THETFORD, VERMONT
2020 TOWN PLAN

ADOPTED SEPTEMBER 11, 2020

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PURPOSE

This 2020 Thetford Town Plan was written for the residents of Thetford and those interested in the growth and development of the Town. The Plan is intended to summarize information about Thetford and identify goals, policies, recommendations, and enabling language (consistent with Vermont law).

A town plan is intended to maintain some control over inevitable and constant change. Every eight years, as required by state law, we imagine what we would like our town to look like when our grandchildren have grandchildren. We balance the individual's right to live the way she or he wants with the needs and desires of townspeople as a whole, today and in the foreseeable future.

ACKNOWLEDGEMENTS

The Planning Commission extends its thanks to Thetford residents who attended Planning Commission meetings, village community forums, and warned hearings between 2013 and 2020. Their input, along with consultation with Two Rivers-Ottauquechee Regional Commission (TRORC) has resulted in extensive modifications to the previous Town Plan (2012). Residents have also contributed directly by drafting some chapters, or sections of chapters. The purpose of this process and of the Plan has been to determine and encourage the appropriate use of all lands in the Town of Thetford and its villages, and to foster development in a manner that promotes and safeguards the health, safety and general welfare of citizens.

OBJECTIVES, POLICIES, AND PROGRAMS

Several specific objectives are referenced in the Plan that are intended to point the community towards a sustainable future. These are:

1. To encourage a rational pattern of development founded upon the importance of forests, agriculture, waters, and the historical uniqueness of Thetford, while balancing the needs and demands of residential, recreational, business, and light industrial uses.
2. To accommodate housing that is affordable for a range of households including those of moderate to low income, that is focused on areas of preexisting development.

3. To support access to childcare and education for all residents.
4. To provide an environment conducive to diverse local jobs.
5. To evaluate existing facilities and their infrastructure and seek practical solutions for improvements that would benefit residents and encourage business.
6. To protect soils, water, air, habitat and other natural heritage elements.
7. To protect the town from flood damage by preserving flood storage capacity and protecting infrastructure.
8. To encourage energy efficiency and reduce energy impact.
9. To promote alternatives to the one person - one car model of commuting.
10. To increase the vitality of Thetford's historic villages while preserving their aesthetic heritage and the scenic and natural resources of surrounding rural areas.

DECLARATION OF CLIMATE EMERGENCY

Most nations of the world agree that "climate change represents an urgent and potentially irreversible threat to human societies and the planet,"[1] and this constitutes a global emergency. The 2018 report from the United Nations International Panel on Climate Change (IPCC) details the consequences of failure to limit global warming to 1.5°C above pre-industrial levels.[2] The planet has already warmed 1°C and will reach an increase of 1.5°C around 2040 at the current pace of warming.[3] Warming would reach or exceed 3°C by 2100 even if all of the nations under the Paris Agreement meet their promised emissions reductions.[4]

The IPCC report also describes various measures to avoid a rise of 1.5 °C and its accompanying disastrous impacts. It shows that steep reductions in greenhouse gases are urgent but feasible. Carbon dioxide emissions must be cut by 45% by 2030. The

[1] Adoption of the Paris Agreement, https://unfccc.int/resource/docs/2015/cop21/eng/l09.pdf

[2] Global Warming of 1.5ºC, https://www.ipcc.ch/sr15/

[3] The report notes that there are regional differences in warming and that many regions have already exceeded a 1.5 °C increase. Burlington, VT has seen the greatest average winter-time warming of any U.S. city, 3.9 °C since 1970. https://www.climatecentral.org/gallery/maps/heres-where-winters-are-warming-the-most

[4] The Climate Action Tracker Thermometer, https://climateactiontracker.org/global/cat-thermometer/

challenge is enormous, but it is imperative if we are to avert the profound disruption of human society should we fail.[5]

There is no comprehensive plan at the Federal level to address the climate emergency, and this country has threatened to withdraw from the Paris Agreement, also known as the United Nations Framework Convention on Climate Change (UNFCCC).

The State of Vermont has missed its 2012 statutory goal for greenhouse gas reduction and is on an emissions trajectory that would make its goals for 2028 and 2050 unattainable.

This situation highlights the need for local action. Thetford has already demonstrated leadership in addressing the emergency, most notably in establishing the first town energy committee in Vermont, a model being followed by other towns. Thetford was also the first municipality in the state to adopt a climate and energy resolution at Town Meeting in 2018. However, we recognize that there is far more that will be required of our community to adapt to the changes that are imminent. While this Town Plan acknowledges the goal of switching to 90% renewable energy by 2050, as stated in Vermont's Comprehensive Energy Plan of 2016, it does not address the climate emergency as understood by the IPCC as of 2019. That task must be taken up now, immediately, by all sectors of our community and town government.

- The town recognizes that we – our region, our country, our world – have entered a period of unprecedented climate emergency, which requires unparalleled responses at all levels of government and society.
- The town also recognizes that refugees and immigration, along with economic, social, and racial justice, are embedded aspects of the climate emergency, as is the protection of farms, forests, wildlife, and natural areas.
- Town government must fully integrate these understandings into its future decision-making.
- Town government must work with the citizens and organizations of the town, as well as regional and state organizations, to cut CO2 by 45% by 2030. If we fail to do that, the IPCC predicts that the effects on all life will be catastrophic.

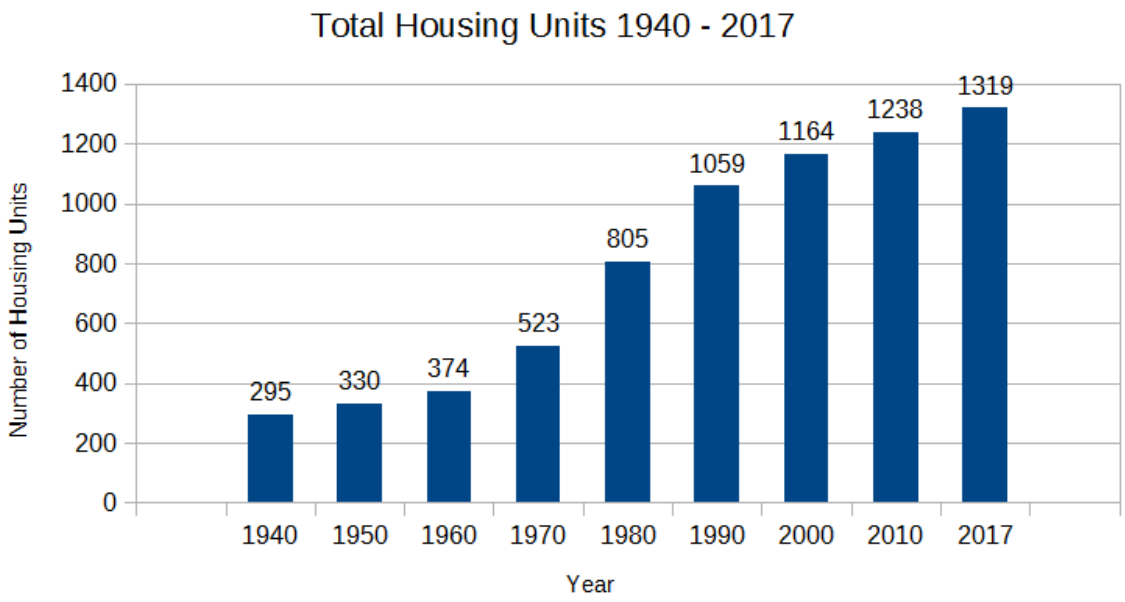
[5] Slash Climate Emissions 45% by 2030; Children's Health Would Benefit, Says UN Climate Head, https://www.healthpolicy-watch.org/slash-climate-emmissions-by-45-by-2030-childrens-health-would-benefit-says-unfccc-head/

CHAPTER I: HOUSING

Many towns in New England experienced rapid economic growth and residential sprawl in the last forty years of the 20th century. Quite often, their present appearance bears little resemblance to the pre-World War II historical development. Thetford, however, has not experienced a great deal of dislocated development and still bears a strong resemblance to its past settlement patterns.

Residential growth has slowed in the past 20 years. Housing, a key element of the town's character, will have a large influence on the rate and direction of economic growth.

Figure 1: Total Housing Units, 1940–2017



Source: Mean average of data from East Central Vermont Economic Development District, Two Rivers-Ottauquechee Regional Commission, Green Mountain Economic Development Corporation, HousingData.org, and American Community Survey 5 year estimates.

Although the provision and maintenance of a town's housing stock is primarily a private sector activity, the growth and development of housing affects the local environment as well as the demand for town facilities and services. Housing constructed in the absence of adequate public planning can overburden schools, roads, and other municipal services. Poorly located housing can also: overburden the soils important to safe sewage disposal; pollute water supplies, destroy important wildlife habitat; and be washed away in floods.

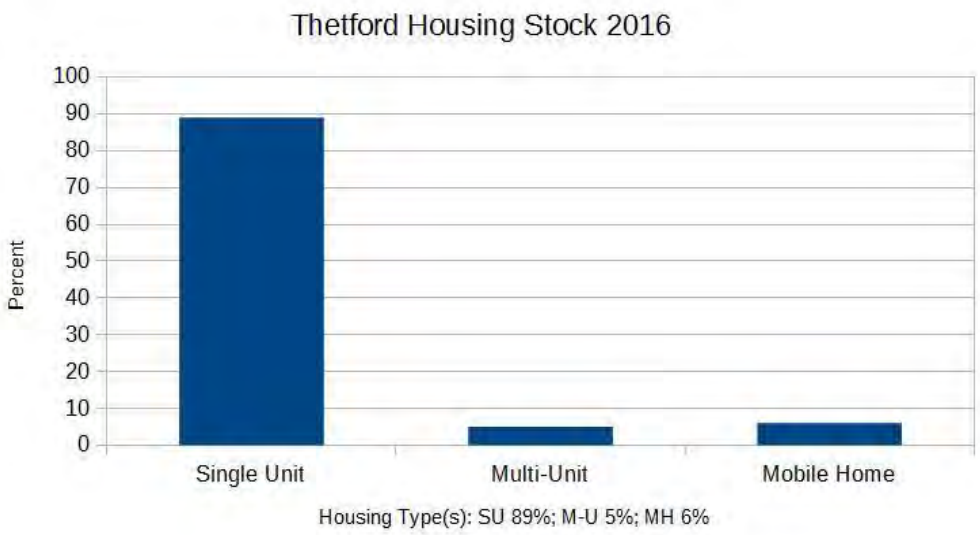
Housing that is inadequate to meet the demand of one town can strain adjacent towns and prevent people from living close to their jobs.

HOUSING PROFILE

There were 1238 housing units in Thetford in 2010, up from the 2000 total of 1164 (see Figure 1). This amounted to an increase of 74 units, or 6% over the ten-year period. Between 2010 and 2017, there was an additional increase of 81 units, or 6.5%, to 1319.

In a separate dataset from the US Census, the definition of a housing unit includes houses, apartments, mobile homes, and rooms for occupancy. The bulk of Thetford's housing units are single-family homes, similar to other Orange County towns of the same size. Thetford also has an average proportion of mobile homes (6%), which are dispersed throughout the town.

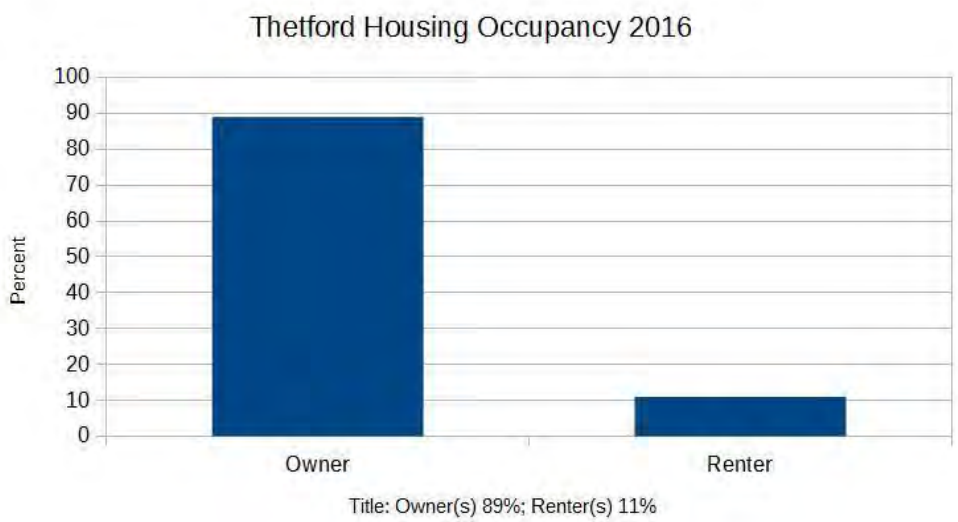
Figure 2: Thetford Housing Stock, 2016



Source: US Census (2017/18 breakdowns not available.)

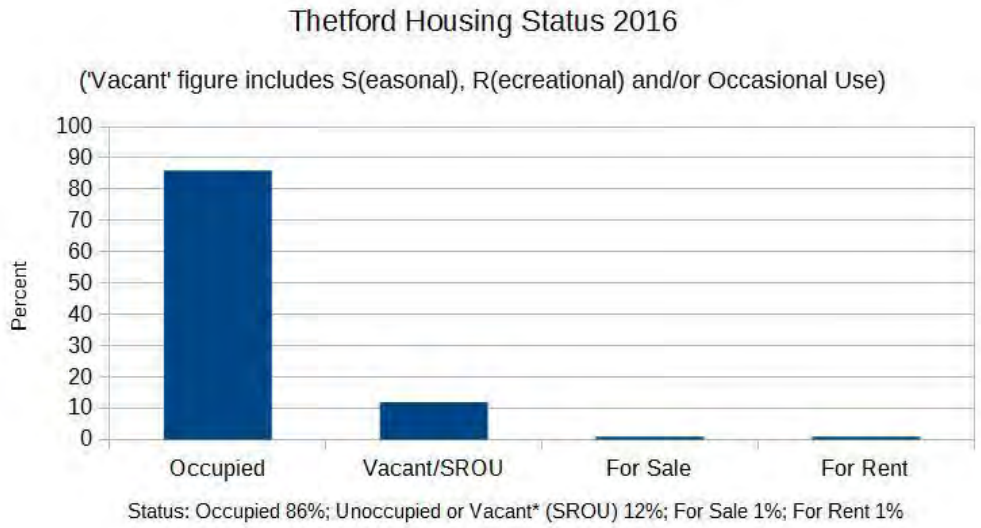
The majority of Thetford's homes are owner-occupied with 28% either being rented or used for seasonal, recreational, or second home use. The percentage of second homes in Thetford (11%) is low compared to the neighboring towns of Fairlee (25%) and Strafford (19%), as well as Orange County in general (14.5%). Only Norwich has a smaller percentage of second homes (5.3%).

Figure 3: Thetford Housing Occupancy, 2016



Source: US Census (2017/18 breakdown not available)

Figure 4: Thetford Housing, 2016



Source: US Census (2017/18 breakdown not available)

The US Census shows that in 2010 a low percentage of homes were unoccupied (for sale or for rent). This indicates that Thetford was experiencing a shortage of available housing stock.

AFFORDABLE HOUSING

Since 2000, housing prices have increased statewide. Thetford experienced a 38% price increase between 2000 and 2010, followed by a lesser decrease of 8.9% between 2010 and 2017.

Figure 5: Price of Residential Houses in Thetford and Surrounding Area, 2000, 2010, 2017

Town	Lot Size (Acres)	2000 No. Sold	2000 Avg. Price	2010 No. Sold	2010 Avg. Price	2017 No. Sold	2017 Avg. Price
Thetford	Under 6	36	$152,363	20	$227,950	41	$208,380
	6 or More	8	$253,750	9	$285,712	11	$256,125
Norwich	Under 6	57	$213,886	23	$392,163	49	$435,495
	6 or More	11	$443,818	17	$645,328	16	$663,788
Strafford	Under 6	8	$182,625	5	$300,840	12	$198,321
	6 or More	5	$119,320	6	$282,086	16	$315,563
Fairlee	Under 6	16	$137,804	8	$205,750	13	$180,808
	6 or More	0		3	$126,333	2	$244,500

Source: VT Dept. of Taxes. Data do not include mobile home sales.

"Affordable housing" is defined as costing less than 30% of the county median household income. For a homeowner, housing costs include payments for mortgage principal and interest, taxes, utilities, and upkeep. For renters, housing costs include rent and utilities.

In its annual publication *Between a Rock and A Hard Place: Housing and Wages in Vermont*, the Vermont Housing Finance Agency notes that the median purchase price of a primary home in Vermont in 2010 reached $195,000[6], $35,000 less than in Thetford that year. A household would need an annual income of $58,000 as well as $16,000 in cash (for closing costs and a 5% down payment) to purchase a home at that price. The Vermont median household income (2009-2013 average) was $54,267.[7] In 2018, the Orange County median household income was $59,995; in Thetford, it was $67,800, reflecting our housing costs. Housing data shows that 29% of owners' and 50% of renters' households are cost burdened[8], suggesting a shortfall of roughly 2-300 affordable owner housing units.

Another barrier to affordable housing is the age of homes in Thetford. *Between a Rock and A Hard Place* points out that, "Vermont's housing stock is among the oldest in the United States. 63% of owned houses and 74% of rentals in Vermont were built in 1979 or

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[6] Vermont Housing Finance Agency (VHFA), *Between a Rock and a Hard Place: Housing and Wages in Vermont, 2011 Update* (April 2011). http://www.vhcb.org/pdfs/housing-wages-2011.pdf

[7] US Census Bureau, QuickFacts Beta website, http://www.census.gov/quickfacts/table/PST045214/00 (Accessed July 17, 2015.)

[8] US Census Bureau, American Community Survey https://www.housingdata.org/profile/housing-needs/cost-burdened-households

earlier, before newer energy efficiency technology was available, housing codes were more lax and the use of lead-based paint was wide-spread. These factors make an important impact on the cost of operating housing, assuring the health and safety of all residents, and providing access to Vermonters with different abilities."

It is important for the community to maintain diverse types of housing stock to ensure that housing in Thetford does not become entirely unaffordable. A reasonable mix of single family, multi-family, and rental units is necessary to provide housing options for residents with varying income levels. Accessory apartments, mobile homes, and manufactured homes can all provide affordable housing opportunities.

RENTAL HOUSING

Only 18% of Thetford's 2010 housing stock was rentals. As noted in Figure 4, Thetford's 2010 rental vacancy rate was only 1%, which is consistent with the rest of the State and, according to *Between a Rock and A Hard Place*, the lowest in the nation.

The tight housing market and lack of unoccupied apartments continues to drive up rental costs. In 2000 the US Agency of Housing and Urban Development (HUD) calculated the fair market rent for a modest two-bedroom apartment in Thetford at $564 per month. In 2013, that cost had risen 67% to $940. Based on HUD guidelines that define "affordable" housing as less than 30% of household income, a renter in Thetford would have to make at least $37,600 annually. A HUD survey of 177 of the 200 rental units in Thetford found that 61% had rents at or above 30% of the renters' income, while 23% had rents 50% or more of the renters' income. Thetford renters are currently paying 36.8% of their income towards housing at a median gross rent of $952 per month. Given these figures, at least 100 more affordable rentals are needed.

ELDER HOUSING

Seniors (people aged 65 and older) often want to remain in their homes. Accessibility modifications such as hand rails, grab bars, better lighting, and other minor changes can often provide years of living independently, but seniors may eventually turn to elder housing, including nursing homes or residential care facilities, as they become less comfortable with managing their own homes. As indicated in Figure 6, there are no options in Thetford and limited options in the surrounding area for this type of care. Thetford elders in need of full-time care are typically forced to move away from their community. This is not just a local issue - there is limited elder housing throughout the State of Vermont.

Figure 6: Vermont Area Nursing and Residential Care Facilities, 2011

Facility/Location	Nursing Facilities (# beds)	Memory Care Facilities (# beds)	Assisted Living Residences (# beds)
Bradford	0	19	20
Thetford	0	0	0
Windsor	39	12	72

Source: VT Dept. of Disabilities, Aging and Independent Living

The nearest Vermont options for residential elder care in the Upper Valley are Mertens House in Woodstock and Mt. Ascutney Health Center. Davis Home and Runnemede, located in Windsor, have 15 and 39 residential care beds, respectively. Cedar Hill, also in Windsor, is unique in that it provides a mix of 39 nursing home beds, 12 residential care beds, and 22 assisted living beds. Orange County has a total of 20 licensed nursing facility beds.

The Vermont Housing Finance Agency, in its issue paper "Housing and the Needs of Vermont's Aging Population," acknowledges that more seniors today want to "age in place," choosing to remain at home or in a supportive living community. Considering the lack of nursing homes in Thetford, and Vermont as a whole, aging in place may be the best way to address the need for elder housing in the future. The high cost of housing in Thetford may make this unaffordable for many residents. One solution is the addition to an existing building of an 'accessory unit' or apartment that can house an elderly relative and allow them to receive cost-effective care and supervision from family or a caregiver.

COLLABORATION

Small towns like Thetford have found it difficult to attract funding for senior and affordable housing projects of a size appropriate to the town's population. Developers find it uneconomical to build a project having so few housing units. Lately, neighboring towns have begun to collaborate on senior, affordable, and workforce housing projects. Even though the development is divided between two or more separate lots in two or more towns, the total project may become economically feasible. Thetford's Senior and Affordable Housing Committee has been exploring such a collaboration.

GOALS, POLICIES, AND RECOMMENDATIONS

Goals

1. Safe, adequate, and energy-efficient housing for all ages.

2. Senior, affordable, and workforce housing is welcome in town.
3. Housing compliments agricultural and other natural resource-based occupations.

Policies

1. It is the policy of the Town to encourage a mix of housing density and housing types, from mansions to manufactured housing, in or adjacent to locations that are already developed.
2. It is the policy of the Town to keep housing affordable by planning for appropriately sized lots, accessory apartments, multi-family dwellings, workforce housing, manufactured housing and clustered developments in locations consistent with the desire to maintain the town's village character and rural qualities.
3. It is the policy of the Town to work with businesses and non-profit housing corporations to help Thetford better meet the demand for affordable housing.
4. It is the policy of the Town to record evidence of compliance with Vermont Energy Codes for all housing and building construction.
5. It is the policy of the Town to encourage the building and use of accessory dwelling units, to provide affordable housing or a situation of care and supervision to the disabled or elderly.

Recommendations

1. The Planning Commission shall update the Zoning Bylaws to further accommodate the development of senior, affordable, and workforce housing.
2. The Planning Commission shall update the Zoning Bylaws to further accommodate increased housing and rental density in existing structures or development footprints.
3. The Planning Commission shall update the Zoning Bylaws to require increased energy efficiency and conservation, and restrict greenhouse gas emissions and fossil fuel infrastructure.
4. The Town should collaborate with neighboring Towns to fund and develop senior, affordable, and workforce housing.

CHAPTER II: EDUCATION

Secondary schools were historically less common in Vermont than primary schools, but Thetford's earliest colonial settlers had an appreciation for education. Thetford Academy was founded early in the town's history and is both Vermont's oldest continuously operating secondary school and the state's first co-educational academy.[9]

EARLY CHILDHOOD

Childcare needs have changed significantly since Colonial times. This change was recognized from a legislative perspective whenin 2003 the Vermont Legislature added a thirteenth goal to the *Municipal and Regional Planning and Development Act*: "To ensure the availability of safe and affordable child care and to integrate child care issues into the planning process, including child care financing, infrastructure, business assistance for child care providers, and development." (24 V.S.A. § 4302(c)(13)).[10]

The State of Vermont has two classifications of regulated child care: Registered Family Child Care Home(s) and Licensed Program(s). A list of these providers is available at Vermont's Department for Children & Families childcare information system (Bright Futures).

Registered Family Child Care Home: a childcare program approved only in the provider's residence, limited to a small number of children based on specific criteria.

Licensed Program: a childcare program providing care to children in any approved location. The number and ages of children served are based on available approved space and staffing qualifications, as well as play and learning equipment. A Licensed Program must be inspected by the Vermont Division of Fire Safety's Fire Safety Inspectors, and must obtain a Water and Wastewater Disposal Permit from the Agency of Environmental Conservation. A Licensed Program is considered a public building under Vermont Law. Licensed Programs include: early childhood programs, school-age care, family homes, and non-recurring care programs.

Thetford has more childcare options than any of its neighbors.

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[9] Thetford Academy website. http://www.thetfordacademy.org/about/

[10] All Vermont statues referenced in this Town Plan use this style of notation: Title number, Vermont Statute Annotated (V.S.A.), section (§) or chapter (Ch.) number. See Vermont Statutes Online, http://legislature.vermont.gov/statutes/

Figure 7: Child Care Facilities Thetford and Surrounding Towns, 2015

Town	Registered	Licensed
Fairlee	1	2
Norwich	0	5
Sharon	0	2
Strafford	0	1
Thetford	2	6
West Fairlee	1	2

Source: VT Bright Futures Child Care Information System[11]

Pre-school education overall is changing: Act 166 requires school districts to provide access to at least ten hours of instruction per week for 35 weeks to any preschool aged child (three- to five-year-olds not yet enrolled in kindergarten) in Vermont. This rule became effective in 2016.

CHILDREN IN K-12

Most school age students who live in Thetford attend either Thetford Elementary School (TES; grades K-6) or Thetford Academy (TA; grades 7-12). There is also a small independent K-6 school, Open Fields School, that accepts tuition-paying day students from Thetford and surrounding towns.

Governance

Public education is the responsibility of Thetford's citizens, organized as the Thetford School District. Voters use Australian ballot to approve the School Budget and to elect a five-member Board of Directors (the School Board) with responsibility for the education of all students from kindergarten through grade 12.

Thetford maintains its own elementary school and a town vote designated Thetford Academy, a private institution, as its sole public high school.

Thetford Elementary School

Thetford Elementary School is a public school serving students in grades K-6. Anecdotally, Thetford Elementary School has a good reputation based on experienced teachers, strong special education offerings, and small class size.

[11] http://www.brightfutures.dcf.state.vt.us (Accessed July 21, 2015.)

The most recent major renovation project was completed in 2003 and included a new gymnasium, multi-purpose room, kitchen, music room, classroom, and nursing office. No major physical changes are planned at the school.

As with most schools in the Upper Valley, Thetford Elementary School has seen a decline in enrollment, dropping from 262 children enrolled in 2001 to 201 students in 2017. Between 2010 and 2017, enrollment stayed within a relatively constant range of 200.

Thetford Academy

Thetford Academy serves day students in grades 7-12. Originally granted state approval in 1907 as a "private school with a public purpose," Thetford Academy states that it continues to shape its purposes and curriculum to meet local needs. It is currently the only Approved Independent School that also meets standards for Public School Approval in Vermont. The Academy also has full accreditation through the Independent Schools Commission of the New England Association of Schools and Colleges.

Thetford Academy is sited on 295 acres on Thetford Hill. The campus includes three primary buildings: the White Building, the science building, and the state-of-the-art Anderson/Vaughn Gym, which houses the Martha Jane Rich Theater. There are a few accessory buildings and one portable classroom.

Enrollment dropped from 385 in 1999 to 318 in 2018. The Academy has been exploring strategies to increase enrollment. No major work is contemplated for the campus.

Other Schooling

Thetford hosts a small private school, Open Fields School, located on Academy Road. A small percentage of Thetford students are home-schooled.

Continuing Education

Thetford residents have a number of local options for continuing education, including the Community College of Vermont, and The River Bend Career & Technical Center, Dartmouth College, and the Osher Institute for Life Long Learning. Vermont Technical College, located in Randolph, provides opportunities for vocational training.

GOALS, POLICIES, AND RECOMMENDATIONS

Goals

1. Affordable childcare services and facilities that meet or exceed minimum state standards.

2. Ever-improving education for all people, including vocational education.

Policies

1. It is the policy of the Town to support the development of additional or improved facilities to meet the childcare needs of residents.
2. It is the policy of the Town to integrate child care issues into the planning process, including child care financing, infrastructure, business assistance for child care providers, and child care work force development.
3. It is the policy of the Town to ensure educational and vocational training so that all Thetford residents can achieve their full potential.

Recommendations

1. The Town should work with the Regional Planning Commission to conduct a childcare needs assessment.
2. The Town should continue to cooperate and share recreation and meeting room facilities in the schools to maximize public benefits and minimize costs.
3. The Town should work with the schools to ensure that any large capital costs are planned for well ahead so as to minimize drastic tax changes.

CHAPTER III: ECONOMIC DEVELOPMENT

Thetford hopes to achieve a sustainable local economy in harmony with its rural and historic character and its natural resources. While Thetford has never been a regional economic center, there may be viable opportunities for economic growth within the town. For example, the successful expansion of highspeed internet access and the rising demand for locally grown food may broaden economic activity.

Data from the Vermont Department of Labor and Industry indicate that the number of establishments (employers) in Thetford has remained relatively flat for over a decade.

Figure 8: Thetford Labor Force Statistics

Year	Total Labor Force	Employment	Unemployment	Unemployment Rate (%)
2004	1750	1710	30	1.9
2005	1760	1730	30	1.6
2006	1840	1810	30	1.6
2007	1820	1790	40	1.9
2008	1860	1810	40	2.4
2009	1900	1840	70	3.4
2010	1680	1630	50	3.0
2011	1680	1620	60	3.3
2012	1670	1620	50	3.1
2013	1630	1590	40	2.6
2014	1620	1580	40	2.3

Source: US Bureau of Labor Statistics

Figure 9: Thetford Business Establishments

Year	Number of Establishments	Percentage Change from Previous Year
2017	105	6.1
2016	99	7.6
2015	92	5.7
2014	87	1.2
2013	86	-1.1
2012	87	3.6
2011	84	-2.3
2010	86	-6.5
2009	92	2.2
2008	90	4.7

Year	Number of Establishments	Percentage Change from Previous Year
2007	86	6.2

Note: Includes only those businesses covered by unemployment insurance. Source: US Bureau of Labor Statistics

The local economy consists of several elements - activities that occur within the town and regional economic activities in which the town's residents are involved.

VILLAGES

Currently, each of the five historic villages in Thetford is served by a Post Office (East Thetford, Post Mills, Thetford Center, Thetford Hill, and North Thetford). Only three villages, East Thetford, Post Mills, and Thetford Center have commercial operations open to the public. Sustainable development (defined as development that meets the needs of the present without compromising the ability of future generations to meet their needs), would be promoted by the revitalization of our villages through the State of Vermont's Village Center Designation Program with the Vermont Agency of Commerce and Economic Development.

Vermont law defines a Village Center as "the core of a traditional settlement, typically comprising a cohesive mix of residential, civic, religious, commercial, and mixed use buildings, arranged along a main street and intersecting streets that are within walking distance for residents who live within and surrounding the core." (24 V.S.A. §2793a).

Once enrolled in the Village Center Designation program, these areas would receive priority consideration for state grants, training and technical assistance. Commercial property owners would be eligible for tax credits to support building improvements. Village Center Designation will encourage sustainable economic development through incentives to redevelop historic buildings and by concentrating commercial activity to minimize impact on agricultural land and sensitive natural areas.

LOCAL ECONOMY

As of 2020 there are 92 businesses. Numbers by category are: Agriculture/Farm 6; Auto repair 4; Banking 2; Building trades 11; Camps 5; Childcare 6; Education/school 2; Excavation 5; Fitness/exercise 4; Food/beverage 4; Hair/beauty 2; Health/mental health (includes dentist, therapy) 7; Various sole proprietor home based 11; Property maintenance 10; Manufacturing 1; and Miscellaneous 12.

Prominent enterprises include: Pompanoosuc Mills furniture manufacturer, Watson's Automotive, E.C. Brown's Nursery, Northwoods Excavating, and the Post Mills airport.

There are four stores: Baker's in Post Mills, the Village Store in Thetford Center, and Wing's Market and Hugget's in East Thetford. There are three well known vegetable farms, Crossroad Farm in Post Mills, and Cedar Circle Farm and Long Wind Farm in East Thetford. Vaughan Farms may be the only remaining sizable dairy operation. There are also many sole proprietor operations like architects, software designers and therapists.

The challenge faced by Thetford is creating a conducive environment for local economic development while protecting the town's historic, scenic, and natural character. Focusing development in village centers is a top priority, as are relaxed regulations for home-based businesses and considering flexibility in village minimum lot size.

The lack of municipal sewer and water, and of a pressurized hydrant system, in village centers discourage further economic development, and should be addressed. These high cost, but high priority (e.g., fire protection) objectives should be part of any discussion of our local economy. In other parts of Vermont, a grant to the DEC (Department of Environmental Conservation) from federal funds to the area's Regional Commission, plus a grant from the DEC itself, helped to identify cost-effective wastewater solutions for villages. Thetford should investigate whether such opportunities are available in this area of the state.

In addition to encouraging business growth in village centers, the Town should use the next eight years to explore the availability and appropriateness of additional parcels of land to accommodate economic growth. There are many caveats, including protecting surface waters, the desire to preserve scenic views, agricultural land, and the intent to join in regional initiatives to perpetuate forest blocks and wildlife corridors. Nonetheless, if economic development is desired, and if Thetford wants to increase its commercial activity and employment opportunities within the town, the Town should investigate new locations that could be available for economic expansion.

Rezoning, or flexible zoning could allow appropriately scaled, clean, light industries and businesses of a non-retail nature to emerge, for instance in Rural Residential areas. Some types of business, for instance a food processing facility, could use significant amounts of water and generate an equivalent volume of wastewater. Presently these would need to be provided for on-site and would require careful evaluation of their impacts. However, developing these types of enterprise would provide employment that could allow currently low-income workers to advance economically, especially if apprenticeship training were available.

REGIONAL ECONOMY

Thetford has direct access to Interstate 91, Route 113, Route 244, Route 132, and Route 5, which connect the town to its neighbors and the broader region. Thetford is an attractive bedroom community and a significant number of residents are employed at Dartmouth College, the Dartmouth-Hitchcock and VA Medical Centers and technology-based, retail, and service businesses in the Hanover-Lebanon area. The contribution of these generally well-paid "commuter jobs" to Thetford's economy is important and deserves recognition.

Thetford is part of the Upper Valley Chamber of Commerce.

The Dartmouth Entrepreneurial Network is a regional resource for innovative and local business support.

THE FUTURE ECONOMY

The successful build-out of EC Fiber's fiber optic network in Thetford provides access to fast and efficient data technology that is likely to contribute increasingly to our national and regional economy. In particular the ability to work, hold meetings, and teach remotely makes Thetford a viable and attractive place for 'telecommuters' who may hold well-paying jobs based elsewhere.

Likewise, home-based businesses that are driven by information technology represent a low impact way to generate valuable economic activity. Home-based businesses reduce energy consumption by reducing travel, and also lessen the wear and tear on town roads and traffic congestion.

Such occupations usually benefit from higher education, as do many of the "commuter jobs" mentioned above. Regionally there is a shortage of educated workers in health care / social assistance, manufacturing, and scientific / technical services. People employed in these areas (such as at nearby academic and medical centers, high-tech and manufacturing operations in the Hanover/Lebanon region) are likely more able to afford homes in Thetford and contribute to the tax base. Thus it would seem prudent to prepare future generations of workers by cultivating an interest in science and technology with appropriate schooling. Encouraging training in these fields is a long term approach that may benefit Thetford's economy. Another area that should not be overlooked is vocational training. Plumbers, electricians, mechanics, welders and builders (to mention just some) will continue to be essential economic contributors.

There is also potential for increasing economic activity in town. The development pattern of Thetford has not resulted in readily defined areas of high unemployment or low income that would suggest specific places to be targeted for economic improvement. Every village could benefit from economic growth. Agricultural processing operations should be a priority for development within Thetford. This could increase farmers' income, conserve transportation energy, and increase the availability of local agricultural products. Such operations could create local jobs in three ways: increasing on-farm opportunities as demand for agricultural products rises, enabling food related businesses to grow, and providing employment at the facility itself. Job opportunities for the unemployed or those in low-income situations could be increased.

Tourism and related services are a key component of Vermont's economy, and will continue to play an important role in Thetford's future as people travel for recreation, sight-seeing, weddings, and relaxing, rural vacation.

Importantly, a mainstay of our future economy will continue to be the many contractors and businesses that provide services related to home and property care, auto maintenance and construction. Agricultural and forestry workers are also essential, as are those who fabricate value-added products from wood, metal and other raw materials - from boards to wood pellets to fine furniture to welding. These people provide some of the critical expertise needed to sustain our community, both in good times and in states of emergency. In addition, many, while working in town, shop at local stores.

Local stores, fabricators and farms will likely increase in importance in Thetford's future, as people look towards local solutions to growingly complex global problems.

GOALS, POLICIES, AND RECOMMENDATIONS

Goals

1. Strong historic identity and economic vitality of Thetford and its villages.
2. A robust and diverse local economy that provides satisfying and rewarding employment opportunities for residents while maintaining the community's rural character.
3. A suitably-educated workforce.
4. A sustainable economy that supports land use that helps create sustainable local jobs that pay a living wage.
5. Businesses that do not endanger natural resources.

6. An expanded commercial tax base without sprawl and strip development.
7. Municipal water and sewer systems that serve core areas.

Policies

1. It is the policy of the Town to encourage diverse and sustainable businesses that create jobs and contribute to the year-round, local mixed-use economy and village life.
2. It is the policy of the Town to encourage home-based and small businesses with appropriate safeguards to limit any off-site impacts.
3. It is the policy of the Town to encourage agricultural operations that foster growth of local food sources.
4. It is the policy of the Town to review industrial and commercial uses with careful attention to their environmental and visual impacts.
5. It is the policy of the Town to retain open space in sparsely populated areas. The clustering of any business development shall be encouraged.
6. It is the policy of the Town to encourage farm- and forest-based businesses that build on our natural strengths.

Recommendations

1. The Town should focus on the revitalization of its villages through the State of Vermont's Village Center Designation Program with the Vermont Agency of Commerce and Economic Development, and apply for Village Designation for East Thetford, North Thetford, Post Mills, Thetford Center, and Thetford Hill.
2. The Planning Commission should explore expanding the Community Business District in East Thetford, and adding additional such districts in other villages.
3. The Planning Commission should consider updating the Zoning Bylaws to encourage commercial development, such as food processing facilities, within existing development footprints that may be outside of commercial and village centers.
4. The Town should work towards public water and sewer infrastructure in the village areas.

5. The Town shall preserve its historic character and economic vitality while using all available tools to increase energy efficiency and conservation, and restrict greenhouse gas emissions and fossil fuel infrastructure.
6. The Town should request an update to the signage preceding the north-bound and south-bound I-91 exits to Thetford alerting travelers to services (food, gas, etc.).
7. Schools should be encouraged to promote an interest in science and technology.

CHAPTER IV: FACILITIES, SERVICES, AND UTILITIES

Community facilities are physical assets such as the Town Hall and town roads. Community services include health, safety, recreation, and other programs that serve the town's residents. They are generally administered by a town department or nonprofit organization, but may include private operations. Community utilities may combine both facilities and services through an organization that delivers a commodity such as water.

The extent and adequacy of community facilities, services, and utilities, whether publicly or privately operated, play an important role by contributing to the general welfare of residents and the quality of life in town, and by attracting development. The layout and location of facilities also influences the pattern of growth.

It should be noted that the primary concern in this Town Plan is with physical facilities and not with operating programs. To plan for future needs, it is necessary to inventory existing facilities, examine their needs, and project future costs for upkeep. Existing facilities may become inadequate through structural deterioration or functional obsolescence as well as through increased or new demands that accompany population growth and changes in lifestyles.

TOWN AND COMMUNITY FACILITIES

Town Hall

The red brick Thetford Town Hall is located on Route 113 in Thetford Center. Built in 1830, it is listed on the National Register of Historic Places. It was renovated in the 1960s to add offices for the Town Clerk, Town Treasurer, Listers, Zoning Administration, Selectboard, Records Vault, and eventually the Police Department. In 2003 a major renovation was funded by a bond vote to restore the original meeting hall and adjacent red brick Wallace Vault. A wood frame addition was built to connect both brick buildings and provide additional office and storage space, doubling the size of the original facility. The meeting hall is used frequently for public meetings and community activities.

Thetford's Town Hall is now centrally wired for voice and data communications, providing computerized functions for all Town offices and for public access. The offices, meeting hall, and restrooms are handicapped accessible, and the building is fine for the foreseeable future in terms of major systems. The gravel parking lot has space for about 20 cars, which may prove inadequate as needs increase. Paving the parking lot should

be a priority for the Town; an early estimate suggested that this could cost at least $20,000. This could be paid for by using any surplus in the paving fund, or by an increased future allocation to that fund.

Although the Town Hall was renovated in 2003 and has functioned well since, the Police Department has expressed a desire for additional space. Moving the Police Department to a separate facility is an expensive option, and no likely facility has been identified. Relocating the Police Department to the basement of Town Hall, which would provide more square footage than their current space, may be an affordable solution, as the basement may need only modest renovations. Exploring the feasibility of this move is a medium priority for the Town as the Police Department, while limited in space, is still operationally capable. In addition, police officers spend most of their shift outside the building.

The Town completed an energy audit of the Town Hall building in 2013. Work has slowly been undertaken to improve the efficiency of the building, such as switching over to LED lightbulbs, however a larger effort towards energy efficiency and conservation is a high priority for the facility to save energy, money, and greenhouse gas emissions. A lot of the improvements, such as window shades, would only cost a few thousand dollars, and could be done within the annual budget. Roughing out costs and benefits for more significant improvements would give us information on which to base future actions.

In 2020-21, Thetford will be taking part in a regional initiative together with five neighboring Towns to collectively fund an Intermunicipal Regional Energy Coordinator (IREC), whose overall charge is to improve energy efficiency and lower the carbon footprint of the towns, as Vermont tries to reach the goal of halving emissions by 2028. A plan for improving energy efficiency of Town Hall and identifying sources of funding is a suitable project for the IREC in concert with the Thetford Energy Committee. The hope is that the intertown effort will bear fruit and keep going into the future.

Town Garage

The Town Garage is located on a one-acre site on Route 113 in Thetford Center. The one-story wood frame structure, built in 1971, contains a total of 3,200 square feet of space. The Garage has five bays and is heated by oil. During 1990 and 1991 the road crew completed insulating the 2nd through 5th bays. Heating oil tanks are stored in one space and another is used for unheated storage. Also located on the site are a salt shed and one diesel fuel tank that holds 2,000 gallons of fuel.

The facility is undersized as it is situated on less than an acre (3-8 acres is recommended). Some large equipment has to be stored outside due to the limited number of bays. Concerns include inadequacy of storage space for equipment and materials both inside the building and on the surrounding grounds. The Town and community have consistently expressed a desire to find a new location for the Town Garage. This high priority objective is attainable only at very high cost, estimated at over one million dollars (at least). However no suitable, alternative site has been identified and no project is planned. A conceptual study that looked at possible sites and costs would help to plan for the eventual replacement of the facility.

At least one other Vermont town has applied for a Community Development Block Grant for a new town garage in this price range, but there are multiple hurdles, including financing for plans and cost estimates, and finding a site that can pass environmental review. However, relocating the Town Garage could result in the benefit of freeing up the current site for commercial or residential development in Thetford Center. The Town should investigate whether pursuing a Community Development Block Grant is a viable financing option.

In absence of grant assistance, the Town would likely need to seek a bond vote to purchase a property and cover other costs associated with designing and building a new facility.

Recycling Center

The Recycling Center is located at 4659 Route 113 in Thetford Center. Traffic problems entering and exiting the site can arise because the limited hours of operation force many people to use the facility within a small time frame. The Town has been setting aside capital reserves since 2008 to support infrastructure improvements such as purchasing a more appropriately sized piece of property, which is a priority of the Town – the current facility was always supposed to be temporary. A benefit to relocating the Recycling Center could be the redevelopment of the site into a food processing facility, or other needed development.

One possibility worth exploring is property on Thetford Hill currently owned by the Thetford School District. This more than forty-acre parcel houses Thetford Elementary School's wastewater system and solar array. It could be that a suitable location could be found here for a relocated (and permanent) recycling center. The Town could commission a study of this property for $5,000-$10,000, depending on the scope of the study.

This should be a priority for the Town as the property is already publicly owned and could more than adequately serve some of the long-term strategic needs of the Town. If this parcel proves viable, a relocated facility could be partially funded with capital reserves, grants, or a bond. It is possible that additional needs could be served, such as sand and salt or gravel storage for the Department of Public Works, or even senior, affordable, or workforce housing.

Libraries

There are five libraries in Thetford: the Elementary School and Academy libraries, the George Peabody libraries, and the co-housed Thetford Historical Society Library and Latham Memorial Library. The Thetford Library Federation, formed in the late 1960s, is a coordinated group representing all five. These libraries collectively appear to adequately serve the needs of Thetford residents.

PEABODY LIBRARY

The George Peabody Library is located on Route 113 in Post Mills. Built in 1867, this wood frame, clapboarded and gable-roofed structure is on the National Register of Historic Places. This building has no potable water, but does have an electric toilet facility and central heat. A major renovation of the library was completed in 2002 and no major work is planned.

The Peabody Library is particularly noteworthy as the oldest library building in Vermont still functioning as a public library. Its collection ranges from some of the original volumes purchased in 1867 to modern works.

BICENTENNIAL BUILDING

Built in 1975 by the Thetford Library Federation, the Bicentennial Building on Thetford Hill houses the Thetford Historical Society and Latham Memorial Library. The building was constructed through private fundraising and with the help of the first federal building grant honoring the nation's bicentennial. The building, which is heated with oil, is handicapped-accessible and includes a reading room, workroom, two vaults, and an exhibit room. The historical collection includes 2,500 volumes that do not circulate. The two collections together include over 13,000 volumes, 40 manuscript collections, a genealogical file, photographs and glass negatives, and framed portraits and paintings. Genealogical research, preschool story hour, art exhibits, an after school teen space, and programs for all ages are offered in the building. Thanks to volunteers, the library can be kept open more hours and provide a level of service beyond what two part-time librarians can provide. This building would benefit from additional energy conservation

measures and switching from fuel oil, but those changes are still in the planning phase, so no cost is known.

Cemeteries

Thetford has 14 cemeteries distributed throughout town. Of these, two cemeteries are privately owned, Thetford Center (new) and Post Mills. Along with North Thetford, these three are the only cemeteries with available space.

Responding to a request from the Evergreen Cemetery Board, the Cemetery Commission is weighing the possibility of taking over the Thetford Center (new) cemetery as a Town cemetery. The Town anticipates that older cemeteries with no management will also ask to become part of the Town system. The current needs of Thetford appear to be met, however at some future time more burial space may become necessary.

Figure 10: Cemeteries in Thetford

Cemetery	Ownership	Size
East Thetford	Town	2.75 ac
Ellis	Town	1.5 – 2 ac
Follett	Town	15' x 15'
Glebe	Town	15' x 15'
Jackman	Town	20' x 20'
Judd	Town	1.25 ac
Kinney	Town	0.5 - 0.75 ac
Knox	Town	25' x 25'
North Thetford	Town	3.5 ac
Post Mills	Private	3.8 ac
Rice's Mills	Town	1.5 ac
Sawnee Bean	Town	1.0 ac
Thetford Center (new)	Private	6.0 ac
Thetford Center (old)	Town	1.25 ac

Source: Wesley Clay, Arthur Shoppe, and Mark McMahon

Churches

Thetford has a church building in every village. While these churches are not Town-owned, they serve as social gathering places, hosting a number of activities, including public services. Among these are social services such as the WIC (Women, Infants, and Children) program and monthly senior meals hosted by the Thetford Elder Network

(TEN). Without its churches Thetford would lack sufficient public and neighborhood assembly spaces and the sense of village character would be diminished. The churches are prominent historic structures and contribute significantly to village identity.

The Thetford Baptist Church (East Thetford) was established in 1982. It was originally constructed in Cambridgeport, Vermont, in 1836 and was dismantled, moved, and reconstructed in East Thetford in 1985. The building has no known structural problems.

The First Congregational Church, United Church of Christ (Thetford Hill) was established in 1773. The first services were held in a log building on Garey Road. The church on Thetford Hill was constructed in 1787. It is notable as the oldest meetinghouse in the state still in continuous use. A daycare facility is housed in the church in addition to church-related functions, concerts and a variety of social activities.

The North Thetford church dates from 1860 with additions in 1900 and 1958. Serving a United Church of Christ and United Methodist congregation, the structure is believed to be unique, as it is thought to be the only church in North America with a gold leaf-covered pineapple at the top of the steeple. There is also a large fellowship hall with a stage and fully equipped kitchen that is available to the community.

Built in 1836, the deconsecrated Timothy Frost Methodist Church in Thetford Center was named after an early minister. The building was recently acquired by the Town, which established a committee to determine how it will be used in the future. The building lacks running water and is poorly weatherized. In 2019 when the Town accepted the building it also established a Town fund for upkeep. A concerted drive to raise funds from private sources to build up the Town fund would be an appropriate step towards addressing renovations. Finding a productive use for this prominent building is a high priority, and likely a high cost endeavor, but it contributes crucially to the village character and its use as a public space will enhance the vitality of Thetford Center.

The Post Mills Congregational Church began in 1818 and was completed in 1828. In addition to year-round residents, campers from the youth camps on Lake Fairlee attend summer church services. The Post Mills Congregational Church has a kitchen and a spacious utility room in the basement, currently used by Caring Communities Preschool.

In general, church congregations in Thetford have been diminishing and churches are struggling with the costs of maintaining these historic buildings. Rather than a shortage of church space, the Town appears to have somewhat more than the present system can comfortably support.

Public Gathering Places

Thetford's historical pattern of settlement in many small villages has left a legacy of public and institutional structures around town. These include: the Thetford Center Community Building, the Rice's Mills Community Building, and the Eclipse Grange and American Legion Hall on Thetford Hill. These structures are important architecturally, visually, and historically. Each is included in the Vermont Historic Sites and Structures Survey. The American Legion Hall and Eclipse Grange are included in the Thetford Hill National Register Historic District. The Thetford Center Community Building is included in the Thetford Center National Historic District.

The Thetford Center Community Building was built c. 1870 and served Thetford School District #8. It is now owned by the Thetford Center Community Association and is rented out for local activities (such as yoga).

Built c. 1928, the Rice's Mills Community Building was used as a schoolhouse until the construction of the Elementary School on Thetford Hill. In 1961, 12 families bought the building from the town. The community association has made substantial repairs in the past few years, including replacing the roof. This building is used for recreation, such as dancing, and frequently hosts potluck suppers.

The American Legion Hall was built in 1910 and was the last schoolhouse to serve District #10. Its use as a school was discontinued in 1945 and it was sold to the American Legion in 1952.

In general, these gathering places seem capable of absorbing additional use and amply meet community needs. These are not municipality owned, and so capital upkeep projects would not be a town cost and have not been estimated.

TOWN AND COMMUNITY SERVICES

Unlike urban areas, which frequently offer many services such as sewer and water, Thetford is rural and sparsely populated. Most households have their own well and septic systems. Beyond the educational system, primary services offered by the municipality are road maintenance, emergency services, and recycling. There are no public water or sewer systems in Thetford, however there are several private water systems operating in the community. Water and sewer needs may be adequately met for now, but likely not for future needs. As noted in the Economic Development chapter, instituting some form of public sewer and/or water supply in villages would help maintain and improve their vitality.

Water Supplies

Thetford has several private/non-profit community water systems that supply water for domestic purposes. All have wellhead protection areas that must be protected from contaminants such as fertilizer, insecticides, and herbicides.

THETFORD HILL

The Thetford Water Cooperative, Inc. provides water to 41 residences and 7 community organizations on Thetford Hill. The Cooperative draws water from two drilled wells: a 500' well drilled in 2001 and a second well approximately 700' deep drilled in 2010. Both wells are located in the Houghton Hill State Forest where the Cooperative possesses a water rights easement. The Houghton Hill land was donated by Dwight Goddard in 1931 for the purpose of providing water to the village.

Water from the wells is pumped to two 10,000-gallon tanks and is gravity fed from these reservoirs to the users, providing on average 6000 gallons of water per day. Water quality is monitored through scheduled testing set by the State of Vermont.

An annual fee is assessed for each connection to the Cooperative's water main. A source protection plan for the Cooperative's wells is on file with the State of Vermont. Wellhead protection areas are shown on the *Water & Slope* map (see Appendix).

This water supply appears to be more than adequate, the two drilled wells presently exceed the state's water requirements for the number of users.

NORTH THETFORD

The North Thetford Union Water Company serves approximately 23 households. A bedrock spring is tapped to provide water that is gravity fed. The water is chlorinated. Users are unmetered and pay an annual fee.

The North Thetford Water Company split into two water companies in 1995—the North Village Water Company and the South Village Water Company. There are 11-12 connections for each water company. The water supplies appear to be adequate.

EAST THETFORD

The East Thetford Water Company was formed in 1989 when the source for the original water system serving the village of East Thetford was contaminated by road salt, and individual wells north of Route 113 were contaminated probably by the salt piles at the State's highway garage. The State drilled the new well and turned it over to the water company. In 2019, a new well was drilled by the water company on land leased from the Vaughan Farms. While it is not yet on line it is expected to produce 25.5 GPM (gallons

per minute.) The water will be chlorinated and treated for iron and manganese. The well serving the current system produces 5 GPM and supports 35 connections, including homes and apartments in East Thetford village, East Thetford businesses and a few locations outside the village boundaries. The existing 5 GPM well and its reservoir appear to adequately serve these current domestic water uses. The new, 700 ft deep, well and its reservoir, currently set to deliver 25.5 GPM but capable of more, would be able to support new business and residential development in East Thetford, thus making this planned growth area more attractive to development.

It should be noted that this does not include fire protection. None of the water systems in Thetford have enough reservoir capacity to provide the quantity of water necessary to fight even a single-residence fire (60,000 gallons minimum for a dry hydrant according to NFPA 1142.). A dry hydrant was installed at Childs Pond to provide emergency water to the Pompanoosuc Mills furniture manufacturing facility in East Thetford. Pumping water from the nearby Connecticut River may be another, stop-gap emergency solution.

POST MILLS

A shared well was drilled to supply nine residences after their wells were contaminated by the former landfill in Post Mills. The system was installed by the Vermont Agency of Natural Resources using funds collected through a legal action against the Upper Valley Regional Landfill Corporation. This private water system has been built to public water supply standards and has a designated protection area. The wellhead protection area is located within a 104-acre conserved parcel abutting the landfill parcel, which is owned by the Town of Thetford. The system is owned and run by the Post Mills Water Association and is currently sized only for those nine residences.

Water quality will remain an ongoing question in Post Mills as the impacts of the former Post Mills landfill are monitored over time.

Sanitary Sewer

In Thetford all sewage, whether domestic, institutional, or industrial, is disposed of by on-site systems. The creation of building lots hinges, to a large extent, on the land's capacity to handle sewage. As of July 1, 2007, statewide Town septic regulations were superseded by new state rules that established uniform design and technical standards for potable water supplies and wastewater systems statewide. These rules have allowed more lenient site requirements than did the old Thetford rules, which has increased the amount of land in Thetford where septic systems may be permitted. At present there are

no areas with sufficient density of housing to warrant the construction of a sewage treatment plant.

Septage

Approximately 125,000 gallons of septage are pumped from septic tanks annually in Thetford. Land application of septage is a common disposal method. Both the nutrient and water content of septage can benefit the land on which it is spread, however there are risks of surface and groundwater contamination. Careful site selection and responsible site management can substantially reduce these risks.

The Town has no control over the ultimate disposal location of septage It is the responsibility of the Town Health Officer to respond to complaints about failed septic systems.

Each year the Town of Thetford signs a non-binding contract with the Town of Hanover for the option to dispose of septage from Thetford. Historically very little septage from Thetford has been disposed of at the Hanover Wastewater Treatment Facility, but the contract ensures that the option remains open. The septage facilities at the Hanover Wastewater Treatment Facility co-mingle the septage with the treatment plant sludge for disposal at the Lebanon Landfill.

At present, on-site treatment of septage seems to meet the Town's needs. However, research on treating higher volumes of septage in the future, not necessarily with a very costly centralized sewer but via technologically innovative, multi-user systems, should be considered a priority, in order to encourage local economic and housing development. As a starting point, the VT DEC provides a guide to the planning process for organizing village wastewater solutions. Village wastewater treatment would be particularly important in stimulating development in these areas of planned growth.

Solid Waste

A number of companies offer residential curbside trash pickup. Many Thetford residents use this service. Other residents dispose of waste at Thetford's Recycling Center. Thetford's mixed waste goes to the Lebanon Landfill in Lebanon, NH.

Thetford is a member of the Greater Upper Valley Solid Waste Management District. The district arranges special pick-up events for hazardous waste, tires, books, electronics, textiles, and scrap metal and assists with planning for solid waste management.

In 2012, the Vermont Legislature passed Act 148[12], a universal recycling and composting law to encourage the development of infrastructure that would enable everyone in Vermont to keep reusable resources out of the landfill and make progress in energy and resource conservation.

Thetford's present solutions for solid waste disposal appear adequate.

Police Protection

The Thetford Police Department currently consists of a Police Chief and two full-time officers, and funding was approved at the 2013 Town Meeting for a part-time administrative assistant. Dispatching services are provided through Vermont State Dispatch. The town also relies upon the Vermont State Police and the Orange County Sheriff's Department in Chelsea, as well as police in neighboring communities, for police protection and response to emergency situations. At three full-time positions, Thetford's police coverage is ample. As noted above, the department's physical space might be expanded.

Fire and Emergency Protection

The Thetford Volunteer Fire Department, Inc. (TVFD) is a 501-c3 nonprofit organization that provides fire, rescue, and emergency medical services to the town. TVFD is an active member of the regional mutual aid system.

The lack of an adequate water supply is a major hindrance to effective fire protection in several areas of town. The Fire Insurance Underwriter's Bureau, an agency that establishes the level of rate coverage for community fire insurance, places a 60 percent emphasis upon water supply and a 40 percent emphasis on available equipment. For residential properties, the Bureau requires a water flow of 500 gallons per minute for a two-hour duration and somewhat greater volume and duration for commercial, industrial, and agricultural properties.

The majority of properties in Thetford are within 3,000 feet of an existing water supply, however many supplies are inadequate in summer, inaccessible in winter, or do not have access via a dry hydrant. The Fire Insurance Underwriter's Bureau recently revised

[12] VT ANR, Vermont's Universal Recycling Law. http://dec.vermont.gov/waste-management/solid/universal-recycling

Thetford's Public Protection Classification (PPC) upward, from 9 to 8b. The PPC uses a scale from 1 to 10, with 1 being the best and 10 being the worst rating.[13]

The feasibility of developing an improved system of water supply, via underground water mains, has been investigated, however the expense associated with providing such service to six widely separated villages proved to be too great. At the present time, Thetford is the only town on the west bank of the Connecticut River between Wells River and Hartford that does not provide underground water mains for fire protection in at least part of town. As a partial remedy to this situation, the town voted at Town Meeting in 1992 to begin raising funds for the Fire Department to install dry hydrants in existing ponds at key locations around town. This plan has been successful. The town now has close to twenty dry hydrants.

There appears to be room for improvement in the provision of fire protection. Risk avoidance is important, thus, the building of structures requiring fire protection in remote areas of town creates additional risk and is not encouraged.

Increasing public safety and promoting economic development are both priorities in Thetford. Toward these ends, installing a municipal water supply in East Thetford and other village centers that are planned as areas of economic and residential growth, is a high priority, albeit with a presumably very high cost (in the millions). A first approach to this proposition would be to investigate the VT DEC's Engineering Planning Advance Program that is applicable to municipalities for obtaining feasibility studies for community water solutions. Repayment for such a study does not start unless the proposed project goes to construction. The Village Wastewater Solutions initiative also assists communities in finding drinking water and wastewater solutions to stimulate opportunities and reinvestment in Vermont's small towns.

Emergency Medical Services

THETFORD FAST SQUAD

Emergency medical calls are answered initially by the Thetford FAST (First Aid Stabilization Team) Squad, which is a part of the Thetford Volunteer Fire Department. The purpose of the FAST Squad is to provide immediate response to emergencies while

[13] For information on the rating system see: https://www.isomitigation.com/ppc/iso-s-public-protection-classification-ppc-program.html

an ambulance from Upper Valley Ambulance is en route. Currently the FAST Squad appears to satisfy Thetford's first responder needs.

UPPER VALLEY AMBULANCE

Located in Fairlee, VT, the Upper Valley Ambulance, Inc. (UVA) is a not-for-profit emergency ambulance and rescue service composed of paid full-time staff. UVA covers an area consisting of nine towns in Vermont, including Thetford, and several towns in New Hampshire. In addition to emergency services, UVA offers non-emergency services including transportation to hospitals, nursing homes, and other residences as well as training in CPR (cardiopulmonary resuscitation) and first aid.

Emergency Planning in Thetford

The Town maintains an Emergency Management Director. This individual coordinates local and regional emergency services to ensure that the town is prepared in the event of an emergency.

Thetford Elementary School has been designated the Town's emergency shelter.

Health Care Facilities

Thetford is home to a pediatric practice, a dental practice and a homeopathic and acupuncture center. Community Nurse of Thetford, Inc., a small non-profit organization, employs a part-time nurse to assist Thetford residents of any age with care coordination, planning for discharge after hospitalization, patient education, medication management, identification of needed resources, and caregiver support.

Outside of Thetford but within ready driving distance there are a number of smaller health clinics, optometrists, dentists, etc. located in neighboring towns. Also, within driving distance are regional health care centers including Alice Peck Day Hospital, located in Lebanon NH and Gifford Medical Center, located in Randolph. The Dartmouth-Hitchcock Medical Center located in Lebanon, NH, is a large, nationally recognized teaching hospital that offers expansive services ranging from primary care to many advanced specialties.

Overall, an ample range of health care options are available to Thetford residents. Barriers to health care arise not from accessibility but affordability.

Recreation

Treasure Island is a Town-owned public recreation area located in the towns of West Fairlee and Fairlee. The area consists of 10.6 acres of land, including extensive frontage

on Lake Fairlee with a 150-foot artificial sandy beach. The facilities here are well-worn and in need of major upgrade before the town can realize the significant potential that exists in this site. This is a high cost objective, however some of the burden could be offset with volunteerism as has been done in the past. Without well-focused planning preferably guided by a commissioned study, it is difficult to estimate the cost of upgrades or to make use of the full potential of this facility.

There are four town commons. The common on Thetford Hill hosts occasional outdoor events such as the annual Thetford Hill Fair. Volunteers assist with the common's maintenance. The Thetford Center Common, beside the Thetford Center Community Association building was donated to Thetford by Charles Hughes in 1998. There is a very small common at the junction of Buzzell Bridge Road and Route 113 in Thetford Center, and another small common, Memorial Park, in Post Mills at the junction of Robinson Hill Road and Route 244. The Thetford Center common is underutilized and has good potential to accommodate a play area as the nearby Community Center building has water and bathroom facilities. A playground structure for the common is a high priority that would draw young families and increase the vitality of the village center. The project will cost $10,000-40,000 depending on the design, and could be funded with donations and grants. A playground in this prominent location would enliven the character of Thetford Center Village and set a welcoming tone.

Thetford Elementary School has approximately two acres of playground. Outdoor fields at the school are used for sports including baseball, softball, soccer, youth tennis, and outdoor basketball. A skating rink is set up in winter months for school and recreational use. Thetford Academy also makes its playing fields available to the public.

There is also a Little League field used and maintained by the Recreation Department, located in Post Mills and owned by the Thetford Volunteer Fire Department.

The Thetford Recreation Department is a member of the Upper Valley Recreation Association. This association helps coordinate programs, camps, and the scheduling of games. Thetford is also a member of the Vermont Recreation and Parks Association and the New England Recreation and Parks Association.

The 229-acre Thetford Hill Recreation land has public access from Academy Road. The Thetford Academy cross-country trail runs through the forest and is maintained by Thetford Academy.

Thetford Hill State Forest, adjacent to Houghton Hill Road, is a 262-acre undeveloped tract with trails for hiking, cross-country skiing, and snowmobiling. About 50 acres is

leased to the Upper Valley Fish and Game Club, a membership organization that provides a shooting range, hunter safety classes and runs an annual childrens' fishing derby.

A fishing access point maintained by the Vermont State Department of Fish and Wildlife is located on the Connecticut River in North Thetford. It is open to the public without charge.

The US Army Corps of Engineers oversees the Union Village Dam, a flood control project along the East and West Branches of the Ompompanoosuc River, which includes 991 acres of land. Recreation activities include fishing, swimming, hunting, picnicking, hiking, biking, and cross-country skiing. It is open to the public at no charge.

Through the years the town has received land from several sources. A Thetford Town Forest is located off Five Corners Road, near Thetford Center. This tract of woodland is home to the Upper Valley Fish and Game Club, Inc. The Club has cleared a section of land near the road and has set up ranges for rifle, pistol, archery, and trap shooting. The club sponsors Hunter Safety courses twice a year. Children's fishing derbies are held at the man-made pond to the north of the range.

The Post Mills Nature Area was created from 104 acres donated to the Town by the state. The land is managed for wildlife with an emphasis on keeping the fields open and allowing the forest to mature. Non-motorized recreation such as walking, birding, and skiing are permitted. Parking is available on a right-of-way to the area. A management plan has been approved for this property by the Selectboard and the Upper Valley Land Trust and is available at the Town Hall or through the Thetford Conservation Commission.

The Hughes Forest is a 280-acre parcel owned by the Town through a donation by the Vermont Nature Conservancy. The property can be accessed from Sawnee Bean Road, Poor Farm Road, or Whippoorwill Road. There is a small parking area on Sawnee Bean Road with a walking trail near the pond. The parcel is managed as a woodlot with an equal emphasis on wildlife. In 2008 the Town adopted a forestry management plan that documents the result of the forestry inventory and lays out a plan for improving timber quality.

In late 2005, a 21-acre Class 2 wetland known informally as "the DeCola wetland" located on Godfrey Road was donated to the Town. The Thetford Conservation Commission inventoried the wetland for significant wildlife and plants in 2009 and 2015. The property will be used for educational purposes illustrating the critical role

wetlands play in providing habitat, flood protection, stabilizing soil and improving water quality and removing pollutants by filtration.

The Zebedee wetland, located off Houghton Hill Road, is another parcel available for exploration and used as an outdoor classroom by the nearby Elementary School. This ecologically rich, 27-acre parcel is conserved through the Upper Valley Land Trust.

The Taylor Flood Plain Preserve consists of 36 acres of vegetated and wetland area bordering the Ompompanoosuc River in Post Mills. In July 2013, this property was officially protected with a conservation easement held by the Upper Valley Land Trust. This nature preserve provides significant floodwater storage and is owned by the Town of Thetford. It is open to the public.

While there are many recreational opportunities in Thetford, preschool-aged children and young families not explicitly served by Thetford Elementary School and Thetford Academy facilities may be underserved. Developing facilities for this demographic has an unknown cost, but because of the priority of serving *all* Thetford residents, it should be studied.

TOWN AND COMMUNITY UTILITIES

Cell phone service and high-speed Internet access have become a part of our everyday lives. This technology utilizes towers, antennae, and wire strung along poles or run underground. Cell and internet services provide benefits to residents including safety and security, education, economic, health monitoring and entertainment.

Thetford residents may obtain high-speed internet and phone service through EC Fiber (East Central Fiber) a fiber-optic provider owned by a compact of 24 Vermont towns. The optical fiber network to all parts of Thetford was fully realized in 2019. Some areas of town also have access to broadband Internet service over satellite, cable, DSL (digital subscriber line) or through wireless providers. Thus, provider coverage for high speed internet and phone from homes and businesses is available to all Thetford residents.

Thetford's hilly terrain and the small number of towers cause cell service in some areas to be spotty or nonexistent. While improved telecommunications service provides a public benefit and serves the public good, telecommunications towers and their infrastructure can present adverse effects on important public values and investments.

The Town values and prioritizes the preservation of its aesthetic, scenic, historic, environmental, and agricultural resources, including its rural and rural-residential landscapes, ridgelines and open spaces.

The Town may develop telecommunication services in line with their goals while causing minimal impact on the above listed characteristics and appearance of the Town.

TOWN ROADS

Roads (and the bridges and culverts that enable them) are critical infrastructure. Thetford's roads have suffered from disrepair and a lack of adequate funding (including state and federal aid).

Needed repairs to Route 132 for example, a state-numbered town highway, were at one point estimated at over $12 million. While significant work has been done on this almost 6-mile stretch of Thetford road, it is estimated that additional work of over $3 million is still needed between the intersection of Tucker Hill Road and the Norwich Town line. This is a high priority repair that, absent state or federal assistance, will require a municipal bond – something that may be difficult for taxpayers to afford given the small size of the Town of Thetford's tax base.

Route 132 is currently classified as a Class 2 town highway; asking the Agency of Transportation to reclassify this road as a Class 1 town highway would result in additional state aid of over $36,000/year.

Other roads in Thetford suffer from similar issues. The recent transition to a Town Manager form of government will help the Town inventory and prioritize needed repairs, a high priority and consuming task that has previously been beyond the capacity of limited Town personnel and its elected and appointed officials. More information on transportation facilities and services can be found in the Transportation chapter.

GOALS, POLICIES, AND RECOMMENDATIONS

Thetford is committed to supporting the continued vitality of the community by maintaining and upgrading shared facilities, services, and utilities, balanced by careful consideration of Town needs and taxpayer resources.

Town and Community Facilities

Goal

1. Well-maintained facilities that do not contribute to greenhouse gas emissions.
2. Elimination of reliance on fossil fuels.
3. Appropriately sited facilities.
4. Efficient use of existing Town-owned facilities.

5. Town lands that are maintained and enhanced to sequester carbon.

Policies

1. It is the policy of the Town to identify and correct any maintenance and repair issues with Town-owned facilities.
2. It is the policy of the Town to optimize the use of its facilities and correct underutilization and improper siting.
3. It is the policy of the Town to optimize its fleet to achieve the greatest possible reduction in emissions while meeting the operational needs of the Town and remaining cost-effective, as outlined in the Green Fleet Policy.

Recommendations

1. The Town should maintain its inventory of existing facilities and design a capital plan for maintenance and repair or new construction.
2. The Town should continue its search for and evaluation of property to accommodate its long-term strategic needs.
3. The Town shall seek to reduce or eliminate its greenhouse gas emissions.

LIBRARIES

Goals

1. Library services with strategic plans that meet the needs of residents.

Policies

1. It is the policy of the Town to review the Library Federation's strategic plan whenever amended and continue Town support as appropriate.

CEMETERIES

Goal

1. Maintenance of existing cemeteries.

Policy

1. It is the policy of the Town to maintain existing cemeteries.

Recommendations

1. The Cemetery Commission should develop a plan for the long-term maintenance and upkeep of existing cemeteries.

Town and Community Services and Utilities

WATER

Goal

1. Adequate water resources that anticipate future needs.

Policy

1. It is the policy of the Town to practice and/or encourage the monitoring and prevention of contamination of Thetford's water resources by such things as road salt, erosion, agricultural runoff, failed septic systems, and the former Post Mills landfill.

Recommendation

1. The Planning Commission should assess the feasibility of central water that supports the planned growth of East Thetford village and provides fire protection.
2. To ensure an adequate and safe water supply, the Town should require continued water quality monitoring in and around Post Mills.

SOLID WASTE AND SEPTAGE

Goal

1. Reduction, reuse and recycling of waste.

Policy

1. It is the policy of the Town to support regional solutions for solid waste and septage.

Recommendations

1. The Town should monitor the effects of Vermont Act 148 on waste disposal volume and costs to the Town.
2. The Town should investigate feasibility and funding sources for installing municipal sewers or multi-facility waste treatment facilities to support planned growth areas.

POLICE PROTECTION

Goal

1. Public safety and law enforcement.

Policy

1. It is the policy of the Town to support the needs of the Police Department in its support of the community without adding undue financial burden to taxpayers.

Recommendation

1. The Town should look for a new space for the changing needs of the Police Department and the Town.

FIRE AND EMERGENCY SERVICES

Goals

1. A well-trained and well-equipped Thetford Volunteer Fire Department and emergency services.
2. Fire safety in homes and businesses.

Policies

1. It is the policy of the Town to require the Development Review Board to address water supply issues in all major developments that come before it.
2. It is the policy of the Town to ensure driveway standards in zoning or Town ordinances comply with emergency services recommendations.

Recommendations

1. The Town should encourage home and business owners and community facilities to make use of early detection systems.
2. The Town should encourage home and business owners to consider installing approved fire suppression systems.
3. The Town should work in coordination with emergency services providers to support the most effective safety measures in Thetford.
4. The Town should investigate funding for water mains in planned growth centers.

RECREATION

Goal

1. Recreation opportunities for people of all ages in Thetford.

Policy

1. It is the policy of the Town to cooperate with Thetford schools in the use of current recreation facilities and in the potential development of new recreation facilities.

Recommendations

1. The Town should build and maintain playground facilities for preschool-aged children and young families on the Thetford Center Green.
2. The Town should develop and maintain recreation facilities and programs for residents of all ages.
3. The Town should work with the schools to make their facilities available to the community at large.

TELECOMMUNICATIONS

Policies

1. It is the policy of the Town to oppose siting of telecommunication structures that undermines the public investment in land use planning, including the identification, protection, and preservation of natural, agricultural, scenic and historic features, open space preservation, scenic roads, waterways and views, outdoor recreation, tourism, public facilities and services, and land resources.
2. It is the policy of the Town that siting of telecommunication structures shall be treated in a manner consistent to the siting recommendations of energy generation and transmission facilities noted in Chapter VII: Energy.
3. It is the policy of the Town that Telecommunication structures shall be sited to avoid negative impacts on forest blocks and habitat connectors per the State planning goal 4302 (b)(6)(C) and Chapter V: Natural Resources, which reinforce the importance of forest blocks, forest connectivity and contiguous wildlife habitat.

Recommendations

1. The Town should support public and private efforts to pursue appropriately scaled and sited infrastructure that is in keeping with community and natural values, to support high-speed Internet services to all areas of Thetford.

Town Roads

Goals

1. Well-maintained roads, bridges, and culverts

Policies

1. It is the policy of the Town to systemically inventory and prioritize road maintenance and repair so that no road, bridge, or culvert falls into a condition of disrepair.

Recommendations

1. The Town should ask the Agency of Transportation to reclassify Route 132 as a Class 1 town highway.

CHAPTER V: NATURAL RESOURCES

The beauty and diversity of Thetford's natural resources enrich our quality of life and are a source of pride in our town. Any actions that may threaten their integrity warrant careful consideration. It is impossible to put a price on this irreplaceable natural legacy and residents of Thetford can consider themselves stewards of it.

WATER

(See *Surface Water, Wetland and Riparian Resources* map, Appendix.)

In 1986, the Vermont Legislature amended Vermont's water quality statutes to require all river watersheds to have a "basin plan" under §303(e) of the federal Clean Water Act (33 U.S.C. §§1251-1387) and 40 C.F.R. part 131.[14] The original basin plan for the Ompompanoosuc was finalized in 2008 and is the basis for some of the recommendations in this chapter. The basin plan has been refined in recent years.

The Vermont Agency of Natural Resources recommends maintaining buffers of native woody plants and establishing setbacks between the edge of the water and structures in order to protect water quality, channel and floodplain stability, and wildlife habitats. Equally important is ensuring that sand, salt, and other materials are properly stored and used so they do not adversely impact water resources adjacent to roads.

The Connecticut River

Thetford has approximately 8.5 miles of frontage on the Connecticut River, the largest river in New England. The river is a major migration route for waterfowl and its watershed contains premier fish and wildlife habitat. Millennia of flooding and sediment deposition in the floodplain have created some of the richest agricultural soils in the entire continent.

Flooding on the Connecticut River causes costly damage through inundation or fluvial erosion. In Thetford, the level of the Connecticut River is controlled by the downstream Wilder Dam and several dams upstream, and is kept unnaturally high and wide. Erosion caused by frequent changes in water levels by dam operations and the action of boat wakes causes ongoing loss of our best agricultural soils. Two studies by the EPA detected

[14] 10 V.S.A. §1250: Water Pollution Control

heavy metals and polycyclic aromatic hydrocarbons (PAH) from automobiles in Connecticut River sediments in the Upper Valley.[15]

The Connecticut River is a popular destination for swimming, boating, fishing, and riverside camping. Recreational access to the river is provided via the North Thetford Fish and Wildlife Department boat launch.

The Ompompanoosuc River and Tributaries

The Ompompanoosuc is a major natural, scenic, and recreational feature in Thetford. It is bordered by a mix of forest, agricultural land, and settlements. A 3.8-mile section of the east branch, from the outlet stream of the Gillette Swamp to just upstream of the confluence with the west branch, was designated by the state of Vermont as an Outstanding Resource Water in 1996, due to its scenic, recreational, and historic value.[16]

The Ompompanoosuc River is designated as one of Vermont's fisheries. The river above the Union Village dam is also designated an Eastern Brook Trout protection watershed.[17]

The Basin 14 Water Quality Management Plan cites polluted runoff from developments and sediment from erosion, agriculture, and logging as leading causes of poor water quality in the Ompompanoosuc River.[18] Tests at Sandy Beach (Union Village Dam Recreation Area) and in Post Mills have shown levels of *E. coli*, a marker of fecal contamination, that periodically exceed Vermont water quality standards.

The 2009 Phase 1 Stream Geomorphic Assessment of the Ompompanoosuc found that the river suffers from historical straightening and berming, primarily to accommodate roads next to the river.[19] Channel straightening makes the river flow more swiftly, eroding and destabilizing its banks. Protecting undeveloped river sections allows the space for natural channel adjustment.

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[15] CRJC, *Water Resources—Upper Valley Region, Connecticut River Management Plan* (2009), pp. 84-85. http://www.crjc.org/new%20WR3%20chapter/WATER_RESOURCES_UpperValley.pdf

[16] VT Water Resources Board, https://anrweb.vt.gov/PubDocs/DEC/Decisions/wrp/1996/orw95-01-dec.pdf archived at http://dec.vermont.gov/watershed/laws/wrp-decisions

[17] Trout: Volumes 34-37; p. 53. Trout Unlimited, 1993

[18] VT ANR, *Basin 14 - Basin Planning for the Watersheds Drained by the Ompompanoosuc, Stevens, Waits and Wells Rivers.* http://dec.vermont.gov/watershed/map/basin-planning/basin14

[19] *Ompompanoosuc Phase I Geomorphic Assessment Report – 2009*, prepared for Thetford Conservation Commission. http://thetfordvermont.us/wp/departments/conservation-commission/

Undersized or improperly installed bridges and culverts for both roads and driveways create problems. When squeezed through an undersized space, the water speeds up and erodes the downstream channel.

The Ompompanoosuc and its tributaries are interrupted by several dams. The largest is the United States Army Corps of Engineers Union Village flood control dam that allows free flow during the summer. Other dams include the derelict Montague Rod and Reel Mill dam in Post Mills and the recently rebuilt Lake Fairlee Outlet dam. The 2011 Ompompanoosuc Phase 2 Geomorphic Assessment and River Corridor Plan for West Fairlee and upper Post Mills recommends that the Montague Rod and Reel Dam be removed.[20]

Lakes and Ponds

Thetford's lakes and ponds include Lake Fairlee and Child's Pond, Mud Pond (also known as Lake Abenaki), Payson Pond (also called Lily Pond), Norford Lake, and Forsythe Pond also known as Mud Pond) and another 128 ponds under ten acres.

Child's Pond is a kettle pond ten acres in size with lake-like depth and temperature stratification. Less than 200 feet from the Connecticut River, its surface is over 150 feet above the river. The underlying soil is quicksand.

Ponds become degraded by nutrient enrichment, exotic species, acidification and toxins. The Agency of Natural Resources Basin 14 Water Quality Management plan recommends protecting the shorelines of Lake Abenaki and Lake Fairlee through voluntary conservation of shoreline property.

Lake Fairlee straddles the town lines of Fairlee, Thetford, and West Fairlee. It covers about 460 acres and collects water from the surrounding 22 square miles. Middle Brook and Blood Brook are the primary inlets. The lake level is maintained by the outlet dam at the Thetford end of the lake.

The lake has a rich ecosystem. There are perch, bass, and pickerel and the state stocks the lake annually with brown trout and rainbow trout. Diverse wildlife are attracted to the lake for its shoreland and freshwater habitat.

Studies by the state of Vermont showed a highly significant decline in shoreland/lake habitat and an increase in aquatic invasive species. More than 50% of Lake Fairlee's

[20] *Ompompanoosuc River Corridor Plan—West Fairlee to Thetford, Vermont* (2011). Available at https://anrweb.vt.gov/DEC/SGA/finalReports.aspx

native shore vegetation has been replaced by lawns to the water's edge, destroying shore and shallow water habitat. Highly developed shores are ranked by the US Environmental Protection Agency as the number one threat to a lake's biology.[21] Excessive nutrients coming from erosion and runoff in unbuffered sections of Middle Brook and Blood Brook threaten lake water quality.

Effective July 1, 2014, the Vermont Legislature passed the Shoreland Protection Act[22] (Chapter 49A of Title 10, §1441 et seq.), which regulates shoreland development within 250 feet of lakes over 10 acres to prevent degradation of water quality, preserve shoreline habitat and maintain the economic benefits of lakes. A summary[23] of the Shoreland Protection Act and *The Vermont Shoreland Protection Act: A Handbook for Shoreland Development*[24] help to explain the Shoreland Protection Act and the permit process.

The Tri-Town Commission was formed in 2015 under interlocal agreements between Thetford, Fairlee, and West Fairlee to collaborate on managing the dam on Lake Fairlee. Through the persistent efforts of the Commission, the Lake Fairlee dam was rebuilt in 2016 under current code.

Wetlands

Wetlands are hotspots of biodiversity and among the most productive of all ecosystems. About half of our rare and endangered species rely on them, some requiring connections between wetlands. The hydric soils of wetlands support communities of uniquely adapted plants.

Wetlands perform many essential functions for which they are protected by Vermont's Wetland Rules.[25] They temporarily store floodwaters and stormwater runoff, attenuate flood flows, and reduce property damage caused by inundation or erosion. Water flowing through wetlands is cleansed of sediment, organic matter, and excess nutrients such as phosphate. Wetlands also recharge groundwater by allowing water to percolate into the soil.

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[21] VT ANR, R*esilience—A Report on the Health of Vermont's Environment.* (2011) p.14. http://anr.vermont.gov/sites/anr/files/aboutus/documents/Resilience%202011.pdf

[22] http://dec.vermont.gov/sites/dec/files/wsm/lakes/docs/Shoreland/lp_ACT172_Shoreland Protection Law.pdf

[23] http://dec.vermont.gov/sites/dec/files/wsm/lakes/docs/Shoreland/ShorelandProtectionActSummary_2272017.pdf

[24] http://dec.vermont.gov/sites/dec/files/wsm/lakes/docs/Shoreland/lp_ShorelandHandbook.pdf

[25] VT ANR, "Vermont Wetland Rules." http://dec.vermont.gov/watershed/wetlands/jurisdictional/rules

Wetlands contribute substantially to open space and the aesthetics of our landscape. They offer recreational and educational opportunities, and support game and threatened and endangered species.

The Thetford Wetlands Inventory funded by the Conservation Commission in 2011 documented a total of 21 different natural community types.[26] The Vermont Significant Wetlands Inventory shows many additional, unnamed significant wetlands. (See *Water & Slope* map and *Surface Water, Wetland and Riparian Resources* map, Appendix.)

VERNAL POOLS

Vernal pools are small, seasonal wetlands that fill with snowmelt and spring rains. They frequently dry up by late summer. Predatory fish cannot survive there, making them critical breeding habitats for wood frogs and salamanders - species of conservation concern. A working definition of a vernal pool is one that contains evidence of two or more indicator species such as wood frog, salamander and fairy shrimp, or over 20 egg masses of one of these species.

A partial inventory of Thetford's vernal pools was conducted in 2010. Information and help identifying vernal pools is available through VINS (the Vermont Institute of Natural Science) and the Vermont NRCS (Natural Resources Conservation Service).

Although small (generally under 0.5 acre), vernal pools contribute an outsized amount of food to animals of the surrounding upland in the form of water insects, frogs and salamanders, and their tadpoles.

GROUNDWATER AND AQUIFERS

While many communities in the US struggle with water issues, our area is blessed with an abundance of clean water. The Town should consider a variety of strategies to protect groundwater, the primary source of our drinking water.

Groundwater is often used for crop irrigation and livestock, and is a potential resource for businesses such as processing facilities. Groundwater is threatened by pollution, for instance spills of hazardous materials, septage, poor agricultural practices, road salt, and leaks from underground fuel tanks.

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[26] Site visits determined that the following wetlands are of local or state significance: Balsam Swamp, Town Forest Swamp, Conant Swamp, Gillette Swamp, Godfrey Road Marsh, Gove Hill Seep, Norwich-Thetford Swamp, Post Mills Alluvial Wetlands, Zebedee Headwaters/Thetford Hill Marsh, Thetford/Old Gillette Swamp, Twayblade Swamp, Union Village Beaver Wetland, Zebedee Brook Marsh (at the confluence with the Connecticut River) and two unnamed vernal pools.

The Vermont Legislature passed Act 199 in 2008, creating new groundwater protection options for municipalities by declaring groundwater to be a public trust resource.

EARTH

Slope

Slopes are a crucial part of Thetford's topography. They determine how fast water flows downhill, how much soil moisture is retained, and how much solar radiation heats the ground, which affects the freeze-thaw cycle. These factors influence productivity of the land for agriculture, forestry, and wildlife.

Thetford's topography can be expressed in three slope percentage categories: 0-15%, 15-25% (Steep), and greater than 25% (Very Steep). (See *Water & Slope* map, Appendix). On both "Steep" and "Very Steep" slopes, soil erosion is of great concern. Though development on such slopes is theoretically possible, the erosion issues require extraordinary care and extra cost in engineering and landscaping. Providing emergency services to buildings with steep access can be problematic, particularly in winter and during heavy rainstorms.

Exposing the lower layers, or substrata, of soils can irreversibly harm their structural integrity and many slopes will immediately erode, compromising their strength for supporting roadways or foundations. The plants native to steep, wooded areas in Vermont do not grow in the sterile soils exposed by hillside erosion.

Destabilized slopes rapidly send sediments downhill. Silt travels in runoff for over 400 ft. polluting streams and surface water along that entire distance.

Agricultural and Silvicultural Soils

Thetford possesses outstanding soils for agriculture that are recognized for their prime or statewide importance (see *Farmland Resources* map, Appendix).

Prime farmland has the soil quality, growing season, and moisture supply needed to economically produce sustained high yields of crops under accepted farming methods. Prime soils are porous to water and air, contain few if any rocks, and are not flooded frequently. They are also available for agricultural use and may be cropland, pasture, or forestland, but not currently developed. As of 2013, Thetford has 2500 acres of designated Prime soil.

Soils and farmlands designated as "Important" statewide are less productive than Prime soils due to one or more of the following conditions: excessive slope, erosion hazard,

excessive wetness or slow permeability, flooding hazard, depth less than 20 inches or moderately low to very low available water capacity. Thetford has 3,900 acres designated as being of Statewide Agricultural Importance. Areas identified by the NRCS as Prime Agricultural land in Thetford are identified on the accompanying *Natural Resources* map. (See Appendix).

The gentle slopes and deep soils that make land good for farming also make it easy to develop. Although Thetford generally has been active in conserving land for wildlife protection, soils of agricultural significance are virtually unprotected.

Figure 11: Thetford Agricultural Area and Soils

	Number of Acres	% of Town Acreage
Total acreage in town (1.3% is in water)	28,288	100
Prime Agricultural Soils	2,500	9
Soils of Statewide Agricultural Importance	3,900	13.8
Total of Primary Agricultural Soils	*6,446*	*22.8*
Working Farms (not all on Primary Agricultural Soils)	1,340	4.7
In Current Use (includes all Working Farm acreage)	1,969	6.9
Conserved Primary Ag soils (16% of total Primary Ag soil)	1,025	3.6
Conserved lands (Primary Ag soils and all others)	4,300	15.2

Source: Thetford Listers

Productive forest soils are not of agricultural quality, but have a reasonable potential for commercial forestry and are undeveloped. Productive forest land is of a size and location relative to adjoining land uses and ownership patterns that allows it to support a commercial forestry operation (see *Working Forest Resources* map, Appendix). Usually, a timber harvesting forest must cover at least 50 acres to be considered economically viable.[27]

Much of the forest land in Thetford is enrolled in the Current Use program and is under active forest management.

Like farmland, forests are under threat from development. While less developable than open lands and not under such intense pressure, they are cheaper and more isolated than agricultural land, two factors that can make them desirable as house lots.

[27] TRORC Regional Forest Stewardship Report 2012

Landscape Features

Enduring features include topographic elements (mountains, hills, valleys) and landscape features such as bedrock and surficial deposits (e.g., sand gravel, silt, clay, and peat).

Enduring features may be home to specific species and plant communities. Ledges, cliffs, and other outcrops provide den or nest sites for bobcat, bats, eagles, falcons, and ravens. Rocky crevices, caves, boulder piles, and talus slopes provide shelter for rare small-footed and other bats, snakes, and many mammals. Gravel pits and sandy bare areas support declining species like wood turtles, nighthawks, larks, and vesper sparrows. Other species create burrows in muddy banks (muskrats, otters) and sandy banks (kingfishers, bank swallows). Protecting a variety of enduring features preserves the town's biodiversity of plants and animals.

FLORA & FAUNA

Forests

(See *Forest Block, Connectivity, and Resilience Resources* map, Appendix.)

Forests are the major vegetative cover in Thetford and give the landscape its essence and character. Forests provide many "capital services." They prevent erosion, protect water quality, filter groundwater, cleanse the air by photosynthesis, and prevent floods by absorbing rainwater. In contrast to costly, man-made, single-service facilities, healthy forests provide many services simultaneously at no cost to the town.

Timber and wood products provide income for many residents (see *Working Forest Resources* map, Appendix). Firewood, pulpwood, saw logs, woodchips, maple syrup, and Christmas trees are all potential products from our woods, as is biomass energy in the form of wood pellets The state of Vermont has recently enacted State statutes,[28] which define a forest block (a contiguous area of forest in any stage of succession, not currently developed for non-forest use) and provide for the designation of priority forest blocks within this management framework. Thetford lies in the transition forest region between the coniferous boreal forest and the deciduous woodlands of temperate North America. Transition forests are extremely productive ecosystems that support the vast majority of the region's wildlife species, from signature mammals like moose, bear, and

[28] 24 V.S.A. § 4302(c), 24 V.S.A. § 4303 and 24 V.S.A. § 4348a(a)(2)

bobcat to songbirds, salamanders, rodents, and insects. Groups of mature oak and beech trees (mast stands) are a key wildlife food source.

One of the greatest threats to healthy forests and functioning ecosystems is forest fragmentation – the division or conversion of a contiguous forest block by land development. Since the 1980s, Vermont has experienced increasing "parcelization" - land being divided into smaller ownerships making it likely that the land will ultimately be developed with infrastructure (such as roads and utilities) and buildings. Forest fragmentation affects water quality and quantity, fish and wildlife populations, and the biological health and diversity of the forest itself. Many small habitat losses over time may be as dramatic as one large loss. Forest fragmentation can disrupt animal travel corridors, increase flooding, promote the onset of invasive vegetation, expose forest interiors, and create conflicts between people and wildlife. Thetford's Highest Priority and Priority Interior Forest blocks and Highest Priority and Priority Connectivity Forest Blocks are shown in the Thetford Forest Block, Connectivity and Resilience Resources map. Within Forest Blocks, Priority Resilience Lands are those providing the best conditions for ecosystem adaptation to climate change.

To help mitigate the effects of human population growth and land consumption, many scientists and conservationists urge governments to establish protected forest blocks and habitat connectors/corridors, which connect important wildlife habitat.

A Land Management Plan for 575 acres of Town-owned forest was developed in 2008 and allows for the possibility of harvesting lumber and recreational access. Thetford has 255 acres of State Forest in two parcels: the Thetford State Park on Academy Road (177 ac.), now being managed by Thetford Academy, and a forest block of 78 acres on Houghton Hill Road. Thetford also contains the bulk of the federally owned Union Village Dam Area, totaling just over 922 acres in three contiguous parcels, all managed by the Army Corps of Engineers.

Wildlife

(See *Wildlife, Plant, and Natural Community Resources* map, Appendix)

Thetford has a diversity of wildlife, with species overlapping at the northern or southern extents of their range. Both northern and southern flying squirrels are found here as well as hermit thrush (a northern species) and wood thrush (a southern species). In fact, the transition forests of the northeast harbor the greatest diversity of songbirds in the US.

Wildlife is one of the popular attractions to the area and provides some citizens of Thetford with direct and indirect income from sports, tourism or harvest of wildlife.

Wildlife habitat is the area required for food, shelter, and successful breeding. For some species, such as insects and rodents, the requirement is fairly small (1-2 acres). But for other species this area can be much larger - for barred owls at least 100 acres of forest, for Scarlet tanagers about 500 acres, for gray fox about 1,900 acres, while moose need up to 30,000 acres.

The biggest threat to habitat is loss to development and fragmentation by roads, driveways, and trails. Studies on the occurrence of 32 representative wildlife species in different sized forest blocks show that the number of species decreases rapidly in response to fragmentation.

Not all species thrive in forest habitat. Grassland birds are a priority for conservation in Vermont.[29] For survival and reproduction, they need lands dominated by grasses, sedges, and forbs. Mowing prior to the end of July destroys their nests and young.

Shrubland birds are songbirds and game birds (grouse, woodcock) that depend upon areas of low, thick woody growth. Many shrubland bird populations are declining. Most species prefer large (> 2.5 acre), blocks of shrub or early succession habitat.

Species that rely on riparian habitat have been greatly reduced throughout Vermont by riverside development. The state Wildlife Action Plan[30] lists protection and restoration of riparian areas as highest priority activities.

WILDLIFE CORRIDORS

Wide-ranging animals such as moose, bear, and bobcat need large areas of forest habitat. Several smaller areas can function as a large forest if they are connected via wildlife travel corridors. Corridor connections also enable populations to interbreed, thus preserving genetic fitness. Animals naturally travel along ridgelines and down drainage basins and rivers and prefer to cross roads alongside large, unfragmented blocks (500 acres or more).

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[29] Henslow's Sparrow, Sedge Wren (both endangered), Upland Sandpiper, Grasshopper Sparrow (both threatened), Vesper Sparrow (uncommon), and Savannah Sparrow, Bobolink and Eastern Meadowlark (declining.)

[30] VT Fish & Wildlife Dept., "Draft 2015 Wildlife Action Plan for Public Review." http://www.vtfishandwildlife.com/about_us/budget_and_planning/revising_vermont_s_wildlife_action_plan/draft_2015_wildlife_action_plan_for_public_review/

Wintering areas are an important habitat requirement for deer. Typically, these areas consist of mature softwood stands, at low elevations or along stream beds, which provide cover and limit snow depths.

Most important when considering development and its impact on wildlife is the concept of habitat fragmentation. Forests provide habitat to a diverse population of wildlife, which are negatively impacted when forested land is fragmented through development

ENDANGERED, THREATENED, AND RARE SPECIES

The small-footed bat (*Myotis leibii*) is threatened globally and has a state ranking of critically imperiled (S1: no more than five populations in Vermont) prior to deadly White Nose Syndrome (WNS), which has killed over 90% of Vermont's bats. These bats roost in rock cracks and talus (enduring features) and were found in the Union Village Dam area. The little brown bat, still found in Thetford, and the northern long-eared bat are now listed as endangered due to WNS.

Valley clayplain forest, a rare plant community, exists in Conant Swamp.

Botanical inventories of Town-owned lands found four rare, threatened, or endangered (RTE) plant species on the Hughes Forest, two RTE plant species on the Taylor parcel, and four RTE plant species on the Town Forest. Large marsh-bedstraw and the marsh mermaid-weed, both ranked S1 (critically imperiled in Vermont), also occur in Thetford.

AIR QUALITY

Air quality is very good in Vermont and is a major contributor to our quality of life and health. It is directly influenced by tree cover and transpiration. Air polluting industries are not a major component of our economy, but automobile traffic, illegal open burning of garbage, and home wood and oil burning pose some threats to air quality. They also contribute carbon dioxide to the atmosphere that drives climate change. Increasing the biomass accumulation in a forest or other vegetative cover increases carbon sequestration.

LIGHT AND DARK, QUIET AND NOISE

Dark clear skies and bright stars contribute to the rural beauty of our town. The increasing use of outdoor lighting, such as security lighting contributes to "light pollution," which diminishes our ability to view the night landscape. Light not directed toward the ground or toward the intended surface can shine into viewers' eyes, and cause safety problems. The *Outdoor Lighting Manual for Vermont Municipalities*

prepared by the Chittenden County Regional Planning Commission is a valuable resource for property owners.

Rural areas are also expected to be quiet settings, even in our village and commercial districts. Noise loud enough to be considered pollution, such as chainsaws, lawn mowers and heavy construction equipment is usually temporary and localized. Loud noises due to lack of neighborly consideration include vehicles with inadequate mufflers, fireworks and persistent gunfire.

CONCLUSION

Thetford is fortunate to have a depth and variety of natural resources. The choices we make now will affect the future vitality of our town. Through informed actions and regulations enlightened by public input we can improve and preserve this wealth of natural resources. Our progress is ultimately guided by the people of the town.

GOALS, POLICIES, AND RECOMMENDATIONS

Water

Goals

1. Quality ground and surface water for public and aquatic health and related recreational benefits.

Policies

1. "Very Steep" slopes should remain completely undisturbed, while "Steep" slopes may be developed only if no viable alternative exists.

Recommendations

1. The Town should provide residents with informational materials on the impacts of toxic products that commonly go down the drain or are washed off lawns and gardens and seep into groundwater and drinking water supplies; include more environmentally friendly alternatives.
2. The Town should discourage activities such as development, filling, road and access construction, heavy livestock grazing, and prohibit dumping and the use of toxics, in known public groundwater recharge areas and areas adjacent to waterways and wetlands.

3. The Town should consider zoning regulations to require that any development of land, including residential development, located in a public identified recharge or source protection area be subject to conditional use approval.
4. The Town should map groundwater recharge areas as information from the state's aquifer/groundwater mapping project becomes available and recommend protections where appropriate.
5. The Town should consider adoption of a groundwater protection ordinance based on the model ordinance developed by ANR.
6. The Town should support buffer zones along Thetford's rivers, streams and in areas where groundwater comes to the surface in order to maintain quality water supply and the community's fishery and plant diversity.
7. The Town should inform developers of sources for guidelines for steam bank and buffer zone protection including proper erosion prevention procedures for construction activities adjacent to waterways.
8. The Town should encourage foresters and loggers to use Acceptable Management Practices for Maintaining Water Quality on Logging Jobs in Vermont (VT Dept. of Forests, Parks and Recreation, 2005) when conducting logging operations adjacent to streams and stream headwaters.
9. The Town should promote voluntary planting of native shrubs and trees in river and stream buffer zone protection areas and in stream bank restoration projects to prevent erosion, silting and to provide food and shelter for wildlife.
10. The Town should integrate into the zoning regulations where appropriate the specific Best Management Practices (BMPs) developed by the Natural Resource Conservation Service for buffer strips, diversion of surface water runoff, and the storage and spreading of manure, fertilizers and pesticides.
11. The Town should encourage the use of farming and gardening methods that eliminate fertilizer, pesticide and herbicide run-off into waterways and wetland areas.
12. The Town should discourage the practice of snow dumping along streams.
13. The Town should train and educate town road crews using the procedures contained in the Vermont Better Backroads Manual (1995) to reduce the amount

of sedimentation and contaminants added to waterways while maintaining dirt and gravel back roads.

14. The Town should discourage the construction of in-stream ponds.
15. The Town should sustain the long-term ability of the Town wetland areas to perform critical hydrological functions, filter surface water, and enhance wildlife and plant diversity.
16. The Town should provide informational materials to landowners, foresters and loggers explaining the functions of vernal pools and wetlands and the integral importance of each in maintaining the Town's hydrological balance and ecological fabric, including critical habitat for plants, animals and rare species.
17. The Town should encourage landowners to protect vernal pools and the surrounding habitat.

Natural Environment

Goal

1. A preserved character of the Thetford community and natural environment.

Policy

1. It is the policy of the Town to thoroughly review and anticipate the impact of development and proposals.

Recommendations

1. The Town should consider the impact of exterior lighting in all development proposals for conformance with the criteria outlined the Outdoor Lighting Manual for Vermont Municipalities.
2. The Town should include information on the potential impact of proposed development on the natural landscape and resources, derived from current GIS layers and Town Natural Resources Inventory, in the permit application file for use by permit applicants, the Planning Commission and Development Review Boards.
3. The Town should refer to the Natural Resources Inventory when updating town zoning regulations and associated maps and in jurisdictional determinations.
4. The Town should catalog significant/exemplary wildlife and plant habitats and develop strategies that protect both common and rare species.

5. The Town should utilize the Vermont Habitat Blocks map, the Town Natural Resources Inventory and the Linking Lands Alliance map as the basis for identifying blocks of undeveloped open land and contiguous forest, core wildlife habitats, critical habitats and corridors linking large land tracts and water resources. These shall be protected to the fullest possible extent in developments and in Act 250 proceedings.
6. The Town should direct landowners to websites that provide information on maintaining wildlife habitats on their land including early successional forest, native shrub habitats and open fields.
7. The Town should continue to support a municipal conservation fund that would enable Thetford to take advantage of land conservation opportunities and provide leverage in seeking grants and/or additional funds for habitat and water quality protection.

Forest Blocks

Goal

1. Maintained and preserved large forest tracts that are sustainable biological and economic resources.

Recommendations

1. The Town should minimize forest fragmentation by utilizing cluster housing and peripheral development planning concepts, and use of forest conservation easements.
2. The Town should encourage dedicated forest conservation easements to retain integrity of large parcels.
3. The Town should encourage foresters and landowners to follow recommendations in “Acceptable Management Practices for Maintaining Water Quality on Logging Jobs in Vermont” published by the Vermont Department of Forests, Parks and Recreation.
4. The Town should encourage forest stewardship techniques that promote the establishment of mature forests with a median canopy age of 150 years.
5. The Town should support the development of value-added farm and forestry products by local businesses.

6. The Town should encourage residents to limit the spread of invasive plants into forests and other areas and provide informational materials to help landowners identify and control invasive plants on their properties.
7. The Town should control invasive plants on public lands. Encourage town and state road maintenance workers and utility, construction and logging crews to clean mowers, backhoes and other equipment before moving on to new sites.

Wildlife

Goal

1. A natural diversity and population of wildlife, including natural predators, in proper balance.

Policy

1. It is the policy of the Town that development in significant natural communities or in the habitat or vicinity of rare or threatened and endangered species should take steps to avoid impacts.

Recommendations

1. The Town should discourage fragmentation of wildlife habitat. Diligent efforts shall be made to maintain connecting links (wildlife corridors) between such areas, referring to the Natural Resources Inventory map of Forest Blocks and Connectors.
2. The Town shall give preference to development that utilizes existing roads and field lines.
3. Developers shall take reasonable steps to avoid disruption or loss of major habitat areas and identified wildlife corridor crossings in new developments.
4. The Town should encourage, where appropriate, management of fields of five acres, or larger, to accommodate breeding grassland birds. Grassland bird nesting success in hayfields can be optimized by delaying mowing until end of July

Earth And Landscape

Goal

1. Preserved land with potential for agricultural production.
2. Uneroded soils.

Policy

1. It is the policy of the Town that development on agricultural soils shall be clustered at the perimeter of parcels.
2. It is the policy of the Town that public investments shall not result in undue disruption of agriculture or loss of agricultural soils to farming.
3. It is the policy of the Town that development and excavation on slopes with high erosion potential may proceed only with in-depth engineering and design plans to explain how erosion and runoff will be prevented.
4. It is the policy of the Town that quarries and gravel and sand pits need to be planned so as to protect surface and ground waters, as well as for the eventual reclamation of the site to a safe condition.

Recommendations

1. The Town should craft flexible land use regulations for prime and statewide agricultural soils that do not penalize farmers while encouraging development with minimal losses of agricultural land.
2. The Town should refer to the Natural Resources Inventory Map of soil types in the review and permit process for development.

Air

Goal

1. Maintain Thetford's existing air quality

Policy

1. Promote best practices to minimize localized air pollution.

Recommendations

1. The Town should consider adopting regulations that minimize unnecessary release of gases and particulates.
2. The Town should consider adopting regulations to control dust from activities such as construction, resource extraction and processing operations.

CHAPTER VI: FLOOD RESILIENCE

BACKGROUND

Following the impact of Tropical Storm Irene in 2011, the Vermont Legislature added a requirement that all communities address flood resilience as part of their Town Plan "Flood resilience" means the ability of Thetford to effectively plan for, resist, manage, and recover reasonably quickly from flooding.

Types of Flooding

There are two types of flooding that impact Vermont, inundation and flash flooding. Inundation occurs when rainfall over an extended period leads to rivers submerging previously dry areas. As inundation flooding can be slow, emergency management teams may have time to respond. It may take days or weeks for flood waters to subside which may severely damage property.

Flash flooding occurs when heavy precipitation falls over a short period of time. Precipitation falls faster than the soil can absorb it, leading to quick-moving runoff that overwhelms upland streams, small tributaries, and ditches as water rushes downslope. Flash flooding typically does not cover a large area, but the water moves at a very high velocity and the flooding manifests quickly, making flash floods particularly dangerous.

Water velocity in channels causes fluvial channel erosion (erosion of stream banks) which can severely damage roads and property. Fast moving water may alter the river channel itself, predisposing roads and structures to future damage. Flash floods can also mobilize large amounts of debris, plugging culverts and compounding the damage. In Vermont, most flood-related damage results from flash flooding and fluvial erosion.

Flood Plains

Floodplains are low lying lands adjacent to watercourses that are periodically inundated by floods, thus they temporarily hold water that would otherwise rush downstream. It is in the public interest to plan for floods with land use strategies that protect flood plains and minimize the risks to public health, safety, and property. Floodplain soils are porous and absorb considerable water. They often make excellent agricultural land but are not suited for development because of the danger of flooding.

Causes of Flooding

Floods in our region are caused by severe storms and these are increasing in frequency and severity. Continuous rain, saturated soils and a high water table worsen floods.

The steep slopes and narrow valleys in the region contribute to flash flooding. Ice jams and melting snow and rain cause winter and early spring floods. Inundation occurs adjacent to the site of the ice jam, with additional flooding upstream. Once the ice dam breaks free, flash flooding may occur downstream as well.

Flooding is worsened by land uses that create impervious surfaces that do not allow water adsorption and cause runoff, and stream modifications that have straightened or dredged channels, creating channel instability.

Flooding is also worsened by the filling of floodplains, or by disconnecting the floodplain from the river with structures or developments. The connection between deforestation and flooding is widely recognized. Forests absorb more water into their spongy, humus-rich soil than do farmland or grassland. The presence of dense trees also slows the passage of water downhill.

Under the provisions of the National Flood Insurance Act (1968), the Federal Emergency Management Agency (FEMA) has conducted a series of evaluations and hydrologic engineering studies to determine the limits of flood hazard areas along streams, rivers, lakes, and ponds expected to be inundated during the 100-year base flood. (The "100-year base flood" means that the flood level has a 1% chance of being equaled or exceeded in any given year.) FEMA's calculations do not take into account the impact of ice dams or debris, and may, therefore, actually underestimate the areas that are subject to flooding damage.

FEMA has prepared a Flood Hazard Boundary Map for the Town of Thetford and a Flood Insurance Rate Map. This map is available at the town office, FEMA's Map Service Center, and is on file at the Two Rivers-Ottauquechee Regional Commission. [31]

FEMA also administers the National Flood Insurance Program, which provides flood hazard insurance at subsidized rates for property owners in affected areas. In order to qualify for federal insurance, towns must adopt and retain a bylaw to control land development within these areas. Thetford has a Flood Hazard Area Zoning Bylaw. Minimum standards must be included and approved by FEMA. Coverage is only available to residents if a town elects to participate in the program, which Thetford has done.

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[31] Two Rivers-Ottauquechee Regional Commission, http://www.trorc.org/

Historic Flood Events

One of the worst flood disasters in Vermont occurred on November 3, 1927, when up to 10 inches of heavy rain from the remnants of a tropical storm fell on frozen ground; eighty-four Vermonters were killed. Tropical Storm Irene, which occurred on August 28, 2011 caused record flooding across the state, several deaths, and hundreds of millions of dollars of damage. Thetford was hit by an unusual storm on July 1st, 2017 that caused over 4 million dollars in damage to town roads alone.

Flood Hazard and River Corridor Areas

There are two sets of official maps that govern development in floodplains in Vermont: the Federal Emergency Management Agency's (FEMA) Flood Insurance Rate Maps (FIRMs) and the VT Agency of Natural Resource's river corridor area maps. The FIRMs show the floodplain calculated by FEMA that would be covered by water in the 100-year base flood. This area of inundation is called the Special Flood Hazard Area (SFHA). FIRMS are only prepared for larger streams and rivers.

A significant portion of flood damage in Vermont occurs outside of the FEMA mapped areas along smaller upland streams, as well as along roads that cannot drain the amount of water they are receiving. It should be noted that although small, mountainous streams may not be mapped by FEMA in NFIP FIRMs, flooding and fluvial erosion along these streams is possible, and should be expected and planned for. Flash flooding in these areas can be extremely erosive, damaging road infrastructure , streambeds and the sides of hills and mountains, creating landslide risk. The presence of undersized or blocked culverts can lead to further erosion and stream bank/mountainside undercutting.

The Vermont Agency of Natural Resources (ANR) river corridor maps show the areas that may be prone to flash flooding or erosion, which may be inside or outside of FEMA-mapped areas. In flash flooding, the associated erosion is a greater threat than inundation by floodwaters. Elevation or flood proofing may not be protective as erosion can undermine structures.

Flood Hazard Regulations

The Town of Thetford has a standalone Flood Hazard Area Bylaw. These regulations were adopted on July 14, 2008. The Town's Flood Hazard Area Bylaw sets standards for development in the Town's floodway and floodway fringe areas. Thus, all new residential and non-residential structures in the special flood hazard area are prohibited, except for liquid or gas storage tanks that serve an existing structure and are

adequately anchored. Exception is granted to accessory structures as described in Article VII Section 2.7 and farm structures covered by the Accepted Agricultural Practice Regulations.

In an effort to help protect structures and road infrastructure, it is important to restore floodplain, improve and/or increase the number of areas for retention of floodwaters to reduce the risk to structures and road infrastructure wherever possible.

PROMOTING FLOOD RESILIENCE: FLOOD HAZARD REGULATION AND NON REGULATORY APPROACHES

It will be important for the Thetford Planning Commission to update the Flood Hazard Area Zoning Bylaw as necessary to ensure that regulated protections remain current and that the bylaw continues to meet the minimum requirements of the NFIP.

It is important that Thetford continue to maintain and install appropriately designed culverts and ditches, to effectively channel heavy rain events to minimize damage from inundation and flash flooding.

GOALS, POLICIES AND RECOMMENDATIONS

Goals

1. Flood hazard areas that are maintained and enhanced as conservation areas, greenways, and non-commercial recreation and/or agricultural land.
2. No net loss of flood storage capacity of floodplains and upland forests.
3. Town infrastructure and buildings that are protected from the potential of flood damage.

Policies

1. It is the policy of the Town to use sound planning practices to address flood risks so that Thetford's citizens, property, economy, and the quality of the Town's rivers and waterways all remain protected.
2. It is the policy of the Town to design new culverts and bridges to, at a minimum, meet current VTrans Hydraulics Manual and ANR (VT Agency of Natural Resources) Stream Alteration Standards and size them appropriately to handle floods.

3. It is the policy of the Town to manage post-event recovery and reconstruction within river and stream areas according to the Vermont River Program's best practices to avoid negative impacts downstream.
4. It is the policy of the Town use all reasonable efforts to limit the extent of impervious land cover and to retain storm water on site.
5. It is the policy of the Town to protect and where possible restore floodplains and upland forests so they may retain and absorb floodwater.

Recommendations

1. The Town should work with VTrans and the Regional Planning Commission in advocating for and improving the flood capabilities of state or Town-owned transportation infrastructure.
2. The Town should continue developing flood mitigation plans, and emergency preparedness and recovery procedures.
3. The Town should continue to send a representative to regularly attend and participate in the region's Local Emergency Planning Committee.
4. The Town should continue to maintain and update town bridge and culvert inventories. This information should be used to develop a schedule to replace undersized culverts using up-to-date hydrological surveys based on current weather patterns.

CHAPTER VII: ENERGY

This energy chapter complies with the standards of enhanced energy planning, as required by 24 V.S.A. § 4382(a)(9) and § 4352. By adopting these standards and receiving a determination of compliance, the Town will receive "substantial deference" from the Public Utility Commission with respect to siting electric generation facilities in Thetford. It is the intent of this chapter to start Thetford on a path to cut carbon dioxide and other greenhouse gas emissions by switching to 90% renewable energy by 2050, as recommended by the state. Further standards will need to be defined, adopted, and implemented if Thetford wishes to cut its emissions by the UN IPCC goal of 45% by 2030.Energy use and generation play an important role in the environmental, economic, and social well-being of our community. The continued use of petroleum-based fuels is causing negative impacts on the environment and contributing to global climate change, which is already affecting our ecosystem, weather, and economy. There is a growing need to plan for energy conservation and a switch to renewable energy sources.

Quality of life for Thetford residents currently depends in large part on conveniently meeting our energy needs with fossil fuels that are not renewable and not produced in Vermont. Their supply is vulnerable to many kinds of interruptions. The Energy Action Network annual report states that 78% of money spent on fossil fuels is paid to out-of-state entities.[32]

The manner in which Thetford plans for future growth has an impact on energy use. Highly dispersed and unplanned development can waste both land and energy resources. By planning the location of jobs, public services, and housing in close proximity to village centers, the consumption of transportation fuel can be reduced. Thoughtful siting and design of buildings and the selection of highly efficient energy systems can reduce the energy needed by balancing concerns about impacts of development with the environmental impacts of our energy use.

The state of Vermont strongly recommends reducing reliance on fossil fuels by improving the energy efficiency of buildings, and utilizing in-state renewable energy

[32] Energy Action Network 2018 Annual Progress Report, p.12, footnote 5. https://www.eanvt.org/wp-content/uploads/2019/02/EAN-report-2018-highres-compressed.pdf

resources. The 2016 Vermont Comprehensive Energy Plan (CEP)[33] describes the state's energy future for electricity, thermal energy, transportation and land use. The CEP set a long-term statewide goal of obtaining 90% of Vermont's energy from renewable sources by 2050 and eliminating our reliance on fossil fuel. Expanding the statutory goal of 25% renewable by 2025 (10 V.S.A. § 580(a)), the CEP established the following set of goals:

- Reduce total energy consumption per capita by 15% by 2025, and by more than one third by 2050.
- Meet 25% of the remaining energy need from renewable sources by 2025, 40% by 2035, and 90% by 2050.
- Three end-use sector goals for 2025: 10 % renewable transportation, 30% renewable buildings, and 67% renewable electric power.

"Energy" as used in the CEP refers to all forms of energy used by people, and is commonly broken down into four sectors: commercial (running machinery, heating and lighting), residential (mainly heating and lighting), industrial (process energy such as smelting or concrete production), and transportation (mainly gasoline and diesel).

To effectively plan for the future, it is important that Thetford understand its current energy use and be able to set targets in order to reach municipal and, ultimately, the state's energy goals. This Energy chapter includes:

- Analysis of town resources, their availability and cost across all energy sectors
- Statements of policy on:
    - Conservation and efficient use of energy
    - Development and siting of renewable energy sources
    - Patterns of density and land use likely to result in the conservation of energy
    - Identification of potential areas for the development and siting of renewable energy resources and areas that are unsuitable for siting those resources

[33] 2016 Vermont Comprehensive Energy Plan: https://legislature.vermont.gov/assets/Legislative-Reports/Executive-summary-for-web.pdf

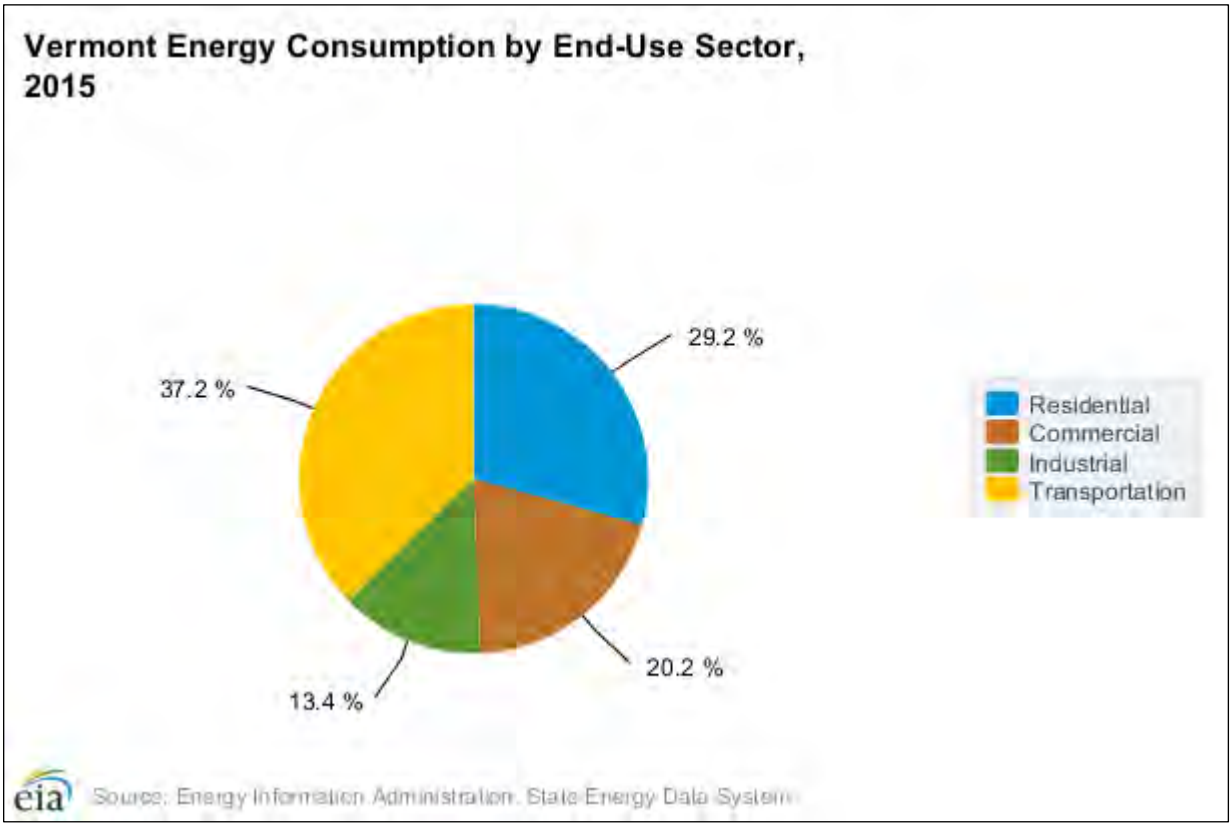
WHERE WE ARE

Municipal plans are required to have an energy planning element. Act 174 of 2016 established a new set of municipal and regional energy planning standards, which if met allow the resulting plans to carry greater weight in the siting of energy generation facilities. Towns and regions that adhere to the enhanced energy planning standards will receive substantial deference before the Public Utilities Commission with respect to both land conservation measures and specific policies included in their plans. This Energy Chapter has been written to meet the energy planning standards of Act 174 to achieve a Determination of Energy Compliance.

Most Thetford residents obtain electricity through a network of transmission lines sited along roads. Of note, Thetford has 3-Phase power lines along Route 113, US Route 5, and Route 244, as well as along some town roads, such as Academy Road, and on Meeting House Hill. There also exists a substation at the bottom of Route 113 in East Thetford just before the intersection with US Route 5.

Current Energy Demands

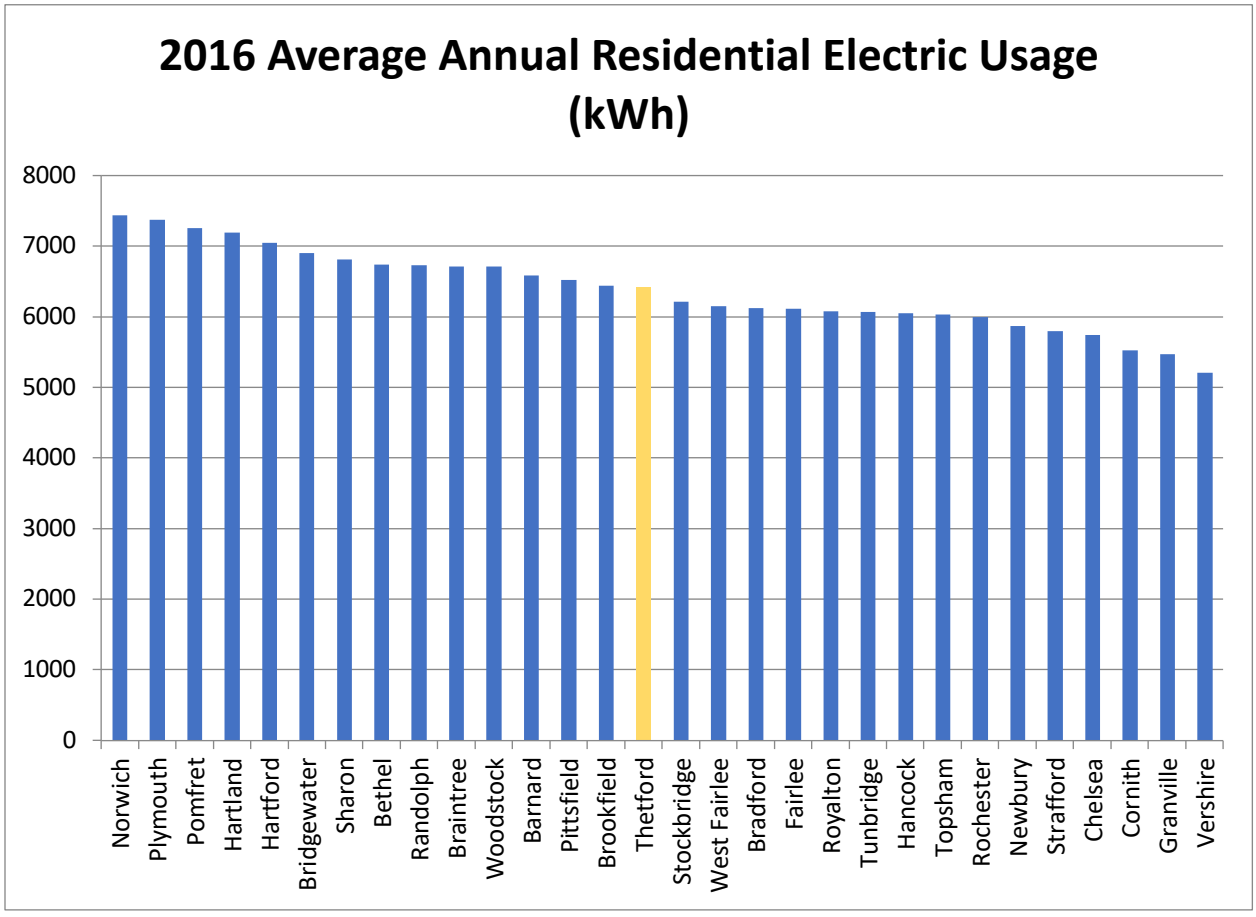
Figure 12: Vermont Energy Use by Sector, 2015



Source: US Energy Information Administration, 2015

Vermont's per capita energy consumption for residential and transportation purposes is typical of the rest of the US. Of the state's total energy use, 29% is accounted for by the residential sector, and of that almost 80% is dedicated to space heating and domestic hot water. The transportation sector uses 37% of the state's total energy use, with over 50% of the transportation energy used by private cars (as opposed to being used for public transit, road maintenance, or other public purposes). The remaining 34% of state energy usage is taken by the commercial and industrial sectors.

Figure 13: Average Annual Residential Energy Use (kWh) in Two Rivers-Ottauquechee region, 2016



Source: Efficiency Vermont

According to data on average annual residential electric energy use collected by Efficiency Vermont in 2016, the Town of Thetford ranks fifteenth among 30 towns in the Two Rivers-Ottauquechee region. In 2016, Thetford used an average of 6,402 kWh (6.402MWh) per residence.

The data in this section provide estimates of Thetford's current energy use in transportation, heating and electric sectors.

Figure 14: 2017 Transportation Energy Use (Calculated)

Transportation Data	Municipal Data
Total # of Vehicles (ACS 2013-2017)	2,200
Average Miles per Vehicle (fhwa.got.gov)	13,228
Total Miles Traveled	29,101,600
Realized MPG (VTrans Transportation Energy Profile 2017)	18.9
Total Gallons Use per Year	1,539,767
Transportation BTUs (Billion)	88
Average Cost per Gallon of Gasoline (eia.gov)	2.31
Gasoline Cost per Year	3,556,862

Source: American Community Survey (ACS) and Vermont Agency of Transportation (VTrans)

The highest percentages of Thetford residents use fuel oil (47.6%) or propane (28.2%) to heat their homes.

Figure 15: Estimated Municipal Residential Heating Energy Use

Fuel Source	Municipal Households (ACS 2013-2017)	Municipal % of Households	Annual BTUs for heating	Municipal BTU (in Billions)
Natural Gas	10	0.9%	1,195,200,000	1.2
Propane	426	36.8%	45,881,280,000	45.9
Electricity	39	3.4%	4,004,640,000	4.0
Fuel Oil	457	39.5%	53,580,960,000	53.6
Coal	13	1.1%	1,553,760,000	1.6
Wood	184	15.9%	21,991,680,000	22.0
Solar	0	0.0%	0	0
Other	29	2.5%	2,426,400,000	2.4
No Fuel	0	0.0%	0	0
Total	1158	100.0%	130,633,920,000	130.6

Source: American Community Survey (ACS)

Figure 16: Estimated Current Commercial Energy Use in Municipality

Commercial Establishments in Municipality (VT DOL)	Estimated Thermal Energy BTUs per Commercial Establishment (in Billions) (VT Dept. of Public Service)	Estimated Thermal Energy BTUs by Commercial Establishments in Municipality (in Billions)
58	0.725	42

Sources: Vermont Department of Labor (VT DOL), Vermont Department of Public Service (DPS)

Figure 17: Current Electricity Use in the Municipality

Sector	2015	2016	2017
Commercial & Industrial (MWh)	3,880	3,890	4,280
Residential (MWh)	8,861	8,624	8,681
Total	12,741	12,514	12,961
Count of Residential Premises	1,337	1,347	1,350
Average Residential Usage	6.628	6.402	6.426

Source: Efficiency Vermont (EVT)

Current Energy Sources

NON-RENEWABLE SOURCES

Fossil Fuels—Thetford, like Vermont as a whole, depends primarily on fossil fuels which account for more than 50% of all energy consumed in Vermont, most of which is used in transportation.

Nuclear Energy—As of July 2015, Vermont's largest utility receives 9% of its mix from nuclear-generated power from Seabrook, NH.

RENEWABLE SOURCES

The CEP goals are 25% renewably sourced energy by 2025, 40% by 2035, and 90% by 2050. The term "renewable energy" refers to energy supplied by sources that are naturally and continually replenished, such as wind, solar, geothermal (using the earth's heat to create power and heat), hydropower, and various forms of biomass (trees, crops, manure, etc.). Although initial setup costs for renewable energy generation systems can be high, these systems can save users money over the long term, and they reduce the consumption of carbon-based fuels, helping to protect our environment, keep more dollars in the state, and reduce our reliance on centralized, out-of-state energy. In Vermont, some of these energy sources are more readily available than others and some are cost effective for the individual energy producer. The types of renewable energy found in Vermont are solar, wind, biomass, and hydro.

Solar Energy—Solar energy can provide clean, reliable, and safe energy, even in Vermont's climate. Most areas in Vermont have the potential for some solar energy production, at least at the residential scale. State statute forbids land use regulations that prohibit renewable energy generation.

Solar Electricity Generation: The cost of installing solar electricity generation has decreased sharply in the last five years. In 2013, Thetford Elementary School installed a

120kW solar array; the first large-scale solar electric generation facility in Thetford. In 2018, The Town of Thetford became an off-taker of the Thetford-Strafford Community Solar LLC, a 148kW group net-metered array. As of February 2019, there are 3 arrays of 148-150kW in Thetford and none larger than 150kW.

Prior to 2014, there were 19 net-metered solar photovoltaic sites in Thetford shown on the Renewable Energy Atlas of Vermont (2013), collecting 62.93kW (81.8MWh). In the spring of 2014, Thetford and Strafford joined the Upper Valley Vital Communities Solarize project, aiming to double the number of their residential solar installations. As of 2015, after the community's Solarize efforts, there were 59 sites. According to the vtenergydashboard.org, as of February 2019 there were 174 solar sites in Thetford, capable of producing 2,020 MWh: 151 of these were photovoltaic sites, capable of producing 2,015 MWh, and 23 were solar hot water systems in town, producing 1.82 MMBTUs (equivalent to 5.33 MWh).

If all potential opportunities to develop solar energy production were utilized, Thetford could generate roughly 981,500MWh.

As of July 2015, Vermont law allows homeowners to use net metering grid-tied connections. Net metering allows users to feed electricity from a PV array back into the grid and get a credit on their electric bills providing an incentive for solar installation. Group net metered installations allow homeowners to pool their assets to initiate a project.

Passive Solar Heating And Lighting: Thetford can promote passive solar heating and lighting by drafting the Zoning Bylaw and Subdivision Regulations to encourage the appropriate placement of buildings and landscaping, and energy-saving building design that equals or exceeds the State Energy Code minimums.

Solar Hot Water: The vtenergydashboard.org, lists 23 solar hot water sites in Thetford as of February 2019.

Wind Energy—Thetford is a poor location for wind energy generation. Potato Hill is the only site recommended for wind and it is a long distance from power lines.

Biomass & Biogas Energy—"Biomass" refers to biologically-based feedstock (algae, food or vegetable wastes, grass, wood, methane, and much more). Biomass can be converted into an energy source to fuel vehicles, heat homes, and generate electricity.

Commercial biomass energy generation facilities should be located close to available biofuels, transportation hubs, and potential consumers to reduce costs. A biomass

power plant requires a great deal of space to accommodate the various stages of storage and conversion of the mass into fuel before burning it to produce heat or electricity. Smaller scaled facilities that produce hot water only can be set up as “heating districts” and serve multiple closely grouped consumers, encouraging high density village development. Vermont’s Clean Energy Development Fund (CEDF) program budget provides incentives for heating that might be considered a biomass project.

In 2014-2015, Vermont households using wood for primary heating consumed about 4.8 cords on average, while those using wood as a supplementary source used 2.1 cords. Vermont households using wood pellets as a primary-heat-source consumed 4.4 tons per household, while supplementary-heat-source consumers burned 3.3 tons for the season. These numbers show that since 2011 Vermonters have been using less cordwood and more pellets for wood heat. Vermonters can exchange old, in-use and non EPA-certified wood stoves for clean, efficient, EPA-qualified cordwood and pellet stoves through a CEDF change-out program.

Thetford is largely forested and contains enough forested land to produce sufficient fuel wood for those who continue to heat their homes with wood. It may be possible that, with proper planning and management, this can be done on a sustainable basis.

Biofuels: The use of biofuels, particularly “biodiesel,” is an increasingly popular option for municipalities to cut costs and reduce the environmental impact of vehicle emissions. The Vermont Biofuels Association defines biodiesel as a clean burning alternative fuel, produced from domestic, renewable resources such as soybeans, sunflowers, canola, waste cooking oil, or animal fats. Biodiesel can be blended with petroleum diesel to create a biodiesel blend, which is often used in colder weather. It can be used in compression-ignition (diesel) engines, oil-fired boilers, or furnaces with little or no modifications. Growing biomass feedstock may be a viable way to encourage farming in Thetford; however, prime agricultural land should be maintained to allow conversion to food production should the need arise.

Biogas (Cow Power): Methane digestion, where the methane from manure is used to power a turbine, is another way farms could generate power. Burning methane for energy then removes this very potent greenhouse gas from the environment. However, these facilities have only been effective in the US when utilized by large scale farming. Green Mountain Dairy is a 950-head Vermont dairy farm that produces 300 kW of power, enough to serve 350 homes. European advances in biomass energy production

on small farms might be applicable to local projects, but biogas generation would require careful examination and permitting before being used in Thetford[34].

Hydropower—Thetford Center, Post Mills, Rice's Mills, and several other locations in Thetford became thriving communities based on hydropower to run mills and even generate electricity. These small-scale hydro facilities have been retired, and Thetford's hydroelectricity now comes from massive facilities such as Hydro Quebec. Electricity is not commercially produced by hydropower in Thetford. While there is potential for small generation projects at Union Village (600-1500kW), Thetford Center (350kW), Post Mills, and Rice's Mills (100kW), and the outlet dam of Lake Fairlee (50kW), there are significant cultural, environment, and regulatory impediments to developing these sites.

Hydropower generating facilities are regulated by the Federal Energy Regulatory Commission and stringent federal water quality standards. As a result, the regulatory process for hydro facilities is extensive and time consuming. Streams are public trust resources and the potential impacts of hydro projects warrant significant consideration.

Given the above methods of renewable generation and existing generation sources, there is no scarcity of energy to meet our needs. While not currently in place, there also appears to be no lack of renewable energy sources that could power our future demands.

ENERGY GOALS AND GENERATION POTENTIAL

The Vermont legislature has established targets for 2025, 2035, and 2050 for conservation and efficiency in the thermal and electric energy sectors. The targets encourage use of renewable energy for transportation, heating, and electricity and for the conversion to alternative heating fuels such as electric heat pumps and efficient wood heating systems.

The following figure displays targets for thermal efficiency for residential and commercial structures based on methods developed by DPS using data available from the regional Long-range Energy Alternatives Planning (LEAP) analysis and ACS. The target percentages in this figure represent the percentage of municipal households that will need to be weatherized in the target years. Making improvements to buildings' heating and cooling systems can decrease fuel consumption and lead to long-term

[34] One of the key advantages to methane digestion is that it reduces the amount of methane released into the environment. Methane is approximately 86 times more potent as a greenhouse gas than carbon dioxide over a 20-year time scale.

savings. The 2013-2017 ACS census data indicates there are 1,343 occupied housing units in Thetford and 511 "companies" in Thetford. Many of these "companies" are run out of home offices. Extrapolating from ACS census data, a target of 33% of current Thetford homes would be 443 homes, and 67% would be 900 homes.

Figure 18: Heating Efficiency Targets

	2025	2035	2050
Residential - Increased Efficiency and Conservation (% of municipal households to be weatherized)	33%	67%	100%
Commercial - Increased Efficiency and Conservation (% of commercial establishments to be weatherized)	6%	9%	18%

Sources: Vermont Department of Public Service (DPS), Long-range Energy Alternatives Planning (LEAP), American Community Survey (ACS)

To meet the overall targets above, residents will have to convert to more efficient technologies, such as efficient wood heat and heat pumps. Targets listed in the following table were calculated using data from LEAP and ACS. This table also provides a target for new efficient wood heating systems for residential and commercial structures in the municipality for each target year. The LEAP model predicts a large decrease in wood use resulting in a negative number for targets. However, the ACS census data for 2013-2017 notes there are 184 Thetford homes that primarily heat with wood. The target of 165 efficient wood heat systems by 2050 reflects the goal of switching away from wood heat to efficient wood heat or heat pumps.

This table also provides a target for using heat pump systems for residential and commercial structures in the municipality for each target year.

Figure 19: Heating Fuel Switching Targets

	2025	2035	2050
New Efficient Wood Heat Systems (in units)	31	82	165
New Heat Pumps (in units)	114	301	633

Source: Vermont Department of Public Service (DPS), Long-range Energy Alternatives Planning (LEAP), American Community Survey (ACS)

The following figures display targets for increased electricity efficiency and conservation, targets for the percentage of transportation energy use coming from renewable sources, and targets for the percentage of heating energy use coming from renewable sources.

Figure 20: Electricity Efficiency Targets

	2025	2035	2050
Increase Efficiency and Conservation	-0.6%	5.7%	9.9%

Source: Long-range Energy Alternatives Planning (LEAP), American Community Survey (ACS)

Figure 21: Renewables – Transportation Goals

	2025	2035	2050
Renewable Energy Use - Transportation	9.6%	23.1%	90.3%

Source: Long-range Energy Alternatives Planning (LEAP), American Community Survey (ACS)

Figure 22: Renewables – Heating Goals

	2025	2035	2050
Renewable Energy Use - Heating	50.3%	62.6%	92.6%

Source: Long-range Energy Alternatives Planning (LEAP), American Community Survey (ACS)

The following figure displays the target for electricity generation coming from renewable sources within the municipality for 2050.

Figure 23: Renewable Generation Goals - Electricity

	2050
Renewable Energy Generation – Electricity (MWh)	14,530 - 17,759

Source: Vermont Department of Public Service (DPS)

The following figure establishes targets for transitioning vehicles to electric and biodiesel fuel sources. The rural nature of our region leads to longer commutes for work, shopping and services. This impacts the number of vehicle miles traveled that directly relates to how much fossil fuel is being burned to power all the cars in the region. The transportation sector is responsible for 37% of the total energy consumed in Vermont, powered mostly from gasoline (76%) and diesel (20%). To reach local, regional and statewide renewable energy goals, residents will need to shift away from petroleum-powered vehicles to electricity and biofuels.

Figure 24: Transportation Switching Goals

	2025	2035	2050
Electric Vehicles	187	1,323	2,751
Biodiesel Vehicles	328	618	1,042

Source: Two Rivers-Ottauquechee Regional Planning Commission, "Municipal Template - Energy Data for Town of Thetford, 4/28/2017, p.5, Worksheet 2.

The following figure shows existing renewable generation in Thetford, in MW and MWh, as of December 2018.

Figure 25: Existing Renewable Generation

	MW	MWh
Solar	1.55	1,859
Wind	0.00	0
Hydro	0.00	0
Biomass	0.00	0
Other	0.00	0
Total Existing Generation	1.55	1,859

Source: Vermont Department of Public Service (DPS)

The following figure shows renewable generation potential, based on mapping completed by the regional planning commission that is based on the Municipal Determination Standards and associated guidance documents developed by DPS.

Figure 26: Renewable Generation Potential

	MW	MWh
Rooftop Solar	1	1,734
Ground-mounted Solar	754	924,552
Wind	20	60,554
Hydro	1	2,344
Biomass and Methane	0	0
Other	0	0
Total Renewable Generation Potential	776	989,184

Source: Vermont Department of Public Service (DPS)

The following figure shows the renewable generation target for Thetford, based on Thetford's population percentage within the region.

Figure 27: Renewable Generation Goals

	2050
Total Renewable Generation Target (in MWh)	14,530-17,759

Source: Vermont Department of Public Service (DPS)

The following figure shows there is sufficient land in Thetford to meet the renewable generation targets based on the renewable generation potential in Thetford (see Figure 26).

Figure 28: Sufficient Land to Meet Generation Goals?

Renewable Sources Available	Yes
Surplus of Generation	6027%

Source: Vermont Department of Public Service Municipal Determination Standards

DECREASING ENERGY NEED

There are a number of ways that Thetford can meet its energy demand locally, first by lowering that demand, and then by working to meet the remaining need with local, renewable energy resources.

Changing Behavior

Raising awareness about wasteful energy behaviors and energy saving behaviors reduces the demand for existing energy resources, helps residents, businesses and the Town save money, and makes the town a more affordable place to live.

Examples include:

- Turning off lights when you leave a room.
- Using a programmable thermostat.
- Using a clothesline to dry clothes.
- Using cold water for laundry.
- Using a smart power strip or unplugging appliances when not in use.
- Combining errands to make fewer car trips.
- Driving 60mph on the interstate.
- The recent adoption by the Town of the Green Fleet Policy that sets guidelines to minimize emissions and reduce short and long-term costs of maintaining and operating Town-owned vehicles.

Implementing Energy Efficiency

Current state building codes set the minimum standard for energy efficiency. Greater energy savings above the minimum standard should be encouraged by implementing the following:

1. Insulate with high R-value (or heat flow resistance) material
2. Seal gaps, holes and air penetrations through the walls, ceilings and floors
3. Use high efficiency windows
4. Install energy efficient refrigerators, freezers, front loading washing machines, moisture sensing driers, and other appliances. Use high efficiency lighting (LED)
5. Use high-efficiency ground or air source heat pumps for heating and cooling

6. and solar hot water heaters
7. Site buildings to make use of existing wind blocks and natural cooling patterns derived from the landscape's topography
8. Site buildings with maximum southern exposure to capture passive solar energy

Building programs like net zero and passive buildings can achieve up to 80% or more energy savings above the minimum standard and should be encouraged. Net zero buildings have all their consumption needs met through renewable energy systems and energy efficiencies. A passive building is designed with such attention to energy efficiency and solar orientation that the heating, cooling and electric needs, and the air infiltration rates fall below standards set by the Passivhaus standard based on the local climate data.

Programs Supporting Energy Efficiency

The Vital Communities Upper Valley Green Real Estate Network Program:

- Resale value of home with certificate of compliance with RBES
- Affordable loans for energy efficient building – homes and additions
- VSECU—a leader in financing for energy improvements and construction
- Work to educate real estate agents
- Identify servicers of heating systems who are knowledgeable about the new technologies

COVER Home Repair – Weatherization Program

- Window Kits
- Door seals
- Water and heating system insulation
- Furnace cleaning
- LED light bulbs
- Smoke detectors

Capstone's Free Income-Qualifying Weatherization Program:

- Decrease a home's energy consumption

- Reduce a client's carbon footprint
- Save a household money
- Show homeowners how they can save energy
- Increase comfort
- Increase property value

Efficiency Vermont Income-based Assistance

- Bill payment assistance
- Energy bill reduction
- Mobile home replacement

Home Performance with Energy Star Weatherization Incentives – not income based

LOCAL PATHWAYS TO ACHIEVE ENERGY GOALS

The 2016 CEP established a goal of meeting 90% of the state's energy needs through renewable sources by 2050. Reaching the goal requires the consideration of the following:

- Finance & Funding
- Innovation and Expertise
- Outreach and Education
- Regulatory Policies and Structures

Meeting this goal requires limiting reliance on fossil fuels, enhancing efficiency and increasing use of clean, renewable sources for electricity, heating and transportation. The enhanced energy planning targets are primarily set for in-town generation and end uses. This is one facet of the state meeting its renewable energy goals .The transition from fossil fuel to electric energy for transportation and space-heating needs will increase usage of electricity in more areas, but increased efficiency and conservation measures actually are expected to result in a relatively flat overall electric demand in the long term. Vermont electric utilities will continue to diversify their portfolios with mixes of renewable energy through in-state and out-of-state sources, to increase total renewable generation in the state's electrical power mix to at least 75% by 2032. Green Mountain Power, the electric utility for Thetford, is 63% renewable now and committed

to being 100% renewable by 2023, well in advance of the state goal The primary purpose of the analysis and data section is to provide a framework to support the local pathways towards meeting statewide goals identified in the Comprehensive Energy Plan.

Permitting Considerations

Energy generation in Vermont is subject to a number of different permitting requirements, most of which are limited to state level permitting. On the municipal level, state statute protects residential renewable energy generation systems from regulations that will completely prohibit their development.

Vermont Section 248 (30 VSA §248) requires energy, gas, telecom and water developers to obtain a Certificate of Public Good (CPG) from the Public Utilities Commission. The PUC considers ten criteria, including environmental criteria from Act 250, and need, reliability, economic benefit, and the public good before issuing a CPG.

Act 174 of 2016, the Energy Development Improvement Act, provides that municipalities and regions which plan according to the enhanced standard envisioned by the Act will receive *substantial deference* before the Public Utilities Commission with respect to both land conservation measures and specific policies included in their plans, when the Board looks at the orderly development criterion. Plan language that is advisory ("should" statements) are advisory only, and mandatory language is needed for the PUC to take town policies as strict.

Substantial deference as defined by Act 174, and used in the Section 248 process, provides towns and regions a strong voice in determining where energy projects should, and should not, be sited. The Act defines substantial deference as: "a land conservation measure or specific policy shall be applied in accordance with its terms unless there is a clear and convincing demonstration that other factors affecting the general good of the State outweigh the application of the measure or policy." Municipalities and regions that do not have enhanced plans continue to receive *due consideration* for those plans.

Regardless of plans, new residential development in the State of Vermont is required to comply with Vermont Residential Building Energy Standard (RBES). Commercial development is subject to similar code regulations. Development, which is required to meet the RBES includes:

1. Detached one- and two-family dwellings
2. Multi-family and other residential buildings three stories or fewer in height
3. Additions, alterations, renovations, and repairs (newly renovated parts only)

4. Factory-built modular homes (not including mobile homes)
5. If a home required to meet the RBES does not comply, a homeowner may seek damages in court.

Municipal Role In Energy Efficiency

THETFORD ENERGY COMMITTEE

The Thetford Energy Committee (TEC) is a volunteer group appointed by the Selectboard for the purpose of establishing and implementing the Town's energy goals and advising the Selectboard and Planning Commission on all things energy-related. Thetford's Energy Committee is very active; their work includes facilitating energy audits on municipal buildings and tracking energy use for these buildings, creating educational opportunities on transportation and home weatherization, promoting home weatherization programs and assistance, energy conservation and renewable energy – both for residential and community solar – and working with the Planning Commission on this chapter of the Town Plan.

AUDITING MUNICIPALLY OWNED BUILDINGS

Thetford owns buildings that are old and inefficient. They have insufficient insulation and thermal bridging, wasteful heating and cooling systems, high infiltration rates, and out-of-date lighting. These infrastructure problems result in high energy cost that is passed onto taxpayers. Audits on Town buildings help determine what improvements are necessary, and which projects have the highest cost-benefit ratio in terms of energy and financial savings.

The Energy Committee has done the audits of town buildings including:

- Town Hall
- Rice's Mills Community Building
- Thetford Center Community Building
- Town garage (DPW)
- Bicentennial Building

Energy efficiency improvements were done on these buildings over a number of years.

Policy Implications

LAND USE

Vermont's land use development goals center on the desire "To plan development so as to maintain the historic settlement pattern of compact village and urban centers separated by rural countryside." (24 VSA §4302 (c)(1)) The statute also includes provisions (7) "To make efficient use of energy, provide for the development of renewable energy resources, and reduce emissions of greenhouse gases. (A) General strategies for achieving these goals include increasing the energy efficiency of new and existing buildings; identifying areas suitable for renewable energy generation; encouraging the use and development of renewable or lower emission energy sources for electricity, heat, and transportation; and reducing transportation energy demand and single occupancy vehicle use."

The Vermont Municipal and Regional Planning and Development Act (24 V.S.A. Ch.117) does not allow communities to impose land use regulation that prohibits or has the effect of prohibiting the installation of solar collectors or other renewable energy devices. The statute does enable Vermont's municipalities to adopt regulatory bylaws, such as zoning and subdivision regulations, for implementing the energy provisions contained in their town plan.

Zoning bylaws control the type and density of development. For example, Thetford's Zoning Bylaw contains provisions for planned unit developments (PUDs). PUDs are a grouping of mixed use or residential structures, pre-planned and developed on a single parcel of land. The setback frontage and density requirements of the PUD may be varied, to allow creative and energy efficient design (i.e., east-west orientation of roads to encourage southern exposure of structures, solar access protection, use of land forms or vegetation for windbreaks, and attached structures), and to encourage the construction of energy efficient buildings.

Subdivision regulations are one of the most effective tools for encouraging energy efficiency and conservation. Subdivision regulations, like PUDs, involve Town review through the Development Review Board in the design process. Because subdivision regulations govern the creation of new building lots, as well as the provision of access and other facilities and services to those lots, a community can impose requirements that a developer site their building to maximize solar gain. Likewise, subdivision can require that landscaping be utilized to reduce thermal loss.

TRANSPORTATION

It is important that communities recognize the clear connection between land use patterns, transportation, and energy use. Most communities encourage the development of residences in rural areas, and these are coveted locations because of the aesthetics that make Vermont special. However, this rural development requires most of our population to drive to reach schools, work, and services.

Transportation and road maintenance are a substantial portion of local energy use, therefore it is in the interest of the community to encourage any new developments that are proposed in town to locate adjacent to existing roads that can handle the size and volume of vehicles needed. Most transportation throughout the town of Thetford is by private vehicle.

Electric Vehicle (EV) charging stations would ideally be located in places where people park for up to 2 hours; i.e., where they go to do business, for entertainment, or for recreation. This allows more vehicles to use the station per day. Thetford's park and ride is not a prime place, as only one car will be able to use the spot during the day. Multiple level 1 charging stations may be useful at the park and ride. A level 2 charging station in East Thetford is more likely to be used by someone traveling the I-91 corridor in a long range EV.

There are three buses that serve Thetford students (both Thetford Elementary School and Thetford Academy), which are operated by First Student. In addition, Thetford Academy contracts with Butler for a southern route (which brings students from Hartland, Strafford and Sharon), and a northern route (Waits River and Lyme). Butler also transports Thetford Academy students to and from the tech centers in Bradford and Oxbow. Thetford Academy owns a van that seats seven and is used when the international students go to Boston, for instance. .

A transit bus line serves the Town of Thetford on its River Route, which travels between Wells River, VT and White River Junction, VT. Except for one morning bus, the bus picks up Thetford riders at the Thetford park and ride by request only, made 24 hours in advance.

ENERGY ASSURANCE PLANNING COSTS AND PROBLEMS

We need energy. As seen above, there is plenty of energy available, but will it be the kind we need? One of the problems with relying on fossil fuels is that their availability and price is largely beyond our control. If the costs of petroleum were to double, Thetford would be challenged to continue offering services and taxpayers would be forced to

absorb those rising costs. Our citizens would also be hit with the increased costs for food, heat, and transportation. This, coupled with the impact such fuel cost price changes would have on the private sector, could spell disaster for any part of the United States. Transitioning to renewable energy will depend not just on the technology and energy being available, but being available at a cost we can afford.

The other main problem ahead in meeting our energy goals is speed and scale. Our energy goals for transportation compared to the current situation appear staggering. For example, we currently have a few dozen all electric vehicles (EVs) in town (the exact amount is not known). Figure 24 shows that should jump to 187 in five years and then to 1,323 ten years after that. We do not produce electric cars in town, and are reliant on them being produced at a price that we can afford. What we can do is make sure that the need for cars in general is less and that charging stations help support the use of EVs.

Additional concerns lie in our ability to maintain our existing energy distribution systems in the event of a severe hazard event. The State of Vermont has seen an increase in the number of declared disasters over the past decade. In 2011, Tropical Storm Irene isolated a number of communities, keeping them from available fuel sources.

GOALS, POLICIES, AND RECOMMENDATIONS

Goal

1. A sustainable energy future that minimizes environmental impact, supports our local economy, emphasizes energy conservation and efficiency, and increases use of local and regional renewable energy sources.

Policies

General Energy Conservation Considerations

It is the policy of the Town to:

1. Encourage a pattern of settlement and land use that uses energy efficiently.
2. Promote the construction of energy efficient homes and buildings.
3. Coordinate land-use and transportation planning that promotes energy efficient transportation, both private and public.
4. Encourage the development of renewable energy generation that is sustainable and protects our natural and rural landscape.

5. Support public and private partnerships that will ensure the affordable, reliable, and sustainable production and delivery of electrical power to the region.
6. Consider the solar potential and building efficiency standards in any new Town construction.
7. Encourage the location of major public and private development in or near the village centers.
8. Support the development of broadband services to encourage home business and minimize commuting.
9. Encourage increased sustainable fuel-wood production through improved forest management.

Transitioning to sustainable transportation models

10. Track, report, and reduce greenhouse gas emissions from the Town's vehicle fleet.
11. Encourage the transition to electric vehicles and the placement of EV charging stations.
12. Consider fuel efficiency for replacement Town vehicles and be alert to the development of new, efficient fuels for Town trucks.
13. Encourage public transportation, ride sharing, or other energy-efficient alternative transportation.

Residential and Commercial Development

14. Only encourage dense residential developments within or adjacent to existing village centers or developed as part of a Planned Unit Development or other approved growth area.
15. Only encourage commercial development that requires trucking and freight handling should only occur on roads that can effectively handle the size of vehicle needed.
16. Discourage energy-inefficient road expansion.

Fuel and Electricity Disruption issues

17. Encourage planning that is designed to mitigate energy supply disruptions and enable a timely response.

18. Specifically address fuel and electricity shortages with a clear set of energy conservation measures in Thetford's Municipal Hazard Mitigation Plan.
19. Inform energy assurance planning, assess impacts to the local supply and distribution system in the event of a fuel shortage.
20. Design a fuel allocation program to ensure available fuel distribution to priority locations during emergencies.
21. Assess the feasibility of using battery or other electric storage technology for our designated emergency shelter to prepare for electric disruption or shortages.

Recommendations

Keeping Current

1. The Town should participate in the Public Utilities Commission's review of new and expanded generation and transmission facilities to ensure that Thetford's energy, resource conservation, and development objectives are met.
2. The Town should work toward receiving a Determination of Energy Compliance for enhanced energy planning, in accordance with Act 174.

Work collaboratively

3. The Town should coordinate energy initiatives with Thetford schools through an advisory Joint Energy Committee.
4. The Town shall coordinate energy initiatives with neighboring towns and the region, for instance through the services of an Intermunicipal Regional Energy Coordinator.

Energy Disruption

5. The Town should develop local emergency contingency plans that ensure access to critical energy supplies and measures to reduce nonessential energy consumption in the event of an abrupt energy shortage.

Energy Efficiency

6. The Town should support statewide programs designed to make energy efficiency improvements more affordable and more likely to be implemented.
7. The Town should continue to inform homeowners of resources available to them for energy efficiency improvements.

8. The Town should construct all new municipal buildings according to standards of energy efficiency that meet or exceed state building energy standards, with the objectives of constructing facilities that result in no net greenhouse gas emissions.
9. The Town shall review and adopt zoning bylaws and subdivision regulations to promote energy-efficient building and site design, and to reduce or eliminate greenhouse gas emissions and/or fossil fuel infrastructure.
10. The Town should take steps toward making the town garage building more efficient, including methods such as weatherization and the use of solar panels.
11. The Town should explore the viability of enforcing the Vermont Residential Building Energy Standards.
12. The Town should advocate for creative solutions for statewide systems (policy, process, administrative mechanisms) to support the Town to expand weatherization programs.
13. If the Town reaches the threshold of municipal water and sewer in any village, the Town should encourage developers to consider shared hot water/heat generation as well.
14. The Energy Committee should form a volunteer committee to help people access existing weatherization resources as they become available.
15. The Energy Committee should advocate for training local volunteers to help install cost-effective weatherization measures in income-qualifying homes with help from COVER and Capstone.
16. The Energy Committee should explore whether regional adult education could offer weatherization training and education on targeting transition points (when systems need replacement, when occupants are aging, when to switch to heat pumps).
17. The Energy Committee should support the training of local tradespeople in order to increase their skill sets and ability to do cost effective projects in homes. This trained labor force would then be able to help homeowners weatherize incrementally.
18. The Energy Committee should work with retailers of heating systems and services to add alternative heating sources to their mix.

19. The Energy Committee should review previous audits of town buildings and identify additional energy saving opportunities.
20. The Energy Committee should work with Thetford Elementary School and Thetford Academy to support weatherization of these town-supported buildings.

Transportation

21. The Town should promote and implement strategies to encourage ride sharing, public transit, bicycling, and walking.
22. The Town should promote the development and use of a system of trails, greenways, sidewalks, bicycle paths, and commuter lots as viable transportation options and pursue federal and state funding for their construction, particularly during road improvement or expansion decisions.
23. The Town should lobby the State for full shoulders to serve as sidewalks and bike lanes in the State Right-of-Way in the village centers of Thetford.
24. The Energy Committee should survey residents to find out which locations in town are the most common biking destinations, as a way to determine where to place bike racks.
25. The Town should review and adopt zoning regulations that support development of mixed-use growth centers containing daily services to residents as a way to reduce transportation needs.
26. The Town should encourage the School Board to investigate electric buses.
27. The Energy Committee should identify locations for EV charging stations within walking distance to businesses.
28. The Energy Committee should engage with Thetford businesses that have fleets of vehicles and provide them with information about EVs and biodiesel.
29. The Town should continue to buy fuel in bulk delivery at the Town Garage and look for opportunities to switch to more efficient biodiesel.
30. The Town should incorporate life-cycle analysis into the Town's Capital Budget planning, and use life-cycle analysis to evaluate decisions concerning the purchases of any Town equipment, vehicles, or other items requiring energy consumption.

31. Since Thetford lacks the population density to make mass transit viable, the Energy Committee should convene the Thetford Elder Network and others to explore the options for providing public transit in town, such as shared electric transit vans and employing a town driver.

Development

32. Future commercial solar facilities should be developed in ways that avoid undue adverse impacts on the rural character of the areas in which they are proposed to be located.

33. Developers shall make reasonable efforts to minimize damage to important natural areas including those identified in the Natural Resources chapter of this Plan.

34. The Town should encourage builders and developers to employ energy efficiency building techniques, including net zero.

Siting Recommendations (By state law these recommendations apply to arrays over 15kW.)

35. Preferred Locations: The Town supports the placement of new generation and transmission facilities in the following areas:

    a. Rooftop

    b. Ground mounted systems not visible in the growing season from class three roads and bigger, or in view sheds -- including on superfund sites (provided development will not compromise or interfere with the remediation action on the site and the site is suitable for development of the facility); mines; sanitary landfills and brown fields as certified by ANR; disturbed portions of quarries or gravel pits, or other similar mineral resource extraction sites even where reclaimed; or a site that was previously covered by a structure or impervious cover.

    c. Sites that currently have an array 100kW or larger.

    d. Parking lots – paved or gravel – may be covered by a canopy array that is consistent with local architecture.

    e. Additionally, the Town, by joint letter of the Planning Commission (in consultation with the Conservation Commission) and Selectboard, may designate a site as preferred.

f. When considering proposals to reclassify a primary agricultural site as preferred, the following shall apply:

i. Primary agricultural lands not in agricultural use may be designated as preferred sites if they will be used for removable solar installations. A “removable installation” is defined as a system with no below-grade concrete foundations. “Not in agricultural use” shall be defined as land not used for agriculture in the last five years, including peripheral and barnyard areas.

ii. Primary agricultural lands currently used for agriculture can be designated as preferred sites only if the system design meets the following requirements:

1. The Solar Generation Unit will not interfere with the continued use of the land beneath the canopy for agricultural purposes.

2. Or the Solar Generation Unit is a raised structure allowing for continuous growth of crops underneath the solar photovoltaic modules, with height enough for labor and/or machinery as it relates to tilling, cultivating, soil amendments, harvesting, etc. and/or for animal husbandry activities such as grazing animals and beekeeping.

g. A specific location designated in a duly adopted municipal plan for the siting of a renewable energy facility.

36. Additional guidelines for siting:

a. Natural Resource Protection: New generation and transmission facilities must be sited to avoid the fragmentation of, and undue adverse impacts to, the town’s working landscape, including large undeveloped forest blocks and habitat connectors, open farm land, and primary agricultural soils mapped by the U.S. Natural Resource Conservation Service.

b. Protection of Wildlife: Among the measures taken by designers to identify and avoid undue adverse impacts on natural resources in the project area, reasonable steps shall be taken to minimize the effects of the project on natural communities; wildlife residing in the area and their migratory routes; the impacts of human activities at or near habitat areas; and any

loss of vegetative cover or food sources for critical habitats (see maps: Natural Resources; Wildlife, Plant and Natural Community Resources; Forest Blocks and Connectivity Resources, in Appendix).

c. Site Selection: Site selection is not limited to generation facilities alone; other elements of the facility must be considered as well. These include access roads, site clearing, onsite power lines, substations, lighting, noise levels, and off-site power lines. Development of these elements shall be done in such a way as to minimize any negative impacts. Unnecessary site clearing and highly visible roadways can have greater visual impacts than the energy generation facility itself. In planning for facilities, designers must take steps to mitigate their impact on natural, scenic and historic resources.

37. Unsuitable Locations: Because of their distinctive natural, historic or scenic value, energy facility development shall be excluded from the following areas.
    a. Highest priority forest blocks
    b. FEMA Floodways; Special flood hazard areas identified by National Flood Insurance Program maps (except as required by hydro facilities)
    c. Federal/State/local protected lands including but not limited to Hughes Forest, Post Mills Natural Area, and Taylor Floodplain Preserve
    d. Vernal pools and their immediate surroundings
    e. Class 1 and 2 wetlands
    f. State-significant natural communities and rare, threatened, and endangered species habitat.
38. Constrained Areas: All new generation, transmission, and distribution facilities shall be sited and designed to reasonably avoid or, if no reasonable alternative exists, to otherwise minimize and mitigate undue adverse impacts to the following, subject to designation of the site by the Town as a preferred area
    a. Historic districts, landmarks, sites and structures listed, or eligible for listing, on state or national historic registers
    b. State or federally designated scenic byways, and municipally designated scenic roads and view sheds

c. Public and private drinking water supplies, including mapped source protection areas.

d. Primary agricultural soils mapped by the U.S. Natural Resources Conservation Service, unless designated as preferred.

e. Protected Lands (Updated 07/26/2016 – State Fee Lands and Private Conservation Lands)

f. Deer Wintering Areas (as Identified by ANR)

g. Act 250 Agricultural Soil Mitigation areas (as Identified by ANR)

h. ANR's Vermont Conservation Design Highest Priority Forest Block Datasets

i. Priority Forest Blocks – Connectivity, Interior and Physical Land Division (as identified by ANR)

j. Hydric Soils (as Identified by ANR)

k. River Corridor Areas as identified by the Vermont Department of Environmental Conservation

CHAPTER VIII: TRANSPORTATION

The private automobile is our primary means of transportation. This has shaped our transportation infrastructure and its accompanying energy use. Climate change and the need to rein in carbon emission should promote radical changes in the way we get from here to there in the coming decades.

Nonetheless, road improvements can and do contribute to the local, regional, and statewide economy. The Vermont State road standards used by Thetford are flexible enough to minimize impacts on important natural and other resources.

PRESENT CONDITIONS

Public Roads

Figure 29: Thetford Road Mileage by Functional Classification

Type of Road	Miles
State highways	26.34
Class 2 town roads	14.23
Class 3 town roads	49.33

Source: Vermont Agency of Transportation, Mileage Statistics County/Town 2012

The road system is shown in the Appendix.

Town roads are classified as local roads (usually unpaved) that serve dwellings, or as collectors. Collectors are generally paved and connect traffic from local roads to arterial highways.

In Thetford, collector roads include Latham, Tucker Hill, Academy, Gove Hill and Sawnee Bean Roads, while the arterial highways are the primary state highways (Routes 5, 113, and 244) and a state-numbered Town road (Route 132).

Route 113 leads to Interstate 91 (Thetford Exit 14) that is a major artery to locations beyond Thetford. This includes the airport in Lebanon, NH. I-91 also connects to I-89 that leads to Logan airport in Boston, or, going north, to the airport in Burlington, VT. Route 113 also connects to the bridge over the Connecticut River in East Thetford that is the most ready connection to New Hampshire.

Given that there are three major rivers to cross (East and West branches of the Ompompanoosuc River and the Connecticut River) the roads in Thetford seem well-integrated with the regional transport system.

Revenue

Highway funds come from two major sources, property taxes and government grants (state and federal). The Town receives grants for specific projects like bridge and culvert replacement and storm damage repair. Details can be found in the yearly budgets in Town Reports. Severe weather events like Tropical Storm Irene and the July 1, 2017 rainstorm have major impacts on Town roads and the budget.

Some of the yearly revenue is deposited in capital accounts for future purchases like equipment and paving projects.

Road Maintenance

The Town of Thetford maintains local and collector roads and arterial Route 132 while the Vermont Agency of Transportation maintains state highways and operates a local facility in Thetford on Route 113.

To ensure proper residential accessibility to the road network the Planning Commission recommends that all private roads be built to minimum standards for a Town Class 3 road.

Development on Class 4 roads is discouraged. Those developing on Class 4 roads are required to sign a waiver to forgo certain town services. The Class 4 road policy limits improvements on a per case basis and any improvements must be performed to current Town standards, under the supervision of the Road Commissioner.

Safety

The Vermont Agency of Transportation analyzes accidents on state highways to locate areas with safety problems. It periodically publishes a compendium of "High Accident Locations." The most recently published volume, 2012-2016, lists no high accident locations in Thetford.

The Town each year adopts the Vermont state road standards as the Town standards. They specify minimum safety standards for grade, drainage, and corner sight distance for intersections and driveways. It is also important to trim vegetation along roads and to enforce speed limits.

Congestion

It is unlikely we will need increased highway capacity during the next ten years. New local roads may be needed to serve subdivisions, and some collector roads may be upgraded or paved. The state highway arterial system is unlikely to change.

Transportation planners measure congestion on a level of service scale ranging from "A" to "F" as defined in the *Highway Capacity Manual*, published by the Transportation Research Board. For Thetford, a service level of "D" for the "design hour," defined as the thirtieth highest hour of traffic of the year, is an acceptable level of service for developers to achieve.

For Thetford, a major traffic generator is defined as a development generating 30 or more one-way peak hour trips. Establishments such as restaurants or stores that generate over 30 peak hour trips could require traffic impact studies. Smaller developments usually do not require traffic impact studies unless there are safety concerns.

East Thetford Village is the center of the Community Business District. It lies at the crossing of two important regional links, Interstate 91 Exit 14 and the bridge to New Hampshire. Future commercial and residential development could require some upgrades to roads in East Thetford to ensure safe traffic merging at the Route 113 / Route 5 intersections and to accommodate pedestrians.

Stagecoach transit bus line covers Orange and Northern Windsor Counties. Its River Route runs between Wells River and White River Junction and serves the Town of Thetford. Six morning buses, four mid-day and four late afternoon buses stop at the Thetford Park and Ride on Route 113 at I-91 Exit 14. Except for the last morning bus, riders need to make a 24 hour advance request.

The Connecticut River Division of the Washington County Railroad runs through Thetford parallel to US Route 5 (a recognized Vermont scenic byway). However, there are no stops in Thetford as these tracks are primarily used for freight transportation and an occasional passenger train. Finally, there is a small, private airport in Post Mills that serves private small-engine flyers, a local soaring club, and hot air balloons.

TRANSPORTATION IN THE FUTURE

A more comprehensive and more direct bus service would help to reduce both residents' transportation costs and car greenhouse gas emissions.

There is a Vermont Rideshare program in Orange County. Anyone wishing to provide rides, needs rides, or wants to save money through sharing rides can call 1-800-685-7433 or go to http://www.vermontrideshare.org/.

The Vermont Agency of Transportation maintains a park-and-ride lot at the intersection of Route 113 and I-91 at Exit 14.

Bicyclists use the state highways during summer months, particularly Route 5. Riders include commuters, athletes, recreational riders, and organized groups. The Town's tertiary byways are also bicycle routes. Bicycle routes may become more necessary in the future as Vermont reduces its carbon emissions.

Pedestrian access to services in Thetford's villages is not optimal, particularly in the East Thetford community business district. Pedestrian amenities could include crosswalks and sidewalks, or simply better shoulders.

GOALS, POLICIES, AND RECOMMENDATIONS

Goals

1. A safe and durable road system including well-maintained collector roads to safely connect residential districts to major arteries that reach areas beyond Thetford and Vermont.
2. Uncongested town roads.
3. Energy-efficient travel, such as public transit, ridesharing, and cycling.
4. Safe pedestrian access in Thetford's villages.

Policies

1. It is the policy of the Town to support Stagecoach bus service with an annual appropriation.
2. It is the policy of the Town to maintain a minimum "D" level of service on all roads in town.
3. It is the policy of the Town to maintain Class 4 roads to state requirements and also to discourage development on Class 4 roads.
4. It is the policy of the Town that driveways accessing Town roads shall meet state driveway standards.
5. It is the policy of the Town that developers proposing major traffic generators shall prepare traffic impact studies.
6. It is the policy of the Town to encourage the transition to electric vehicles and the placement of electric vehicle charging stations.

7. It is the policy of the Town to support commuter and rideshare lots, especially those equipped with electric vehicle charging stations and/or served by energy-efficient public transportation.

Recommendations

1. The Town should install warning signs for hazardous spots on Town roads.
2. The Town should review existing Class 3 roads to determine if they conform to current Town Road Standards.
3. The Town should require traffic impact studies for smaller developments when there are special concerns, such as safety.
4. The Town should construct sidewalks and crosswalks in village centers to make these growth centers more welcoming to pedestrians and to development.
5. The Town should install electric vehicle charging stations on Town-owned lots.

CHAPTER IX: HISTORIC RESOURCES

Trying to plan for the future without a sense of the past is like trying to plant cut flowers.

– Daniel Boorstin, former Librarian of Congress

The area where Thetford's villages sit today has been visited by people for 11,000 years and occupied since at least the 1600s when the Abenaki people and European traders and settlers used the Connecticut River, the Ompompanoosuc River, and Lake Fairlee for transportation and power. Our rivers shaped a settlement pattern of seven village centers—Thetford Hill, Thetford Center, Post Mills, Rice's Mills, Union Village, East Thetford, and North Thetford—which retain some of their distinct identities. Thetford's historic resources include early 19th-century frame, brick, and stone residences, covered bridges, and stately religious structures. Historic resources are particularly valuable because they are nonrenewable; they may vanish with a single action.

ARCHAEOLOGY

Long before colonization by Europeans, the area now known as Thetford was inhabited by indigenous people of the Western Abenaki tribe. These people occupied New Hampshire and Vermont living in the mountains and along tributaries within the drainage system of Lake Champlain, the upper Connecticut River Basin and other rivers. The Abenaki cultivated corn as one of their major crops in fertile river flood plains and had major settlement sites along stretches of the upper Connecticut River that have low gradient, meanders and mid-river islands. In Thetford one such potential location was the floodplain at the boundary with Fairlee. River Terraces located on both sides of the upper Connecticut River and the lower courses of major tributaries (such as the Ompompanoosuc) that were perched well above annual flood lines also presented good localities for settlement sites.

The construction of dams and hydroelectric facilities on the Connecticut River have flooded out large tracts of riparian lands and alluvial meadows, which very likely contain substantial remains of Abenaki settlements. Minimal work has been done to locate remains. The nearest evidence of settlement (including projectile points, drills, gouges, an axe and the skeleton of a 12-year-old boy) was found across the Connecticut River near Post Pond in Lyme. Undoubtedly these people were present in what is now Thetford. A limited survey of the Union Village Dam area found two possible "prehistoric" sites, but the evidence was deemed insufficient. Certain places in Thetford

are considered special to latter day Abenaki people but they have never been subject to archaeological investigation.

Historical documentary evidence of the Western Abenaki in Vermont is rare because after contact with Europeans the Western Abenaki adopted a survival strategy of evasive tactics by withdrawing into safe-refuges hidden from view.

The early European settlers of Thetford needed saw and grist mills. A saw mill and grist mill built in the 1770s once existed at the falls on the Ompompanoosuc in Thetford Center and some of the foundation stones are visible. Similarly, two more sets of saw and grist mills were constructed at the falls south of Lake Fairlee and in Union Village in the same era. The Thetford Center sites are protected from disturbance as they are within the Union Village Dam park.

THETFORD'S HISTORIC STRUCTURES AND SITES

Historic structures and sites contribute to the beauty and grace of Thetford, and historic preservation has been an ongoing effort in the town. In 1979, the Vermont Division for Historic Preservation surveyed two (of a possible six) districts and more than 100 Thetford buildings (some outside the two districts). The districts surveyed were the Thetford Center Historic District (57 structures) and the Thetford Hill Historic District (35 structures).

The Thetford Center Historic District includes the Thetford Center Community Building (included in the Vermont Historic Sites and Structures Survey), and Thetford Town Hall (built in 1830 as a one-story red brick meeting hall and listed on the National Register of Historic Places).

The Thetford Hill district includes the American Legion Building and the Eclipse Grange (already on the National Register of Historic Places), the Congregational Church (the church in longest continuous use in Vermont) and Thetford Academy (the oldest secondary school in Vermont). Thetford Hill figures prominently in the book *Vermont Townscapes*, (Williams, Kellogg and Lavigne, Center for Urban Policy Research, 1987).

Some of the other outstanding structures in town include: Rice's Mills Community Building (in the Vermont Historic Sites and Structures Survey); Latham House in North Thetford (photographed by the Historic American Buildings Survey); Thetford Center Covered Bridge; Union Village Covered Bridge; Peabody Library (built 1866, Thetford's first library and the oldest library building in Vermont); and Post Mills Church. Many of

the historic structures that are publicly owned are currently used as places for dinners, classes, dances, and other community gatherings.

THETFORD'S HISTORIC ARTIFACTS

The Thetford Historical Society (THS), organized in 1943 and housed in the Thetford Bicentennial Building and the Hughes Barn Museum, has taken the lead in collecting and preserving historic artifacts, including stories, paintings, songs, photographs, manuscripts, letters, ledgers, and books. The THS works cooperatively with the Library of Congress to record their holdings with the National Union Catalog of Manuscript Collections (NUCMC) for accessibility to researchers.

The THS creates exhibits, which have been displayed throughout town, and has also hosted walking tours of two villages.

TOOLS FOR HISTORICAL PRESERVATION

A variety of state and private agencies and programs can be useful when planning and implementing historic preservation projects.

Private Citizens and Organizations

Private individuals or groups undertake much of the responsibility for historic preservation. Pride in ownership of older housing units and regular maintenance alone can achieve remarkable results.

Historic Resources Survey

Preservation through documentation is a basic, essential, and non-controversial preservation strategy. In addition to providing a permanent record of a town's architecture, a good inventory is the foundation for other preservation approaches such as design control districts, nominations for listing in the National Register of Historic Places and in environmental reviews required in federally funded projects.

National Register of Historic Places

Listing in the National Register of Historic Places can be an important tool for identifying and planning the future of historic resources. The benefits include:

1. Recognition of local, state, or national significance.
2. Provision for review and amelioration of effects that any federally funded, licensed, or assisted project might have on the property.
3. Qualification for federal and state preservation grants.

Listing is voluntary and does not interfere with an owner's right to alter, manage, dispose of, or even demolish a property unless federal funds are involved. Nor does National Register listing require that an owner open his property to the public.

Local Historic Districts, Design Control Districts, & Transferable Development Rights

The "Vermont Townscape Preservation Act" of 1985 allows any municipality to adopt zoning regulations with provisions for establishing design control districts, historic districts, and landmarks (individual structures worthy of preservation).

A design control district may cover any area containing structures of historical and architectural merit. A design review board may be appointed by the legislative body of the municipality to advise their planning commission.

Easements

Preservation easements have proven to be effective in protecting historic properties. The donation of an easement may make the owner eligible for certain tax advantages. and may also reduce estate and local property taxes. The organization holding the easement is given the right to review any proposed changes to the structure.

Land trusts with both historic preservation and conservation interests are instrumental in safeguarding both architectural and natural features. Easements are a superior method of protecting historic resources and their landscape settings because they are more permanent than zoning or designated historic districts.

Covenants

A covenant is a contractual agreement whereby the owner agrees to maintain the historic and architectural character of her or his home. Covenants are normally enforced through a preservation agency. The general difference between easements and covenants is that easements are considered to be an interest in real estate, whereas covenants are only a contractual obligation.

State Grants

Limited grants may be available from the Department of Historic Preservation. Technical assistance and small grants for project organization may also be available from the Preservation Trust of Vermont in Windsor. Foundation funding may also be explored.

Potential Archaeological Areas

Areas with proximity to water, such as the Connecticut and Ompompanoosuc Rivers and smaller brooks in the case of Thetford, hold great potential for precolonial and more recent archaeological sites. Historically, these water bodies were places where indigenous people fished and hunted, and they settled on and farmed fertile riparian land. Under European colonization, rivers became lined with mills that harnessed their waterpower. Two potential "prehistoric" sites were found in the Union Village Dam area while cellar holes bear silent witness to early colonists.

Investigation of these areas could yield much information relating to the lifestyles of Thetford's earlier inhabitants.

GOALS, POLICIES, AND RECOMMENDATIONS

Goal

1. Preserved historic structures and the landscapes, balanced with energy efficiency and providing for the contemporary needs of residents.

Policies

1. It is the policy of the Town to preserve, rehabilitate, and reuse historic structures, and to encourage the same.
2. It is the policy of the Town to increase awareness of historic documents, artifacts, and environments.
3. It is the policy of the Town to celebrate Thetford's history through publication and education.

Recommendations

4. The Town should encourage the use of publicly owned historic buildings, either for community activities or privately, as long as their exterior appearance is not altered significantly.
5. The Town should develop incentives to encourage landowners to preserve historic resources.
6. The Town should support continued protection of Thetford Hill Historic District.
7. The Town should encourage landowners to provide easements that allow access to historic parts of the community.

8. The Town should explore the possibility of adding appropriate sites to the National Register of Historic Places.
9. The Town should consider supporting the development or improvement of the following vehicles for increasing interest in all things historic:
    a. Photographs and murals in public and commercial buildings;
    b. Markers at key historic structures or sites;
    c. Tours including walking tours with written and audio guides of historic structures and sites;
    d. Oral history projects;
    e. Historic Thetford Quests as part of the Valley Quest Project (a project of Vital Communities35); and
    f. Literature in the Town Hall and on the website regarding historic resources

[35] Vital Communities, "Valley Quest." http://vitalcommunities.org/valleyquest/

CHAPTER X: SCENIC RESOURCES

Thetford's varied terrain, ecosystems, and traditional New England architecture make it a visually appealing town. Visual appeal is an important consideration in land use planning because of its impact on scenic resources. There are several benefits to be derived from identifying, retaining, and improving key elements of the town's visual appeal:

1. Scenic resources engender community pride.
2. A community that has retained and fostered scenic resources will have an advantage in attracting development.
3. Scenic resources stimulate the development of tourism and related businesses.

EXISTING CONDITIONS

Entranceways – the sequence of views as one travels through Thetford's village areas – are critically important to the visual appeal of the town. Entranceways are where first impressions of Thetford are formed, and they are often the visual character nonresidents associate with the town. In the Land Use chapter, it has been proposed that the size of the village residential district at Thetford Hill be changed in order to protect the area around the Interstate 91 interchange—an important entranceway to our town—from the kind of commercial development found around many interstate exits.

Views to the wooded hillsides and natural skyline add to the historic character of Thetford's villages and the rural character of the roads in town.

Academy Road has been designated as a Town Scenic Road because of its panoramic views looking east and the significant amount of open farmland. Route 5 has been designated a state and federal Scenic Byway as part of the Connecticut River Scenic Byway.[36]

THE FUTURE

Landscapes that take centuries to develop can be changed in an afternoon. Scenic views – ridgelines, pastures, village centers, and the surrounding hillsides – paint the picture we see in our mind's eye when we think about what it is we love about our town.

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[36]Vermont Department of Tourism and Marketing. https://www.vermontvacation.com/byways

Conventional land use regulations alone cannot control the threats to the scenic resources of the region.

Design Considerations

The Planning Commission recommends that the design considerations developed by the Vermont Agency of Natural Resources Design Issues Study Committee in 1990 be used in evaluating local development proposals. This document, titled *Vermont's Scenic Landscapes: a Guide for Growth and Protection,* suggests constructive responses to the issue of development in scenic areas.

Scenic Road Designations

Designation of scenic roads enables a town to preserve the rural environs around its historic structures.

Ridgeline Development Controls

The hills of Thetford are a key element to the aesthetic environment for much of town. Views from locations such as our village centers, rivers, hilltops, designated scenic roads, and Interstate 91 have nearly universal appeal as scenic resources.

Minimization of Outdoor Light Pollution

Dark night skies and bright stars are a resource that contributes strongly to the rural beauty of our town. (See also the section on *Light and Dark, Quiet and Noise* and the associated recommendations in Chapter 5, Natural Resources).

Aesthetics of Business Districts

Features that slow traffic and give a village character are aesthetic assets. Concentration of businesses in a village is good and shared driveways are recommended.

Competing Aesthetic, Safety, and Expedience Issues

Many groups have a role in our aesthetic resources. Segmentation of responsibilities is natural, but sometimes counterproductive. It would be easy for only the Town Conservation Commission to deal with resources that are primarily scenic, only the Public Works Department to consider transportation resources, only the Historic Preservation Committee to consider historic aesthetics. However, it is important that we understand how closely our resources are interrelated. For example, preservation of a fence line may be the highest priority of the Historic Preservation Committee, but the resulting view obstruction may seem dangerous to the Public Works Department. It is

the overall aesthetic feeling of the town, not just the feeling of designated scenic roads, that is important here.

GOALS, POLICIES AND RECOMMENDATIONS

Goal

1. Preserved scenic resources such that Thetford's rural, historic, and natural character remains recognizable to future generations.

Policies

1. It is the policy of the Town to evaluate development proposals using the design considerations developed by the Vermont Agency of Natural Resources (ANR) Design Issues Study Committee in 1990. (Available in the Zoning Office.)
2. It is the policy of the Town to consider visual impact in subdivision review and work with developers to minimize adverse impact.

Recommendations

1. The Town should evaluate its roadways for possible designation as scenic roadways pursuant to 19 V.S.A. § 1019.
2. The Town should minimize negative impacts of transportation projects on rural, historic, and natural resources.
3. The Planning Commission should work to strengthen restrictions on ridgeline development that negatively impacts visual appeal.
4. The Town should develop a lighting ordinance that will protect our view of the night sky and reduce impact on neighbors.
5. The Town should update subdivision regulations to mitigate adverse impacts of development on Thetford's aesthetic heritage.
6. The Town should encourage retention of desirable features such as roadside trees, stone walls, hedgerows, fields, contours and enduring features (see Natural Resources Chapter.)
7. The Town should encourage the use of traditional building forms and materials.
8. The Town should encourage development of a size and scale compatible with existing structures.
9. The Town should work to minimize paved or impermeable surfaces.

10. The Town should require development to reduce visual impact and fragmentation by routing access ways along the edges of fields and woods where feasible.
11. The Town should use planning and zoning to address the visual impact of any development that may threaten scenic resources.

CHAPTER XI: LAND USE

Land use in Thetford is a result of both planned and unplanned efforts by private and public interests to create a pattern of development driven by the social and economic conditions at the time. These patterns in turn influence future land use. Land characterized as suitable for development is a finite resource that should be managed wisely.

This section discusses both current and future land use patterns and provides goals, policies and tasks for future implementation. V.S.A. Title 24, §4411(a) authorizes towns to implement land use regulations, such as zoning and subdivision, provided that those regulations are in conformance with the Town Plan and §4302 of Title 24, which addresses the state's planning goals.

In communities facing growth pressures, there is often a struggle to maintain farmland, agricultural soils, natural landscapes, small-town traditions, and rural character. Growth can bring new energy and increased resources. It can also bring traffic and conflicts between the natural resources, economy, and lifestyles not dependent on working lands. When the local economy struggles, however, the focus is more often on strategies that will attract public and private investments. In Thetford, we need to balance maintaining and enhancing our natural resources and quality of life with encouraging a vibrant community in which diverse people can thrive.

Thetford's constructed features—roads, schools, and public and private buildings—are valuable resources that must be managed wisely to ensure their usefulness. The architectural character of Thetford's villages and historic buildings must also be protected. Maintaining the appearance of a traditional Vermont town is not only an aesthetic notion, but also a recognized economic development strategy for Vermont. If Thetford is to continue to provide a high quality of life for its citizens, both the natural and constructed resources of the town must be considered in future land use decisions.

The following is a list of key factors for determining the type, scale and intensity of future land use:

a. Land topography, soils, water, and natural resources;

b. Relative ease of access to roads and other transportation facilities;

c. Availability to public services;

d. Avoiding land use conflicts;

e. The needs of residents

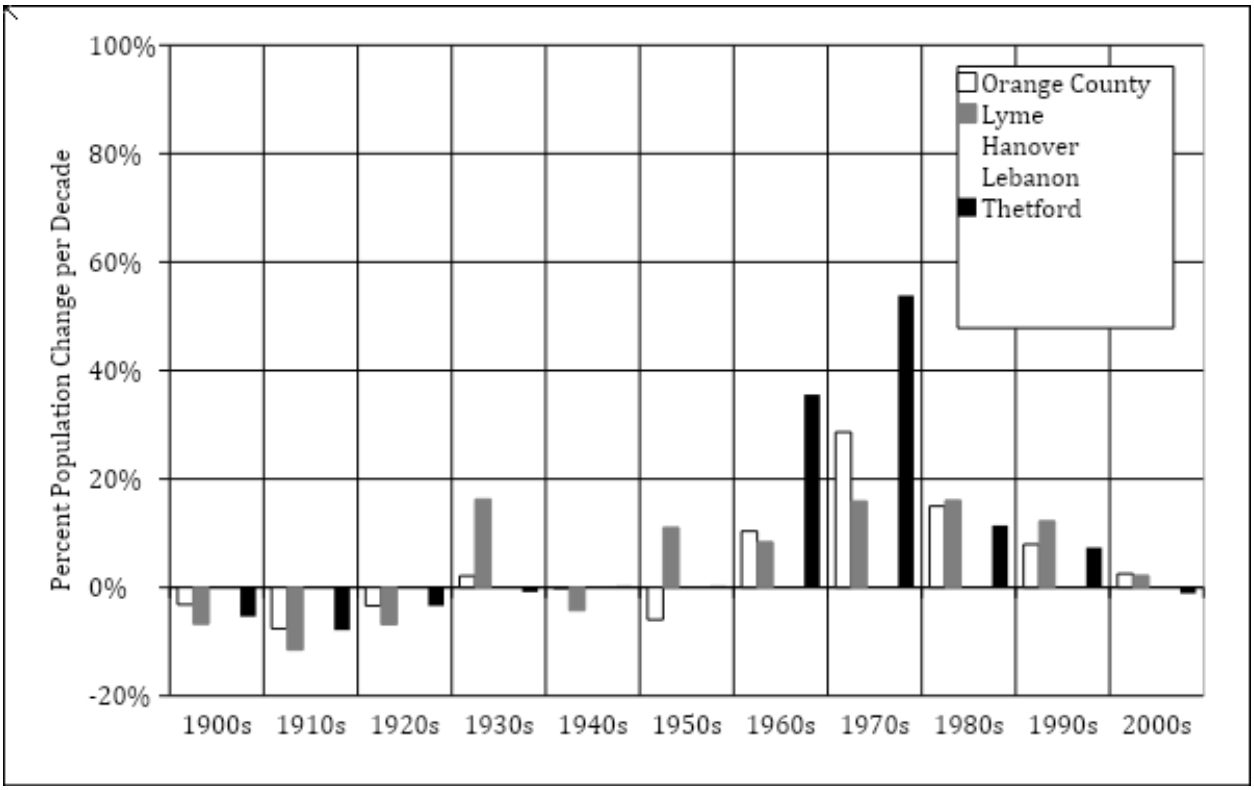
EXISTING CONDITIONS

The present pattern of land use began when Thetford's charter was granted in 1761. People converged on mill sites at Thetford Center, Post Mills, Union Village, and Rice's Mills as well as the fertile land along the Connecticut River in East Thetford. The meetinghouse on Thetford Hill, built in 1787, was another nucleus for a village. The town's agricultural base grew, subsistence farming gave way to sheep-raising and then to mixed farming. The pattern of dispersed residences and several village focal points continues to this day.

While the population of Thetford was consistently just over 1000 from 1920-1960 it increased dramatically in the 1960s and 1970s after Interstate 91 was constructed. During this time changes in land use accelerated as open fields and wooded areas became house lots, reinforcing dispersed residential development.

Since 1980, Thetford's rate of population growth has been less than 20% per decade.

Figure 30: Population Growth Rate per Decade for Orange County, Thetford, and Area Towns



Source: U.S. Census

The taxable property in Thetford (listed by type in the following figure) shows the increase in residences and mobile homes with land between 2011-2018.

Figure 31: Thetford Taxable Property by Type

	2011	2012	2013	2014	2015	2016	2017	2018
Residential (<6A)	648	650	654	656	663	670	677	677
Residential (>6A)	388	390	389	389	390	395	394	393
Mobile Home (w/o land)	9	6	9	9	8	8	9	7
Mobile Home (w/land)	50	52	49	48	47	46	46	49
Vacation (<6A)	26	26	25	26	25	25	26	26
Vacation (>6A)	20	21	22	22	23	21	21	21
Commercial	41	46	43	42	42	42	44	47
Electric Utility	4	4	1	1	1	1	1	1
Other Utility	0	0	0	0	0	0	0	0
Farm	12	12	4	4	3	3	3	3
Woodland	102	101	0	0	0	0	0	0
Miscellaneous	65	63	14	15	15	16	16	16

Source: Thetford Listers

The pace of development that has occurred in town over the past twelve years is reflected in the approved subdivisions and zoning permits issued, as shown in the following figure. The common practice has been to build in rural residential areas.

Figure 32: Approved Subdivisions, 2009–2018

Year	Plats Approved	Lots Created	Annexations
2009	7	13	1
2010	1	2	1
2011	5	13	1
2012	3	5	1
2013	3	6	4
2014	3	6	2
2015	7	6	2
2016	1	0	1
2017	2	6	4
2018	0	0	3

Source: Zoning Administrator

Based on the past twenty years, the trend in Thetford is an increased number of year-round residences. The commercial sector including small home-based businesses has

not changed significantly. The 2007 Town Plan encouraged mixed use development concentrated in villages, and the Zoning Bylaw was updated in 2011 to reflect the town's wishes. The economic recession in 2008 is noticeable in the slower increase in new residences since 2008, so it is difficult to tell yet what the effect of the Zoning Bylaw update has been.

The Town remains concerned about new residential development that is located on the more remote roads, straining the Town's resources to meet demands for road maintenance, the potential need for extension of school bus routes, and a troubling and risky disregard for emergency vehicle access. Additionally, this remote development fractures larger rural parcels, with an adverse effect on wildlife, forestry, water quality, recreation and the aesthetic character of the community.

CURRENT ZONING

Thetford adopted revised zoning regulations in 2011. Five villages (Post Mills, Thetford Center, North Thetford, Union Village and Thetford Hill) are zoned as village residential land use areas (VR.) One village (East Thetford) is zoned as a community business land use area (CB) to share some of the characteristics of a Village Residential district but with more emphasis on encouraging commercial development compatible in scale with existing development. There is one overlay district within the VR zone, the Thetford Hill Historic Preservation District that establishes the protection, enhancement, and renovation of significant architectural and historic resources in Thetford Hill.

Any of these six villages can qualify for Village Center designation (see Chapter III, Future Economic Development).

The sections bordering the Post Mills village area along Route 113 to the north and Route 244 to the east are zoned as a neighborhood residential area (NR). The designation of such an area on a village periphery along major roads is to restrict commercial development to the village center and to discourage sprawl while maintaining the closer settlement characteristic of a village. In the Post Mills case, the boundaries of the area were established with due respect to prominent village features such as the airport and church and the opinions of residents about the effective limits of the town center. The Rural Residential zoned area covers the majority of Thetford and contains most of Thetford's open space, agricultural land, wildlife habitat, connecting corridors and Thetford's priority interior forest blocks protected under 24 V.S.A. § 4303. The scenic quality of Thetford's countryside resides in the Rural Residential land use area. Its appeal derives from various elements such as farms, vegetative cover and

topography that together create a rich visual experience. Also contributing to the visual appeal of this area are the many byways: narrow unpaved roads with roadsides offering diverse and contrasting features. These roads and their mixture of open and closed tree canopy have an appeal that cannot be found in more developed places. Lands adjacent to the Ompompanoosuc and Connecticut Rivers and some smaller streams are subject to periodic flooding or fluvial erosion. Floodplains and Fluvial Erosion Hazard Zones are unsuitable for structures, thus development in FEMA mapped floodplains is controlled by Thetford's Floodplain Ordinance.

FUTURE LAND USE AREAS

Village Residential Land Use Area (VR)

Thetford's villages of Thetford Hill, Thetford Center, Post Mills, North Thetford, and Union Village are proposed as Village Residential land use areas. These areas convey the character of Thetford and give residents a desirable 'sense of place.'

The general purpose of the Village Residential land use area is to create areas of settlement with relatively dense housing along networks of streets. These types of housing may provide affordable opportunities for young people starting their working lives. The purpose of Village Residential areas is also to provide facilities such as gathering places, schools, shops, and libraries within walking distance. A third purpose is to incorporate mixed use economic activity, including commercial and public services, compatible in scale to existing buildings. Mixed uses include retail, cafes and restaurants, offices (or similar uses employing Thetford's high-speed fiber internet access), educational and childcare facilities, home business, and gathering places such as churches. Many of the villages include prime agricultural land.

Minimum density for this land use area is at present no less than 20,000 square feet, though some historic lots may be smaller. Since there is no central sewer or water in any part of the town, Village Center development in these areas (and potential lot infilling) may be limited by the capacity of the soil to accommodate these needs. At this time, the town does not envision the expansion of the Village Residential zones. The conversion of existing buildings, for instance to multiple dwellings or new uses, is one way to incorporate some of the above functions into village centers.

Neighborhood Residential Land Use Area (NR)

Neighborhood Residential land use areas are districts of settlement that are close to Village Residential areas. Their purpose is primarily residential, though less dense than

Village Residential areas. Accessory dwelling units are a use. A second purpose is to encourage non-residential economic activity similar to those in Village Residential areas, but conditionally including somewhat larger scale enterprises such as farmers' markets, contractors' yards, cultural facilities, cemeteries and light commercial services provided they are not primary or dominant uses.

Community Business Land Use Area (CB)

The purpose of the Community Business land use area is to provide for an area of businesses that can provide jobs and tax base, while also fitting in with our community and still retain residential uses similar to those found in the villages.

Thetford Hill Historic Preservation Overlay Area

The purpose of the proposed overlay area within the Village Residential area on Thetford Hill is to ensure a closer level of review for development through the conditional use approval process to make sure it is not a detriment to this important area.

Rural Residential Land Use Area (RR)

The purpose of the Rural Residential area that covers the majority of Thetford is to provide for low-density, limited residential development, while allowing for the continuation of agricultural and forestry operations. In this area, the perpetuation and health of Thetford's open space, farms, wildlife habitat and connectors, forest blocks, scenic features, and water bodies is a major consideration.

Presently the minimal density under our zoning in the Rural Residential area is 2 acres. The town should consider that this current, 2-acre requirement may not, in itself, preserve a low density pattern of development.

PUDs (planned unit development) are an allowed use in any part of Thetford, and in Rural Residential can be used to concentrate structures, services and roads. A development density bonus exists for setting aside open space, farmland, habitat etc. However, allowing PUDs has not encouraged this form of development.

A second purpose of the Rural Residential area is to allow for certain economic activities of a compatible type and scale.

Forest Land Use Area (FR)

The purpose of the Forest land use area is to protect the functions of unfragmented or minimally fragmented forest habitat that exist in large parcels. The division of such

parcels into small, developed lots causes degradation of forest habitat, thus the Vermont Planning Statutes were amended by Act 171 to allow municipalities to protect forest blocks and habitat connectors while supporting the local forest products industry. While current zoning standards call for the 'minimization' of forest and habitat fragmentation, Thetford should consider adding standards or flexible zoning in certain locations to maintain the integrity of its remaining forest blocks under Act 171.

Energy

How we choose to use our land affects the energy use of the town. Siting of residences and businesses has a greatly affects the options for efficient heating and transportation. All these factors relate to carbon emissions that cause climate change. Thetford shall strive to meet the goals set out in the Energy Chapter and Vermont's Comprehensive Energy Plan.

GOALS, POLICIES, AND RECOMMENDATIONS

Goals

1. Conserved natural resources.
2. Preserved rural character
3. Community activity centered in villages.
4. Appropriately scaled and sited economic development.
5. An inter-generational population, with housing, education, and employment opportunities for all.

Policies

1. It is the policy of the Town to develop standards for preservation of rural and village character and natural resources.
2. It is the policy of the Town to promote mixed-use, higher-density development, which includes walkable neighborhoods, energy efficiency, and protection of natural resources.
3. It is the policy of the Town to ensure project developers and owners meet or exceed state-mandated construction standards for energy performance.
4. It is the policy of the Town that accessory dwelling units should be a permitted use in the VR area.

5. It is the policy of the Town that multifamily dwellings or workforce housing, consistent in appearance with village character, are appropriate in the VR area.
6. The historic character of the Village Residential areas should be preserved.
7. Multi-family, affordable, or workforce housing, compatible in style with neighboring buildings, is appropriate in the NR area.
8. Facilities that are generally associated with strip development or sprawl are prohibited in the NR area.
9. A diverse range of commercial services including motels, hotels, lumberyards, food processing and light industry are appropriate in the Community Business area, along with residential uses. Facilities that are generally associated with strip development or sprawl are prohibited.
10. All uses permitted in the VR zone shall be conditional uses in the Thetford Hill Historic Preservation Overlay District.
11. Appropriately sized agricultural processing facilities, silviculture, home businesses, inns and recreation are appropriate in the Rural Residential area, and kennels, cemeteries, and other cultural uses may be. Strip development and sprawl are not permitted. High density or intensive uses that would require additional municipal services, such as extending roads, are not permitted.
12. Development should maintain or enhance the visual focus on important scenic features in the Rural Residential area, and the protection of natural resources, outlined in the Natural Resource Inventory Maps, is strongly recommended

Recommendations

1. The Town should work with the Connecticut River Joint Commission to protect the river's water quality and shoreline.
2. The Town should support the use of conservation easements (and the purchase of development rights) to protect natural resources and open spaces (e.g., with Vermont Land Trust or Upper Valley Land Trust).
3. The Town shall use information about Thetford's natural resources, including the Natural Resource Inventory Maps, in development reviews.
4. To retain farms and agricultural soils, the Town should develop flexible regulation that promotes protection of the working landscape without an undue burden on farmers.

5. The Town should maintain the integrity of its remaining forest blocks by adopting subdivision standards or flexible zoning.
6. The Town shall update the zoning to include the new forest area to avoid fragmentation of forests and habitat connectors, and agricultural soils as feasible.
7. The Town should consider how to incentivize PUDs in Rural Residential areas.
8. The Town shall not improve or create roads that open up currently inaccessible parts of the town unless rerouting of roads is the only way to move them away from flood-prone areas.
9. The Town should promote development, including commercial development, in Thetford's village areas that is sensitive to the visual aesthetic of the traditional Vermont town.
10. The Town shall encourage multifamily dwellings or workforce housing in Village and Neighborhood Residential zones as feasible.
11. The Town should consider reducing the minimum lot size in Village Residential if septic and water supply permits.
12. The Town should consider ways to encourage innovative, multi-user septic systems without introducing any threat to village water supplies.
13. The Planning Commission shall update the Zoning Bylaws to require increased energy efficiency and conservation, and to restrict greenhouse gas emissions and fossil fuel infrastructure.
14. The Planning Commission should update the Zoning Bylaw and land use map to include a Neighborhood Residential (NR) District in Post Mills based on the description of the NR Area in this chapter.
15. The Planning Commission should update the Zoning Bylaw and land use map to change the Thetford Hill Village Residential District to Rural Residential along Route 113 east of Garey and Godfrey Roads to the I-91 interchange.
16. The Town shall deter development around the Interstate 91 interchange that has the hallmarks of commercial development found around many interstate exits.
17. The Planning Commission should investigate new locations that would be available for economic expansion and consider commercial, village, and neighborhood land use areas away from prime agricultural land and towards extant development footprints and lower quality soils.

18. The Town should research alternate ways of interpreting and predicting areas of flood and fluvial erosion hazard because recent experiences suggest the FEMA mapped floodplains are not accurate predictors of true flood damage and revise the flood regulations to take into account these new flood risk areas.

CHAPTER XII: RELATIONSHIP OF THIS PLAN TO THE REGION

An important premise behind planning is the necessity of looking beyond a single community's borders, to coordinate, and mitigate the influence of development with neighboring communities.

Thetford is a member of the Two Rivers-Ottauquechee Regional Commission (TRORC) that borders on five Vermont towns: West Fairlee, Fairlee, Norwich, Sharon, and Strafford. Thetford is also part of the Greater Upper Valley Solid Waste District.

Based on a review of this plan's relationship to neighboring town plans, the Thetford Town Plan does not conflict with the town plans of the following towns: Norwich, Sharon, Strafford, and West Fairlee. There is a potential conflict with the Fairlee Town Plan in that Fairlee has a designated Industrial Area located around Route 5 bordering Thetford that Thetford has designated as Rural Residential.

The Two Rivers-Ottauquechee Regional Plan, adopted August 31, 2017, was reviewed for consistency with Thetford's proposed Town Plan, particularly land use goals and policies, and plan implementation. TRORC has recommended that the Thetford Town Plan of 2007, readopted in 2012, be revised to bring it into conformance with the required elements listed in 24 V.S.A. § 4382 to make it consistent with the Regional Plan. These recommendations are taken into account in this current plan.

CHAPTER XIII: IMPLEMENTATION OF THE PLAN

The goals, policies, and recommendations of this plan lay a foundation for the future development of Thetford. This Town Plan will be effective for eight years from the date of adoption (24 V.S.A. § 4387) unless replaced earlier. During that time, the Town shall move to implement the goals of the plan and the related policies and recommendations through several regulatory and non-regulatory tools including, but not limited to, those listed here. (See 24 V.S.A. § 4401- 4403 for a complete list.)

REGULATORY APPROACHES TO IMPLEMENTATION

1. Zoning Bylaws: Zoning is a legal process designed to protect the health, safety, and welfare of a community by control of the use of land. A municipality may adopt zoning regulations to permit, prohibit, restrict, and determine land development.
2. Subdivision Regulations: Subdivision regulations set forth the procedures, requirements, and specifications for the division of land into two or more parcels. Such things as design of streets and lots, installation of utilities, and reservation of park or school land are normally contained in a subdivision bylaw.

LAND USE REGULATIONS AND ACT 250

Goal

1. An unambiguous Town Plan.

Recommendations

Lot Layout

1. Developers shall avoid a suburban pattern of repeated buildings situated at or near the middle of adjacent lots one after another.
2. Developers should not create more than one adjacent lot with a depth greater than four times its frontage (“spaghetti lots”).
3. Developers shall locate buildings at the edges of woodlands and fields, relatively close to roads, in an effort to preserve tillable units, forest blocks and habitat, whether or not in the same ownership.
4. Developers shall lay out lots to take advantage of and preserve desirable features, such as stone walls, hedgerows, fields, natural clearings, and land contours.

5. Developers shall not incorporate excavation for roads or buildings where excessive erosion will result.
6. Developers shall locate buildings and other construction such that they will not detract from the visual appeal of natural or scenic features, including but not limited to bodies of water, historic resources, and ridgelines. In the case of multiple unit projects, developers shall cluster buildings near the perimeter of the lot.
7. Developers shall incorporate shared driveways where practical in developments with adjacent buildings or lots.
8. Developers shall screen industrial and commercial uses or locate them to minimize impact on the character of the surrounding area.
9. Developers shall locate any noisy, toxic, or noxious uses where they will least impact public roads or neighboring uses (especially housing), and/or take all reasonable means to screen or lessen any detrimental impacts of such uses. This provision does not apply to agricultural uses.

Village Areas

1. Developers shall construct buildings that are of the size and scale of other buildings in the Villages.
2. Developers shall use traditional building forms and materials.
3. Developers must demonstrate that their development will not have negative effects on public or private water supplies within this area.

Commercial Development

1. Where feasible, developers shall reuse existing buildings or parts thereof for commercial development.
2. Developers shall screen large parking or delivery areas in front of commercial buildings (e.g. with plantings) where feasible. Where practical, developers shall share parking areas between adjacent uses.
3. If developers require illuminated, commercial signs they shall be illuminated from above.
4. Developers are strongly encouraged to maintain existing trees and vegetation adjacent to State or Town roads. The Town strongly recommends a generously

landscaped buffer (using native plants and trees) for any new construction adjacent to State or Town roads.

5. Developers shall minimize paved or impermeable areas.

Landscape and Site Planning

1. Developers are encouraged to use fences and other traditional devices to define a property's relationship to the road where feasible and retain existing fence lines, tree lines, hedgerows and stone walls, whenever possible.
2. Developers are encouraged to plant substantial trees along the roadside to help shade and give definition to the road.
3. Developers shall consider designs for new buildings that do not result in bulky, box-like masses.
4. Developers are encouraged to choose designs that complement the neighboring traditional buildings.
5. Developers are encouraged to minimize building footprint to enable more efficient use of land as feasible.
6. Developers shall minimize where feasible alteration of natural site features.
7. Developers shall design projects to help discourage excessive traffic speeds.
8. Developers shall screen outdoor storage of trash in areas of public view.

Signage and Lighting

1. Developers shall provide light levels and distribution appropriate to the use of the site and compatible with the character of the neighborhood.
2. Developers shall choose lighting that minimizes glare and light beyond the boundaries of the site.

NON-REGULATORY APPROACHES TO IMPLEMENTATION

Implementation of the Plan requires public involvement and coordination between the various interest groups in the community.

Private initiatives and non-regulatory approaches to land use such as tax stabilization agreements, land purchase, conservation easements, and gifts of land can supplement regulation. Such efforts may be supported by groups like Thetford's Conservation Commission and Energy Committee, as well as private non-profit organizations such as

the Thetford Historical Society, conservation foundations, historical societies, land trusts, and watershed associations.

APPENDIX–MAPS OF THETFORD, VT

Maps of Thetford are provided in a separate appendix file available from the Town Clerk and on the Town of Thetford website:

1. Current Land Use
2. Current and Proposed Transportation
3. Current and Proposed Utilities, Facilities, & Education
4. Water & Slope
5. Proposed Future Land Use
6. Natural Resources
7. Existing Energy Generation
8. Solar Energy Potential
9. Wind Energy Potential
10. Forest Resources
11. Wildlife, Plant, and Natural Community Resources
12. Recreation Resources
13. Forest Blocks and Connectivity Resources
14. Farmland Resources
15. Surface Water, Wetland, and Riparian Resources

THETFORD, VERMONT, 2020 TOWN PLAN — MAP APPENDIX

Adopted September 11, 2020.

CONTENTS

Current
Land Use Map
Thetford, Vermont
Town Plan 2020

Adopted 9/11/2020

1:43,969

1 inch = 3,664 feet

0 0.5 1

Miles

N

- Interstate Highway
- US Highway
- State Highway
- Town Highway Class 2
- Town Highway Class 3
- Town Highway Class 4
- Private Road
- State Forest Highway
- 911 structure
- Federal Lands
- State Lands
- Town Lands
- Private Conserved Lands
- Current Use

TRORC
Two Rivers-Ottauquechee
REGIONAL COMMISSION

For Planning purposes only.
Not for regulatory interpretation.

Current and Proposed Transportation Map
Thetford, Vermont
Town Plan 2020

Adopted 9/11/2020

1:43,969
1 inch = 3,664 feet
0 0.5 1
Miles

- VT route/TH cls 1
- TH cls 2
- TH cls 2 gravel
- TH cls 3
- TH cls 3 gravel
- TH cls 4
- trail
- private
- US route
- US interstate
- VT forest hwy
- RR
- Stagecoach 91 Service

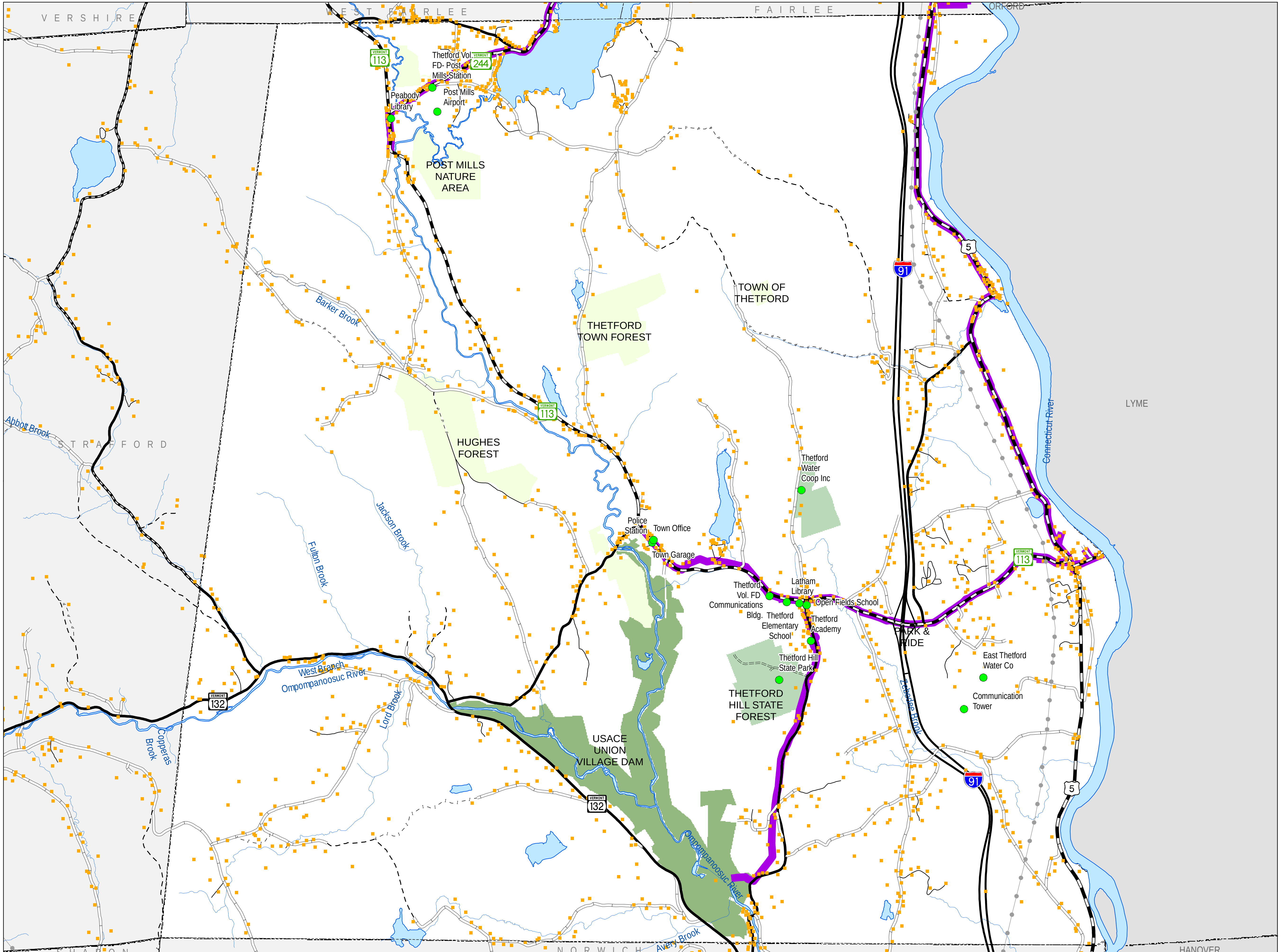
Public Lands

N

Park and Ride

TRORC
Two Rivers-Ottauquechee
REGIONAL COMMISSION

For Planning purposes only.
Not for regulatory interpretation.



VERSHIRE
WEST FAIRLEE
FAIRLEE
ORFORD
STRAFFORD
LYME
SHARON
NORWICH
HANOVER
Thetford Vol. FD- Post Mills Station
Peabody Library
Post Mills Airport
POST MILLS NATURE AREA
THETFORD TOWN FOREST
TOWN OF THETFORD
HUGHES FOREST
Barker Brook
Abbott Brook
Jackson Brook
Fulton Brook
Police Station
Town Office
Town Garage
Thetford Water Coop Inc
Latham Library
Thetford Vol. FD Communications Bldg.
Thetford Elementary School
Open Fields School
Thetford Academy
PARK & RIDE
Thetford Hill State Park
THETFORD HILL STATE FOREST
East Thetford Water Co
Communication Tower
West Branch Ompompanoosuc River
Lord Brook
Copperas Brook
USACE UNION VILLAGE DAM
Ompompanoosuc River
Zebedee Brook
Connecticut River
Avery Brook
113
244
132
91
5

Current and Proposed Utilities, Facilities & Education Map

Thetford, Vermont

Town Plan 2020

Adopted 9/11/2020

- VT route/TH cls 1
- TH cls 2
- TH cls 2 gravel
- TH cls 3
- TH cls 3 gravel
- TH cls 4
- trail
- private
- US route
- US interstate
- VT forest hwy
- 911 structure
- Facilities
- 3 Phase Line
- Transmission Line

- Federal Lands
- State Lands
- Town Lands

1:43,994

1 inch = 3,666 feet

0 0.5 1

Miles

N

For Planning purposes only.
Not for regulatory interpretation.

TRORC
Two Rivers-Ottauquechee
REGIONAL COMMISSION

Water & Slope
Thetford, Vermont
Town Plan 2020

Adopted 9/11/2020

- VT route/TH cls 1
- TH cls 2
- TH cls 2 gravel
- TH cls 3
- TH cls 3 gravel
- TH cls 4
- trail
- private
- US route
- US interstate
- VT forest hwy

- Wetlands
- WellHead Protection Areas
- SPECIAL FLOOD HAZARD AREA
- VT RIVER CORRIDORS

SLOPE

- 0 - 15 %
- 15 - 25 % Steep
- > 25 % Very Steep

River Corridor and FEMA NFIP maps are available for Vermont here:

http://tinyurl.com/floodreadyatlas

N

1:42,290
1 inch = 3,524 feet

0 0.5 1
Miles

TRORC
Two Rivers-Ottauquechee
REGIONAL COMMISSION

For Planning purposes only. Not for regulatory interpretation.

Proposed Future Land Use Map
Thetford, Vermont
Town Plan 2020

Adopted 9/11/2020

1:43,969

1 inch = 3,664 feet

0 0.5 1

Miles

- VT route/TH cls 1
- TH cls 2
- TH cls 2 gravel
- TH cls 3
- TH cls 3 gravel
- TH cls 4
- trail
- private
- US route
- US interstate
- VT forest hwy
- 911 structure

LAND USE AREAS

- Neighborhood Residential NR
- Village Residential VR
- Community Business CB
- Rural
- Thetford Hill Historic Overlay
- Forest Block Overlay

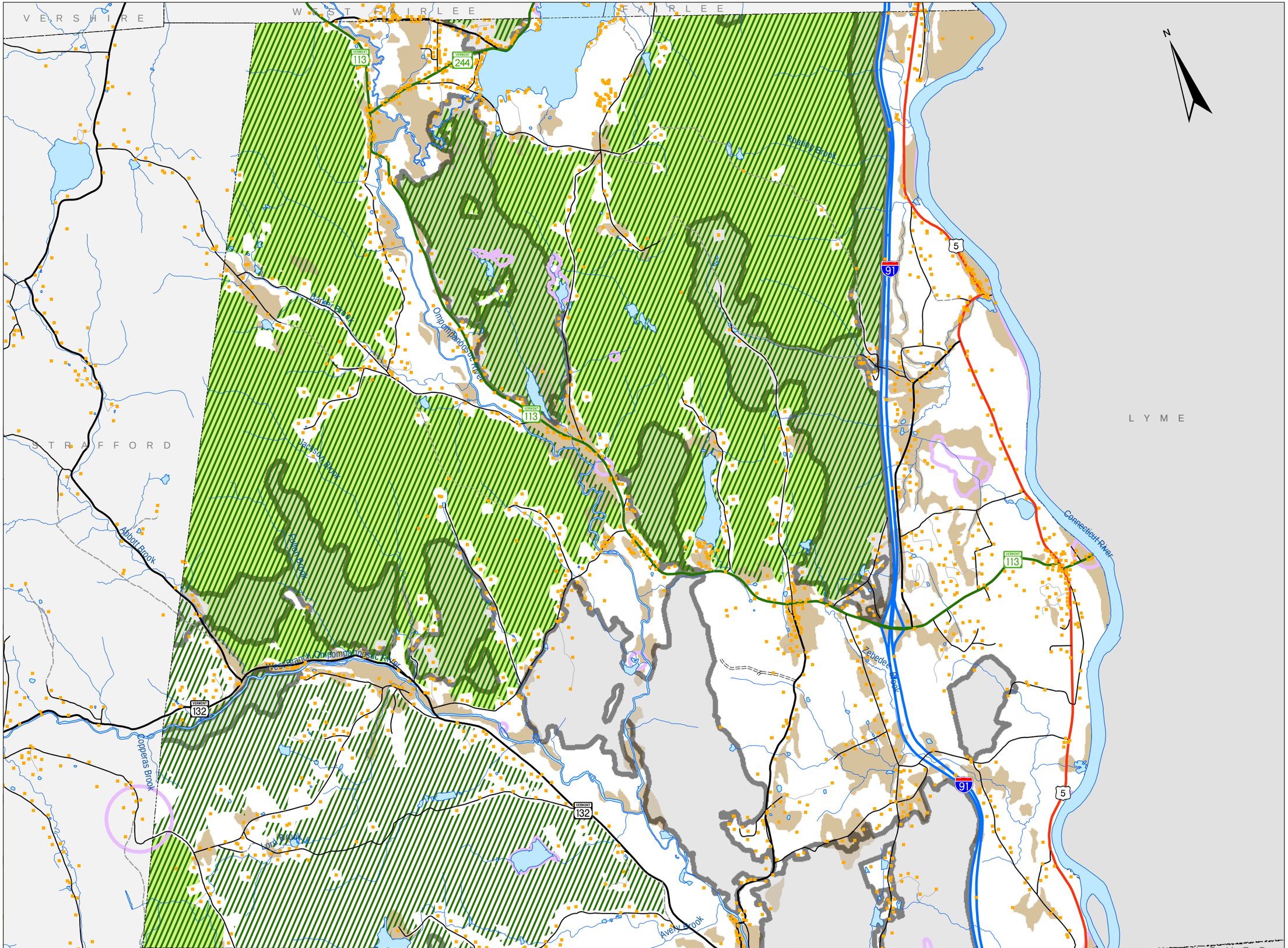
OTHER AREAS

- Federal Lands
- State Lands
- Town Lands

TRORC
Two Rivers-Ottauquechee
REGIONAL COMMISSION

Natural Resources
Thetford, Vermont
Town Plan 2020

Adopted 9/11/2020



- Interstate Highway
- US Highway
- State Highway

- Town Highway Class 2
- Town Highway Class 3
- Town Highway Class 4
- Private Road
- State Forest Highway

- Natural Communities
- Deer Wintering Areas
- NRCS Prime Ag.

VT Conservation Design

- Highest Priority Interior Forest Blocks
- Highest Priority Connector Forest Blocks

1:42,290

1 inch = 3,524 feet

0 0.5 1

Miles

TRORC
Two Rivers-Ottauquechee
REGIONAL COMMISSION

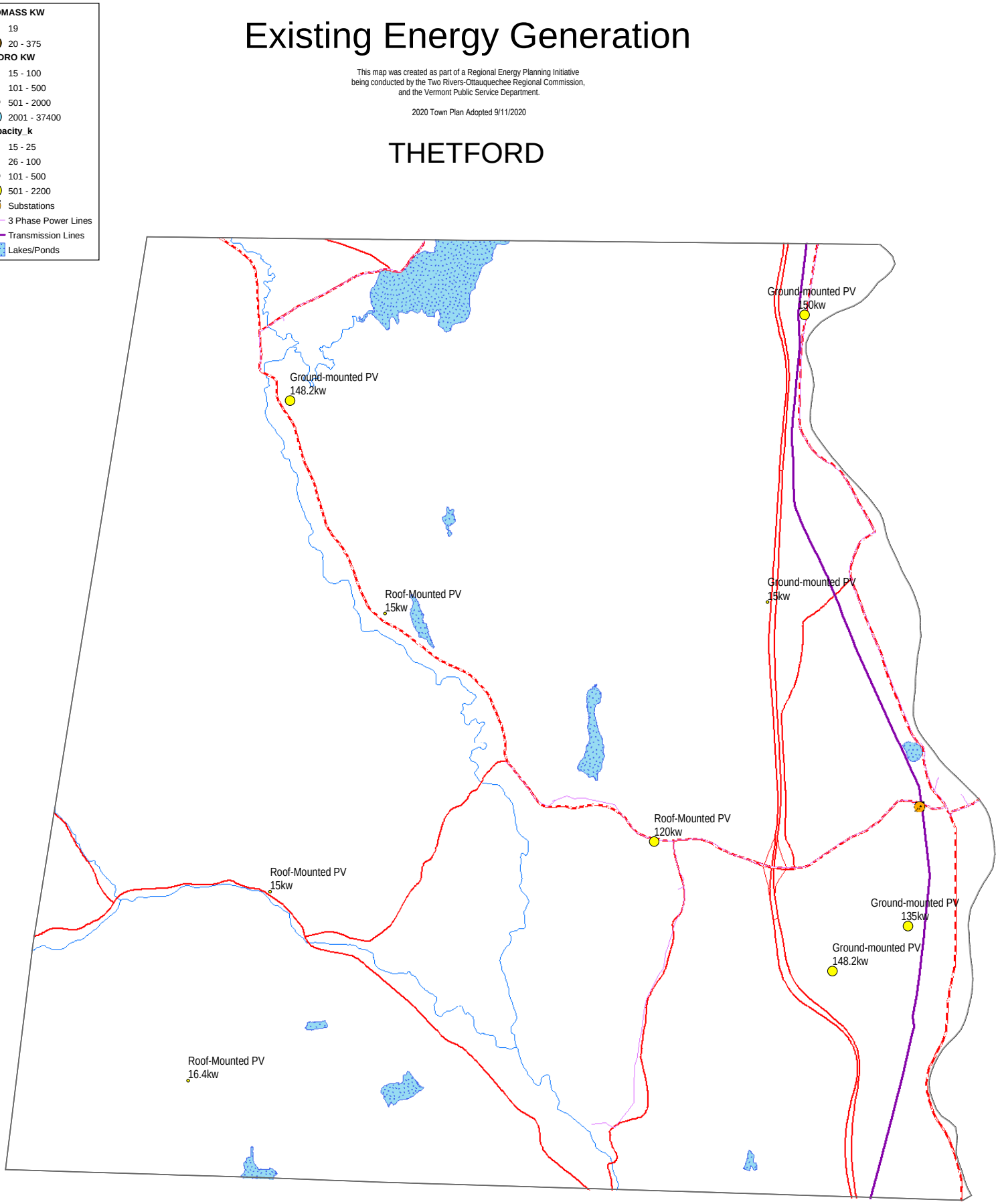
For Planning purposes only. Not for regulatory interpretation.

Existing Energy Generation

This map was created as part of a Regional Energy Planning Initiative being conducted by the Two Rivers-Ottauquechee Regional Commission, and the Vermont Public Service Department.

2020 Town Plan Adopted 9/11/2020

THETFORD



Two Rivers-Ottauquechee REGIONAL COMMISSION
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Solar Energy Potential

This map was created as part of a Regional Energy Planning Initiative being conducted by the Two Rivers-Ottauquechee Regional Commission, and the Vermont Public Service Department.

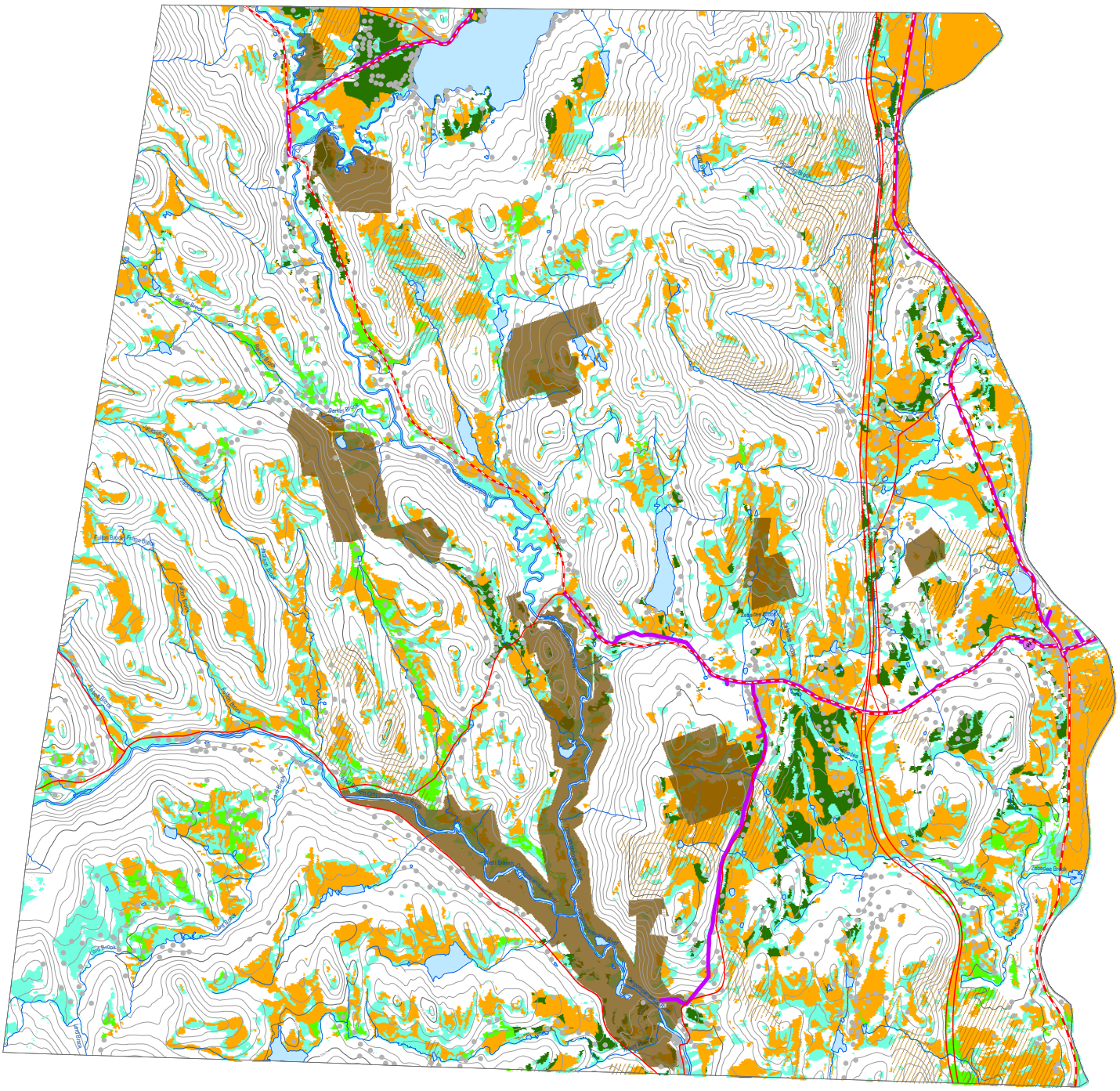
2020 Town Plan Adopted 9/11/2020

THETFORD

Substations
3 Phase Power Lines
Structures w/1ac buffer

Conserved
Public Cons
Private Cons

SOLAR POTENTIAL
Suitability
Prime
Constraints
Prime 1m 3phase
RAW solar



Solar
This map shows areas of potential electricity generation from solar energy. It includes areas with good access to solar radiation and also considers other conditions that may limit the feasibility of solar energy development. These limiting factors are referred to as constraints. Areas of prime solar potential exist where the natural conditions make development feasible and no constraints are present.

These maps are designed to initially identify areas and follow-up on-site work is required to verify the areas are feasible for projects. They are subject to revision and are NOT intended to green-light or fast-track projects.

DARK GREEN Prime: No Constraints within 1 mile 3 phase power
GREEN Prime: No Constraints no known or possible constraints present
ORANGE Constraints no known but at least one or more possible constraints
BLUE GREEN Raw potential with constraints

Known Constraints
Vernal Pools (confirmed and unconfirmed layers)
DEC River Corridors
FEMA Floodways
State-significant Natural Communities and Rare, Threatened, and Endangered Species
Wilderness Areas, including National Wilderness Areas
Class 1 and Class 2 Wetlands (VSWI and advisory layers)

Possible Constraints
Agricultural Soils (VT Agriculturally Important Soil Units)
FEMA Special Flood Hazard Areas
Protected Lands (Updated 07/26/2016.)
Act 250 Agricultural Soil Mitigation areas
Deer Wintering Areas
ANR's Vermont Conservation Design Highest Priority Forest Block Datasets
Forest Blocks - Connectivity
Forest Blocks - Interior
Forest Blocks - Physical Land Division
Hydric Soils

TRORC Unsuitable areas (included in known constraints)
FEMA Floodways
Wilderness Areas, including National Wilderness Areas
Class 1 Wetland

N

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Two Rivers-Ottauquechee
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0 0.475 0.95 1.9
Miles

Wind Energy Potential

This map was created as part of a Regional Energy Planning Initiative being conducted by the Two Rivers-Ottauquechee Regional Commission, and the Vermont Public Service Department.

2020 Town Plan Adopted 9/11/2020

THETFORD

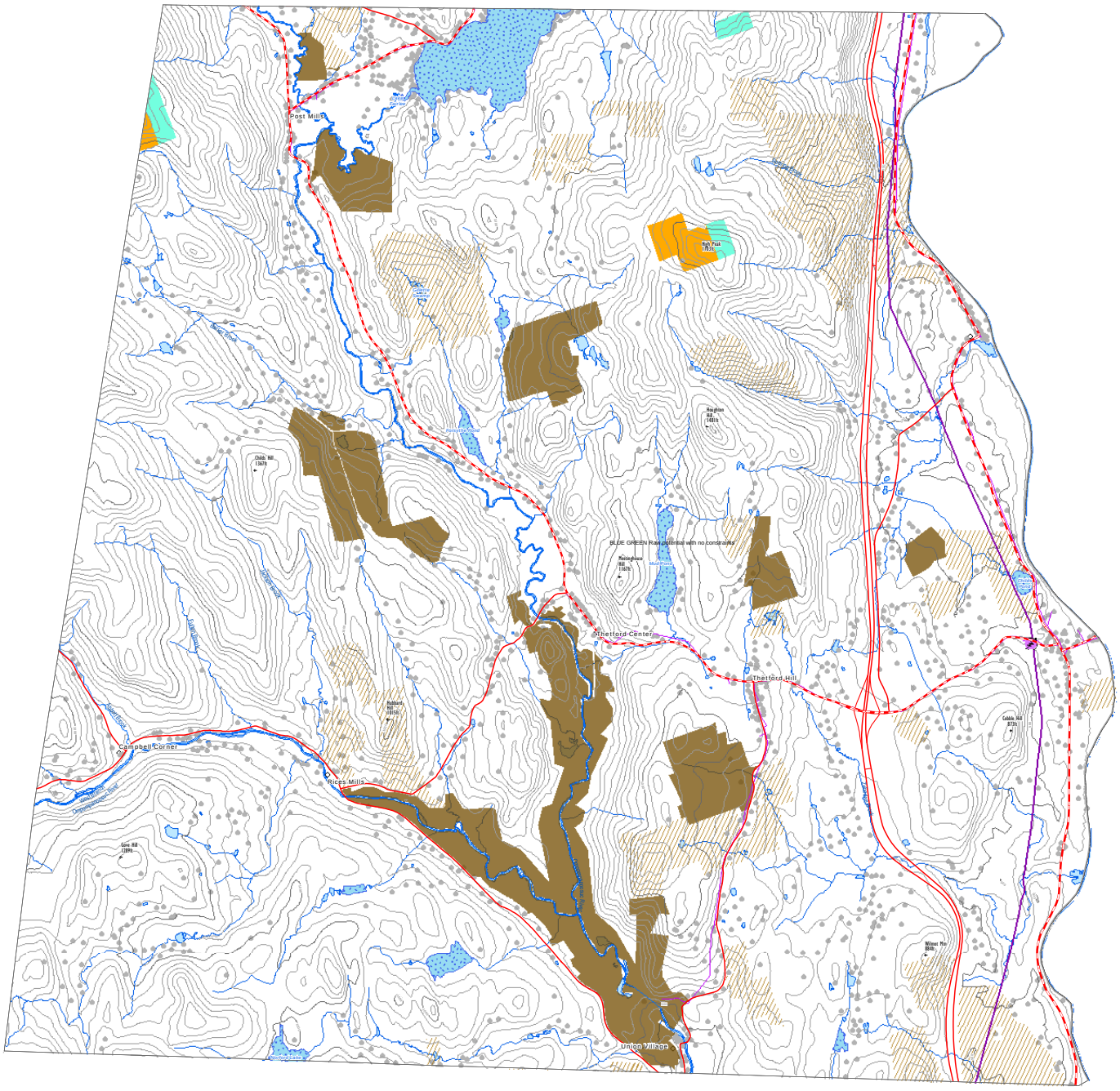
- Substations
- 3 Phase Power Lines
- Transmission Lines
- Lakes/Ponds
- Rivers/Streams

Conserved

- Public Cons
- Private Cons
- Structures w/1ac buffer

Wind Potential Suitability, HubHeight

- Prime, 50
- Prime, 70
- Constraints, 50
- Constraints, 70
- Prime 1m 3phase
- RAW wind



Wind
This map shows areas of potential wind energy development. It includes areas with good access to wind resources and also considers other conditions that may limit the feasibility of wind energy development. These limiting factors are referred to as constraints. Areas of prime wind potential exist where the natural conditions make development feasible and no constraints are present.

These maps are designed to initially identify areas and follow-up on-site work is required to verify the areas are feasible for projects. They are subject to revision and are NOT intended to green-light or fast-track projects.

DARK GREEN Prime: No Constraints within 1 mile 3 phase power
GREEN Prime: No Constraints no known or possible constraints present
ORANGE Constraints no known but at least one or more possible constraints
BLUE GREEN Raw potential with constraints

Known Constraints
Vernal Pools (confirmed and unconfirmed layers)
DEC River Corridors
FEMA Floodways
State-significant Natural Communities and Rare, Threatened, and Endangered Species
Wilderness Areas, including National Wilderness Areas
Class 1 and Class 2 Wetlands (VSWI and advisory layers)

Possible Constraints
Agricultural Soils (VT Agriculturally Important Soil Units)
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Forest Blocks - Physical Land Division
Hydric Soils

TRORC Unsuitable areas (included in known constraints)
FEMA Floodways
Wilderness Areas, including National Wilderness Areas
Class 1 Wetland

N

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0 0.5 1 2 Miles

Town of Thetford Vermont

Phase-I Natural Resources Inventory

Thetford Working Forest Resources

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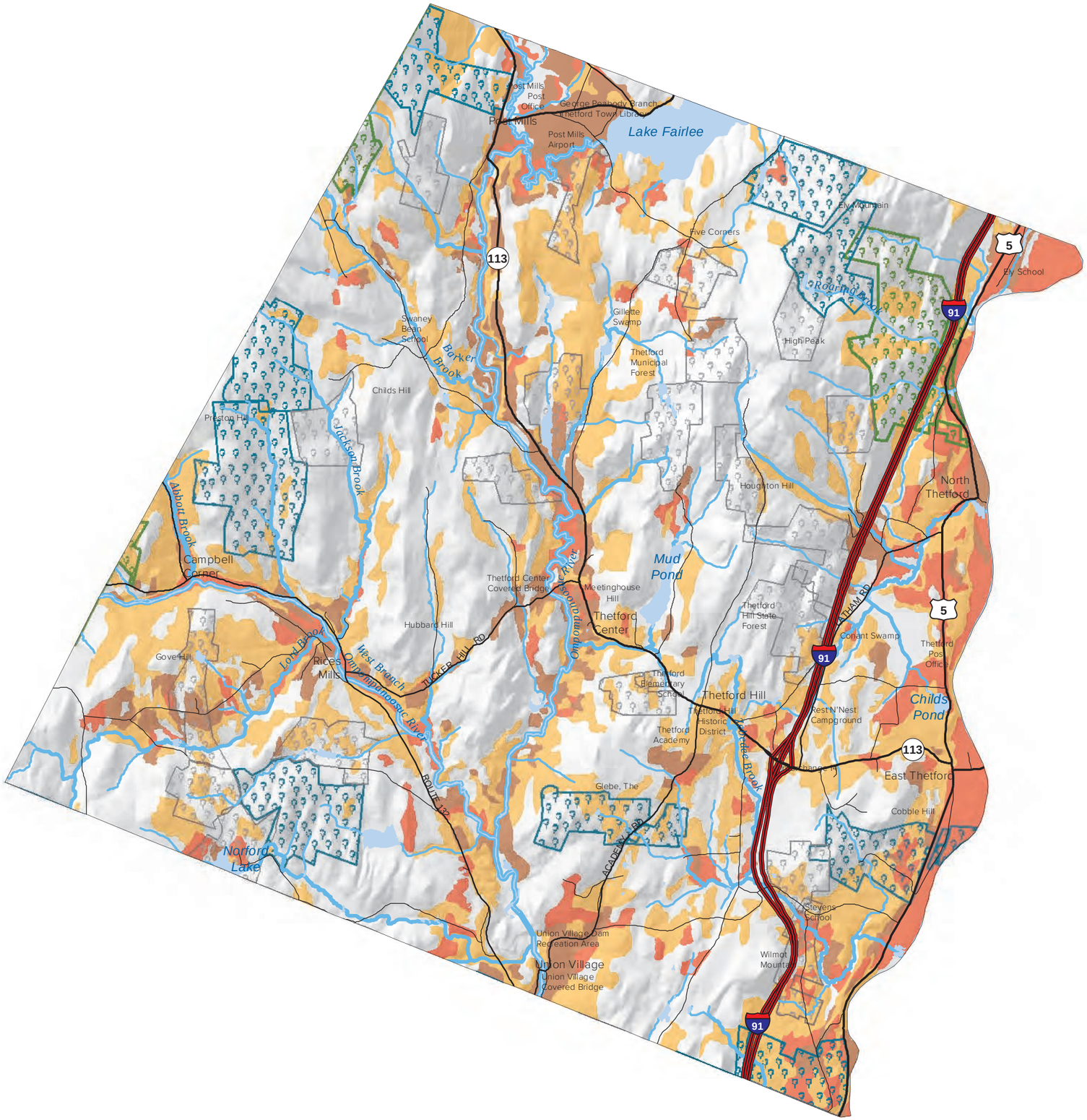


This map is not a survey. Map contains data of varying accuracy and age.

Map produced: 11/11/2019
Map Coordinate System: VT State Plane (NAD 83)

Analysis by:

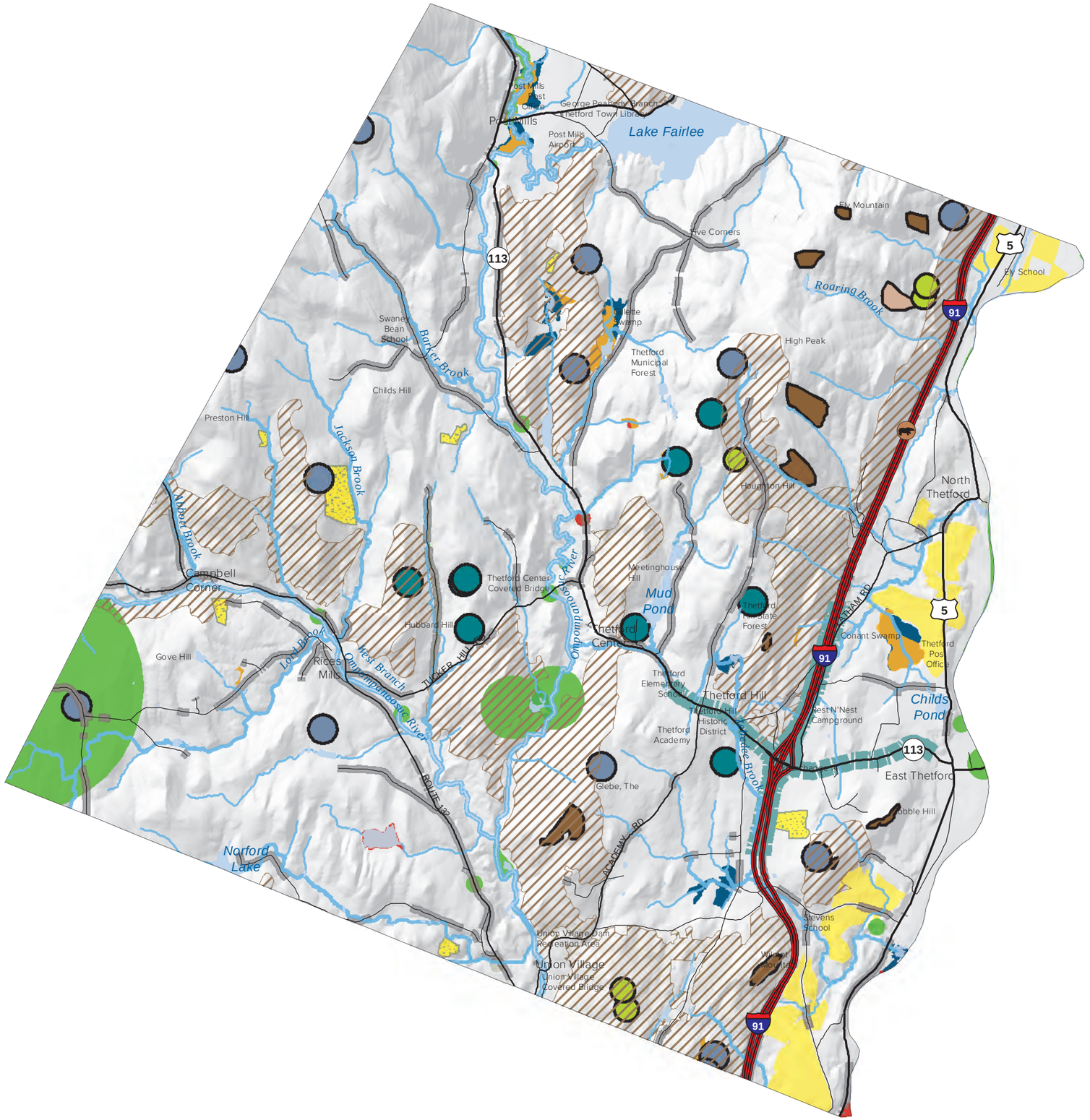
Native Geographic, LLC

Town of Thetford Vermont

Phase-I Natural Resources Inventory

Thetford Wildlife Plant, and Natural Community Resources

1:55,000



- Bear Crossing
- Moose Crossings (Medium)
- Potential High Priority Wildlife Crossings
- Deer Wintering Area
- Confirmed Vernal Pools (VVMP)
- Confirmed Vernal Pools (NG)
- Unconfirmed Vernal Pools
- Rare, Threated, and/or Endangered Animal
- Rare, Threated, and/or Endangered Plant
- State Sig. Natural Community
- Uncommon Animal
- Uncommon Plant
- Locally Sig. Wetland (AE)
- Shrublands
- Grassland Bird Core Habitat
- Mast Area (NG)
- Potential Mast Area (NG)

This map is not a survey. Map contains data of varying accuracy and age.

Map produced: 11/11/2019
Map Coordinate System: VT State Plane (NAD 83)

Analysis by:

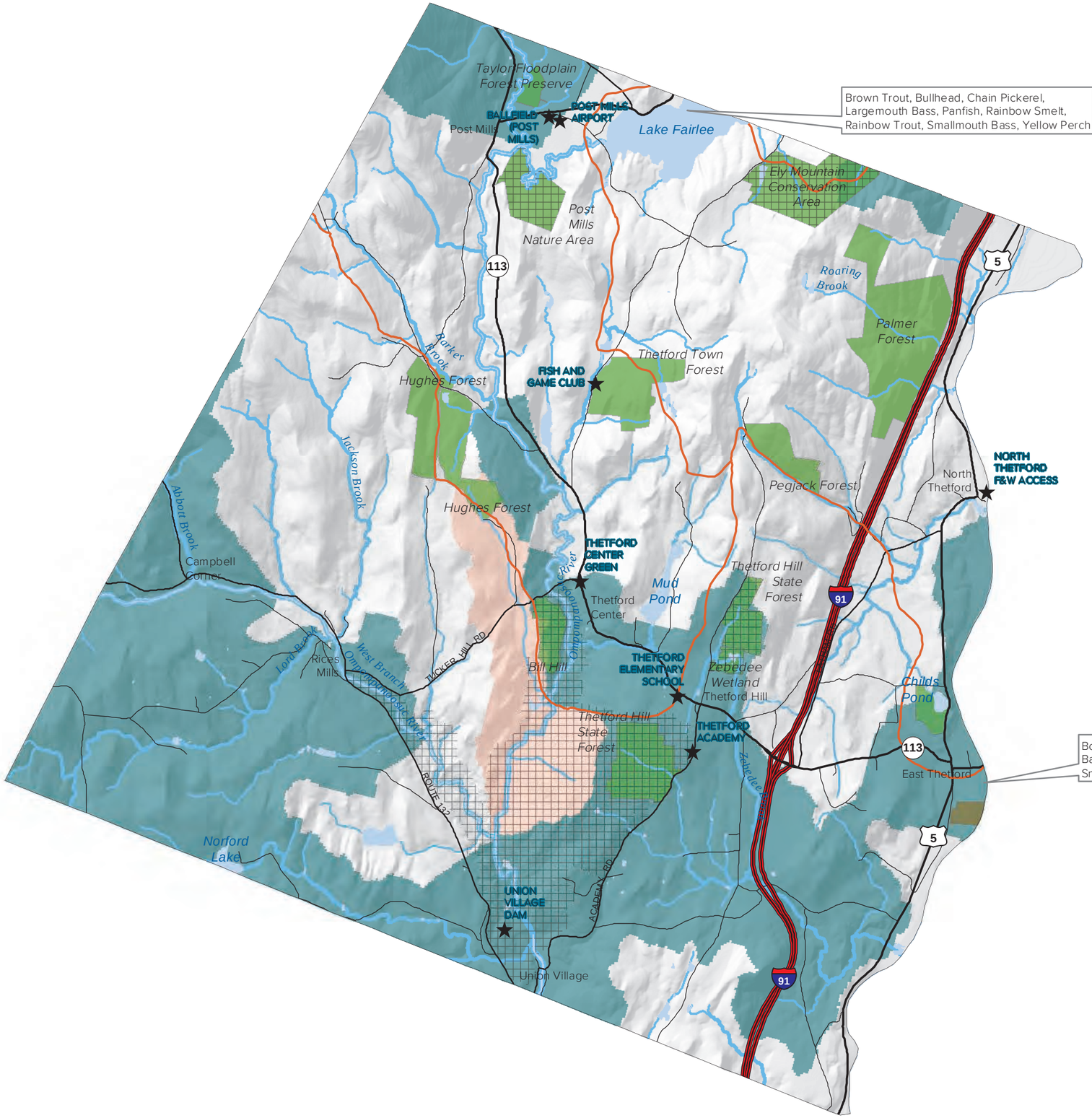
Native Geographic, LLC

Town of Thetford Vermont

Phase-I Natural Resources Inventory

Thetford Recreation Resources

1:55,000



- Outdoor Recreation Sites
- Snowmobile Trail
- Property with Public Trails

Protected Lands with Public Access

- Public Access
- Limited Public Access

Trout Streams and Rivers

- Mixed Wild Trout
- Wild Brook Trout

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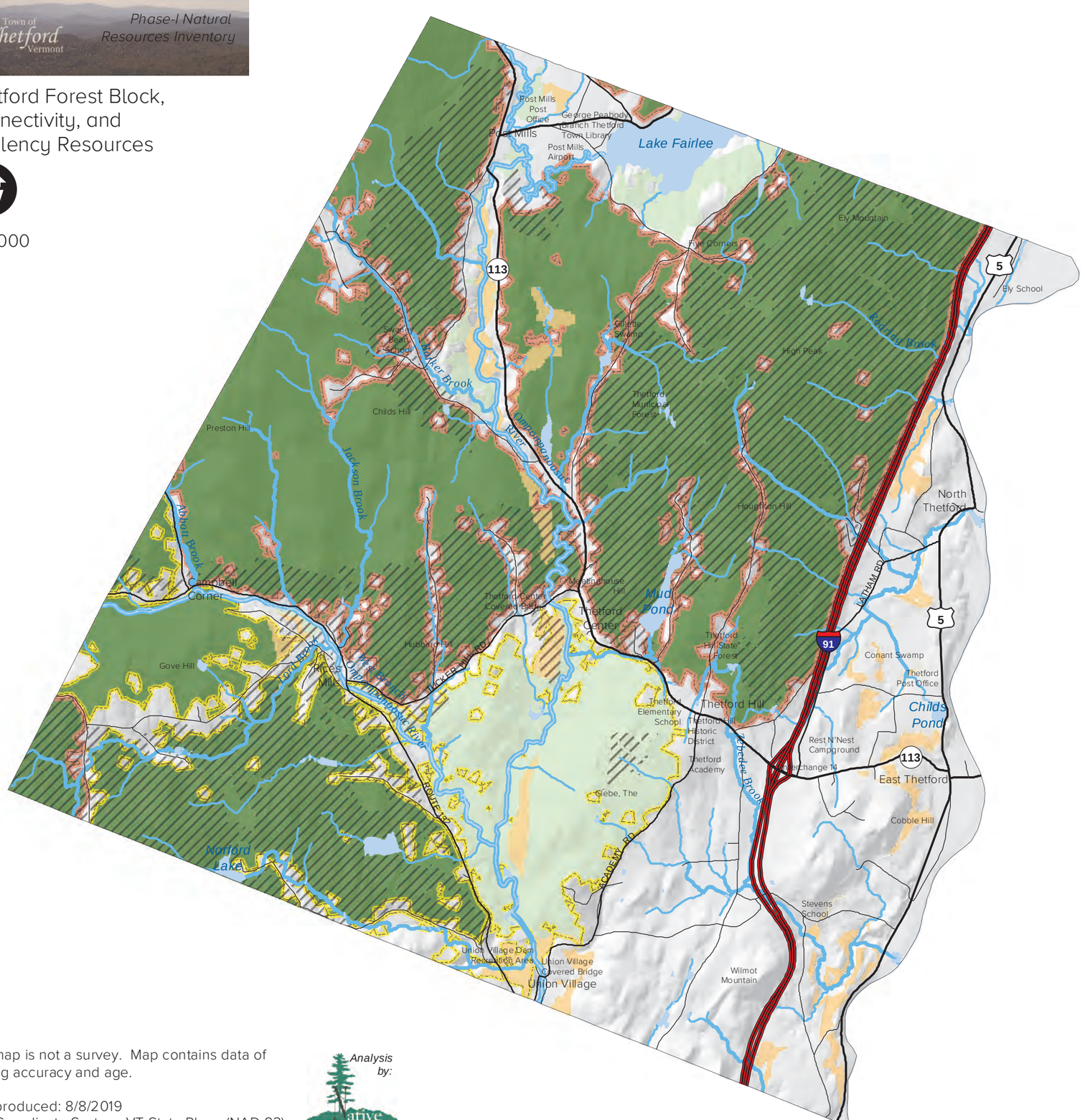
Town of Thetford Vermont

Phase-I Natural Resources Inventory

Thetford Forest Block, Connectivity, and Resilency Resources

1:55,000



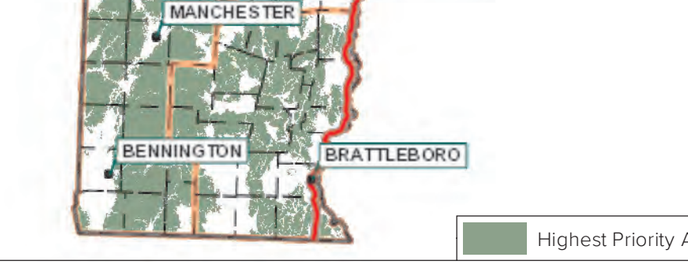
- Highest Priority Interior Forest Blocks
- Priority Interior Forest Blocks
- Highest Priority Connectivity Blocks
- Priority Connectivity Forest Blocks
- Physical Landscape Diversity Blocks
- Priority Resilient Lands

This map is not a survey. Map contains data of varying accuracy and age.

Map produced: 8/8/2019
Map Coordinate System: VT State Plane (NAD 83)

Analysis by: Native Geographic, LLC

Vermont Highest Priority Interior Forest Blocks, Connector Blocks, and Physical Landscape Diversity Blocks



Highest Priority Area

Town of Thetford Vermont

Phase-I Natural Resources Inventory

Thetford Farmland Resources

1:55,000

- Active Farms
- Fields

Important Agricultural Soils

- Prime
- Prime with limitations
- Statewide
- Statewide with limitations

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Analysis by:

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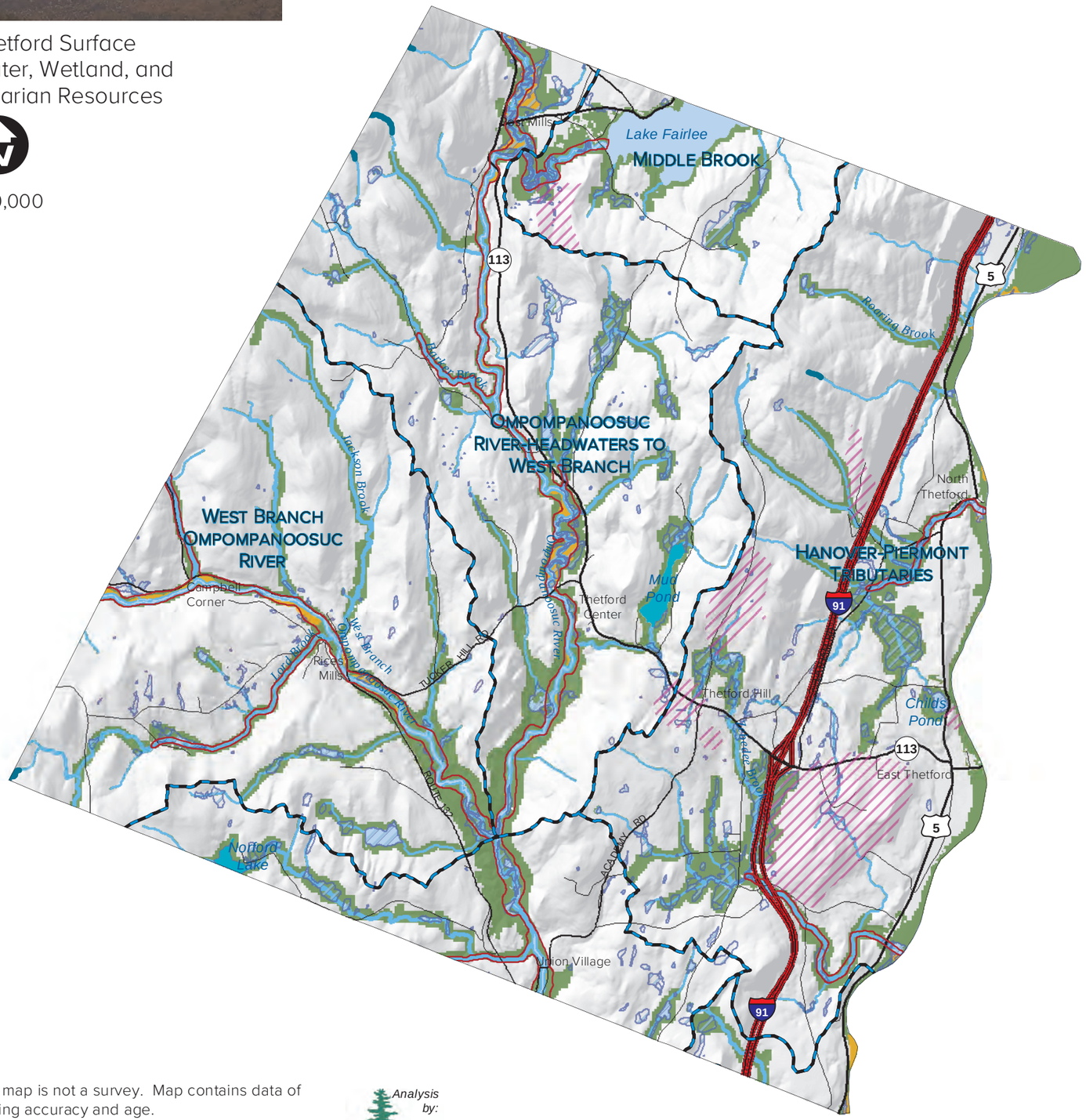
Town of Thetford Vermont

Phase-I Natural Resources Inventory

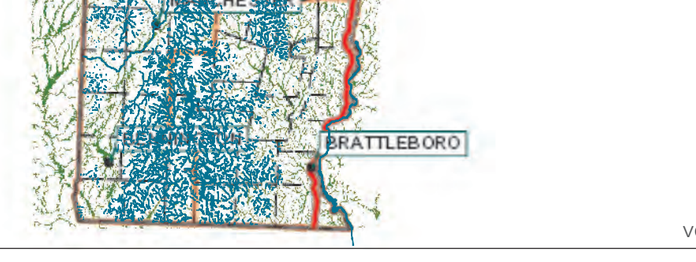
Thetford Surface Water, Wetland, and Riparian Resources

1:60,000



- Watershed (HUC 12)
- Representative Lakes/Ponds
- Exemplary Surface Waters
- River Corridors
- Ground Water Source Protection Areas
- Wetlands (Advisory)
- Potential Floodplain Forest
- Priority Surface Waters/Riparian Areas

Vermont Exemplary Surface Waters and Priority Surface Waters/Riparian Areas



VCGI

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