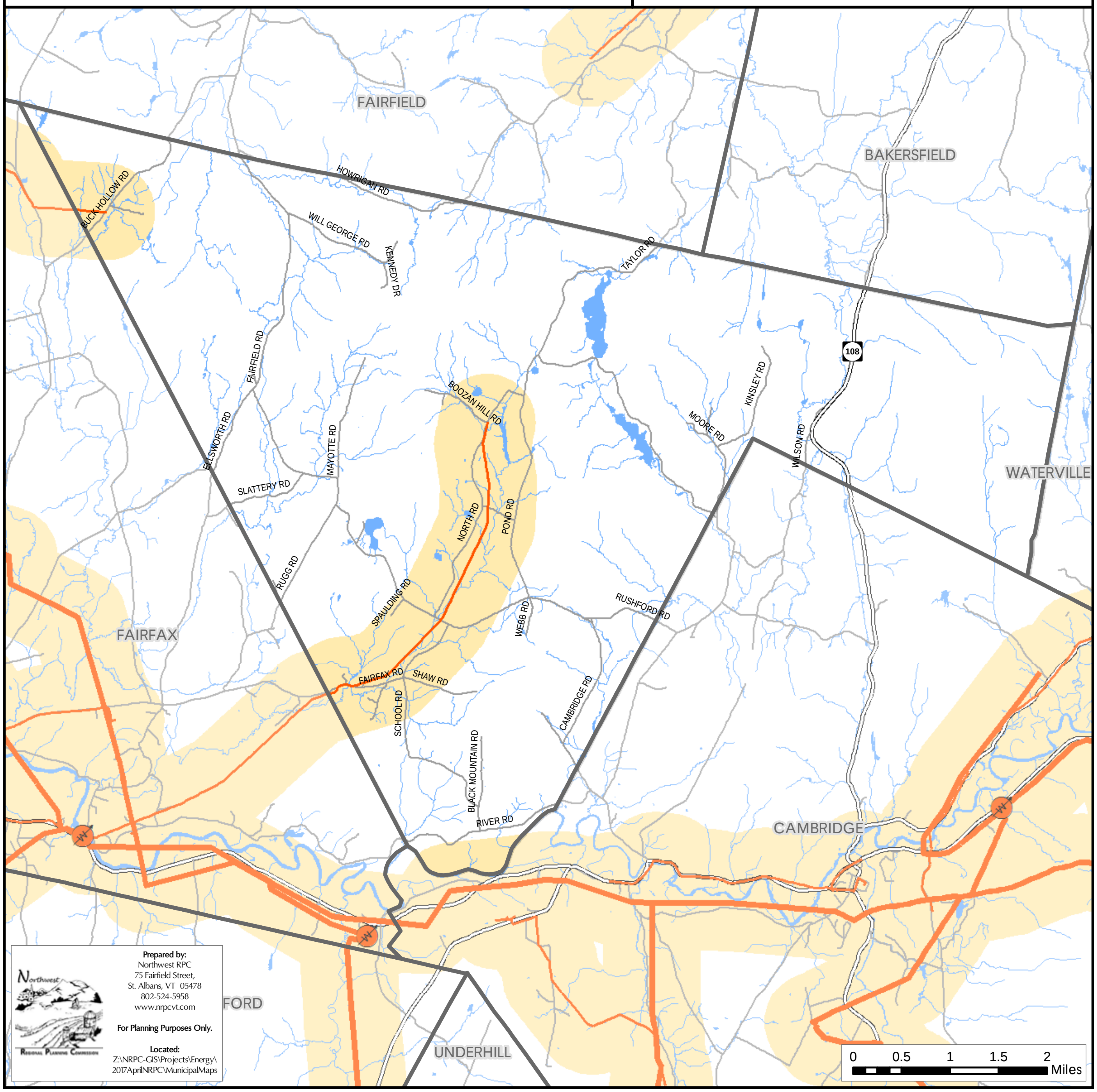

Existing Generation Facilities

Fletcher, Vermont
Act 174
The Energy Development Improvement Act of 2016

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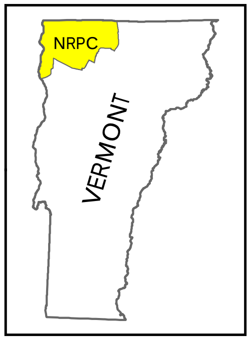

Legend

- Biomass Facility
- Hydro Facility
- Solar Facility
- Wind Facility

Note: Only generators 15kW are shown on the map. A full list of all generators is available.

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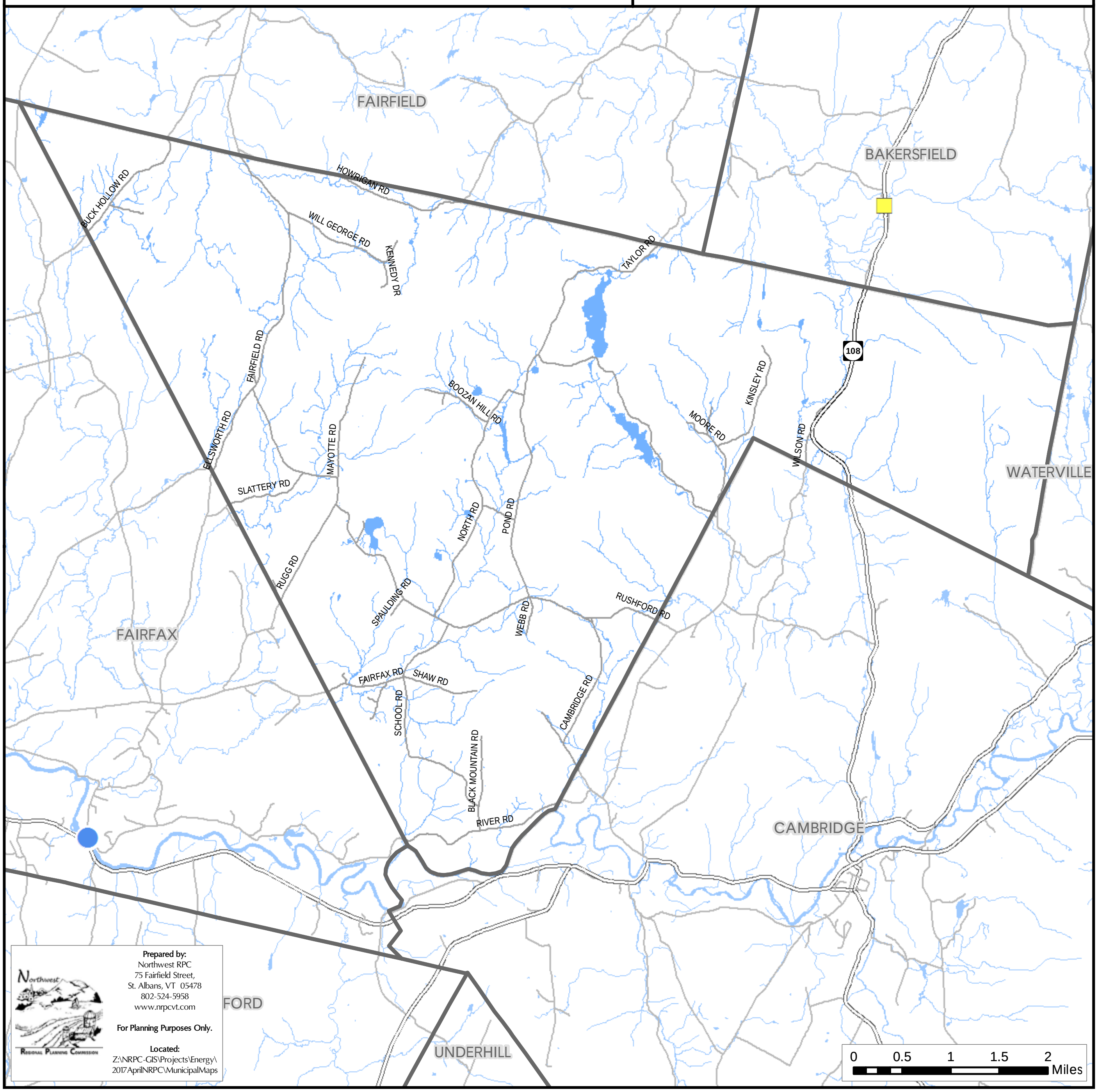

Hydro

Fletcher, Vermont
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N

Legend

- Substation
- 3 Phase Power Line
- Transmission Line
- Designated Outstanding Resource Water
- Known Constraint - Designated National Wild & Scenic River
- Possible Constraint - Stressed or Impaired Water
- Possible Constraint - RINAs

Potential Hydroelectric Facility

- < 50 kW Capacity
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- High Hazard with < 50 kW Capacity
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Operating Hydroelectric Facility

- Dam not on National Wild and Scenic River
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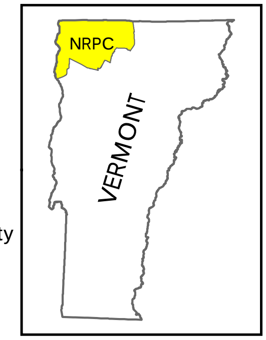

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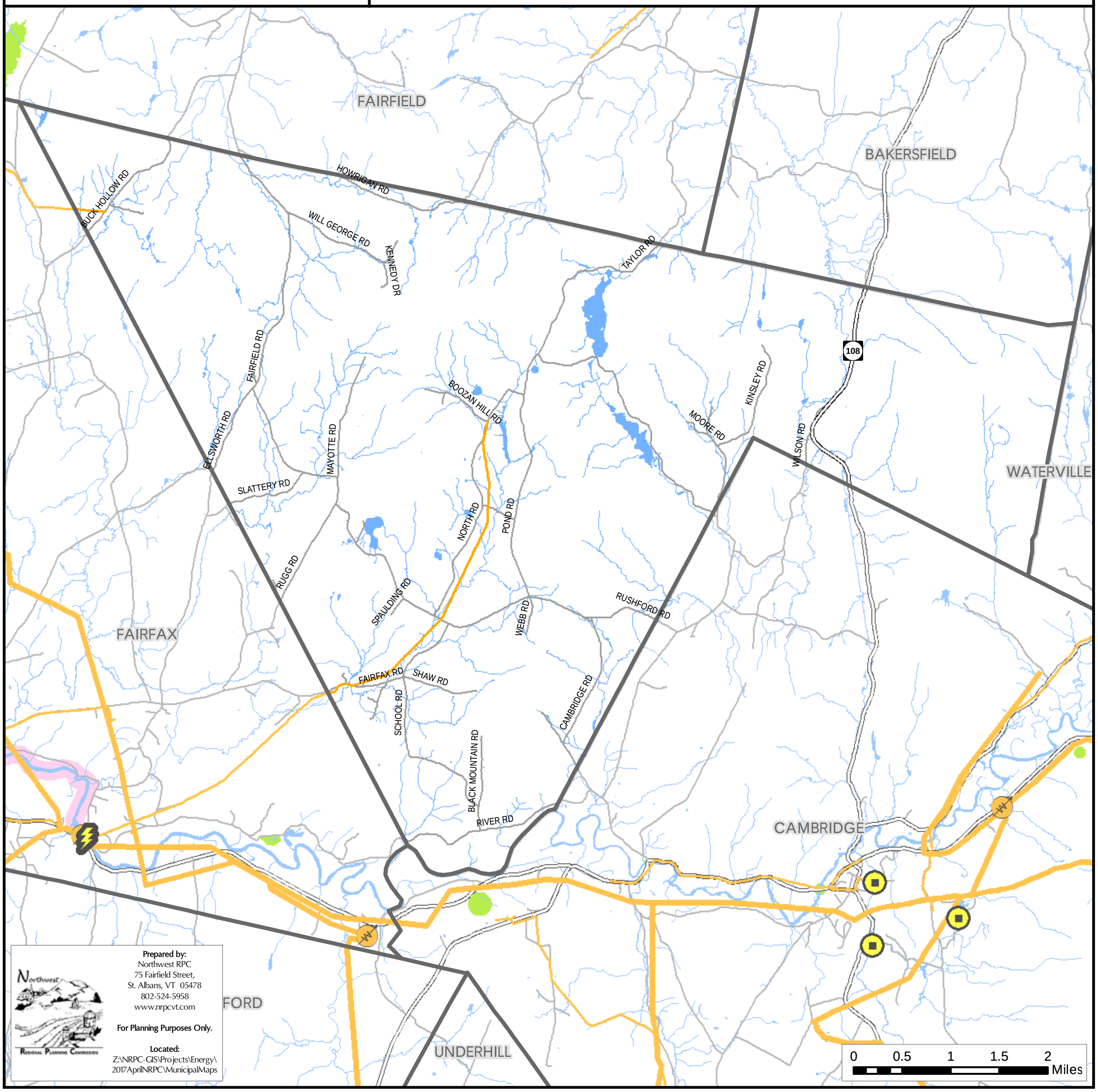

Solar

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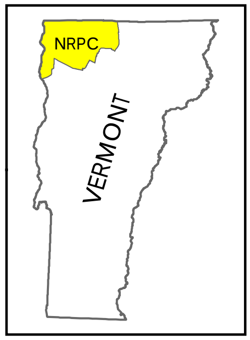

Legend

- Substation
- 3 Phase Power Line
- Transmission Line
- 1/2 Mile Buffer (3 Phase Power Line & Transmission Line)
- Prime Solar/No Known Constraints
- Base Solar/Possible Constraints

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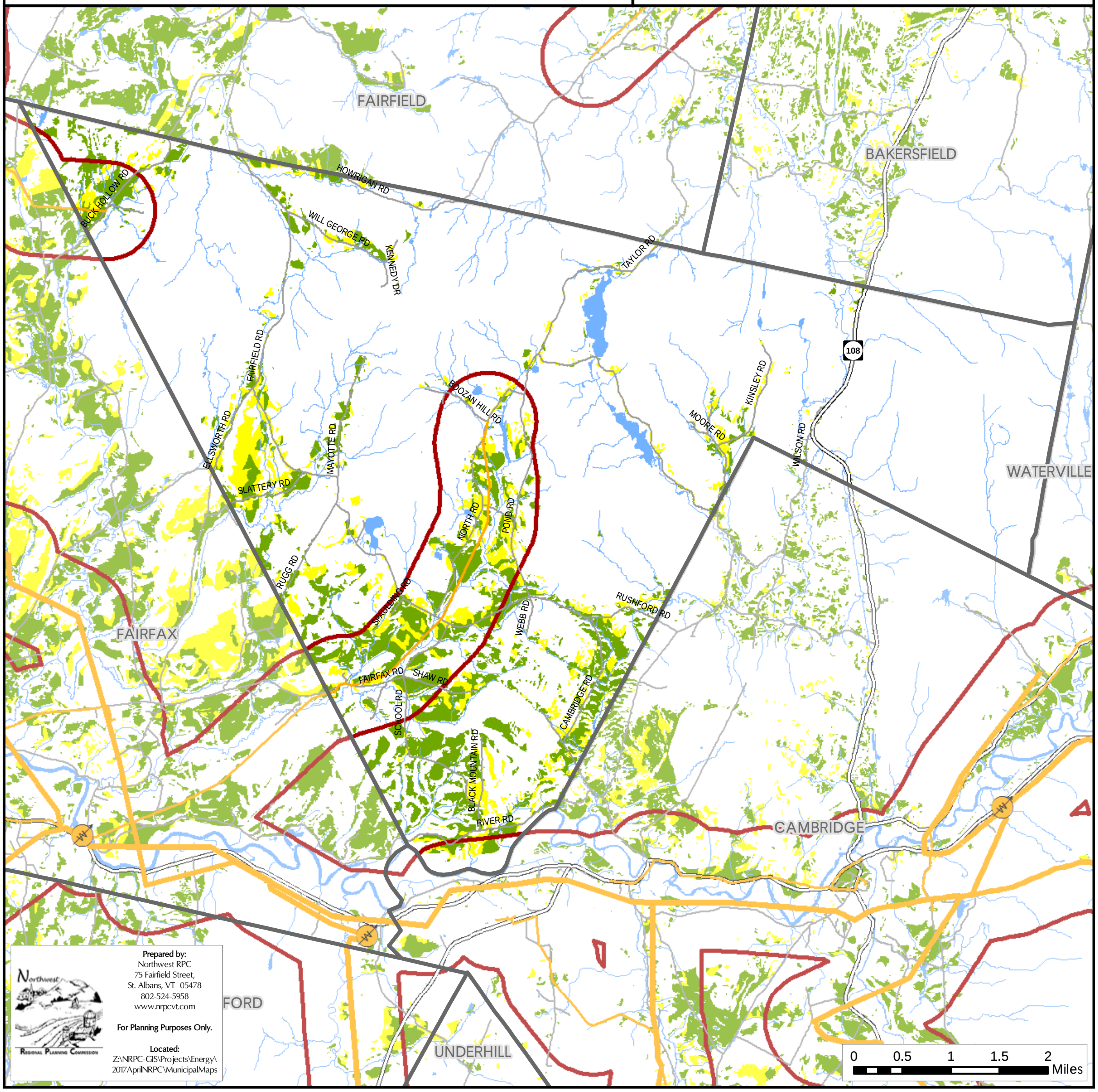

Wind

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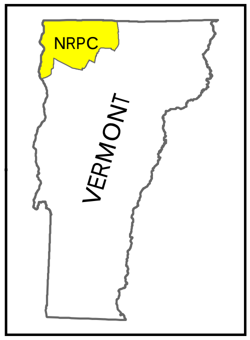

Legend

- Substation
- 3 Phase Power Line
- Transmission Line
- Prime Wind: Areas of high wind potential and no known constraints. Darker areas have higher wind speeds.
- Base Wind: Areas of high wind potential and a presence of possible constraints. Darker areas have higher wind speeds.

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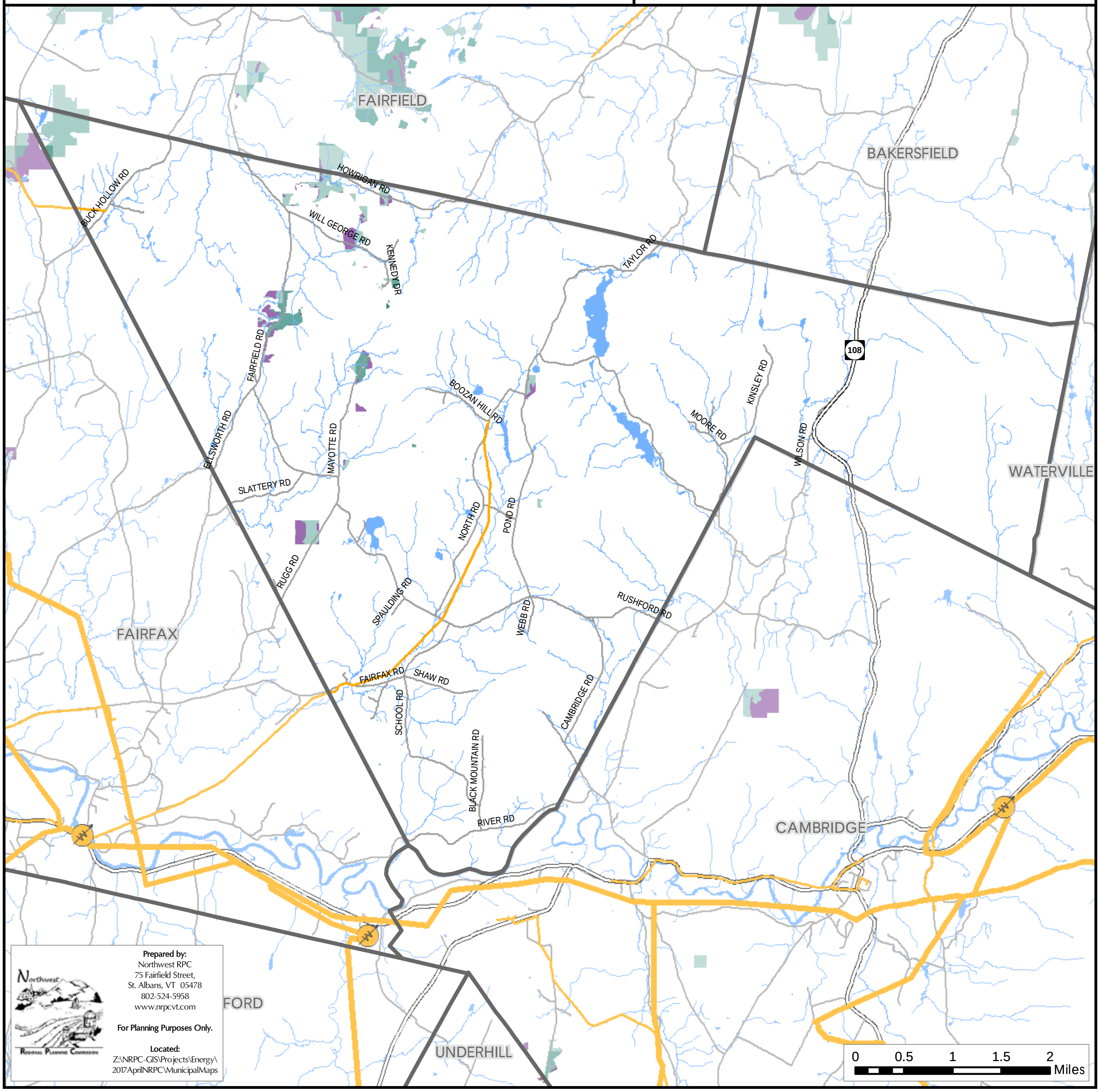
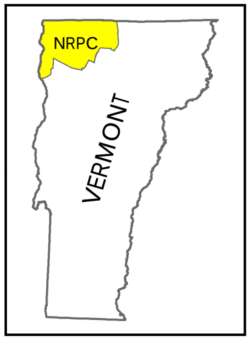


Woody Biomass

Fletcher, Vermont
Act 174
The Energy Development Improvement Act of 2016



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N

Legend

- Biomass System
- Cow Power
- Substation
- 3 Phase Power Line
- Transmission Line
- Prime Woody Biomass/No Known Constraints
- Base Woody Biomass/Possible Constraints

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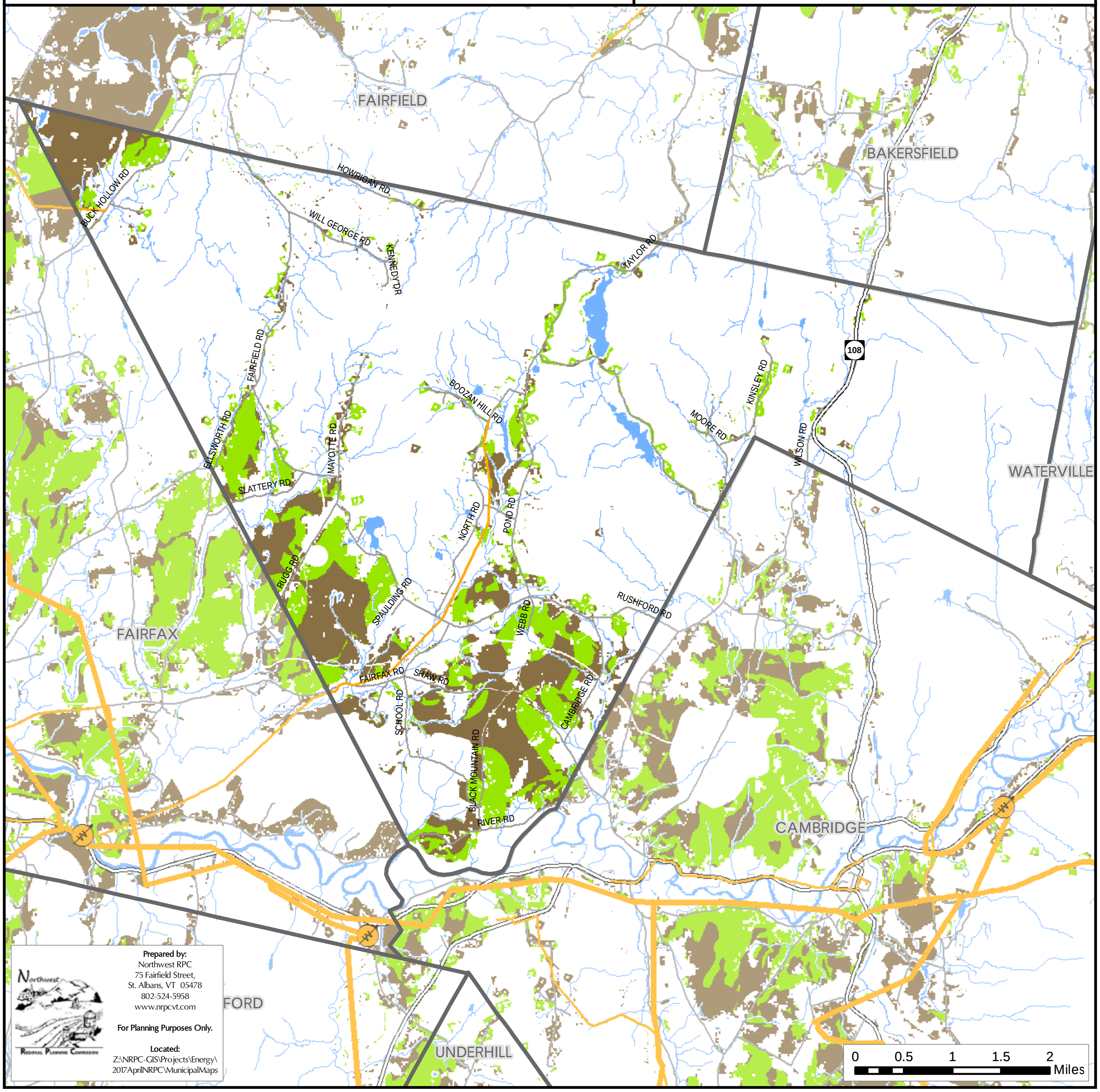

Prepared by:
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For Planning Purposes Only.

Located:
Z:\NRPC-GIS\Projects\Energy\2017April\NRPC\MunicipalMaps

All Generators in Municipality

Category	Sub - Category	Organization Type	Address	City	CPG Number	Capacity kW
Solar	Ground-mounted PV: Fixed Rack	Residential	246 Drinkwine Road	Fletcher	7005	7.6
Solar	Ground-mounted PV: Pole	Residential	567 Rugg Rd	Fletcher	5502	10.8
Solar	Ground-mounted PV: Pole	Residential	706 School Rd	Fletcher	3461	6.8
Solar	Ground-mounted PV: Pole	Residential	1199 Taylor Road	Fletcher	7275	7.6
Solar	Ground-mounted PV: Tracker	Residential	658 Ellsworth Rd	Fletcher	3828	6.4
Solar	Ground-mounted PV: Tracker	Residential	221 Black Mountain Rd	Fletcher	3884	9
Solar	Roof-Mounted PV	Farm	2150 Buck Hollow Rd	Fletcher	549	11.9
Solar	Roof-Mounted PV	Residential	17 Rushford Rd	Fletcher	4018	5
Solar	Roof-Mounted PV	Residential	495 Lloyd Road	Fletcher	3310	2.9
Solar	Roof-Mounted PV	Residential	81 Oak Hill Rd	Fletcher	3422	5.1
Solar	Roof-Mounted PV	Residential	1078 River Rd	Fletcher	1881	3.6
Solar	Roof-Mounted PV	Residential	271 Wright Rd	Fletcher	3161	3.1
Solar	Roof-Mounted PV	Residential	819 Fairfax Road	Fletcher	16-0231	3.8
Solar	Roof-Mounted PV	Residential	168 Stone Lane	Fletcher	7353	3.6
Solar	Roof-Mounted PV	Residential	172 Oustinoff Road	Fletcher	7199	3.8
Solar	Roof-Mounted PV	Residential	523 Shaw Road	Fletcher		6
Solar	Roof-Mounted PV	Residential	160 Whitetail Way	Fletcher	7270	7.6
Solar	Roof-Mounted PV	Residential	78 Oustinoff Road	Fletcher	16-0818	3.6
Solar	Roof-Mounted PV	Residential	2895 Pond Road	Fletcher	7269	4
Solar	Roof-Mounted PV	Residential	50 Mountain View Dr	Fletcher		5
Solar	Roof-Mounted PV	Residential	1541 Fairfax Road	Fletcher	16-1487	3

Municipal Analysis & Targets - Franklin

The following is an explanation of the municipal energy data compiled by Northwest Regional Planning Commission (NRPC). The intent of the municipal energy data is to provide the municipalities with data required to ensure compliance with the requirements of Act 174 and "Enhanced Energy Planning" (24 V.S.A. 4352). The following tables contain data that estimates current energy use and provides targets for future energy use across all sectors (transportation, heating, and electricity). It also sets targets for renewable energy generation within the municipality.

This data is meant to be a starting point for the municipality to begin planning its energy future and to talk about the changes that may need to occur within the municipality to ensure that local, regional and state energy goals are met. This includes the State of Vermont's goal to have 90% of all energy demand be met from renewable sources by 2050.

Figure 1 - Data Sources

ACS – American Community Survey

DOL –Vermont Department of Labor

DPS – Vermont Department of Public Service

EIA – Energy Information Administration

EVT – Efficiency Vermont

LEAP – Long-Range Energy Alternatives Planning

VEIC – Vermont Energy Investment Corporation

VTrans – Vermont Agency of Transportation

Data Sources

Estimates of current energy use consist primarily of data available from the American Community Survey (ACS), the Vermont Agency of Transportation (VTrans), the Vermont Department of Labor (DOL), and the Vermont Department of Public Service (DPS). Targets for future energy use are reliant upon the Long-range Energy Alternatives Planning (LEAP) analysis for the region completed the Vermont Energy Investment Corporation (VEIC). Targets for future energy generation have come from the regional planning commission and DPS. For more information on LEAP, see the Northwest Regional Energy Plan (www.nrpcvt.com). Targets for both future energy use and energy generation have been generally developed using a "top down" method of disaggregating regional data to the municipal level.

It is possible to develop "bottom up" data. For those municipalities interested in that approach, please see the Department of Public Service's Analysis and Targets Guidance (http://publicservice.vermont.gov/content/act-174-recommendations-and-determination-standards).

Please remember that the targets established by LEAP represent only one way to achieve energy goals. There may several other similar pathways that a municipality may choose to take in order to meet the 90x50 goal.

Below is a worksheet by worksheet explanation of the Municipal Template spreadsheet:

1. Municipal Data Summary

The following tables summarize all data that is required to be in a municipal plan if the plan is to meet the "determination" standards established by the Vermont Department of Public Service.

Table 1A: Current Municipal Transportation Energy Use

Transportation Data	Municipal Data
Total # of Passenger Vehicles (ACS 2011-2015)	1,118
Average Miles per Vehicle (Vtrans)	11,356
Total Miles Traveled	12,696,008
Realized MPG (2013 - VTrans 2015 Energy Profile)	18.6
Total Gallons Use per Year	682,581
Transportation BTUs (Billion)	82
Average Cost per Gallon of Gasoline (RPC)	2.31
Gasoline Cost per Year	1,576,762

This table uses data from the American Community Survey (ACS) and Vermont Agency of Transportation (VTrans) to calculate current transportation energy use and energy costs in the municipality.

Table 1B: Current Municipal Residential Heating Energy Use

Fuel Source	Municipal Households (ACS 2011-2015)	% of Municipal Households	Municipal Square Footage Heated	Municipal BTU (in Billions)
Natural Gas	0	0.0%	0	0
Propane	37	6.7%	65,520	4
Electricity	9	1.6%	12,912	1
Fuel Oil	346	62.3%	617,952	37
Coal	0	0.0%	0	0
Wood	147	26.5%	278,480	17
Solar	0	0.0%	0	0
Other	16	2.9%	30,464	2
No Fuel	0	0.0%	0	0
Total	555	100.0%	1,005,328	60

This table displays data from the ACS that estimates current municipal residential heating energy use.

Table 1C: Current Municipal Commercial Energy Use

	Commercial Establishments in Municipality (VT DOL)	Estimated Thermal Energy BTUs per Commercial Establishment (in Billions) (VDPS)	Estimated Thermal Energy BTUs by Commercial Establishments in Municipality (in Billions)
Municipal Commercial Energy Use	15	0.725	11

The table uses data available from the Vermont Department of Labor (VT DOL) and the Vermont Department of Public Service (DPS) to estimate current municipal commercial establishment energy use in the municipality.

Table 1D: Current Electricity Use

Use Sector	Current Electricity Use
Residential (kWh)	4,989,085
Commercial and Industrial (kWh)	3,848,599
Total (kWh)	8,837,683

This table displays current electricity use within the municipality. This data is available from Efficiency Vermont (EVT).

Table 1E: Residential Thermal Efficiency Targets

	2025	2035	2050
"Residential - Increased Efficiency and Conservation (% of municipal households to be weatherized)"	5%	16%	78%

This table displays targets for thermal efficiency of residential structures. The data is based on a methodology developed by DPS using data available from the regional Long-range Energy Alternatives Planning (LEAP) analysis and ACS. The data in this table represents the percentage of municipal households that will need to be weatherized in the target years. The target is cumulative.

Table 1F: Commercial Thermal Efficiency Target

	2025	2035	2050
"Commercial - Increased Efficiency and Conservation (% of commercial establishments to be weatherized)"	25%	25%	73%

This table shows the same information as Table 1E, but sets a target for commercial thermal efficiency and weatherization. Information from the VT DOL is required to complete this target. The target is cumulative.

Table 1G: Thermal Fuel Switching (Residential and Commercial) – Wood Systems

	2025	2035	2050
New Efficient Wood Heat Systems (in units)	0	0	0

This table provides a target for new wood heating systems for residential and commercial structures in the municipality for each target year. This target was calculated using data from LEAP and ACS. The target is cumulative.

Table 1H: Thermal Fuel Switching (Residential and Commercial) – Heat Pumps

	2025	2035	2050
New Heat Pumps (in units)	66	152	283

This table provides a target for new heat pump systems for residential and commercial structures in the municipality for each target year. This target was calculated using data from LEAP and ACS. The target is cumulative.

Table 1I: Electricity Efficiency Targets

	2025	2035	2050
Increase Efficiency and Conservation (BTUs)	25.2%	48.3%	100.7%

Data in this table displays a target for increased electricity efficiency and conservation during the target years. This target will be met through conversions to high efficiency appliances, electric heat pumps, and electric light-duty vehicles. These targets were developed using regional LEAP analysis. The target is cumulative.

Table 1J: Use of Renewables – Transportation

	2025	2035	2050
Renewable Energy Use - Transportation (BTUs)	7.8%	28.2%	89.1%

This data displays targets for the percentage of transportation energy use coming from renewable sources during each target year. This target will be met through conversions to electric light-duty vehicles and biodiesel heavy-duty vehicles. This data was developed using the LEAP analysis. The target is cumulative.

Table 1K: Use of Renewables – Heating

	2025	2035	2050
Renewable Energy Use - Heating (BTUs)	46.3%	59.9%	87.9%

This data displays targets for the percentage of heating energy use coming from renewable sources during each target year. This target will be met through conversions to electric heat pumps and high efficiency wood heating systems. This data was developed using information from the LEAP analysis. The target is cumulative.

Table 1L: Use of Renewables – Electricity

	2025	2035	2050
Renewable Energy Use - Electricity (MWh)	6,507.4	13,014.8	19,719.4

This data displays targets for MWh of electricity generation coming from renewable sources within the municipality during each target year. This data was developed using information from the regional planning commission and DPS. This data is the same as the data in Table 1Q. The target is cumulative.

Table 1M: Transportation Fuel Switching Targets – Electric Vehicles

	2025	2035	2050
Electric Vehicles	98	733	1,743

This tables displays a target for switching from fossil fuel based vehicles (gasoline and diesel) to electric vehicles. This target is calculated using LEAP and ACS data. The target is cumulative.

Table 1N: Transportation Fuel Switching Targets – Biodiesel

	2025	2035	2050
Biodiesel Vehicles	125	247	474

This tables displays a target for switching from fossil fuel based vehicles to biodiesel-powered vehicles. This target is calculated using LEAP and ACS data. The target is cumulative.

Table 1O: Existing Renewable Generation

Renewable Type	MW	MWh
Solar	0.20	245.28
Wind	0.00	7.67
Hydro	0.00	0.00
Biomass	0.18	736.37
Other	0.00	0.00
Total Existing Generation	0.38	989.31

Table 1O shows existing renewable generation in the municipality, in MW and MWh, based on information available from the Vermont Department of Public Service.

Table 1P: Renewable Generation Potential

Renewable Type	MW	MWh
Rooftop Solar	1	773
Ground-mounted Solar	821	1,006,421
Wind	117	359,358
Hydro	0.023	81
Biomass and Methane	0	0
Other	0	0
Total Renewable Generation Potential	938	1,366,632

Renewable generation potential is based on mapping completed by the regional planning commission that is based on the Municipal Determination Standards and associated guidance documents developed by DPS. The renewable generation potential is expressed in MW and MWh by the type of renewable resource (solar, wind, hydro, etc.).

Table 1Q: Renewable Generation Targets

	2025	2035	2050
Total Renewable Generation Target (in MWh)	6,507.40	13,014.79	19,719.39

This data displays targets for MWh of electricity generation coming from renewable sources within the municipality during each target year. This data was developed using information from the regional planning commission and DPS. This data is the same as the data in Table 1L.

Table 1R: Sufficient Land?

	Y/N
Solar	Y
Wind	Y

This table shows whether or not there is sufficient land in the municipality to meet the renewable generation targets based on the renewable generation potential in the municipality.

Utility Service Areas

Franklin, Vermont
Act 174
The Energy Development Improvement Act of 2016

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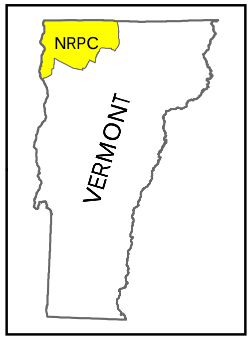

Legend

Utility Service Area Features

- Green Mountain Power
- Swanton Village Electric
- Vermont Electric Co-op
- Enosburg Falls Electric
- Substation
- 3 Phase Power Line
- Transmission Line

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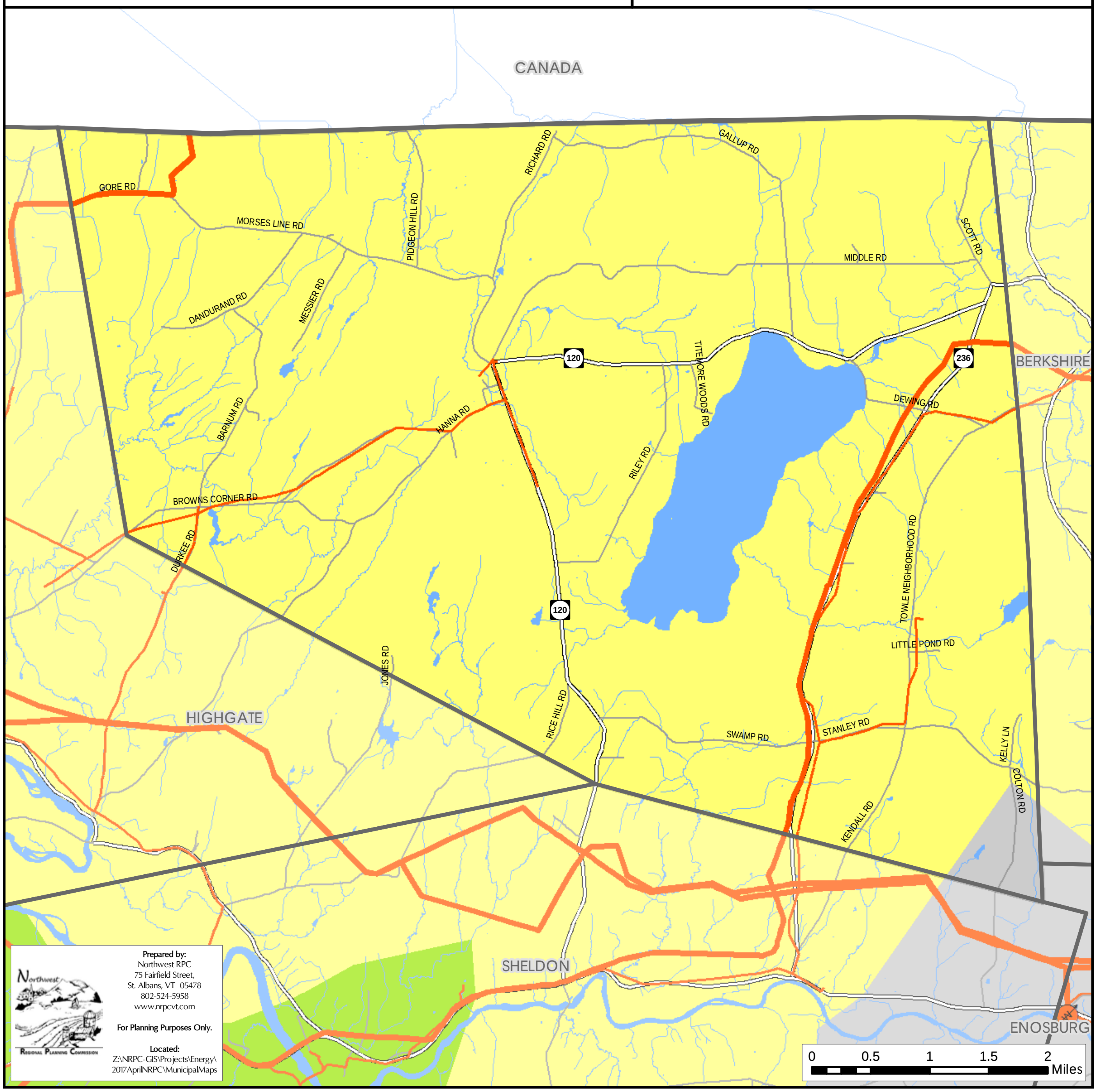

Transmission & 3 Phase Power Infrastructure

Franklin, Vermont
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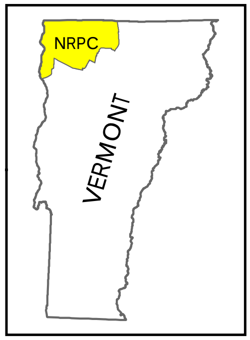

Legend

- Substation
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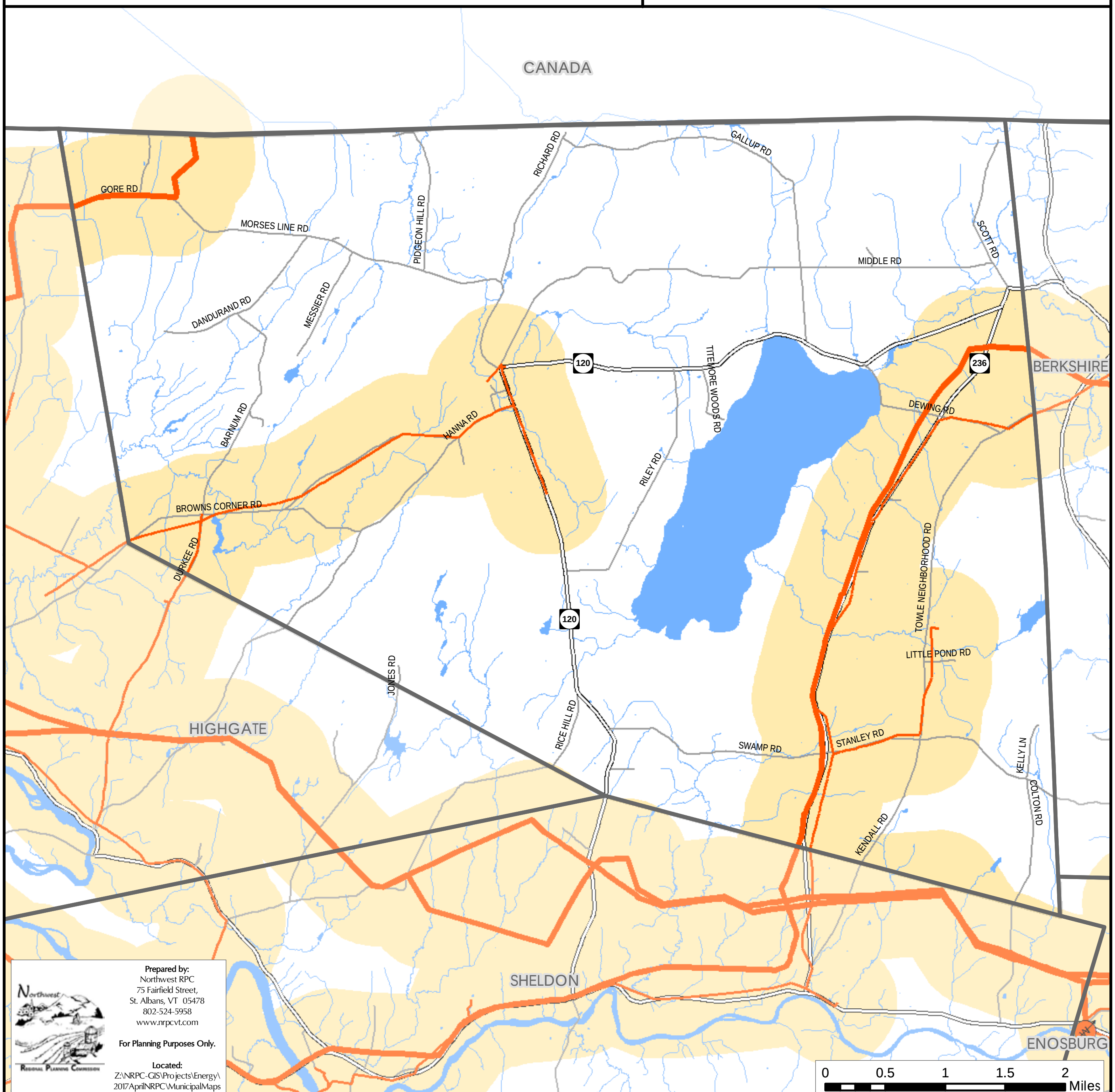

Existing Generation Facilities

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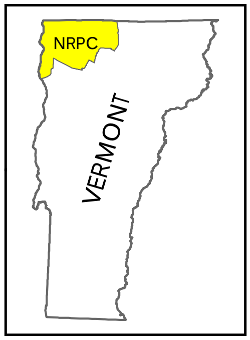

Legend

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- Hydro Facility
- Solar Facility
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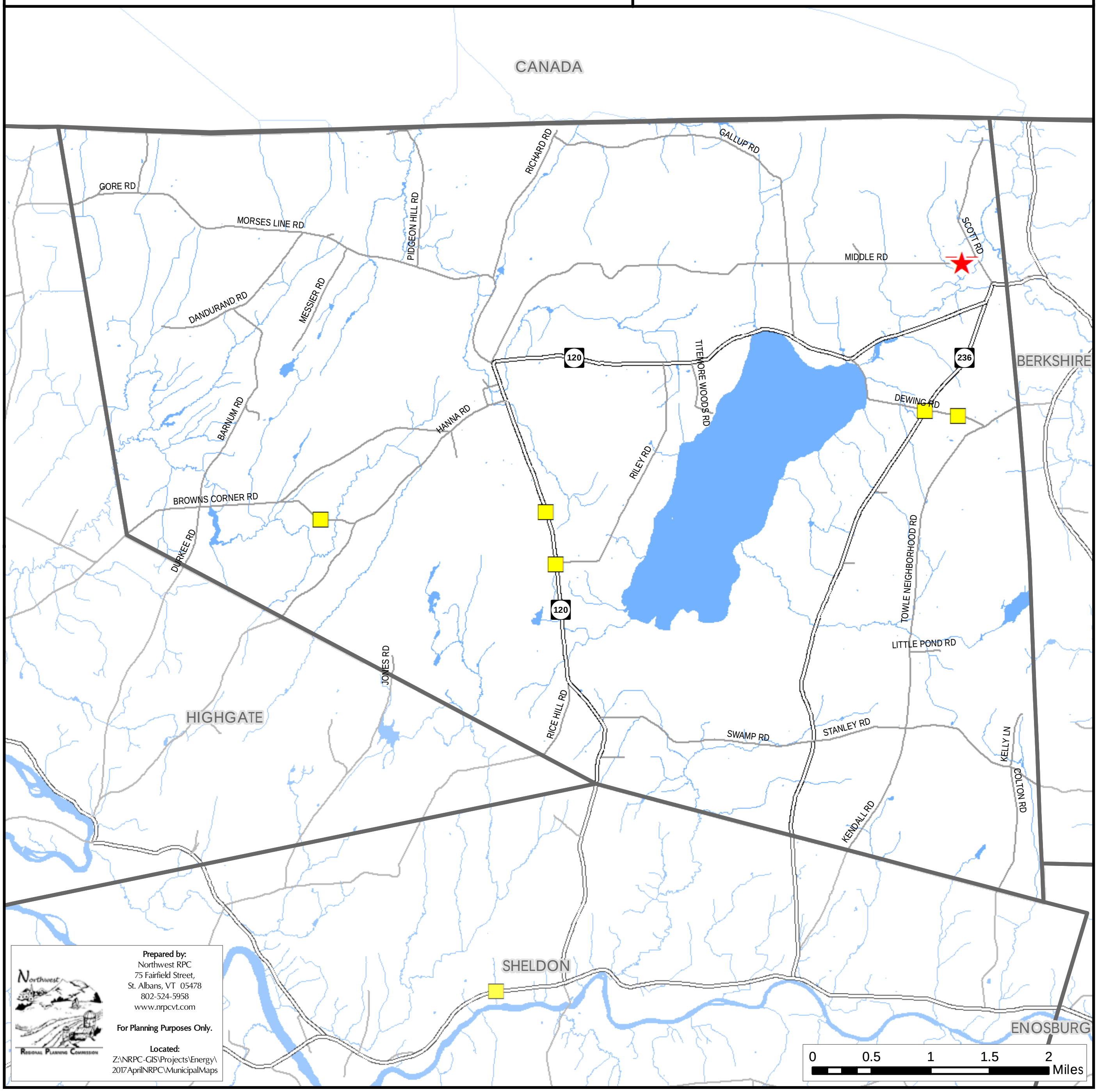

Hydro

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Potential Hydroelectric Facility

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- > 50 kW Capacity
- High Hazard with < 50 kW Capacity
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Operating Hydroelectric Facility

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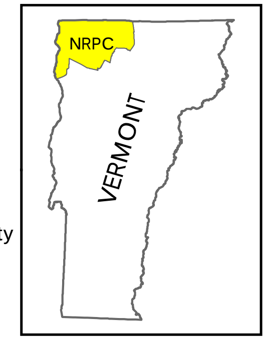

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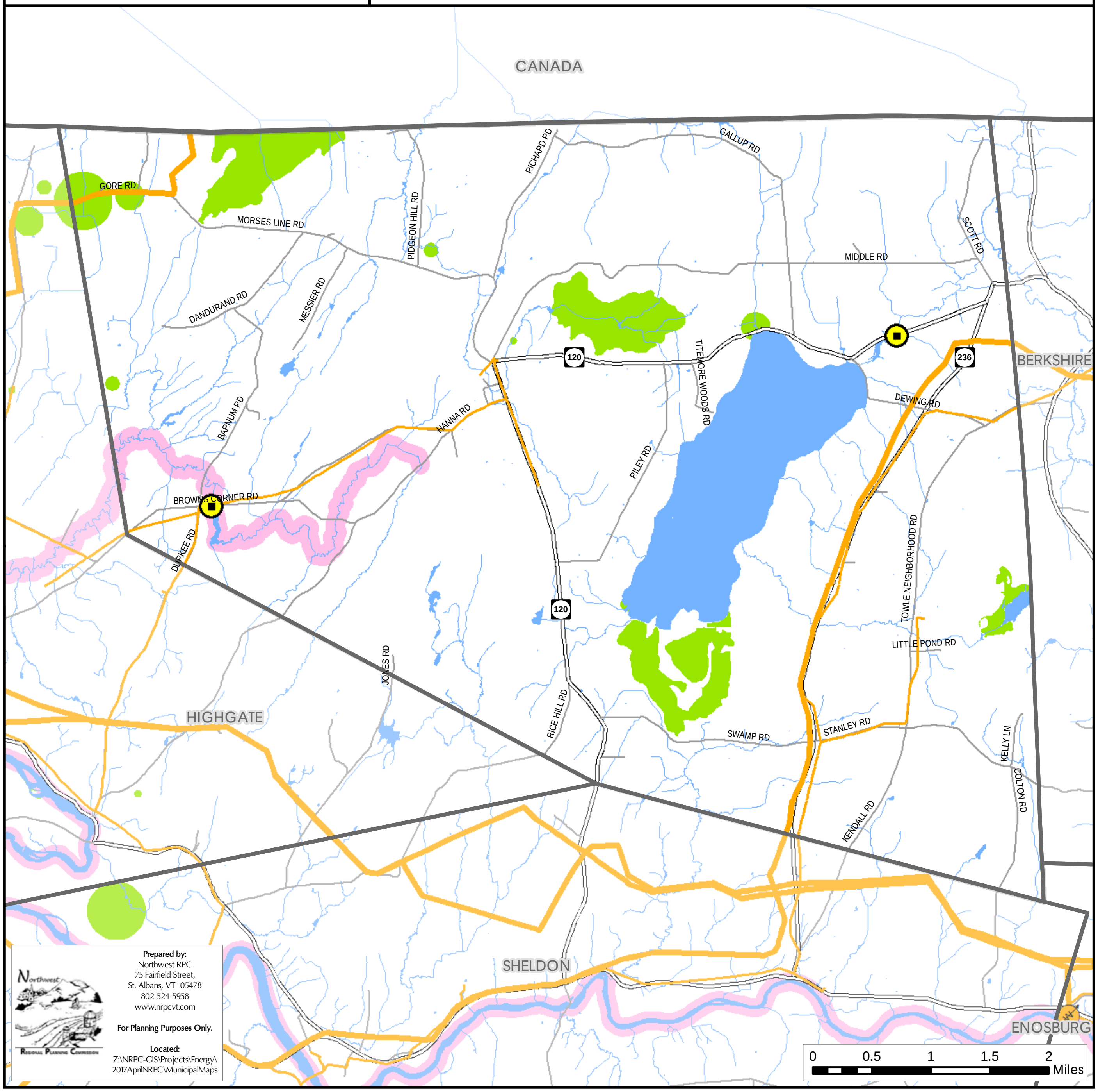

Solar

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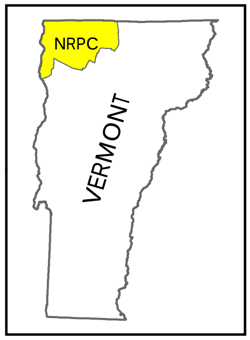

Legend

- Substation
- 3 Phase Power Line
- Transmission Line
- 1/2 Mile Buffer (3 Phase Power Line & Transmission Line)
- Prime Solar/No Known Constraints
- Base Solar/Possible Constraints

Sources: VCGI
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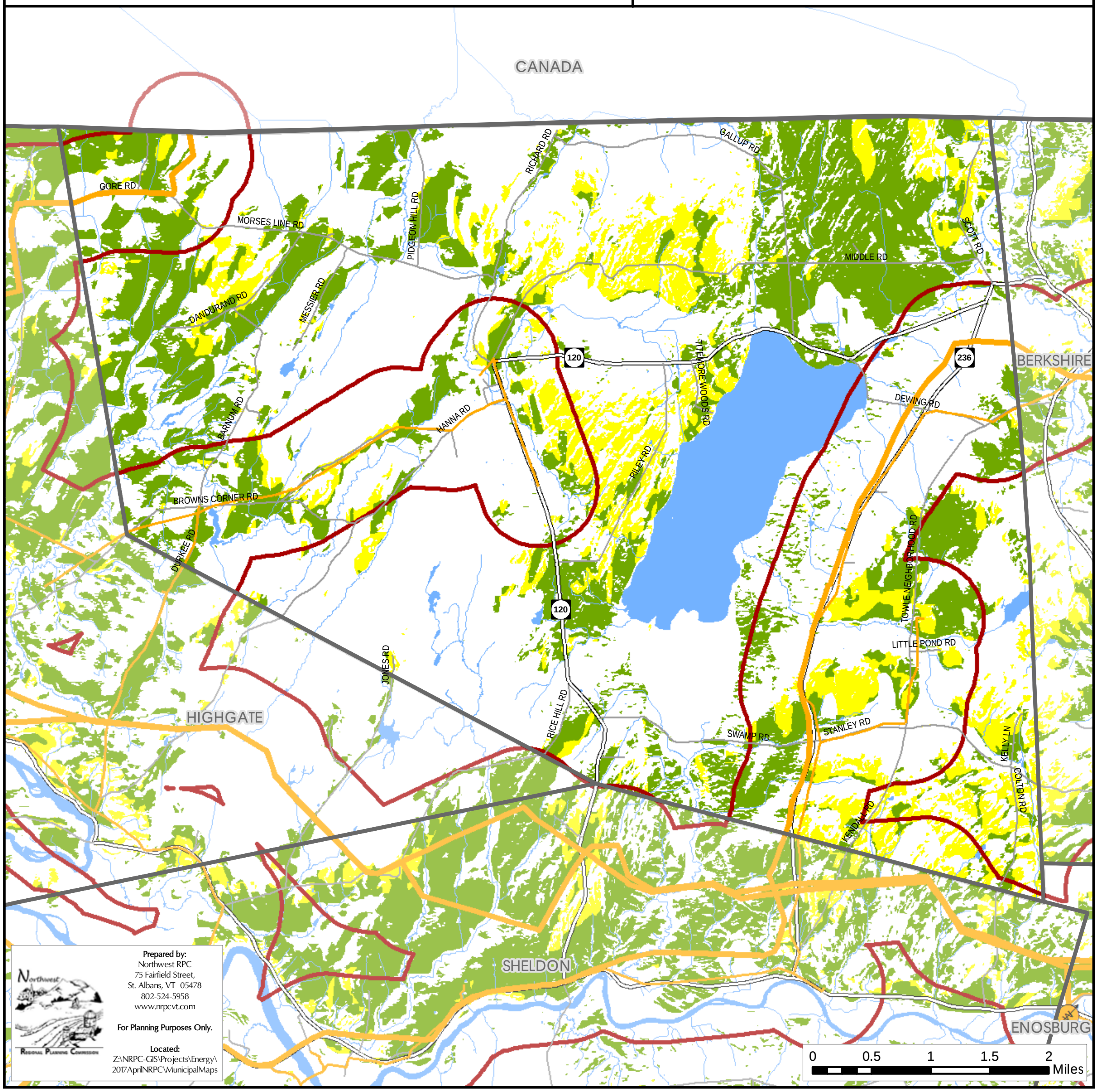

Wind

Franklin, Vermont
Act 174
The Energy Development Improvement Act of 2016

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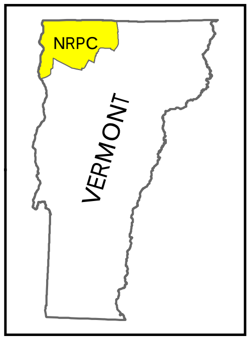

Legend

- Substation
- 3 Phase Power Line
- Transmission Line
- Prime Wind: Areas of high wind potential and no known constraints. Darker areas have higher wind speeds.
- Base Wind: Areas of high wind potential and a presence of possible constraints. Darker areas have higher wind speeds.

Sources: VCGI

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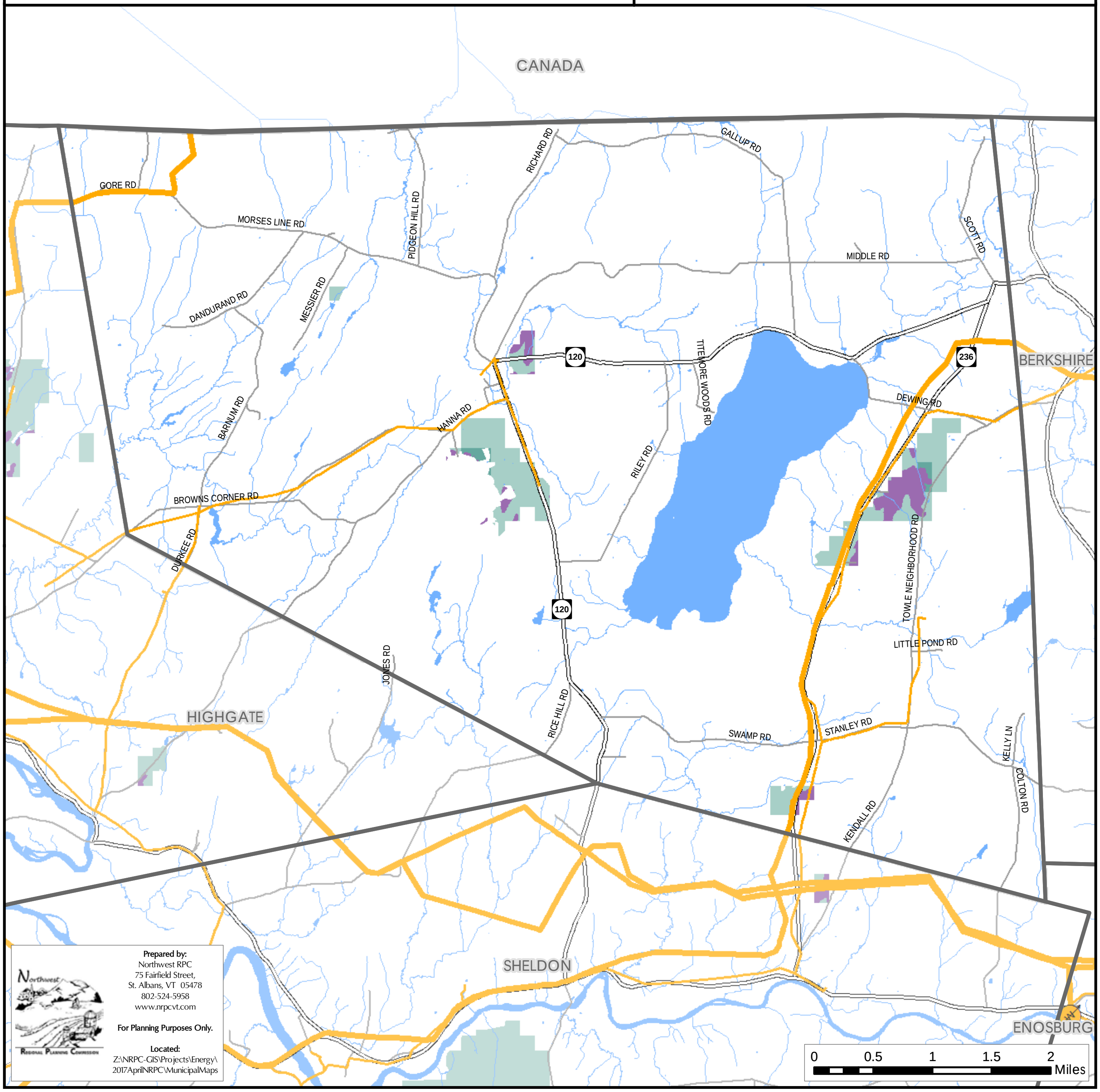

Woody Biomass

Franklin, Vermont
Act 174
The Energy Development Improvement Act of 2016

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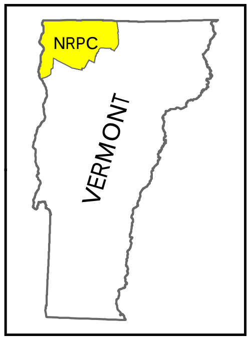

Legend

- Biomass System
- Cow Power
- Substation
- 3 Phase Power Line
- Transmission Line
- Prime Woody Biomass/No Known Constraints
- Base Woody Biomass/Possible Constraints

Sources: VCGI

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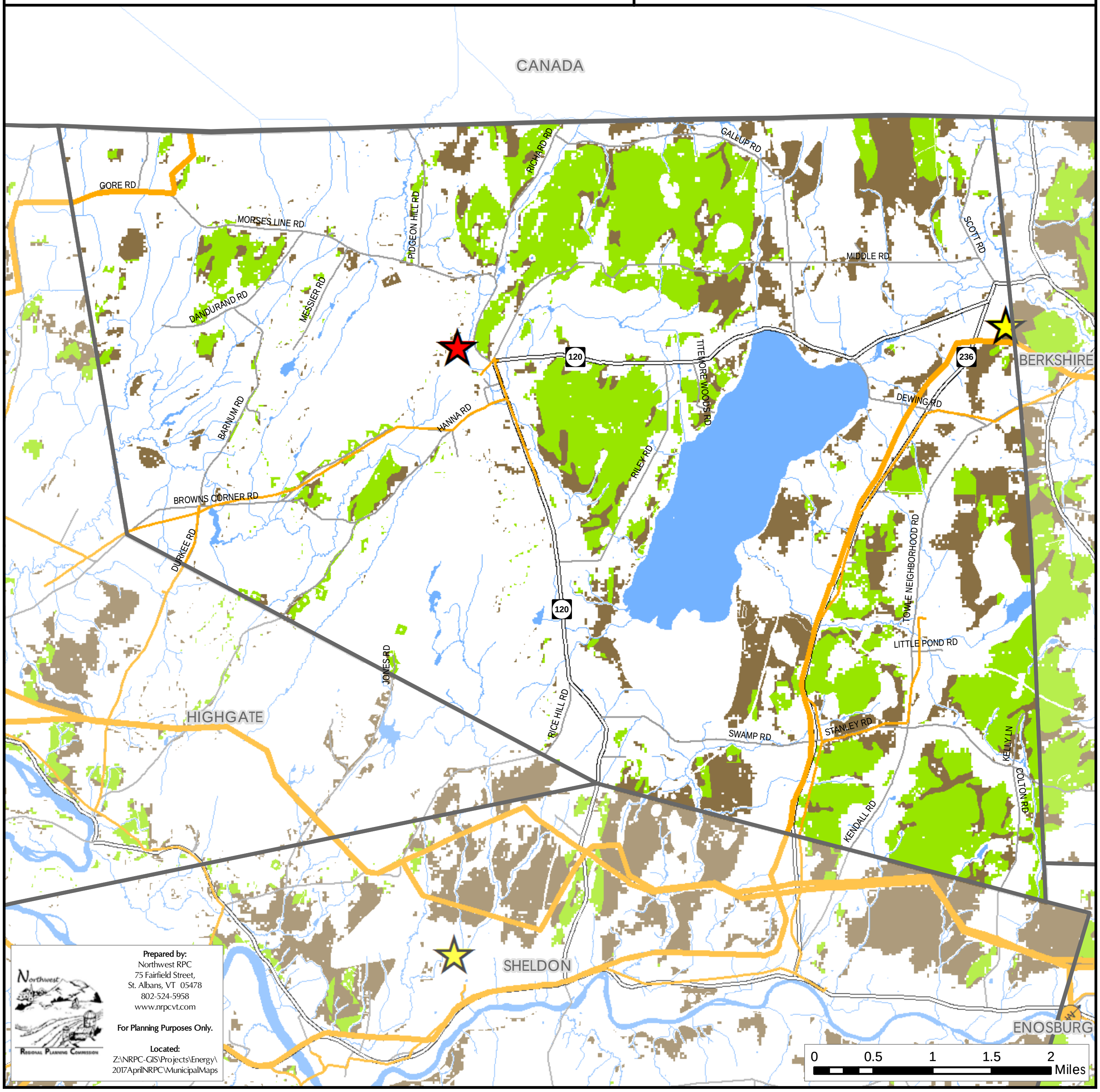

All Generators in Municipality

Category	Sub - Category	Organization Type	Address	City	CPG Number	Capacity kW
Biomass	Anaerobic Digester	Farm	4654 Middle Road	Franklin		180
Solar	Ground-mounted PV: Fixed Rack	Residential	4120 Middle Road	Franklin	4253	14.2
Solar	Ground-mounted PV: Fixed Rack	Residential	1651 Dewing Road	Franklin	95	3.8
Solar	Ground-mounted PV: Fixed Rack	Residential	3885 North Sheldon Road	Franklin	7193	15
Solar	Ground-mounted PV: Fixed Rack	Farm	280 Beaver Mdw Rd	Franklin	6437	34
Solar	Ground-mounted PV: Fixed Rack	Residential	5032 State Park Road	Franklin	7163	15
Solar	Ground-mounted PV: Pole	Residential	331 Sandy Bay Rd	Franklin	2718	7.5
Solar	Ground-mounted PV: Pole	Residential	3604 North Sheldon Rd	Franklin	7194	15
Solar	Ground-mounted PV: Tracker	Residential	507 Richard Rd	Franklin	3086	5.7
Solar	Ground-mounted PV: Tracker	Residential	280 Beaver Meadow Rd	Franklin	6437	34.2
Solar	Hot Water	Residential	50 Pierce Rd	Franklin		
Solar	Hot Water	Residential	5385 Main Street	Franklin		
Solar	Roof-Mounted PV	Farm	149 Bliss Road	Franklin	3891	5.4
Solar	Roof-Mounted PV	Residential	5600 State Park Rd	Franklin	3837	11.4
Solar	Roof-Mounted PV	Residential	1350 Towle Neighborhood Rd	Franklin	3106	4
Solar	Roof-Mounted PV	Residential	1090 Riley Road	Franklin	906	8
Solar	Roof-Mounted PV	Residential	35 Square Road	Franklin	2749	9.3
Solar	Roof-Mounted PV	Residential	1212 Dewing Rd	Franklin	2068	17.3
Solar	Roof-Mounted PV	Residential	4746 State Park Rd	Franklin	3717	10.8
Solar	Roof-Mounted PV	Residential	2334 Towle Neighborhood Rd	Franklin	3757	9.5
Solar	Roof-Mounted PV	Residential	1087 Colton Road	Franklin	16-0068	10
Solar	Roof-Mounted PV	Residential	3459 Rice Hill Rd	Franklin	6838	6
Wind	Small Wind	Residential	1651 Dewing Road	Franklin	95	2.5

Municipal Analysis & Targets - Georgia

The following is an explanation of the municipal energy data compiled by Northwest Regional Planning Commission (NRPC). The intent of the municipal energy data is to provide the municipalities with data required to ensure compliance with the requirements of Act 174 and "Enhanced Energy Planning" (24 V.S.A. 4352). The following tables contain data that estimates current energy use and provides targets for future energy use across all sectors (transportation, heating, and electricity). It also sets targets for renewable energy generation within the municipality.

This data is meant to be a starting point for the municipality to begin planning its energy future and to talk about the changes that may need to occur within the municipality to ensure that local, regional and state energy goals are met. This includes the State of Vermont's goal to have 90% of all energy demand be met from renewable sources by 2050.

Figure 1 - Data Sources

ACS – American Community Survey

DOL –Vermont Department of Labor

DPS – Vermont Department of Public Service

EIA – Energy Information Administration

EVT – Efficiency Vermont

LEAP – Long-Range Energy Alternatives Planning

VEIC – Vermont Energy Investment Corporation

VTrans – Vermont Agency of Transportation

Data Sources

Estimates of current energy use consist primarily of data available from the American Community Survey (ACS), the Vermont Agency of Transportation (VTrans), the Vermont Department of Labor (DOL), and the Vermont Department of Public Service (DPS). Targets for future energy use are reliant upon the Long-range Energy Alternatives Planning (LEAP) analysis for the region completed the Vermont Energy Investment Corporation (VEIC). Targets for future energy generation have come from the regional planning commission and DPS. For more information on LEAP, see the Northwest Regional Energy Plan (www.nrpcvt.com). Targets for both future energy use and energy generation have been generally developed using a "top down" method of disaggregating regional data to the municipal level.

It is possible to develop "bottom up" data. For those municipalities interested in that approach, please see the Department of Public Service's Analysis and Targets Guidance (http://publicservice.vermont.gov/content/act-174-recommendations-and-determination-standards).

Please remember that the targets established by LEAP represent only one way to achieve energy goals. There may several other similar pathways that a municipality may choose to take in order to meet the 90x50 goal.

Below is a worksheet by worksheet explanation of the Municipal Template spreadsheet:

1. Municipal Data Summary

The following tables summarize all data that is required to be in a municipal plan if the plan is to meet the "determination" standards established by the Vermont Department of Public Service.

Table 1A: Current Municipal Transportation Energy Use

Transportation Data	Municipal Data
Total # of Passenger Vehicles (ACS 2011-2015)	3,637
Average Miles per Vehicle (Vtrans)	11,356
Total Miles Traveled	41,301,772
Realized MPG (2013 - VTrans 2015 Energy Profile)	18.6
Total Gallons Use per Year	2,220,525
Transportation BTUs (Billion)	267
Average Cost per Gallon of Gasoline (RPC)	2.31
Gasoline Cost per Year	5,129,414

This table uses data from the American Community Survey (ACS) and Vermont Agency of Transportation (VTrans) to calculate current transportation energy use and energy costs in the municipality.

Table 1B: Current Municipal Residential Heating Energy Use

Fuel Source	Municipal Households (ACS 2011-2015)	% of Municipal Households	Municipal Square Footage Heated	Municipal BTU (in Billions)
Natural Gas	348	21.6%	607,680	36
Propane	239	14.9%	447,312	27
Electricity	17	1.1%	32,368	2
Fuel Oil	684	42.5%	1,192,512	72
Coal	8	0.5%	15,232	1
Wood	299	18.6%	555,920	33
Solar	0	0.0%	0	0
Other	14	0.9%	26,656	2
No Fuel	0	0.0%	0	0
Total	1,609	100.0%	2,877,680	173

This table displays data from the ACS that estimates current municipal residential heating energy use.

Table 1C: Current Municipal Commercial Energy Use

	Commercial Establishments in Municipality (VT DOL)	Estimated Thermal Energy BTUs per Commercial Establishment (in Billions) (VDPS)	Estimated Thermal Energy BTUs by Commercial Establishments in Municipality (in Billions)
Municipal Commercial Energy Use	32	0.725	23

The table uses data available from the Vermont Department of Labor (VT DOL) and the Vermont Department of Public Service (DPS) to estimate current municipal commercial establishment energy use in the municipality.

Table 1D: Current Electricity Use

Use Sector	Current Electricity Use
Residential (kWh)	14,463,851
Commercial and Industrial (kWh)	8,210,344
Total (kWh)	22,674,195

This table displays current electricity use within the municipality. This data is available from Efficiency Vermont (EVT).

Table 1E: Residential Thermal Efficiency Targets

	2025	2035	2050
"Residential - Increased Efficiency and Conservation (% of municipal households to be weatherized)"	5%	16%	78%

This table displays targets for thermal efficiency of residential structures. The data is based on a methodology developed by DPS using data available from the regional Long-range Energy Alternatives Planning (LEAP) analysis and ACS. The data in this table represents the percentage of municipal households that will need to be weatherized in the target years. The target is cumulative.

Table 1F: Commercial Thermal Efficiency Target

	2025	2035	2050
"Commercial - Increased Efficiency and Conservation (% of commercial establishments to be weatherized)"	25%	25%	73%

This table shows the same information as Table 1E, but sets a target for commercial thermal efficiency and weatherization. Information from the VT DOL is required to complete this target. The target is cumulative.

Table 1G: Thermal Fuel Switching (Residential and Commercial) – Wood Systems

	2025	2035	2050
New Efficient Wood Heat Systems (in units)	6	15	66

This table provides a target for new wood heating systems for residential and commercial structures in the municipality for each target year. This target was calculated using data from LEAP and ACS. The target is cumulative.

Table 1H: Thermal Fuel Switching (Residential and Commercial) – Heat Pumps

	2025	2035	2050
New Heat Pumps (in units)	165	394	778

This table provides a target for new heat pump systems for residential and commercial structures in the municipality for each target year. This target was calculated using data from LEAP and ACS. The target is cumulative.

Table 1I: Electricity Efficiency Targets

	2025	2035	2050
Increase Efficiency and Conservation (BTUs)	25.2%	48.3%	100.7%

Data in this table displays a target for increased electricity efficiency and conservation during the target years. This target will be met through conversions to high efficiency appliances, electric heat pumps, and electric light-duty vehicles. These targets were developed using regional LEAP analysis. The target is cumulative.

Table 1J: Use of Renewables – Transportation

	2025	2035	2050
Renewable Energy Use - Transportation (BTUs)	6.5%	25.9%	88.1%

This data displays targets for the percentage of transportation energy use coming from renewable sources during each target year. This target will be met through conversions to electric light-duty vehicles and biodiesel heavy-duty vehicles. This data was developed using the LEAP analysis. The target is cumulative.

Table 1K: Use of Renewables – Heating

	2025	2035	2050
Renewable Energy Use - Heating (BTUs)	46.7%	60.4%	88.4%

This data displays targets for the percentage of heating energy use coming from renewable sources during each target year. This target will be met through conversions to electric heat pumps and high efficiency wood heating systems. This data was developed using information from the LEAP analysis. The target is cumulative.

Table 1L: Use of Renewables – Electricity

	2025	2035	2050
Renewable Energy Use - Electricity (MWh)	8,360.3	16,720.7	25,334.3

This data displays targets for MWh of electricity generation coming from renewable sources within the municipality during each target year. This data was developed using information from the regional planning commission and DPS. This data is the same as the data in Table 1Q. The target is cumulative.

Table 1M: Transportation Fuel Switching Targets – Electric Vehicles

	2025	2035	2050
Electric Vehicles	318	2,383	5,669

This tables displays a target for switching from fossil fuel based vehicles (gasoline and diesel) to electric vehicles. This target is calculated using LEAP and ACS data. The target is cumulative.

Table 1N: Transportation Fuel Switching Targets – Biodiesel

	2025	2035	2050
Biodiesel Vehicles	311	614	1,171

This tables displays a target for switching from fossil fuel based vehicles to biodiesel-powered vehicles. This target is calculated using LEAP and ACS data. The target is cumulative.

Table 1O: Existing Renewable Generation

Renewable Type	MW	MWh
Solar	0.71	870.74
Wind	5.02	15,380.90
Hydro	0.00	0.00
Biomass	0.00	0.00
Other	0.00	0.00
Total Existing Generation	5.73	16,251.64

Table 1O shows existing renewable generation in the municipality, in MW and MWh, based on information available from the Vermont Department of Public Service.

Table 1P: Renewable Generation Potential

Renewable Type	MW	MWh
Rooftop Solar	2	2,170
Ground-mounted Solar	657	806,230
Wind	870	2,667,113
Hydro	0.008	28
Biomass and Methane	0	0
Other	0	0
Total Renewable Generation Potential	1,529	3,475,541

Renewable generation potential is based on mapping completed by the regional planning commission that is based on the Municipal Determination Standards and associated guidance documents developed by DPS. The renewable generation potential is expressed in MW and MWh by the type of renewable resource (solar, wind, hydro, etc.).

Table 1Q: Renewable Generation Targets

	2025	2035	2050
Total Renewable Generation Target (in MWh)	8,360.33	16,720.66	25,334.34

This data displays targets for MWh of electricity generation coming from renewable sources within the municipality during each target year. This data was developed using information from the regional planning commission and DPS. This data is the same as the data in Table 1L.

Table 1R: Sufficient Land?

	Y/N
Solar	Y
Wind	Y

This table shows whether or not there is sufficient land in the municipality to meet the renewable generation targets based on the renewable generation potential in the municipality.

Utility Service Areas

Georgia, Vermont
Act 174
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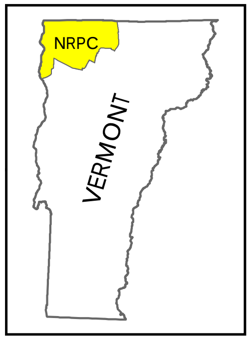
N



Legend

Utility Service Area Features

- Green Mountain Power
- Swanton Village Electric
- Vermont Electric Co-op
- Enosburg Falls Electric
- Substation
- 3 Phase Power Line
- Transmission Line

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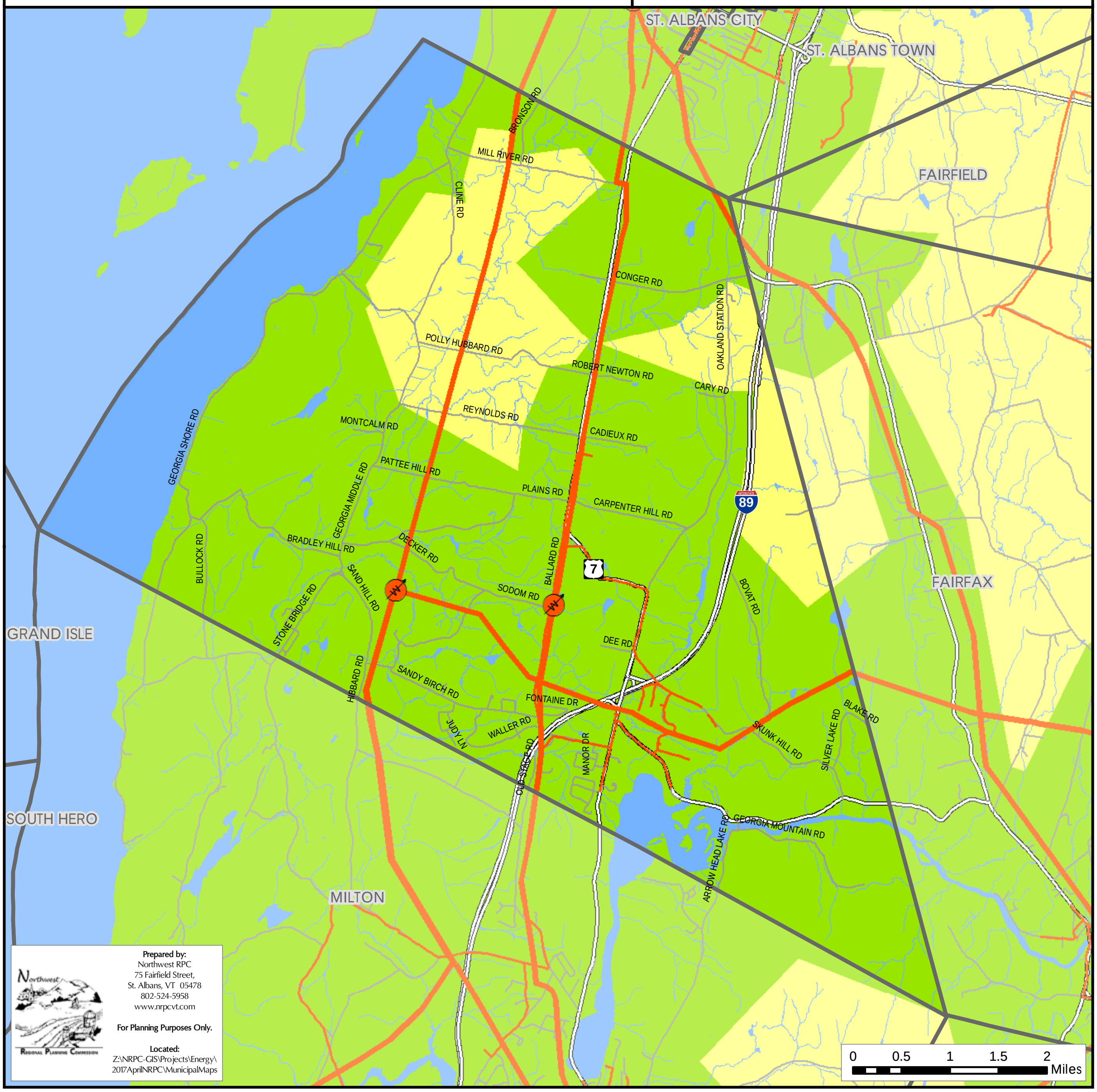

Transmission & 3 Phase Power Infrastructure

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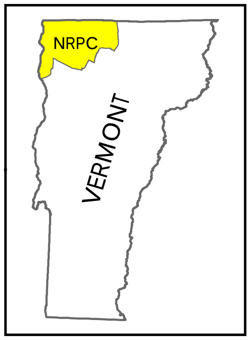

Legend

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- 3 Phase Power Line
- Transmission Line
- 1/2 Mile Buffer (3 Phase Power Line & Transmission Line)

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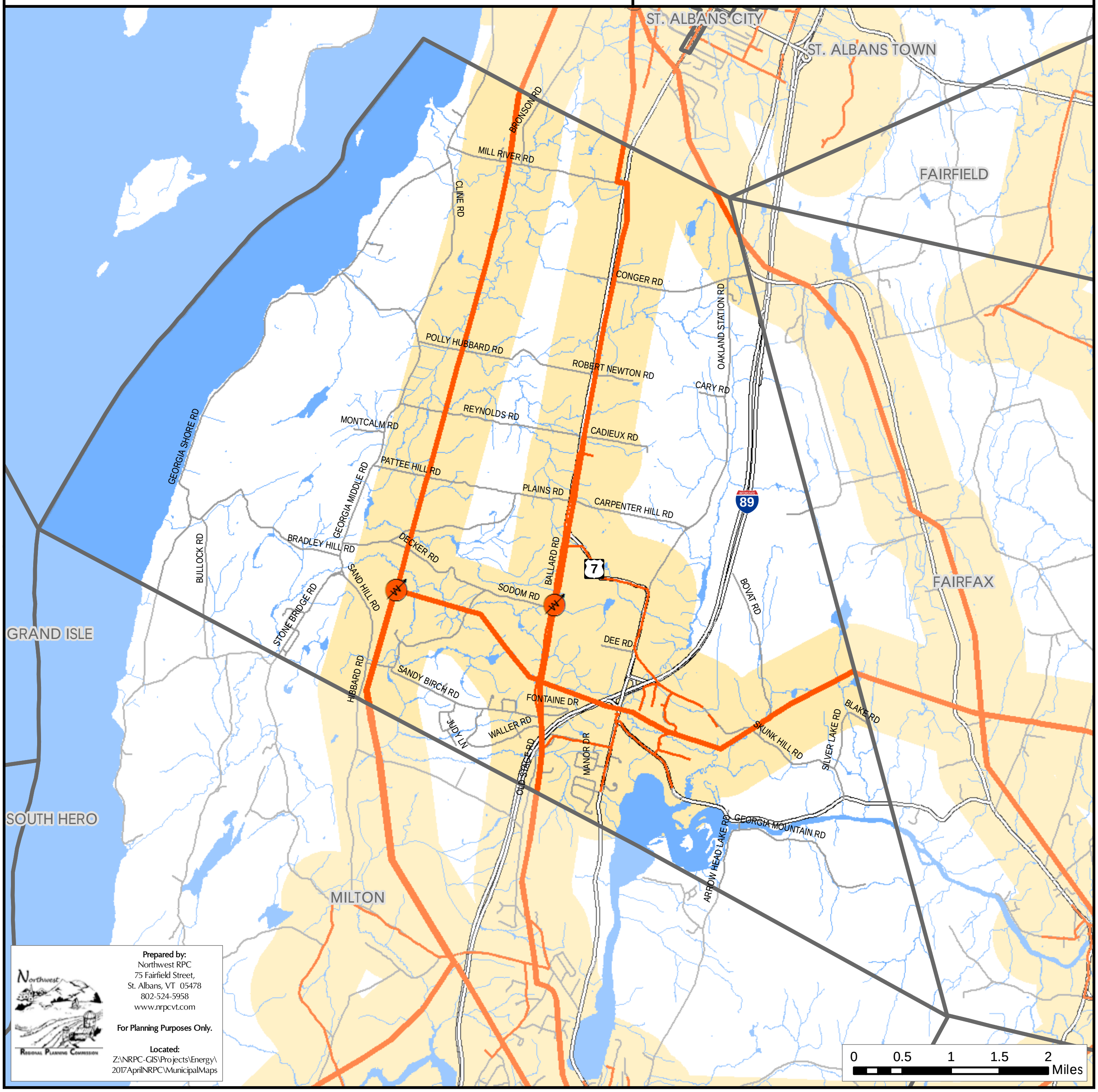

Existing Generation Facilities

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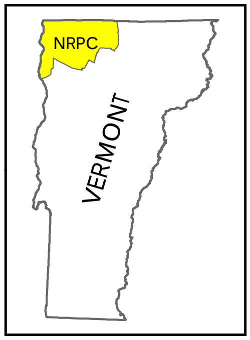

Legend

- Biomass Facility
- Hydro Facility
- Solar Facility
- Wind Facility

Note: Only generators 15kW are shown on the map. A full list of all generators is available.

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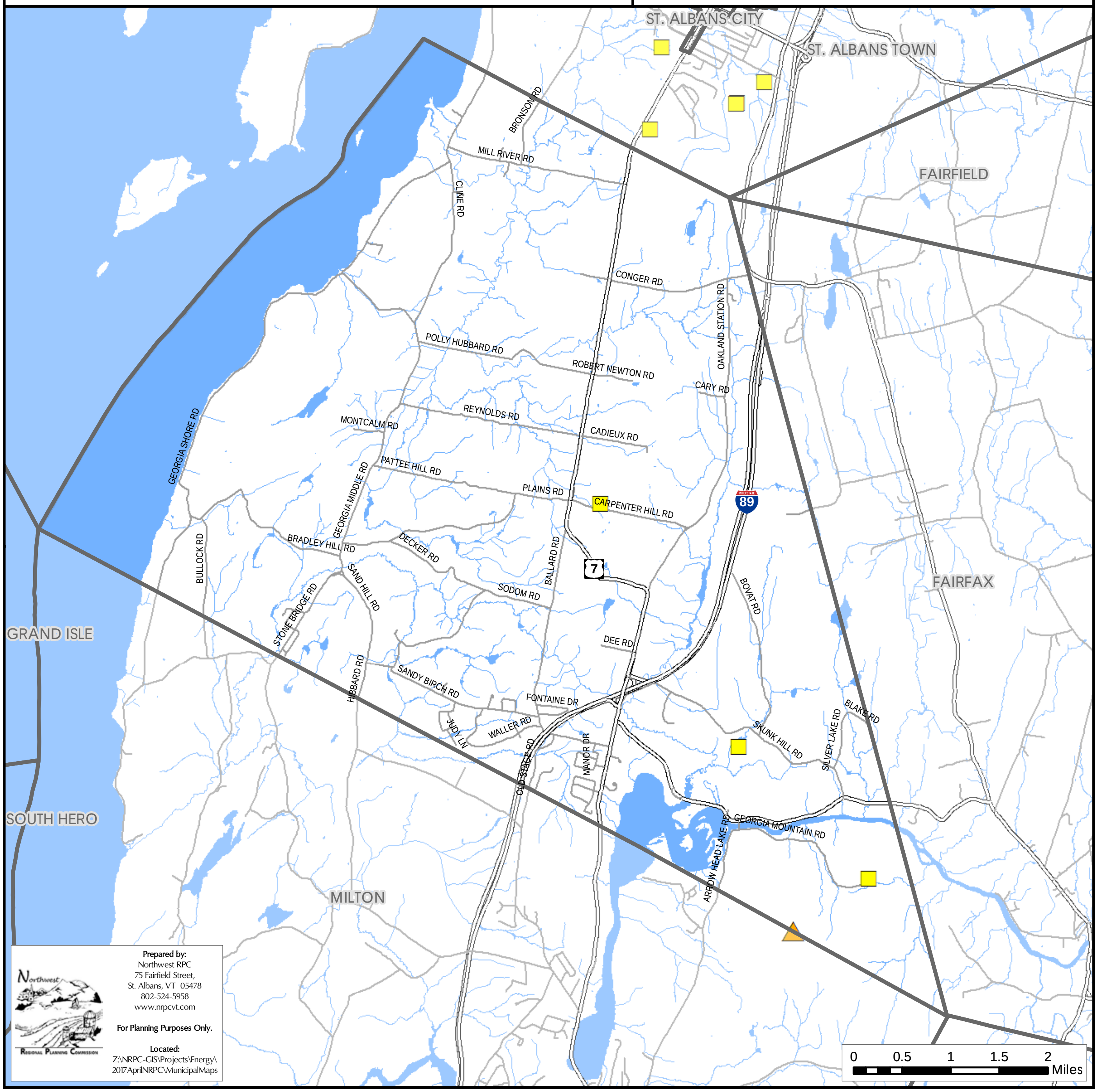

Natural Gas Lines

Georgia, Vermont
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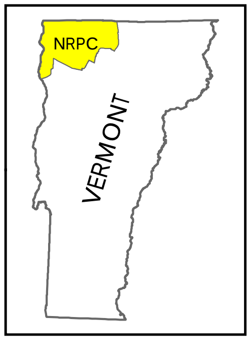

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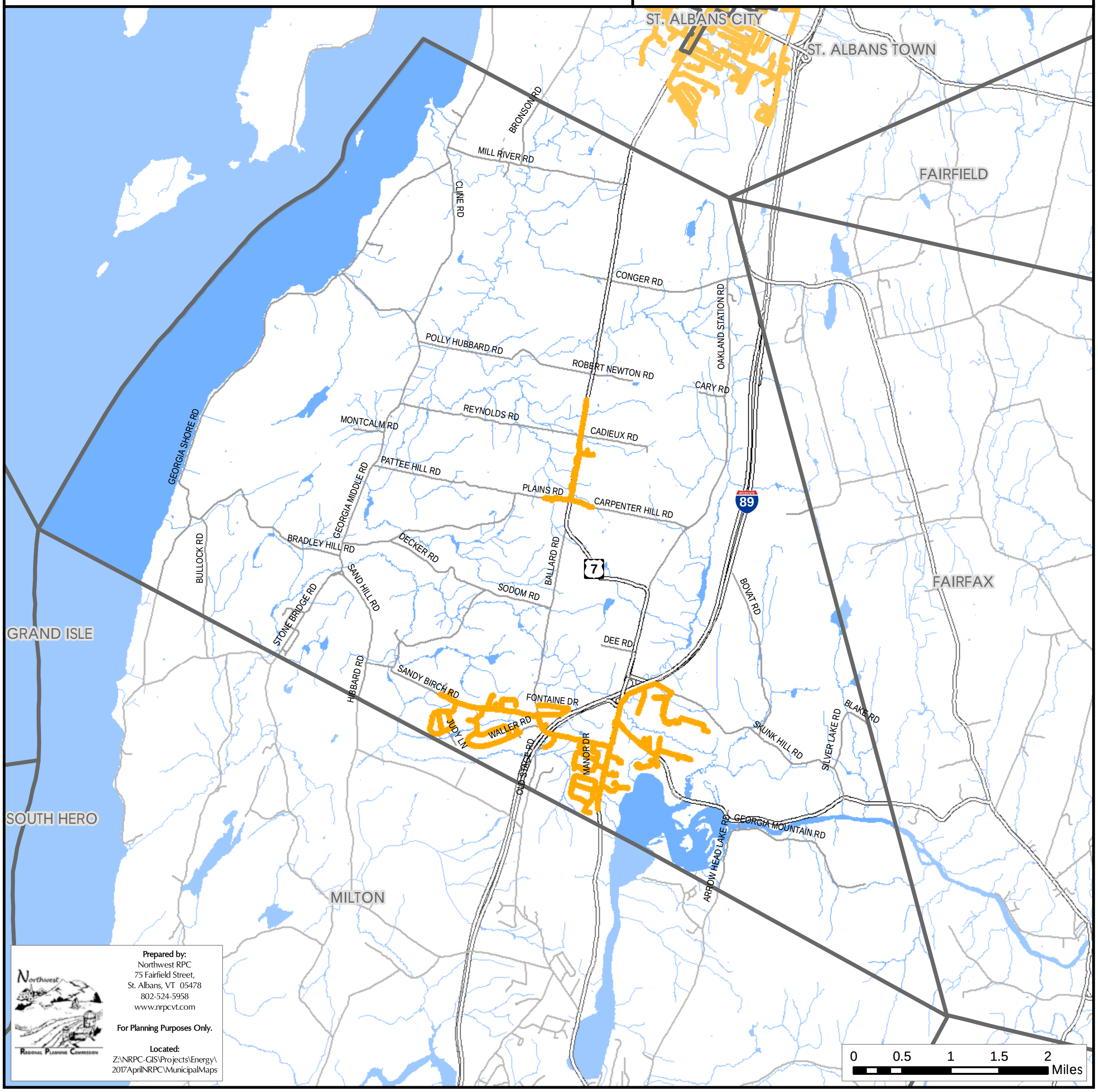

Hydro

Georgia, Vermont
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N

Legend

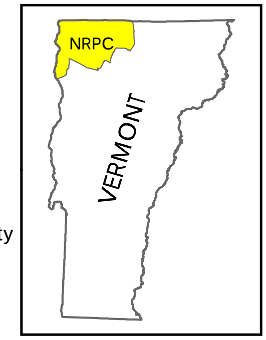
- Substation
- 3 Phase Power Line
- Transmission Line
- Designated Outstanding Resource Water
- Known Constraint - Designated National Wild & Scenic River
- Possible Constraint - Stressed or Impaired Water
- Possible Constraint - RINAs

Potential Hydroelectric Facility

- < 50 kW Capacity
- > 50 kW Capacity
- High Hazard with < 50 kW Capacity
- High Hazard with > 50 kW Capacity

Operating Hydroelectric Facility

- Dam not on National Wild and Scenic River
- Dam on National Wild and Scenic River



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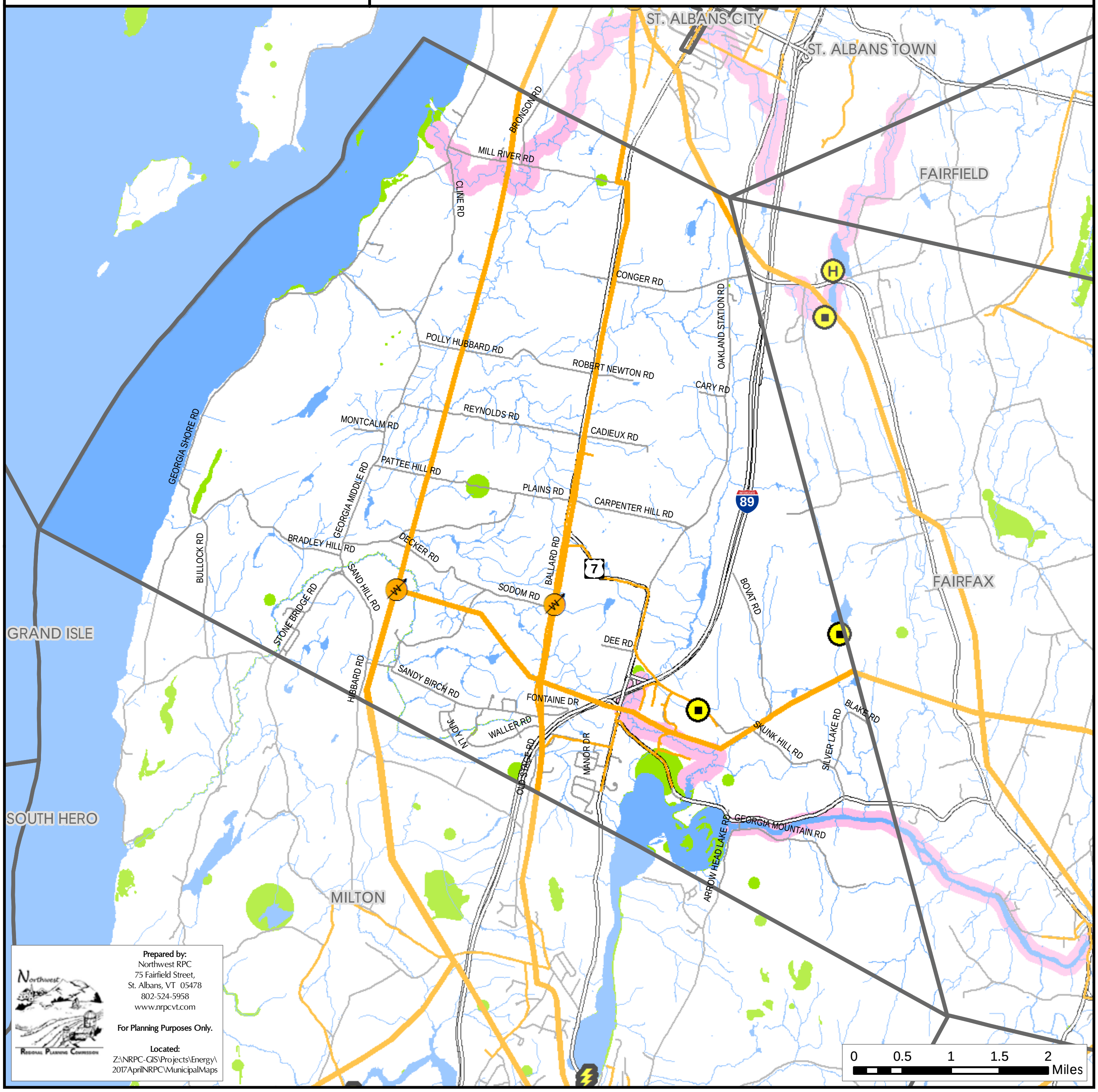

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Solar

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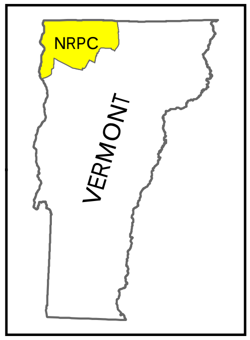

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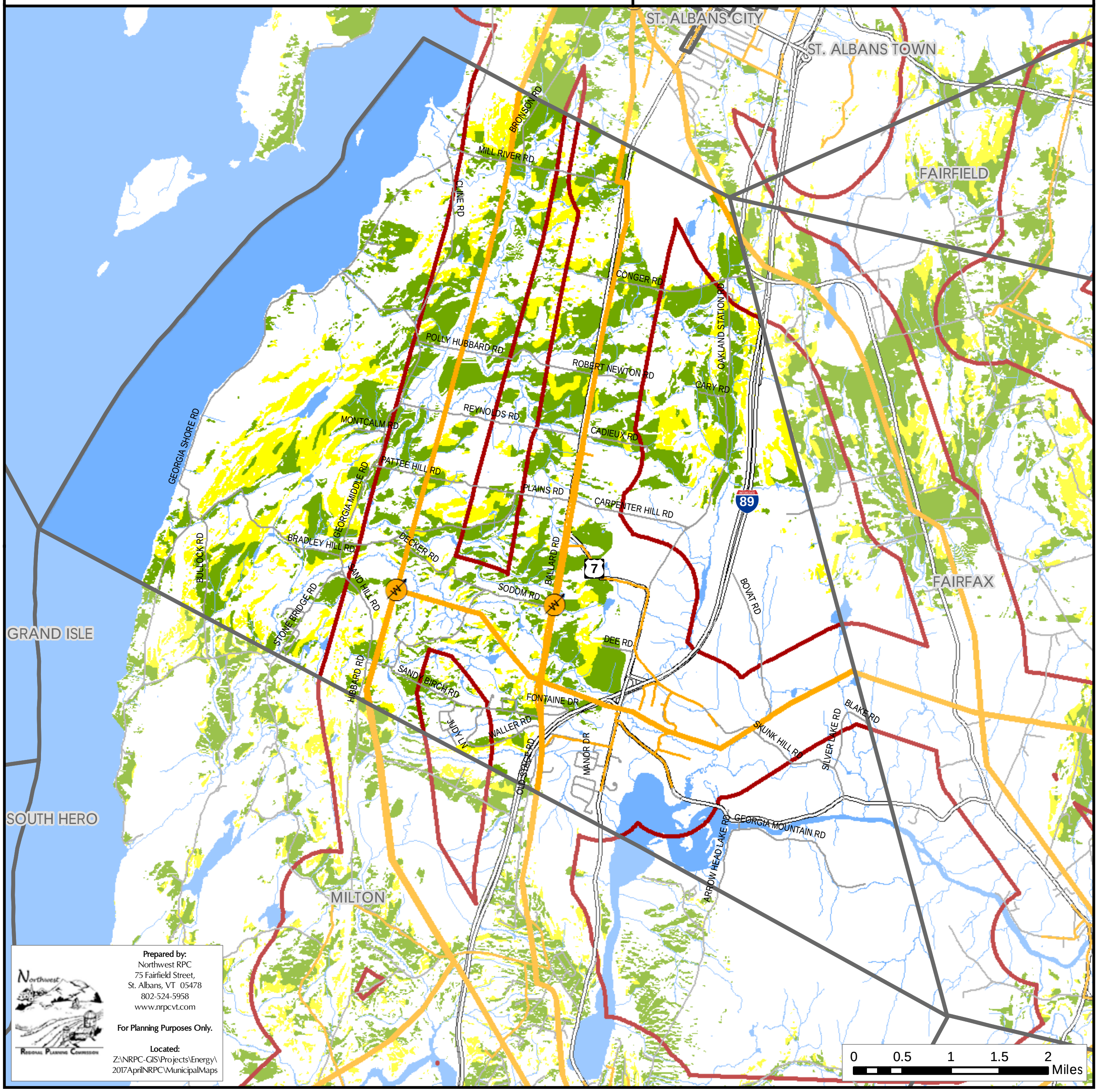

Wind

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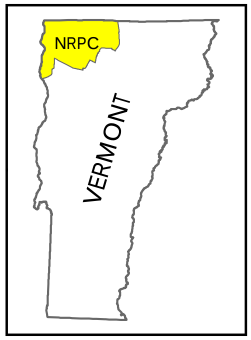

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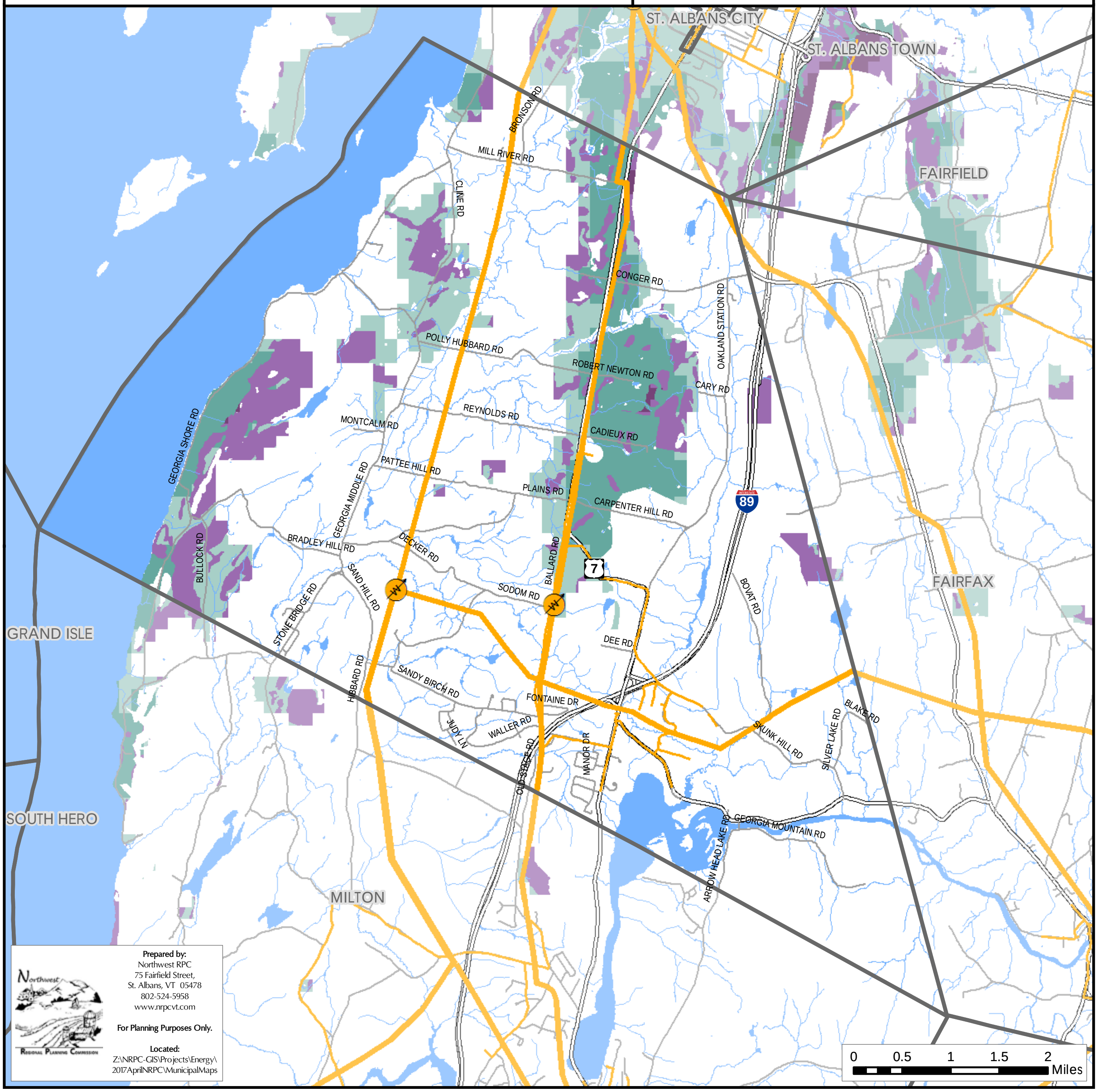

Woody Biomass

Georgia, Vermont
Act 174
The Energy Development Improvement Act of 2016

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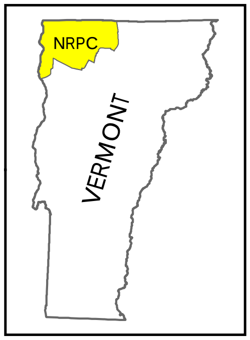

Legend

- Biomass System
- Cow Power
- Substation
- 3 Phase Power Line
- Transmission Line
- Prime Woody Biomass/No Known Constraints
- Base Woody Biomass/Possible Constraints

Sources: VCGI
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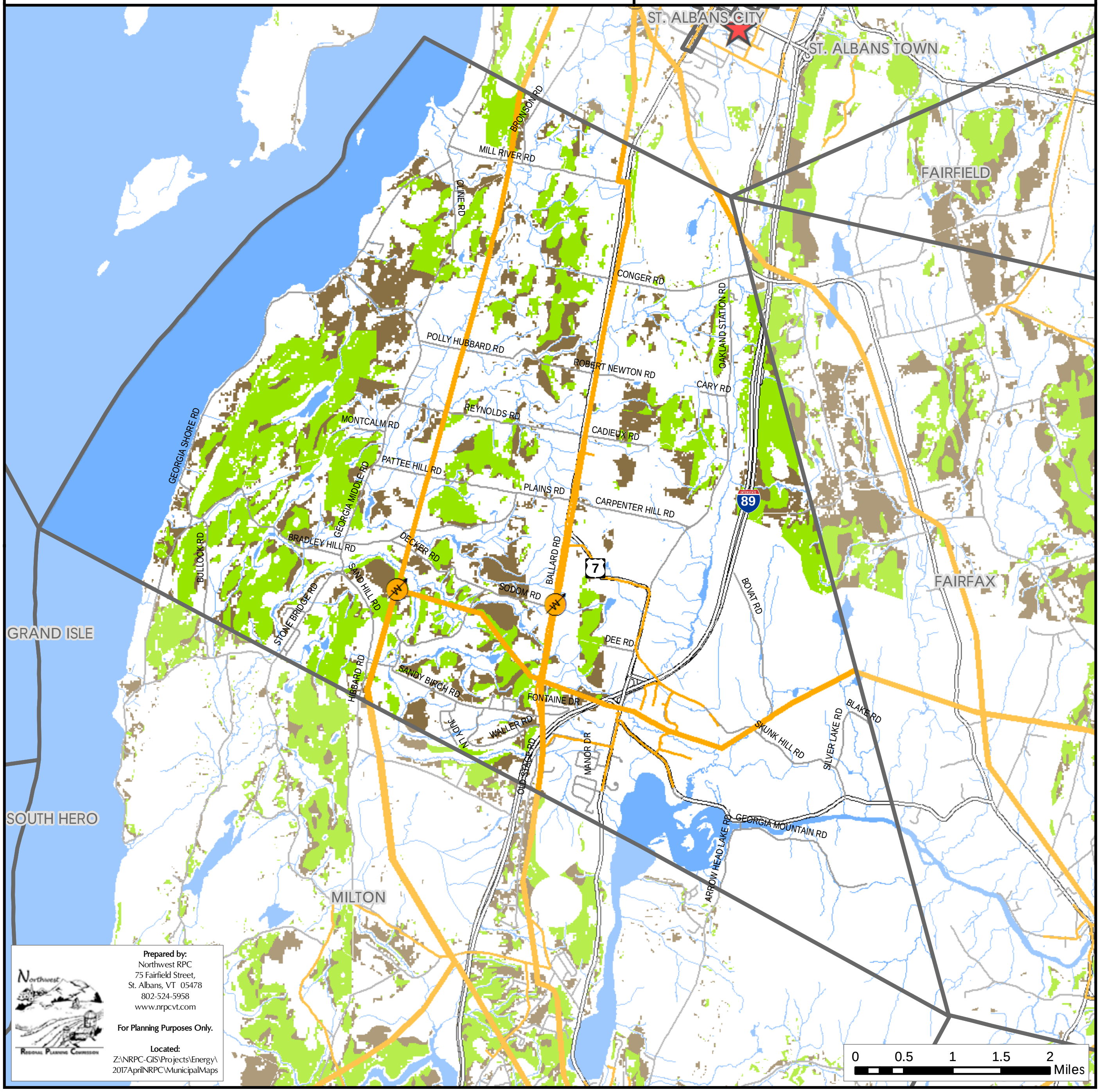

All Generators in Municipality

Category	Sub - Category	Organization Type	Address	City	CPG Number	Capacity kW
Solar	Ground-mounted PV: Fixed Rack	Residential	24 Old Quarry Rd	Georgia	5900	9.8
Solar	Ground-mounted PV: Fixed Rack	Business	331 Carpenter Hill Rd	Georgia	2408	17.5
Solar	Ground-mounted PV: Fixed Rack	Residential	1545 Skunk Hill Road	Georgia	6775	255
Solar	Ground-mounted PV: Pole	Residential	365 Carpenter Hill Road	Georgia	3541	10.2
Solar	Ground-mounted PV: Pole	Residential	1959 Ethan Allen Hwy	Georgia	2747	11.9
Solar	Ground-mounted PV: Pole	Residential	81 Town Common South	Georgia		10.3
Solar	Ground-mounted PV: Pole	Residential	784 Sandy Birch Rd	Georgia	3732	10.3
Solar	Ground-mounted PV: Pole	Residential	794 Stone Bridge Rd	Georgia	3243	5.9
Solar	Ground-mounted PV: Pole	Residential	5685 Georgia Shore Rd	Georgia	16-0541	5
Solar	Ground-mounted PV: Tracker	Residential	577 Georgia Middle Rd	Georgia	4195	7
Solar	Ground-mounted PV: Tracker	Residential	4149 HIGHBRIDGE RD	Georgia	2832	6.4
Solar	Ground-mounted PV: Tracker	Residential	2852 Ethan Allen Hwy	Georgia	2922	6
Solar	Ground-mounted PV: Tracker	Residential	599 Plains Road	Georgia	16-0454	7
Solar	Ground-mounted PV: Tracker	Residential	2895 Ethan Allen Hwy	Georgia	16-0809	11
Solar	Hot Water	Residential	133 Mansfield View Drive	Georgia		
Solar	Hot Water	Residential	2980 Ethan Allen Hwy	Georgia		
Solar	Roof-Mounted PV	Residential	108 Bradley Hill Rd	Georgia		5.6
Solar	Roof-Mounted PV	Residential	408 Sodom Rd	Georgia	3659	5.3
Solar	Roof-Mounted PV	Residential	5843 Georgia Shore Rd	Georgia	2403	6.5
Solar	Roof-Mounted PV	Residential	1007 Sodom Rd	Georgia	5707	8.8
Solar	Roof-Mounted PV	Residential	646 Fontaine Dr	Georgia	5057	2.9
Solar	Roof-Mounted PV	Residential	583 Stone Bridge Road	Georgia	2934	3.7
Solar	Roof-Mounted PV	Residential	5746 Ethan Allen Hwy	Georgia	3567	3.4
Solar	Roof-Mounted PV	Residential	43 Kissane Rd	Georgia	3182	4
Solar	Roof-Mounted PV	Residential	170 Fontaine Dr	Georgia	3299	4.3
Solar	Roof-Mounted PV	Business	7506 Ethan Allen Hwy	Georgia	619	1
Solar	Roof-Mounted PV	Residential	21 Old Quarry Rd	Georgia	5338	6

All Generators in Municipality

Category	Sub - Category	Organization Type	Address	City	CPG Number	Capacity kW
Solar	Roof-Mounted PV	Residential	1740 Plains Rd	Georgia	6294	8
Solar	Roof-Mounted PV	Residential	133 Mansfield View Dr	Georgia	3980	11.3
Solar	Roof-Mounted PV	Residential	161 Cary Road	Georgia		5
Solar	Roof-Mounted PV	Residential	286 Red Barn Rd	Georgia	5179	8
Solar	Roof-Mounted PV	Residential	81 Bovat Rd	Georgia	3637	6.3
Solar	Roof-Mounted PV	Residential	1627 Georgia Mtn. Rd	Georgia		18.6
Solar	Roof-Mounted PV	Residential	727 Ethan Allen Highway	Georgia	2475	6.5
Solar	Roof-Mounted PV	Residential	7572 Ethan Allen Hwy	Georgia	1530	2.9
Solar	Roof-Mounted PV	Residential	691 Waller Rd	Georgia	1478	4.6
Solar	Roof-Mounted PV	Residential	573 Ballard Rd	Georgia	2287	3.7
Solar	Roof-Mounted PV	Residential	5420 Georgia Shore Rd	Georgia	3255	8.6
Solar	Roof-Mounted PV	Residential	190 Smittybrook Road	Georgia	773	4.8
Solar	Roof-Mounted PV	Residential	85 Riverview Court	Georgia	5094	10
Solar	Roof-Mounted PV	Residential	25 Mansfield View Rd	Georgia	2374	8.1
Solar	Roof-Mounted PV	Residential	1129 Georgia Middle Rd	Georgia	2783	4.7
Solar	Roof-Mounted PV	Residential	2432 Ballard Rd	Georgia	6622	3.8
Solar	Roof-Mounted PV	Residential	861 Stone Bridge Road	Georgia	16-0655	6
Solar	Roof-Mounted PV	Residential	20 Sand Hill Rd	Georgia	7061	6
Solar	Roof-Mounted PV	Residential	196 Bradley Hill Rd	Georgia	16-0713	8.2
Solar	Roof-Mounted PV	Residential	1046 Stone Bridge Rd.	Georgia	16-0206	4
Solar	Roof-Mounted PV	Residential	1007 Stone Bridge Road	Georgia	16-0652	6
Solar	Roof-Mounted PV	Residential	186 Austin Rd	Georgia	16-0376	5
Solar	Roof-Mounted PV	Residential	146 Fontaine Dr	Georgia	16-0545	10
Solar	Roof-Mounted PV	Residential	362 Woods Hollow Drive	Georgia	16-0288	7.6
Solar	Roof-Mounted PV	Residential	1057 Decker Rd	Georgia	16-0768	10
Solar	Roof-Mounted PV	Residential	6 Wilder Drive	Georgia	16-0814	6
Solar	Roof-Mounted PV	Residential	980 Decker Road	Georgia		7.6

All Generators in Municipality

Category	Sub - Category	Organization Type	Address	City	CPG Number	Capacity kW
Solar	Roof-Mounted PV	Residential	33 Bovat Road	Georgia	16-1667	8.2
Solar	Roof-Mounted PV	Residential	5769 Georgia Shore Rd	Georgia		7.5
Solar	Roof-Mounted PV	Residential	759 Sandy Birch Rd	Georgia	6940	7
Solar	Roof-Mounted PV	Residential	207 Bronson Rd	Georgia	16-0801	8.2
Solar	Roof-Mounted PV	Residential	1803 Georgia Plains Rd	Georgia	16-0840	3.6
Solar	Roof-Mounted PV	Residential	681 Pattee Hill Road	Georgia		3.8
Solar	Roof-Mounted PV	Residential	553 Fontaine Rd	Georgia	6814	5
Solar	Roof-Mounted PV	Residential	289 Bradley Hill Rd	Georgia	16-0419	5
Solar	Roof-Mounted PV	Residential	2018 Georgia Plains Rd	Georgia	16-0763	7.6
Solar	Roof-Mounted PV	Residential	138 Ridgeview Dr	Georgia	16-0767	3
Solar	Roof-Mounted PV	Residential	6478 Georgia Shore Rd N	Georgia	16-0783	9.6
Solar	Roof-Mounted PV	Residential	157 Red Barn Hill Rd	Georgia	6732	5
Solar	Roof-Mounted PV	Residential	1462 Sandy Birch Road	Georgia	16-0089	3.8
Solar	Roof-Mounted PV	Residential	575 Spooner Rd	Georgia	16-0751	5
Solar	Roof-Mounted PV	Residential	308 Nottingham Drive	Georgia		3
Solar	Roof-Mounted PV	Residential	944 Stone Bridge Rd	Georgia	16-0766	6
Solar	Roof-Mounted PV	Residential	354 Old Stage Rd	Georgia	16-1117	6
Solar	Roof-Mounted PV	Residential	214 Manor Dr	Georgia	16-1156	7.6
Solar	Roof-Mounted PV	Residential	192 Decker Road	Georgia	16-1433	3.6
Solar	Roof-Mounted PV	Residential	116 Kay Dr	Georgia	16-1113	3
Solar	Roof-Mounted PV	Residential	699 Sandy Birch Road	Georgia	16-1543	3.6
Solar	Roof-Mounted PV	Residential	279 Bronson Road	Georgia		8.2
Solar	Roof-Mounted PV	Residential	719 Stone Bridge Rd	Georgia	16-1314	5
Wind	Commercial Wind	Business	Georgia Mountain	Georgia		10000
Wind	Small Wind	Residential	3482 Ethan Allen Hwy	Georgia	266	9.5
Wind	Small Wind	Residential	487 Mill River Rd	Georgia	5	7.1

Municipal Analysis & Targets - Grand Isle

The following is an explanation of the municipal energy data compiled by Northwest Regional Planning Commission (NRPC). The intent of the municipal energy data is to provide the municipalities with data required to ensure compliance with the requirements of Act 174 and "Enhanced Energy Planning" (24 V.S.A. 4352). The following tables contain data that estimates current energy use and provides targets for future energy use across all sectors (transportation, heating, and electricity). It also sets targets for renewable energy generation within the municipality.

This data is meant to be a starting point for the municipality to begin planning its energy future and to talk about the changes that may need to occur within the municipality to ensure that local, regional and state energy goals are met. This includes the State of Vermont's goal to have 90% of all energy demand be met from renewable sources by 2050.

Figure 1 - Data Sources

ACS – American Community Survey

DOL –Vermont Department of Labor

DPS – Vermont Department of Public Service

EIA – Energy Information Administration

EVT – Efficiency Vermont

LEAP – Long-Range Energy Alternatives Planning

VEIC – Vermont Energy Investment Corporation

VTrans – Vermont Agency of Transportation

Data Sources

Estimates of current energy use consist primarily of data available from the American Community Survey (ACS), the Vermont Agency of Transportation (VTrans), the Vermont Department of Labor (DOL), and the Vermont Department of Public Service (DPS). Targets for future energy use are reliant upon the Long-range Energy Alternatives Planning (LEAP) analysis for the region completed the Vermont Energy Investment Corporation (VEIC). Targets for future energy generation have come from the regional planning commission and DPS. For more information on LEAP, see the Northwest Regional Energy Plan (www.nrpcvt.com). Targets for both future energy use and energy generation have been generally developed using a "top down" method of disaggregating regional data to the municipal level.

It is possible to develop "bottom up" data. For those municipalities interested in that approach, please see the Department of Public Service's Analysis and Targets Guidance (http://publicservice.vermont.gov/content/act-174-recommendations-and-determination-standards).

Please remember that the targets established by LEAP represent only one way to achieve energy goals. There may several other similar pathways that a municipality may choose to take in order to meet the 90x50 goal.

Below is a worksheet by worksheet explanation of the Municipal Template spreadsheet:

1. Municipal Data Summary

The following tables summarize all data that is required to be in a municipal plan if the plan is to meet the "determination" standards established by the Vermont Department of Public Service.

Table 1A: Current Municipal Transportation Energy Use

Transportation Data	Municipal Data
Total # of Passenger Vehicles (ACS 2011-2015)	1,939
Average Miles per Vehicle (Vtrans)	11,356
Total Miles Traveled	22,019,284
Realized MPG (2013 - VTrans 2015 Energy Profile)	18.6
Total Gallons Use per Year	1,183,832
Transportation BTUs (Billion)	143
Average Cost per Gallon of Gasoline (RPC)	2.31
Gasoline Cost per Year	2,734,653

This table uses data from the American Community Survey (ACS) and Vermont Agency of Transportation (VTrans) to calculate current transportation energy use and energy costs in the municipality.

Table 1B: Current Municipal Residential Heating Energy Use

Fuel Source	Municipal Households (ACS 2011-2015)	% of Municipal Households	Municipal Square Footage Heated	Municipal BTU (in Billions)
Natural Gas	30	3.3%	42,336	3
Propane	265	28.7%	453,872	27
Electricity	57	6.2%	83,184	5
Fuel Oil	406	44.0%	713,888	43
Coal	0	0.0%	0	0
Wood	161	17.4%	302,320	18
Solar	0	0.0%	0	0
Other	4	0.4%	7,616	0
No Fuel	0	0.0%	0	0
Total	923	100.0%	1,603,216	96

This table displays data from the ACS that estimates current municipal residential heating energy use.

Table 1C: Current Municipal Commercial Energy Use

	Commercial Establishments in Municipality (VT DOL)	Estimated Thermal Energy BTUs per Commercial Establishment (in Billions) (VDPS)	Estimated Thermal Energy BTUs by Commercial Establishments in Municipality (in Billions)
Municipal Commercial Energy Use	49	0.725	36

The table uses data available from the Vermont Department of Labor (VT DOL) and the Vermont Department of Public Service (DPS) to estimate current municipal commercial establishment energy use in the municipality.

Table 1D: Current Electricity Use

Use Sector	Current Electricity Use
Residential (kWh)	8,297,163
Commercial and Industrial (kWh)	12,572,089
Total (kWh)	20,869,251

This table displays current electricity use within the municipality. This data is available from Efficiency Vermont (EVT).

Table 1E: Residential Thermal Efficiency Targets

	2025	2035	2050
"Residential - Increased Efficiency and Conservation (% of municipal households to be weatherized)"	5%	16%	78%

This table displays targets for thermal efficiency of residential structures. The data is based on a methodology developed by DPS using data available from the regional Long-range Energy Alternatives Planning (LEAP) analysis and ACS. The data in this table represents the percentage of municipal households that will need to be weatherized in the target years. The target is cumulative.

Table 1F: Commercial Thermal Efficiency Target

	2025	2035	2050
"Commercial - Increased Efficiency and Conservation (% of commercial establishments to be weatherized)"	25%	25%	73%

This table shows the same information as Table 1E, but sets a target for commercial thermal efficiency and weatherization. Information from the VT DOL is required to complete this target. The target is cumulative.

Table 1G: Thermal Fuel Switching (Residential and Commercial) – Wood Systems

	2025	2035	2050
New Efficient Wood Heat Systems (in units)	0	0	5

This table provides a target for new wood heating systems for residential and commercial structures in the municipality for each target year. This target was calculated using data from LEAP and ACS. The target is cumulative.

Table 1H: Thermal Fuel Switching (Residential and Commercial) – Heat Pumps

	2025	2035	2050
New Heat Pumps (in units)	110	253	473

This table provides a target for new heat pump systems for residential and commercial structures in the municipality for each target year. This target was calculated using data from LEAP and ACS. The target is cumulative.

Table 1I: Electricity Efficiency Targets

	2025	2035	2050
Increase Efficiency and Conservation (BTUs)	25.2%	48.3%	100.7%

Data in this table displays a target for increased electricity efficiency and conservation during the target years. This target will be met through conversions to high efficiency appliances, electric heat pumps, and electric light-duty vehicles. These targets were developed using regional LEAP analysis. The target is cumulative.

Table 1J: Use of Renewables – Transportation

	2025	2035	2050
Renewable Energy Use - Transportation (BTUs)	9.5%	31.2%	90.2%

This data displays targets for the percentage of transportation energy use coming from renewable sources during each target year. This target will be met through conversions to electric light-duty vehicles and biodiesel heavy-duty vehicles. This data was developed using the LEAP analysis. The target is cumulative.

Table 1K: Use of Renewables – Heating

	2025	2035	2050
Renewable Energy Use - Heating (BTUs)	45.1%	58.3%	86.2%

This data displays targets for the percentage of heating energy use coming from renewable sources during each target year. This target will be met through conversions to electric heat pumps and high efficiency wood heating systems. This data was developed using information from the LEAP analysis. The target is cumulative.

Table 1L: Use of Renewables – Electricity

	2025	2035	2050
Renewable Energy Use - Electricity (MWh)	3,650.3	7,300.7	11,061.6

This data displays targets for MWh of electricity generation coming from renewable sources within the municipality during each target year. This data was developed using information from the regional planning commission and DPS. This data is the same as the data in Table 1Q. The target is cumulative.

Table 1M: Transportation Fuel Switching Targets – Electric Vehicles

	2025	2035	2050
Electric Vehicles	170	1,270	3,022

This tables displays a target for switching from fossil fuel based vehicles (gasoline and diesel) to electric vehicles. This target is calculated using LEAP and ACS data. The target is cumulative.

Table 1N: Transportation Fuel Switching Targets – Biodiesel

	2025	2035	2050
Biodiesel Vehicles	295	588	1,132

This tables displays a target for switching from fossil fuel based vehicles to biodiesel-powered vehicles. This target is calculated using LEAP and ACS data. The target is cumulative.

Table 1O: Existing Renewable Generation

Renewable Type	MW	MWh
Solar	0.27	331.13
Wind	0.13	403.18
Hydro	0.00	0.00
Biomass	0.00	0.00
Other	0.00	0.00
Total Existing Generation	0.40	734.31

Table 1O shows existing renewable generation in the municipality, in MW and MWh, based on information available from the Vermont Department of Public Service.

Table 1P: Renewable Generation Potential

Renewable Type	MW	MWh
Rooftop Solar	1	1,432
Ground-mounted Solar	477	584,588
Wind	1,330	4,077,473
Hydro	0	0
Biomass and Methane	0	0
Other	0	0
Total Renewable Generation Potential	1,808	4,663,494

Renewable generation potential is based on mapping completed by the regional planning commission that is based on the Municipal Determination Standards and associated guidance documents developed by DPS. The renewable generation potential is expressed in MW and MWh by the type of renewable resource (solar, wind, hydro, etc.).

Table 1Q: Renewable Generation Targets

	2025	2035	2050
Total Renewable Generation Target (in MWh)	3,650.33	7,300.66	11,061.61

This data displays targets for MWh of electricity generation coming from renewable sources within the municipality during each target year. This data was developed using information from the regional planning commission and DPS. This data is the same as the data in Table 1L.

Table 1R: Sufficient Land?

	Y/N
Solar	Y
Wind	Y

This table shows whether or not there is sufficient land in the municipality to meet the renewable generation targets based on the renewable generation potential in the municipality.

Utility Service Areas

Grand Isle, Vermont
Act 174
The Energy Development Improvement Act of 2016

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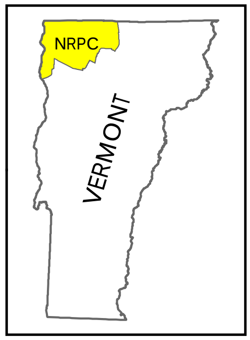
N



Legend

Utility Service Area Features

- Green Mountain Power
- Swanton Village Electric
- Vermont Electric Co-op
- Enosburg Falls Electric
- Substation
- 3 Phase Power Line
- Transmission Line

Sources: VCGI
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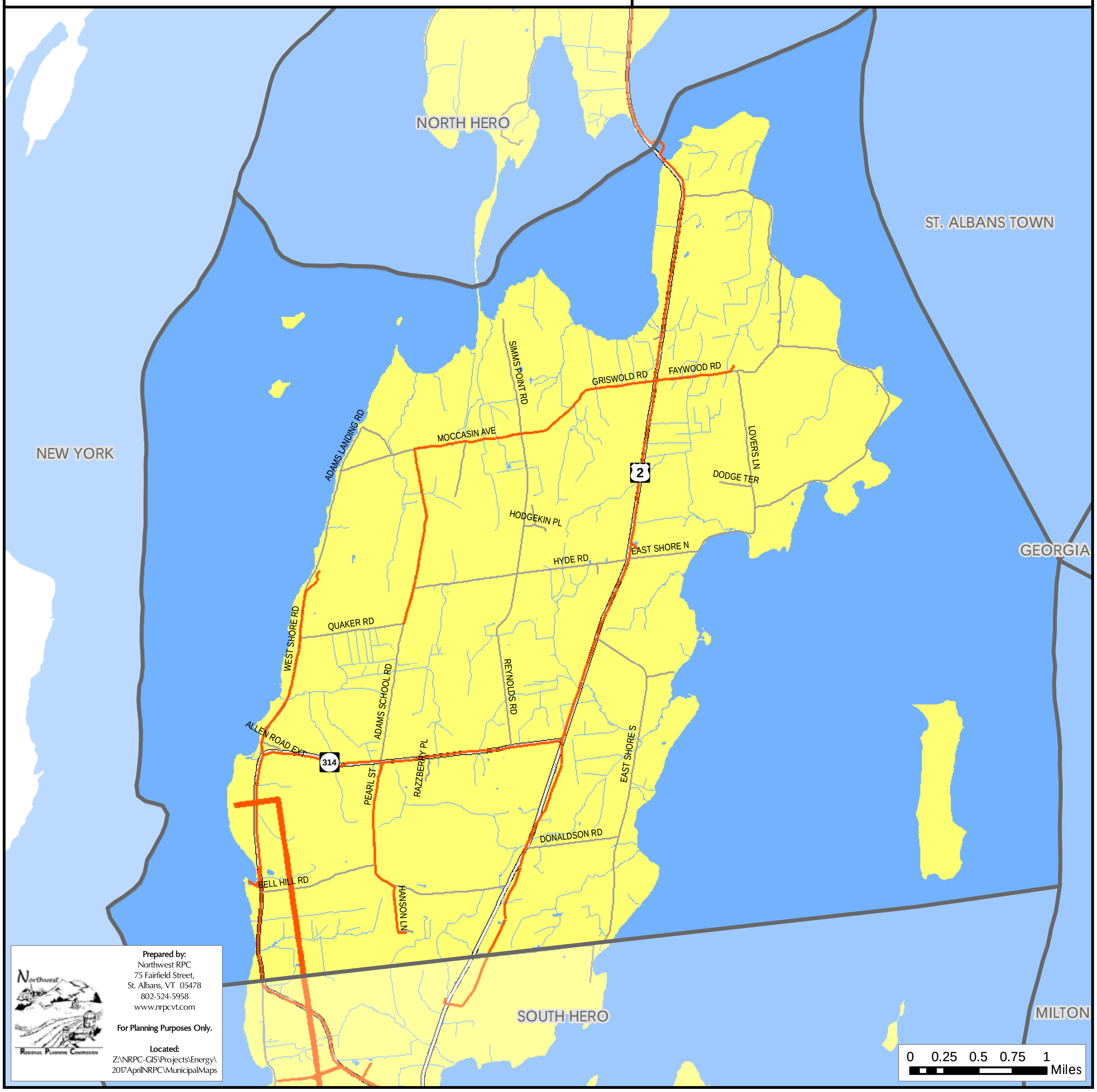

Transmission & 3 Phase Power Infrastructure

Grand Isle, Vermont
Act 174
The Energy Development Improvement Act of 2016

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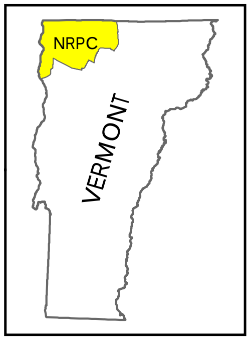
N



Legend

- Substation
- 3 Phase Power Line
- Transmission Line
- 1/2 Mile Buffer (3 Phase Power Line & Transmission Line)

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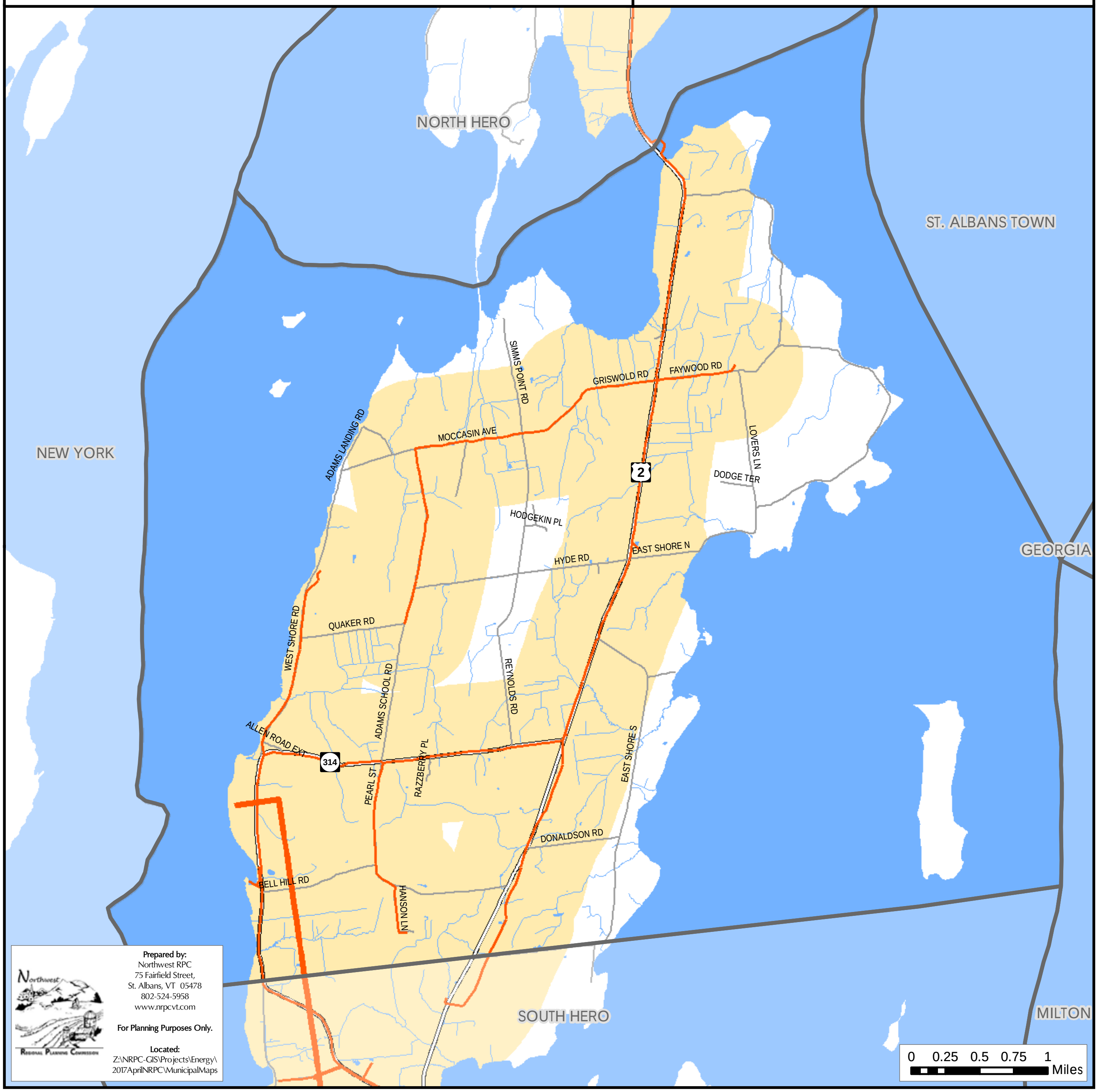

Existing Generation Facilities

Grand Isle, Vermont
Act 174
The Energy Development Improvement Act of 2016

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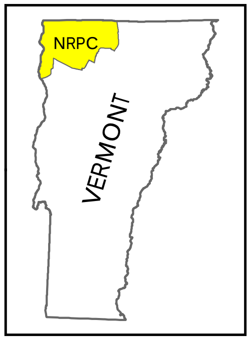

Legend

- Biomass Facility
- Hydro Facility
- Solar Facility
- Wind Facility

Note: Only generators 15kW are shown on the map. A full list of all generators is available.

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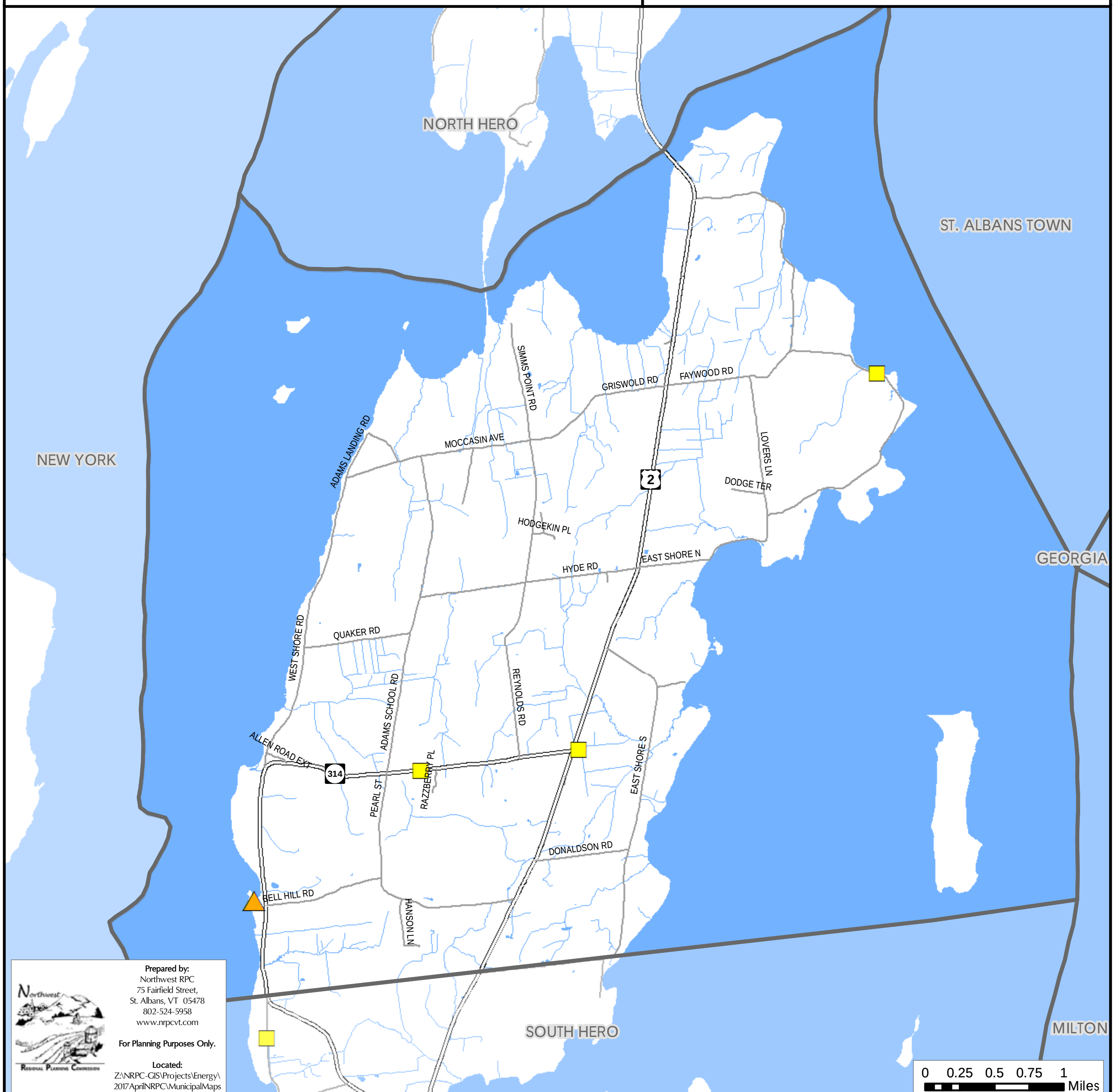

Hydro

Grand Isle, Vermont
Act 174
The Energy Development Improvement Act of 2016

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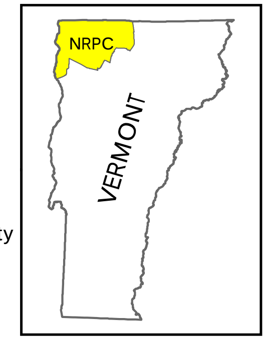
N

Legend
- Substation
- 3 Phase Power Line
- Transmission Line
- Designated Outstanding Resource Water
- Known Constraint - Designated National Wild & Scenic River
- Possible Constraint - Stressed or Impaired Water
- Possible Constraint - RINAs

Potential Hydroelectric Facility
- < 50 kW Capacity
- > 50 kW Capacity
- High Hazard with < 50 kW Capacity
- High Hazard with > 50 kW Capacity

Operating Hydroelectric Facility
- Dam not on National Wild and Scenic River
- Dam on National Wild and Scenic River



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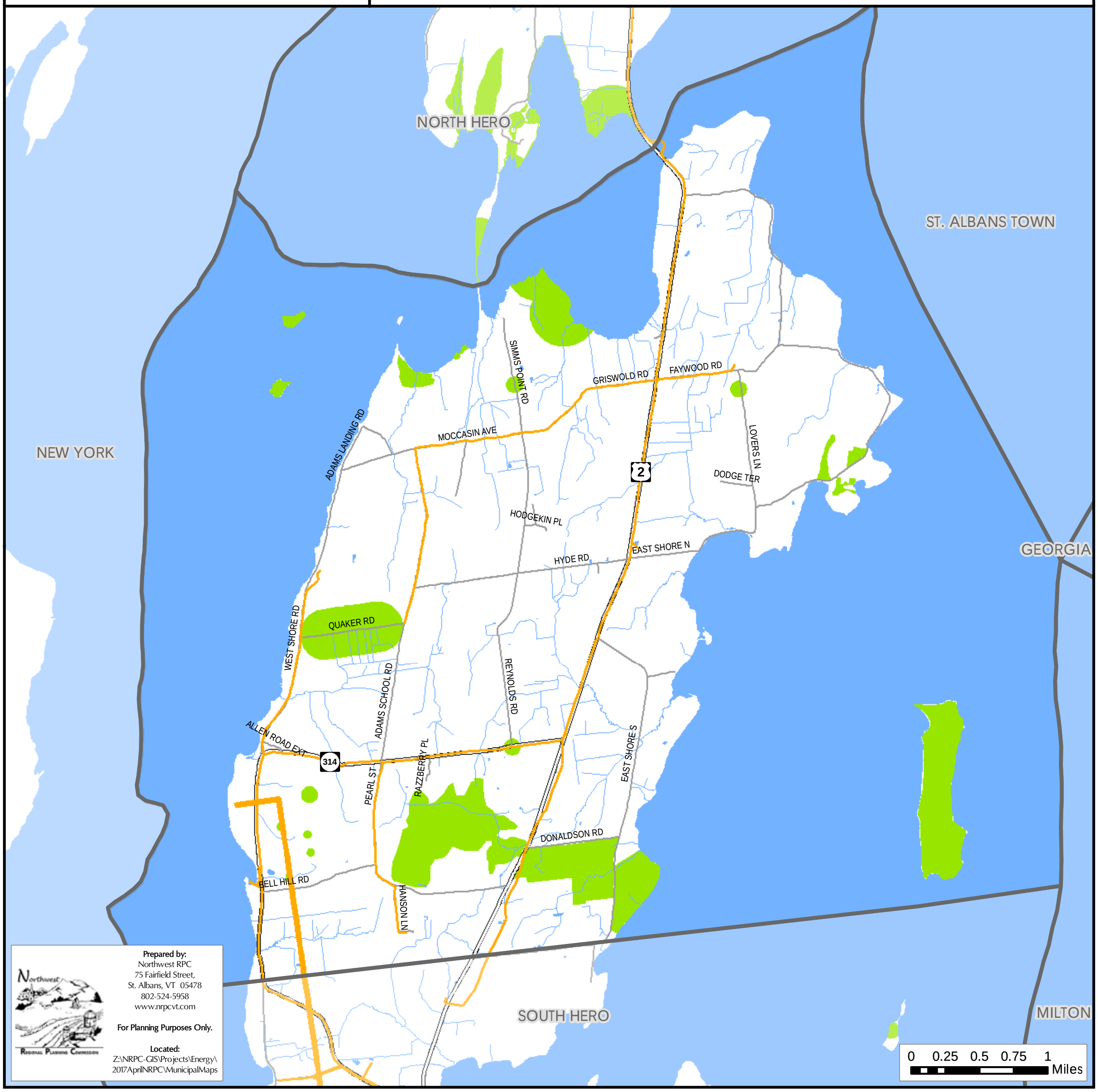

Solar

Grand Isle, Vermont
Act 174
The Energy Development Improvement Act of 2016

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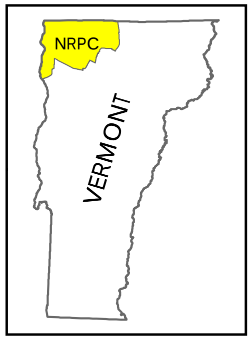

Legend

- Substation
- 3 Phase Power Line
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- 1/2 Mile Buffer (3 Phase Power Line & Transmission Line)
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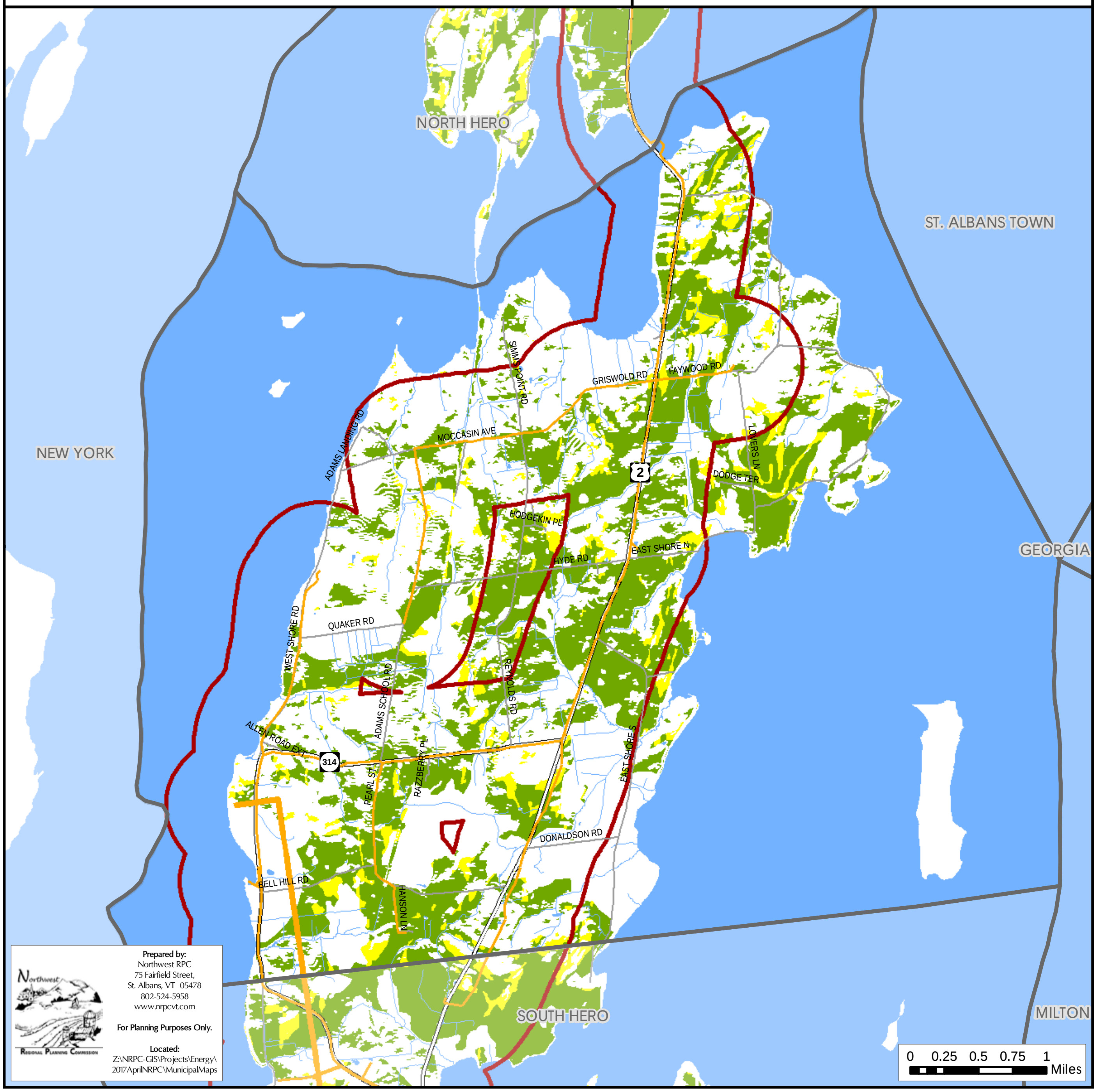

Wind

Grand Isle, Vermont
Act 174
The Energy Development Improvement Act of 2016

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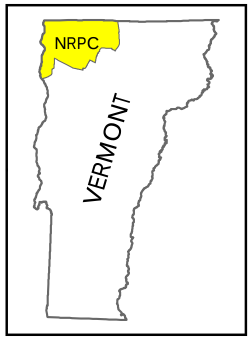

Legend

- Substation
- 3 Phase Power Line
- Transmission Line
- Prime Wind: Areas of high wind potential and no known constraints. Darker areas have higher wind speeds.
- Base Wind: Areas of high wind potential and a presence of possible constraints. Darker areas have higher wind speeds.

Sources: VCGI

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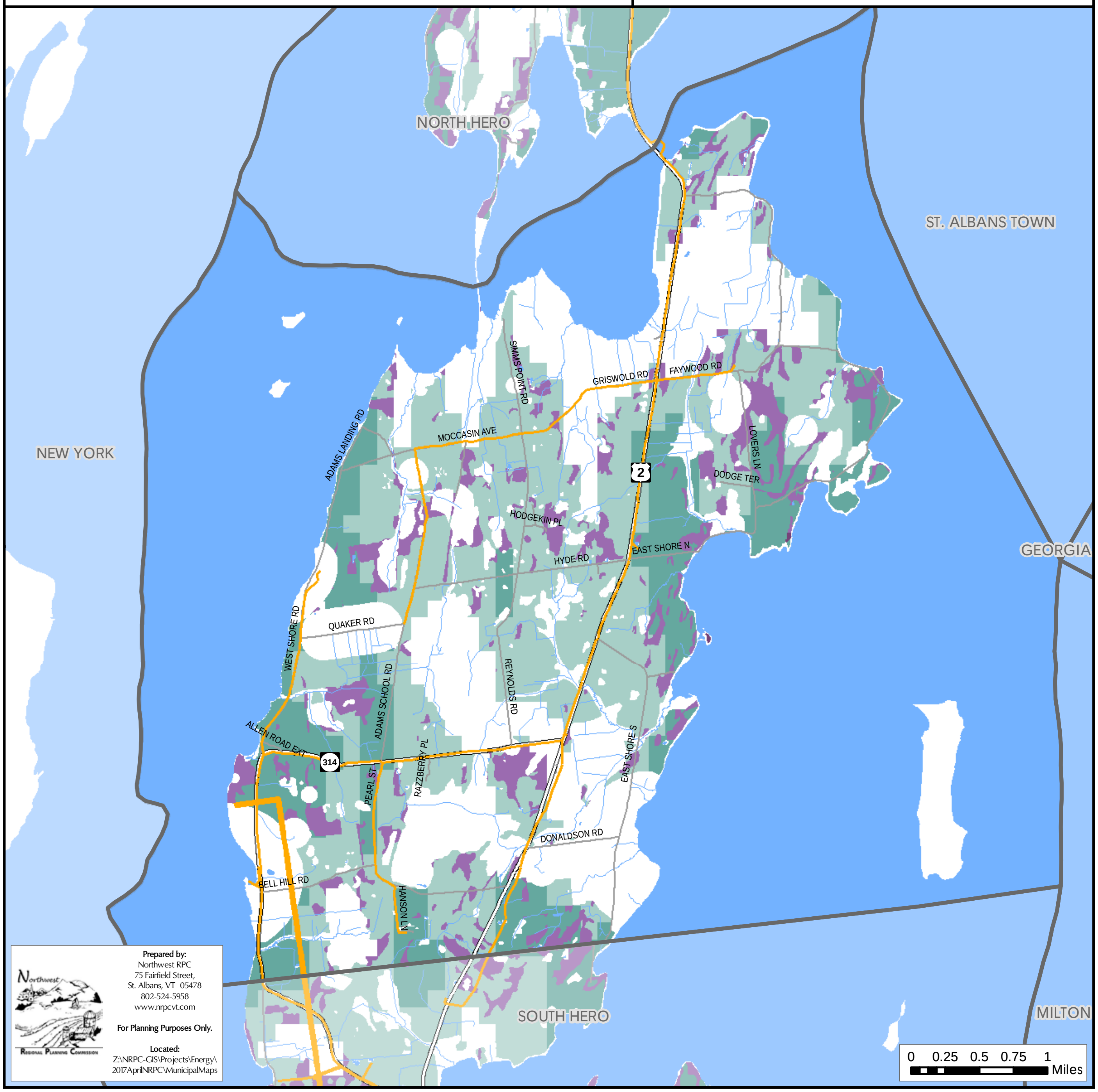

Woody Biomass

Grand Isle, Vermont
Act 174
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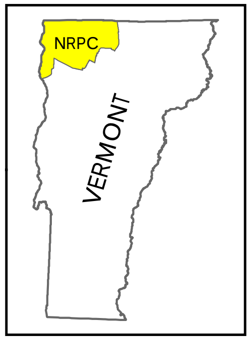

Legend

- Biomass System
- Cow Power
- Substation
- 3 Phase Power Line
- Transmission Line
- Prime Woody Biomass/No Known Constraints
- Base Woody Biomass/Possible Constraints

Sources: VCGI
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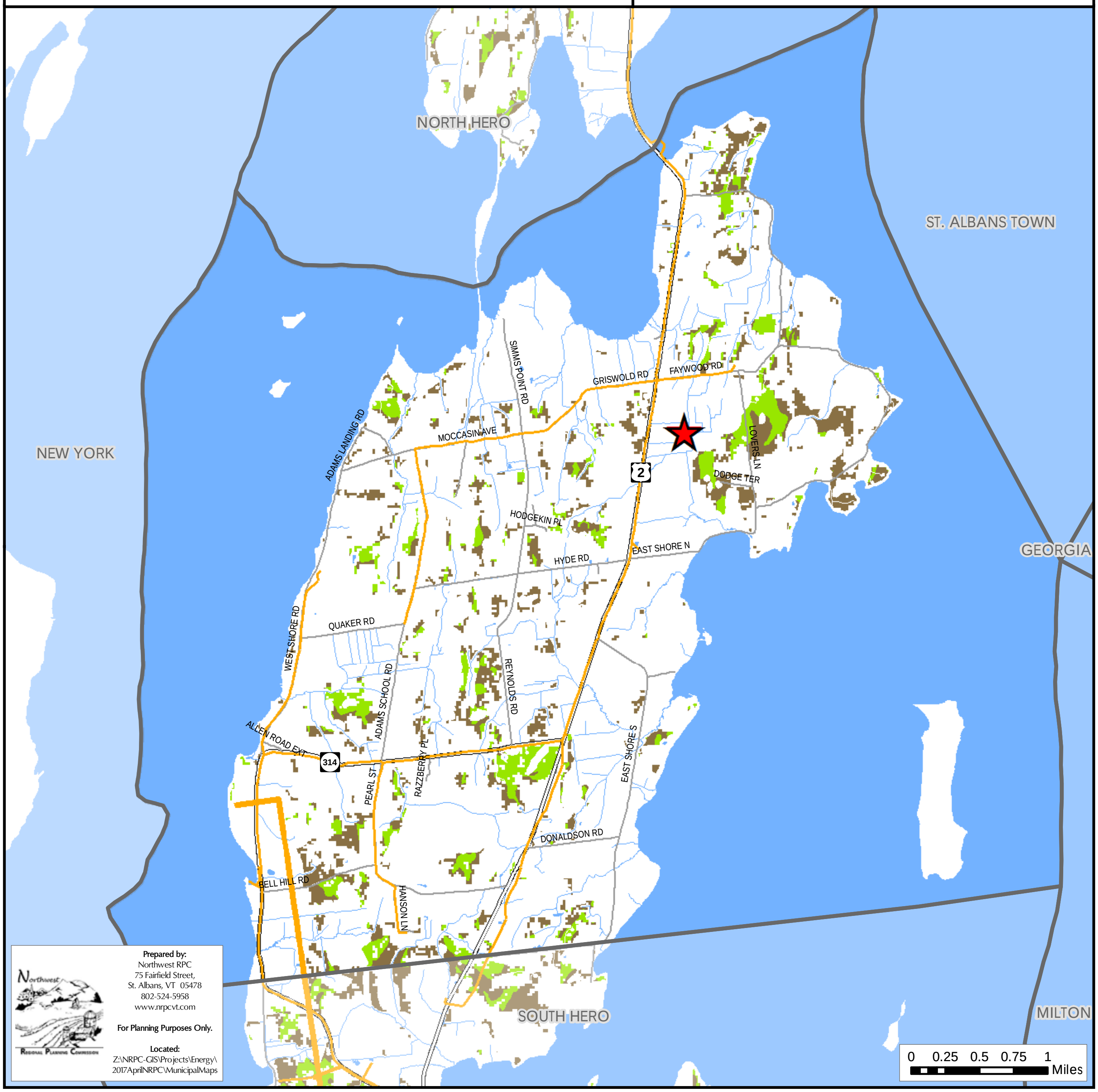

All Generators in Municipality

Category	Sub - Category	Organization Type	Address	City	CPG Number	Capacity kW
Solar	Ground-mounted PV: Fixed Rack	Residential	1 Hoag Lane	Grand Isle	4289	8.8
Solar	Ground-mounted PV: Fixed Rack	Residential	29 Faywood Rd	Grand Isle	6615	
Solar	Ground-mounted PV: Pole	Residential	3 Canamak Dr	Grand Isle	3720	6.8
Solar	Ground-mounted PV: Tracker	Farm	69 East Shore North	Grand Isle		4
Solar	Hot Water	Residential	10 Lightning Road	Grand Isle		
Solar	Hot Water	Residential	122 Reynolds Road	Grand Isle		
Solar	Hot Water	Residential	4 Maynard Court	Grand Isle		
Solar	Hot Water	Residential	69 East Shore North	Grand Isle		
Solar	Roof-Mounted PV	Residential	146 East Shore North	Grand Isle	1896	17.9
Solar	Roof-Mounted PV	Residential	6 Old Town Ln	Grand Isle	2582	5.5
Solar	Roof-Mounted PV	Residential	137 East Shore N	Grand Isle	2100	6.1
Solar	Roof-Mounted PV	Residential	112 Pearl Street	Grand Isle	1145	3.2
Solar	Roof-Mounted PV	Residential	30 Cooper Bay Lane	Grand Isle	4263	11
Solar	Roof-Mounted PV	Residential	9 Dodge Terrace	Grand Isle	5071	7.6
Solar	Roof-Mounted PV	Residential	12 Adams Landing Rd	Grand Isle	2935	5
Solar	Roof-Mounted PV	Residential	10 Tebeau Terrace	Grand Isle	2649	3.7
Solar	Roof-Mounted PV	Residential	283 East Shore North	Grand Isle	696	2.4
Solar	Roof-Mounted PV	Residential	122 Reynolds Rd	Grand Isle		4.3
Solar	Roof-Mounted PV	Business	4 Island Cir	Grand Isle	2343	47.2
Solar	Roof-Mounted PV	Residential	8 Cedar Point Rd	Grand Isle	3014	6.2
Solar	Roof-Mounted PV	Residential	32 Lovers Lane	Grand Isle	5410	7.2
Solar	Roof-Mounted PV	Residential	6 Canamak West	Grand Isle	5367	7
Solar	Roof-Mounted PV	Residential	82 Adams School Rd	Grand Isle	1511	7.8
Solar	Roof-Mounted PV	Residential	1 Island Meadow Lane	Grand Isle	3876	7.2
Solar	Roof-Mounted PV	Residential	2 Mackenzie Lane	Grand Isle	2936	6.8
Solar	Roof-Mounted PV	Residential	33 East Shore N	Grand Isle	1856	6.8
Solar	Roof-Mounted PV	Residential	207 U.S. Route 2	Grand Isle	917	4.2

All Generators in Municipality

Category	Sub - Category	Organization Type	Address	City	CPG Number	Capacity kW
Solar	Roof-Mounted PV	Residential	9 Canamak W	Grand Isle	2842	10.5
Solar	Roof-Mounted PV	Residential	39 Pearl St	Grand Isle	2836	4
Solar	Roof-Mounted PV	Residential	6 Pond Road	Grand Isle	7236	8.8
Solar	Roof-Mounted PV	Residential	37 Bell Hill Road	Grand Isle	6793	6
Solar	Roof-Mounted PV	Residential	9 Bell Hill Rd	Grand Isle	6700	4
Solar	Roof-Mounted PV	Residential	37 Moccasin Avenue	Grand Isle	7292	3.8
Solar	Roof-Mounted PV	Business	79 Allen Road	Grand Isle	7206	15
Solar	Roof-Mounted PV	Residential	258 West Shore Road	Grand Isle	7244	8
Solar	Roof-Mounted PV	Residential	393 US Route 2	Grand Isle	6964	10
Solar	Roof-Mounted PV	Residential	8 Maynard Ct	Grand Isle	3075	5.6
Solar	Roof-Mounted PV	Residential	15 Allen Pond Road	South Hero	7257	
Wind	Small Wind	Residential	9 Dodge Terrace	Grand Isle	1944	10
Wind	Small Wind	Residential	283 East Shore North	Grand Isle	265	9.5
Wind	Small Wind	Farm	69 East Shore North	Grand Isle	226	2.5
Wind	Small Wind	Business	1268 Gordons Landing	Grand Isle	1221	100
Wind	Small Wind	Institution	54 West Shore Road	Grand Isle	406	9.5

Municipal Analysis & Targets - Highgate

The following is an explanation of the municipal energy data compiled by Northwest Regional Planning Commission (NRPC). The intent of the municipal energy data is to provide the municipalities with data required to ensure compliance with the requirements of Act 174 and "Enhanced Energy Planning" (24 V.S.A. 4352). The following tables contain data that estimates current energy use and provides targets for future energy use across all sectors (transportation, heating, and electricity). It also sets targets for renewable energy generation within the municipality.

This data is meant to be a starting point for the municipality to begin planning its energy future and to talk about the changes that may need to occur within the municipality to ensure that local, regional and state energy goals are met. This includes the State of Vermont's goal to have 90% of all energy demand be met from renewable sources by 2050.

Figure 1 - Data Sources

ACS – American Community Survey

DOL –Vermont Department of Labor

DPS – Vermont Department of Public Service

EIA – Energy Information Administration

EVT – Efficiency Vermont

LEAP – Long-Range Energy Alternatives Planning

VEIC – Vermont Energy Investment Corporation

VTrans – Vermont Agency of Transportation

Data Sources

Estimates of current energy use consist primarily of data available from the American Community Survey (ACS), the Vermont Agency of Transportation (VTrans), the Vermont Department of Labor (DOL), and the Vermont Department of Public Service (DPS). Targets for future energy use are reliant upon the Long-range Energy Alternatives Planning (LEAP) analysis for the region completed the Vermont Energy Investment Corporation (VEIC). Targets for future energy generation have come from the regional planning commission and DPS. For more information on LEAP, see the Northwest Regional Energy Plan (www.nrpcvt.com). Targets for both future energy use and energy generation have been generally developed using a "top down" method of disaggregating regional data to the municipal level.

It is possible to develop "bottom up" data. For those municipalities interested in that approach, please see the Department of Public Service's Analysis and Targets Guidance (http://publicservice.vermont.gov/content/act-174-recommendations-and-determination-standards).

Please remember that the targets established by LEAP represent only one way to achieve energy goals. There may several other similar pathways that a municipality may choose to take in order to meet the 90x50 goal.

Below is a worksheet by worksheet explanation of the Municipal Template spreadsheet:

1. Municipal Data Summary

The following tables summarize all data that is required to be in a municipal plan if the plan is to meet the "determination" standards established by the Vermont Department of Public Service.

Table 1A: Current Municipal Transportation Energy Use

Transportation Data	Municipal Data
Total # of Passenger Vehicles (ACS 2011-2015)	2,879
Average Miles per Vehicle (Vtrans)	11,356
Total Miles Traveled	32,693,924
Realized MPG (2013 - VTrans 2015 Energy Profile)	18.6
Total Gallons Use per Year	1,757,738
Transportation BTUs (Billion)	212
Average Cost per Gallon of Gasoline (RPC)	2.31
Gasoline Cost per Year	4,060,374

This table uses data from the American Community Survey (ACS) and Vermont Agency of Transportation (VTrans) to calculate current transportation energy use and energy costs in the municipality.

Table 1B: Current Municipal Residential Heating Energy Use

Fuel Source	Municipal Households (ACS 2011-2015)	% of Municipal Households	Municipal Square Footage Heated	Municipal BTU (in Billions)
Natural Gas	13	1.0%	24,752	1
Propane	299	22.6%	540,432	32
Electricity	19	1.4%	22,800	1
Fuel Oil	741	56.0%	1,350,320	81
Coal	0	0.0%	0	0
Wood	223	16.8%	368,976	22
Solar	0	0.0%	0	0
Other	29	2.2%	55,216	3
No Fuel	0	0.0%	0	0
Total	1,324	100.0%	2,362,496	142

This table displays data from the ACS that estimates current municipal residential heating energy use.

Table 1C: Current Municipal Commercial Energy Use

	Commercial Establishments in Municipality (VT DOL)	Estimated Thermal Energy BTUs per Commercial Establishment (in Billions) (VDPS)	Estimated Thermal Energy BTUs by Commercial Establishments in Municipality (in Billions)
Municipal Commercial Energy Use	32	0.725	23

The table uses data available from the Vermont Department of Labor (VT DOL) and the Vermont Department of Public Service (DPS) to estimate current municipal commercial establishment energy use in the municipality.

Table 1D: Current Electricity Use

Use Sector	Current Electricity Use
Residential (kWh)	11,901,889
Commercial and Industrial (kWh)	8,210,344
Total (kWh)	20,112,232

This table displays current electricity use within the municipality. This data is available from Efficiency Vermont (EVT).

Table 1E: Residential Thermal Efficiency Targets

	2025	2035	2050
"Residential - Increased Efficiency and Conservation (% of municipal households to be weatherized)"	5%	16%	78%

This table displays targets for thermal efficiency of residential structures. The data is based on a methodology developed by DPS using data available from the regional Long-range Energy Alternatives Planning (LEAP) analysis and ACS. The data in this table represents the percentage of municipal households that will need to be weatherized in the target years. The target is cumulative.

Table 1F: Commercial Thermal Efficiency Target

	2025	2035	2050
"Commercial - Increased Efficiency and Conservation (% of commercial establishments to be weatherized)"	25%	25%	73%

This table shows the same information as Table 1E, but sets a target for commercial thermal efficiency and weatherization. Information from the VT DOL is required to complete this target. The target is cumulative.

Table 1G: Thermal Fuel Switching (Residential and Commercial) – Wood Systems

	2025	2035	2050
New Efficient Wood Heat Systems (in units)	5	12	55

This table provides a target for new wood heating systems for residential and commercial structures in the municipality for each target year. This target was calculated using data from LEAP and ACS. The target is cumulative.

Table 1H: Thermal Fuel Switching (Residential and Commercial) – Heat Pumps

	2025	2035	2050
New Heat Pumps (in units)	136	325	641

This table provides a target for new heat pump systems for residential and commercial structures in the municipality for each target year. This target was calculated using data from LEAP and ACS. The target is cumulative.

Table 1I: Electricity Efficiency Targets

	2025	2035	2050
Increase Efficiency and Conservation (BTUs)	25.2%	48.3%	100.7%

Data in this table displays a target for increased electricity efficiency and conservation during the target years. This target will be met through conversions to high efficiency appliances, electric heat pumps, and electric light-duty vehicles. These targets were developed using regional LEAP analysis. The target is cumulative.

Table 1J: Use of Renewables – Transportation

	2025	2035	2050
Renewable Energy Use - Transportation (BTUs)	6.2%	25.3%	87.8%

This data displays targets for the percentage of transportation energy use coming from renewable sources during each target year. This target will be met through conversions to electric light-duty vehicles and biodiesel heavy-duty vehicles. This data was developed using the LEAP analysis. The target is cumulative.

Table 1K: Use of Renewables – Heating

	2025	2035	2050
Renewable Energy Use - Heating (BTUs)	46.4%	60.1%	88.1%

This data displays targets for the percentage of heating energy use coming from renewable sources during each target year. This target will be met through conversions to electric heat pumps and high efficiency wood heating systems. This data was developed using information from the LEAP analysis. The target is cumulative.

Table 1L: Use of Renewables – Electricity

	2025	2035	2050
Renewable Energy Use - Electricity (MWh)	5,746.5	11,493.0	17,413.6

This data displays targets for MWh of electricity generation coming from renewable sources within the municipality during each target year. This data was developed using information from the regional planning commission and DPS. This data is the same as the data in Table 1Q. The target is cumulative.

Table 1M: Transportation Fuel Switching Targets – Electric Vehicles

	2025	2035	2050
Electric Vehicles	252	1,886	4,487

This tables displays a target for switching from fossil fuel based vehicles (gasoline and diesel) to electric vehicles. This target is calculated using LEAP and ACS data. The target is cumulative.

Table 1N: Transportation Fuel Switching Targets – Biodiesel

	2025	2035	2050
Biodiesel Vehicles	227	449	854

This tables displays a target for switching from fossil fuel based vehicles to biodiesel-powered vehicles. This target is calculated using LEAP and ACS data. The target is cumulative.

Table 1O: Existing Renewable Generation

Renewable Type	MW	MWh
Solar	0.09	110.38
Wind	0.00	0.00
Hydro	9.40	32,937.60
Biomass	0.00	0.00
Other	0.00	0.00
Total Existing Generation	9.49	33,047.98

Table 1O shows existing renewable generation in the municipality, in MW and MWh, based on information available from the Vermont Department of Public Service.

Table 1P: Renewable Generation Potential

Renewable Type	MW	MWh
Rooftop Solar	1	1,820
Ground-mounted Solar	1,196	1,467,293
Wind	1,080	3,312,736
Hydro	0	0
Biomass and Methane	0	0
Other	0	0
Total Renewable Generation Potential	2,278	4,781,849

Renewable generation potential is based on mapping completed by the regional planning commission that is based on the Municipal Determination Standards and associated guidance documents developed by DPS. The renewable generation potential is expressed in MW and MWh by the type of renewable resource (solar, wind, hydro, etc.).

Table 1Q: Renewable Generation Targets

	2025	2035	2050
Total Renewable Generation Target (in MWh)	5,746.48	11,492.96	17,413.58

This data displays targets for MWh of electricity generation coming from renewable sources within the municipality during each target year. This data was developed using information from the regional planning commission and DPS. This data is the same as the data in Table 1L.

Table 1R: Sufficient Land?

	Y/N
Solar	Y
Wind	Y

This table shows whether or not there is sufficient land in the municipality to meet the renewable generation targets based on the renewable generation potential in the municipality.

Utility Service Areas

Highgate, Vermont
Act 174
The Energy Development Improvement Act of 2016

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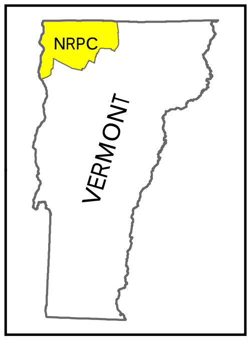

Legend

Utility Service Area Features

- Green Mountain Power
- Swanton Village Electric
- Vermont Electric Co-op
- Enosburg Falls Electric
- Substation
- 3 Phase Power Line
- Transmission Line

Sources: VCGI
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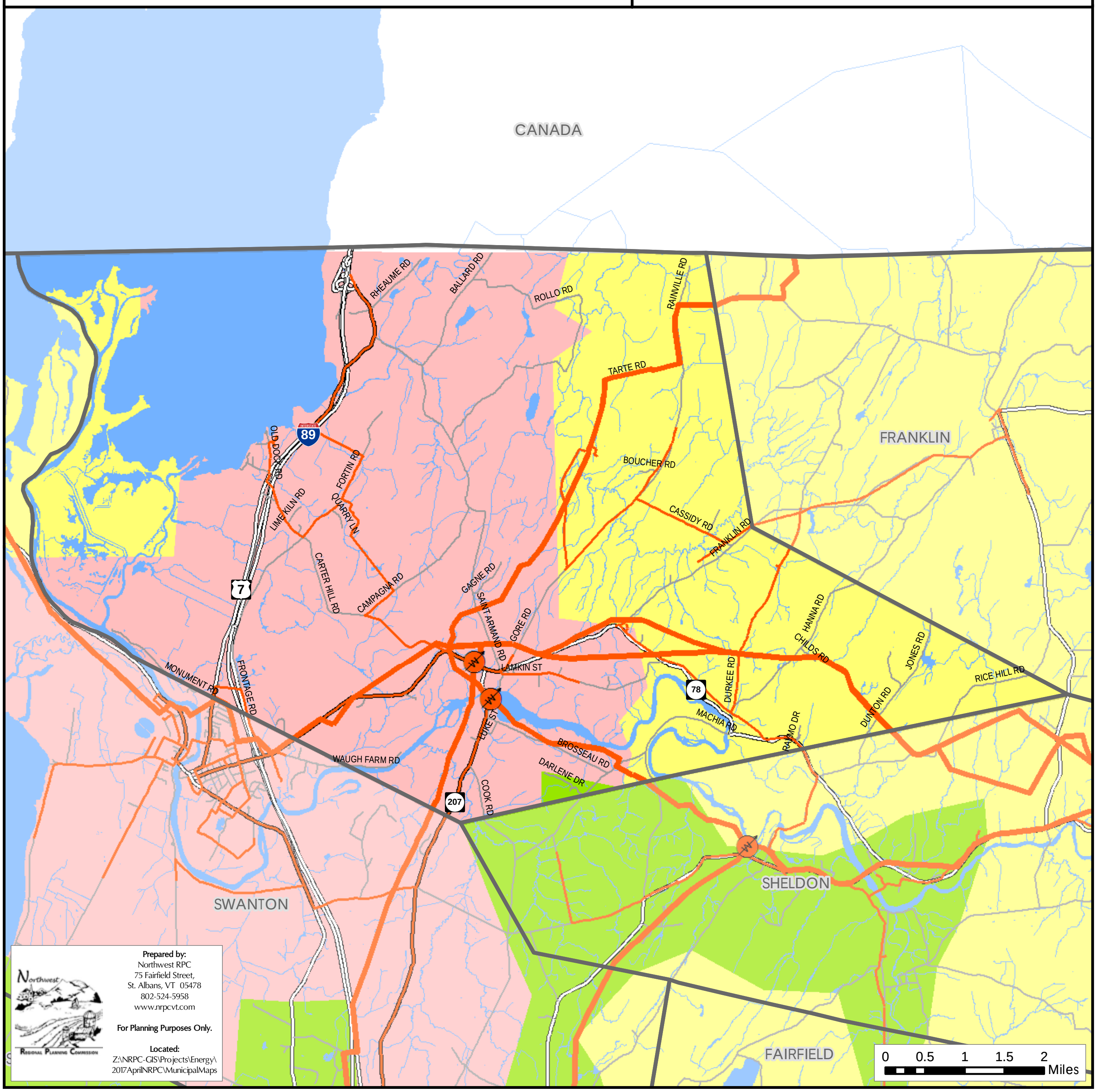

Transmission & 3 Phase Power Infrastructure

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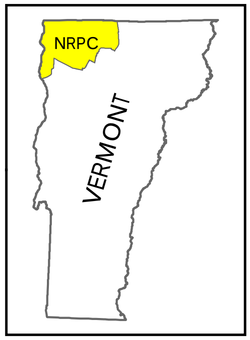

Legend

- Substation
- 3 Phase Power Line
- Transmission Line
- 1/2 Mile Buffer (3 Phase Power Line & Transmission Line)

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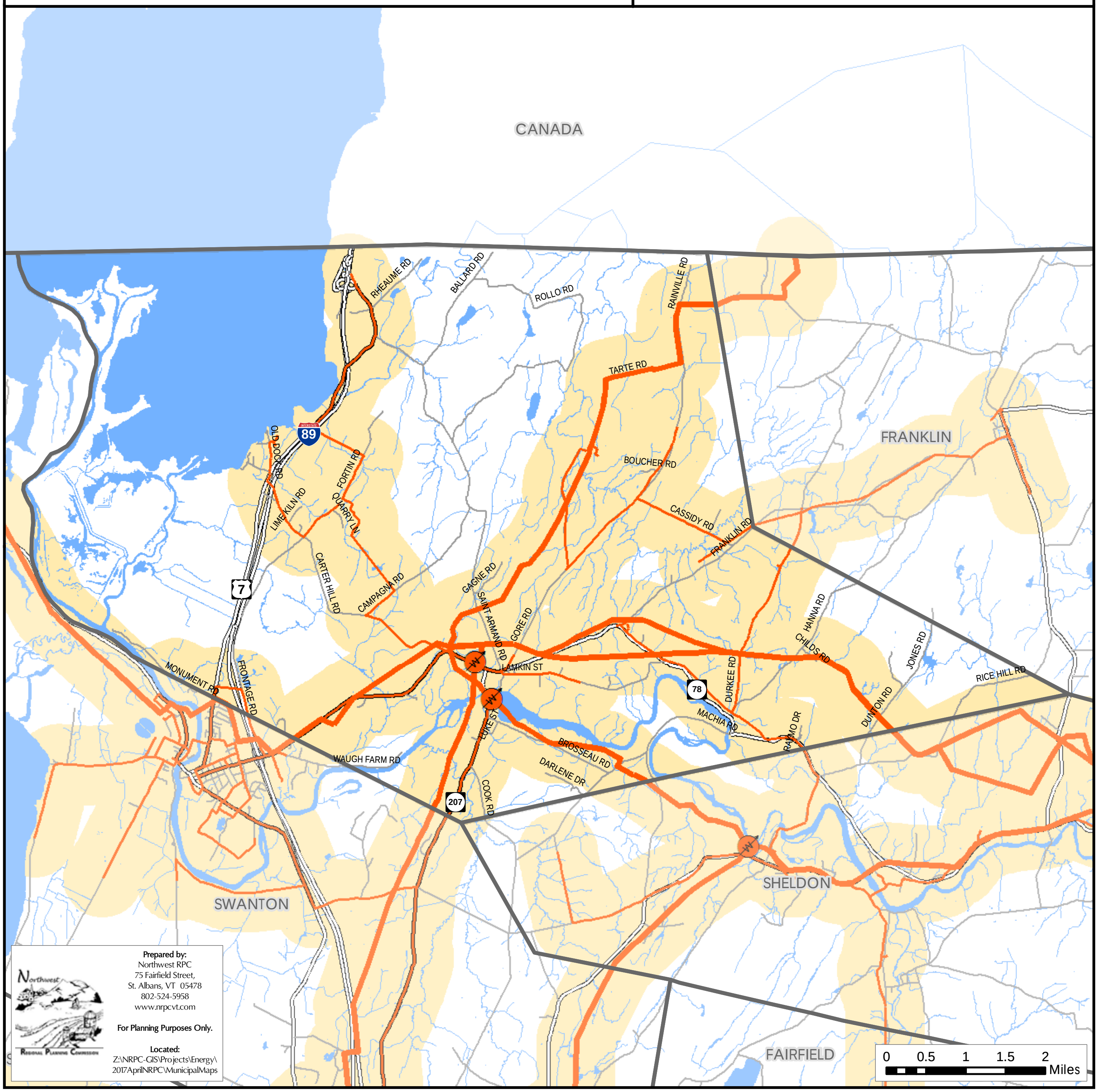

Existing Generation Facilities

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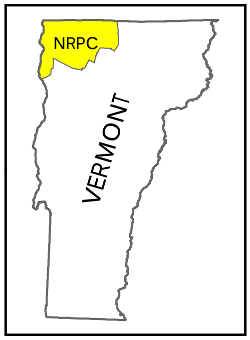

Legend

- Biomass Facility
- Hydro Facility
- Solar Facility
- Wind Facility

Note: Only generators 15kW are shown on the map. A full list of all generators is available.

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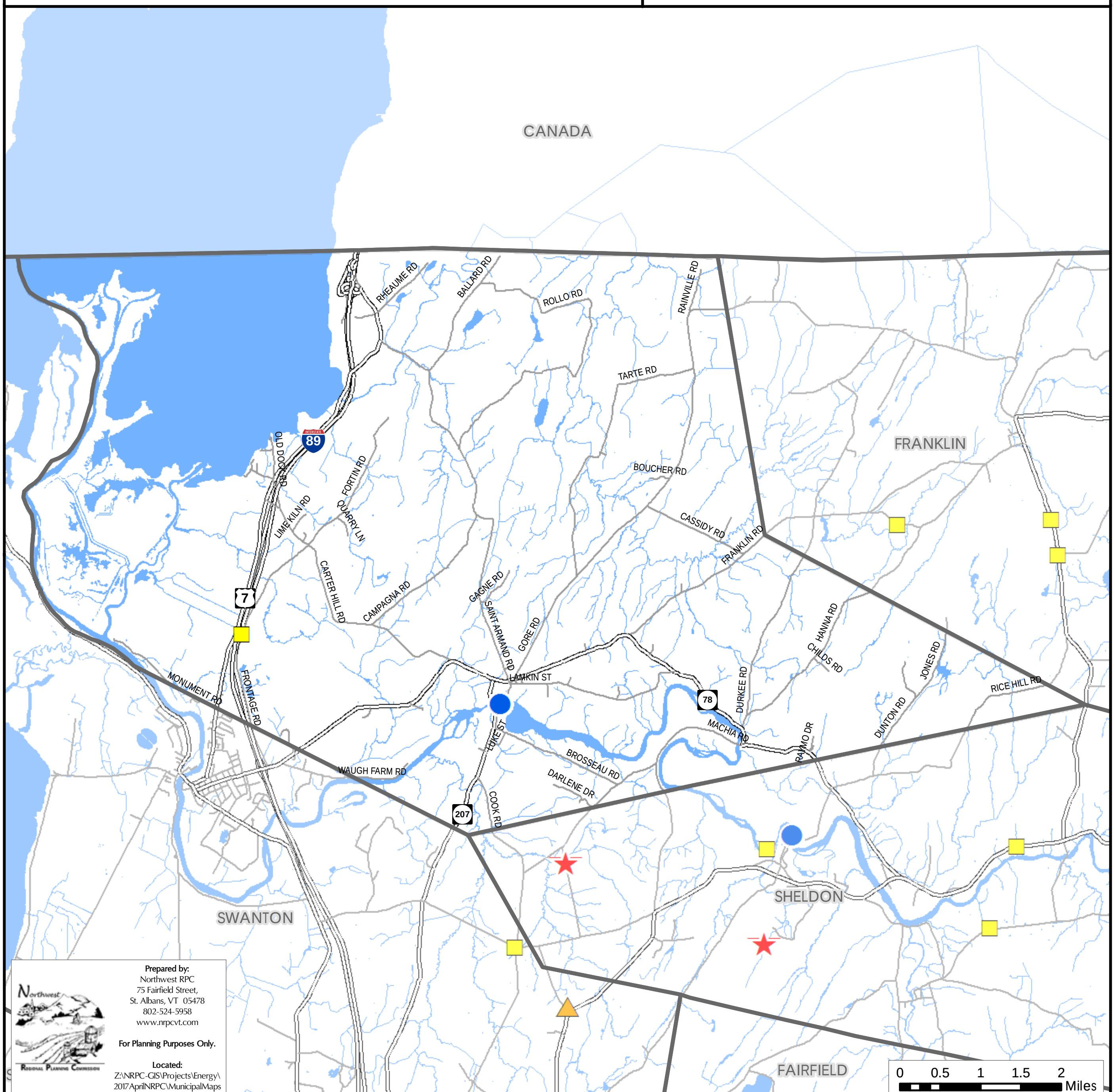

Natural Gas Lines

Highgate, Vermont
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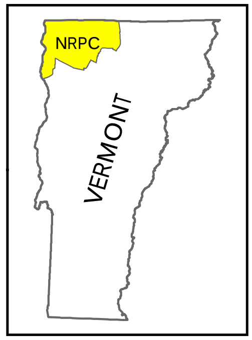

Legend

Natural Gas Line

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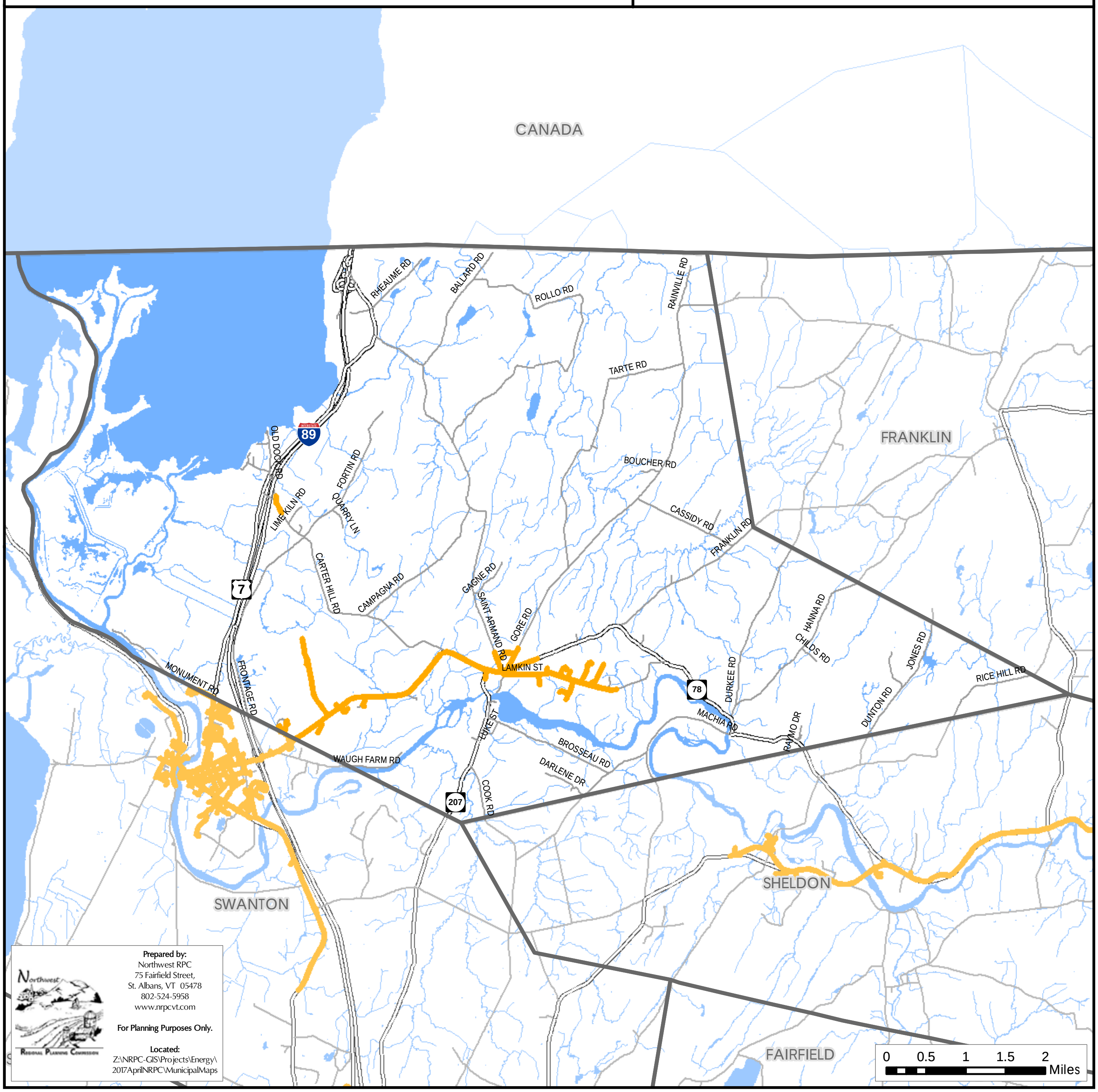

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For Planning Purposes Only.

Located:
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Hydro

Highgate, Vermont Act 174 The Energy Development Improvement Act of 2016

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Legend
- Substation
- 3 Phase Power Line
- Transmission Line
- Designated Outstanding Resource Water
- Known Constraint - Designated National Wild & Scenic River
- Possible Constraint - Stressed or Impaired Water
- Possible Constraint - RINAs

Potential Hydroelectric Facility
- < 50 kW Capacity
- > 50 kW Capacity
- High Hazard with < 50 kW Capacity
- High Hazard with > 50 kW Capacity

Operating Hydroelectric Facility
- Dam not on National Wild and Scenic River
- Dam on National Wild and Scenic River

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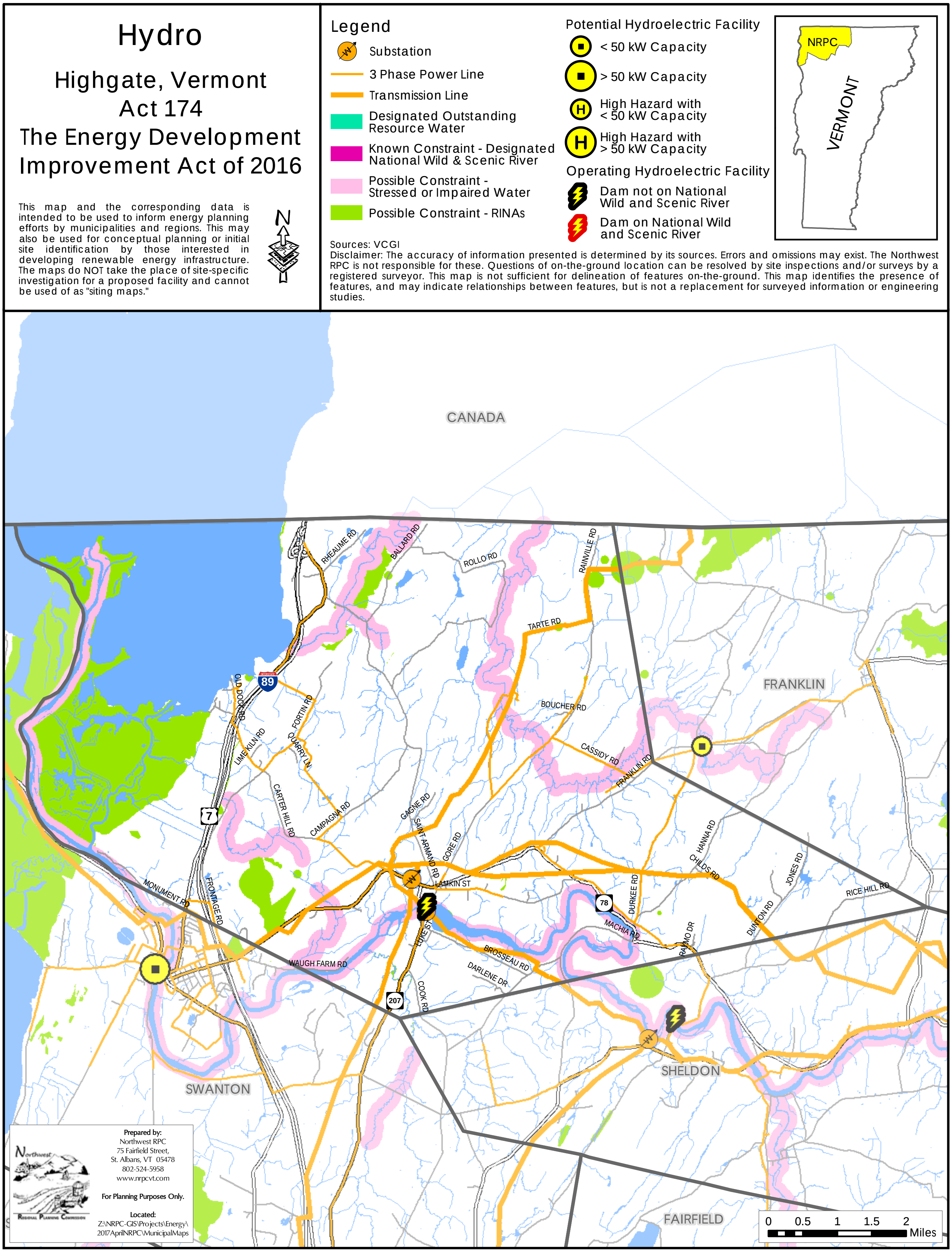

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Solar

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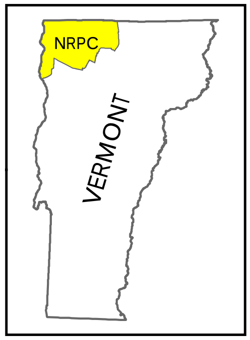

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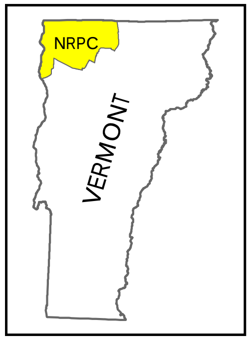

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- Base Wind: Areas of high wind potential and a presence of possible constraints. Darker areas have higher wind speeds.

Sources: VCGI

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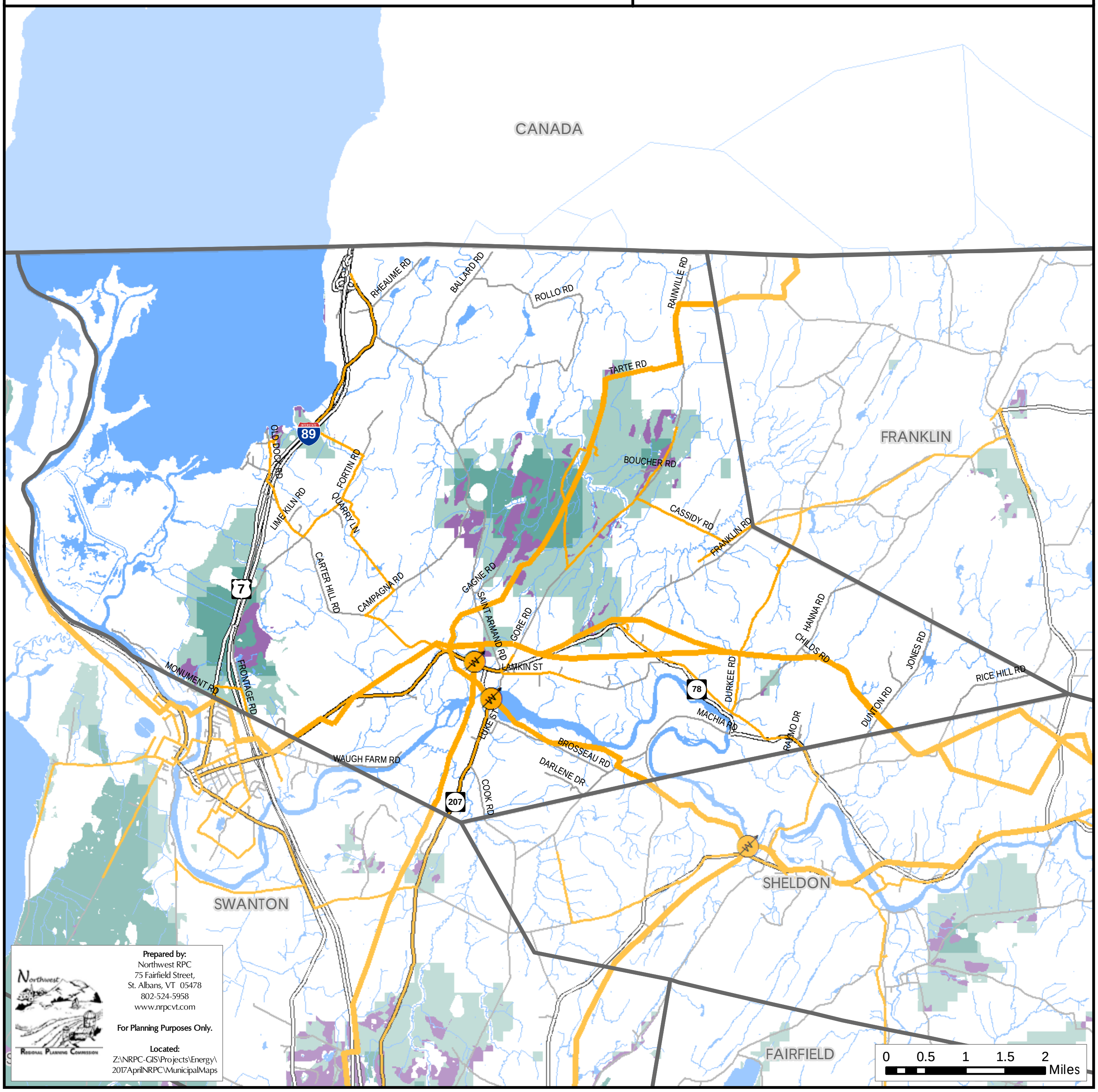

Woody Biomass

Highgate, Vermont
Act 174
The Energy Development Improvement Act of 2016

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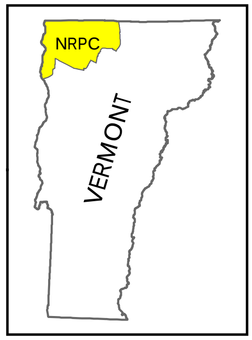

Legend

- Biomass System
- Cow Power
- Substation
- 3 Phase Power Line
- Transmission Line
- Prime Woody Biomass/No Known Constraints
- Base Woody Biomass/Possible Constraints

Sources: VCGI

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All Generators in Municipality

Category	Sub - Category	Organization Type	Address	City	CPG Number	Capacity kW
Hydro	Hydropower	Business		Highgate		9400
Solar	Ground-mounted PV: Fixed Rack	Residential	1797 Gore Road	Highgate		10
Solar	Ground-mounted PV: Pole	Residential	73 Frontage Rd	Highgate	3772	11
Solar	Ground-mounted PV: Pole	Residential	3276 Rice Hill Rd	Highgate	3731	6.8
Solar	Ground-mounted PV: Pole	Residential	1862 Highgate Road	Highgate	16-0096	6
Solar	Ground-mounted PV: Fixed Rack	Residential	1400 Frontage Road	Highgate	16-0014	500
Solar	Roof-Mounted PV	Residential	548 Frontage Rd	Highgate	3844	6.38
Solar	Roof-Mounted PV	Residential	145 St. Armand Rd	Highgate	3583	4.6
Solar	Roof-Mounted PV	Residential	1759 Morey Rd	Highgate	6100	10.3
Solar	Roof-Mounted PV	Residential	53 Homestead Lane	Highgate	5361	5
Solar	Roof-Mounted PV	Residential	388 Ballard Road	Highgate		7.6
Solar	Roof-Mounted PV	Residential	7473 Vt Route 78	Highgate	5392	7
Solar	Roof-Mounted PV	Residential	3308 Gore Rd	Highgate	3799	6
Solar	Roof-Mounted PV	Residential	7735 VT RTE 78	Highgate	5769	6
Solar	Roof-Mounted PV	Residential	1427 VT Rt 78	Highgate	3803	3.8
Solar	Roof-Mounted PV	Residential	3948 VT-78	Highgate	7230	7.6

Municipal Analysis & Targets - Isle La Motte

The following is an explanation of the municipal energy data compiled by Northwest Regional Planning Commission (NRPC). The intent of the municipal energy data is to provide the municipalities with data required to ensure compliance with the requirements of Act 174 and "Enhanced Energy Planning" (24 V.S.A. 4352). The following tables contain data that estimates current energy use and provides targets for future energy use across all sectors (transportation, heating, and electricity). It also sets targets for renewable energy generation within the municipality.

This data is meant to be a starting point for the municipality to begin planning its energy future and to talk about the changes that may need to occur within the municipality to ensure that local, regional and state energy goals are met. This includes the State of Vermont's goal to have 90% of all energy demand be met from renewable sources by 2050.

Figure 1 - Data Sources

ACS – American Community Survey

DOL –Vermont Department of Labor

DPS – Vermont Department of Public Service

EIA – Energy Information Administration

EVT – Efficiency Vermont

LEAP – Long-Range Energy Alternatives Planning

VEIC – Vermont Energy Investment Corporation

VTrans – Vermont Agency of Transportation

Data Sources

Estimates of current energy use consist primarily of data available from the American Community Survey (ACS), the Vermont Agency of Transportation (VTrans), the Vermont Department of Labor (DOL), and the Vermont Department of Public Service (DPS). Targets for future energy use are reliant upon the Long-range Energy Alternatives Planning (LEAP) analysis for the region completed the Vermont Energy Investment Corporation (VEIC). Targets for future energy generation have come from the regional planning commission and DPS. For more information on LEAP, see the Northwest Regional Energy Plan (www.nrpcvt.com). Targets for both future energy use and energy generation have been generally developed using a "top down" method of disaggregating regional data to the municipal level.

It is possible to develop "bottom up" data. For those municipalities interested in that approach, please see the Department of Public Service's Analysis and Targets Guidance (http://publicservice.vermont.gov/content/act-174-recommendations-and-determination-standards).

Please remember that the targets established by LEAP represent only one way to achieve energy goals. There may several other similar pathways that a municipality may choose to take in order to meet the 90x50 goal.

Below is a worksheet by worksheet explanation of the Municipal Template spreadsheet:

1. Municipal Data Summary

The following tables summarize all data that is required to be in a municipal plan if the plan is to meet the "determination" standards established by the Vermont Department of Public Service.

Table 1A: Current Municipal Transportation Energy Use

Transportation Data	Municipal Data
Total # of Passenger Vehicles (ACS 2011-2015)	419
Average Miles per Vehicle (Vtrans)	11,356
Total Miles Traveled	4,758,164
Realized MPG (2013 - VTrans 2015 Energy Profile)	18.6
Total Gallons Use per Year	255,815
Transportation BTUs (Billion)	31
Average Cost per Gallon of Gasoline (RPC)	2.31
Gasoline Cost per Year	590,933

This table uses data from the American Community Survey (ACS) and Vermont Agency of Transportation (VTrans) to calculate current transportation energy use and energy costs in the municipality.

Table 1B: Current Municipal Residential Heating Energy Use

Fuel Source	Municipal Households (ACS 2011-2015)	% of Municipal Households	Municipal Square Footage Heated	Municipal BTU (in Billions)
Natural Gas	3	1.4%	5,712	0
Propane	49	22.5%	88,368	5
Electricity	12	5.5%	20,736	1
Fuel Oil	100	45.9%	190,400	11
Coal	0	0.0%	0	0
Wood	52	23.9%	86,336	5
Solar	0	0.0%	0	0
Other	0	0.0%	0	0
No Fuel	2	0.9%	3,808	0
Total	218	100.0%	395,360	24

This table displays data from the ACS that estimates current municipal residential heating energy use.

Table 1C: Current Municipal Commercial Energy Use

	Commercial Establishments in Municipality (VT DOL)	Estimated Thermal Energy BTUs per Commercial Establishment (in Billions) (VDPS)	Estimated Thermal Energy BTUs by Commercial Establishments in Municipality (in Billions)
Municipal Commercial Energy Use	12	0.725	9

The table uses data available from the Vermont Department of Labor (VT DOL) and the Vermont Department of Public Service (DPS) to estimate current municipal commercial establishment energy use in the municipality.

Table 1D: Current Electricity Use

Use Sector	Current Electricity Use
Residential (kWh)	1,959,677
Commercial and Industrial (kWh)	3,078,879
Total (kWh)	5,038,555

This table displays current electricity use within the municipality. This data is available from Efficiency Vermont (EVT).

Table 1E: Residential Thermal Efficiency Targets

	2025	2035	2050
"Residential - Increased Efficiency and Conservation (% of municipal households to be weatherized)"	5%	16%	78%

This table displays targets for thermal efficiency of residential structures. The data is based on a methodology developed by DPS using data available from the regional Long-range Energy Alternatives Planning (LEAP) analysis and ACS. The data in this table represents the percentage of municipal households that will need to be weatherized in the target years. The target is cumulative.

Table 1F: Commercial Thermal Efficiency Target

	2025	2035	2050
"Commercial - Increased Efficiency and Conservation (% of commercial establishments to be weatherized)"	25%	25%	73%

This table shows the same information as Table 1E, but sets a target for commercial thermal efficiency and weatherization. Information from the VT DOL is required to complete this target. The target is cumulative.

Table 1G: Thermal Fuel Switching (Residential and Commercial) – Wood Systems

	2025	2035	2050
New Efficient Wood Heat Systems (in units)	-1	-2	1

This table provides a target for new wood heating systems for residential and commercial structures in the municipality for each target year. This target was calculated using data from LEAP and ACS. The target is cumulative.

Table 1H: Thermal Fuel Switching (Residential and Commercial) – Heat Pumps

	2025	2035	2050
New Heat Pumps (in units)	26	60	112

This table provides a target for new heat pump systems for residential and commercial structures in the municipality for each target year. This target was calculated using data from LEAP and ACS. The target is cumulative.

Table 1I: Electricity Efficiency Targets

	2025	2035	2050
Increase Efficiency and Conservation (BTUs)	25.2%	48.3%	100.7%

Data in this table displays a target for increased electricity efficiency and conservation during the target years. This target will be met through conversions to high efficiency appliances, electric heat pumps, and electric light-duty vehicles. These targets were developed using regional LEAP analysis. The target is cumulative.

Table 1J: Use of Renewables – Transportation

	2025	2035	2050
Renewable Energy Use - Transportation (BTUs)	10.7%	33.1%	90.9%

This data displays targets for the percentage of transportation energy use coming from renewable sources during each target year. This target will be met through conversions to electric light-duty vehicles and biodiesel heavy-duty vehicles. This data was developed using the LEAP analysis. The target is cumulative.

Table 1K: Use of Renewables – Heating

	2025	2035	2050
Renewable Energy Use - Heating (BTUs)	45.0%	58.2%	86.1%

This data displays targets for the percentage of heating energy use coming from renewable sources during each target year. This target will be met through conversions to electric heat pumps and high efficiency wood heating systems. This data was developed using information from the LEAP analysis. The target is cumulative.

Table 1L: Use of Renewables – Electricity

	2025	2035	2050
Renewable Energy Use - Electricity (MWh)	1,969.0	3,938.0	5,966.6

This data displays targets for MWh of electricity generation coming from renewable sources within the municipality during each target year. This data was developed using information from the regional planning commission and DPS. This data is the same as the data in Table 1Q. The target is cumulative.

Table 1M: Transportation Fuel Switching Targets – Electric Vehicles

	2025	2035	2050
Electric Vehicles	37	275	653

This tables displays a target for switching from fossil fuel based vehicles (gasoline and diesel) to electric vehicles. This target is calculated using LEAP and ACS data. The target is cumulative.

Table 1N: Transportation Fuel Switching Targets – Biodiesel

	2025	2035	2050
Biodiesel Vehicles	77	153	296

This tables displays a target for switching from fossil fuel based vehicles to biodiesel-powered vehicles. This target is calculated using LEAP and ACS data. The target is cumulative.

Table 1O: Existing Renewable Generation

Renewable Type	MW	MWh
Solar	0.08	98.11
Wind	0.00	0.00
Hydro	0.00	0.00
Biomass	0.00	0.00
Other	0.00	0.00
Total Existing Generation	0.08	98.11

Table 1O shows existing renewable generation in the municipality, in MW and MWh, based on information available from the Vermont Department of Public Service.

Table 1P: Renewable Generation Potential

Renewable Type	MW	MWh
Rooftop Solar	0	341
Ground-mounted Solar	204	250,504
Wind	272	833,883
Hydro	0	0
Biomass and Methane	0	0
Other	0	0
Total Renewable Generation Potential	477	1,084,728

Renewable generation potential is based on mapping completed by the regional planning commission that is based on the Municipal Determination Standards and associated guidance documents developed by DPS. The renewable generation potential is expressed in MW and MWh by the type of renewable resource (solar, wind, hydro, etc.).

Table 1Q: Renewable Generation Targets

	2025	2035	2050
Total Renewable Generation Target (in MWh)	1,968.99	3,937.98	5,966.64

This data displays targets for MWh of electricity generation coming from renewable sources within the municipality during each target year. This data was developed using information from the regional planning commission and DPS. This data is the same as the data in Table 1L.

Table 1R: Sufficient Land?

	Y/N
Solar	Y
Wind	Y

This table shows whether or not there is sufficient land in the municipality to meet the renewable generation targets based on the renewable generation potential in the municipality.

Utility Service Areas

Isle La Motte, Vermont
Act 174
The Energy Development Improvement Act of 2016

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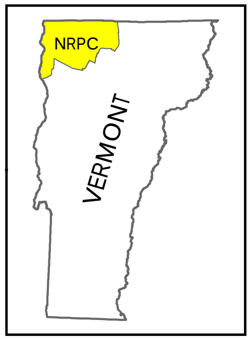

N

Legend

Utility Service Area Features

- Green Mountain Power
- Swanton Village Electric
- Vermont Electric Co-op
- Enosburg Falls Electric
- Substation
- 3 Phase Power Line
- Transmission Line

Sources: VCGI
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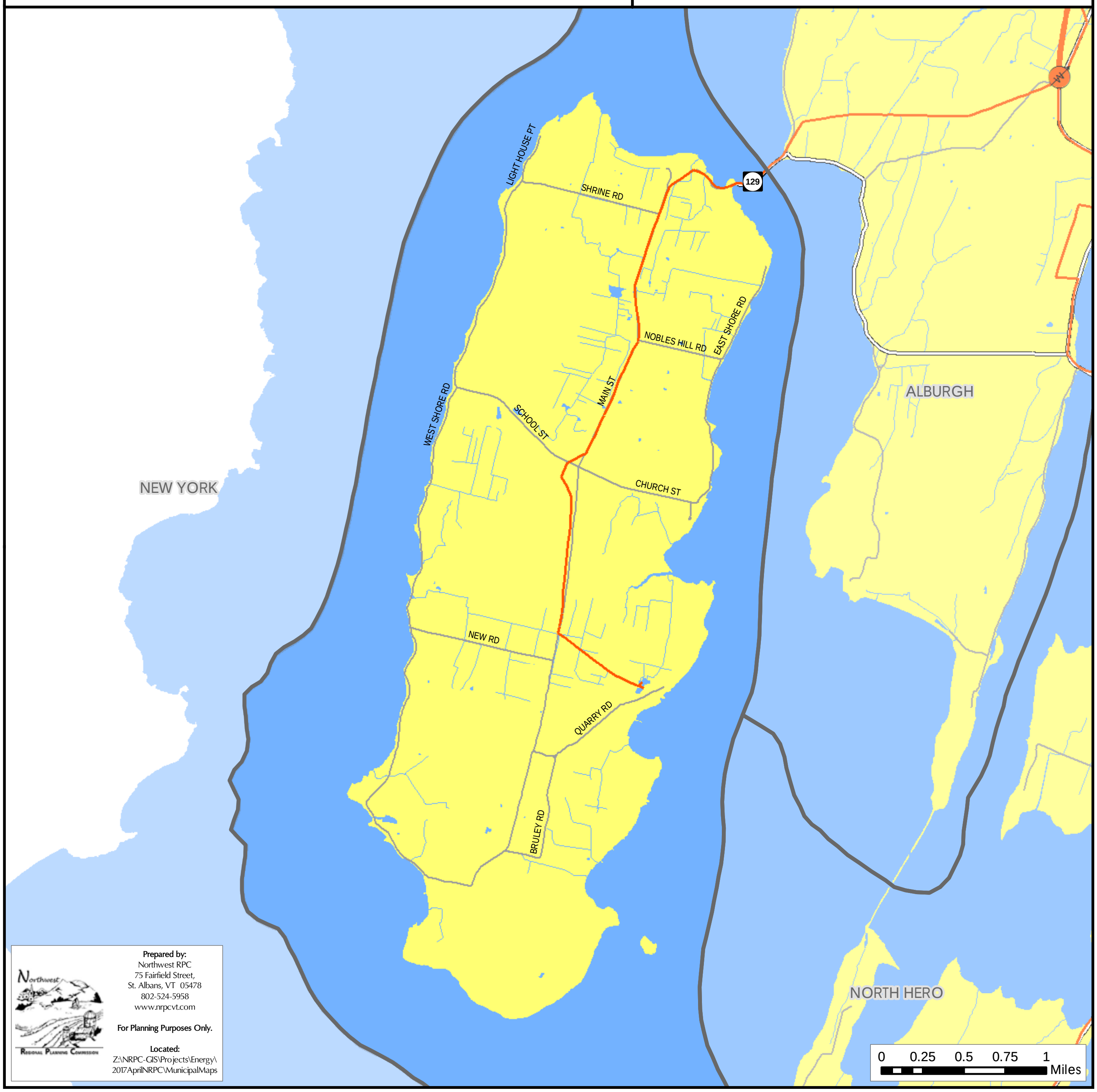

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Transmission & 3 Phase Power Infrastructure

Isle La Motte, Vermont
Act 174
The Energy Development Improvement Act of 2016

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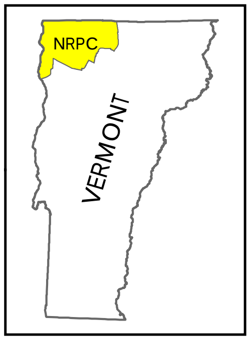

Legend

- Substation
- 3 Phase Power Line
- Transmission Line
- 1/2 Mile Buffer (3 Phase Power Line & Transmission Line)

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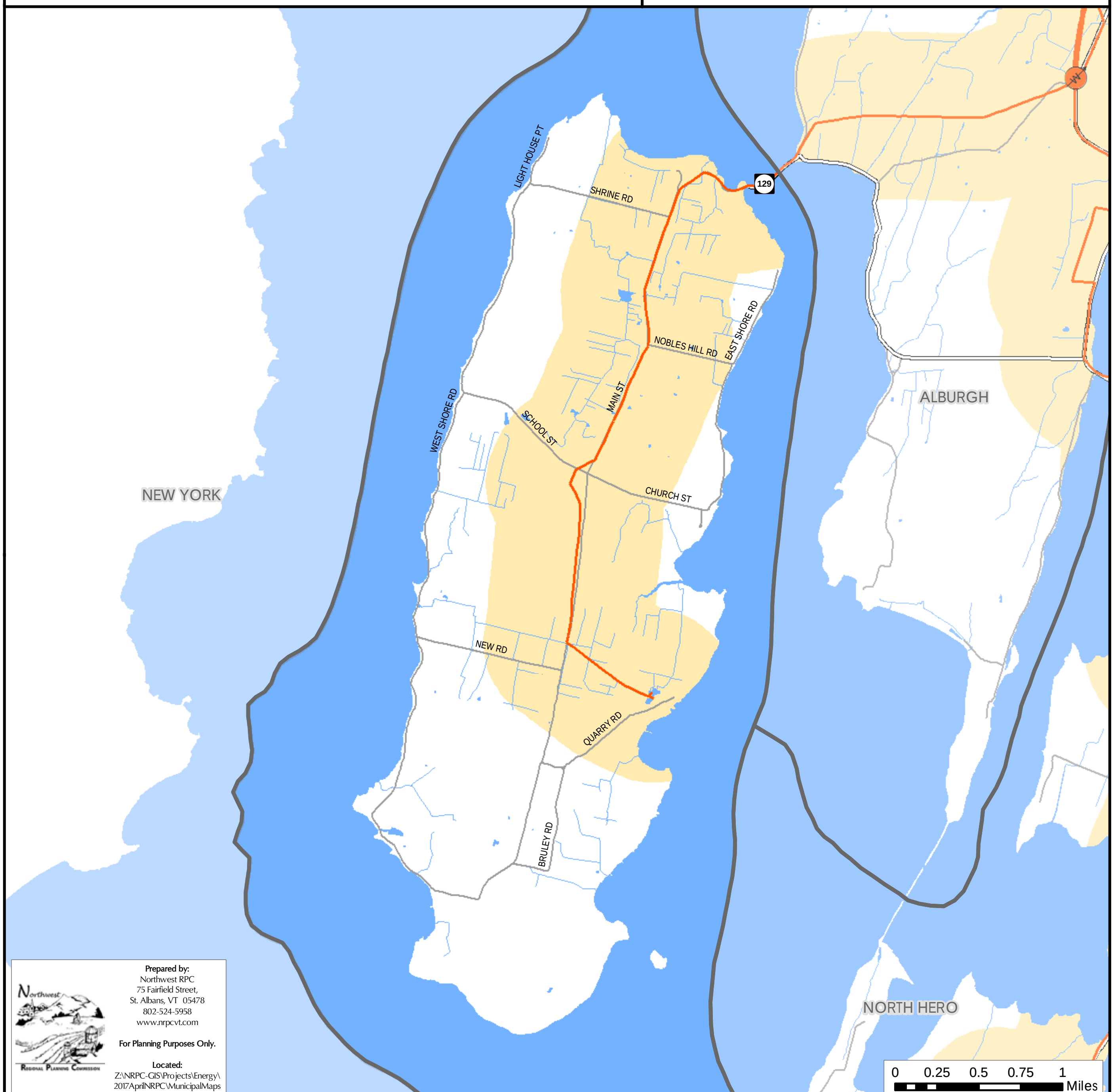

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Existing Generation Facilities

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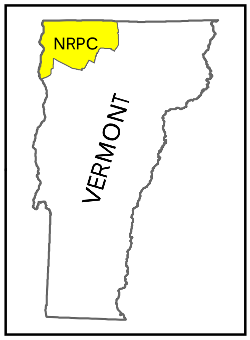

Legend

- Biomass Facility
- Hydro Facility
- Solar Facility
- Wind Facility

Note: Only generators 15kW are shown on the map. A full list of all generators is available.

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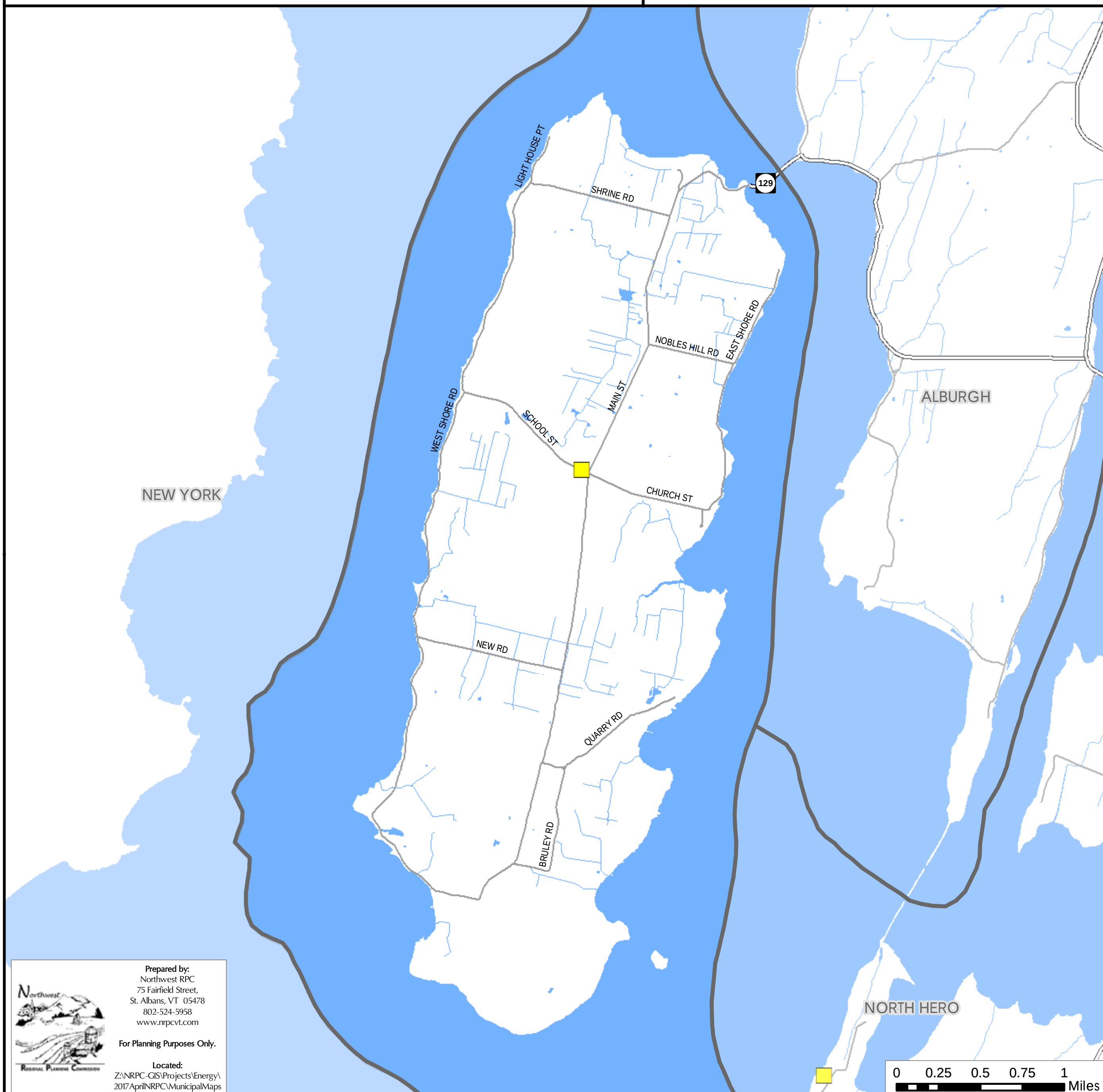

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Hydro

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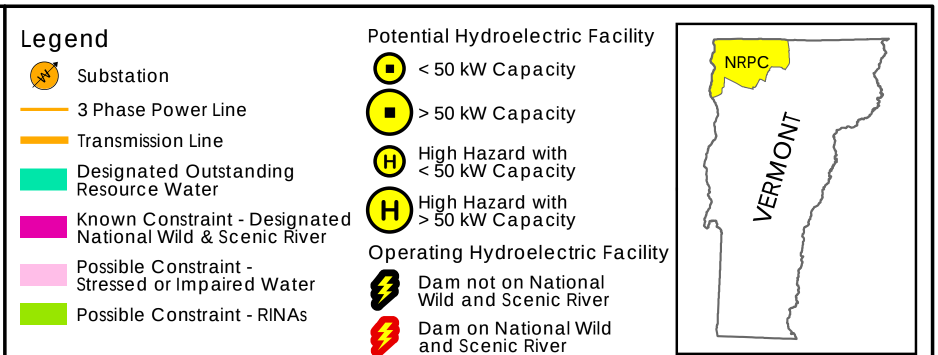

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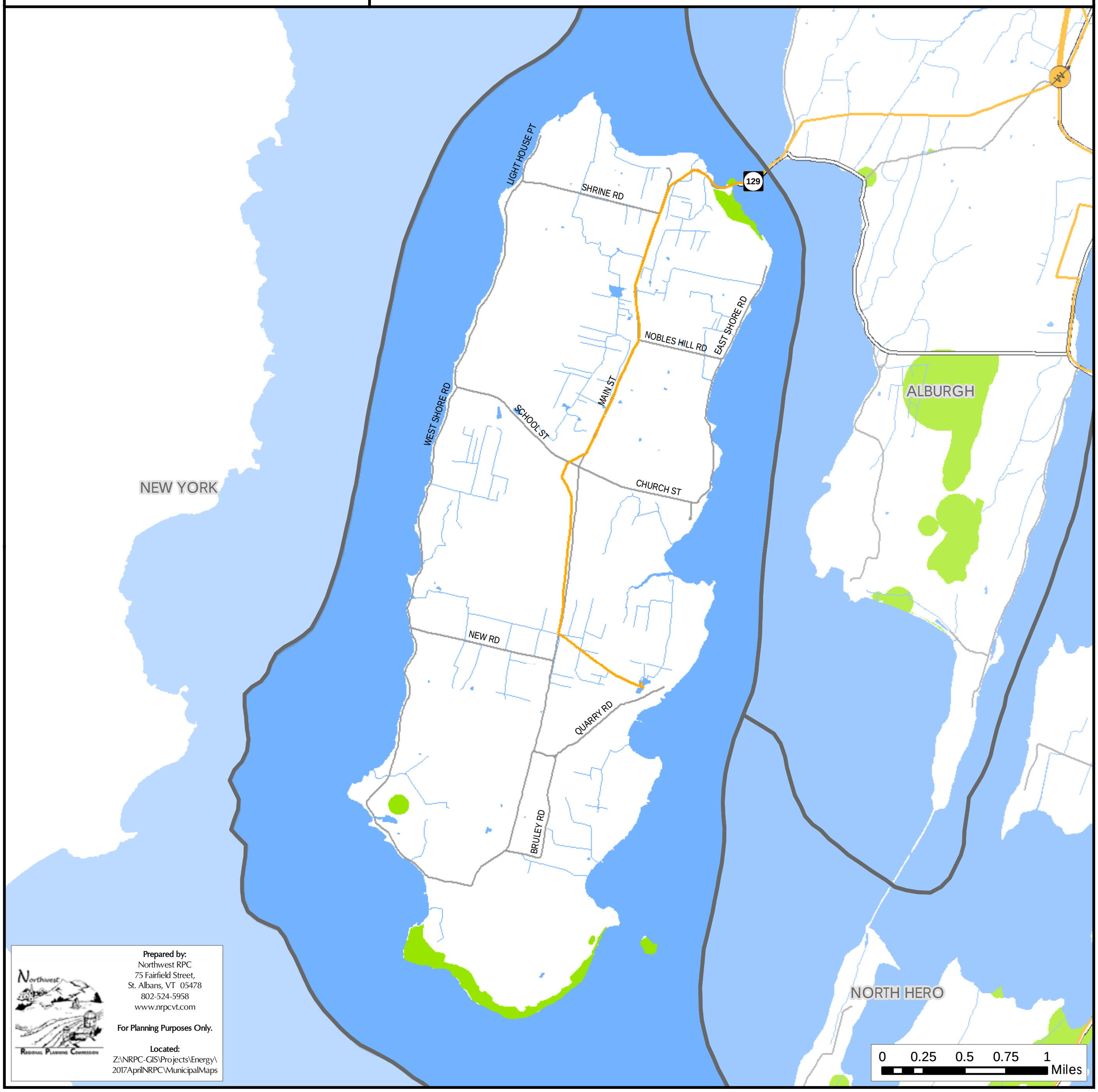

Solar

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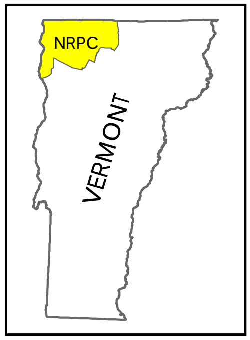

Legend

- Substation
- 3 Phase Power Line
- Transmission Line
- 1/2 Mile Buffer (3 Phase Power Line & Transmission Line)
- Prime Solar/No Known Constraints
- Base Solar/Possible Constraints

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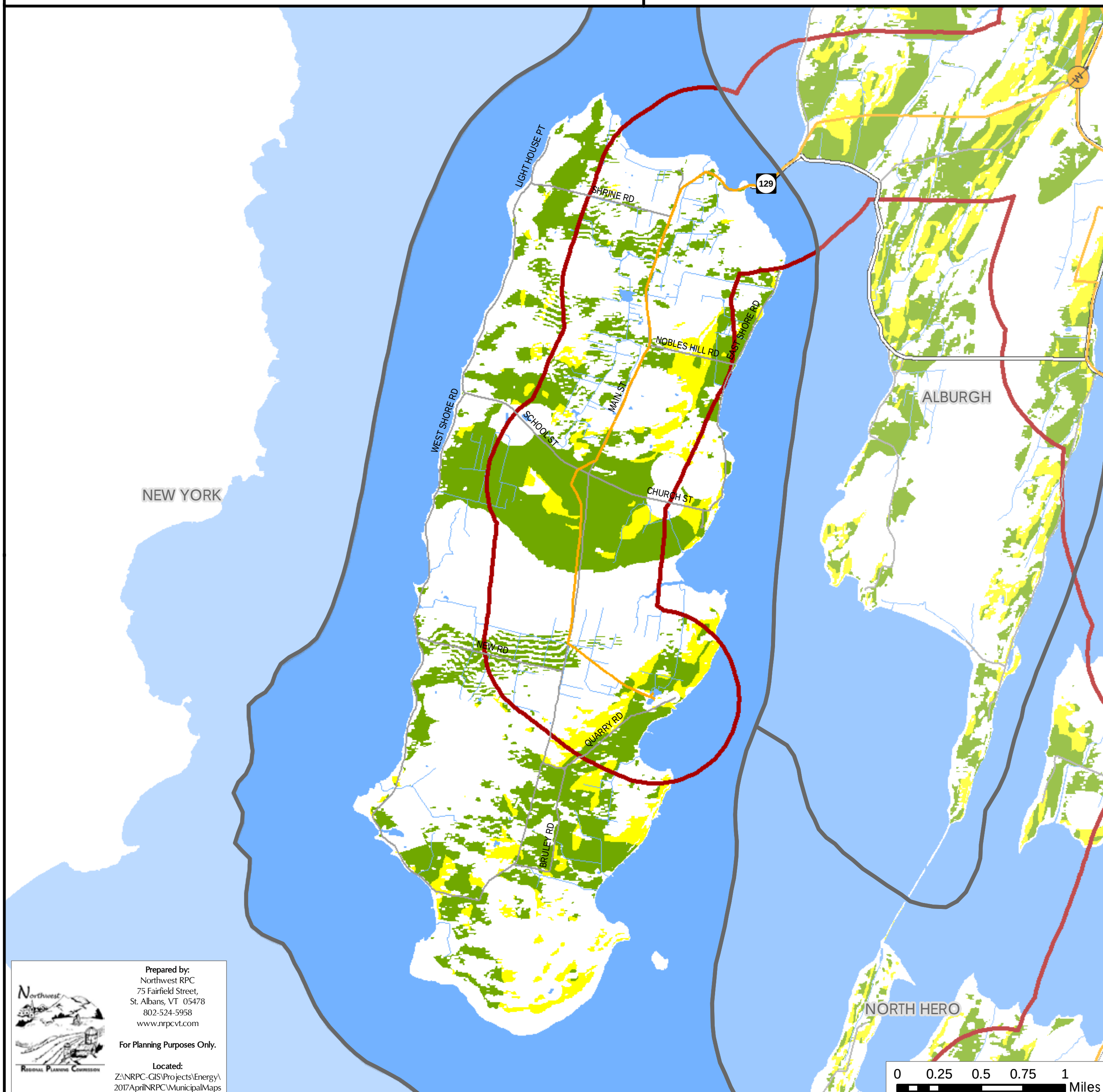

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Wind

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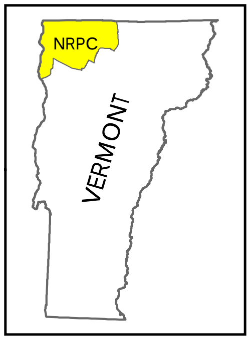
N



Legend

- Substation
- 3 Phase Power Line
- Transmission Line
- Prime Wind
  Areas of high wind potential and no known constraints.
  Darker areas have higher wind speeds.
- Base Wind
  Areas of high wind potential and a presence of possible constraints.
  Darker areas have higher wind speeds.

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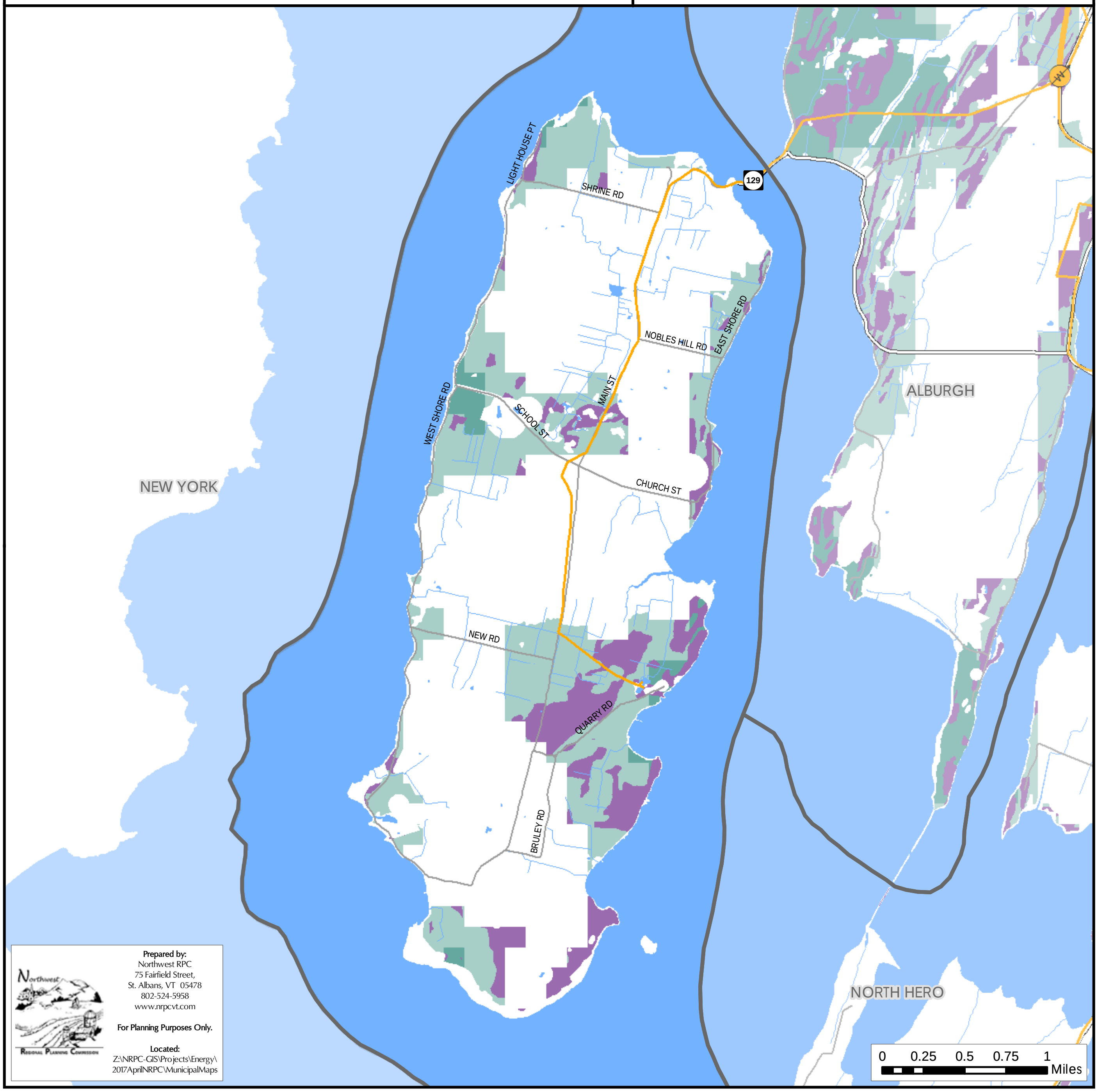

Woody Biomass

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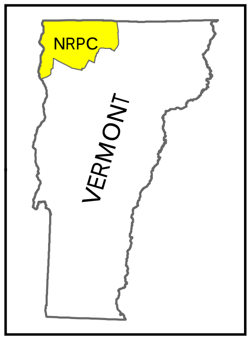

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All Generators in Municipality

Category	Sub - Category	Organization Type	Address	City	CPG Number	Capacity kW
Solar	Ground-mounted PV: Fixed Rack	Residential	383 Church St	Isle La Motte	7207	10
Solar	Hot Water	Residential	241 N Point Rd	Isle La Motte		
Solar	Roof-Mounted PV	Residential	598 New Rd	Isle La Motte	5644	10
Solar	Roof-Mounted PV	Institution	42 School St	Isle La Motte	2502	47.2
Solar	Roof-Mounted PV	Residential	1553 W Shore Rd	Isle La Motte	6205	4
Solar	Roof-Mounted PV	Residential	2430 Main Street	Isle La Motte	7274	5
Solar	Roof-Mounted PV	Residential	320 New Rd	Isle La Motte	7293	6

Municipal Analysis & Targets - Montgomery

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Table 1A: Current Municipal Transportation Energy Use

Transportation Data	Municipal Data
Total # of Passenger Vehicles (ACS 2011-2015)	857
Average Miles per Vehicle (Vtrans)	11,356
Total Miles Traveled	9,732,092
Realized MPG (2013 - VTrans 2015 Energy Profile)	18.6
Total Gallons Use per Year	523,231
Transportation BTUs (Billion)	63
Average Cost per Gallon of Gasoline (RPC)	2.31
Gasoline Cost per Year	1,208,663

This table uses data from the American Community Survey (ACS) and Vermont Agency of Transportation (VTrans) to calculate current transportation energy use and energy costs in the municipality.

Table 1B: Current Municipal Residential Heating Energy Use

Fuel Source	Municipal Households (ACS 2011-2015)	% of Municipal Households	Municipal Square Footage Heated	Municipal BTU (in Billions)
Natural Gas	0	0.0%	0	0
Propane	93	20.8%	155,248	9
Electricity	0	0.0%	0	0
Fuel Oil	189	42.2%	308,464	19
Coal	0	0.0%	0	0
Wood	166	37.1%	299,872	18
Solar	0	0.0%	0	0
Other	0	0.0%	0	0
No Fuel	0	0.0%	0	0
Total	448	100.0%	763,584	46

This table displays data from the ACS that estimates current municipal residential heating energy use.

Table 1C: Current Municipal Commercial Energy Use

	Commercial Establishments in Municipality (VT DOL)	Estimated Thermal Energy BTUs per Commercial Establishment (in Billions) (VDPS)	Estimated Thermal Energy BTUs by Commercial Establishments in Municipality (in Billions)
Municipal Commercial Energy Use	27	0.725	20

The table uses data available from the Vermont Department of Labor (VT DOL) and the Vermont Department of Public Service (DPS) to estimate current municipal commercial establishment energy use in the municipality.

Table 1D: Current Electricity Use

Use Sector	Current Electricity Use
Residential (kWh)	4,027,225
Commercial and Industrial (kWh)	6,927,477
Total (kWh)	10,954,703

This table displays current electricity use within the municipality. This data is available from Efficiency Vermont (EVT).

Table 1E: Residential Thermal Efficiency Targets

	2025	2035	2050
"Residential - Increased Efficiency and Conservation (% of municipal households to be weatherized)"	5%	16%	78%

This table displays targets for thermal efficiency of residential structures. The data is based on a methodology developed by DPS using data available from the regional Long-range Energy Alternatives Planning (LEAP) analysis and ACS. The data in this table represents the percentage of municipal households that will need to be weatherized in the target years. The target is cumulative.

Table 1F: Commercial Thermal Efficiency Target

	2025	2035	2050
"Commercial - Increased Efficiency and Conservation (% of commercial establishments to be weatherized)"	25%	25%	73%

This table shows the same information as Table 1E, but sets a target for commercial thermal efficiency and weatherization. Information from the VT DOL is required to complete this target. The target is cumulative.

Table 1G: Thermal Fuel Switching (Residential and Commercial) – Wood Systems

	2025	2035	2050
New Efficient Wood Heat Systems (in units)	-1	-5	3

This table provides a target for new wood heating systems for residential and commercial structures in the municipality for each target year. This target was calculated using data from LEAP and ACS. The target is cumulative.

Table 1H: Thermal Fuel Switching (Residential and Commercial) – Heat Pumps

	2025	2035	2050
New Heat Pumps (in units)	54	123	230

This table provides a target for new heat pump systems for residential and commercial structures in the municipality for each target year. This target was calculated using data from LEAP and ACS. The target is cumulative.

Table 1I: Electricity Efficiency Targets

	2025	2035	2050
Increase Efficiency and Conservation (BTUs)	25.2%	48.3%	100.7%

Data in this table displays a target for increased electricity efficiency and conservation during the target years. This target will be met through conversions to high efficiency appliances, electric heat pumps, and electric light-duty vehicles. These targets were developed using regional LEAP analysis. The target is cumulative.

Table 1J: Use of Renewables – Transportation

	2025	2035	2050
Renewable Energy Use - Transportation (BTUs)	11.0%	33.6%	91.1%

This data displays targets for the percentage of transportation energy use coming from renewable sources during each target year. This target will be met through conversions to electric light-duty vehicles and biodiesel heavy-duty vehicles. This data was developed using the LEAP analysis. The target is cumulative.

Table 1K: Use of Renewables – Heating

	2025	2035	2050
Renewable Energy Use - Heating (BTUs)	44.8%	58.0%	85.8%

This data displays targets for the percentage of heating energy use coming from renewable sources during each target year. This target will be met through conversions to electric heat pumps and high efficiency wood heating systems. This data was developed using information from the LEAP analysis. The target is cumulative.

Table 1L: Use of Renewables – Electricity

	2025	2035	2050
Renewable Energy Use - Electricity (MWh)	3,073.3	6,146.5	9,312.9

This data displays targets for MWh of electricity generation coming from renewable sources within the municipality during each target year. This data was developed using information from the regional planning commission and DPS. This data is the same as the data in Table 1Q. The target is cumulative.

Table 1M: Transportation Fuel Switching Targets – Electric Vehicles

	2025	2035	2050
Electric Vehicles	75	562	1336

This tables displays a target for switching from fossil fuel based vehicles (gasoline and diesel) to electric vehicles. This target is calculated using LEAP and ACS data. The target is cumulative.

Table 1N: Transportation Fuel Switching Targets – Biodiesel

	2025	2035	2050
Biodiesel Vehicles	165	330	638

This tables displays a target for switching from fossil fuel based vehicles to biodiesel-powered vehicles. This target is calculated using LEAP and ACS data. The target is cumulative.

Table 1O: Existing Renewable Generation

Renewable Type	MW	MWh
Solar	0.07	85.85
Wind	0.00	0.00
Hydro	0.00	0.00
Biomass	0.00	0.00
Other	0.00	0.00
Total Existing Generation	0.07	85.85

Table 1O shows existing renewable generation in the municipality, in MW and MWh, based on information available from the Vermont Department of Public Service.

Table 1P: Renewable Generation Potential

Renewable Type	MW	MWh
Rooftop Solar	1	715
Ground-mounted Solar	231	282,738
Wind	38	117,451
Hydro	0	0
Biomass and Methane	0	0
Other	0	0
Total Renewable Generation Potential	269	400,904

Renewable generation potential is based on mapping completed by the regional planning commission that is based on the Municipal Determination Standards and associated guidance documents developed by DPS. The renewable generation potential is expressed in MW and MWh by the type of renewable resource (solar, wind, hydro, etc.).

Table 1Q: Renewable Generation Targets

	2025	2035	2050
Total Renewable Generation Target (in MWh)	3,073.25	6,146.50	9,312.88

This data displays targets for MWh of electricity generation coming from renewable sources within the municipality during each target year. This data was developed using information from the regional planning commission and DPS. This data is the same as the data in Table 1L.

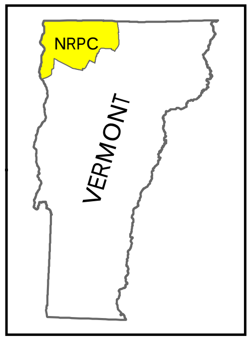
Table 1R: Sufficient Land?

	Y/N
Solar	Y
Wind	Y

This table shows whether or not there is sufficient land in the municipality to meet the renewable generation targets based on the renewable generation potential in the municipality.

Utility Service Areas

Montgomery, Vermont
Act 174
The Energy Development Improvement Act of 2016



This map and the corresponding data is intended to be used to inform energy planning efforts by municipalities and regions. This may also be used for conceptual planning or initial site identification by those interested in developing renewable energy infrastructure. The maps do NOT take the place of site-specific investigation for a proposed facility and cannot be used of as "siting maps."

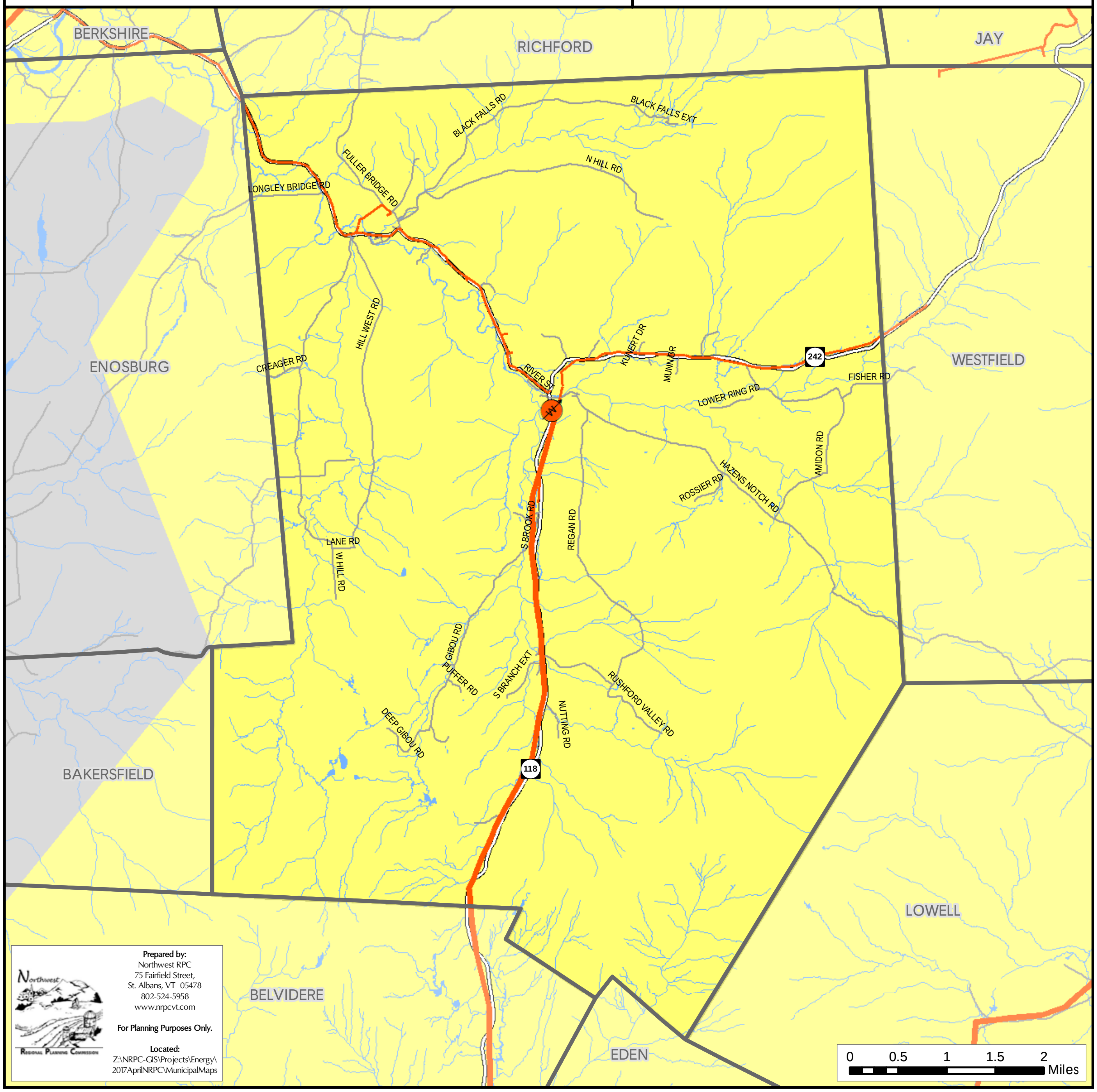
N

Legend

Utility Service Area Features

- Green Mountain Power
- Swanton Village Electric
- Vermont Electric Co-op
- Enosburg Falls Electric
- Substation
- 3 Phase Power Line
- Transmission Line

Sources: VCGI
Disclaimer: The accuracy of information presented is determined by its sources. Errors and omissions may exist. The Northwest RPC is not responsible for these. Questions of on-the-ground location can be resolved by site inspections and/or surveys by a registered surveyor. This map is not sufficient for delineation of features on-the-ground. This map identifies the presence of features, and may indicate relationships between features, but is not a replacement for surveyed information or engineering studies.



Prepared by:
Northwest RPC
75 Fairfield Street,
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For Planning Purposes Only.

Located:
Z:\NRPC-GIS\Projects\Energy\2017April\NRPC\MunicipalMaps

Transmission & 3 Phase Power Infrastructure

Montgomery, Vermont
Act 174
The Energy Development Improvement Act of 2016

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Legend

- Substation
- 3 Phase Power Line
- Transmission Line
- 1/2 Mile Buffer (3 Phase Power Line & Transmission Line)

Sources: VCGI
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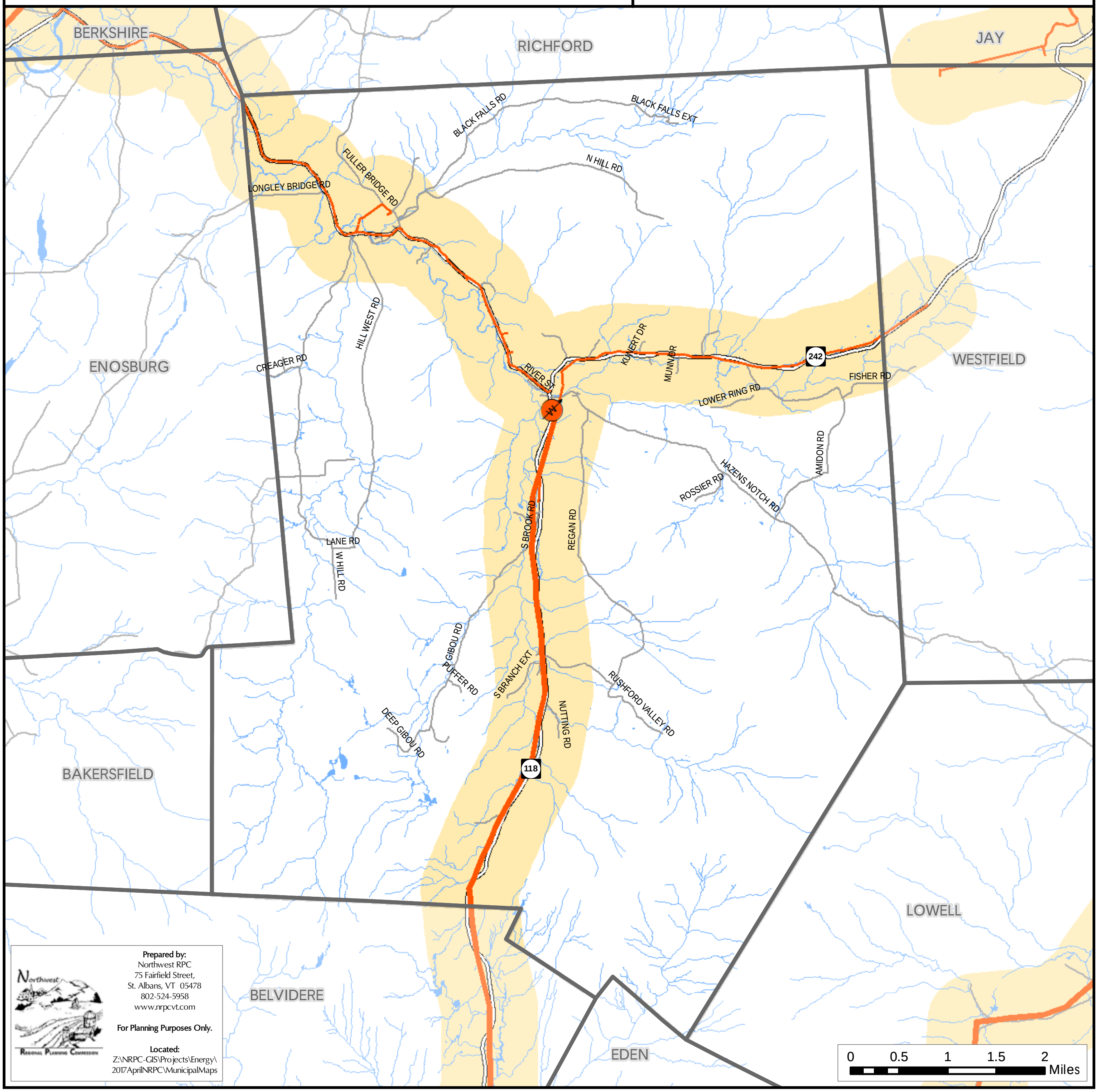

Existing Generation Facilities

Montgomery, Vermont
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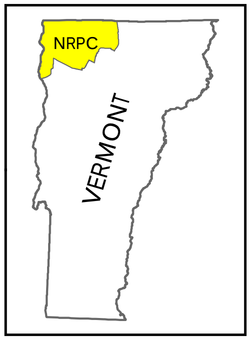

Legend

- Biomass Facility
- Hydro Facility
- Solar Facility
- Wind Facility

Note: Only generators 15kW are shown on the map. A full list of all generators is available.

Sources: VCGI
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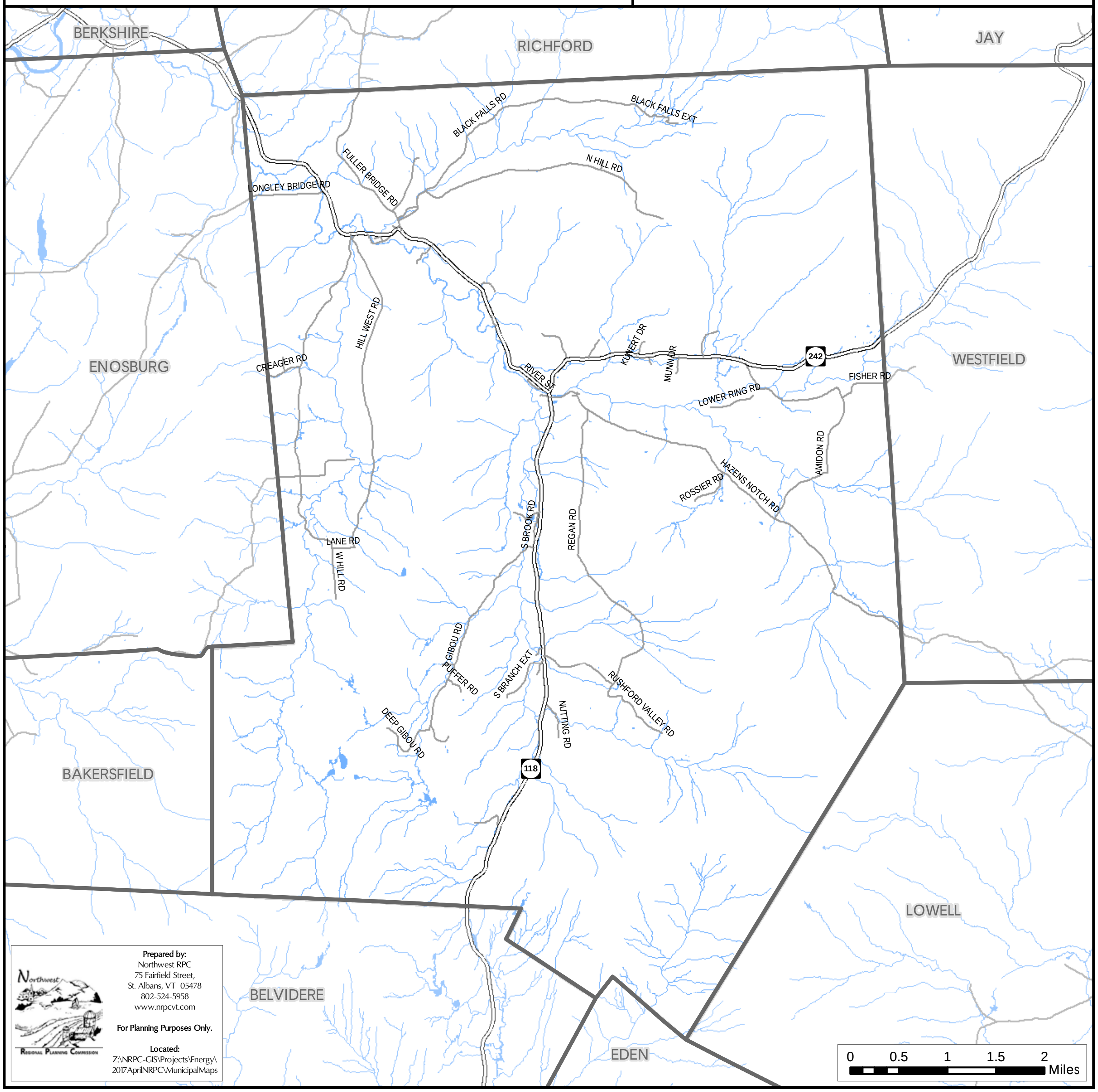

Hydro

Montgomery, Vermont
Act 174
The Energy Development Improvement Act of 2016

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N

Legend

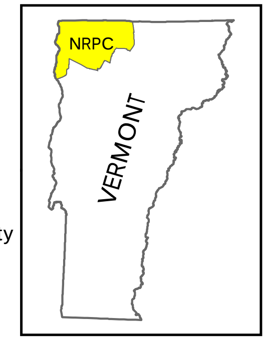
- Substation
- 3 Phase Power Line
- Transmission Line
- Designated Outstanding Resource Water
- Known Constraint - Designated National Wild & Scenic River
- Possible Constraint - Stressed or Impaired Water
- Possible Constraint - RINAs

Potential Hydroelectric Facility

- < 50 kW Capacity
- > 50 kW Capacity
- High Hazard with < 50 kW Capacity
- High Hazard with > 50 kW Capacity

Operating Hydroelectric Facility

- Dam not on National Wild and Scenic River
- Dam on National Wild and Scenic River



Sources: VCGI

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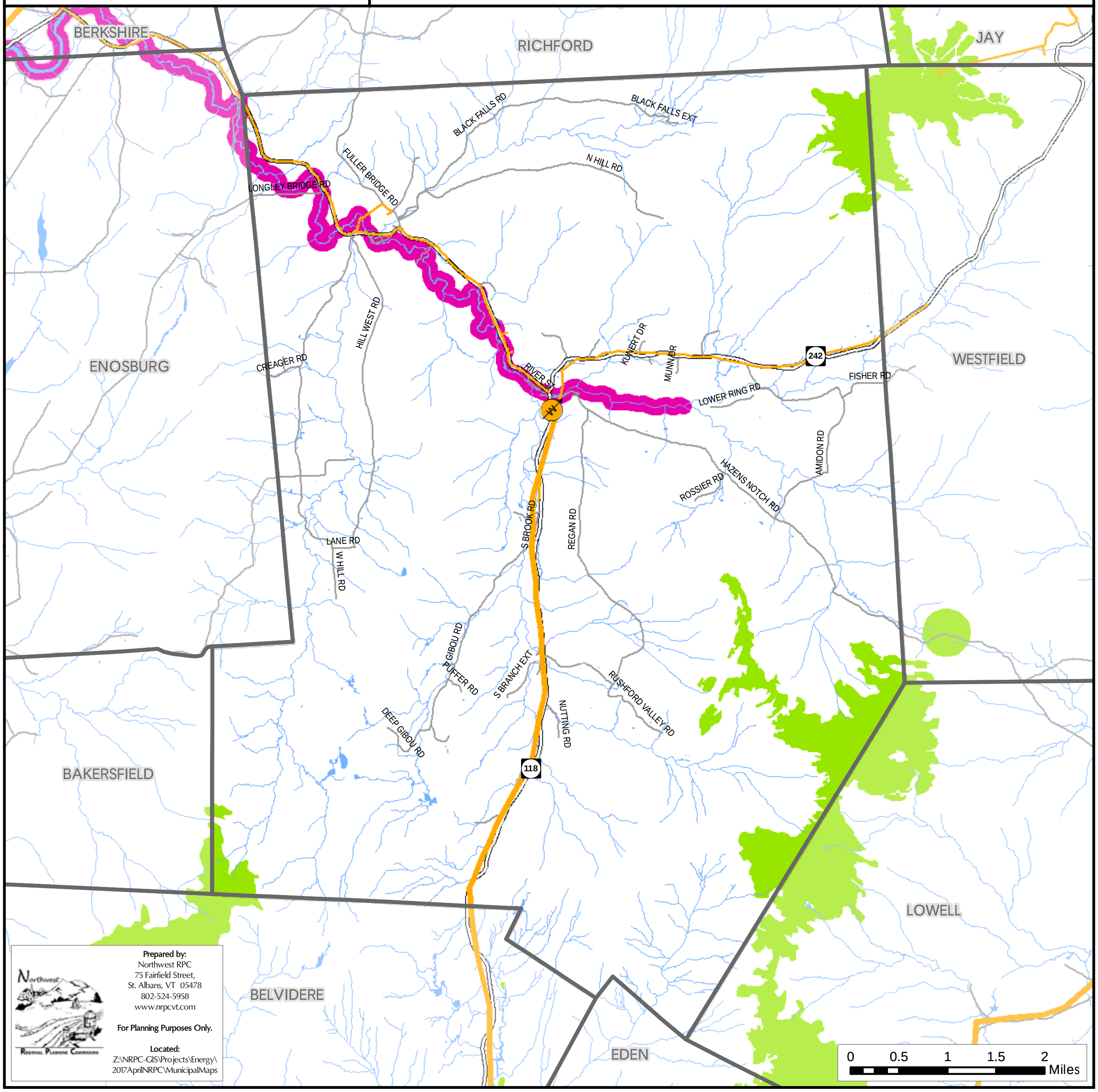

Solar

Montgomery, Vermont
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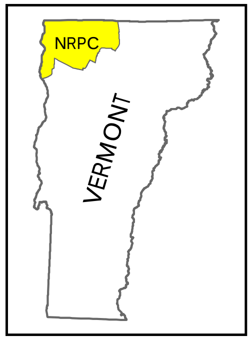
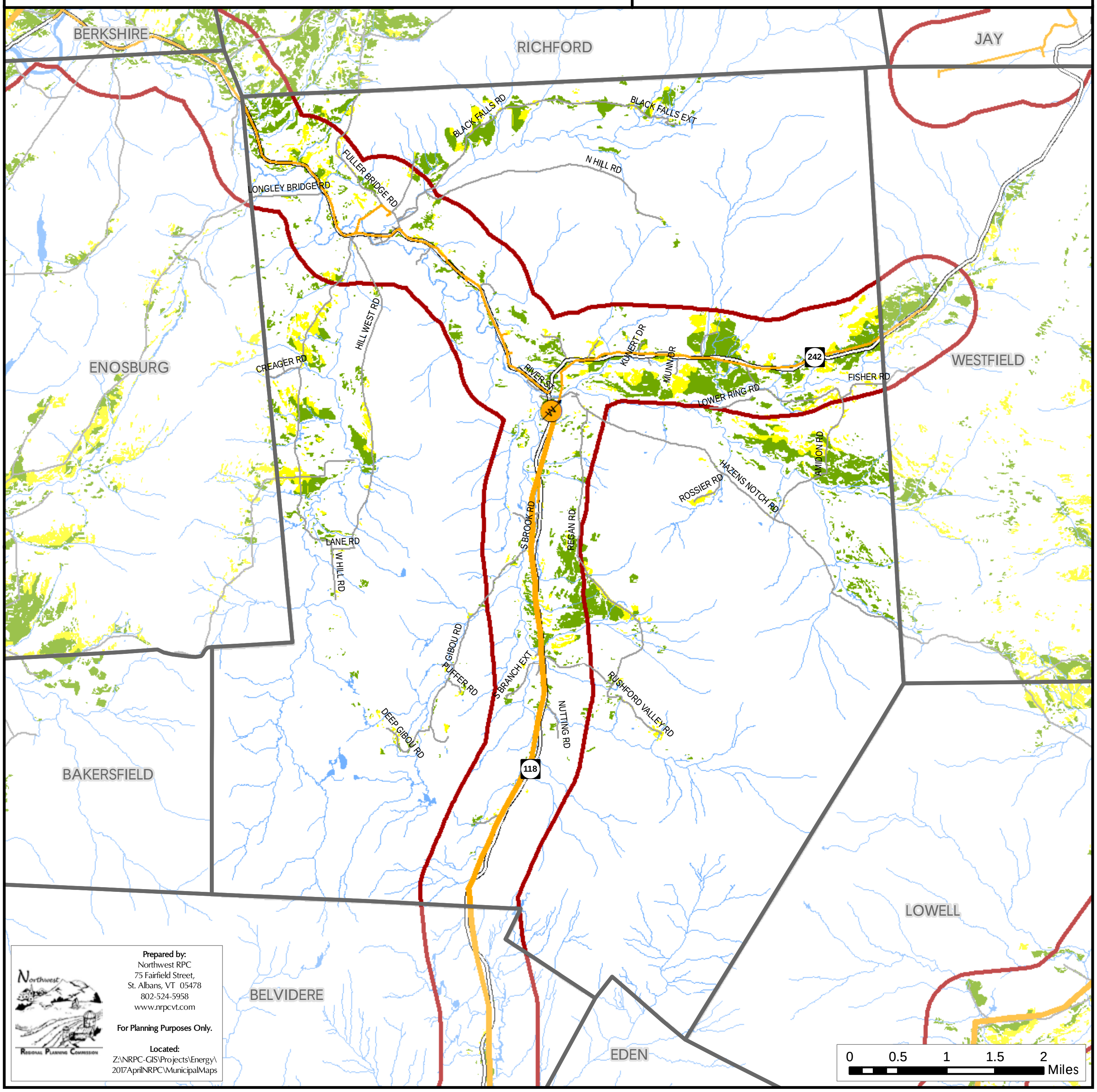
N



Legend

- Substation
- 3 Phase Power Line
- Transmission Line
- 1/2 Mile Buffer (3 Phase Power Line & Transmission Line)
- Prime Solar/No Known Constraints
- Base Solar/Possible Constraints

Sources: VCGI
Disclaimer: The accuracy of information presented is determined by its sources. Errors and omissions may exist. The Northwest RPC is not responsible for these. Questions of on-the-ground location can be resolved by site inspections and/or surveys by a registered surveyor. This map is not sufficient for delineation of features on-the-ground. This map identifies the presence of features, and may indicate relationships between features, but is not a replacement for surveyed information or engineering studies.



Wind

Montgomery, Vermont
Act 174
The Energy Development Improvement Act of 2016

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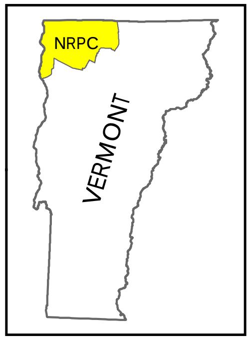
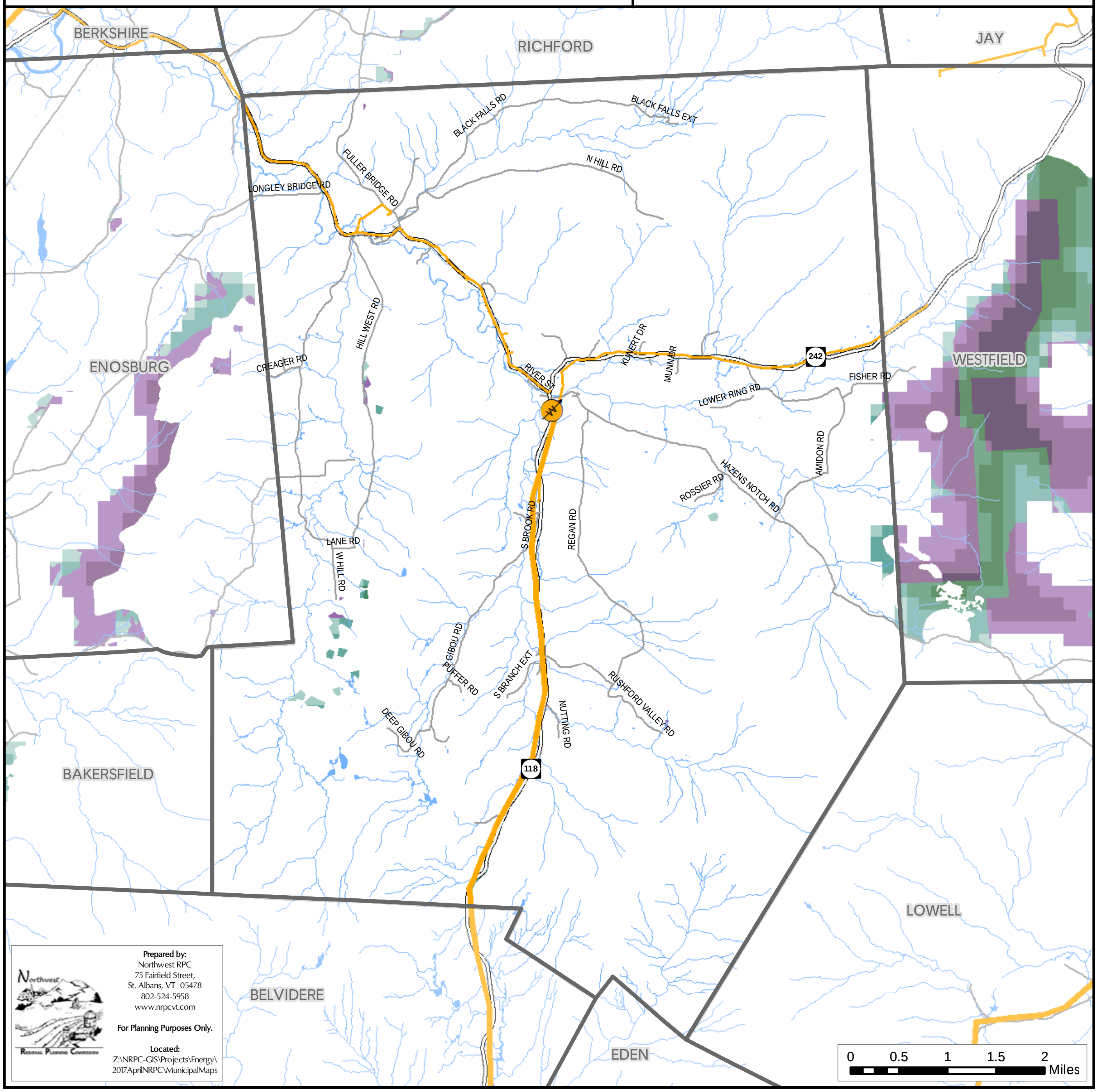


Legend

- Substation
- 3 Phase Power Line
- Transmission Line
- Prime Wind: Areas of high wind potential and no known constraints. Darker areas have higher wind speeds.
- Base Wind: Areas of high wind potential and a presence of possible constraints. Darker areas have higher wind speeds.

Sources: VCGI
Disclaimer: The accuracy of information presented is determined by its sources. Errors and omissions may exist. The Northwest RPC is not responsible for these. Questions of on-the-ground location can be resolved by site inspections and/or surveys by a registered surveyor. This map is not sufficient for delineation of features on-the-ground. This map identifies the presence of features, and may indicate relationships between features, but is not a replacement for surveyed information or engineering studies.



Woody Biomass

Montgomery, Vermont
Act 174
The Energy Development Improvement Act of 2016

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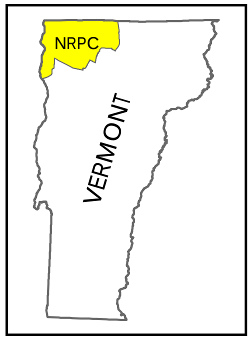

Legend

- Biomass System
- Cow Power
- Substation
- 3 Phase Power Line
- Transmission Line
- Prime Woody Biomass/No Known Constraints
- Base Woody Biomass/Possible Constraints

Sources: VCGI
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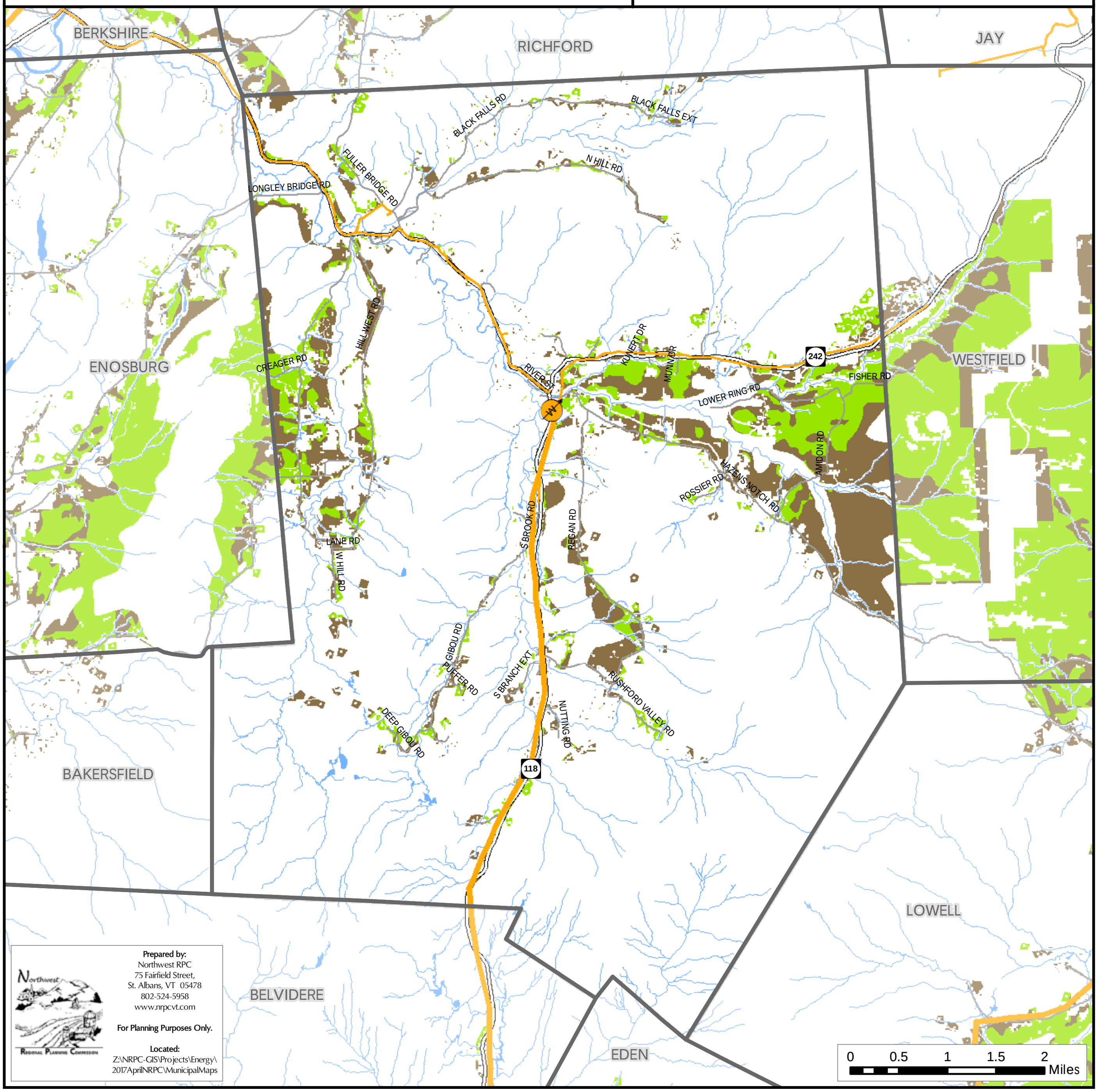

All Generators in Municipality

Category	Sub - Category	Organization Type	Address	City	CPG Number	Capacity kW
Solar	Ground-mounted PV: Fixed Rack	Residential	219 Rossier Rd	Montgomery	2611	8.2
Solar	Ground-mounted PV: Fixed Rack	Residential	2812 Black Falls Rd	Montgomery	372	1.3
Solar	Ground-mounted PV: Pole	Residential	2637 South Main St	Montgomery		7.6
Solar	Ground-mounted PV: Pole	Residential	3592 Hazens Notch Rd	Montgomery	3801	9
Solar	Ground-mounted PV: Tracker	Residential	854 Rushford Valley Rd	Montgomery		12
Solar	Roof-Mounted PV	Residential	1325 Regan Rd	Montgomery	3248	4
Solar	Roof-Mounted PV	Residential	1427 Regan Rd	Montgomery	812	3.2
Solar	Roof-Mounted PV	Residential	169 Fuller St	Montgomery	3709	4.6
Solar	Roof-Mounted PV	Residential	3376 Mountain Rd	Montgomery	7170	8
Solar	Roof-Mounted PV	Residential	2534 Hill West Rd	Montgomery	6981	5
Solar	Roof-Mounted PV	Residential	2060 N Main Street	Montgomery	7291	6

Municipal Analysis & Targets - North Hero

The following is an explanation of the municipal energy data compiled by Northwest Regional Planning Commission (NRPC). The intent of the municipal energy data is to provide the municipalities with data required to ensure compliance with the requirements of Act 174 and "Enhanced Energy Planning" (24 V.S.A. 4352). The following tables contain data that estimates current energy use and provides targets for future energy use across all sectors (transportation, heating, and electricity). It also sets targets for renewable energy generation within the municipality.

This data is meant to be a starting point for the municipality to begin planning its energy future and to talk about the changes that may need to occur within the municipality to ensure that local, regional and state energy goals are met. This includes the State of Vermont's goal to have 90% of all energy demand be met from renewable sources by 2050.

Figure 1 - Data Sources

ACS – American Community Survey

DOL –Vermont Department of Labor

DPS – Vermont Department of Public Service

EIA – Energy Information Administration

EVT – Efficiency Vermont

LEAP – Long-Range Energy Alternatives Planning

VEIC – Vermont Energy Investment Corporation

VTrans – Vermont Agency of Transportation

Data Sources

Estimates of current energy use consist primarily of data available from the American Community Survey (ACS), the Vermont Agency of Transportation (VTrans), the Vermont Department of Labor (DOL), and the Vermont Department of Public Service (DPS). Targets for future energy use are reliant upon the Long-range Energy Alternatives Planning (LEAP) analysis for the region completed the Vermont Energy Investment Corporation (VEIC). Targets for future energy generation have come from the regional planning commission and DPS. For more information on LEAP, see the Northwest Regional Energy Plan (www.nrpcvt.com). Targets for both future energy use and energy generation have been generally developed using a "top down" method of disaggregating regional data to the municipal level.

It is possible to develop "bottom up" data. For those municipalities interested in that approach, please see the Department of Public Service's Analysis and Targets Guidance (http://publicservice.vermont.gov/content/act-174-recommendations-and-determination-standards).

Please remember that the targets established by LEAP represent only one way to achieve energy goals. There may several other similar pathways that a municipality may choose to take in order to meet the 90x50 goal.

Below is a worksheet by worksheet explanation of the Municipal Template spreadsheet:

1. Municipal Data Summary

The following tables summarize all data that is required to be in a municipal plan if the plan is to meet the "determination" standards established by the Vermont Department of Public Service.

Table 1A: Current Municipal Transportation Energy Use

Transportation Data	Municipal Data
Total # of Passenger Vehicles (ACS 2011-2015)	816
Average Miles per Vehicle (Vtrans)	11,356
Total Miles Traveled	9,266,496
Realized MPG (2013 - VTrans 2015 Energy Profile)	18.6
Total Gallons Use per Year	498,199
Transportation BTUs (Billion)	60
Average Cost per Gallon of Gasoline (RPC)	2.31
Gasoline Cost per Year	1,150,839

This table uses data from the American Community Survey (ACS) and Vermont Agency of Transportation (VTrans) to calculate current transportation energy use and energy costs in the municipality.

Table 1B: Current Municipal Residential Heating Energy Use

Fuel Source	Municipal Households (ACS 2011-2015)	% of Municipal Households	Municipal Square Footage Heated	Municipal BTU (in Billions)
Natural Gas	4	1.0%	7,616	0
Propane	115	27.8%	206,992	12
Electricity	6	1.4%	11,424	1
Fuel Oil	218	52.7%	398,880	24
Coal	2	0.5%	3,808	0
Wood	64	15.5%	119,744	7
Solar	0	0.0%	0	0
Other	5	1.2%	9,520	1
No Fuel	0	0.0%	0	0
Total	414	100.0%	757,984	45

This table displays data from the ACS that estimates current municipal residential heating energy use.

Table 1C: Current Municipal Commercial Energy Use

	Commercial Establishments in Municipality (VT DOL)	Estimated Thermal Energy BTUs per Commercial Establishment (in Billions) (VDPS)	Estimated Thermal Energy BTUs by Commercial Establishments in Municipality (in Billions)
Municipal Commercial Energy Use	29	0.725	21

The table uses data available from the Vermont Department of Labor (VT DOL) and the Vermont Department of Public Service (DPS) to estimate current municipal commercial establishment energy use in the municipality.

Table 1D: Current Electricity Use

Use Sector	Current Electricity Use
Residential (kWh)	3,721,588
Commercial and Industrial (kWh)	7,440,624
Total (kWh)	11,162,212

This table displays current electricity use within the municipality. This data is available from Efficiency Vermont (EVT).

Table 1E: Residential Thermal Efficiency Targets

	2025	2035	2050
"Residential - Increased Efficiency and Conservation (% of municipal households to be weatherized)"	5%	16%	78%

This table displays targets for thermal efficiency of residential structures. The data is based on a methodology developed by DPS using data available from the regional Long-range Energy Alternatives Planning (LEAP) analysis and ACS. The data in this table represents the percentage of municipal households that will need to be weatherized in the target years. The target is cumulative.

Table 1F: Commercial Thermal Efficiency Target

	2025	2035	2050
"Commercial - Increased Efficiency and Conservation (% of commercial establishments to be weatherized)"	25%	25%	73%

This table shows the same information as Table 1E, but sets a target for commercial thermal efficiency and weatherization. Information from the VT DOL is required to complete this target. The target is cumulative.

Table 1G: Thermal Fuel Switching (Residential and Commercial) – Wood Systems

	2025	2035	2050
New Efficient Wood Heat Systems (in units)	-1	-4	3

This table provides a target for new wood heating systems for residential and commercial structures in the municipality for each target year. This target was calculated using data from LEAP and ACS. The target is cumulative.

Table 1H: Thermal Fuel Switching (Residential and Commercial) – Heat Pumps

	2025	2035	2050
New Heat Pumps (in units)	50	114	212

This table provides a target for new heat pump systems for residential and commercial structures in the municipality for each target year. This target was calculated using data from LEAP and ACS. The target is cumulative.

Table 1I: Electricity Efficiency Targets

	2025	2035	2050
Increase Efficiency and Conservation (BTUs)	25.2%	48.3%	100.7%

Data in this table displays a target for increased electricity efficiency and conservation during the target years. This target will be met through conversions to high efficiency appliances, electric heat pumps, and electric light-duty vehicles. These targets were developed using regional LEAP analysis. The target is cumulative.

Table 1J: Use of Renewables – Transportation

	2025	2035	2050
Renewable Energy Use - Transportation (BTUs)	10.8%	33.3%	91.0%

This data displays targets for the percentage of transportation energy use coming from renewable sources during each target year. This target will be met through conversions to electric light-duty vehicles and biodiesel heavy-duty vehicles. This data was developed using the LEAP analysis. The target is cumulative.

Table 1K: Use of Renewables – Heating

	2025	2035	2050
Renewable Energy Use - Heating (BTUs)	44.5%	57.5%	85.3%

This data displays targets for the percentage of heating energy use coming from renewable sources during each target year. This target will be met through conversions to electric heat pumps and high efficiency wood heating systems. This data was developed using information from the LEAP analysis. The target is cumulative.

Table 1L: Use of Renewables – Electricity

	2025	2035	2050
Renewable Energy Use - Electricity (MWh)	2,316.8	4,633.6	7,020.5

This data displays targets for MWh of electricity generation coming from renewable sources within the municipality during each target year. This data was developed using information from the regional planning commission and DPS. This data is the same as the data in Table 1Q. The target is cumulative.

Table 1M: Transportation Fuel Switching Targets – Electric Vehicles

	2025	2035	2050
Electric Vehicles	71	535	1272

This tables displays a target for switching from fossil fuel based vehicles (gasoline and diesel) to electric vehicles. This target is calculated using LEAP and ACS data. The target is cumulative.

Table 1N: Transportation Fuel Switching Targets – Biodiesel

	2025	2035	2050
Biodiesel Vehicles	153	306	590

This tables displays a target for switching from fossil fuel based vehicles to biodiesel-powered vehicles. This target is calculated using LEAP and ACS data. The target is cumulative.

Table 1O: Existing Renewable Generation

Renewable Type	MW	MWh
Solar	0.10	122.64
Wind	0.00	0.00
Hydro	0.00	0.00
Biomass	0.00	0.00
Other	0.00	0.00
Total Existing Generation	0.10	122.64

Table 1O shows existing renewable generation in the municipality, in MW and MWh, based on information available from the Vermont Department of Public Service.

Table 1P: Renewable Generation Potential

Renewable Type	MW	MWh
Rooftop Solar	1	686
Ground-mounted Solar	397	486,825
Wind	602	1,845,165
Hydro	0.001	4
Biomass and Methane	0	0
Other	0	0
Total Renewable Generation Potential	999	2,332,679

Renewable generation potential is based on mapping completed by the regional planning commission that is based on the Municipal Determination Standards and associated guidance documents developed by DPS. The renewable generation potential is expressed in MW and MWh by the type of renewable resource (solar, wind, hydro, etc.).

Table 1Q: Renewable Generation Targets

	2025	2035	2050
Total Renewable Generation Target (in MWh)	2,316.78	4,633.56	7,020.54

This data displays targets for MWh of electricity generation coming from renewable sources within the municipality during each target year. This data was developed using information from the regional planning commission and DPS. This data is the same as the data in Table 1L.

Table 1R: Sufficient Land?

	Y/N
Solar	Y
Wind	Y

This table shows whether or not there is sufficient land in the municipality to meet the renewable generation targets based on the renewable generation potential in the municipality.

Utility Service Areas

North Hero, Vermont
Act 174
The Energy Development Improvement Act of 2016

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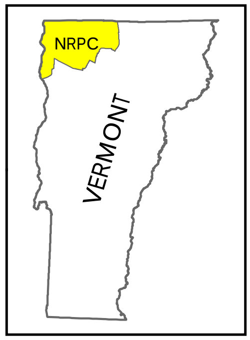
N



Legend

Utility Service Area Features

- Green Mountain Power
- Swanton Village Electric
- Vermont Electric Co-op
- Enosburg Falls Electric
- Substation
- 3 Phase Power Line
- Transmission Line

Sources: VCGI
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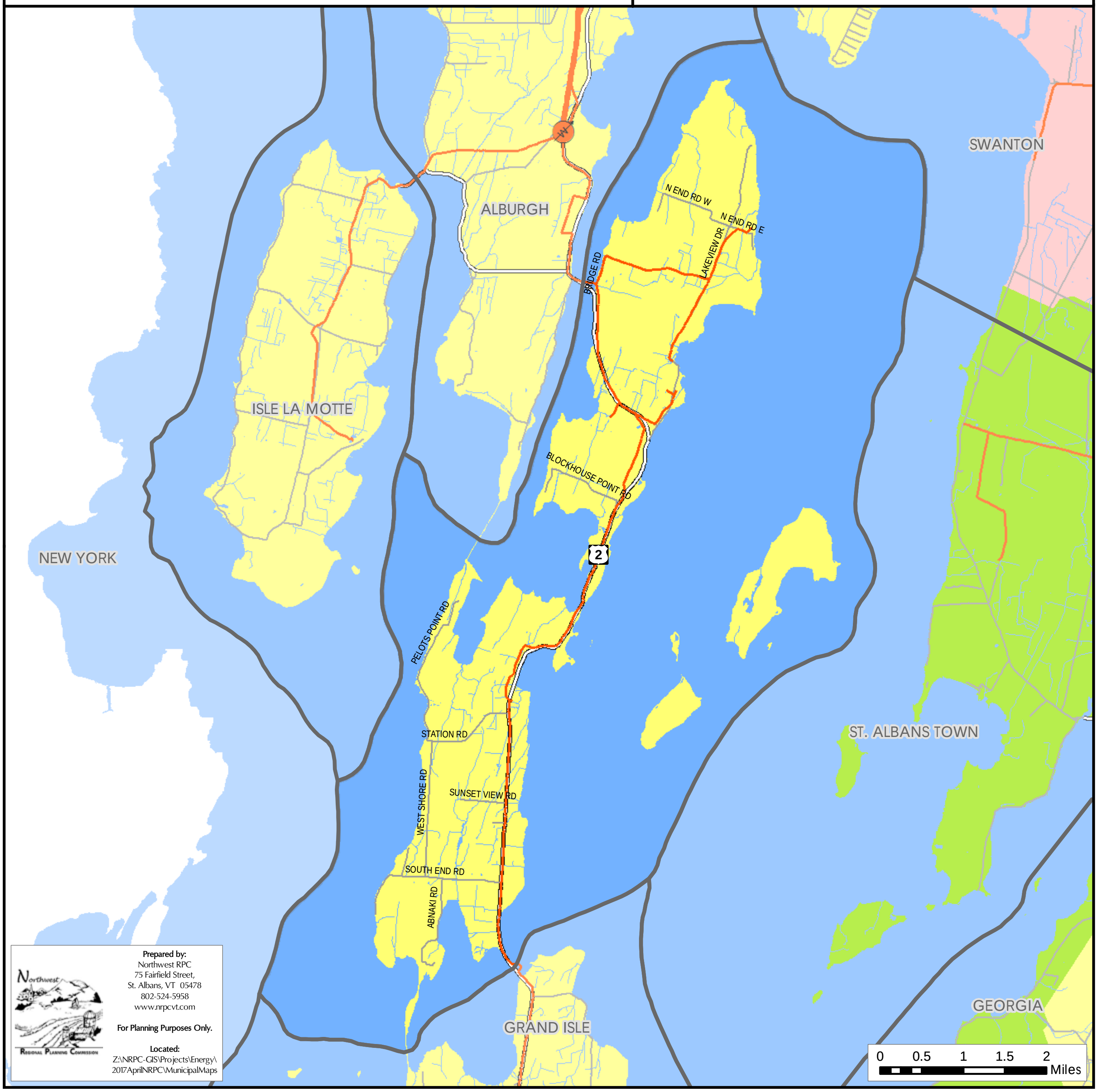

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Transmission & 3 Phase Power Infrastructure

North Hero, Vermont
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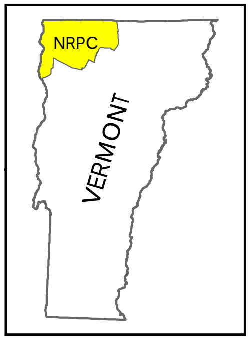

Legend

- Substation
- 3 Phase Power Line
- Transmission Line
- 1/2 Mile Buffer (3 Phase Power Line & Transmission Line)

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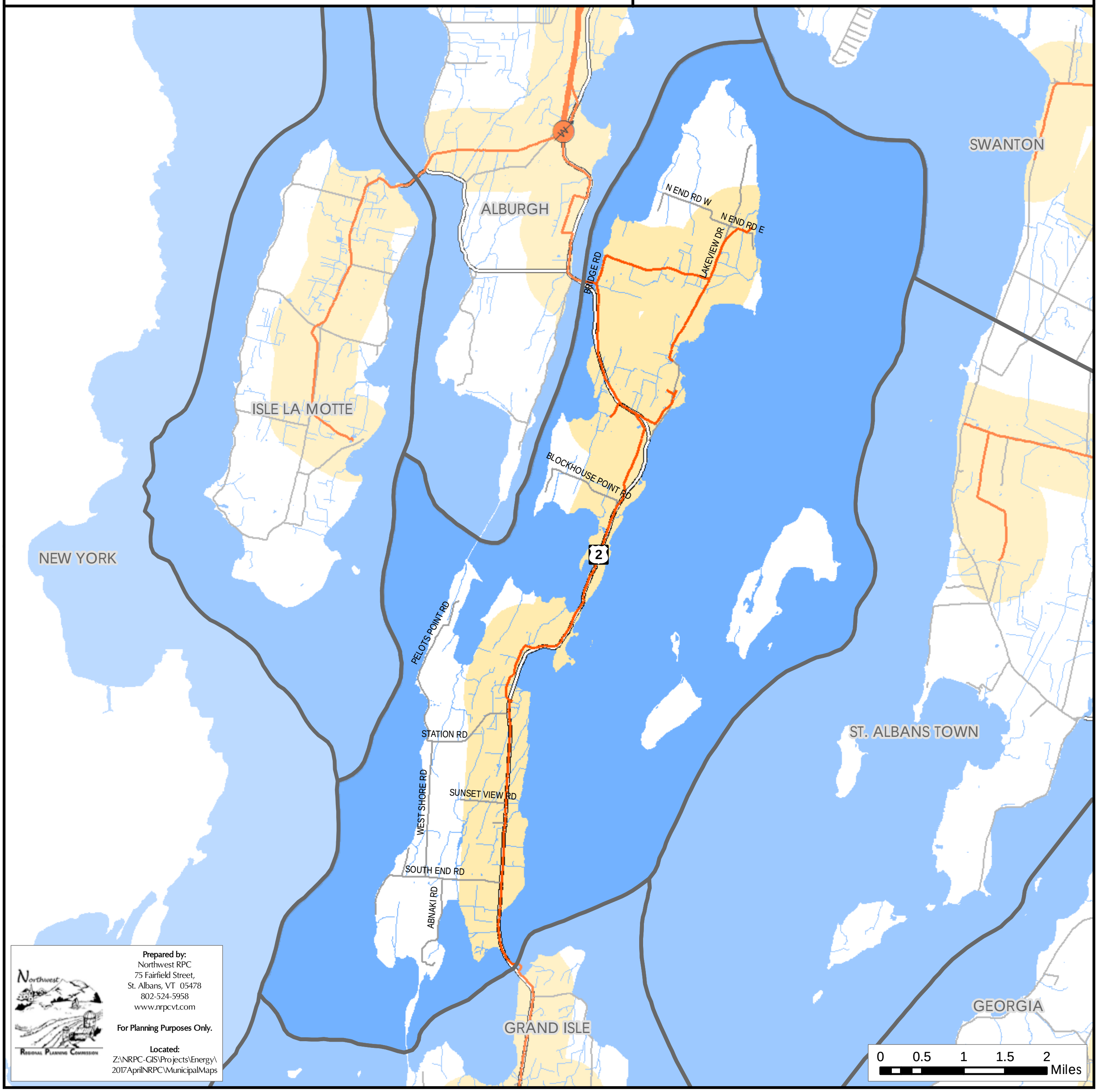

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Existing Generation Facilities

North Hero, Vermont
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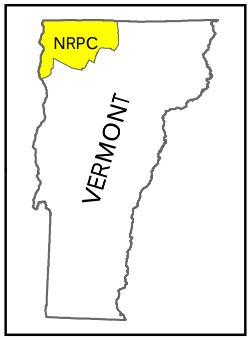

Legend

- Biomass Facility
- Hydro Facility
- Solar Facility
- Wind Facility

Note: Only generators 15kW are shown on the map. A full list of all generators is available.

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Hydro

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N

Legend

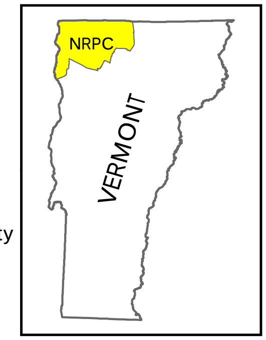
- Substation
- 3 Phase Power Line
- Transmission Line
- Designated Outstanding Resource Water
- Known Constraint - Designated National Wild & Scenic River
- Possible Constraint - Stressed or Impaired Water
- Possible Constraint - RINAs

Potential Hydroelectric Facility

- < 50 kW Capacity
- > 50 kW Capacity
- High Hazard with < 50 kW Capacity
- High Hazard with > 50 kW Capacity

Operating Hydroelectric Facility

- Dam not on National Wild and Scenic River
- Dam on National Wild and Scenic River



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Solar

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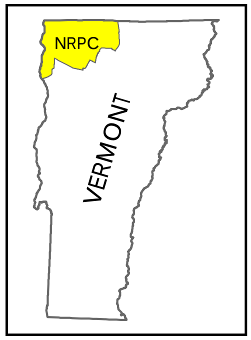

Legend

- Substation
- 3 Phase Power Line
- Transmission Line
- 1/2 Mile Buffer (3 Phase Power Line & Transmission Line)
- Prime Solar/No Known Constraints
- Base Solar/Possible Constraints

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Wind

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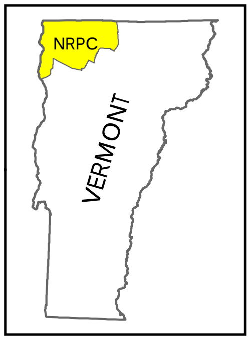

Legend

- Substation
- 3 Phase Power Line
- Transmission Line
- Prime Wind: Areas of high wind potential and no known constraints. Darker areas have higher wind speeds.
- Base Wind: Areas of high wind potential and a presence of possible constraints. Darker areas have higher wind speeds.

Sources: VCGI
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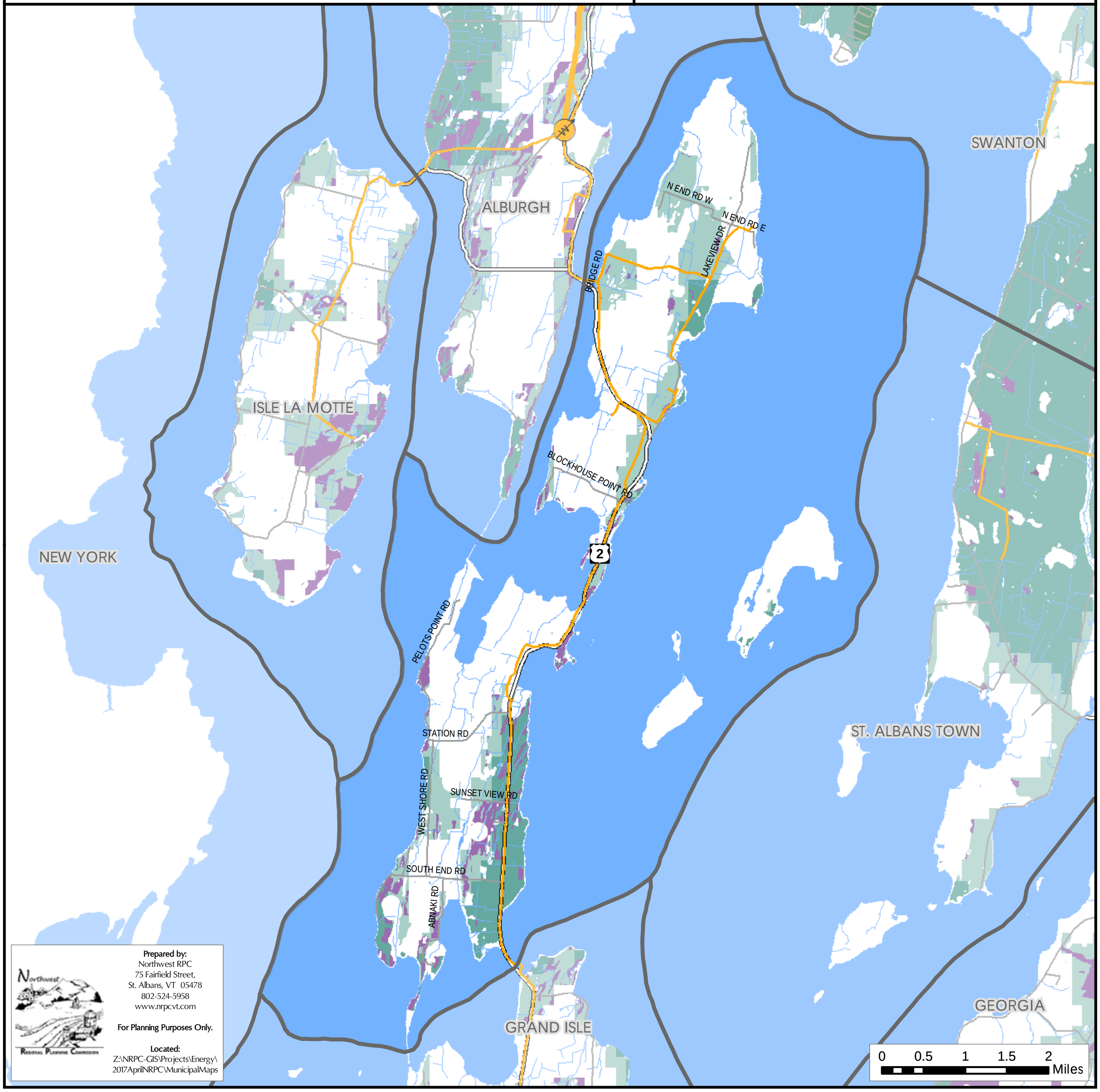

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Woody Biomass

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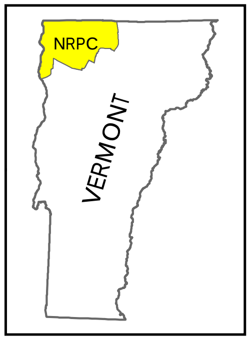

Legend
- Biomass System
- Cow Power
- Substation
- 3 Phase Power Line
- Transmission Line
- Prime Woody Biomass/No Known Constraints
- Base Woody Biomass/Possible Constraints

Sources: VCGI
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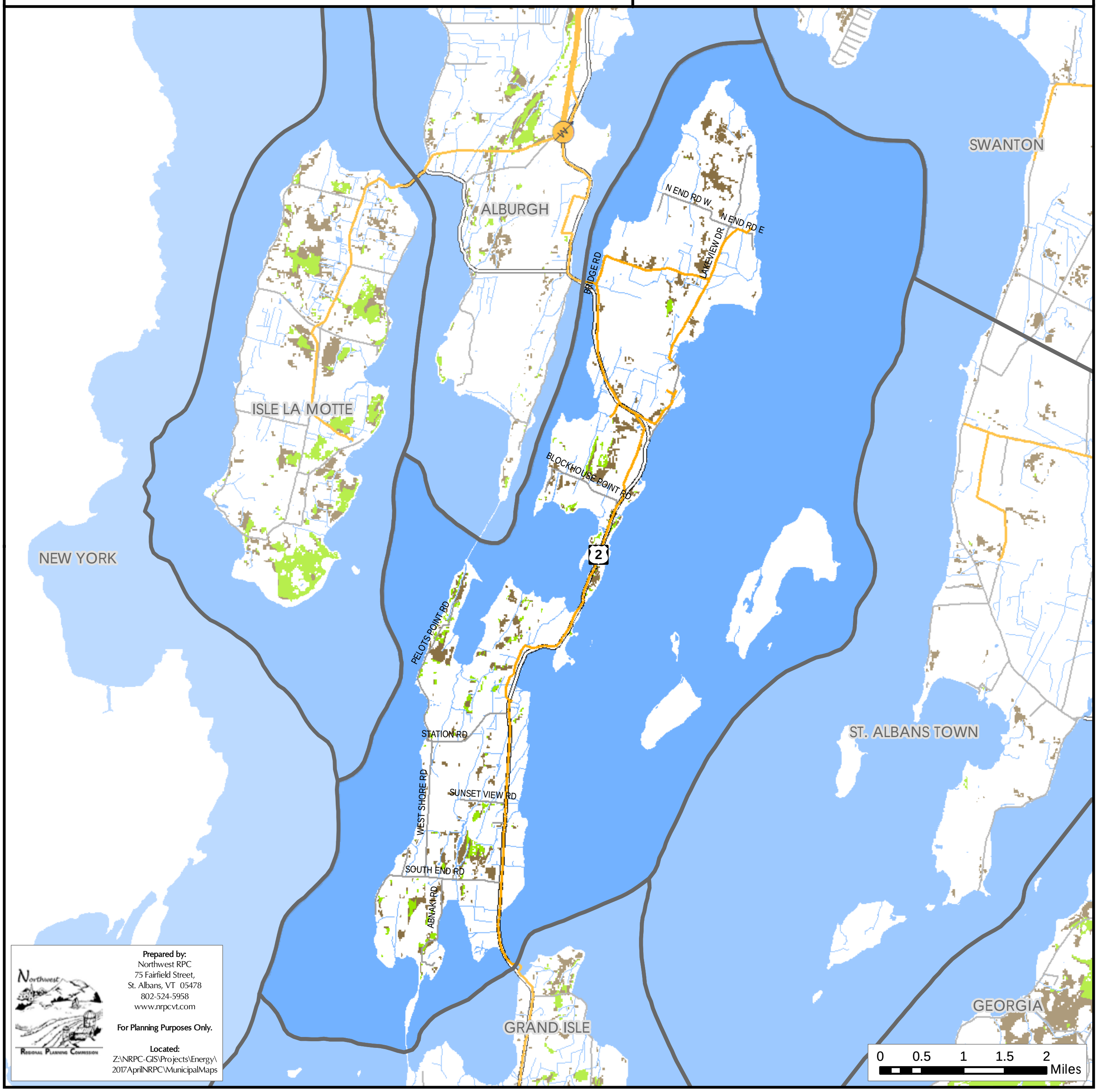

All Generators in Municipality

Category	Sub - Category	Organization Type	Address	City	CPG Number	Capacity kW
Solar	Ground-mounted PV: Fixed Rack	Residential	532 Savage Point Rd	North Hero	2940	9.1
Solar	Ground-mounted PV: Fixed Rack	Residential	578 Station Rd	North Hero	5351	11.4
Solar	Ground-mounted PV: Fixed Rack	Business	5072 US Route 2	North Hero	7131	15
Solar	Ground-mounted PV: Fixed Rack	Residential	5072 US-2	North Hero	7131	
Solar	Hot Water	Residential	252 Station Rd	North Hero		
Solar	Roof-Mounted PV	Residential	310 Watson's Ridge	North Hero	2835	4.7
Solar	Roof-Mounted PV	Residential	1541 South End Rd	North Hero	3827	6
Solar	Roof-Mounted PV	Residential	1485 Pelots Point Rd	North Hero	2861	18.7
Solar	Roof-Mounted PV	Residential	458 Pelots Point Rd	North Hero	1433	4.6
Solar	Roof-Mounted PV	Residential	5944 Rt 2	North Hero	2876	6.2
Solar	Roof-Mounted PV	Residential	840 Station Rd	North Hero	2686	7.5
Solar	Roof-Mounted PV	Residential	57 Strong House Ln	North Hero	1396	3.5
Solar	Roof-Mounted PV	Residential	3097 US Rt 2	North Hero	6929	10

Municipal Analysis & Targets - Richford

The following is an explanation of the municipal energy data compiled by Northwest Regional Planning Commission (NRPC). The intent of the municipal energy data is to provide the municipalities with data required to ensure compliance with the requirements of Act 174 and "Enhanced Energy Planning" (24 V.S.A. 4352). The following tables contain data that estimates current energy use and provides targets for future energy use across all sectors (transportation, heating, and electricity). It also sets targets for renewable energy generation within the municipality.

This data is meant to be a starting point for the municipality to begin planning its energy future and to talk about the changes that may need to occur within the municipality to ensure that local, regional and state energy goals are met. This includes the State of Vermont's goal to have 90% of all energy demand be met from renewable sources by 2050.

Figure 1 - Data Sources

ACS – American Community Survey

DOL –Vermont Department of Labor

DPS – Vermont Department of Public Service

EIA – Energy Information Administration

EVT – Efficiency Vermont

LEAP – Long-Range Energy Alternatives Planning

VEIC – Vermont Energy Investment Corporation

VTrans – Vermont Agency of Transportation

Data Sources

Estimates of current energy use consist primarily of data available from the American Community Survey (ACS), the Vermont Agency of Transportation (VTrans), the Vermont Department of Labor (DOL), and the Vermont Department of Public Service (DPS). Targets for future energy use are reliant upon the Long-range Energy Alternatives Planning (LEAP) analysis for the region completed the Vermont Energy Investment Corporation (VEIC). Targets for future energy generation have come from the regional planning commission and DPS. For more information on LEAP, see the Northwest Regional Energy Plan (www.nrpcvt.com). Targets for both future energy use and energy generation have been generally developed using a "top down" method of disaggregating regional data to the municipal level.

It is possible to develop "bottom up" data. For those municipalities interested in that approach, please see the Department of Public Service's Analysis and Targets Guidance (http://publicservice.vermont.gov/content/act-174-recommendations-and-determination-standards).

Please remember that the targets established by LEAP represent only one way to achieve energy goals. There may several other similar pathways that a municipality may choose to take in order to meet the 90x50 goal.

Below is a worksheet by worksheet explanation of the Municipal Template spreadsheet:

1. Municipal Data Summary

The following tables summarize all data that is required to be in a municipal plan if the plan is to meet the "determination" standards established by the Vermont Department of Public Service.

Table 1A: Current Municipal Transportation Energy Use

Transportation Data	Municipal Data
Total # of Passenger Vehicles (ACS 2011-2015)	1,549
Average Miles per Vehicle (Vtrans)	11,356
Total Miles Traveled	17,590,444
Realized MPG (2013 - VTrans 2015 Energy Profile)	18.6
Total Gallons Use per Year	945,723
Transportation BTUs (Billion)	114
Average Cost per Gallon of Gasoline (RPC)	2.31
Gasoline Cost per Year	2,184,620

This table uses data from the American Community Survey (ACS) and Vermont Agency of Transportation (VTrans) to calculate current transportation energy use and energy costs in the municipality.

Table 1B: Current Municipal Residential Heating Energy Use

Fuel Source	Municipal Households (ACS 2011-2015)	% of Municipal Households	Municipal Square Footage Heated	Municipal BTU (in Billions)
Natural Gas	2	0.2%	3,808	0
Propane	61	6.7%	109,808	7
Electricity	58	6.4%	75,936	5
Fuel Oil	571	62.7%	984,400	59
Coal	0	0.0%	0	0
Wood	215	23.6%	409,360	25
Solar	0	0.0%	0	0
Other	3	0.3%	5,712	0
No Fuel	0	0.0%	0	0
Total	910	100.0%	1,589,024	95

This table displays data from the ACS that estimates current municipal residential heating energy use.

Table 1C: Current Municipal Commercial Energy Use

	Commercial Establishments in Municipality (VT DOL)	Estimated Thermal Energy BTUs per Commercial Establishment (in Billions) (VDPS)	Estimated Thermal Energy BTUs by Commercial Establishments in Municipality (in Billions)
Municipal Commercial Energy Use	30	0.725	22

The table uses data available from the Vermont Department of Labor (VT DOL) and the Vermont Department of Public Service (DPS) to estimate current municipal commercial establishment energy use in the municipality.

Table 1D: Current Electricity Use

Use Sector	Current Electricity Use
Residential (kWh)	8,180,301
Commercial and Industrial (kWh)	7,697,197
Total (kWh)	15,877,498

This table displays current electricity use within the municipality. This data is available from Efficiency Vermont (EVT).

Table 1E: Residential Thermal Efficiency Targets

	2025	2035	2050
"Residential - Increased Efficiency and Conservation (% of municipal households to be weatherized)"	5%	16%	78%

This table displays targets for thermal efficiency of residential structures. The data is based on a methodology developed by DPS using data available from the regional Long-range Energy Alternatives Planning (LEAP) analysis and ACS. The data in this table represents the percentage of municipal households that will need to be weatherized in the target years. The target is cumulative.

Table 1F: Commercial Thermal Efficiency Target

	2025	2035	2050
"Commercial - Increased Efficiency and Conservation (% of commercial establishments to be weatherized)"	25%	25%	73%

This table shows the same information as Table 1E, but sets a target for commercial thermal efficiency and weatherization. Information from the VT DOL is required to complete this target. The target is cumulative.

Table 1G: Thermal Fuel Switching (Residential and Commercial) – Wood Systems

	2025	2035	2050
New Efficient Wood Heat Systems (in units)	-3	-12	2

This table provides a target for new wood heating systems for residential and commercial structures in the municipality for each target year. This target was calculated using data from LEAP and ACS. The target is cumulative.

Table 1H: Thermal Fuel Switching (Residential and Commercial) – Heat Pumps

	2025	2035	2050
New Heat Pumps (in units)	109	249	465

This table provides a target for new heat pump systems for residential and commercial structures in the municipality for each target year. This target was calculated using data from LEAP and ACS. The target is cumulative.

Table 1I: Electricity Efficiency Targets

	2025	2035	2050
Increase Efficiency and Conservation (BTUs)	25.2%	48.3%	100.7%

Data in this table displays a target for increased electricity efficiency and conservation during the target years. This target will be met through conversions to high efficiency appliances, electric heat pumps, and electric light-duty vehicles. These targets were developed using regional LEAP analysis. The target is cumulative.

Table 1J: Use of Renewables – Transportation

	2025	2035	2050
Renewable Energy Use - Transportation (BTUs)	8.4%	29.4%	89.6%

This data displays targets for the percentage of transportation energy use coming from renewable sources during each target year. This target will be met through conversions to electric light-duty vehicles and biodiesel heavy-duty vehicles. This data was developed using the LEAP analysis. The target is cumulative.

Table 1K: Use of Renewables – Heating

	2025	2035	2050
Renewable Energy Use - Heating (BTUs)	46.0%	59.5%	87.5%

This data displays targets for the percentage of heating energy use coming from renewable sources during each target year. This target will be met through conversions to electric heat pumps and high efficiency wood heating systems. This data was developed using information from the LEAP analysis. The target is cumulative.

Table 1L: Use of Renewables – Electricity

	2025	2035	2050
Renewable Energy Use - Electricity (MWh)	4,276.2	8,552.3	12,958.1

This data displays targets for MWh of electricity generation coming from renewable sources within the municipality during each target year. This data was developed using information from the regional planning commission and DPS. This data is the same as the data in Table 1Q. The target is cumulative.

Table 1M: Transportation Fuel Switching Targets – Electric Vehicles

	2025	2035	2050
Electric Vehicles	136	1015	2414

This tables displays a target for switching from fossil fuel based vehicles (gasoline and diesel) to electric vehicles. This target is calculated using LEAP and ACS data. The target is cumulative.

Table 1N: Transportation Fuel Switching Targets – Biodiesel

	2025	2035	2050
Biodiesel Vehicles	196	389	748

This tables displays a target for switching from fossil fuel based vehicles to biodiesel-powered vehicles. This target is calculated using LEAP and ACS data. The target is cumulative.

Table 1O: Existing Renewable Generation

Renewable Type	MW	MWh
Solar	0.13	159.43
Wind	0.01	29.13
Hydro	0.00	0.00
Biomass	0.00	0.00
Other	0.00	0.00
Total Existing Generation	0.14	188.56

Table 1O shows existing renewable generation in the municipality, in MW and MWh, based on information available from the Vermont Department of Public Service.

Table 1P: Renewable Generation Potential

Renewable Type	MW	MWh
Rooftop Solar	1	1,300
Ground-mounted Solar	406	497,515
Wind	133	408,499
Hydro	0	0
Biomass and Methane	0	0
Other	0	0
Total Renewable Generation Potential	540	907,314

Renewable generation potential is based on mapping completed by the regional planning commission that is based on the Municipal Determination Standards and associated guidance documents developed by DPS. The renewable generation potential is expressed in MW and MWh by the type of renewable resource (solar, wind, hydro, etc.).

Table 1Q: Renewable Generation Targets

	2025	2035	2050
Total Renewable Generation Target (in MWh)	4,276.16	8,552.32	12,958.06

This data displays targets for MWh of electricity generation coming from renewable sources within the municipality during each target year. This data was developed using information from the regional planning commission and DPS. This data is the same as the data in Table 1L.

Table 1R: Sufficient Land?

	Y/N
Solar	Y
Wind	Y

This table shows whether or not there is sufficient land in the municipality to meet the renewable generation targets based on the renewable generation potential in the municipality.

Utility Service Areas

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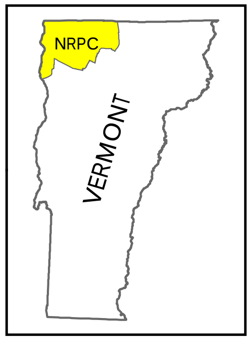

Legend

Utility Service Area Features

- Green Mountain Power
- Swanton Village Electric
- Vermont Electric Co-op
- Enosburg Falls Electric
- Substation
- 3 Phase Power Line
- Transmission Line

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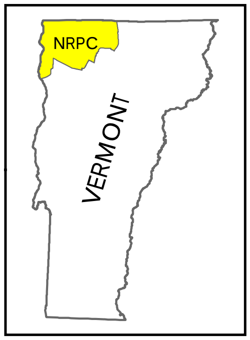

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- Substation
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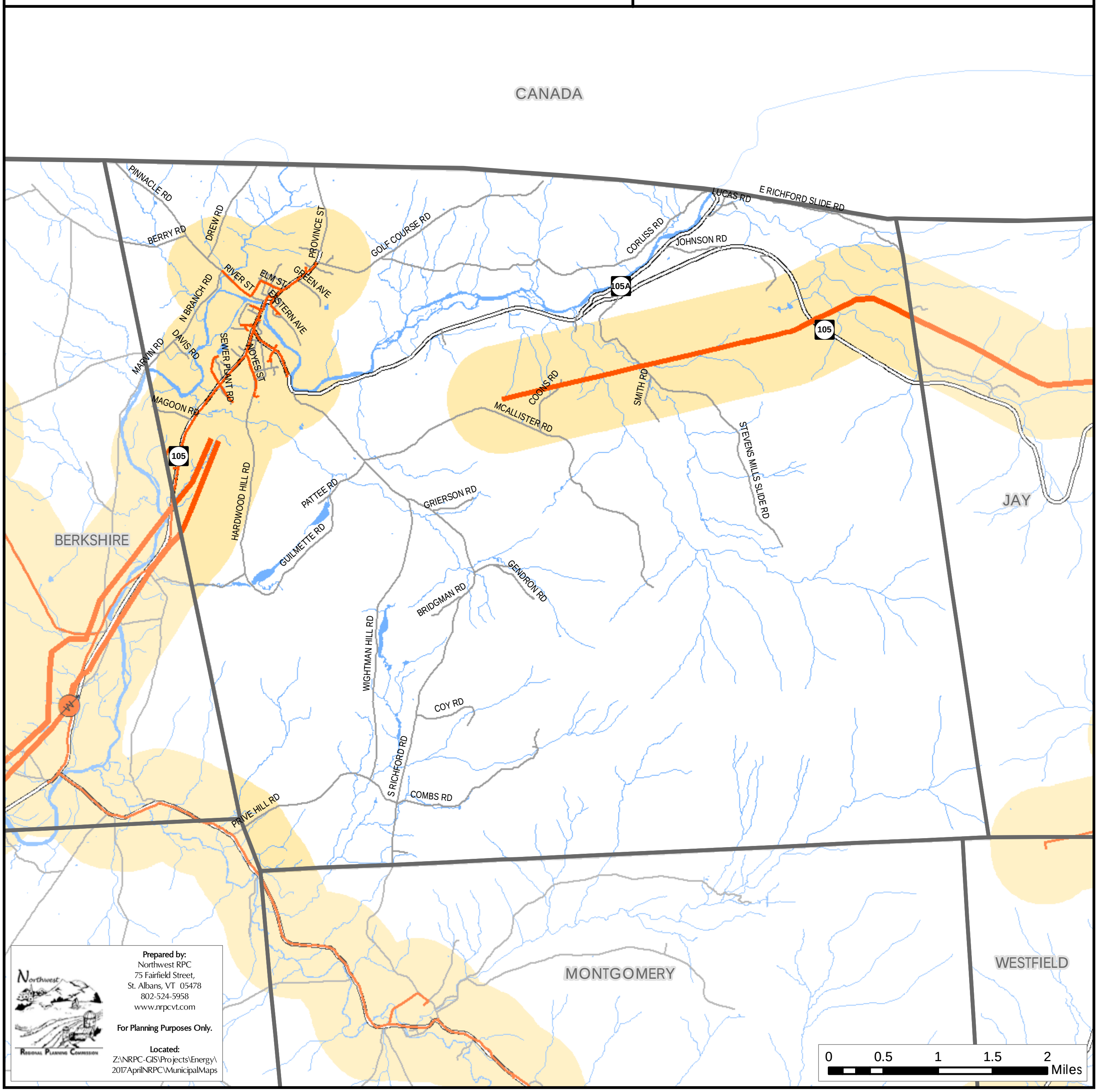

Existing Generation Facilities

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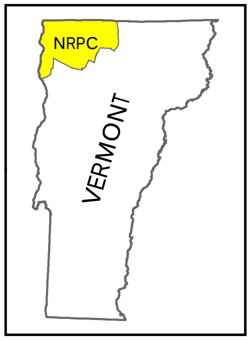

Legend

- Biomass Facility
- Hydro Facility
- Solar Facility
- Wind Facility

Note: Only generators 15kW are shown on the map. A full list of all generators is available.

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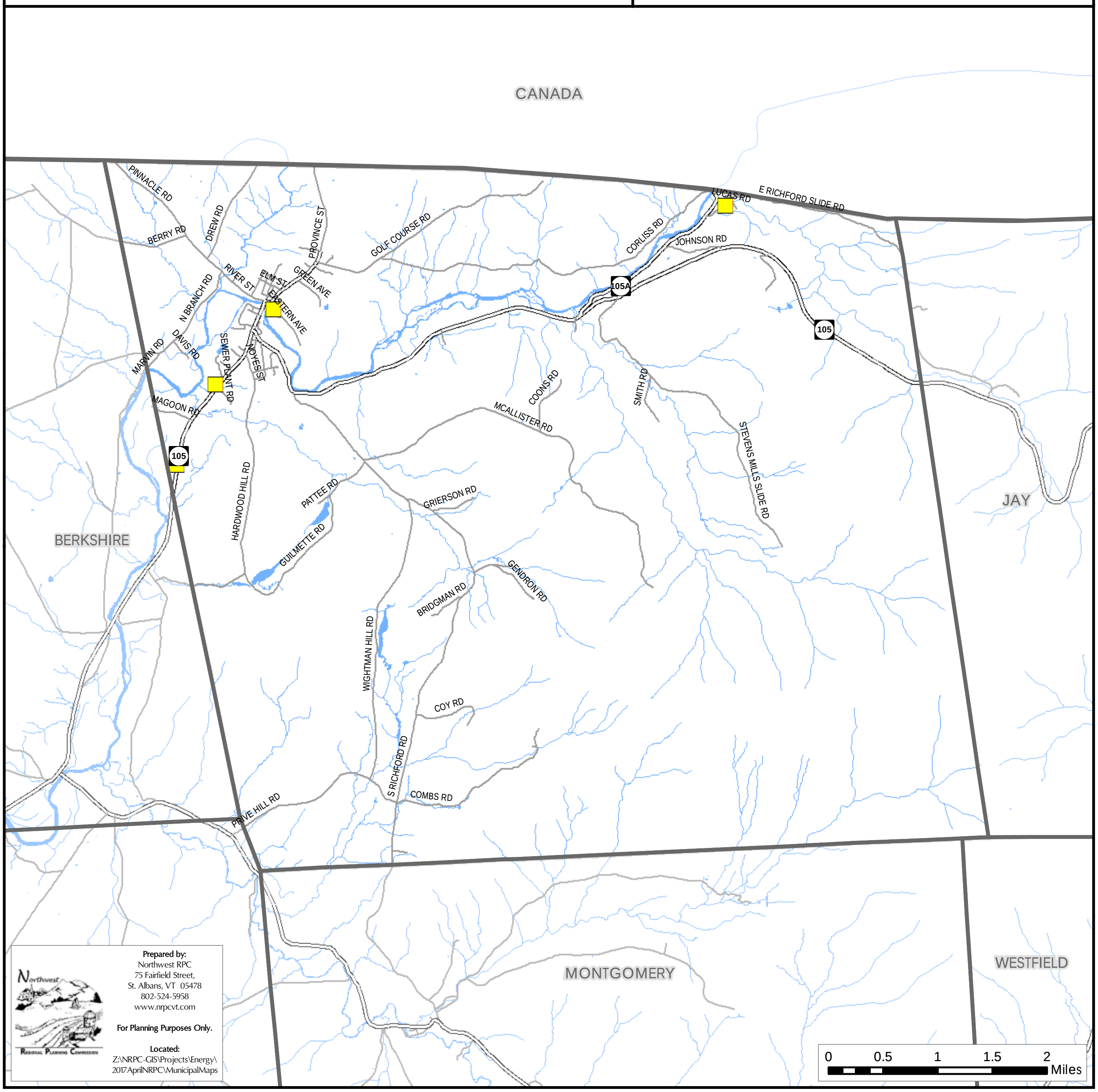

Hydro

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N

Legend

- Substation
- 3 Phase Power Line
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- Designated Outstanding Resource Water
- Known Constraint - Designated National Wild & Scenic River
- Possible Constraint - Stressed or Impaired Water
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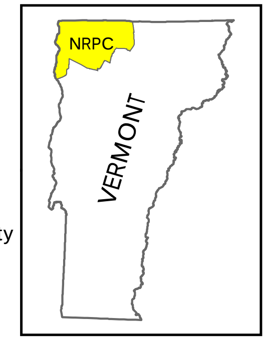
Potential Hydroelectric Facility

- < 50 kW Capacity
- > 50 kW Capacity
- High Hazard with < 50 kW Capacity
- High Hazard with > 50 kW Capacity

Operating Hydroelectric Facility

- Dam not on National Wild and Scenic River
- Dam on National Wild and Scenic River



Sources: VCGI
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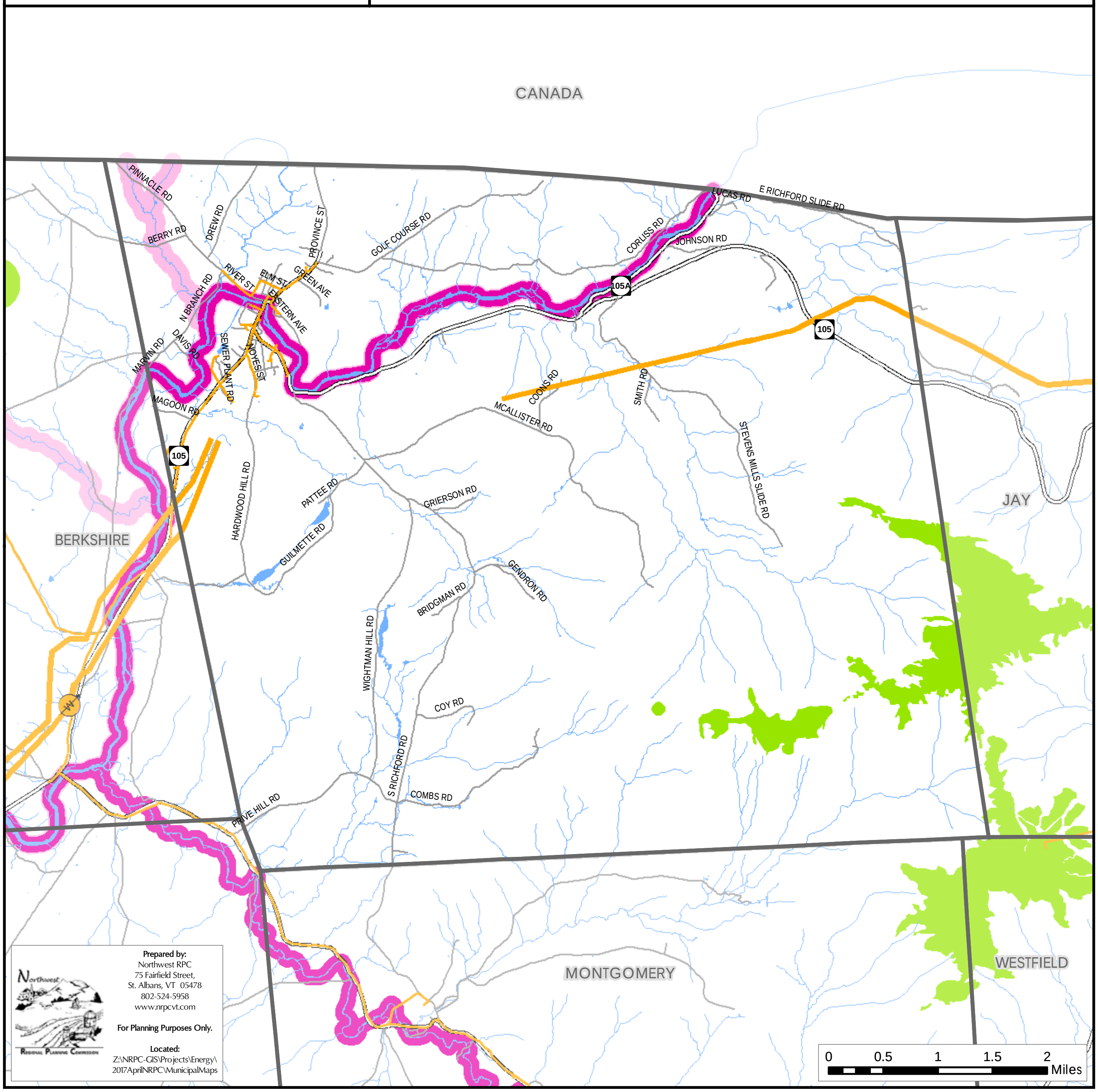

Solar

Richford, Vermont
Act 174
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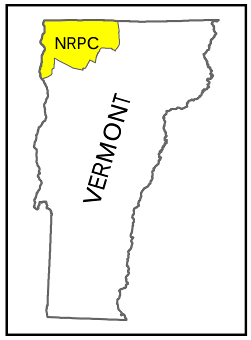

N

Legend

- Substation
- 3 Phase Power Line
- Transmission Line
- 1/2 Mile Buffer (3 Phase Power Line & Transmission Line)
- Prime Solar/No Known Constraints
- Base Solar/Possible Constraints

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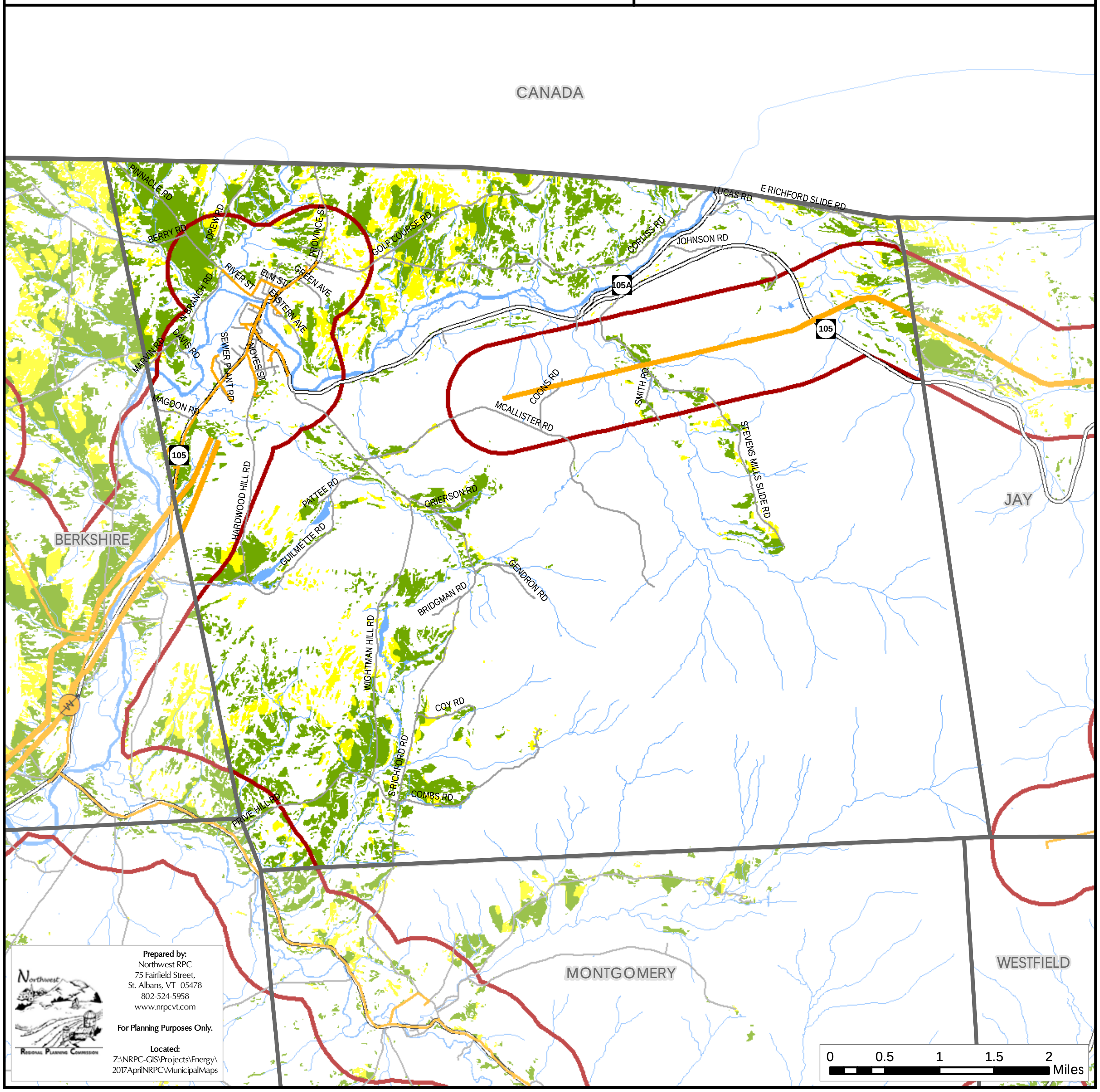

Wind

Richford, Vermont
Act 174
The Energy Development Improvement Act of 2016

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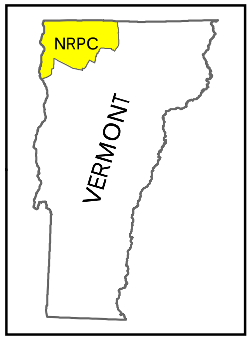
N



Legend

- Substation
- 3 Phase Power Line
- Transmission Line
- Prime Wind — Areas of high wind potential and no known constraints. Darker areas have higher wind speeds.
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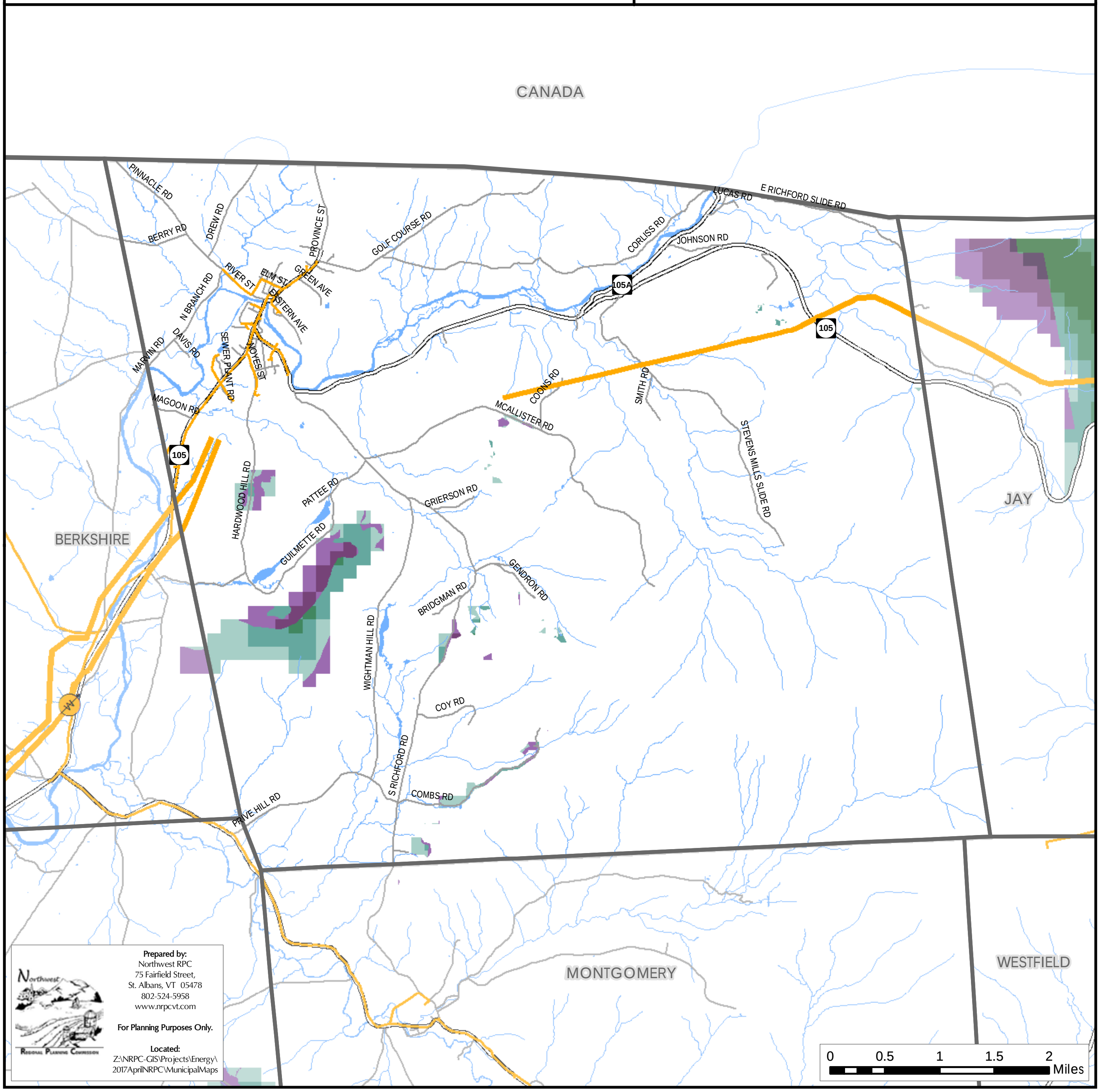
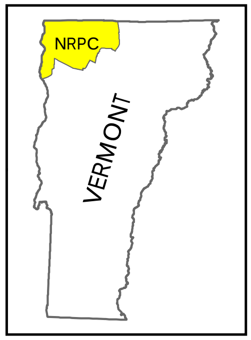


Woody Biomass

Richford, Vermont
Act 174
The Energy Development Improvement Act of 2016



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N

Legend

- Biomass System
- Cow Power
- Substation
- 3 Phase Power Line
- Transmission Line
- Prime Woody Biomass/No Known Constraints
- Base Woody Biomass/Possible Constraints

Sources: VCGI

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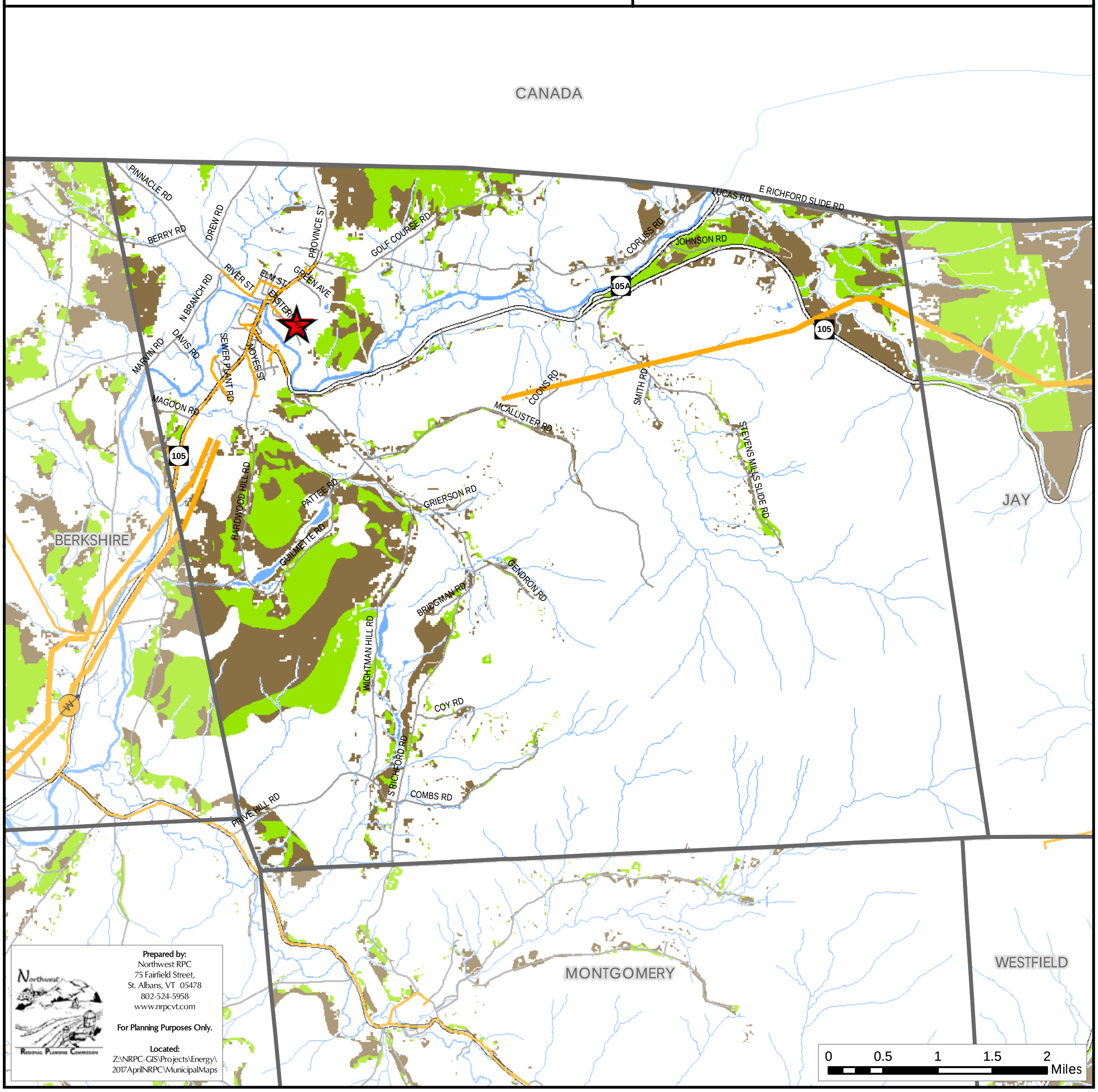


All Generators in Municipality

Category	Sub - Category	Organization Type	Address	City	CPG Number	Capacity kW
Solar	Ground-mounted PV: Fixed Rack	Residential	321 Prive Hill Road	Richford	1792	9.1
Solar	Ground-mounted PV: Fixed Rack	Residential	26 Lucas Road	Richford	7255	15
Solar	Ground-mounted PV: Pole	Residential	510 Stevens Mills Slide Rd	Richford	6605	4
Solar	Roof-Mounted PV	Residential	463 Hardwood Hill Rd	Richford	2822	4.9
Solar	Roof-Mounted PV	Residential	232 Hardwood Hill Rd	Richford	3030	4
Solar	Roof-Mounted PV	Institution	1 Corliss Heights	Richford	6009	50.7
Solar	Roof-Mounted PV	Business	328 S Main St	Richford	1136	28.8
Solar	Roof-Mounted PV	Business	1645 St. Albans Road	Richford	1146	15.7

Municipal Analysis & Targets - Saint Albans City

The following is an explanation of the municipal energy data compiled by Northwest Regional Planning Commission (NRPC). The intent of the municipal energy data is to provide the municipalities with data required to ensure compliance with the requirements of Act 174 and "Enhanced Energy Planning" (24 V.S.A. 4352). The following tables contain data that estimates current energy use and provides targets for future energy use across all sectors (transportation, heating, and electricity). It also sets targets for renewable energy generation within the municipality.

This data is meant to be a starting point for the municipality to begin planning its energy future and to talk about the changes that may need to occur within the municipality to ensure that local, regional and state energy goals are met. This includes the State of Vermont's goal to have 90% of all energy demand be met from renewable sources by 2050.

Figure 1 - Data Sources

ACS – American Community Survey

DOL –Vermont Department of Labor

DPS – Vermont Department of Public Service

EIA – Energy Information Administration

EVT – Efficiency Vermont

LEAP – Long-Range Energy Alternatives Planning

VEIC – Vermont Energy Investment Corporation

VTrans – Vermont Agency of Transportation

Data Sources

Estimates of current energy use consist primarily of data available from the American Community Survey (ACS), the Vermont Agency of Transportation (VTrans), the Vermont Department of Labor (DOL), and the Vermont Department of Public Service (DPS). Targets for future energy use are reliant upon the Long-range Energy Alternatives Planning (LEAP) analysis for the region completed the Vermont Energy Investment Corporation (VEIC). Targets for future energy generation have come from the regional planning commission and DPS. For more information on LEAP, see the Northwest Regional Energy Plan (www.nrpcvt.com). Targets for both future energy use and energy generation have been generally developed using a "top down" method of disaggregating regional data to the municipal level.

It is possible to develop "bottom up" data. For those municipalities interested in that approach, please see the Department of Public Service's Analysis and Targets Guidance (http://publicservice.vermont.gov/content/act-174-recommendations-and-determination-standards).

Please remember that the targets established by LEAP represent only one way to achieve energy goals. There may several other similar pathways that a municipality may choose to take in order to meet the 90x50 goal.

Below is a worksheet by worksheet explanation of the Municipal Template spreadsheet:

1. Municipal Data Summary

The following tables summarize all data that is required to be in a municipal plan if the plan is to meet the "determination" standards established by the Vermont Department of Public Service.

Table 1A: Current Municipal Transportation Energy Use

Transportation Data	Municipal Data
Total # of Passenger Vehicles (ACS 2011-2015)	4,144
Average Miles per Vehicle (Vtrans)	11,356
Total Miles Traveled	47,059,264
Realized MPG (2013 - VTrans 2015 Energy Profile)	18.6
Total Gallons Use per Year	2,530,068
Transportation BTUs (Billion)	305
Average Cost per Gallon of Gasoline (RPC)	2.31
Gasoline Cost per Year	5,844,457

This table uses data from the American Community Survey (ACS) and Vermont Agency of Transportation (VTrans) to calculate current transportation energy use and energy costs in the municipality.

Table 1B: Current Municipal Residential Heating Energy Use

Fuel Source	Municipal Households (ACS 2011-2015)	% of Municipal Households	Municipal Square Footage Heated	Municipal BTU (in Billions)
Natural Gas	1897	66.0%	2,999,408	180
Propane	121	4.2%	176,880	11
Electricity	131	4.6%	174,096	10
Fuel Oil	598	20.8%	942,176	57
Coal	0	0.0%	0	0
Wood	89	3.1%	160,304	10
Solar	0	0.0%	0	0
Other	31	1.1%	53,392	3
No Fuel	9	0.3%	10,800	1
Total	2876	100.0%	4,517,056	271

This table displays data from the ACS that estimates current municipal residential heating energy use.

Table 1C: Current Municipal Commercial Energy Use

	Commercial Establishments in Municipality (VT DOL)	Estimated Thermal Energy BTUs per Commercial Establishment (in Billions) (VDPS)	Estimated Thermal Energy BTUs by Commercial Establishments in Municipality (in Billions)
Municipal Commercial Energy Use	356	0.725	258

The table uses data available from the Vermont Department of Labor (VT DOL) and the Vermont Department of Public Service (DPS) to estimate current municipal commercial establishment energy use in the municipality.

Table 1D: Current Electricity Use

Use Sector	Current Electricity Use
Residential (kWh)	25,853,348
Commercial and Industrial (kWh)	91,340,073
Total (kWh)	117,193,421

This table displays current electricity use within the municipality. This data is available from Efficiency Vermont (EVT).

Table 1E: Residential Thermal Efficiency Targets

	2025	2035	2050
"Residential - Increased Efficiency and Conservation (% of municipal households to be weatherized)"	5%	16%	78%

This table displays targets for thermal efficiency of residential structures. The data is based on a methodology developed by DPS using data available from the regional Long-range Energy Alternatives Planning (LEAP) analysis and ACS. The data in this table represents the percentage of municipal households that will need to be weatherized in the target years. The target is cumulative.

Table 1F: Commercial Thermal Efficiency Target

	2025	2035	2050
"Commercial - Increased Efficiency and Conservation (% of commercial establishments to be weatherized)"	25%	25%	73%

This table shows the same information as Table 1E, but sets a target for commercial thermal efficiency and weatherization. Information from the VT DOL is required to complete this target. The target is cumulative.

Table 1G: Thermal Fuel Switching (Residential and Commercial) – Wood Systems

	2025	2035	2050
New Efficient Wood Heat Systems (in units)	21	50	167

This table provides a target for new wood heating systems for residential and commercial structures in the municipality for each target year. This target was calculated using data from LEAP and ACS. The target is cumulative.

Table 1H: Thermal Fuel Switching (Residential and Commercial) – Heat Pumps

	2025	2035	2050
New Heat Pumps (in units)	306	731	1444

This table provides a target for new heat pump systems for residential and commercial structures in the municipality for each target year. This target was calculated using data from LEAP and ACS. The target is cumulative.

Table 1I: Electricity Efficiency Targets

	2025	2035	2050
Increase Efficiency and Conservation (BTUs)	25.2%	48.3%	100.7%

Data in this table displays a target for increased electricity efficiency and conservation during the target years. This target will be met through conversions to high efficiency appliances, electric heat pumps, and electric light-duty vehicles. These targets were developed using regional LEAP analysis. The target is cumulative.

Table 1J: Use of Renewables – Transportation

	2025	2035	2050
Renewable Energy Use - Transportation (BTUs)	16.3%	41.3%	93.2%

This data displays targets for the percentage of transportation energy use coming from renewable sources during each target year. This target will be met through conversions to electric light-duty vehicles and biodiesel heavy-duty vehicles. This data was developed using the LEAP analysis. The target is cumulative.

Table 1K: Use of Renewables – Heating

	2025	2035	2050
Renewable Energy Use - Heating (BTUs)	43.1%	55.6%	83.0%

This data displays targets for the percentage of heating energy use coming from renewable sources during each target year. This target will be met through conversions to electric heat pumps and high efficiency wood heating systems. This data was developed using information from the LEAP analysis. The target is cumulative.

Table 1L: Use of Renewables – Electricity

	2025	2035	2050
Renewable Energy Use - Electricity (MWh)	2,984.8	5,969.5	9,044.7

This data displays targets for MWh of electricity generation coming from renewable sources within the municipality during each target year. This data was developed using information from the regional planning commission and DPS. This data is the same as the data in Table 1Q. The target is cumulative.

Table 1M: Transportation Fuel Switching Targets – Electric Vehicles

	2025	2035	2050
Electric Vehicles	363	2715	6459

This tables displays a target for switching from fossil fuel based vehicles (gasoline and diesel) to electric vehicles. This target is calculated using LEAP and ACS data. The target is cumulative.

Table 1N: Transportation Fuel Switching Targets – Biodiesel

	2025	2035	2050
Biodiesel Vehicles	1649	3303	6416

This tables displays a target for switching from fossil fuel based vehicles to biodiesel-powered vehicles. This target is calculated using LEAP and ACS data. The target is cumulative.

Table 1O: Existing Renewable Generation

Renewable Type	MW	MWh
Solar	0.93	1140.55
Wind	0.00	0.00
Hydro	0.00	0.00
Biomass	0.00	0.00
Other	0.00	0.00
Total Existing Generation	0.93	1140.55

Table 1O shows existing renewable generation in the municipality, in MW and MWh, based on information available from the Vermont Department of Public Service.

Table 1P: Renewable Generation Potential

Renewable Type	MW	MWh
Rooftop Solar	5	5,710
Ground-mounted Solar	33	40,932
Wind	53	163,977
Hydro	0	0
Biomass and Methane	0	0
Other	0	0
Total Renewable Generation Potential	92	210,619

Renewable generation potential is based on mapping completed by the regional planning commission that is based on the Municipal Determination Standards and associated guidance documents developed by DPS. The renewable generation potential is expressed in MW and MWh by the type of renewable resource (solar, wind, hydro, etc.).

Table 1Q: Renewable Generation Targets

	2025	2035	2050
Total Renewable Generation Target (in MWh)	2,984.75	5,969.50	9,044.70

This data displays targets for MWh of electricity generation coming from renewable sources within the municipality during each target year. This data was developed using information from the regional planning commission and DPS. This data is the same as the data in Table 1L.

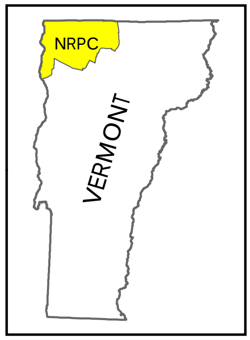
Table 1R: Sufficient Land?

	Y/N
Solar	Y
Wind	Y

This table shows whether or not there is sufficient land in the municipality to meet the renewable generation targets based on the renewable generation potential in the municipality.

Utility Service Areas

St. Albans City, Vermont
Act 174
The Energy Development Improvement Act of 2016



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N

Legend

Utility Service Area Features

- Green Mountain Power
- Swanton Village Electric
- Vermont Electric Co-op
- Enosburg Falls Electric
- Substation
- 3 Phase Power Line
- Transmission Line

Sources: VCGI
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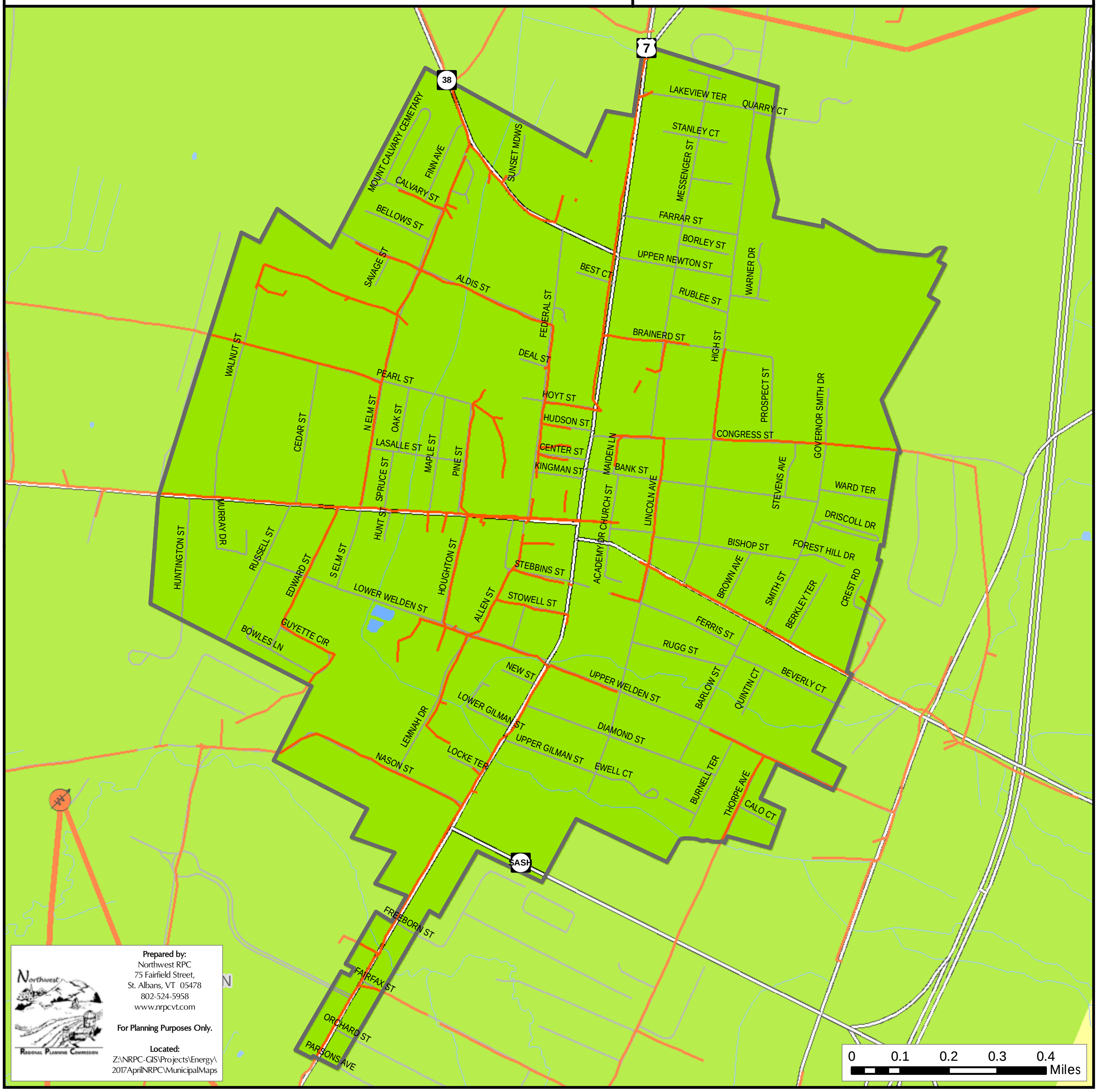

Prepared by:
Northwest RPC
75 Fairfield Street,
St. Albans, VT 05478
802-524-5958
www.nrpcvt.com

For Planning Purposes Only.

Located:
Z:\NRPC-GIS\Projects\Energy\2017AprilNRPC\MunicipalMaps

Transmission & 3 Phase Power Infrastructure

St. Albans City, Vermont
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The Energy Development Improvement Act of 2016

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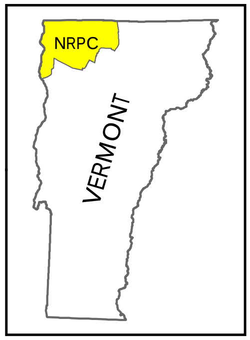

Legend

- Substation
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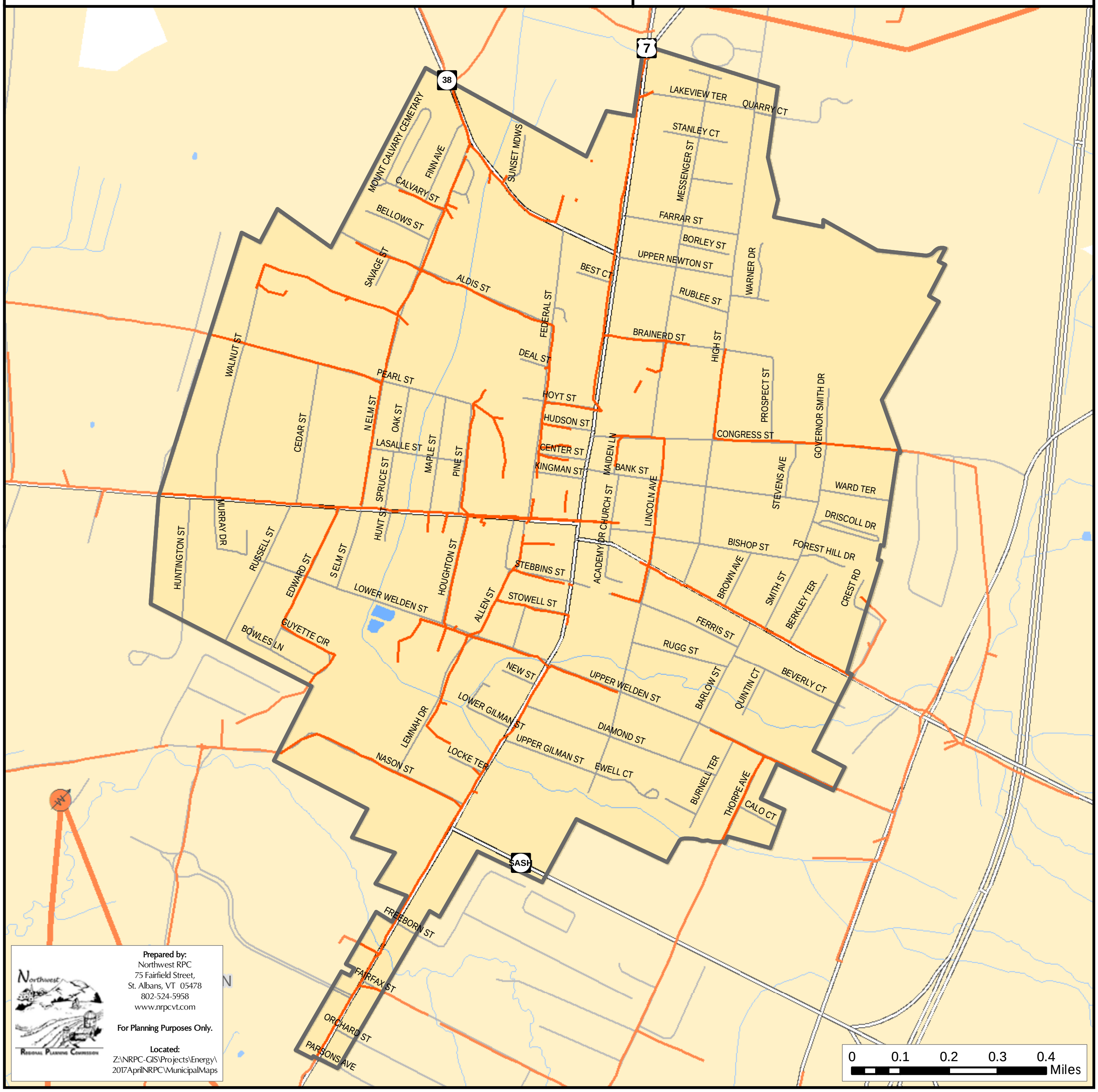

Existing Generation Facilities

St. Albans City, Vermont
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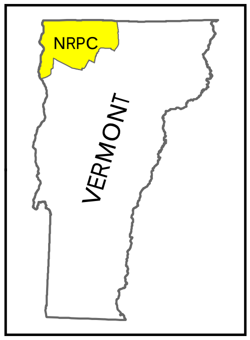

Legend

- Biomass Facility
- Hydro Facility
- Solar Facility
- Wind Facility

Note: Only generators 15kW are shown on the map. A full list of all generators is available.

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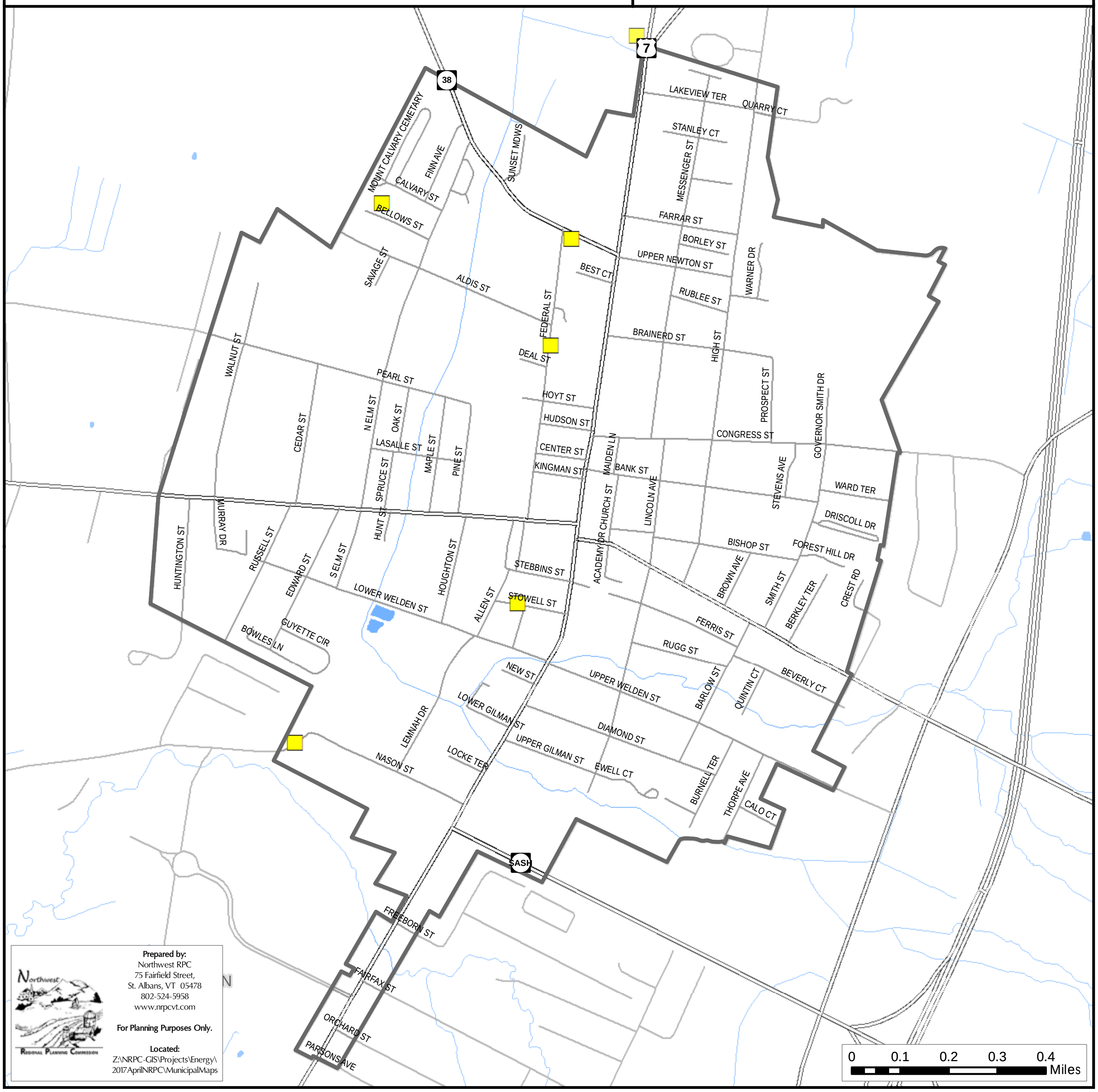

Natural Gas Lines

St. Albans City, Vermont
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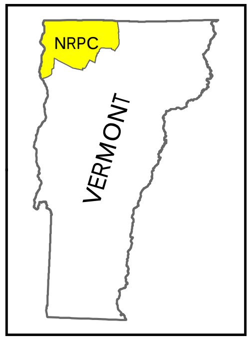

Legend

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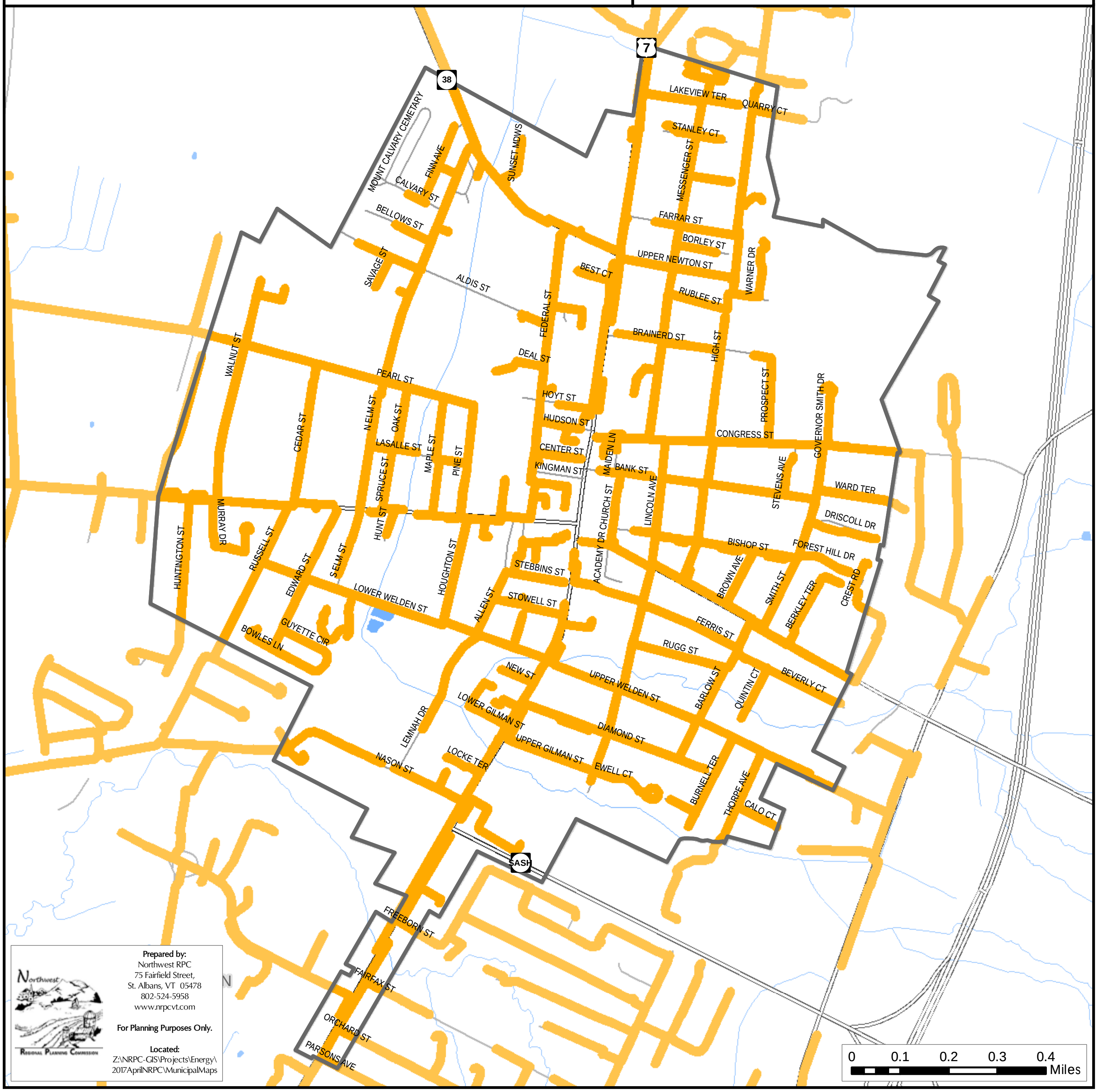

Hydro

St. Albans City, Vermont
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Potential Hydroelectric Facility

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Operating Hydroelectric Facility

- Dam not on National Wild and Scenic River
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NRPC

VERMONT

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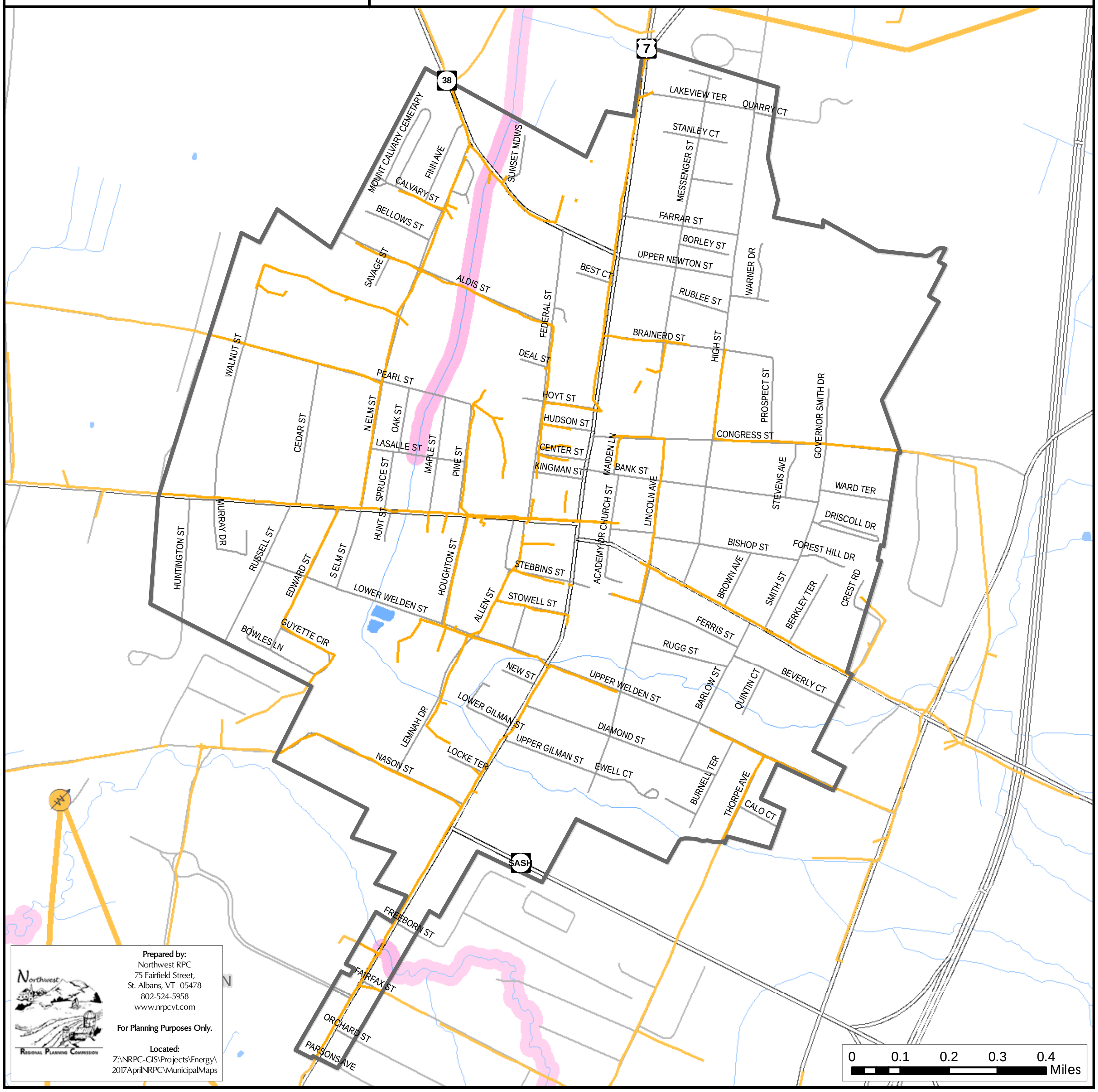

Solar

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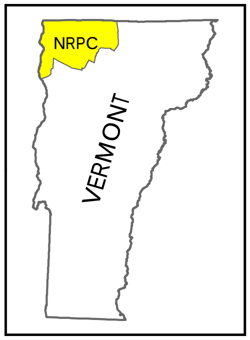

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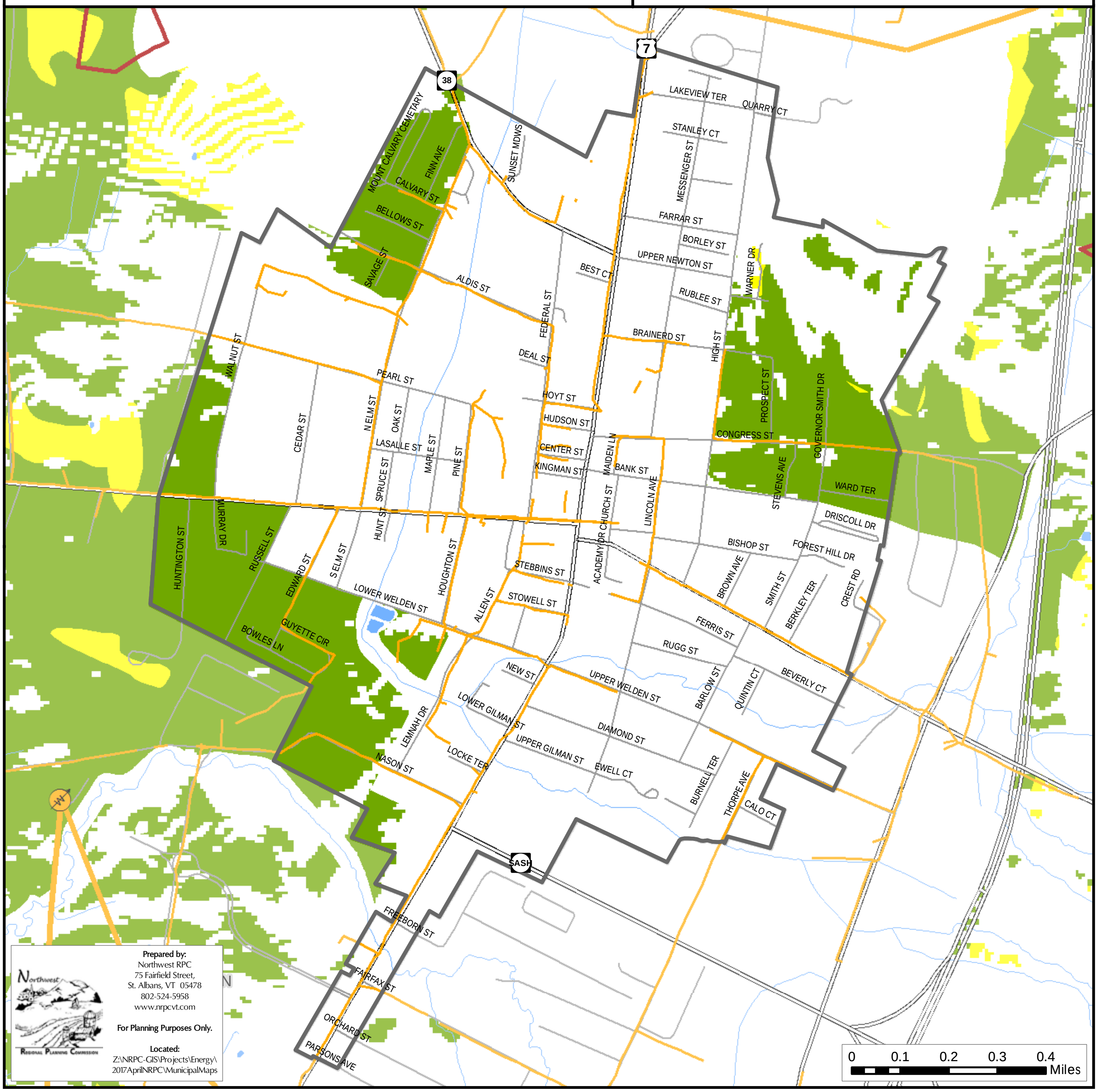

Wind

St. Albans City, Vermont
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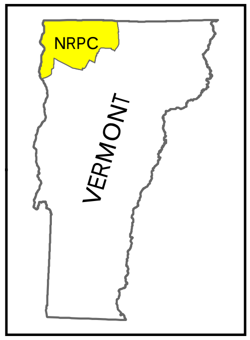

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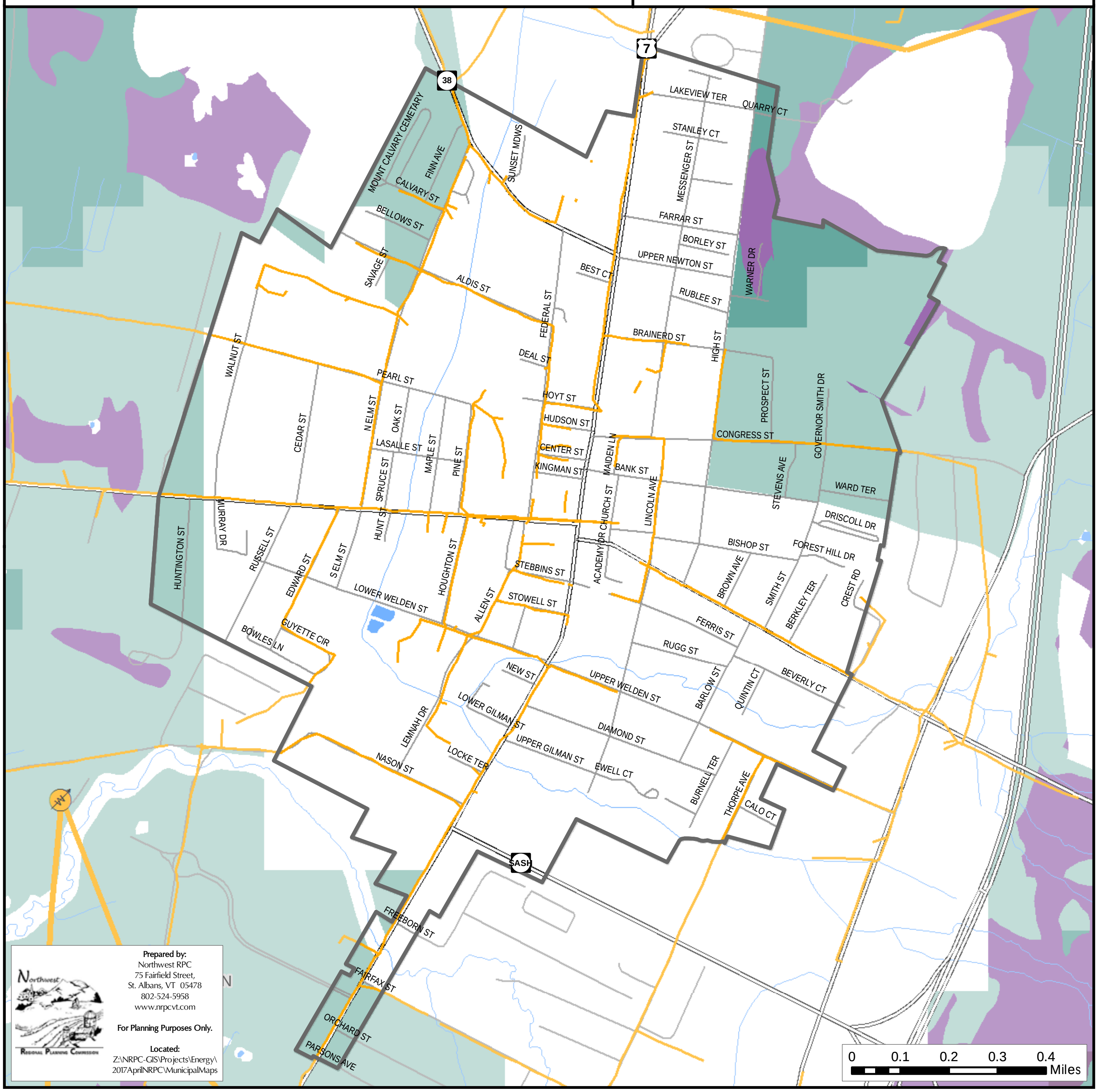

Woody Biomass

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Act 174
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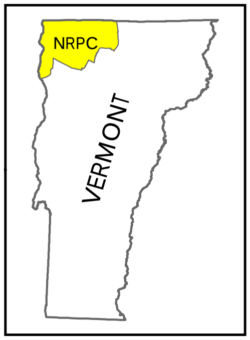

Legend

- Biomass System
- Cow Power
- Substation
- 3 Phase Power Line
- Transmission Line
- Prime Woody Biomass/No Known Constraints
- Base Woody Biomass/Possible Constraints

Sources: VCGI

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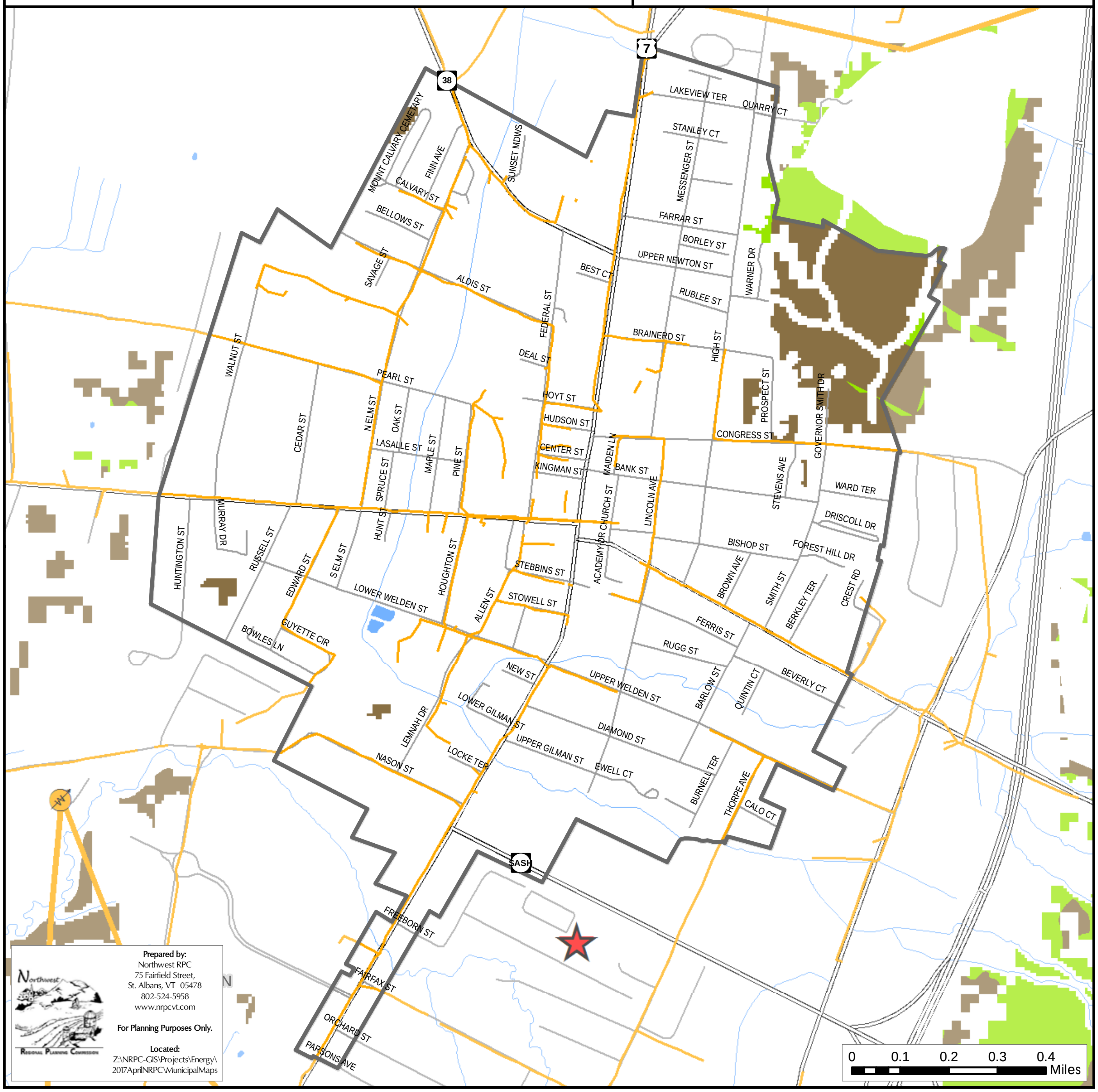

All Generators in Municipality						
Category	Sub - Category	Organization Type	Address	City	CPG Number	Capacity kW
Solar	Ground-mounted PV: Tracker	Institution	29 Bellows Road	St. Albans	3065.00	142.50
Solar	Roof-Mounted PV	Residential	8 Hodges St	St. Albans	3530.00	4.60
Solar	Roof-Mounted PV	Institution	71 South Main Street	St. Albans	1036.00	12.00
Solar	Roof-Mounted PV	Residential	153 Federal St	St. Albans	2194.00	25.70
Solar	Roof-Mounted PV	Residential	34 Beverly Ct	St. Albans	2751.00	5.60
Solar	Roof-Mounted PV	Residential	147 High St	St. Albans	3590.00	4.30
Solar	Roof-Mounted PV	Residential	95 High St	St. Albans	6102.00	6.40
Solar	Roof-Mounted PV	Residential	68 Smith St	St. Albans	3816.00	5.00
Solar	Roof-Mounted PV	Residential	10 Upper Welden Street	St. Albans	3488.00	4.80
Solar	Roof-Mounted PV	Residential	8 Beverly Ct	St. Albans	2640.00	3.70
Solar	Roof-Mounted PV	Residential	73 Ferris Street	St. Albans	4227.00	6.00
Solar	Roof-Mounted PV	Residential	60 Walnut St	St. Albans	2721.00	4.30
Solar	Roof-Mounted PV	Residential	112 Lincoln Av	St. Albans	2682.00	3.70
Solar	Roof-Mounted PV	Residential	12 Nason St	St. Albans	3765.00	4.00
Solar	Roof-Mounted PV	Residential	27 Beverly Court	St. Albans	2904.00	5.70
Solar	Roof-Mounted PV	Residential	25 Stowell St	St. Albans	1795.00	36.10
Solar	Roof-Mounted PV	Residential	76 Bank Street	St. Albans	0.00	10.00
Solar	Roof-Mounted PV	Residential	21 Barlow Street	St. Albans	0.00	6.00
Solar	Roof-Mounted PV	Residential	9 Thorpe Ave	St. Albans	0.00	7.60
Solar	Roof-Mounted PV	Residential	59 Cedar Street	St. Albans	6977.00	3.80
Solar	Roof-Mounted PV	Residential	77 Nason Street	St. Albans	6537.00	22.52
Solar	Roof-Mounted PV	Residential	23 Cedar Street	St. Albans	7315.00	4.00
Solar	Roof-Mounted PV	Residential	12 Thorpe Avenue	St. Albans	0.00	4.20
Solar	Roof-Mounted PV	Residential	57 Walnut Street	St. Albans	0.00	3.00
Solar	Roof-Mounted PV	Residential	10 Thorpe Ave	St. Albans	0.00	5.00
Solar	Roof-Mounted PV	Residential	128 S Main St	St. Albans	7493.00	3.60
Solar	Roof-Mounted PV	Residential	48 Maple Street	St. Albans	0.00	3.60

All Generators in Municipality

Category	Sub - Category	Organization Type	Address	City	CPG Number	Capacity kW
Solar	Roof-Mounted PV	Residential	7 Lakeview Terr	St. Albans	0.00	3.60
Solar	Roof-Mounted PV	Residential	45 Huntington Street	St. Albans	0.00	7.60
Solar	Roof-Mounted PV	Residential	120 Lincoln Avenue	St. Albans	0.00	3.80
Solar	Roof-Mounted PV	Residential	9 Ewell Court	St. Albans	0.00	4.20
Solar	Roof-Mounted PV	Business	20 Lower Newton Street	St. Albans	0.00	500.00
Solar	Roof-Mounted PV	Residential	28 Beverly Court	St. Albans	0.00	5.00
Solar	Roof-Mounted PV	Residential	17 Murray Drive	St. Albans	0.00	5.50
Solar	Roof-Mounted PV	Residential	11 Brown Avenue	St. Albans	0.00	5.20
Solar	Roof-Mounted PV	Residential	29 Beverly Court	St. Albans	0.00	3.80
Solar	Roof-Mounted PV	Residential	20 Lakeview Terrace	St. Albans	0.00	6.00
Solar	Roof-Mounted PV	Residential	70 Bank Street	St. Albans	0.00	11.40
Solar	Roof-Mounted PV	Residential	100 Congress St	St. Albans	6609.00	5.00
Solar	Roof-Mounted PV	Residential	113 Bank Street	St. Albans	0.00	3.00
Solar	Roof-Mounted PV	Residential	74 Upper Welden St	St. Albans	0.00	6.00
Solar	Roof-Mounted PV	Residential	19 Guyette Circle	St. Albans	0.00	5.00
Solar	Roof-Mounted PV	Residential	26 Finn Avenue	St. Albans	0.00	5.00
Solar	Roof-Mounted PV	Residential	20 Thorpe Avenue	St. Albans	0.00	5.00

Municipal Analysis & Targets - Saint Albans Town

The following is an explanation of the municipal energy data compiled by Northwest Regional Planning Commission (NRPC). The intent of the municipal energy data is to provide the municipalities with data required to ensure compliance with the requirements of Act 174 and "Enhanced Energy Planning" (24 V.S.A. 4352). The following tables contain data that estimates current energy use and provides targets for future energy use across all sectors (transportation, heating, and electricity). It also sets targets for renewable energy generation within the municipality.

This data is meant to be a starting point for the municipality to begin planning its energy future and to talk about the changes that may need to occur within the municipality to ensure that local, regional and state energy goals are met. This includes the State of Vermont's goal to have 90% of all energy demand be met from renewable sources by 2050.

Figure 1 - Data Sources

ACS – American Community Survey

DOL –Vermont Department of Labor

DPS – Vermont Department of Public Service

EIA – Energy Information Administration

EVT – Efficiency Vermont

LEAP – Long-Range Energy Alternatives Planning

VEIC – Vermont Energy Investment Corporation

VTrans – Vermont Agency of Transportation

Data Sources

Estimates of current energy use consist primarily of data available from the American Community Survey (ACS), the Vermont Agency of Transportation (VTrans), the Vermont Department of Labor (DOL), and the Vermont Department of Public Service (DPS). Targets for future energy use are reliant upon the Long-range Energy Alternatives Planning (LEAP) analysis for the region completed the Vermont Energy Investment Corporation (VEIC). Targets for future energy generation have come from the regional planning commission and DPS. For more information on LEAP, see the Northwest Regional Energy Plan (www.nrpcvt.com). Targets for both future energy use and energy generation have been generally developed using a "top down" method of disaggregating regional data to the municipal level.

It is possible to develop "bottom up" data. For those municipalities interested in that approach, please see the Department of Public Service's Analysis and Targets Guidance (http://publicservice.vermont.gov/content/act-174-recommendations-and-determination-standards).

Please remember that the targets established by LEAP represent only one way to achieve energy goals. There may several other similar pathways that a municipality may choose to take in order to meet the 90x50 goal.

Below is a worksheet by worksheet explanation of the Municipal Template spreadsheet:

1. Municipal Data Summary

The following tables summarize all data that is required to be in a municipal plan if the plan is to meet the "determination" standards established by the Vermont Department of Public Service.

Table 1A: Current Municipal Transportation Energy Use

Transportation Data	Municipal Data
Total # of Passenger Vehicles (ACS 2011-2015)	4,433
Average Miles per Vehicle (Vtrans)	11,356
Total Miles Traveled	50,341,148
Realized MPG (2013 - VTrans 2015 Energy Profile)	18.6
Total Gallons Use per Year	2,706,513
Transportation BTUs (Billion)	326
Average Cost per Gallon of Gasoline (RPC)	2.31
Gasoline Cost per Year	6,252,046

This table uses data from the American Community Survey (ACS) and Vermont Agency of Transportation (VTrans) to calculate current transportation energy use and energy costs in the municipality.

Table 1B: Current Municipal Residential Heating Energy Use

Fuel Source	Municipal Households (ACS 2011-2015)	% of Municipal Households	Municipal Square Footage Heated	Municipal BTU (in Billions)
Natural Gas	892	38.8%	1,499,136	90
Propane	196	8.5%	373,184	22
Electricity	0	0.0%	0	0
Fuel Oil	902	39.2%	1,590,688	95
Coal	0	0.0%	0	0
Wood	279	12.1%	531,216	32
Solar	0	0.0%	0	0
Other	32	1.4%	38,400	2
No Fuel	0	0.0%	0	0
Total	2301	100.0%	4,032,624	242

This table displays data from the ACS that estimates current municipal residential heating energy use.

Table 1C: Current Municipal Commercial Energy Use

	Commercial Establishments in Municipality (VT DOL)	Estimated Thermal Energy BTUs per Commercial Establishment (in Billions) (VDPS)	Estimated Thermal Energy BTUs by Commercial Establishments in Municipality (in Billions)
Municipal Commercial Energy Use	101	0.725	73

The table uses data available from the Vermont Department of Labor (VT DOL) and the Vermont Department of Public Service (DPS) to estimate current municipal commercial establishment energy use in the municipality.

Table 1D: Current Electricity Use

Use Sector	Current Electricity Use
Residential (kWh)	20,684,476
Commercial and Industrial (kWh)	25,913,897
Total (kWh)	46,598,373

This table displays current electricity use within the municipality. This data is available from Efficiency Vermont (EVT).

Table 1E: Residential Thermal Efficiency Targets

	2025	2035	2050
"Residential - Increased Efficiency and Conservation (% of municipal households to be weatherized)"	5%	16%	78%

This table displays targets for thermal efficiency of residential structures. The data is based on a methodology developed by DPS using data available from the regional Long-range Energy Alternatives Planning (LEAP) analysis and ACS. The data in this table represents the percentage of municipal households that will need to be weatherized in the target years. The target is cumulative.

Table 1F: Commercial Thermal Efficiency Target

	2025	2035	2050
"Commercial - Increased Efficiency and Conservation (% of commercial establishments to be weatherized)"	25%	25%	73%

This table shows the same information as Table 1E, but sets a target for commercial thermal efficiency and weatherization. Information from the VT DOL is required to complete this target. The target is cumulative.

Table 1G: Thermal Fuel Switching (Residential and Commercial) – Wood Systems

	2025	2035	2050
New Efficient Wood Heat Systems (in units)	10	25	103

This table provides a target for new wood heating systems for residential and commercial structures in the municipality for each target year. This target was calculated using data from LEAP and ACS. The target is cumulative.

Table 1H: Thermal Fuel Switching (Residential and Commercial) – Heat Pumps

	2025	2035	2050
New Heat Pumps (in units)	238	568	1122

This table provides a target for new heat pump systems for residential and commercial structures in the municipality for each target year. This target was calculated using data from LEAP and ACS. The target is cumulative.

Table 1I: Electricity Efficiency Targets

	2025	2035	2050
Increase Efficiency and Conservation (BTUs)	25.2%	48.3%	100.7%

Data in this table displays a target for increased electricity efficiency and conservation during the target years. This target will be met through conversions to high efficiency appliances, electric heat pumps, and electric light-duty vehicles. These targets were developed using regional LEAP analysis. The target is cumulative.

Table 1J: Use of Renewables – Transportation

	2025	2035	2050
Renewable Energy Use - Transportation (BTUs)	8.4%	29.3%	89.5%

This data displays targets for the percentage of transportation energy use coming from renewable sources during each target year. This target will be met through conversions to electric light-duty vehicles and biodiesel heavy-duty vehicles. This data was developed using the LEAP analysis. The target is cumulative.

Table 1K: Use of Renewables – Heating

	2025	2035	2050
Renewable Energy Use - Heating (BTUs)	45.5%	58.8%	86.7%

This data displays targets for the percentage of heating energy use coming from renewable sources during each target year. This target will be met through conversions to electric heat pumps and high efficiency wood heating systems. This data was developed using information from the LEAP analysis. The target is cumulative.

Table 1L: Use of Renewables – Electricity

	2025	2035	2050
Renewable Energy Use - Electricity (MWh)	7,524.9	15,049.9	22,802.8

This data displays targets for MWh of electricity generation coming from renewable sources within the municipality during each target year. This data was developed using information from the regional planning commission and DPS. This data is the same as the data in Table 1Q. The target is cumulative.

Table 1M: Transportation Fuel Switching Targets – Electric Vehicles

	2025	2035	2050
Electric Vehicles	388	2905	6910

This tables displays a target for switching from fossil fuel based vehicles (gasoline and diesel) to electric vehicles. This target is calculated using LEAP and ACS data. The target is cumulative.

Table 1N: Transportation Fuel Switching Targets – Biodiesel

	2025	2035	2050
Biodiesel Vehicles	555	1103	2119

This tables displays a target for switching from fossil fuel based vehicles to biodiesel-powered vehicles. This target is calculated using LEAP and ACS data. The target is cumulative.

Table 1O: Existing Renewable Generation

Renewable Type	MW	MWh
Solar	4.33	5310.31
Wind	0.01	42.92
Hydro	0.00	0.00
Biomass	0.00	0.00
Other	0.00	0.00
Total Existing Generation	4.34	5353.24

Table 1O shows existing renewable generation in the municipality, in MW and MWh, based on information available from the Vermont Department of Public Service.

Table 1P: Renewable Generation Potential

Renewable Type	MW	MWh
Rooftop Solar	3	3,441
Ground-mounted Solar	993	1,217,284
Wind	2,487	7,626,537
Hydro	0	0
Biomass and Methane	0	0
Other	0	0
Total Renewable Generation Potential	3,483	8,847,263

Renewable generation potential is based on mapping completed by the regional planning commission that is based on the Municipal Determination Standards and associated guidance documents developed by DPS. The renewable generation potential is expressed in MW and MWh by the type of renewable resource (solar, wind, hydro, etc.).

Table 1Q: Renewable Generation Targets

	2025	2035	2050
Total Renewable Generation Target (in MWh)	7,524.93	15,049.86	22,802.82

This data displays targets for MWh of electricity generation coming from renewable sources within the municipality during each target year. This data was developed using information from the regional planning commission and DPS. This data is the same as the data in Table 1L.

Table 1R: Sufficient Land?

	Y/N
Solar	Y
Wind	Y

This table shows whether or not there is sufficient land in the municipality to meet the renewable generation targets based on the renewable generation potential in the municipality.

Utility Service Areas

St. Albans Town, Vermont
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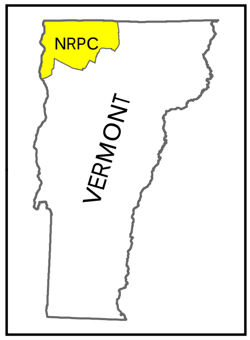

Legend

Utility Service Area Features

- Green Mountain Power
- Swanton Village Electric
- Vermont Electric Co-op
- Enosburg Falls Electric
- Substation
- 3 Phase Power Line
- Transmission Line

Sources: VCGI
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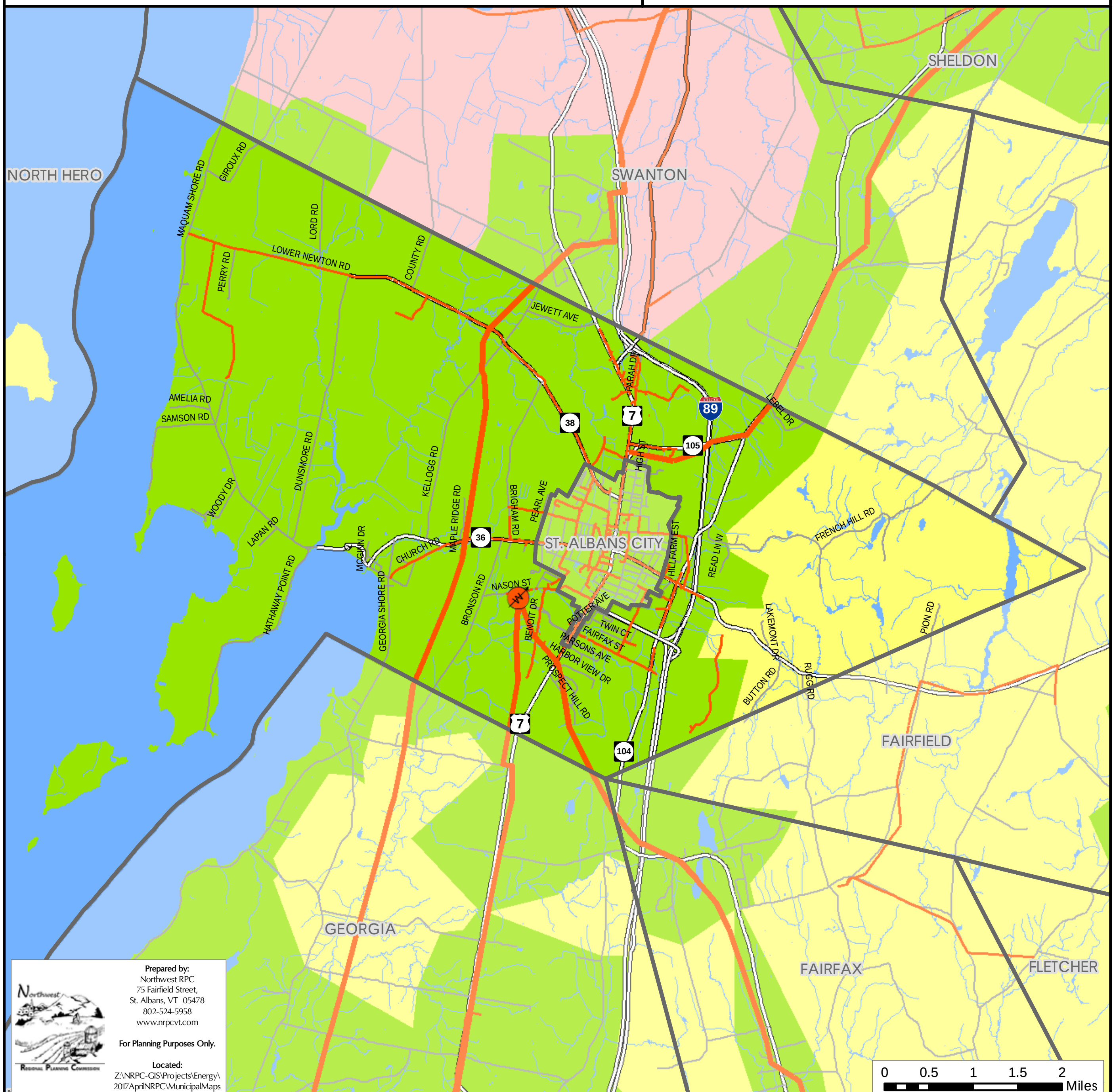

Transmission & 3 Phase Power Infrastructure

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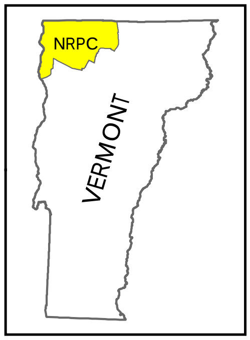

Legend

- Substation
- 3 Phase Power Line
- Transmission Line
- 1/2 Mile Buffer (3 Phase Power Line & Transmission Line)

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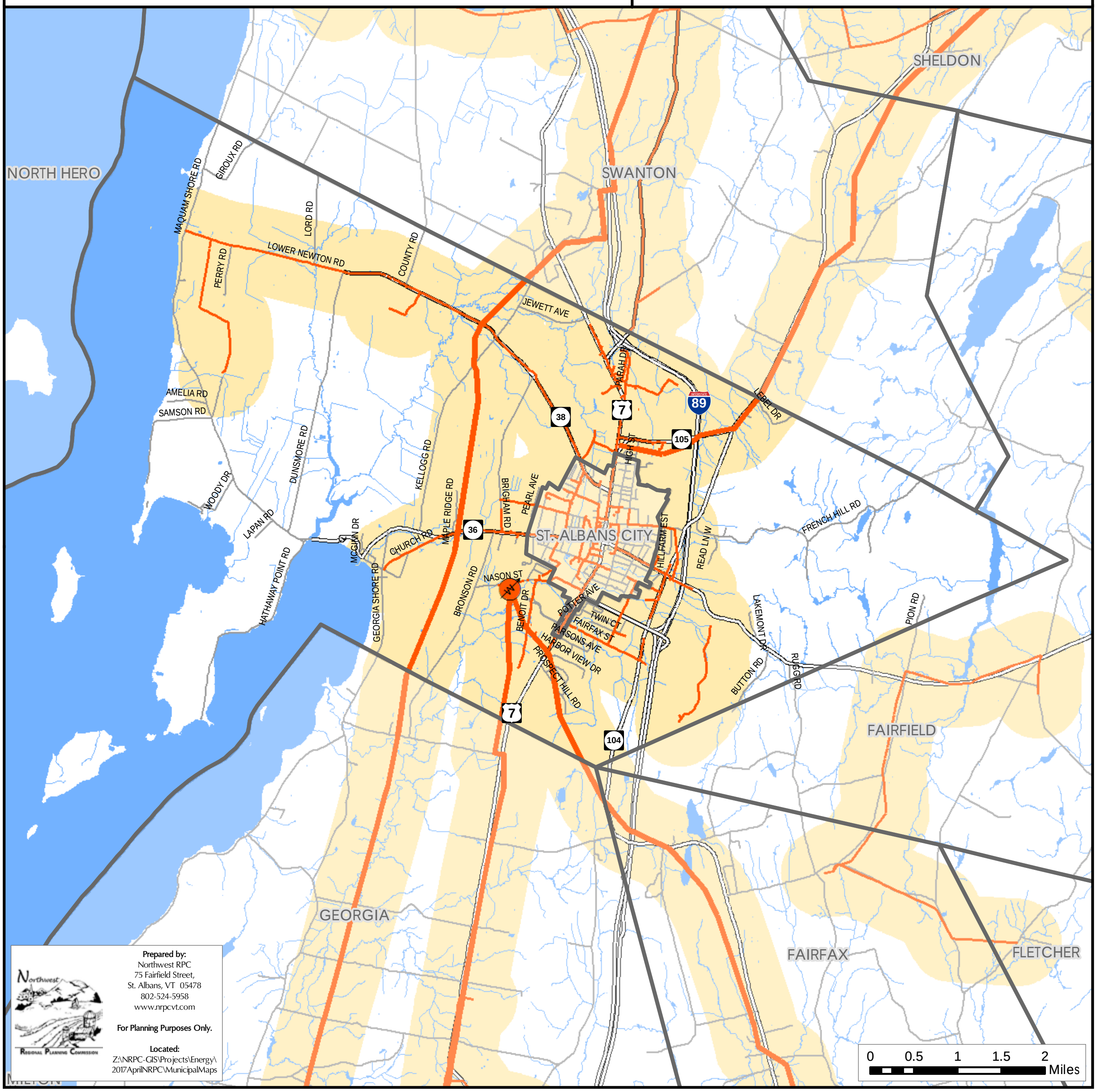

Existing Generation Facilities

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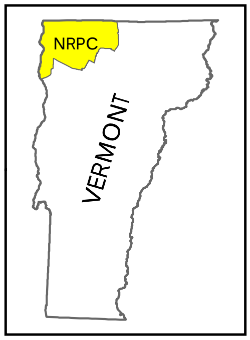

Legend

- Biomass Facility
- Hydro Facility
- Solar Facility
- Wind Facility

Note: Only generators 15kW are shown on the map. A full list of all generators is available.

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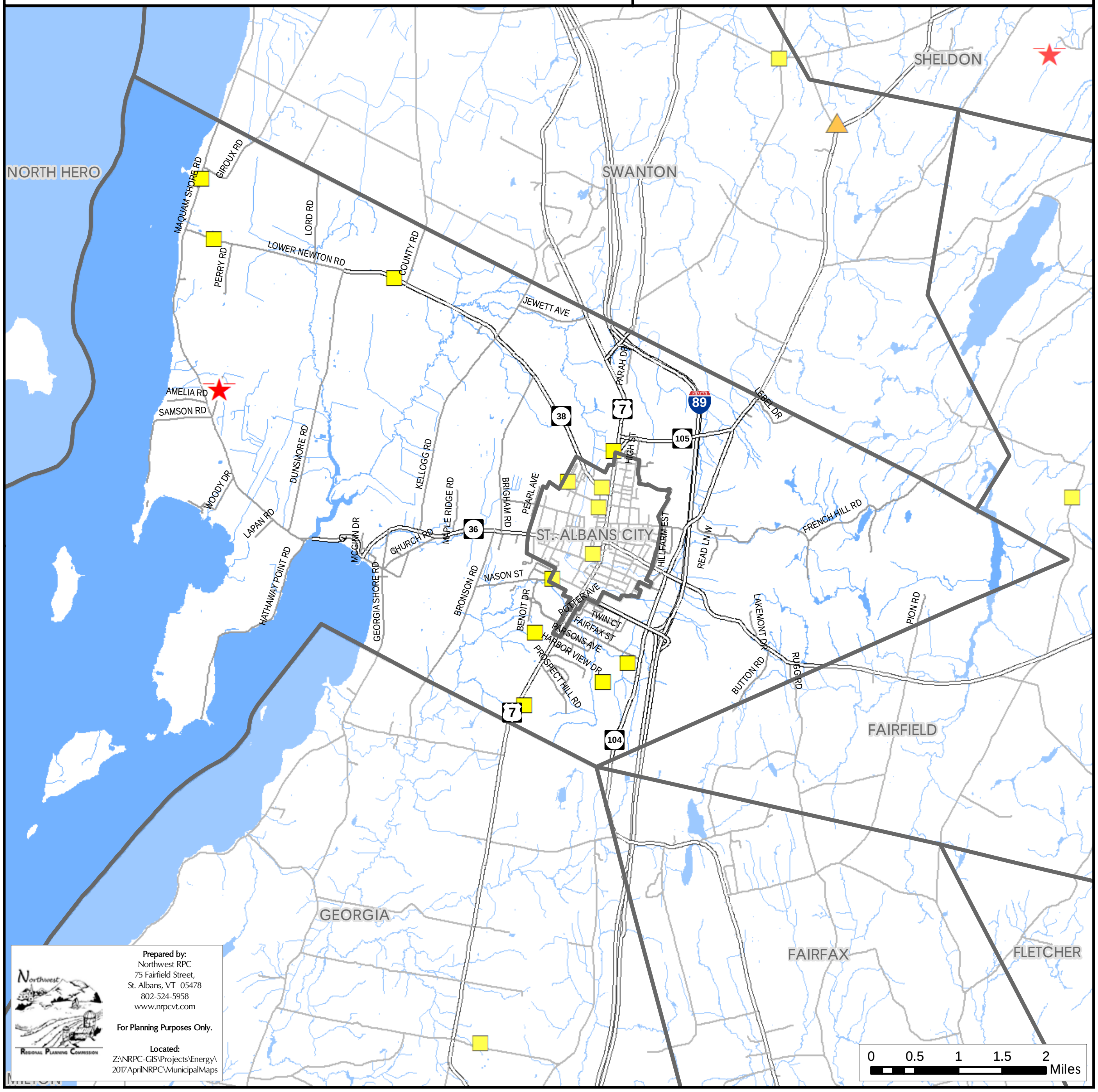

Natural Gas Lines

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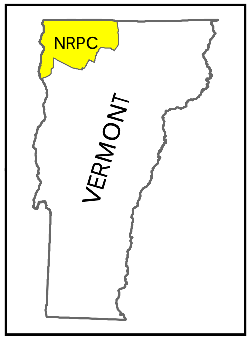

Legend

Natural Gas Line

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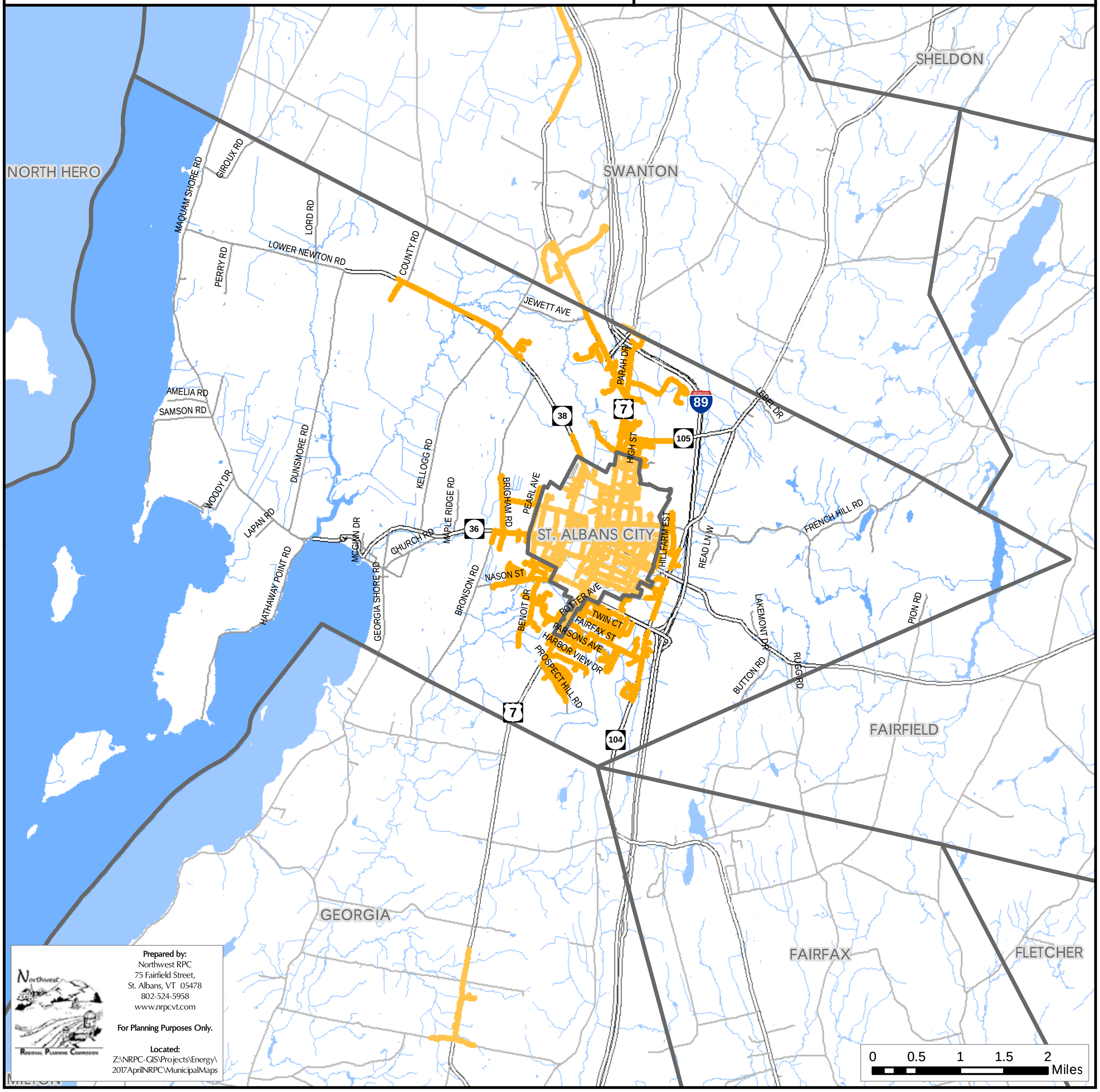

Hydro

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N

Legend

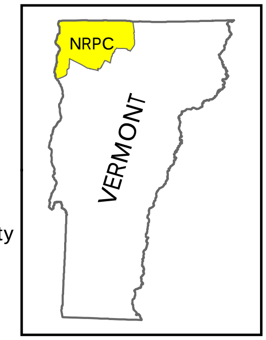
- Substation
- 3 Phase Power Line
- Transmission Line
- Designated Outstanding Resource Water
- Known Constraint - Designated National Wild & Scenic River
- Possible Constraint - Stressed or Impaired Water
- Possible Constraint - RINAs

Potential Hydroelectric Facility

- < 50 kW Capacity
- > 50 kW Capacity
- High Hazard with < 50 kW Capacity
- High Hazard with > 50 kW Capacity

Operating Hydroelectric Facility

- Dam not on National Wild and Scenic River
- Dam on National Wild and Scenic River



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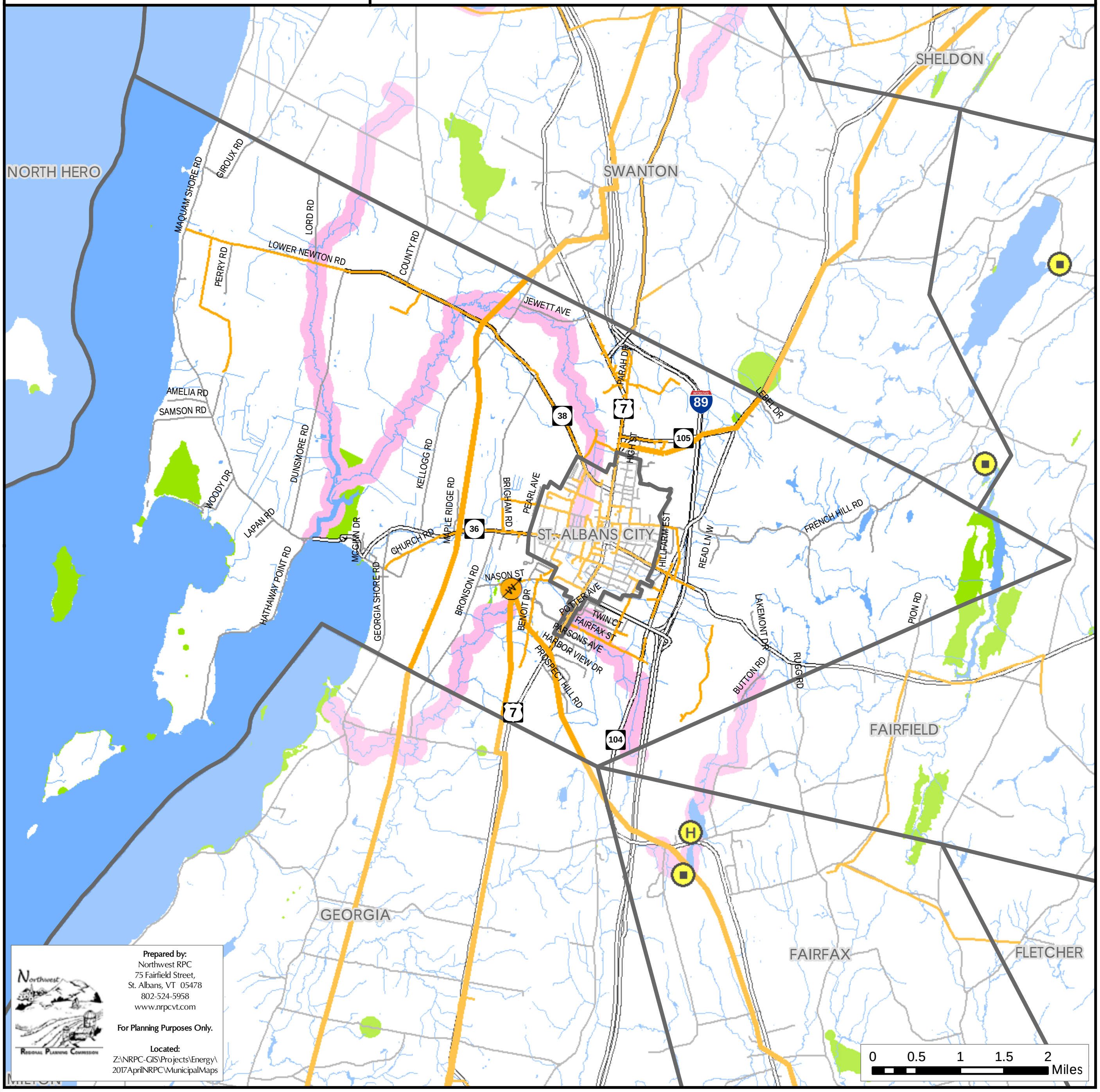

Solar

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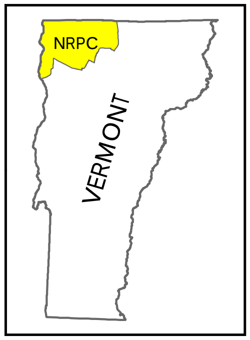

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N

Legend

- Substation
- 3 Phase Power Line
- Transmission Line
- 1/2 Mile Buffer (3 Phase Power Line & Transmission Line)
- Prime Solar/No Known Constraints
- Base Solar/Possible Constraints

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Wind

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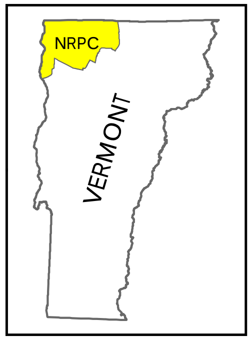

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N

Legend

- Substation
- 3 Phase Power Line
- Transmission Line
- Prime Wind: Areas of high wind potential and no known constraints. Darker areas have higher wind speeds.
- Base Wind: Areas of high wind potential and a presence of possible constraints. Darker areas have higher wind speeds.

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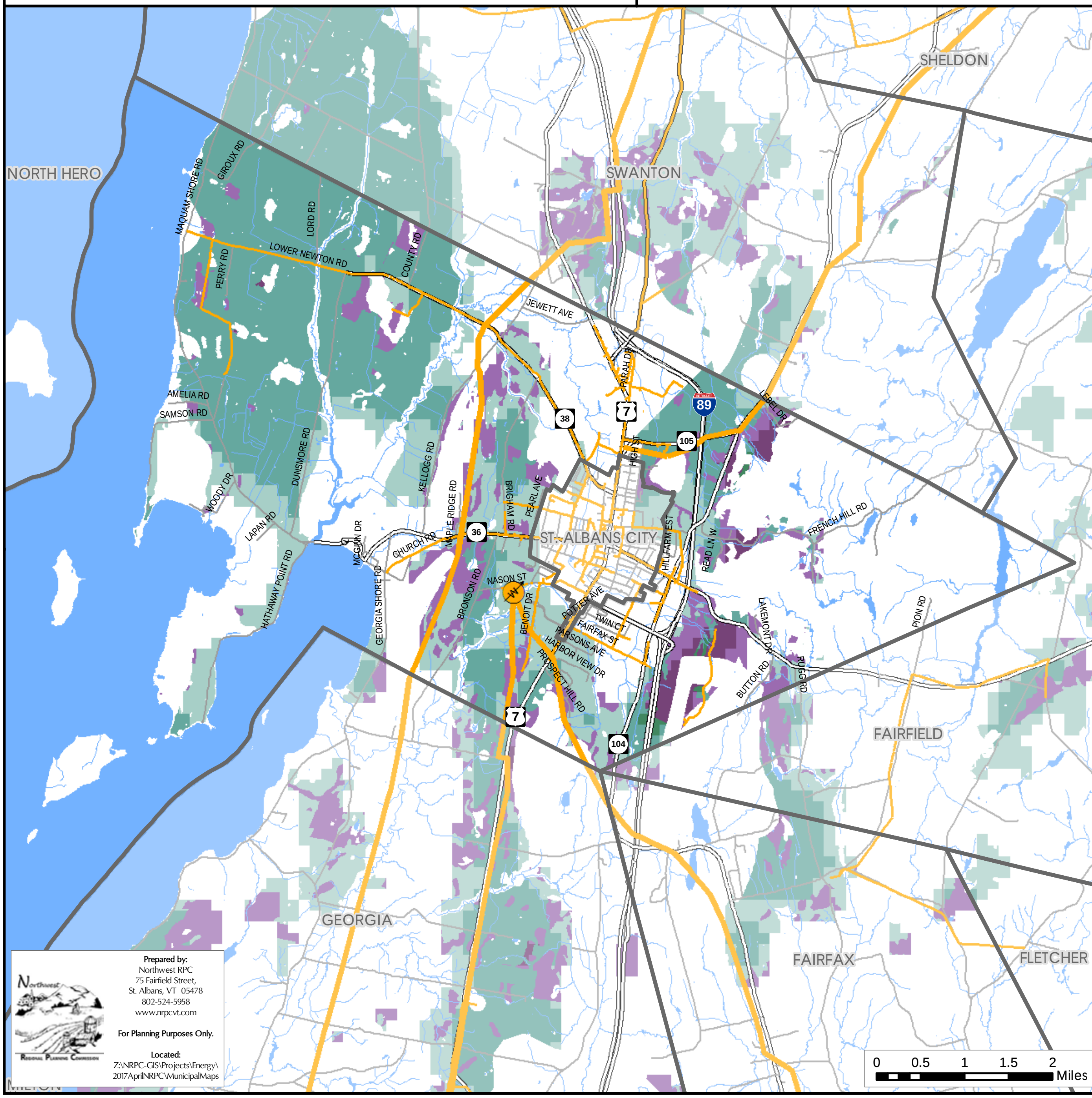

Woody Biomass

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N

NRPC

VERMONT

Legend

- Biomass System
- Cow Power
- Substation
- 3 Phase Power Line
- Transmission Line
- Prime Woody Biomass/No Known Constraints
- Base Woody Biomass/Possible Constraints

Sources: VCGI

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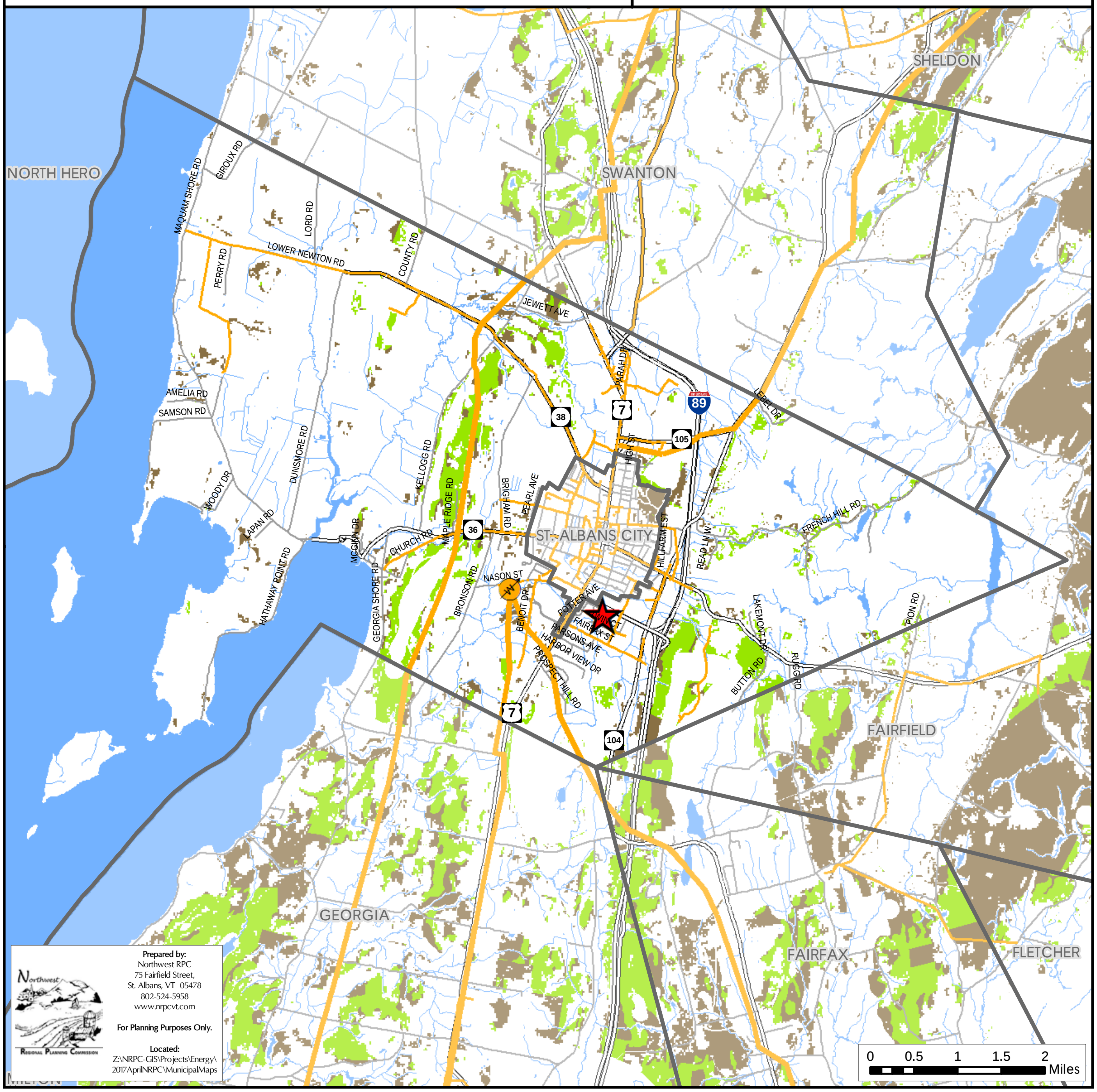


All Generators in Municipality

Category	Sub - Category	Organization Type	Address	City	CPG Number	Capacity kW
Solar	Ground-mounted PV: Fixed Rack	Residential	870 Maquam Shore Rd	St. Albans	2684.00	11.90
Solar	Ground-mounted PV: Fixed Rack	Residential		St. Albans	6479.00	150.00
Solar	Ground-mounted PV: Fixed Rack	Residential	1045 Bronson Road	St. Albans	6577.00	9.10
Solar	Ground-mounted PV: Fixed Rack	Residential	11 Cedar Hill Drive	St. Albans	0.00	15.00
Solar	Ground-mounted PV: Fixed Rack	Residential	322 Maquam Shore Rd	St. Albans	0.00	500.00
Solar	Ground-mounted PV: Fixed Rack	Business	33 Rewes Drive	St. Albans	0.00	148.40
Solar	Ground-mounted PV: Fixed Rack	Residential		St. Albans	0.00	2200.00
Solar	Ground-mounted PV: Pole	Residential	136 Lapan Rd	St. Albans	2910.00	5.90
Solar	Ground-mounted PV: Pole	Residential	69 Little Country Rd	St. Albans	3552.00	7.50
Solar	Ground-mounted PV: Tracker	Institution	3649 Lower Newton Rd	St. Albans	0.00	500.00
Solar	Ground-mounted PV: Tracker	Residential	233 French Hill Road	St. Albans	6884.00	4.00
Solar	Ground-mounted PV: Tracker	Residential		St. Albans	6884.00	4.00
Solar	Hot Water	Residential	136 LaPan Road	St. Albans	0.00	0.00
Solar	Hot Water	Residential	172 Tranquility Lane	St. Albans	0.00	0.00
Solar	Roof-Mounted PV	Residential	2 Vt Rt 36	Fairfield	0.00	6.00
Solar	Roof-Mounted PV	Residential	4 Sullys Wy	St. Albans	2677.00	8.70
Solar	Roof-Mounted PV	Residential	32 Parsons Ave	St. Albans	5658.00	12.00
Solar	Roof-Mounted PV	Residential	335 Lake Rd	St. Albans	3208.00	3.10
Solar	Roof-Mounted PV	Residential	713 Maquam Shore Rd	St. Albans	3674.00	4.00
Solar	Roof-Mounted PV	Business	900 Industrial Park Road	St. Albans	1138.00	99.50
Solar	Roof-Mounted PV	Residential	71 French Hill Rd	St. Albans	3965.00	14.60
Solar	Roof-Mounted PV	Residential	505 Bingham Shore Road	St. Albans	3806.00	7.30
Solar	Roof-Mounted PV	Residential	29 Hill Farm Estates	St. Albans	2793.00	3.70
Solar	Roof-Mounted PV	Residential	913 W Shore Rd	St. Albans	2866.00	4.60
Solar	Roof-Mounted PV	Residential	2201 Bronson Rd	St. Albans	5839.00	10.00
Solar	Roof-Mounted PV	Residential	198 Button Rd	St. Albans	2952.00	4.20
Solar	Roof-Mounted PV	Residential	16 Prospect Hill Rd	St. Albans	3871.00	5.00

All Generators in Municipality

Category	Sub - Category	Organization Type	Address	City	CPG Number	Capacity kW
Solar	Roof-Mounted PV	Residential	128 Loomis Lane	St. Albans	3879.00	6.00
Solar	Roof-Mounted PV	Residential	391 South Main	St. Albans	2734.00	4.30
Solar	Roof-Mounted PV	Residential	172 Tranquility Lane	St. Albans	3503.00	9.90
Solar	Roof-Mounted PV	Residential	35 Pearl Avenue	St. Albans	2697.00	3.70
Solar	Roof-Mounted PV	Residential	718 Maquam Shore Rd	St. Albans	1962.00	7.80
Solar	Roof-Mounted PV	Residential	870 Maquam Shore Rd	St. Albans	2684.00	4.20
Solar	Roof-Mounted PV	Residential	1 Wiley Place	St. Albans	2748.00	13.00
Solar	Roof-Mounted PV	Residential	11 Elizabeth St	St. Albans	3510.00	5.00
Solar	Roof-Mounted PV	Residential	183 Connor Rd	St. Albans	3893.00	4.00
Solar	Roof-Mounted PV	Residential	3 Potter Ave	St. Albans	3090.00	6.50
Solar	Roof-Mounted PV	Residential	344 Read Lane	St. Albans	5362.00	11.40
Solar	Roof-Mounted PV	Residential	21 Orchard Street	St. Albans	3238.00	5.00
Solar	Roof-Mounted PV	Residential	23 Hill Farm	St. Albans	3241.00	4.40
Solar	Roof-Mounted PV	Residential	24 Fairfax St	St. Albans	3738.00	3.80
Solar	Roof-Mounted PV	Residential	4 Potter Ave	St. Albans	3010.00	7.50
Solar	Roof-Mounted PV	Residential	17 Quarry Ct	St. Albans	3571.00	3.70
Solar	Roof-Mounted PV	Residential	64 Adirondak Drive	St. Albans	6170.00	4.00
Solar	Roof-Mounted PV	Residential	724 Maquam Shore Rd	St. Albans	2838.00	3.20
Solar	Roof-Mounted PV	Residential	339 Kellogg Rd	St. Albans	3822.00	7.80
Solar	Roof-Mounted PV	Residential	2072 Hathaway Point Rd	St. Albans	3940.00	8.50
Solar	Roof-Mounted PV	Residential	213 Fairfield Hill	St. Albans	2916.00	5.20
Solar	Roof-Mounted PV	Residential	45 Lebel Drive	St. Albans	801.00	3.60
Solar	Roof-Mounted PV	Residential	5 Parsons Ave	St. Albans	3580.00	3.10
Solar	Roof-Mounted PV	Residential	12 Lakemont Dr	St. Albans	4276.00	10.00
Solar	Roof-Mounted PV	Residential	763 Maquam Shore Rd	St. Albans	0.00	7.60
Solar	Roof-Mounted PV	Residential	33 Hill Farm Estates	St. Albans	0.00	3.60
Solar	Roof-Mounted PV	Residential	14 Hill Farm Estates	St. Albans	0.00	3.60

All Generators in Municipality

Category	Sub - Category	Organization Type	Address	City	CPG Number	Capacity kW
Solar	Roof-Mounted PV	Residential	12 Twin Court	St. Albans	0.00	3.00
Solar	Roof-Mounted PV	Residential	1227 Route 104	St. Albans	0.00	4.20
Solar	Roof-Mounted PV	Residential	1407 Route 104	St. Albans	0.00	7.50
Solar	Roof-Mounted PV	Residential	24 Summit Place	St. Albans	7007.00	5.00
Solar	Roof-Mounted PV	Residential	93 Trombly Road	St. Albans	0.00	3.00
Solar	Roof-Mounted PV	Residential	14 Georgie Ave	St. Albans	0.00	3.00
Solar	Roof-Mounted PV	Residential	6 Marcel Drive	St. Albans	0.00	5.00
Solar	Roof-Mounted PV	Business	4 Victoria Lane	St. Albans	0.00	132.30
Solar	Roof-Mounted PV	Residential	6 Stoney Acre Dr	St. Albans	6772.00	4.00
Solar	Roof-Mounted PV	Residential	4 Bayview Drive	St. Albans	0.00	3.60
Solar	Roof-Mounted PV	Residential	3 Sunset Terrace	St. Albans	0.00	3.60
Solar	Roof-Mounted PV	Residential	86 Trombly Road	St. Albans	0.00	6.00
Solar	Roof-Mounted PV	Residential	12 Georgie Ave	St. Albans	0.00	6.00
Solar	Roof-Mounted PV	Residential	180 Wharf St	St. Albans	0.00	3.00
Solar	Roof-Mounted PV	Residential	3159 Kellogg Rd	St. Albans	6582.00	6.00
Solar	Roof-Mounted PV	Residential	122 Lone Oak Rd	St. Albans	6576.00	11.40
Solar	Roof-Mounted PV	Residential	29 Tanglewood Drive	St. Albans	7419.00	5.00
Solar	Roof-Mounted PV	Residential	48 Hill Farm Est	St. Albans	0.00	6.00
Solar	Roof-Mounted PV	Residential	12 Meadowbrook Lane	St. Albans	0.00	3.60
Solar	Roof-Mounted PV	Residential	15 Clyde Allen Drive	St. Albans	0.00	3.60
Solar	Roof-Mounted PV	Residential	3 Parsons Lane	St. Albans	0.00	3.60
Solar	Roof-Mounted PV	Residential	16 Allaire Drive	St. Albans	7307.00	7.60
Solar	Roof-Mounted PV	Residential	42 Hill Farm Estates	St. Albans	0.00	7.60
Solar	Roof-Mounted PV	Residential	17 Thorpe Ave Ext	St. Albans	0.00	6.00
Solar	Roof-Mounted PV	Residential	122 Lone Oak Rd	St. Albans	0.00	11.40
Solar	Roof-Mounted PV	Residential	15 Eastview Dr	St. Albans	0.00	3.00
Solar	Roof-Mounted PV	Residential	5 Ethel Court	St. Albans	0.00	6.00

All Generators in Municipality

Category	Sub - Category	Organization Type	Address	City	CPG Number	Capacity kW
Solar	Roof-Mounted PV	Residential	2 Cody Drive	St. Albans	0.00	8.80
Solar	Roof-Mounted PV	Residential	2 Sunset Ter	St. Albans	0.00	6.00
Solar	Roof-Mounted PV	Residential	8 Hathaway Shore Ests.	St. Albans	6434.00	5.00
Solar	Roof-Mounted PV	Residential	13 Meadowbrook Lane	St. Albans	6432.00	5.00
Solar	Roof-Mounted PV	Residential	5 Georgie Avenue	St. Albans	0.00	3.00
Solar	Roof-Mounted PV	Residential	6 Wiley Place	St. Albans	7490.00	8.40
Solar	Roof-Mounted PV	Residential	810 Maquam Shore Rd	St. Albans	6593.00	7.50
Solar	Roof-Mounted PV	Residential	31 Hill Farm Est	St. Albans	0.00	3.00
Solar	Roof-Mounted PV	Residential	20 Adams St	St. Albans	0.00	3.60
Solar	Roof-Mounted PV	Residential	24 Tanglewood Dr	St. Albans	0.00	7.60
Solar	Roof-Mounted PV	Residential	10 Meadowbrook Lane	St. Albans	0.00	3.60
Solar	Roof-Mounted PV	Residential	16 Meadowbrook Lane	St. Albans	0.00	3.00
Solar	Roof-Mounted PV	Residential	8 Potter Avenue	St. Albans	0.00	3.80
Solar	Roof-Mounted PV	Residential	61 W Shore Rd	St. Albans	6809.00	5.00
Solar	Roof-Mounted PV	Residential	2609 Lower Newton St	St. Albans	0.00	3.60
Solar	Roof-Mounted PV	Residential	35 Clyde Allen Drive	St. Albans	0.00	3.00
Solar	Roof-Mounted PV	Residential	760 West Shore Road	St. Albans	0.00	5.00
Solar	Roof-Mounted PV	Residential	5 Bay View Drive	St. Albans	0.00	3.00
Solar	Roof-Mounted PV	Residential	7 Stoney Acre Drive	St. Albans	0.00	4.20
Solar	Roof-Mounted PV	Residential	34 Allaire Drive	St. Albans	0.00	3.60
Solar	Roof-Mounted PV	Residential	27 Hill Farm Estates	St. Albans	0.00	3.80
Solar	Roof-Mounted PV	Residential	269 Bingham Shore Rd	St. Albans	0.00	10.00
Solar	Roof-Mounted PV	Residential	38 Hill Farm Estates	St. Albans	0.00	7.60
Solar	Roof-Mounted PV	Residential	1704 Fairfax Road	St. Albans	0.00	5.00
Solar	Roof-Mounted PV	Residential	580 Maquam Shore Rd	St. Albans	0.00	14.00
Solar	Roof-Mounted PV	Residential	4847 Lower Newton Rd	St. Albans	0.00	6.00
Solar	Roof-Mounted PV	Business	5700 Lower Newton Rd	St. Albans	0.00	15.00

All Generators in Municipality

Category	Sub - Category	Organization Type	Address	City	CPG Number	Capacity kW
Solar	Roof-Mounted PV	Residential	1063 Maquam Shore Rd	St. Albans	0.00	7.50

Municipal Analysis & Targets - Sheldon

The following is an explanation of the municipal energy data compiled by Northwest Regional Planning Commission (NRPC). The intent of the municipal energy data is to provide the municipalities with data required to ensure compliance with the requirements of Act 174 and "Enhanced Energy Planning" (24 V.S.A. 4352). The following tables contain data that estimates current energy use and provides targets for future energy use across all sectors (transportation, heating, and electricity). It also sets targets for renewable energy generation within the municipality.

This data is meant to be a starting point for the municipality to begin planning its energy future and to talk about the changes that may need to occur within the municipality to ensure that local, regional and state energy goals are met. This includes the State of Vermont's goal to have 90% of all energy demand be met from renewable sources by 2050.

Figure 1 - Data Sources

ACS – American Community Survey

DOL –Vermont Department of Labor

DPS – Vermont Department of Public Service

EIA – Energy Information Administration

EVT – Efficiency Vermont

LEAP – Long-Range Energy Alternatives Planning

VEIC – Vermont Energy Investment Corporation

VTrans – Vermont Agency of Transportation

Data Sources

Estimates of current energy use consist primarily of data available from the American Community Survey (ACS), the Vermont Agency of Transportation (VTrans), the Vermont Department of Labor (DOL), and the Vermont Department of Public Service (DPS). Targets for future energy use are reliant upon the Long-range Energy Alternatives Planning (LEAP) analysis for the region completed the Vermont Energy Investment Corporation (VEIC). Targets for future energy generation have come from the regional planning commission and DPS. For more information on LEAP, see the Northwest Regional Energy Plan (www.nrpcvt.com). Targets for both future energy use and energy generation have been generally developed using a "top down" method of disaggregating regional data to the municipal level.

It is possible to develop "bottom up" data. For those municipalities interested in that approach, please see the Department of Public Service's Analysis and Targets Guidance (http://publicservice.vermont.gov/content/act-174-recommendations-and-determination-standards).

Please remember that the targets established by LEAP represent only one way to achieve energy goals. There may several other similar pathways that a municipality may choose to take in order to meet the 90x50 goal.

Below is a worksheet by worksheet explanation of the Municipal Template spreadsheet:

1. Municipal Data Summary

The following tables summarize all data that is required to be in a municipal plan if the plan is to meet the "determination" standards established by the Vermont Department of Public Service.

Table 1A: Current Municipal Transportation Energy Use

Transportation Data	Municipal Data
Total # of Vehicles (ACS 2011-2015)	1,879
Average Miles per Vehicle (Vtrans)	11,356
Total Miles Traveled	21,337,924
Realized MPG (2013 - VTrans 2015 Energy Profile)	18.6
Total Gallons Use per Year	1,147,200
Transportation BTUs (Billion)	138
Average Cost per Gallon of Gasoline (RPC)	2.31
Gasoline Cost per Year	2,650,032

This table uses data from the American Community Survey (ACS) and Vermont Agency of Transportation (VTrans) to calculate current transportation energy use and energy costs in the municipality.

Table 1B: Current Municipal Residential Heating Energy Use

Fuel Source	Municipal Households (ACS 2011-2015)	% of Municipal Households	Municipal Square Footage Heated	Municipal BTU (in Billions)
Natural Gas	66	7.4%	125,664	8
Propane	151	17.0%	267,792	16
Electricity	13	1.5%	24,752	1
Fuel Oil	341	38.4%	587,312	35
Coal	0	0.0%	0	0
Wood	289	32.5%	539,696	32
Solar	0	0.0%	0	0
Other	28	3.2%	49,088	3
No Fuel	0	0.0%	0	0
Total	888	100.0%	1,594,304	96

This table displays data from the ACS that estimates current municipal residential heating energy use.

Table 1C: Current Municipal Commercial Energy Use

	Commercial Establishments in Municipality (VT DOL)	Estimated Thermal Energy BTUs per Commercial Establishment (in Billions) (VDPS)	Estimated Thermal Energy BTUs by Commercial Establishments in Municipality (in Billions)
Municipal Commercial Energy Use	17	0.725	12

The table uses data available from the Vermont Department of Labor (VT DOL) and the Vermont Department of Public Service (DPS) to estimate current municipal commercial establishment energy use in the municipality.

Table 1D: Current Electricity Use

Use Sector	Current Electricity Use
Residential (kWh)	7,982,536
Commercial and Industrial (kWh)	4,361,745
Total (kWh)	12,344,281

This table displays current electricity use within the municipality. This data is available from Efficiency Vermont (EVT).

Table 1E: Residential Thermal Efficiency Targets

	2025	2035	2050
"Residential - Increased Efficiency and Conservation (% of municipal households to be weatherized)"	5%	16%	78%

This table displays targets for thermal efficiency of residential structures. The data is based on a methodology developed by DPS using data available from the regional Long-range Energy Alternatives Planning (LEAP) analysis and ACS. The data in this table represents the percentage of municipal households that will need to be weatherized in the target years. The target is cumulative.

Table 1F: Commercial Thermal Efficiency Target

	2025	2035	2050
"Commercial - Increased Efficiency and Conservation (% of commercial establishments to be weatherized)"	25%	25%	73%

This table shows the same information as Table 1E, but sets a target for commercial thermal efficiency and weatherization. Information from the VT DOL is required to complete this target. The target is cumulative.

Table 1G: Thermal Fuel Switching (Residential and Commercial) – Wood Systems

	2025	2035	2050
New Efficient Wood Heat Systems (in units)	3	8	36

This table provides a target for new wood heating systems for residential and commercial structures in the municipality for each target year. This target was calculated using data from LEAP and ACS. The target is cumulative.

Table 1H: Thermal Fuel Switching (Residential and Commercial) – Heat Pumps

	2025	2035	2050
New Heat Pumps (in units)	91	217	429

This table provides a target for new heat pump systems for residential and commercial structures in the municipality for each target year. This target was calculated using data from LEAP and ACS. The target is cumulative.

Table 1I: Electricity Efficiency Targets

	2025	2035	2050
Increase Efficiency and Conservation (BTUs)	25.2%	48.3%	100.7%

Data in this table displays a target for increased electricity efficiency and conservation during the target years. This target will be met through conversions to high efficiency appliances, electric heat pumps, and electric light-duty vehicles. These targets were developed using regional LEAP analysis. The target is cumulative.

Table 1J: Use of Renewables – Transportation

	2025	2035	2050
Renewable Energy Use - Transportation (BTUs)	6.6%	26.0%	88.1%

This data displays targets for the percentage of transportation energy use coming from renewable sources during each target year. This target will be met through conversions to electric light-duty vehicles and biodiesel heavy-duty vehicles. This data was developed using the LEAP analysis. The target is cumulative.

Table 1K: Use of Renewables – Heating			
	2025	2035	2050
Renewable Energy Use - Heating (BTUs)	46.7%	60.4%	88.5%

This data displays targets for the percentage of heating energy use coming from renewable sources during each target year. This target will be met through conversions to electric heat pumps and high efficiency wood heating systems. This data was developed using information from the LEAP analysis. The target is cumulative.

Table 1L: Use of Renewables – Electricity			
	2025	2035	2050
Renewable Energy Use - Electricity (MWh)	3,948.2	7,896.4	11,964.2

This data displays targets for MWh of electricity generation coming from renewable sources within the municipality during each target year. This data was developed using information from the regional planning commission and DPS. This data is the same as the data in Table 1Q. The target is cumulative.

Table 1M: Transportation Fuel Switching Targets – Electric Vehicles			
	2025	2035	2050
Electric Vehicles	164	1231	2929

This tables displays a target for switching from fossil fuel based vehicles (gasoline and diesel) to electric vehicles. This target is calculated using LEAP and ACS data. The target is cumulative.

Table 1N: Transportation Fuel Switching Targets – Biodiesel			
	2025	2035	2050
Biodiesel Vehicles	162	321	612

This tables displays a target for switching from fossil fuel based vehicles to biodiesel-powered vehicles. This target is calculated using LEAP and ACS data. The target is cumulative.

Table 1O: Existing Renewable Generation

Renewable Type	MW	MWh
Solar	2.50	3066.00
Wind	0.00	0.00
Hydro	26.38	92435.52
Biomass	0.83	3375.01
Other	0.00	0.00
Total Existing Generation	29.71	98876.53

Table 1O shows existing renewable generation in the municipality, in MW and MWh, based on information available from the Vermont Department of Public Service.

Table 1P: Renewable Generation Potential

Renewable Type	MW	MWh
Rooftop Solar	1	1,193
Ground-mounted Solar	959	1,176,112
Wind	731	2,241,576
Hydro	0	0
Biomass and Methane	0	0
Other	0	0
Total Renewable Generation Potential	1,691	3,418,881

Renewable generation potential is based on mapping completed by the regional planning commission that is based on the Municipal Determination Standards and associated guidance documents developed by DPS. The renewable generation potential is expressed in MW and MWh by the type of renewable resource (solar, wind, hydro, etc.).

Table 1Q: Renewable Generation Targets

	2025	2035	2050
Total Renewable Generation Target (in MWh)	3,948.19	7,896.38	11,964.22

This data displays targets for MWh of electricity generation coming from renewable sources within the municipality during each target year. This data was developed using information from the regional planning commission and DPS. This data is the same as the data in Table 1L.

Table 1R: Sufficient Land?

	Y/N
Solar	Y
Wind	Y

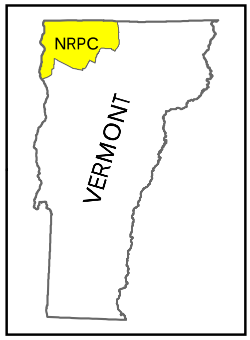
This table shows whether or not there is sufficient land in the municipality to meet the renewable generation targets based on the renewable generation potential in the municipality.

Utility Service Areas

Sheldon, Vermont
Act 174
The Energy Development Improvement Act of 2016

This map and the corresponding data is intended to be used to inform energy planning efforts by municipalities and regions. This may also be used for conceptual planning or initial site identification by those interested in developing renewable energy infrastructure. The maps do NOT take the place of site-specific investigation for a proposed facility and cannot be used of as "siting maps."

N

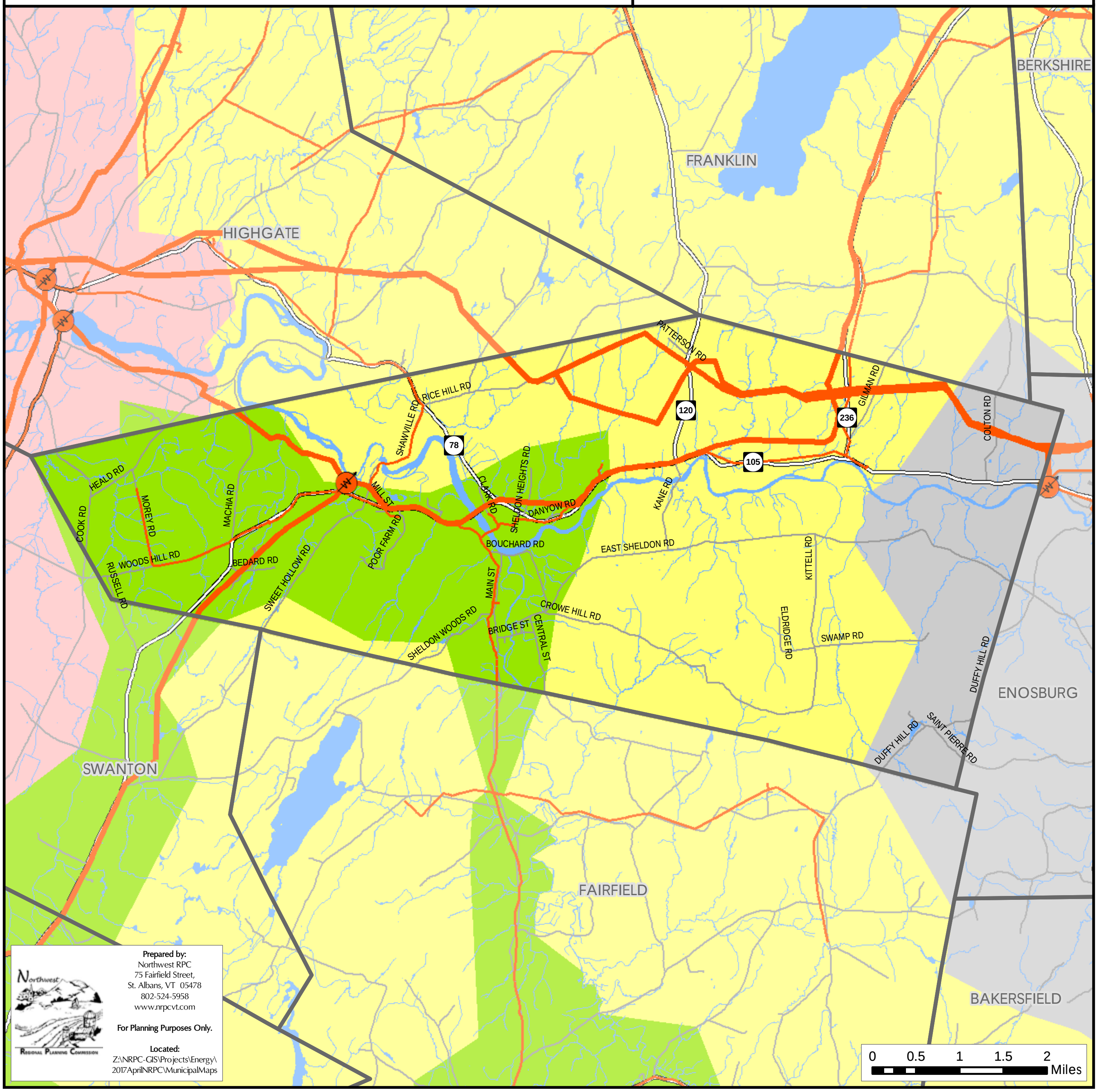


Legend

Utility Service Area Features

- Green Mountain Power
- Swanton Village Electric
- Vermont Electric Co-op
- Enosburg Falls Electric
- Substation
- 3 Phase Power Line
- Transmission Line

Sources: VCGI
Disclaimer: The accuracy of information presented is determined by its sources. Errors and omissions may exist. The Northwest RPC is not responsible for these. Questions of on-the-ground location can be resolved by site inspections and/or surveys by a registered surveyor. This map is not sufficient for delineation of features on-the-ground. This map identifies the presence of features, and may indicate relationships between features, but is not a replacement for surveyed information or engineering studies.



Transmission & 3 Phase Power Infrastructure

Sheldon, Vermont
Act 174
The Energy Development Improvement Act of 2016

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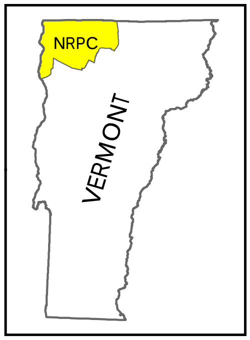

Legend

- Substation
- 3 Phase Power Line
- Transmission Line
- 1/2 Mile Buffer (3 Phase Power Line & Transmission Line)

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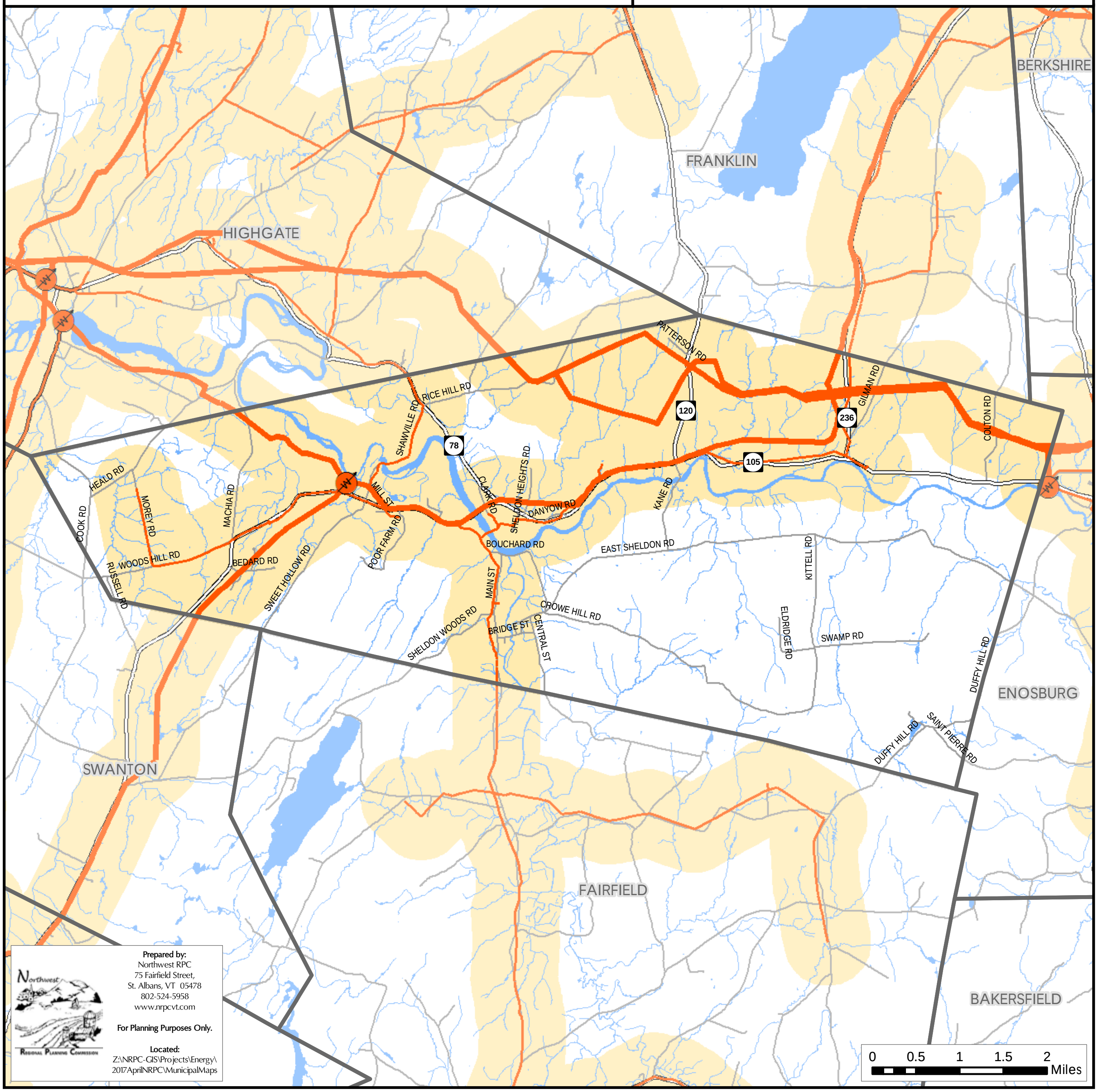

Existing Generation Facilities

Sheldon, Vermont
Act 174
The Energy Development Improvement Act of 2016

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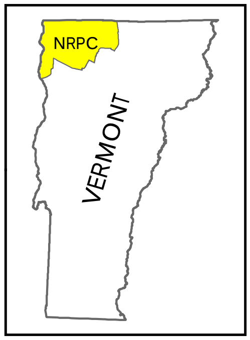

Legend

- Biomass Facility
- Hydro Facility
- Solar Facility
- Wind Facility

Note: Only generators 15kW are shown on the map. A full list of all generators is available.

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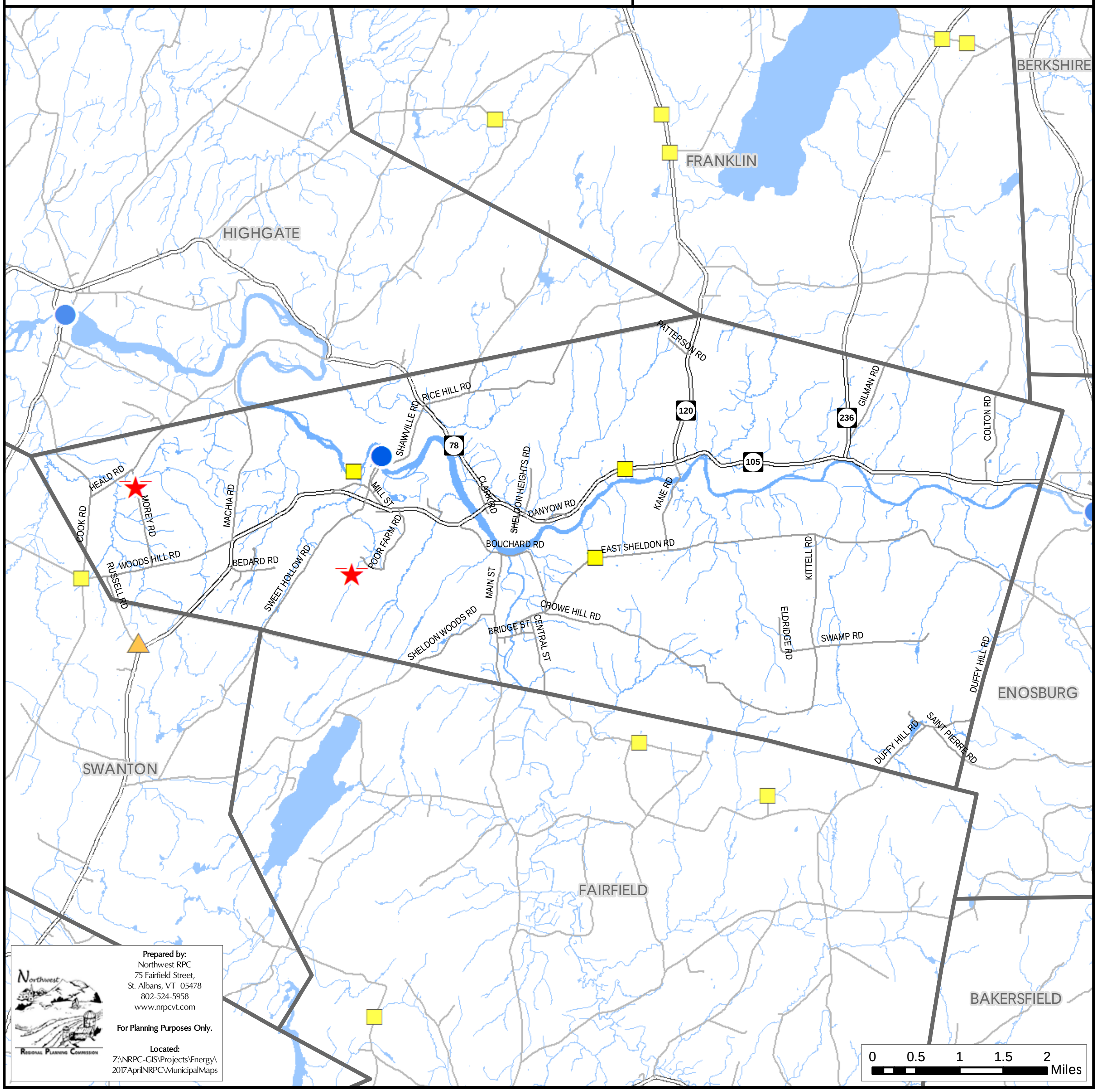

Natural Gas Lines

Sheldon, Vermont
Act 174
The Energy Development Improvement Act of 2016

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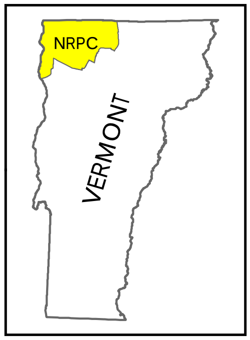
N



Legend

Natural Gas Line

Sources: VCGI
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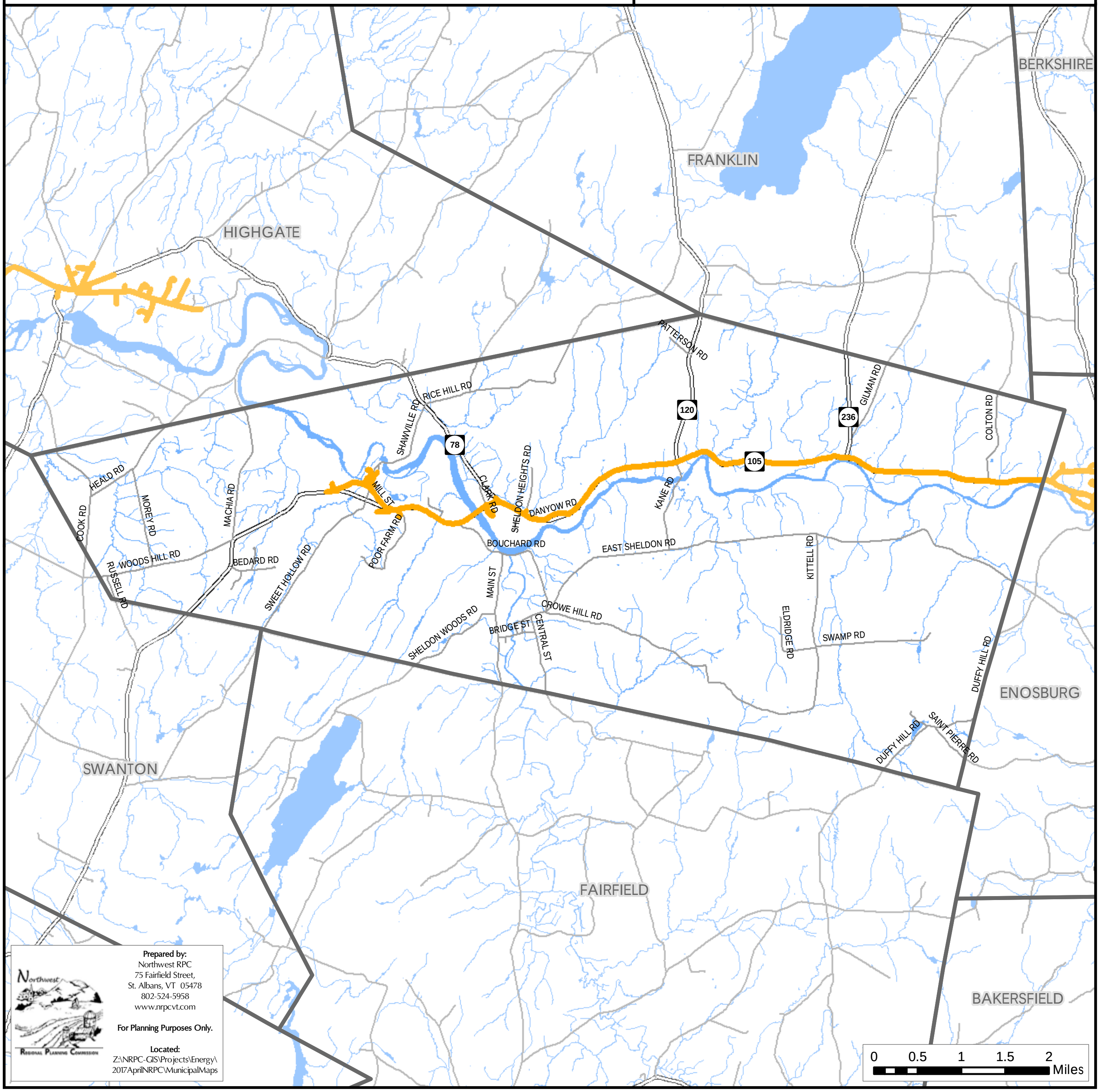

Hydro

Sheldon, Vermont
Act 174
The Energy Development Improvement Act of 2016

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N

Legend

- Substation
- 3 Phase Power Line
- Transmission Line
- Designated Outstanding Resource Water
- Known Constraint - Designated National Wild & Scenic River
- Possible Constraint - Stressed or Impaired Water
- Possible Constraint - RINAs

Potential Hydroelectric Facility

- < 50 kW Capacity
- > 50 kW Capacity
- High Hazard with < 50 kW Capacity
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Operating Hydroelectric Facility

- Dam not on National Wild and Scenic River
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NRPC

VERMONT

Sources: VCGI

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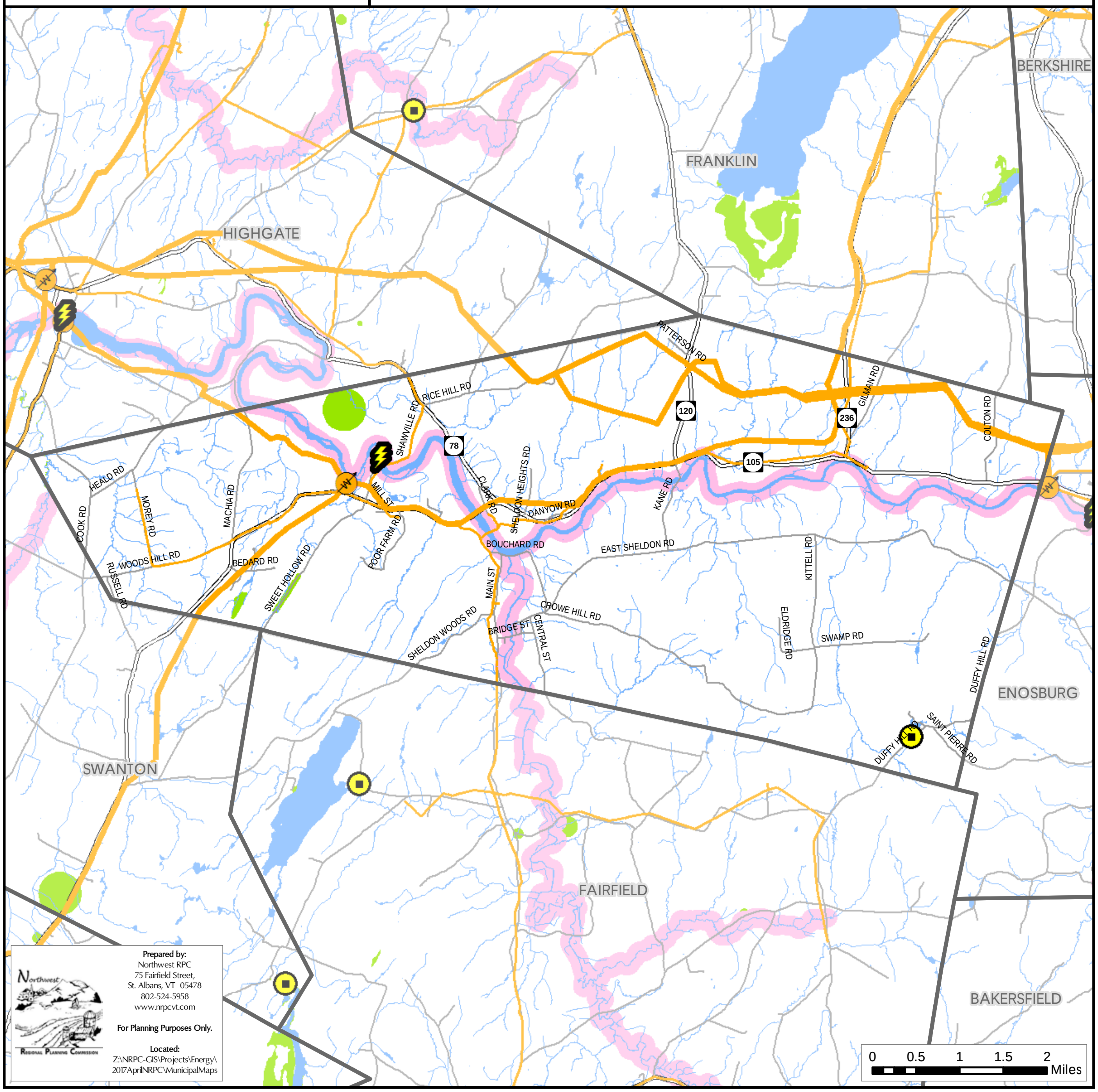

Solar

Sheldon, Vermont
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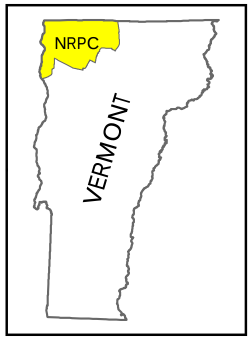

Legend

- Substation
- 3 Phase Power Line
- Transmission Line
- 1/2 Mile Buffer (3 Phase Power Line & Transmission Line)
- Prime Solar/No Known Constraints
- Base Solar/Possible Constraints

Sources: VCGI

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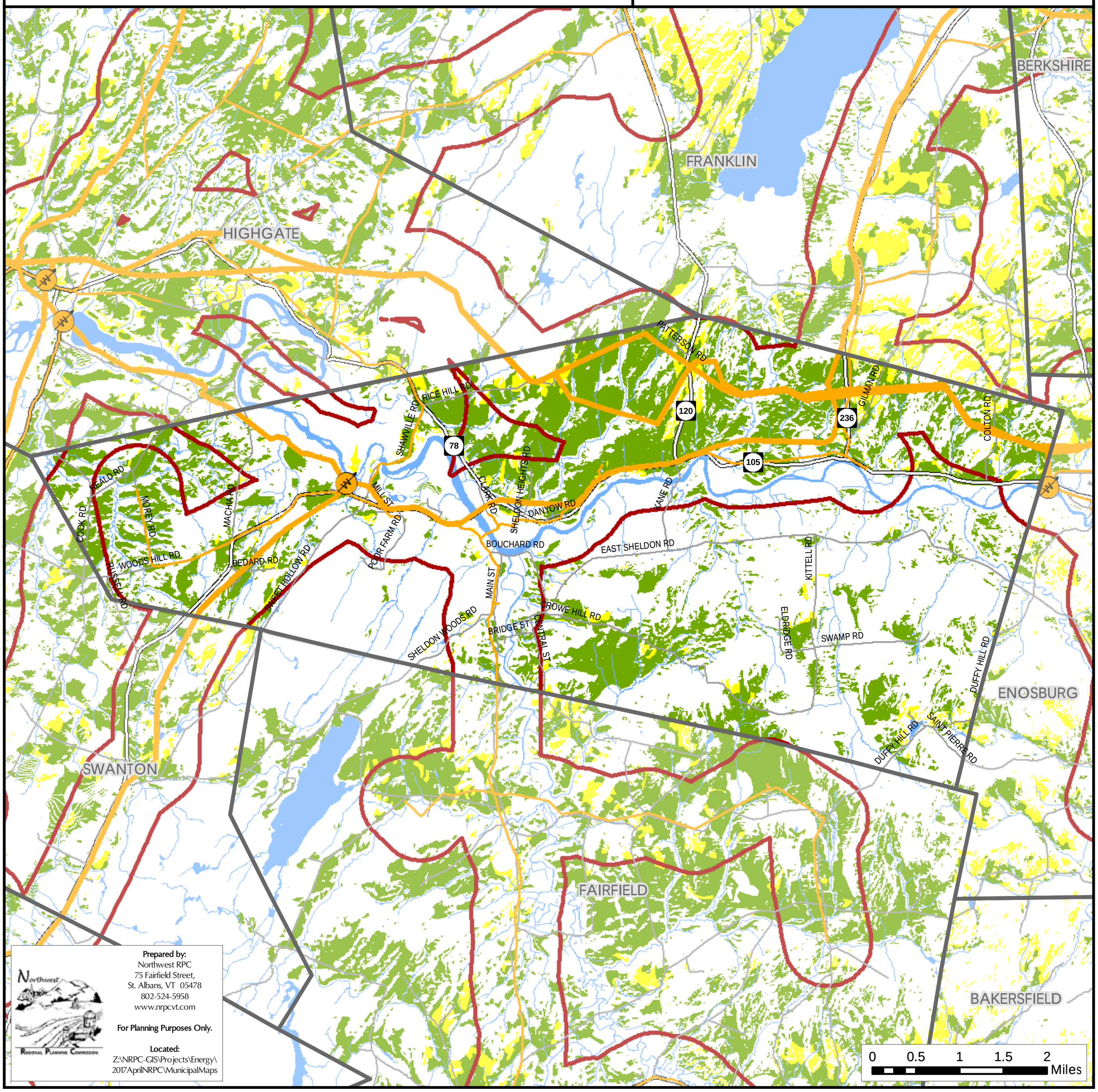

Wind

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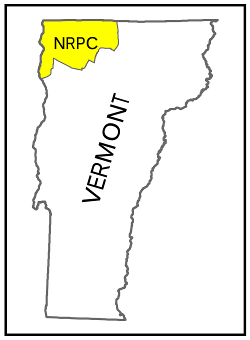

Legend

- Substation
- 3 Phase Power Line
- Transmission Line
- Prime Wind: Areas of high wind potential and no known constraints. Darker areas have higher wind speeds.
- Base Wind: Areas of high wind potential and a presence of possible constraints. Darker areas have higher wind speeds.

Sources: VCGI
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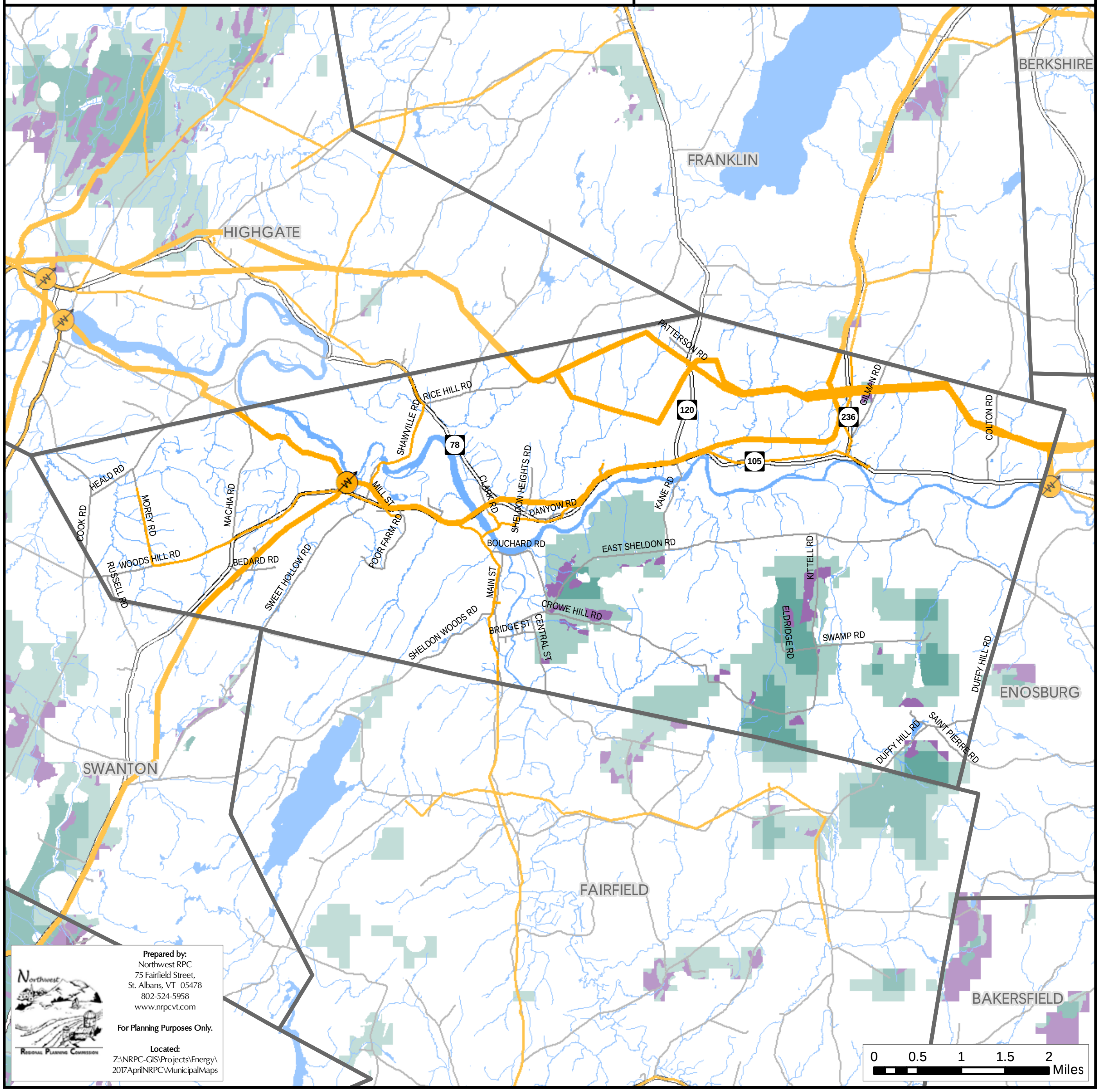

Woody Biomass

Sheldon, Vermont
Act 174
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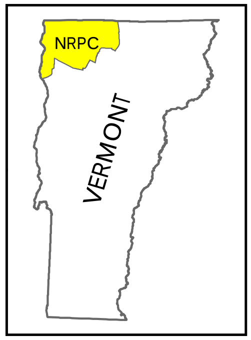

Legend

- Biomass System
- Cow Power
- Substation
- 3 Phase Power Line
- Transmission Line
- Prime Woody Biomass/No Known Constraints
- Base Woody Biomass/Possible Constraints

Sources: VCGI
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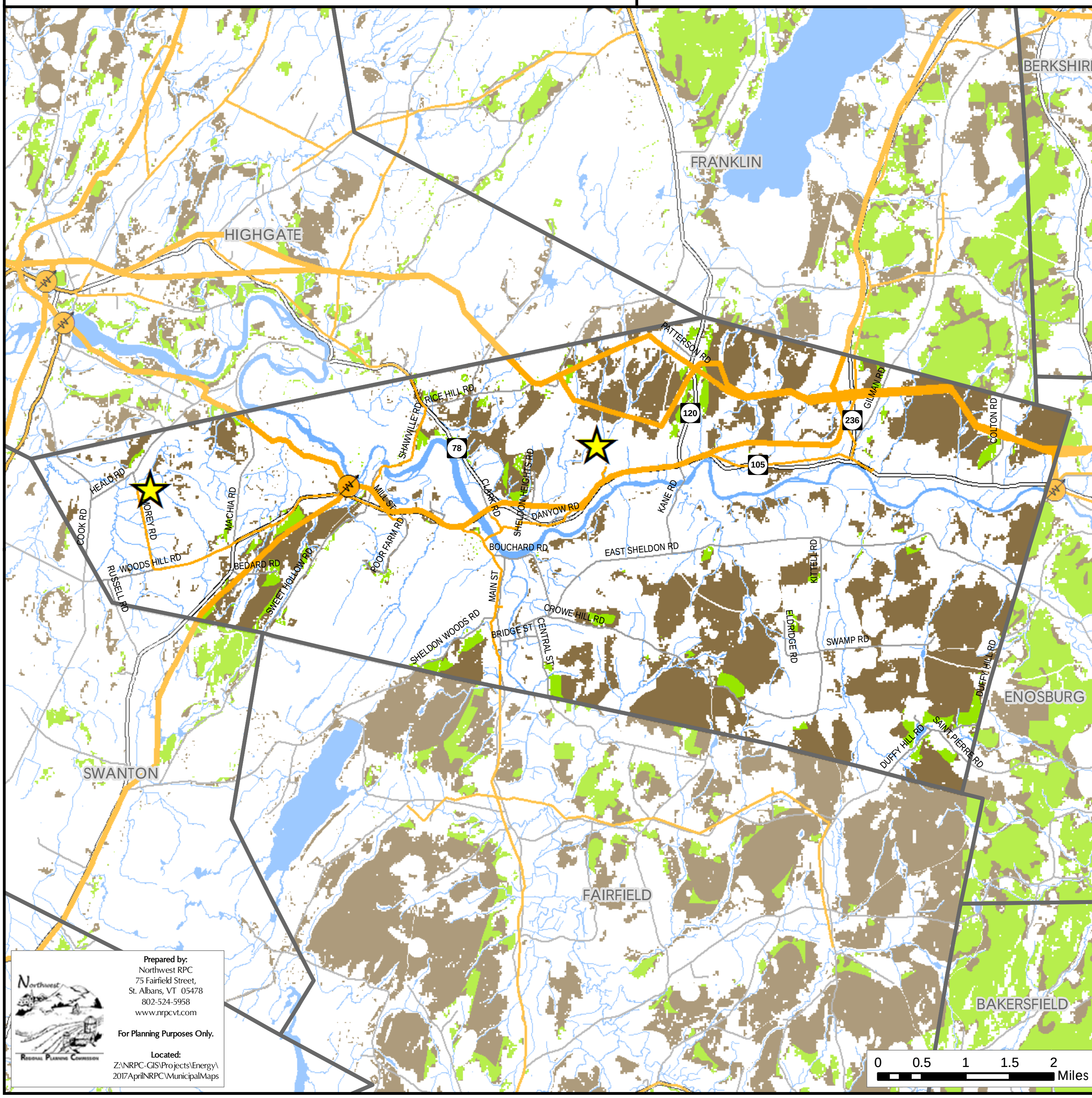

All Generators in Municipality

Category	Sub - Category	Organization Type	Address	City	CPG Number	Capacity kW
Biomass	Anaerobic Digester	Farm	962 Morey Road	Sheldon		600
Biomass	Anaerobic Digester	Farm	5893 Route 105	Sheldon		225
Hydro	Hydropower	Business		Sheldon		26380
Solar	Ground-mounted PV: Fixed Rack	Residential	1321 Main St	Sheldon	3389	8.2
Solar	Ground-mounted PV: Fixed Rack	Business	Heather Lane	Sheldon		2200
Solar	Ground-mounted PV: Fixed Rack	Residential	567 East Sheldon Road	Sheldon	7211	15
Solar	Ground-mounted PV: Fixed Rack	Residential	1660 Sweet Hollow Rd	Sheldon	7036	10
Solar	Ground-mounted PV: Pole	Residential	898 VT-105	Sheldon	16-0902	7.6
Solar	Ground-mounted PV: Tracker	Business	6212 VT-105	Sheldon		148.2
Solar	Roof-Mounted PV	Residential	206 Pleasant St	Sheldon	3490	4
Solar	Roof-Mounted PV	Residential	515 Crowe Hill Road	Sheldon	2932	7.4
Solar	Roof-Mounted PV	Residential	1012 Sweet Hollow Rd	Sheldon	1882	9.7
Solar	Roof-Mounted PV	Residential	1310 Sweet Hollow Rd	Sheldon	5968	5
Solar	Roof-Mounted PV	Residential	388 Crowe Hill Road	Sheldon	2914	5.2
Solar	Roof-Mounted PV	Residential	1495 Rice Hill Rd	Sheldon	2862	6.5
Solar	Roof-Mounted PV	Residential	1231 VT Route 120	Sheldon	5849	8
Solar	Roof-Mounted PV	Residential	132 SEVERANCE RD	Sheldon	2623	3.7
Solar	Roof-Mounted PV	Residential	698 Rice Hill Rd	Sheldon	5770	7
Solar	Roof-Mounted PV	Residential	332 Rice Hill Rd	Sheldon	3712	3.4
Solar	Roof-Mounted PV	Residential	580 Mill St	Sheldon	2806	4.3
Solar	Roof-Mounted PV	Residential	377 Pleasant Street	Sheldon	7159	5
Solar	Roof-Mounted PV	Residential	285 Colton Road	Sheldon	16-0094	10
Solar	Roof-Mounted PV	Residential	489 Pleasant St	Sheldon	16-0736	3.5
Solar	Roof-Mounted PV	Residential	263 Cook Rd	Sheldon		6
Solar	Roof-Mounted PV	Residential	193 Forest Heights	Sheldon	16-1607	8.2
Solar	Roof-Mounted PV	Residential	353 Trophy Lane	Sheldon	16-1213	5

Municipal Analysis & Targets - South Hero

The following is an explanation of the municipal energy data compiled by Northwest Regional Planning Commission (NRPC). The intent of the municipal energy data is to provide the municipalities with data required to ensure compliance with the requirements of Act 174 and "Enhanced Energy Planning" (24 V.S.A. 4352). The following tables contain data that estimates current energy use and provides targets for future energy use across all sectors (transportation, heating, and electricity). It also sets targets for renewable energy generation within the municipality.

This data is meant to be a starting point for the municipality to begin planning its energy future and to talk about the changes that may need to occur within the municipality to ensure that local, regional and state energy goals are met. This includes the State of Vermont's goal to have 90% of all energy demand be met from renewable sources by 2050.

Figure 1 - Data Sources

ACS – American Community Survey

DOL –Vermont Department of Labor

DPS – Vermont Department of Public Service

EIA – Energy Information Administration

EVT – Efficiency Vermont

LEAP – Long-Range Energy Alternatives Planning

VEIC – Vermont Energy Investment Corporation

VTrans – Vermont Agency of Transportation

Data Sources

Estimates of current energy use consist primarily of data available from the American Community Survey (ACS), the Vermont Agency of Transportation (VTrans), the Vermont Department of Labor (DOL), and the Vermont Department of Public Service (DPS). Targets for future energy use are reliant upon the Long-range Energy Alternatives Planning (LEAP) analysis for the region completed the Vermont Energy Investment Corporation (VEIC). Targets for future energy generation have come from the regional planning commission and DPS. For more information on LEAP, see the Northwest Regional Energy Plan (www.nrpcvt.com). Targets for both future energy use and energy generation have been generally developed using a "top down" method of disaggregating regional data to the municipal level.

It is possible to develop "bottom up" data. For those municipalities interested in that approach, please see the Department of Public Service's Analysis and Targets Guidance (http://publicservice.vermont.gov/content/act-174-recommendations-and-determination-standards).

Please remember that the targets established by LEAP represent only one way to achieve energy goals. There may several other similar pathways that a municipality may choose to take in order to meet the 90x50 goal.

Below is a worksheet by worksheet explanation of the Municipal Template spreadsheet:

1. Municipal Data Summary

The following tables summarize all data that is required to be in a municipal plan if the plan is to meet the "determination" standards established by the Vermont Department of Public Service.

Table 1A: Current Municipal Transportation Energy Use

Transportation Data	Municipal Data
Total # of Passenger Vehicles (ACS 2011-2015)	1,430
Average Miles per Vehicle (Vtrans)	11,356
Total Miles Traveled	16,239,080
Realized MPG (2013 - VTrans 2015 Energy Profile)	18.6
Total Gallons Use per Year	873,069
Transportation BTUs (Billion)	105
Average Cost per Gallon of Gasoline (RPC)	2.31
Gasoline Cost per Year	2,016,789

This table uses data from the American Community Survey (ACS) and Vermont Agency of Transportation (VTrans) to calculate current transportation energy use and energy costs in the municipality.

Table 1B: Current Municipal Residential Heating Energy Use

Fuel Source	Municipal Households (ACS 2011-2015)	% of Municipal Households	Municipal Square Footage Heated	Municipal BTU (in Billions)
Natural Gas	11	1.6%	20,944	1
Propane	220	31.6%	392,128	24
Electricity	31	4.4%	47,056	3
Fuel Oil	322	46.2%	561,696	34
Coal	0	0.0%	0	0
Wood	81	11.6%	134,512	8
Solar	0	0.0%	0	0
Other	32	4.6%	58,112	3
No Fuel	0	0.0%	0	0
Total	697	100.0%	1,214,448	73

This table displays data from the ACS that estimates current municipal residential heating energy use.

Table 1C: Current Municipal Commercial Energy Use

	Commercial Establishments in Municipality (VT DOL)	Estimated Thermal Energy BTUs per Commercial Establishment (in Billions) (VDPS)	Estimated Thermal Energy BTUs by Commercial Establishments in Municipality (in Billions)
Municipal Commercial Energy Use	48	0.725	35

The table uses data available from the Vermont Department of Labor (VT DOL) and the Vermont Department of Public Service (DPS) to estimate current municipal commercial establishment energy use in the municipality.

Table 1D: Current Electricity Use

Use Sector	Current Electricity Use
Residential (kWh)	6,265,571
Commercial and Industrial (kWh)	12,315,515
Total (kWh)	18,581,087

This table displays current electricity use within the municipality. This data is available from Efficiency Vermont (EVT).

Table 1E: Residential Thermal Efficiency Targets

	2025	2035	2050
"Residential - Increased Efficiency and Conservation (% of municipal households to be weatherized)"	5%	16%	78%

This table displays targets for thermal efficiency of residential structures. The data is based on a methodology developed by DPS using data available from the regional Long-range Energy Alternatives Planning (LEAP) analysis and ACS. The data in this table represents the percentage of municipal households that will need to be weatherized in the target years. The target is cumulative.

Table 1F: Commercial Thermal Efficiency Target

	2025	2035	2050
"Commercial - Increased Efficiency and Conservation (% of commercial establishments to be weatherized)"	25%	25%	73%

This table shows the same information as Table 1E, but sets a target for commercial thermal efficiency and weatherization. Information from the VT DOL is required to complete this target. The target is cumulative.

Table 1G: Thermal Fuel Switching (Residential and Commercial) – Wood Systems

	2025	2035	2050
New Efficient Wood Heat Systems (in units)	-1	-7	5

This table provides a target for new wood heating systems for residential and commercial structures in the municipality for each target year. This target was calculated using data from LEAP and ACS. The target is cumulative.

Table 1H: Thermal Fuel Switching (Residential and Commercial) – Heat Pumps

	2025	2035	2050
New Heat Pumps (in units)	84	191	358

This table provides a target for new heat pump systems for residential and commercial structures in the municipality for each target year. This target was calculated using data from LEAP and ACS. The target is cumulative.

Table 1I: Electricity Efficiency Targets

	2025	2035	2050
Increase Efficiency and Conservation (BTUs)	25.2%	48.3%	100.7%

Data in this table displays a target for increased electricity efficiency and conservation during the target years. This target will be met through conversions to high efficiency appliances, electric heat pumps, and electric light-duty vehicles. These targets were developed using regional LEAP analysis. The target is cumulative.

Table 1J: Use of Renewables – Transportation

	2025	2035	2050
Renewable Energy Use - Transportation (BTUs)	11.2%	34.0%	91.2%

This data displays targets for the percentage of transportation energy use coming from renewable sources during each target year. This target will be met through conversions to electric light-duty vehicles and biodiesel heavy-duty vehicles. This data was developed using the LEAP analysis. The target is cumulative.

Table 1K: Use of Renewables – Heating

	2025	2035	2050
Renewable Energy Use - Heating (BTUs)	44.5%	57.6%	85.3%

This data displays targets for the percentage of heating energy use coming from renewable sources during each target year. This target will be met through conversions to electric heat pumps and high efficiency wood heating systems. This data was developed using information from the LEAP analysis. The target is cumulative.

Table 1L: Use of Renewables – Electricity

	2025	2035	2050
Renewable Energy Use - Electricity (MWh)	3,606.1	7,212.1	10,927.4

This data displays targets for MWh of electricity generation coming from renewable sources within the municipality during each target year. This data was developed using information from the regional planning commission and DPS. This data is the same as the data in Table 1Q. The target is cumulative.

Table 1M: Transportation Fuel Switching Targets – Electric Vehicles

	2025	2035	2050
Electric Vehicles	125	937	2229

This tables displays a target for switching from fossil fuel based vehicles (gasoline and diesel) to electric vehicles. This target is calculated using LEAP and ACS data. The target is cumulative.

Table 1N: Transportation Fuel Switching Targets – Biodiesel

	2025	2035	2050
Biodiesel Vehicles	285	569	1100

This tables displays a target for switching from fossil fuel based vehicles to biodiesel-powered vehicles. This target is calculated using LEAP and ACS data. The target is cumulative.

Table 1O: Existing Renewable Generation

Renewable Type	MW	MWh
Solar	0.39	478.30
Wind	0.01	15.33
Hydro	0.00	0.00
Biomass	0.00	0.00
Other	0.00	0.00
Total Existing Generation	0.40	493.63

Table 1O shows existing renewable generation in the municipality, in MW and MWh, based on information available from the Vermont Department of Public Service.

Table 1P: Renewable Generation Potential

Renewable Type	MW	MWh
Rooftop Solar	1	1,149
Ground-mounted Solar	515	631,111
Wind	1,285	3,939,726
Hydro	0	0
Biomass and Methane	0	0
Other	0	0
Total Renewable Generation Potential	1,801	4,571,986

Renewable generation potential is based on mapping completed by the regional planning commission that is based on the Municipal Determination Standards and associated guidance documents developed by DPS. The renewable generation potential is expressed in MW and MWh by the type of renewable resource (solar, wind, hydro, etc.).

Table 1Q: Renewable Generation Targets

	2025	2035	2050
Total Renewable Generation Target (in MWh)	3,606.06	7,212.12	10,927.45

This data displays targets for MWh of electricity generation coming from renewable sources within the municipality during each target year. This data was developed using information from the regional planning commission and DPS. This data is the same as the data in Table 1L.

Table 1R: Sufficient Land?

	Y/N
Solar	Y
Wind	Y

This table shows whether or not there is sufficient land in the municipality to meet the renewable generation targets based on the renewable generation potential in the municipality.

Utility Service Areas

South Hero, Vermont
Act 174
The Energy Development Improvement Act of 2016

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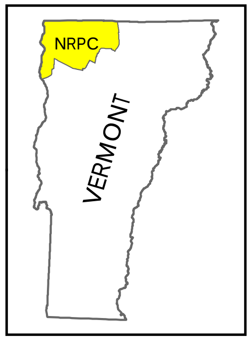

Legend

Utility Service Area Features

- Green Mountain Power
- Swanton Village Electric
- Vermont Electric Co-op
- Enosburg Falls Electric
- Substation
- 3 Phase Power Line
- Transmission Line

Sources: VCGI
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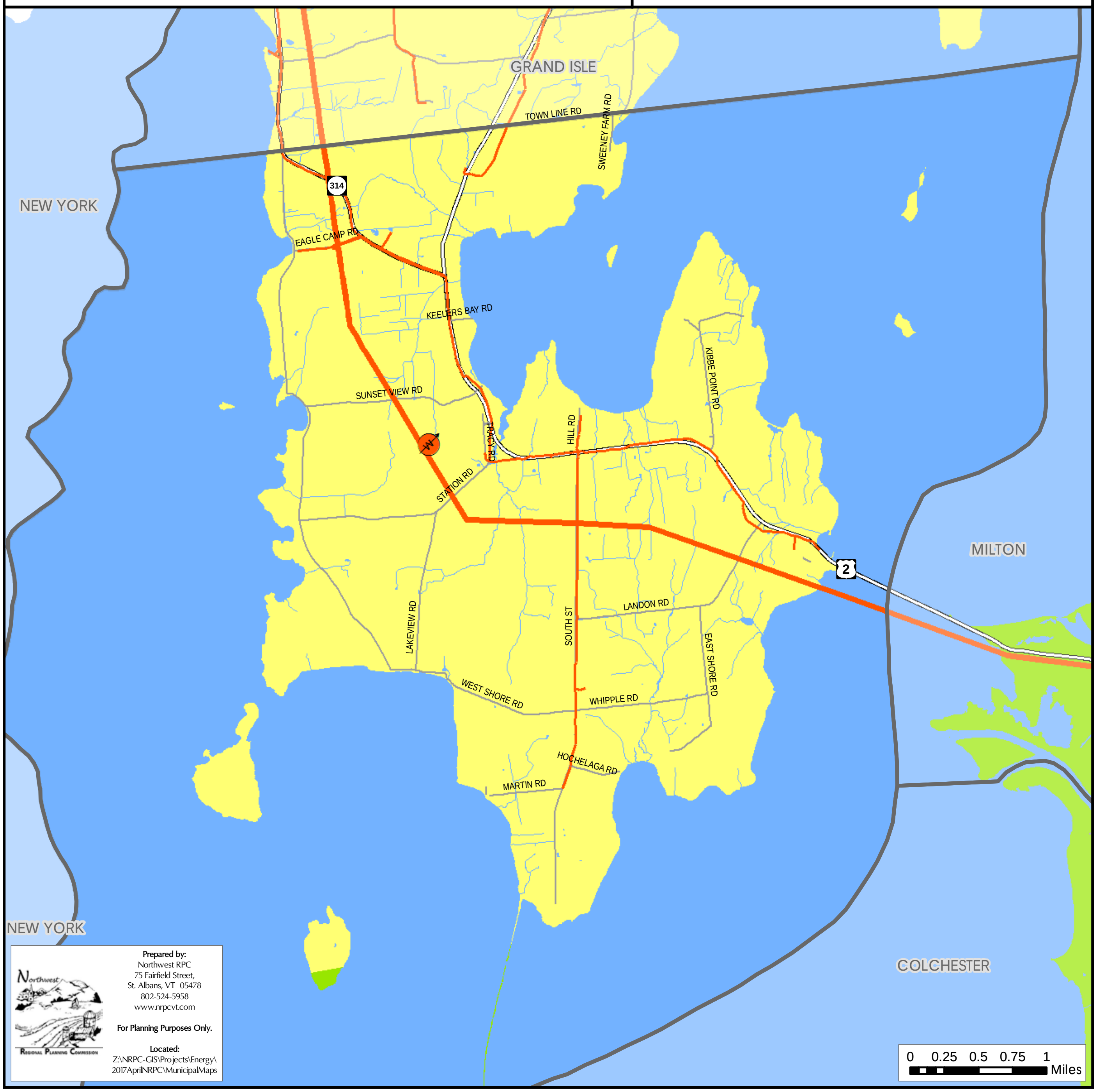

Transmission & 3 Phase Power Infrastructure

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Legend
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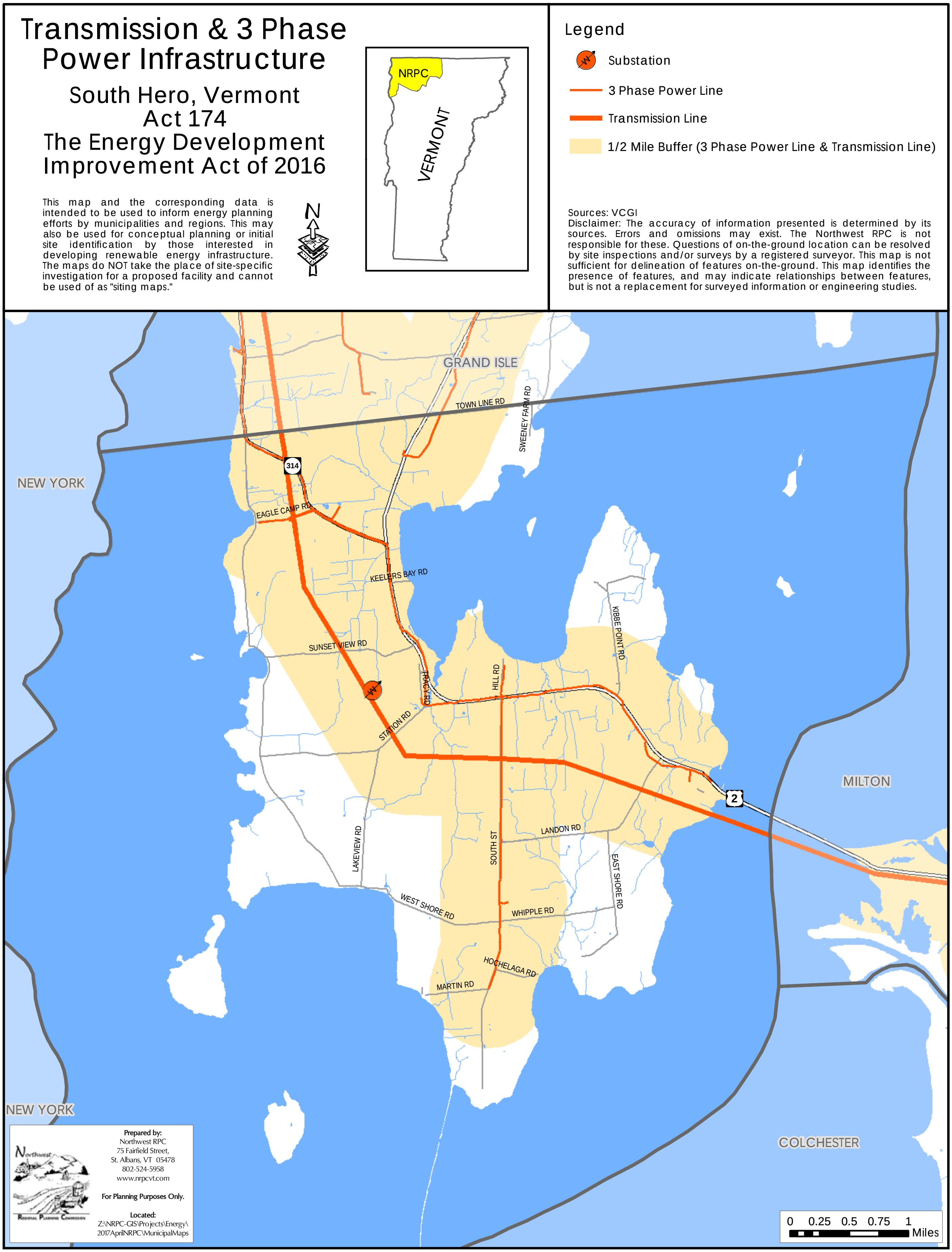

Prepared by:
Northwest RPC
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St. Albans, VT 05478
802-524-5958
www.nrpcvt.com

For Planning Purposes Only.

Located:
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Existing Generation Facilities

South Hero, Vermont
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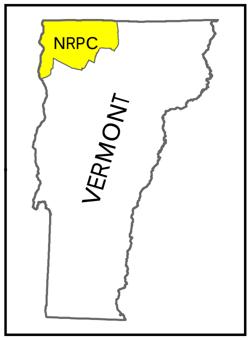

Legend

- Biomass Facility
- Hydro Facility
- Solar Facility
- Wind Facility

Note: Only generators 15kW are shown on the map. A full list of all generators is available.

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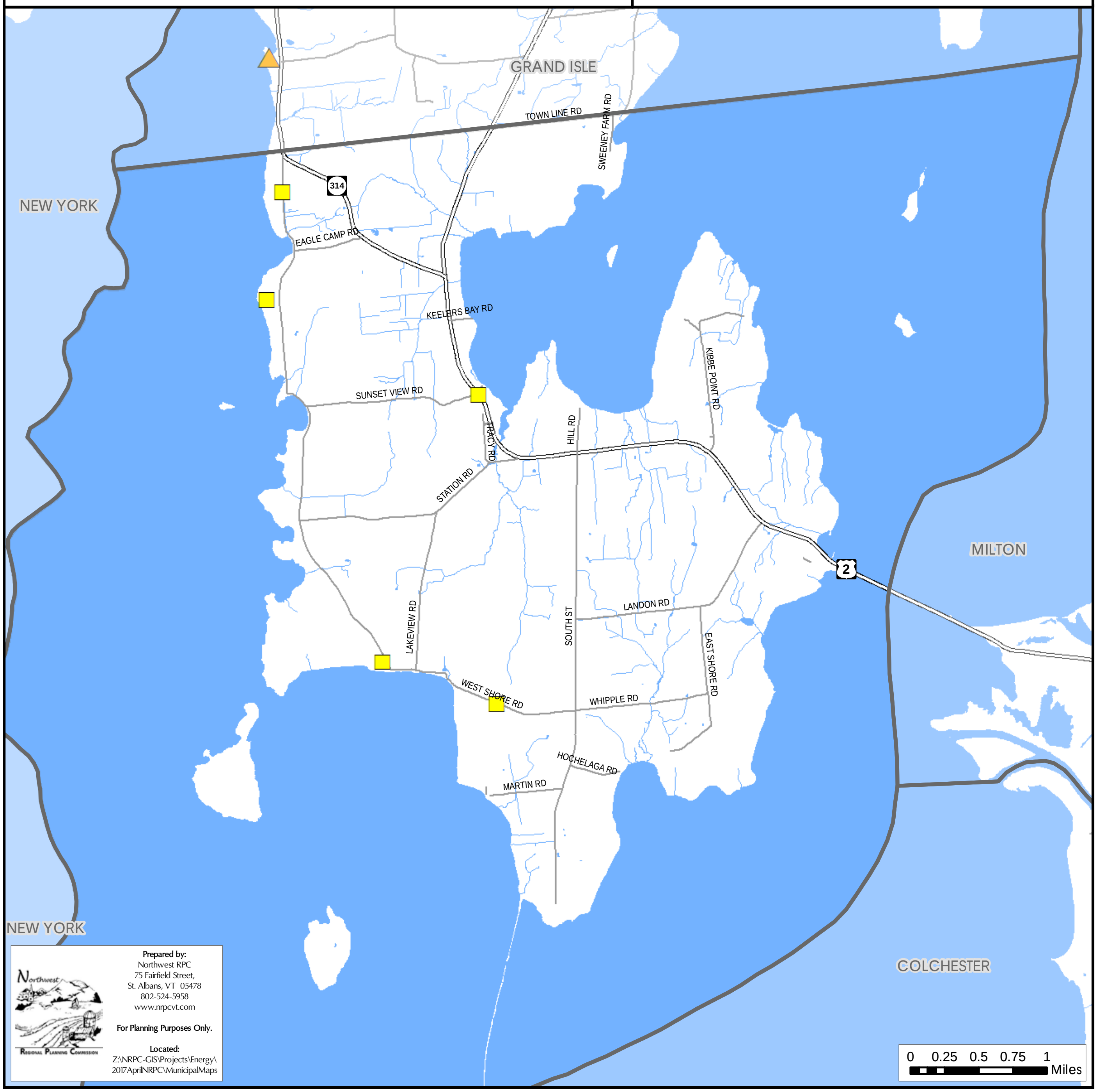

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Hydro

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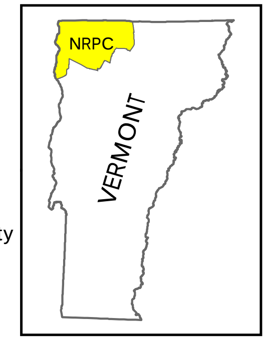

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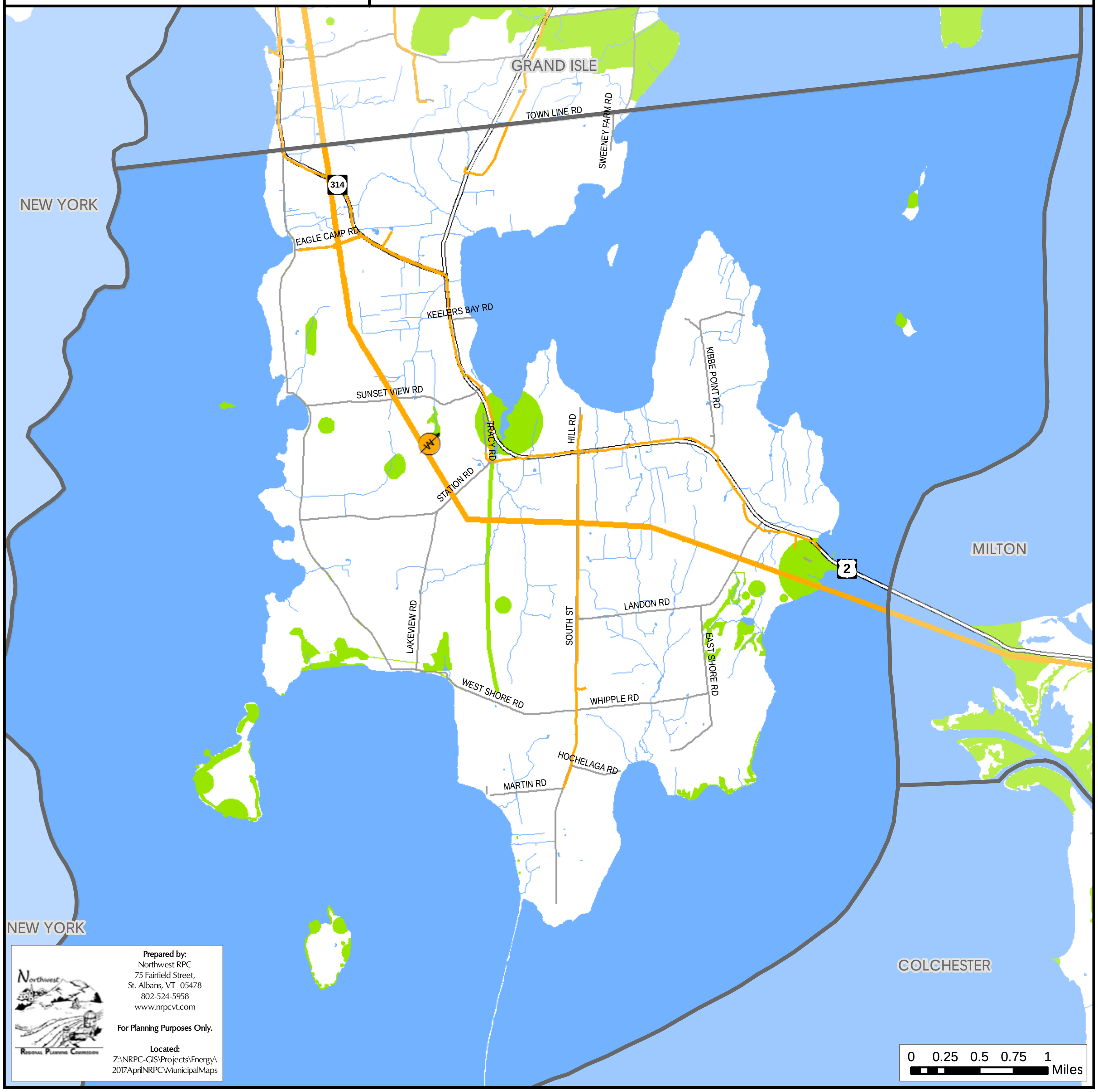

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Solar

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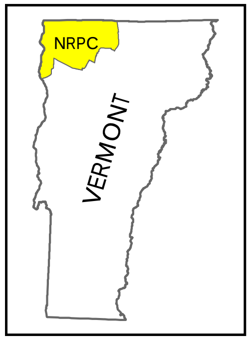

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- Base Solar/Possible Constraints

Sources: VCGI
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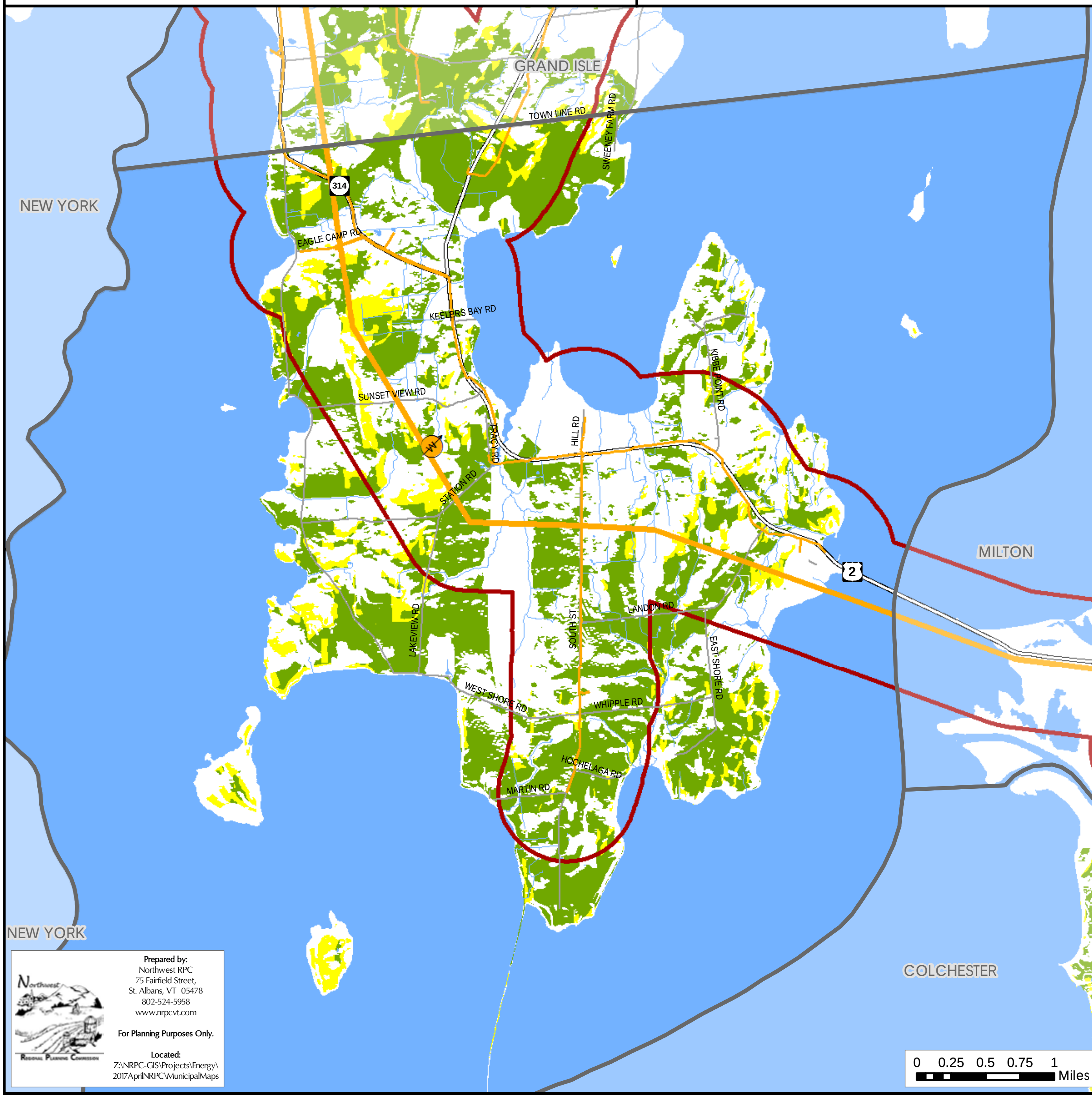

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Wind

South Hero, Vermont
Act 174
The Energy Development Improvement Act of 2016

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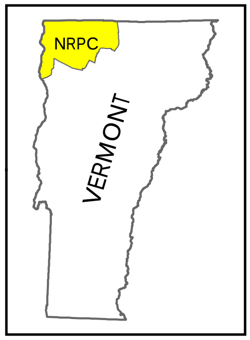

Legend

- Substation
- 3 Phase Power Line
- Transmission Line
- Prime Wind: Areas of high wind potential and no known constraints. Darker areas have higher wind speeds.
- Base Wind: Areas of high wind potential and a presence of possible constraints. Darker areas have higher wind speeds.

Sources: VCGI
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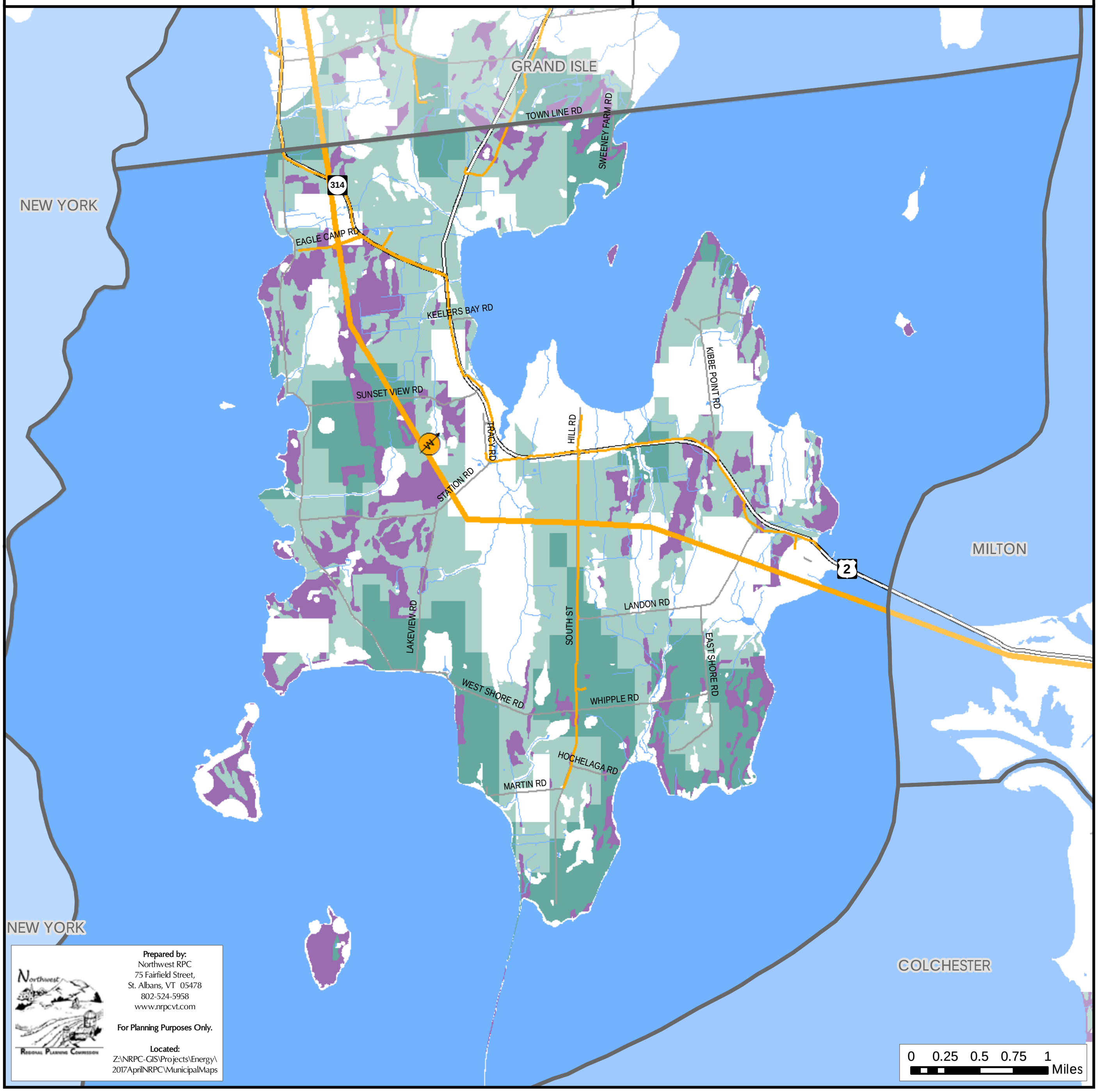

Woody Biomass

South Hero, Vermont
Act 174
The Energy Development Improvement Act of 2016

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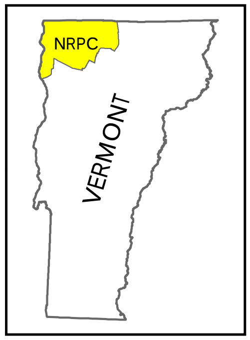

Legend

- Biomass System
- Cow Power
- Substation
- 3 Phase Power Line
- Transmission Line
- Prime Woody Biomass/No Known Constraints
- Base Woody Biomass/Possible Constraints

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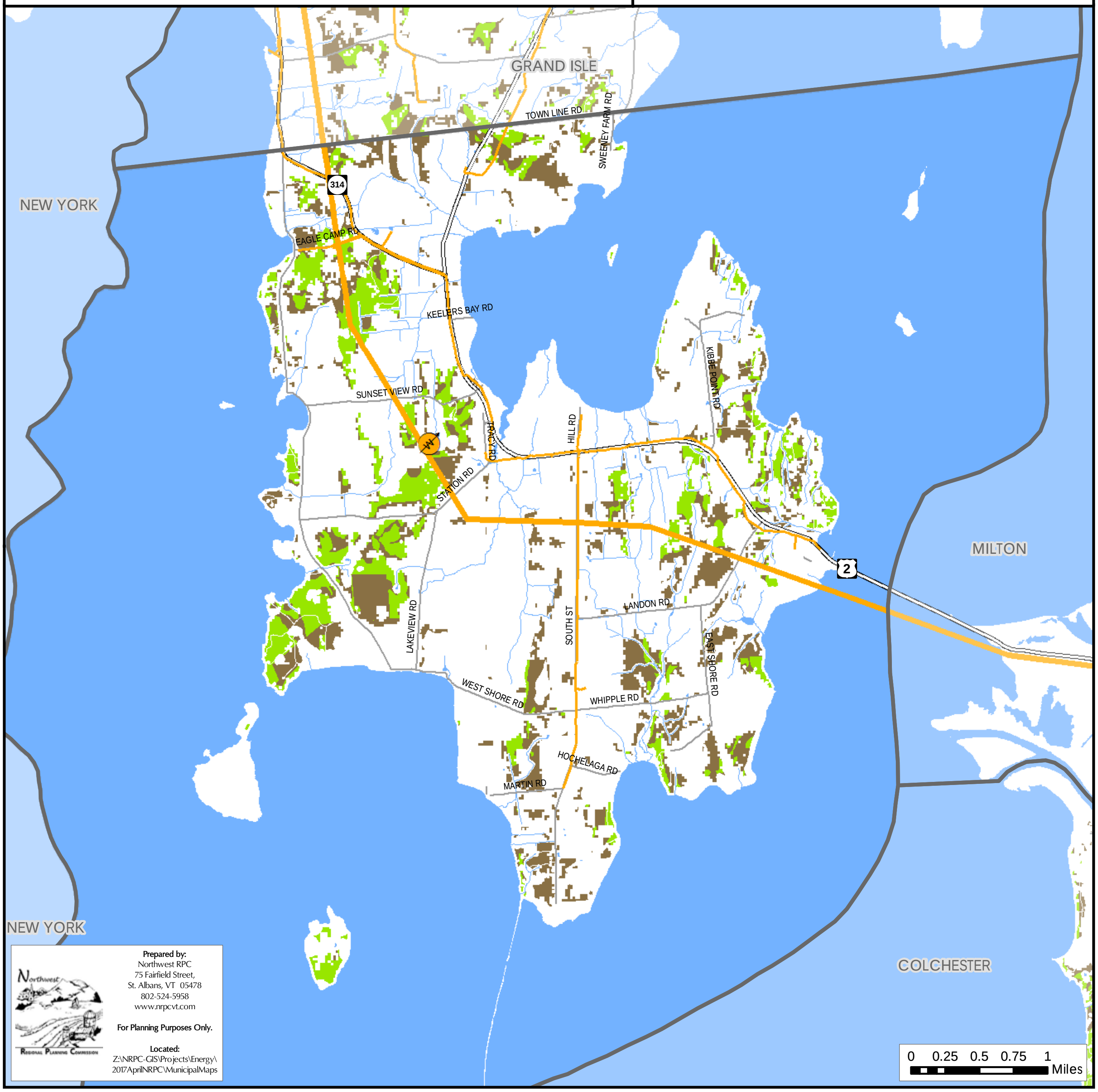

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All Generators in Municipality

Category	Sub - Category	Organization Type	Address	City	CPG Number	Capacity kW
Solar	Ground-mounted PV: Fixed Rack	Residential	14 Whipple Rd	South Hero	1740	2.7
Solar	Ground-mounted PV: Fixed Rack	Residential	16 Hall Road	South Hero	3063	4
Solar	Ground-mounted PV: Fixed Rack	Residential	14 Narrows Road	South Hero	506	2.2
Solar	Ground-mounted PV: Fixed Rack	Residential	565 West Shore Road	South Hero	2960	22.2
Solar	Ground-mounted PV: Pole	Residential	561 West Shore Road	South Hero	2977	8.9
Solar	Ground-mounted PV: Pole	Residential	549 Rt 2	South Hero	2345	3.6
Solar	Ground-mounted PV: Tracker	Residential	76 Lakeview Road	South Hero	414	4
Solar	Ground-mounted PV: Tracker	Residential	142 Ferry Rd	South Hero	3986	10.8
Solar	Ground-mounted PV: Tracker	Residential	135 Kibbie Point Rd	South Hero	5078	11
Solar	Ground-mounted PV: Tracker	Residential	134 East Shore Road	South Hero		4
Solar	Ground-mounted PV: Tracker	Residential	316 South Street	South Hero	7288	12
Solar	Hot Water	Residential	103 Lakeview Road	South Hero		
Solar	Hot Water	Residential	153 West Shore Rd	South Hero		
Solar	Hot Water	Residential	224 South Street	South Hero		
Solar	Hot Water	Residential	255 West Shore Rd	South Hero		
Solar	Hot Water	Residential	33 Gifford Lane	South Hero		
Solar	Hot Water	Residential	366 Route 2	South Hero		
Solar	Hot Water	Residential	380 South Street	South Hero		
Solar	Hot Water	Residential	389 South Street	South Hero		
Solar	Hot Water	Residential	42 Sweeney Farm Road	South Hero		
Solar	Hot Water	Residential	565 West Shore Road	South Hero		
Solar	Hot Water	Residential	8 Whipple Road	South Hero		
Solar	Hot Water	Residential	82 Lakeview Rd	South Hero		
Solar	Hot Water	Residential	83 Kibbe Farm Road	South Hero		
Solar	Roof-Mounted PV	Residential	88 Kibbe Point Road	South Hero	2722	6.4
Solar	Roof-Mounted PV	Business	328 U.S. Route 2	South Hero	1135	6.9
Solar	Roof-Mounted PV	Residential	64 Featherbed Lane	South Hero	5642	6

All Generators in Municipality

Category	Sub - Category	Organization Type	Address	City	CPG Number	Capacity kW
Solar	Roof-Mounted PV	Residential	25 Haycorn Hollow	South Hero		5.3
Solar	Roof-Mounted PV	Residential	19 Ferry Rd	South Hero	3894	6
Solar	Roof-Mounted PV	Residential	30 Ferry Rd	South Hero	1716	7.9
Solar	Roof-Mounted PV	Residential	117 Lakeview Rd	South Hero	2692	6.4
Solar	Roof-Mounted PV	Residential	479 West Shore Rd	South Hero	1861	26.9
Solar	Roof-Mounted PV	Residential	29 Kibbe Farm Rd	South Hero	2796	9.8
Solar	Roof-Mounted PV	Residential	30 Whipple Rd	South Hero	3756	9.5
Solar	Roof-Mounted PV	Residential	320 South St	South Hero	2726	12.1
Solar	Roof-Mounted PV	Residential	321 Rt 2	South Hero	2877	5.2
Solar	Roof-Mounted PV	Residential	33 Crescent Bay Road	South Hero	3881	7.6
Solar	Roof-Mounted PV	Residential	47 Colodny Way	South Hero	3929	3.3
Solar	Roof-Mounted PV	Residential	58 West Shore Road	South Hero	2851	3.2
Solar	Roof-Mounted PV	Residential	30 Haycorn Hollow	South Hero	5563	5
Solar	Roof-Mounted PV	Residential	104 Kibbe Point Road	South Hero	2302	3.7
Solar	Roof-Mounted PV	Residential	380 South Street	South Hero	1026	3.2
Solar	Roof-Mounted PV	Residential	42 Sweeney Farm Rd	South Hero	5370	6
Solar	Roof-Mounted PV	Residential	45 Heron Ridge Road	South Hero	2732	5.9
Solar	Roof-Mounted PV	Residential	7 Hochelaga Road	South Hero	2639	8.1
Solar	Roof-Mounted PV	Residential	30 Wally's Point Rd	South Hero	3935	11
Solar	Roof-Mounted PV	Residential	21 Contentment Lane	South Hero	2875	5.6
Solar	Roof-Mounted PV	Residential	15 Fox Crossing Rd	South Hero	2652	5.9
Solar	Roof-Mounted PV	Residential	122 Station St	South Hero	4007	6.2
Solar	Roof-Mounted PV	Residential	25 Ministry Lane	South Hero	5530	6.7
Solar	Roof-Mounted PV	Farm	153 West Shore Road	South Hero	3801	18.4
Solar	Roof-Mounted PV	Institution	75 South Street	South Hero	1268	9.2
Solar	Roof-Mounted PV	Residential	77 Landon Rd	South Hero	5437	7
Solar	Roof-Mounted PV	Residential	50 Whipple Rd	South Hero	1838	3.2

All Generators in Municipality

Category	Sub - Category	Organization Type	Address	City	CPG Number	Capacity kW
Solar	Roof-Mounted PV	Residential	86 Lombard Lane	South Hero	7222	3.8
Solar	Roof-Mounted PV	Residential	14 Melcher Place	South Hero	6932	10
Solar	Roof-Mounted PV	Residential	33 Colony Way	South Hero	7263	7.6
Solar	Roof-Mounted PV	Residential	69 Sunset Beach Road	South Hero	7277	5
Solar	Roof-Mounted PV	Residential	15 Iodine Spring Street	South Hero	7221	5
Solar	Roof-Mounted PV	Residential	63 West Shore Road	South Hero	7245	15
Solar	Roof-Mounted PV	Business	330-334 U.S. 2	South Hero	7282	15
Solar	Roof-Mounted PV	Residential	113 East Shore Rd	South Hero	6673	10
Solar	Roof-Mounted PV	Residential	1 Town Line Road	South Hero	2715	5.6
Solar	Roof-Mounted PV	Residential	8 Whipple Rd	South Hero	3099	4.3
Wind	Small Wind	Residential	76 Lakeview Road	South Hero	414	2.5
Wind	Small Wind	Residential	134 East Shore Road	South Hero	398	2.5

Municipal Analysis & Targets - Swanton

The following is an explanation of the municipal energy data compiled by Northwest Regional Planning Commission (NRPC). The intent of the municipal energy data is to provide the municipalities with data required to ensure compliance with the requirements of Act 174 and "Enhanced Energy Planning" (24 V.S.A. 4352). The following tables contain data that estimates current energy use and provides targets for future energy use across all sectors (transportation, heating, and electricity). It also sets targets for renewable energy generation within the municipality.

This data is meant to be a starting point for the municipality to begin planning its energy future and to talk about the changes that may need to occur within the municipality to ensure that local, regional and state energy goals are met. This includes the State of Vermont's goal to have 90% of all energy demand be met from renewable sources by 2050.

Figure 1 - Data Sources

ACS – American Community Survey

DOL –Vermont Department of Labor

DPS – Vermont Department of Public Service

EIA – Energy Information Administration

EVT – Efficiency Vermont

LEAP – Long-Range Energy Alternatives Planning

VEIC – Vermont Energy Investment Corporation

VTrans – Vermont Agency of Transportation

Data Sources

Estimates of current energy use consist primarily of data available from the American Community Survey (ACS), the Vermont Agency of Transportation (VTrans), the Vermont Department of Labor (DOL), and the Vermont Department of Public Service (DPS). Targets for future energy use are reliant upon the Long-range Energy Alternatives Planning (LEAP) analysis for the region completed the Vermont Energy Investment Corporation (VEIC). Targets for future energy generation have come from the regional planning commission and DPS. For more information on LEAP, see the Northwest Regional Energy Plan (www.nrpcvt.com). Targets for both future energy use and energy generation have been generally developed using a "top down" method of disaggregating regional data to the municipal level.

It is possible to develop "bottom up" data. For those municipalities interested in that approach, please see the Department of Public Service's Analysis and Targets Guidance (http://publicservice.vermont.gov/content/act-174-recommendations-and-determination-standards).

Please remember that the targets established by LEAP represent only one way to achieve energy goals. There may several other similar pathways that a municipality may choose to take in order to meet the 90x50 goal.

Below is a worksheet by worksheet explanation of the Municipal Template spreadsheet:

1. Municipal Data Summary

The following tables summarize all data that is required to be in a municipal plan if the plan is to meet the "determination" standards established by the Vermont Department of Public Service.

Table 1A: Current Municipal Transportation Energy Use

Transportation Data	Municipal Data
Total # of Passenger Vehicles (ACS 2011-2015)	4,916
Average Miles per Vehicle (Vtrans)	11,356
Total Miles Traveled	55,826,096
Realized MPG (2013 - VTrans 2015 Energy Profile)	18.6
Total Gallons Use per Year	3,001,403
Transportation BTUs (Billion)	361
Average Cost per Gallon of Gasoline (RPC)	2.31
Gasoline Cost per Year	6,933,241

This table uses data from the American Community Survey (ACS) and Vermont Agency of Transportation (VTrans) to calculate current transportation energy use and energy costs in the municipality.

Table 1B: Current Municipal Residential Heating Energy Use

Fuel Source	Municipal Households (ACS 2011-2015)	% of Municipal Households	Municipal Square Footage Heated	Municipal BTU (in Billions)
Natural Gas	937	35.7%	1,532,720	92
Propane	333	12.7%	568,560	34
Electricity	55	2.1%	70,224	4
Fuel Oil	1003	38.2%	1,735,120	104
Coal	0	0.0%	0	0
Wood	245	9.3%	448,880	27
Solar	0	0.0%	0	0
Other	45	1.7%	77,936	5
No Fuel	10	0.4%	19,040	1
Total	2628	100.0%	4,452,480	267

This table displays data from the ACS that estimates current municipal residential heating energy use.

Table 1C: Current Municipal Commercial Energy Use

	Commercial Establishments in Municipality (VT DOL)	Estimated Thermal Energy BTUs per Commercial Establishment (in Billions) (VDPS)	Estimated Thermal Energy BTUs by Commercial Establishments in Municipality (in Billions)
Municipal Commercial Energy Use	175	0.725	127

The table uses data available from the Vermont Department of Labor (VT DOL) and the Vermont Department of Public Service (DPS) to estimate current municipal commercial establishment energy use in the municipality.

Table 1D: Current Electricity Use

Use Sector	Current Electricity Use
Residential (kWh)	23,623,991
Commercial and Industrial (kWh)	44,900,317
Total (kWh)	68,524,308

This table displays current electricity use within the municipality. This data is available from Efficiency Vermont (EVT).

Table 1E: Residential Thermal Efficiency Targets

	2025	2035	2050
"Residential - Increased Efficiency and Conservation (% of municipal households to be weatherized)"	5%	16%	78%

This table displays targets for thermal efficiency of residential structures. The data is based on a methodology developed by DPS using data available from the regional Long-range Energy Alternatives Planning (LEAP) analysis and ACS. The data in this table represents the percentage of municipal households that will need to be weatherized in the target years. The target is cumulative.

Table 1F: Commercial Thermal Efficiency Target

	2025	2035	2050
"Commercial - Increased Efficiency and Conservation (% of commercial establishments to be weatherized)"	25%	25%	73%

This table shows the same information as Table 1E, but sets a target for commercial thermal efficiency and weatherization. Information from the VT DOL is required to complete this target. The target is cumulative.

Table 1G: Thermal Fuel Switching (Residential and Commercial) – Wood Systems

	2025	2035	2050
New Efficient Wood Heat Systems (in units)	14	34	128

This table provides a target for new wood heating systems for residential and commercial structures in the municipality for each target year. This target was calculated using data from LEAP and ACS. The target is cumulative.

Table 1H: Thermal Fuel Switching (Residential and Commercial) – Heat Pumps

	2025	2035	2050
New Heat Pumps (in units)	274	654	1293

This table provides a target for new heat pump systems for residential and commercial structures in the municipality for each target year. This target was calculated using data from LEAP and ACS. The target is cumulative.

Table 1I: Electricity Efficiency Targets

	2025	2035	2050
Increase Efficiency and Conservation (BTUs)	25.2%	48.3%	100.7%

Data in this table displays a target for increased electricity efficiency and conservation during the target years. This target will be met through conversions to high efficiency appliances, electric heat pumps, and electric light-duty vehicles. These targets were developed using regional LEAP analysis. The target is cumulative.

Table 1J: Use of Renewables – Transportation

	2025	2035	2050
Renewable Energy Use - Transportation (BTUs)	9.9%	31.8%	90.5%

This data displays targets for the percentage of transportation energy use coming from renewable sources during each target year. This target will be met through conversions to electric light-duty vehicles and biodiesel heavy-duty vehicles. This data was developed using the LEAP analysis. The target is cumulative.

Table 1K: Use of Renewables – Heating

	2025	2035	2050
Renewable Energy Use - Heating (BTUs)	44.6%	57.7%	85.5%

This data displays targets for the percentage of heating energy use coming from renewable sources during each target year. This target will be met through conversions to electric heat pumps and high efficiency wood heating systems. This data was developed using information from the LEAP analysis. The target is cumulative.

Table 1L: Use of Renewables – Electricity

	2025	2035	2050
Renewable Energy Use - Electricity (MWh)	9,408.3	18,816.7	28,510.1

This data displays targets for MWh of electricity generation coming from renewable sources within the municipality during each target year. This data was developed using information from the regional planning commission and DPS. This data is the same as the data in Table 1Q. The target is cumulative.

Table 1M: Transportation Fuel Switching Targets – Electric Vehicles

	2025	2035	2050
Electric Vehicles	430	3221	7663

This tables displays a target for switching from fossil fuel based vehicles (gasoline and diesel) to electric vehicles. This target is calculated using LEAP and ACS data. The target is cumulative.

Table 1N: Transportation Fuel Switching Targets – Biodiesel

	2025	2035	2050
Biodiesel Vehicles	793	1581	3048

This tables displays a target for switching from fossil fuel based vehicles to biodiesel-powered vehicles. This target is calculated using LEAP and ACS data. The target is cumulative.

Table 1O: Existing Renewable Generation

Renewable Type	MW	MWh
Solar	0.79	968.86
Wind	0.00	0.00
Hydro	0.00	0.00
Biomass	0.00	0.00
Other	0.00	0.00
Total Existing Generation	0.79	968.86

Table 1O shows existing renewable generation in the municipality, in MW and MWh, based on information available from the Vermont Department of Public Service.

Table 1P: Renewable Generation Potential

Renewable Type	MW	MWh
Rooftop Solar	4	4,296
Ground-mounted Solar	1,180	1,447,523
Wind	2,131	6,534,213
Hydro	0.865	3,031
Biomass and Methane	0	0
Other	0	0
Total Renewable Generation Potential	3,316	7,989,064

Renewable generation potential is based on mapping completed by the regional planning commission that is based on the Municipal Determination Standards and associated guidance documents developed by DPS. The renewable generation potential is expressed in MW and MWh by the type of renewable resource (solar, wind, hydro, etc.).

Table 1Q: Renewable Generation Targets

	2025	2035	2050
Total Renewable Generation Target (in MWh)	9,408.35	18,816.69	28,510.14

This data displays targets for MWh of electricity generation coming from renewable sources within the municipality during each target year. This data was developed using information from the regional planning commission and DPS. This data is the same as the data in Table 1L.

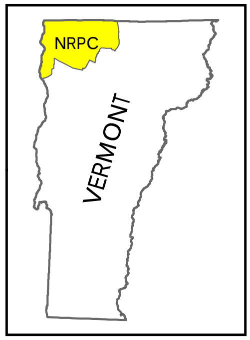
Table 1R: Sufficient Land?

	Y/N
Solar	Y
Wind	Y

This table shows whether or not there is sufficient land in the municipality to meet the renewable generation targets based on the renewable generation potential in the municipality.

Utility Service Areas

Swanton, Vermont
Act 174
The Energy Development Improvement Act of 2016



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N

Legend

Utility Service Area Features

- Green Mountain Power
- Swanton Village Electric
- Vermont Electric Co-op
- Enosburg Falls Electric
- Substation
- 3 Phase Power Line
- Transmission Line

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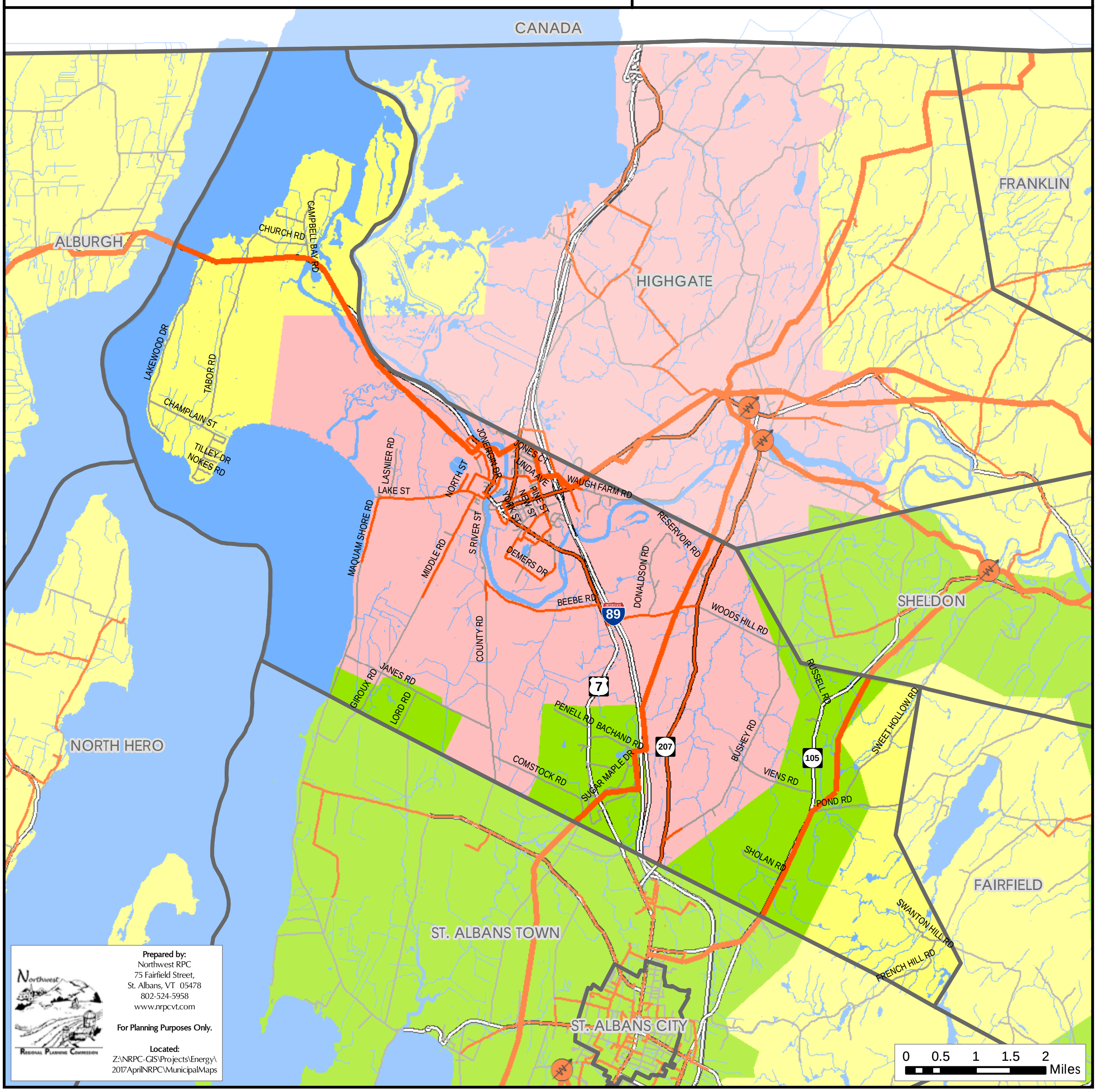

Transmission & 3 Phase Power Infrastructure

Swanton, Vermont
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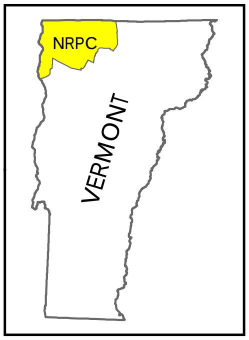

Legend

- Substation
- 3 Phase Power Line
- Transmission Line
- 1/2 Mile Buffer (3 Phase Power Line & Transmission Line)

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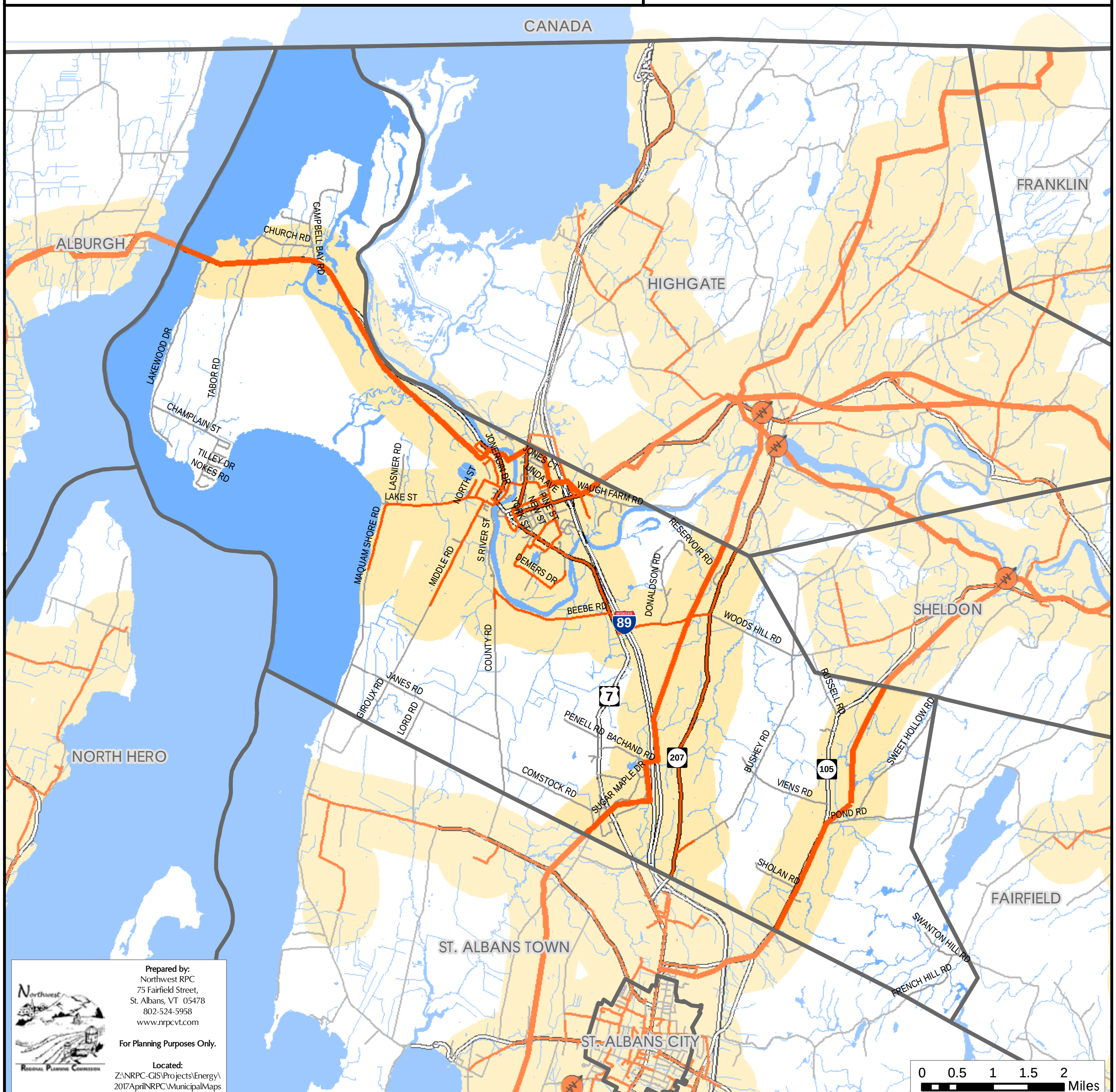

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Existing Generation Facilities

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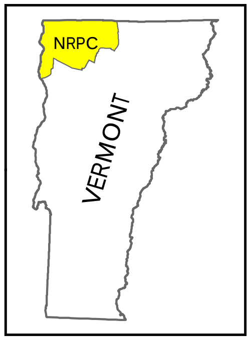

Legend

- Biomass Facility
- Hydro Facility
- Solar Facility
- Wind Facility

Note: Only generators 15kW are shown on the map. A full list of all generators is available.

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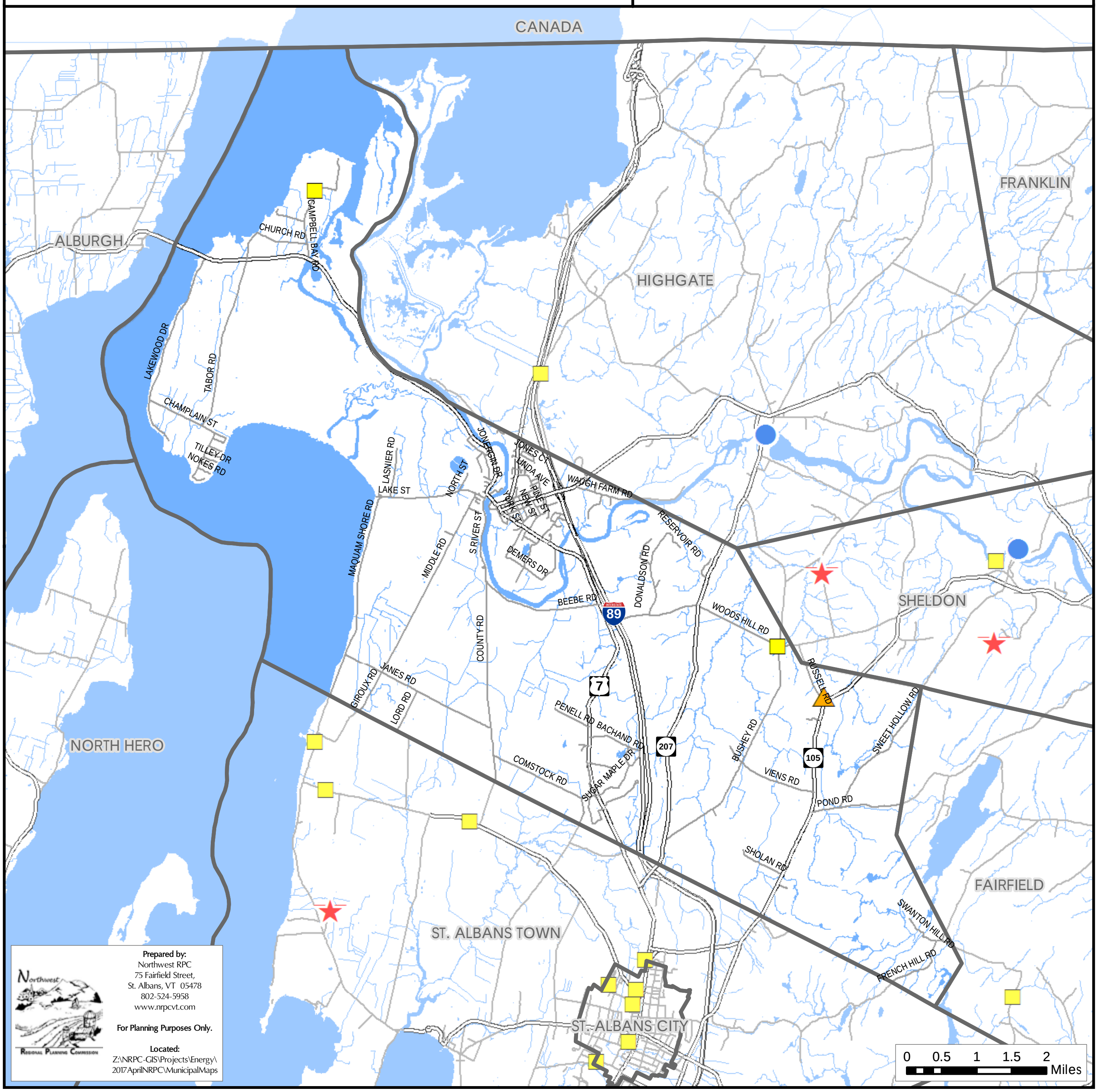

Natural Gas Lines

Swanton, Vermont
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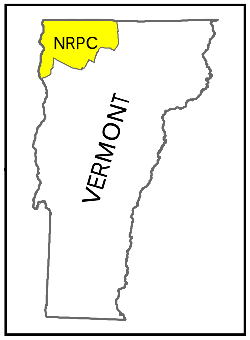

Legend

Natural Gas Line

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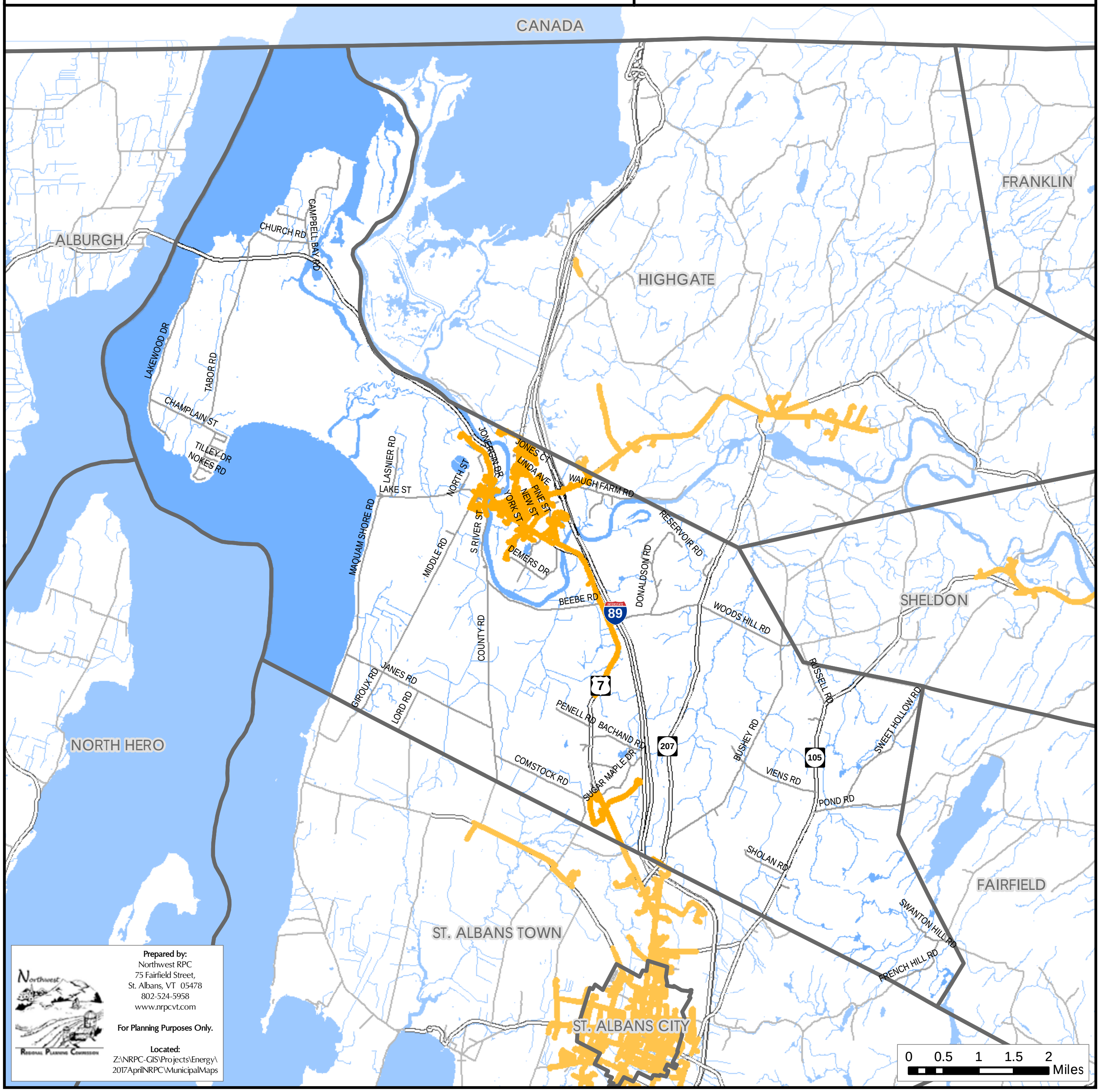

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Hydro

Swanton, Vermont
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N

Legend

- Substation
- 3 Phase Power Line
- Transmission Line
- Designated Outstanding Resource Water
- Known Constraint - Designated National Wild & Scenic River
- Possible Constraint - Stressed or Impaired Water
- Possible Constraint - RINAs

Potential Hydroelectric Facility

- < 50 kW Capacity
- > 50 kW Capacity
- High Hazard with < 50 kW Capacity
- High Hazard with > 50 kW Capacity

Operating Hydroelectric Facility

- Dam not on National Wild and Scenic River
- Dam on National Wild and Scenic River

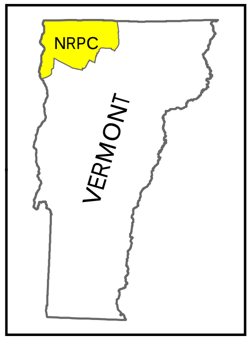
NRPC
VERMONT

Sources: VCGI
Disclaimer: The accuracy of information presented is determined by its sources. Errors and omissions may exist. The Northwest RPC is not responsible for these. Questions of on-the-ground location can be resolved by site inspections and/or surveys by a registered surveyor. This map is not sufficient for delineation of features on-the-ground. This map identifies the presence of features, and may indicate relationships between features, but is not a replacement for surveyed information or engineering studies.

Solar

Swanton, Vermont
Act 174
The Energy Development Improvement Act of 2016

This map and the corresponding data is intended to be used to inform energy planning efforts by municipalities and regions. This may also be used for conceptual planning or initial site identification by those interested in developing renewable energy infrastructure. The maps do NOT take the place of site-specific investigation for a proposed facility and cannot be used of as "siting maps."



Legend

- Substation
- 3 Phase Power Line
- Transmission Line
- 1/2 Mile Buffer (3 Phase Power Line & Transmission Line)
- Prime Solar/No Known Constraints
- Base Solar/Possible Constraints

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Wind

Swanton, Vermont
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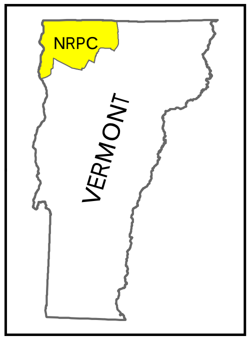

Legend

- Substation
- 3 Phase Power Line
- Transmission Line
- Prime Wind: Areas of high wind potential and no known constraints. Darker areas have higher wind speeds.
- Base Wind: Areas of high wind potential and a presence of possible constraints. Darker areas have higher wind speeds.

Sources: VCGI

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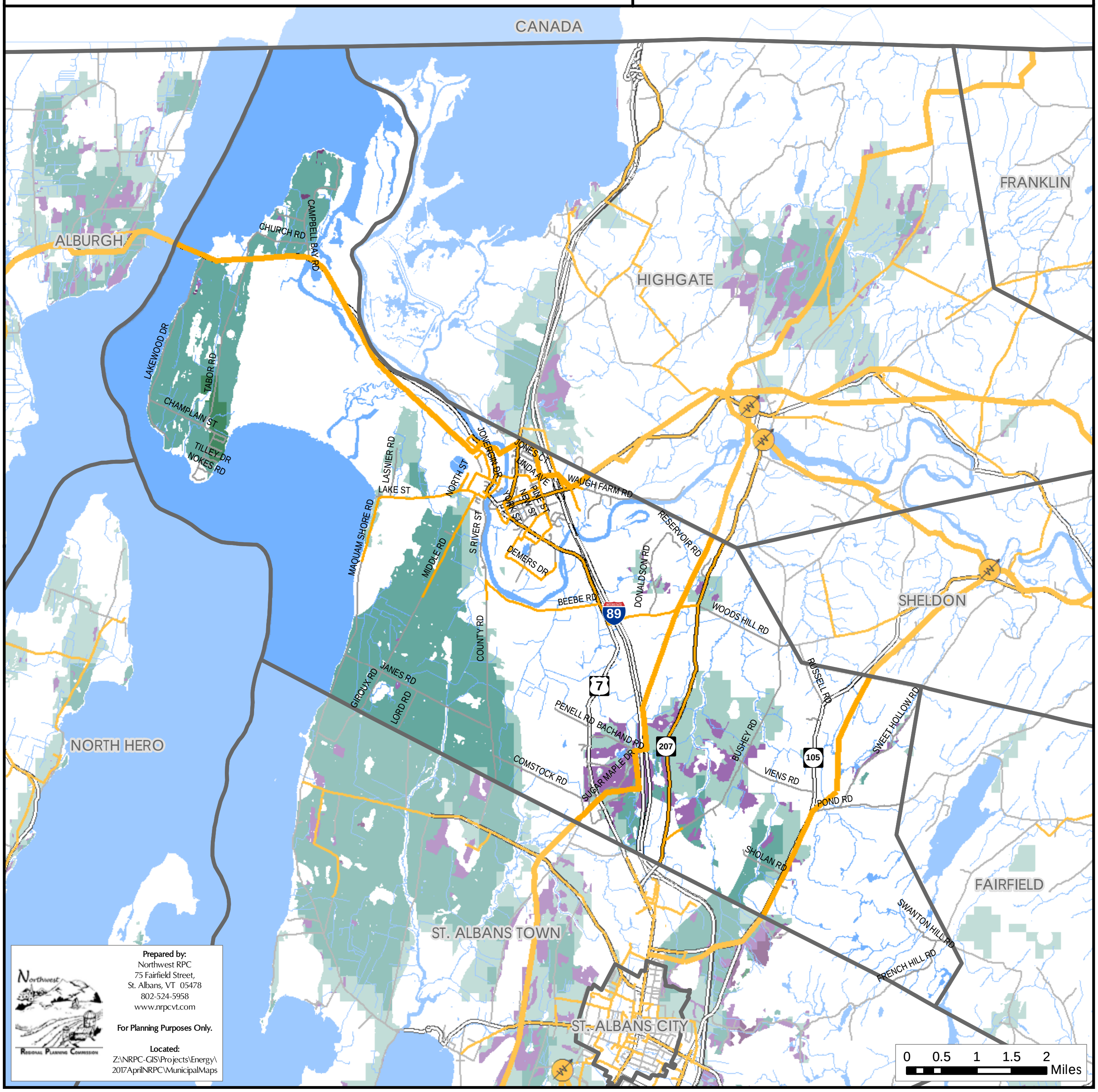

Woody Biomass

Swanton, Vermont
Act 174
The Energy Development Improvement Act of 2016

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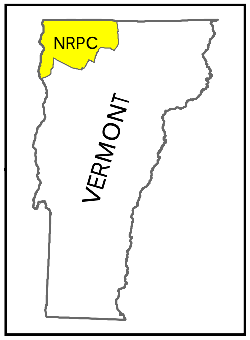

Legend

- Biomass System
- Cow Power
- Substation
- 3 Phase Power Line
- Transmission Line
- Prime Woody Biomass/No Known Constraints
- Base Woody Biomass/Possible Constraints

Sources: VCGI
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All Generators in Municipality

Category	Sub - Category	Organization Type	Address	City	CPG Number	Capacity kW
Solar	Ground-mounted PV: Fixed Rack	Farm	101 Campbell Bay Rd	Swanton	6221	36
Solar	Ground-mounted PV: Fixed Rack	Residential	264 Woods Hill Road	Swanton	16-0234	15
Solar	Ground-mounted PV: Fixed Rack	Residential	4 Cedar Ledges Estate	Swanton	16-0886	12.5
Solar	Ground-mounted PV: Pole	Residential	2502 Highgate Road	Swatnon	212	3.3
Solar	Ground-mounted PV: Tracker	Residential	8 Andersen Ln	Swanton	5072	7
Solar	Ground-mounted PV: Tracker	Business	580 St. Albans Rd	Swanton	3113	6
Solar	Ground-mounted PV: Tracker	Residential	3 Anderson Ln	Swanton	5125	7
Solar	Hot Water	Residential	20 Blake Street	Swanton		
Solar	Hot Water	Residential	1 Abenaki Acres Drive	Swanton		
Solar	Roof-Mounted PV	Residential	220 Mountain View Drive	Swanton		7.5
Solar	Roof-Mounted PV	Residential	2190 Highgate Rd	Swanton	5040	10
Solar	Roof-Mounted PV	Residential	109 Gauthier Dr	Swanton	3895	3
Solar	Roof-Mounted PV	Residential	239 North River St	Swanton	6027	5
Solar	Roof-Mounted PV	Residential	301 Lakewood Dr	Swanton	4110	6
Solar	Roof-Mounted PV	Residential	38 Campbell Bay Road	Swanton		10
Solar	Roof-Mounted PV	Residential	55 Lord Rd	Swanton	2440	1.6
Solar	Roof-Mounted PV	Residential	181 Champlain St	Swanton	2972	6.2
Solar	Roof-Mounted PV	Residential	59 Lasnier Rd	Swanton	3450	6.8
Solar	Roof-Mounted PV	Residential	13 Leduc Dr	Swanton	2849	4
Solar	Roof-Mounted PV	Residential	1910 Sheldon Rd	Swanton	3119	6.8
Solar	Roof-Mounted PV	Residential	79 Comstock Road	Swanton	6276	7
Solar	Roof-Mounted PV	Residential	2180 Highgate Rd	Swanton	3058	6.2
Solar	Roof-Mounted PV	Residential	239 Woods Hill Rd	Swanton	5626	8
Solar	Roof-Mounted PV	Residential	61 Viens Rd	Swanton	3821	10
Solar	Roof-Mounted PV	Residential	319 Lakewood Drive	Swanton	2625	5.6
Solar	Roof-Mounted PV	Residential	227 Maquam Shore Rd	Swanton	2911	4
Solar	Roof-Mounted PV	Residential	103 Dorian Drive	Swanton	3741	9

All Generators in Municipality

Category	Sub - Category	Organization Type	Address	City	CPG Number	Capacity kW
Solar	Roof-Mounted PV	Residential	149 Lasnier Rd	Swanton	5985	9
Solar	Roof-Mounted PV	Residential	482 Maquam Shore	Swanton		9.1
Solar	Roof-Mounted PV	Residential	316 Lakewood Drive	Swanton	2982	7.5
Solar	Roof-Mounted PV	Institution	29 Tabor Road	Swanton	179	7
Solar	Roof-Mounted PV	Residential	28 Swanton Hill Road	Swanton	455	3.7
Solar	Roof-Mounted PV	Residential	5 Rustic Walk	Swanton	16-0399	12
Solar	Roof-Mounted PV	Residential	124 Lakewood Drive	Swanton	6518	6
Solar	Roof-Mounted PV	Residential	4 Tylers Way	Swanton	7200	4
Solar	Roof-Mounted PV	Residential	25 Sugar Maple Drive	Swanton	16-0406	5
Solar	Roof-Mounted PV	Residential	1966 Sheldon Rd	Swanton		3.6
Solar	Roof-Mounted PV	Residential	4 Ceres Circle	Swanton	7218	5
Solar	Roof-Mounted PV	Residential	2029 Highgate Road	Swanton	16-0403	5
Solar	Roof-Mounted PV	Residential	5 Dawn's Way	Swanton	16-0829	3.6
Solar	Roof-Mounted PV	Residential	210 Maquam Shore Rd	Swanton	16-0146	7.6
Solar	Roof-Mounted PV	Residential	62 Brown Ave	Swanton	16-0290	3.8
Solar	Roof-Mounted PV	Residential	10 Penell Rd	Swanton	7330	6.6
Solar	Roof-Mounted PV	Residential	2101 Sheldon Rd	Swanton	16-0364	3.8
Solar	Roof-Mounted PV	Residential	323 Lakewood Dr	Swanton	6851	4
Solar	Roof-Mounted PV	Residential	264 Woods Hill Road	Swanton	16-0234	15
Solar	Roof-Mounted PV	Residential	262 Mountain View Drive	Swanton		7.6
Solar	Roof-Mounted PV	Residential	580 Maquam Shore Rd	Swanton	16-0599	14
Solar	Roof-Mounted PV	Residential	4847 Lower Newton Rd	Swanton	16-1693	6
Solar	Roof-Mounted PV	Business	5700 Lower Newton Rd	Swanton	16-1482	15
Solar	Roof-Mounted PV	Residential	2 Dawns Way	Swanton		3
Solar	Roof-Mounted PV	Residential	220 Mountain View Drive	Swanton		7.5
Solar	Roof-Mounted PV	Residential	1063 Maquam Shore Rd	Swanton	16-1546	7.5
Solar	Roof-Mounted PV	Residential	16 Stanley Center	Swanton		13.2

All Generators in Municipality						
Category	Sub - Category	Organization Type	Address	City	CPG Number	Capacity kW
Solar	Roof-Mounted PV	Residential	39 Mountain View Dr	Swanton		6
Wind	Small Wind	Residential	31 Russell Road	Swanton	258	19
Wind	Small Wind	Institution	29 Tabor Road	Swanton	179	9.5

APPENDIX H

APPENDIX H - REGIONAL TARGET SUMMARY

1A. Current Municipal Transportation Energy Use

Transportation Data	Municipal Data
Total # of Vehicles (ACS 2011-2015)	42,471
Average Miles per Vehicle (Vtrans)	11,356
Total Miles Traveled	482,300,676
Average Gallons Use per Vehicle per Year (VTrans)	19
Total Gallons Use per Year	25,930,144
Transportation BTUs (Billion)	3,122
Average Cost per Gallon of Gasoline (RPC)	2
Gasoline Cost per Year	59,898,632

This table uses data from the American Community Survey (ACS) and Vermont Agency of Transportation (VTrans) to calculate current transportation energy use and energy costs.

1B. Current Municipal Residential Heating Energy Use

Fuel Source	Municipal Households (ACS 2011-2015)	% of Municipal Households	Municipal Square Footage Heated	Municipal BTU (in Billions)
Natural Gas	4,414	20.4%	7,181,408	430,884,480,000
Propane	3,051	14.1%	5,347,984	320,879,040,000
Electricity	470	2.2%	678,048	40,682,880,000
Fuel Oil	9,328	43.1%	16,170,176	970,210,560,000
Coal	17	0.1%	27,440	1,646,400,000
Wood	4,008	18.5%	7,353,856	441,231,360,000
Solar	0	0.0%	0	0
Other	341	1.6%	599,984	35,999,040,000
No Fuel	21	0.1%	33,648	2,018,880,000
Total	21,650	100.0%	37,392,544	2,243,552,640,000

This table displays data from the ACS that estimates current municipal residential heating energy use.

1C. Current Municipal Commercial Energy Use

	Commercial Establishments in Municipality (VT DOL)	Estimated Thermal Energy BTUs per Commercial Establishment (in Billions) (VDPS)	Estimated Thermal Energy BTUs by Commercial Establishments in Municipality (in Billions)
Municipal Commercial Energy Use	1,123	0.725	28

The table uses data available from the Vermont Department of Labor (VT DOL) and the Vermont Department of Public Service (DPS) to estimate current municipal commercial establishment energy use in the municipality.

1D. Current Electricity Use

Use Sector	Current Electricity Use
Residential (MWh)	194,619
Commercial and Industrial (MWh)	288,132
Total (MWh)	482,751

This table displays current electricity use within the municipality. This data is available from Efficiency Vermont (EVT).

1E. Residential Thermal Efficiency Targets

	2025	2035	2050
"Residential - Increased Efficiency and Conservation (% of municipal households to be weatherized)"	4%	14%	57%

This table displays targets for thermal efficiency for residential structures based on a methodology developed by DPS using data available from the regional Long-range Energy Alternatives Planning (LEAP) analysis and ACS. The data in this table represents the percentage of municipal households that will need to be weatherized in the target years.

1F. Commercial Thermal Efficiency Targets

	2025	2035	2050
"Commercial - Increased Efficiency and Conservation (% of commercial establishments to be weatherized)"	24%	32%	64%

This table shows the same information as Table 1E, but sets a target for commercial thermal efficiency. Information from the VT DOL is required to complete this target.

1G. Thermal Fuel Switching Targets (Residential and Commercial) - Wood Systems

	2025	2035	2050
New Efficient Wood Heat Systems (in units)	46	89	720

This table provides a target for new wood heating systems for residential and commercial structures in the municipality for each target year. This target was calculated using data from LEAP and ACS.

1H. Thermal Fuel Switching Targets (Residential and Commercial) - Heat Pumps

	2025	2035	2050
New Heat Pumps (in units)	3,203	6,407	11,603

This table provides a target for new heat pump systems for residential and commercial structures in the municipality for each target year. This target was calculated using data from LEAP and ACS.

1I. Electricity Efficiency Targets

	2025	2035	2050
Increase Efficiency and Conservation (% of BTUs)	25.2%	48.3%	100.7%

Data in this table displays a target for increased electricity efficiency and conservation during the target years. These targets were developed using regional LEAP analysis.

1J. Use of Renewables - Transportation

	2025	2035	2050
Renewable Energy Use - Transportation (% of BTUs)	9.6%	31.3%	90.3%

This data displays targets for the percentage of transportation energy use coming from renewable sources during each target year. This data was developed using the LEAP analysis.

1K. Use of Renewables - Heating

	2025	2035	2050
Renewable Energy Use - Heating (% of BTUs)	48.3%	61.6%	87.7%

This data displays targets for the percentage of heating energy use coming from renewable sources during each target year. This data was developed using information from the LEAP analysis.

1L. Use of Renewables - Electricity

	2025	2035	2050
Renewable Energy Use - Electricity (MWh)	115,169.5	230,338.9	348,998.4

This data displays targets for MWh of electricity generation coming from renewable sources within the municipality during each target year. This data was developed using information from the regional planning commission and DPS. This data is the same as the data in Table 1Q.

1M. Transportation Fuel Switching Target - Electric Vehicles

	2025	2035	2050
Electric Vehicles	3,716	27,828	62,889

This tables displays a target for switching from fossil fuel based vehicles (gasoline and diesel) to electric vehicles. This target is calculated on Worksheet 2. by using LEAP and ACS data.

1N. Transportation Fuel Switching Target - Biodiesel Vehicles

	2025	2035	2050
Biodiesel Vehicles	6,546	13,034	24,989

This tables displays a target for switching from fossil fuel based vehicles to biodiesel-powered vehicles. This target is calculated on Worksheet 2. by using LEAP and ACS data.

1O. Existing Renewable Generation

Renewable Type	MW	MWh
Solar	9.49	11,638.54
Wind	5.26	16,127.16
Hydro	41.38	144,995.52
Biomass	2.31	9,429.57
Other	0	0
Total Existing Renewable Generation	58.44	182,190.79

Table 1O shows existing renewable generation in the municipality, in MW and MWh, based on information available from the Vermont Department of Public Service.

1P. Renewable Generation Potential

Renewable Type	MW	MWh
Rooftop Solar	29	35,351
Ground-mounted Solar	3,455	4,237,037
Wind	3,111	9,536,793
Hydro	1	3,574
Biomass and Methane	0	0
Other	0	0
Total Renewable Generation Potential	6,595	13,812,755

Renewable generation potential is based on mapping completed by the Regional Planning Commission that is based on the Municipal Determination Standards and associated guidance documents developed by DPS. The renewable generation potential is expressed in MW and MWh by the type of renewable resource (solar, wind, hydro, etc.).

1Q. Renewable Generation Targets

	2025	2035	2050
Total Renewable Generation Target (in MWh)	115,169.47	230,338.94	348,998.40

Renewable generation targets for municipalities were developed by the regional planning commission.

1R. Sufficient Land

	Y/N
Solar	Y
Wind	Y

This table shows whether or not there is sufficient land in the municipality to meet the renewable generation targets based on the renewable generation potential in the municipality.