XX. LAND USE

Land Use Pattern Goal: Focus future growth in the Center, Metro, Enterprise, Suburban, Village, and Transit Oriented Development Planning Areas in order to maintain Vermont's historic settlement pattern and respect working and natural landscapes.

Key Issues/Trends/Insights

[Data from this section drawn from Historic Development and Future Land Use/ Transportation Analysis Report, ECOS Project Building Homes Together Campaign, Prevention Institute's Four Shifts to Heal Communities Report]

Land Use Overview

Land use plans and development regulations (zoning bylaws and subdivision regulations) influence how a community situates and accounts for local transportation, recreation opportunities, medical care and emergency response, food access, safe and affordable housing, access to employment, energy use, and environmental quality. Thoughtful land use planning can guide development to provide diverse housing types and options for renting or owning in all communities, robust bike/ped infrastructure, employment opportunities, and community services in a compact development pattern. Compact development patterns enable people to walk instead of drive, engage with neighbors, and obtain the services they need. This all helps preserves the beauty of our area and habitat for wildlife while reducing greenhouse gas emissions and increasing everyone's access to a healthy and livable community.

In Chittenden County, the way we govern how land is used is done through development regulations. Each zoning district has different rules that regulate the use of land and development design. Good land use planning and development regulations result in the benefits listed above. However, as the American Planning Association points out, the practice of zoning is inherently designed to exclude.[i] This is because those with more time to participate in local political systems, and those with more wealth, generally have more influence over the land use planning and the rules the regulate development. This inequitable participation and influence within our land use governance systems often leads to inequitable outcomes. For example, low-income housing is located closer to industrial uses and in areas susceptible to environmental hazards more frequently then more affluent neighborhoods. Poor land use and public facilities planning may lead to inequitable access to green space in a community.

There are six equity concerns the American Planning Association identifies as being impacted by development regulations: public health, environmental justice, fair access to attainable housing, fair access to economic opportunity and services, the ability to age in place, and cultural preservation.[ii] Given that all these concerns have an impact on community health, understanding the impact of land use policy and development regulations have on shaping the places people live is critical to improve health equity in Chittenden County.

Chittenden County Land Use Trends

- **Suburbanization and Smart Growth.** After World War II, development regulations and consumer preference shifted growth away from the metropolitan areas around Burlington to

more suburban and rural locations both inside and outside Chittenden County. This shift resulted in scattered development at low densities that consumed large amounts of land, created high infrastructure costs, caused habitat, forest, and agricultural fragmentation, decreased ability to walk to services and jobs, and diminished opportunities for social interaction.[iii] In recent decades, CCRPC and our municipalities have moved toward creating a regulatory landscape that supports smart growth. Smart growth principles encourage more sustainable and efficient use of land by encouraging higher density development, which make alternative modes of transportation more accessible (carpooling, public transit, transportation of goods, pedestrian/bicycle travel, etc.), protects wildlife habitats, and encourages opportunities for social interaction.

- **Areas Planned for Growth.** CCRPC has designated several locations on the future land use map as areas planned for growth. Areas planned for growth include includes the Center, Metro, Suburban, Village, and Enterprise planning areas. These areas are locations with existing development in a compact form, transit service, water/wastewater infrastructure, employment, broadband service, bike/ped infrastructure, and health/medical services. Many of these attributes enable smart growth. Therefore, CCRPC's land use strategy is to encourage at least 90% of growth in areas planned for growth. Since 2012, the region has seen at least 80% of new housing built in these areas planned for growth. Between 2018 and 2022, the five-year average was 87% of new housing units constructed in areas planned for growth. In the 2025 ECOS Plan, CCRPC added a Transit Oriented Development (TOD) overlay to the Future Planning Area map. This overlay is intended to illustrate area within a ¼ mile walking distance to public transit service in areas planned for growth and to encourage municipalities to consider higher density development within these areas. The TOD overlay constitutes 6% of Chittenden County's land area.

- **Jobs-Homes Index and Commuting.** A balanced jobs-to-homes index (the number of jobs in an area divided by the number of occupied (non-seasonal) homes) promotes more affordable housing, and lower commuting rates. The jobs-homes index in Chittenden County was 1.44 as of 2021, and while the number of jobs has remained relatively steady in Chittenden County, there are fewer workers living in the County now than in 2002. Only 66.37% of County workers lived in Chittenden County in 2021. This is down from 75% of County workers living in Chittenden County in 2002. As of 2022, between 21.5%-27.5% of Chittenden County residents commute 30 or more minutes to work. Though the COVID pandemic led to a sharp increase in employees working from home, it is too soon to whether this shift will endure long-term. Still, these trends indicate a lack of available, affordable homes within the County which results in an increase of commuting from outside the County. This has numerous ramifications, ranging from increased spending on transportation, reduced time for other activities, increased health risks from extended sitting and increased likelihood of vehicular accidents, and increased greenhouse gas emissions from fossil fuel burning cars. Also, the State's 2022 Analysis of Impediments to Fair Housing Choice identifies the following transportation issue for people in protected classes: "Lack of public transit service outside higher-density, developed areas limits housing choice, especially for low income Vermonters, including a disproportionate number of minority groups."

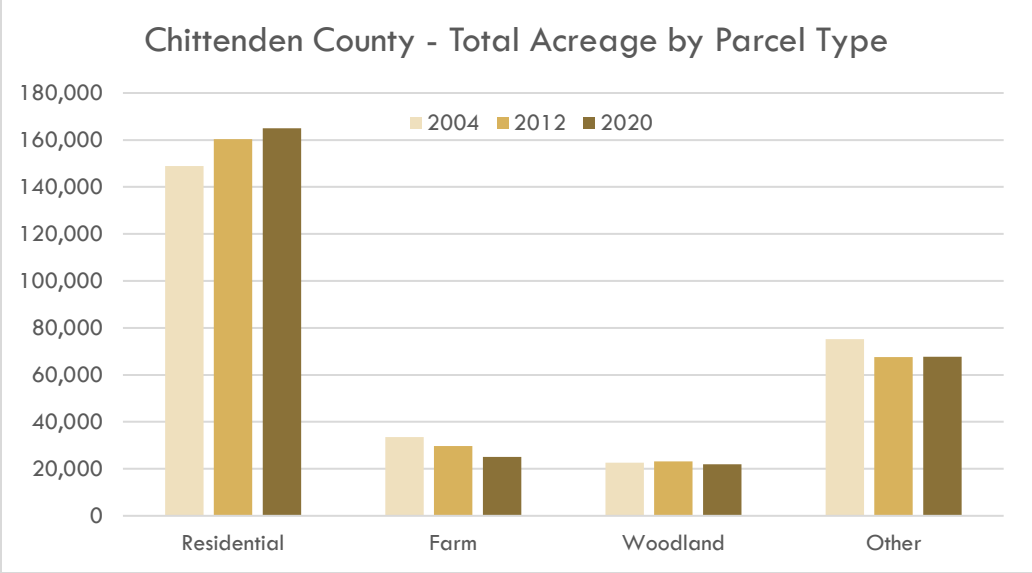
Other Land Use Considerations

- **State Designated Centers.** The State Designation Program is designed, in part, to promote smart growth principles and support traditional development patterns.[iv] Chittenden County includes 15 Villages, 2 Downtowns, 2 Growth Centers, 2 New Town Centers, and 5 Neighborhood Development Areas that are part of the State Designation Program.

- **Historic Sites.** There are over 4,400 designated historic sites (over 2,500 in Burlington alone) and 85 designated historic districts in Chittenden County (see historic resources map here). The original historic surveys used to designate these historic sites and districts were primarily completed in the late 1970s and early 1980s. These surveys should be updated to reflect current conditions. The economic prosperity and social connectedness of Chittenden County both support and depend upon preservation of historic sites and with a compact settlement pattern.

- **Brownfields.** A brownfield is a property for which expansion, redevelopment, or reuse may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant. Contamination impairs the environment, poses risks to human health, and discourages productive use or reuse of the property. Most brownfield sites in Chittenden County are located in our historic downtowns and village centers. The Agency of Natural Resources identifies 81 brownfield sites in Chittenden County. A quarter (28%) of these sites have received a Certificate of Completion of cleanup.[vi] CCRPC operates a Brownfields program to help property owners complete environmental assessments for properties with possible contamination. These assessments are critical to allowing property owners to be able access Federal and State funds for cleanup. Between 2016 and March 2023, CCRPC provided over $500,000 in brownfields assessment funds through grants from the U.S. Environmental Protection Agency and the Vermont Agency of Commerce & Community Development. These grants support identification of old contamination and creation of cleanup plans that enable the redevelopment of new homes and commercial space as well as new community parks, roadway improvements, and other public facilities. CCRPC obtained another $500,000 from EPA in May 2023, and $200,000 from the Vermont legislature in early 2023, to fund future brownfield assessment work in Chittenden County.

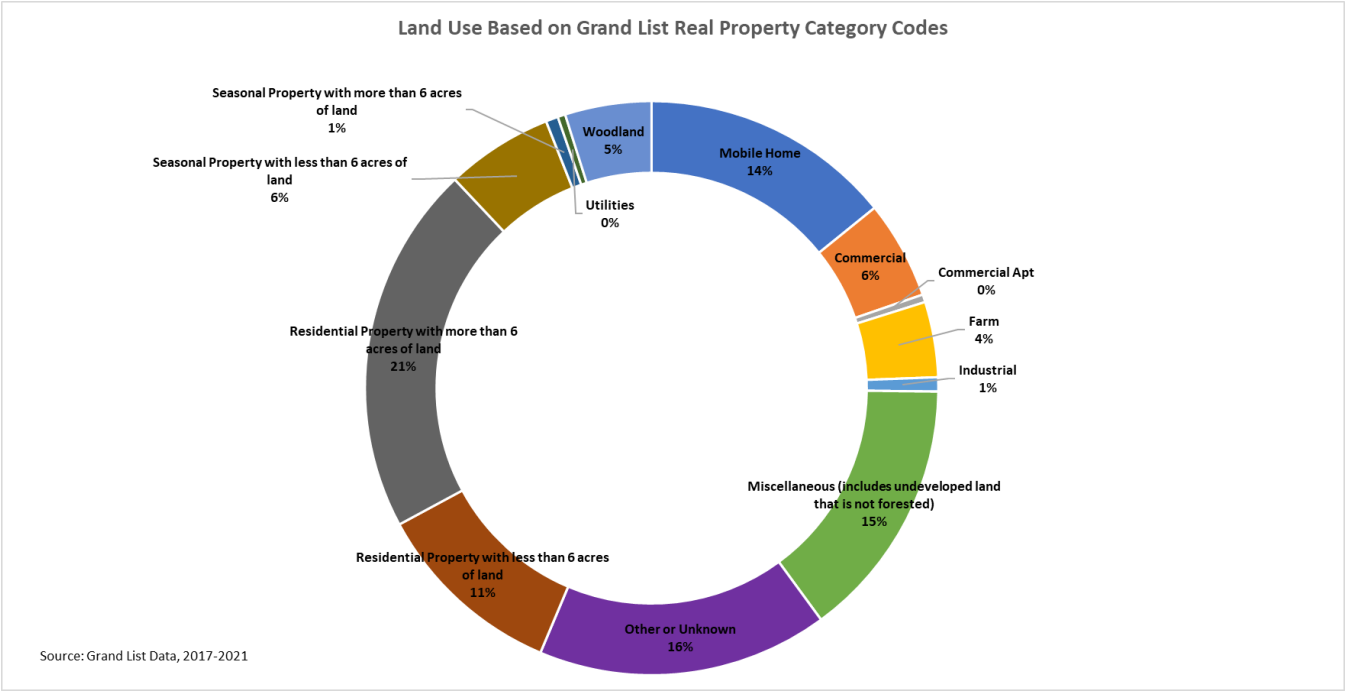
- **Fragmentation.** Future opportunities for farming, forestry, recreation, and tourism in the County will become more limited as suitable open land becomes less available. Land fragmentation, or the increased subdivision of larger lots into smaller lots, has negatively impacted working land in Vermont over the past several decades. The number of parcels in rural areas has increased while average parcel size has decreased. Decreasing parcel size in rural areas diminishes economic viability of agriculture and forestry, may have negative impacts on scenic value, negatively impacts wildlife habitat and connectivity, and negatively impacts the ecological services provided by intact forests (see Ecological Systems Key Issues). Land fragmentation has far-reaching consequences for the future of Vermont's local and tourism economies and our resilience to the effects of climate change.



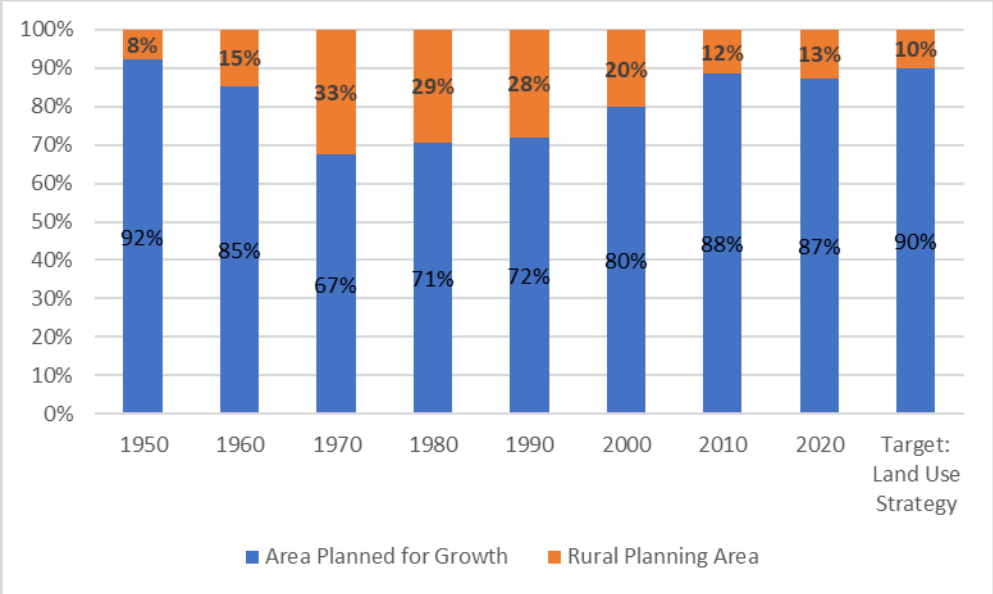
Key Indicators

- **Percent of Land by Real Property Category Code**

FIGURE XX – REAL PROPERTY CATEGORY CODES



- **Percent of Homes in Areas Planned for Growth by Decade: 1950 – 2020**



Additional indicators can be found on the ECOS Scorecard.

Indicators	Location
Density by Planning Areas, 2010	Scorecard
Total New Units Built in Chittenden County	Scorecard
Percent of Residential Development in Areas Planned for Growth	Scorecard
Percent of Residential Development in the Center Planning Area	Scorecard
Commercial and Industrial Development in Areas Planned for Growth	Scorecard

XX. HOUSING

Housing Goal: All households in Chittenden County have access to affordable, safe, energy efficient, accessible and fair housing in all neighborhoods.

Key Issues/Trends/Insights

[Data for this section drawn from Vermont Housing Needs Assessment 2020-2024; ECOS Project Building Homes Together Campaign; HousingData.org; State's 2022 Analysis of Impediments to Fair Housing Choice]

Housing Overview

- **Housing Affordability.** Chittenden County is facing a housing crisis. One third (34%) of all Chittenden County households (both owners and renters) spend more than 30% of their income on housing, the commonly understood threshold for affordability. [viii] Paying more than half of income on housing expenses severely strains a household's budget. This is the case for approximately 8% of owner households (3,550 households) and 28% of renter households (6,890 households) in Chittenden County.[ix] These households are at much higher risk of foreclosure, eviction, homelessness, and frequent moving which harms residents and community connectedness. More housing, and more affordable housing, is needed now.

- **Age of Housing Stock.** Per the American Community Survey, nearly 60% of the County's housing stock was built before 1980 when lead-based paint was widely used, when most home insulating/heating/energy technology was inefficient, and when building and accessibility codes did not yet accommodate all types of residents.[x] Reinvestment in our existing housing stock is needed to ensure high quality homeownership and rental housing opportunities for all Chittenden County residents.

- **Homelessness:** The annual Point in Time (PIT) Count is the only county-wide data available that estimates the number of people experiencing homelessness. The most recent PIT Count shows that on one night in January 2023, there were at least 758 individuals experiencing homelessness in Chittenden County, which represents a quarter of Vermont's homeless population. The PIT count inevitably underrepresents the total number of people experiencing homelessness because it is conducted over one night and does not include those living with friends or family. It does include those sleeping in shelters or transitional housing.

  Racially marginalized communities experience homelessness disproportionately more than the population as a whole in Chittenden County (see Table XX below). To properly address the housing crisis in the county, we must account for these inequities when creating solutions.[xii]

  The COVID pandemic exacerbated many of the existing housing challenges and uncovered a housing market that was even worse than previously documented for low-income households. The number of homeless households in Chittenden County has increased by 149% from the pre-pandemic homeless point-in-time count in January 2020 (217 households) to the count in January 2022 (541 households). Swift response by the State of Vermont with the CARES Act and ARPA funding to support renters and homeowners to cover their housing costs prevented further

catastrophe with regard to homelessness. However, the State's eviction moratorium ended in mid-2021 and most Federal funding to support temporary housing ended in mid-2023. This includes Rental Assistance Program which supported 12,000 households statewide during the height of the pandemic.

TABLE XX: HOMELESSNESS BY RACE COMPARED TO TOTAL POPULATION

Race / Ethnicity	% of Total County Population (2020)	% of 2023 County Homelessness PIT Count
American Indian, Alaska Native, or Indigenous	0.2%	1.3%
Asian or Asian American	4.3%	1.1%
Black, African American, or African	2.9%	7.5%
Native Hawaiian or Pacific Islander	0.0%	0.1%
White	85.7%	37.9%
Multiple Races	5.9%	2.0%
Hispanic / Latin(a)(o)(x)	2.8%	3.2%
Non-Hispanic / Latin(a)(o)(x)	97.2%	46.9%
Sources: 2020 Decennial Census;[xiii] 2023 Chittenden County Point-In-Time Count[xiv]		

- **Homeownership**: Chittenden County residents do not have equal access to housing opportunities. The State's 2022 Analysis of Impediments to Fair Housing Choice identifies many issues that restrict housing choice and participation in local decision making including: a lack of affordable housing supply that is accessible to persons with disabilities; discrimination based on disability, familial status (e.g. presence of minors), and other protected classes; barriers that make it difficult for minority households and new Americans to become homeowners; and lack of representation by members of protected classes on boards and commissions dealing with housing issues. Specifically, historic exclusionary systems have prevented BIPOC households from developing household wealth at the same rate as white households (primarily through equity gained via homeownership). Systemic racism in housing practices means that today some BIPOC households lack financial resources to compete in the Chittenden County homeownership and rental markets. Only 17% of Black and African American households own a home in Chittenden County compared to 64% of White households.[xvi]

- **Rental Housing:** Chittenden County has an extreme scarcity of housing units for rent. As of June 2023, the regional apartment vacancy rate was 1% for market rate units.[xxi] This is among the lowest rental vacancy rates in the entire country.[xvii] The rental vacancy rate is slightly higher than the rate that was measured during the COVID-19 pandemic. During the pandemic, tenant turnover and rent loss was somewhat mitigated by temporary government rent relief programs and eviction moratoriums. Construction delays and work stoppages during the COVID-19 pandemic have also contributed to slow rental housing development. Scarcity of available units has also resulted in higher rental housing costs.[xviii]

- **Short-Term Rental Housing:** Short-term rental properties can reduce the number of available properties for long-term renters. While this doesn't currently appear to be an issue at a county wide level, the City of Burlington began to regulate Short Term Rentals in 2022 by adding restrictions and incorporating a 9% tax that funds the Housing Trust Fund. Some Short-Term Rental landowners have filed a lawsuit in response to the ordinance. The impact of this lawsuit are worth monitoring. According to the 2020 Statewide Housing Needs Assessment, Chittenden County has the lowest rate of short-term rentals (1%) as a percentage of its housing stock in the state. The number of short-term rental homes in the county was 678 in March 2023, compared to 536 in July 2018.[xix]

- **Housing and Employment.** The lack of housing is a major factor in jobs going unfilled, as employees cannot find homes they can afford. When the first ECOS Plan was done in 2013, 83% of Chittenden County businesses identified housing as the #2 obstacle to job growth. Businesses surveyed for the 2023 CEDS update indicated the same problem. Megan Sullivan, vice president of government affairs at the Vermont Chamber of Commerce, describes it well in a VT Digger commentary:[xx]

  > *While funding workforce development and capital investment opportunities remain crucial, there is only one ultimate solution. We need more people to call Vermont home. This requires a robust and sustained marketing effort of Vermont as a welcoming community, with job opportunities and an unmatched quality of life. It also requires taking immediate action to address the glaring barrier to workforce growth: an overwhelming lack of suitable and affordable housing stock for middle-income families*."

  Economic development efforts and infrastructure investments need to focus on housing production and housing affordability.

Our Current Approach

- **Building Homes Together:** Together with Champlain Housing Trust and Evernorth, CCRPC launched the five-year Building Homes Together campaign in 2016 with the goal to build 3,500 new homes, including 700 permanently affordable, through policy changes, increased capital, and education and advocacy. The first five-year campaign was successful in achieving the total homes targets, but it is clear to all partners that production is still falling short of demand due to the impacts of COVID-19, an aging demographic, an increase in single person households, and population growth. Despite a total of 3,659 homes built, only 536 permanently affordable homes were built out of the 700 affordable target.

  Pent-up demand from low housing production rates since the 2000s mean few homeownership opportunities and an extremely low rental vacancy rate. There may also be increased demand from folks moving to the state and region to escape climate change challenges elsewhere (such as: flooding, extreme heat, drought, etc.). Therefore, Building Homes Together 2.0 was launched in 2021 with a new target of 5,000 new homes by 2025 for people of all incomes, including at least 1,250 affordable homes. The first two years of the campaign have fallen short of the annual goal to build 1,000 new homes per year. In 2021, a net total of 900 new homes were added in the County. In 2022, only 594 net new homes were built. See the BHT Dashboard for more details.

- **Zoning and Housing.** In 2023, CCRPC began collaborating with the Vermont Zoning Atlas team to comprehensively inventory and map the where municipal land use regulations restrict the type and density of housing development across the state. The Zoning Atlas translates hundreds of lengthy and complex legal documents into a simple map, allowing for comparisons across jurisdictions and highlighting opportunities for reform.

- **HOME Act.** Act 47 of 2023 removed certain restrictions on housing development from municipal and state regulations with the goal of streamlining review processes for housing development allowing more diverse types of housing to be built and increasing densities in areas with municipal water and sewer service. The law also prevents municipalities from adding restrictions to housing projects and shelters for those experiencing homelessness. Finally, the law established numerous programs to support construction and rehabilitation of affordable housing while setting in motion further reforms to Act 250, the State Designation Program, and how regions and municipalities plan to address housing needs. CCRPC plans to support municipalities with technical assistance as they incorporate necessary changes into their development regulations in order to remove barriers to different housing types and construction.

- **Municipal Efforts.** Chittenden County municipalities have taken significant steps to increase housing production, including but limited to: applying for grant funds to support affordable housing construction projects, increasing density in areas planned for growth, streamlining development review processes, enabling Accessory Dwelling Units, incorporating inclusionary zoning provisions, establishing housing trust funds, housing committees, creating housing needs assessments and action plans, etc. There is no single housing solution for all the municipalities as there are unique circumstances (i.e. income levels, wastewater capacity, bus service, etc.) that will foster different solutions to help increase housing availability, choice and affordability.

Key Indicators

Additional indicators can be found on the ECOS Scorecard.

Indicators	Location
Percent of Owner Households Spending Over 30% of Income on Housing Expenses	Scorecard
Percent of Renter Households Spending Over 30% of Income on Housing Expenses	Scorecard
Percent of BIPOC Homeowners	Scorecard
Percent Black Homeowners	Scorecard
Months of inventory for condos	Scorecard
Months of inventory for single-family homes	Scorecard
County-wide Rental Apartment Vacancy Rate	Scorecard
Burlington and Winooski Rental Apartment Vacancy Rate (Metro)	Scorecard
Rental Apartment Vacancy Rate rest of Chittenden County (Non-Metro)	Scorecard
Homelessness	Scorecard
Inventory of Affordable Rental Units	Scorecard

XX. CLIMATE

Climate Change Goal: Reduce greenhouse gas emissions, adopt practices to mitigate the impacts of climate change on the environment and communities, and adapt to become more resilient to a changing climate.

Key Issues/Trends/Insights

[Data for this section drawn from The 2021 Vermont Climate Assessment]

Climate Change in Vermont

- Vermont is becoming warmer (average annual temperature is about 2°F warmer since 1900) and Vermont's winters are becoming warmer more quickly (winter temperatures have warmed 2.5x more quickly than average annual temperature since 1960). On average, lakes and ponds across Vermont are icing-out one to three days earlier per decade since the 1970s and 1980s Vermont is also becoming wetter (average annual precipitation has increased by 21% or 7.5 inches since 1900). Extreme weather events such as droughts and floods are expected to continue to increase with climate change. Vermont experiences 2.4 more days of heavy precipitation than in the 1960s, most often in summer. However, Vermont still experiences prolonged droughts because of shifts in the water cycle and different regions of Vermont can experience different climate impacts. (2021 Vermont Climate Assessment).

- Scientists overwhelmingly agree that changes in climate worldwide are a result of human activities with the main cause identified as the burning of fossil fuels. Climate model forecasts for the Northeast US predict that during this century temperatures will continue to increase. So too will extreme heat days and heat waves. More total precipitation, and extreme precipitation events, are expected although short-term summer droughts may also become more frequent.

Climate Change Impacts

- **Air Quality.** Air pollution and higher pollen production will increase problems for people with allergies, chronic respiratory diseases and asthma. Additional, warmer temperatures and changes in precipitation could lead to increased wildfire susceptibility in Vermont and in neighboring areas This will have a negative impact on health as smoke exposure is a health hazard. Summer air quality will deteriorate as warmer temperatures promote the formation of smog.

- **Water.** More frequent intense rainfall will increase storm water runoff and the potential for flooding. Increased rain and runoff will wash pollutants into our waterways. Warmer waters and nutrients will encourage growth of bacteria and blue-green algae. Cold-water aquatic species, such as brook trout, will struggle to survive in warmer waters and in competition with better-adapted species.

- **Heat.** High temperatures and heat waves will increase the risk of heat stress for the elderly, very young children and populations living in urbanized areas that lack tree cover and vegetation. Heat stress is especially concerning for the people living in urbanized areas as these areas can experience the heat island effect. The heat island effect occurs in urbanized areas because trees and other vegetation which offer natural shade and cooling are limited. Buildings and roads also reflect the sun's heat more than natural landscapes which increases daytime temperatures. Heat stress can also cause a financial burden for low-income households as they may have difficulty with the increased cost to cool their homes and may also live in less energy efficient homes. It is also important to acknowledge that Chittenden County's urbanized areas are also areas considered disadvantaged according to the Federal Government's Justice40 Initiative.

- **Built Environment.** Flooding will put homes, businesses and public infrastructure in flood-prone areas at risk. Flooding may impact the safety of the water supply; droughts will also threaten water

supplies. Although warmer winters will require less fuel for heating, hotter summers will increase electricity demands for cooling. Urban trees will be increasingly important as urban trees reduce the urban heat island effect through shading and reducing stormwater runoff.

- **Agriculture.** Warmer temperatures will disrupt maple sugar production, reduce yields of cool-weather crops, and decrease production from heat-stressed dairy animals, yet climate change may extend the growing season and allow new crops not previously viable in Vermont to be grown here. However, growing conditions will be tougher because of greater variability in temperatures and precipitation, and increased frequency and intensity of flooding may cause significant crop losses. Regenerative farming practices such as no-till agriculture, cover cropping, innovative rotational grazing and agroforestry, and riparian buffer restoration can mitigate these impacts while improving soil health. In addition, farms that diversify their products will be better prepared to manage uncertain environmental and market conditions. Finally, encouraging widespread small-scale food production in urban and small-lot rural residential areas can help make our local food systems more resilient to supply chain disruptions.

- **Ecological Communities.** Our forests will change: maple, beech and birch trees will gradually be replaced by oak and hickory trees that are better adapted to warmer, wetter conditions. Invasive species, like the hemlock woolly adelgid and the emerald ash borer, will further affect change in forest composition. Warmer temperatures allow the spread of insect-borne diseases, such as West Nile virus and Lyme disease.

- **Recreation and Tourism.** Recreation and tourism is one of the most lucrative industries in the state.[xxiv] Warmer temperatures impacting the ski season and other activities (i.e. leaf peeping and apple picking) that are temperature dependent may decrease tourism dollars coming into the state if these activities are less viable. However, new tourism activities could arise with longer summers and warmer shoulder seasons.

- **Disparate Impact.** Climate change has been shown to disproportionately affect marginalized communities. These communities often face higher levels of vulnerability due to factors such as limited access to resources, inadequate infrastructure, and socioeconomic disparities. For example, VT Digger reports that “Market pressures … are constantly pushing lower income people further and further toward options that reduce their quality of life — older, more degraded housing stock, or housing stock that churns through natural disasters more quickly.”[xxv] This problem could be exacerbated as Vermont develops a national reputation as a climate refuge and people with the means relocate to safer housing.

Climate Change Response

- **Climate Mitigation.** Climate mitigation strategies will reduce the region’s contribution of greenhouse gases. Although Chittenden County is a small part of global greenhouse gas emissions, it is important that Chittenden County do its part to help solve the problem. Specifically, Chittenden County should help the State reach the goals of reducing 40% of greenhouse gas emissions from the 1990 baseline by 2030 and 80% of greenhouse gas emissions from the 1990 baseline by 2050. Climate mitigation is discussed in the energy and greenhouse gas emissions reduction section as well as in Strategy 4.

- **Climate Adaptation.** Climate adaptation strategies help individuals, businesses and communities be able to withstand and bounce back from – or even take advantage of – the impacts of climate change. The Vermont Climate Action Plan includes pathways for adaptation and building resilience for communities and the built environment, natural and working lands, and other cross-cutting pathways. Examples include the following:

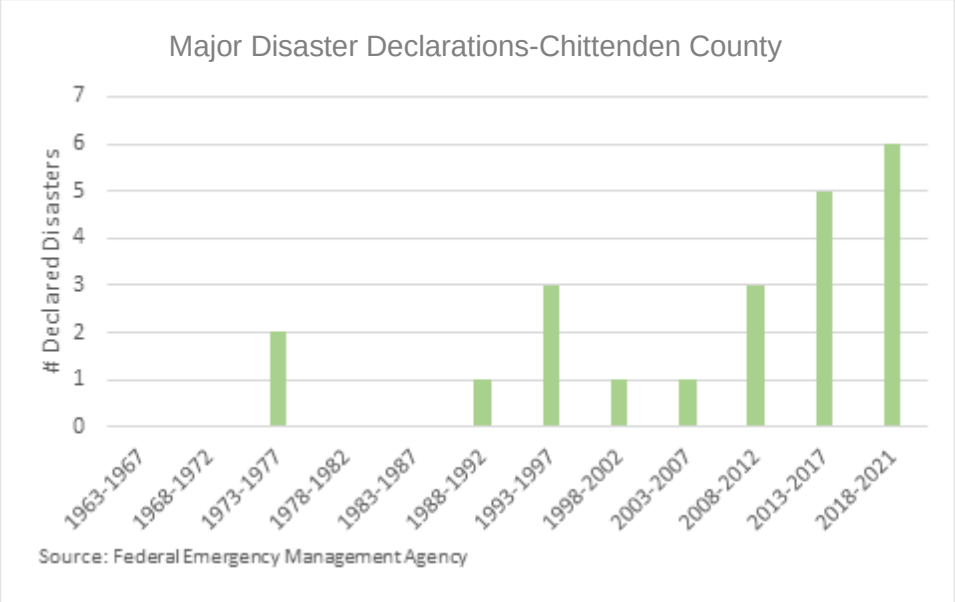
- Emergency management practices help communities adapt to climate change impacts, particularly those related to flooding. This includes strategic retreat from floodplains and river corridors, flood-proofing buildings already at risk, and increasing flood-carrying capacity of culverts and stormwater infrastructure. In addition, restoring riparian buffers and wetlands as well as replacing impervious surfaces with green spaces and increasing urban canopy cover will absorb excess water and reduce the magnitude of flooding while improving wildlife habitat, sequestering carbon, and improving aesthetic value. These efforts aim to reduce the vulnerability of communities to flooding events and ensure their resilience in the face of climate change. Flood mitigation is discussed further in the Emergency Management and Ecological Systems key issues and Strategies 6 & 7.
- Designing buildings with energy-efficient systems, promoting green building practices, and prioritizing clean transportation and reducing emissions can create healthier and more sustainable built environments that can withstand the challenges posed by climate change. These practices can also address public health threats from heat and poor air quality. See the Energy and Greenhouse Gas Emissions Reduction key issue and Strategy 4 for further details.

- **Equitable Responses to Climate Change.** The impacts of climate change will likely exacerbate existing inequalities. Marginalized communities have limited capacity to adapt and recover from climate-related disasters, leading to long-lasting consequences. Addressing the disparate impacts of climate change on marginalized communities requires a comprehensive approach that includes equitable policies, community engagement, and targeted support.

Key Indicators

- **Major Disaster Declarations** - Major disaster declarations are made for natural events causing damage so severe that it is beyond the combined capabilities of state and local governments to respond.

FIGURE 14 - MAJOR DISASTER DECLARATIONS, CHITTENDEN COUNTY
-



- **Climate-Related Infectious Diseases.** Increased transmission of vector-borne diseases is a key supporting indicator associated with climate change. The Vermont Department of Health tracks the number of new Lyme disease, West Nile virus (WNV) and Eastern Equine

Encephalitis (EEE) cases each year. In 2023, the Health Department reported no human cases of WNV or EEE.in Chittenden County.

Indicator	Location
Greenhouse Gas Emissions, 2010	Scorecard
Major Disaster Declarations	Scorecard
Heat Stress Hospitalizations	Scorecard
Number of Confirmed Lyme Disease Cases Reported to be Exposed in Chittenden County,	Scorecard

Additional indicators can be found on the ECOS Scorecard.

X. ENERGY AND GREENHOUSE GAS EMISSIONS REDUCTION

Energy Goal: In pursuit of an equitable transition for all communities, move Chittenden County's energy system toward cleaner, more efficient, and renewable sources in a manner that benefits public health, the natural environment, economic vitality, and the local/global climate in alignment with the State's Comprehensive Energy Plan goals and the Global Warming Solutions Act.

Key Issues/Trends/Insights

[Data for this section is drawn from Energy Analysis, Targets & Methodology in Supplement 6 of this Plan, the State of Vermont Comprehensive Energy Plan, and associated appendices.

Energy Overview

- As noted in the Climate section, fossil fuel combustion is a major cause for increases in the atmospheric concentration of carbon dioxide and other greenhouse gases, which are the causes of global climate change. Because fossil fuels drive our present-day economy, countries with higher gross domestic products and people with wealth have higher carbon footprints than poorer countries or individuals. Climate change will have profound impacts on the environment, public health, infrastructure, and economy of Chittenden County. However, just as the contribution to climate change is not distributed evenly, nor are the impacts of climate change.

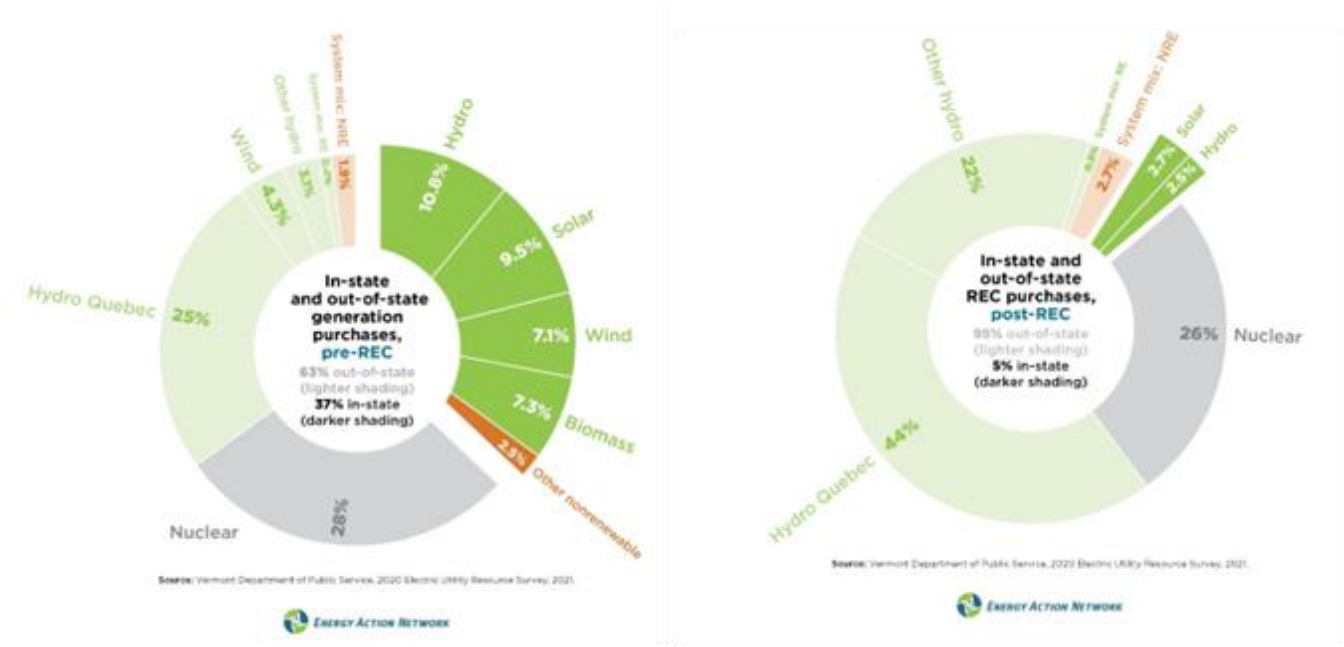
- According to the State of Vermont's Climate Council's Guiding Principles for a Just Transition, studies continue to show that low-income communities, indigenous people, and Black and communities of color are among those who are particularly vulnerable to the impacts of climate change. Impacted populations also include older and chronically ill Vermonters, as well as people with disabilities. Additionally, the initial up-front cost of transitioning to electrification in the renewable energy generation, heating, and transportation sectors may be burdensome to these impacted communities. Therefore, investments, policies, administration, and oversight should tackle the needs of impacted people first by including targeted strategies for different groups that consider their specific histories, sociocultural, and economic realities.

- A transition to renewable energy will drive down carbon emissions to avoid more severe impacts of climate change. To meet the goals in the State of Vermont Comprehensive Energy Plan (CEP), the region is planning for a major shift away from fossil fuels in the transportation and heating sectors to renewable sources of energy, efficiency in all sectors, and an increase in renewable energy generation within the state and from outside the state.

- Vermont citizens, businesses, and industries spend about $1.9 billion a year to pay for imported fossil fuels (2022 Energy Action Network (EAN) Annual Report). About 75% of this money leaves the County and state immediately. This outflow of energy dollars acts as a drain on the local economy. The inverse is true for electricity: about 70% of spending on electricity recirculates within the state economy (regardless of how renewable energy credits are traded). Developing local renewable energy generation systems will provide more jobs and economic stimulation within the state in addition to advancing other energy-related goals.

- The 2022 Vermont Energy Action Network's Annual Progress Report documents the power mix physically delivered to the state (based on contractual, or ownership entitlements) as shown in the pie chart below. The power mix looks different after renewable energy credits are traded, but either approach shows that Vermont's electricity consumption is 96-97% carbon-free and less than 5% fossil fuel based. See the annual report for further information.

Figure X: Sources of Vermont Electricity, pre- and post-REC



- The price of energy is forecasted to continue increasing in the future, which will result in an additional burden on the County's residents and businesses, especially for low- or fixed-income households. Reducing energy consumption and generating on-site renewable energy are ways to mitigate the increasing costs of energy.

- Vermont, and the County, rely heavily on gasoline and diesel for transportation. However, gasoline usage for transportation has decreased due to improved fuel economy standards and the adoption of electric vehicles in the light duty sector. According to the Energy Information Administration, between 2012 and 2021, motor gasoline consumption decreased by almost 11% or from 7,409 to 6,606 thousand barrels.[lxx]

- Chittenden County is home to an international airport and a National Guard base. Transportation fuel consumption in the County not only includes gasoline, diesel, and compressed natural gas, but also aviation gasoline and jet fuel.

Weatherization and Energy Efficiency

- Weatherizing homes has an immediate impact on people's lives and promotes energy efficiency and a cleaner environment. Once a home is weatherized, there is an average annual energy savings of 31%.[lxxi] which puts much-needed money back into the pockets of people who need it the most. Weatherization is a critical anti-poverty program for low-income households that also promotes environmental justice and health equity. For example, weatherization programs reduce carbon emissions and assist in the removal of environmental hazards such as lead, asbestos, and vermiculite. These environmental hazards are typically found in older buildings located within Chittenden County's disadvantaged neighborhoods, as defined by the Federal Justice40 Initiative.

- The 2022 CEP and the State Climate Action Plan call for an ambitious target to weatherize 120,000 homes by 2030 statewide to meet carbon reduction goals and to protect the health and

financial security of Vermont's most impacted communities. According to the state's Low Emissions Analysis Platform (LEAP) model, Chittenden County would need to weatherize 44% of homes by 2030 and 82% of homes by 2050 to advance this weatherization goal. According to the 2022 Vermont Energy Action Report, 31,338 homes have been weatherized statewide as of 2020. To meet the state's weatherization goal, the Energy Action Network estimates that Vermont's qualified weatherization workforce needs to grow from 770 people working in weatherization as field workers, office staff, and energy auditors to 6,200 people by 2030.[lxxii] To meet the weatherization goal, the State needs to address all the challenges affecting the weatherization workforce. These challenges include shortages of skilled workers willing to work in uncomfortable conditions, wage competition with less-strenuous working conditions, fluctuations in funding/incentives for weatherization projects, and affordable housing. As noted in the Comprehensive Economic Development Strategy (CEDS), a current workforce shortage in the weatherization industry represents a challenge to meeting these goals, but there is also an opportunity to address this by supporting reskilling and transitioning from the fossil fuel industry.

- Chittenden County has a long history of electrical and natural gas energy efficiency programs, dating back to 1990 through efficiency utilities such as BED, VGS and Efficiency VT. These programs, along with improvements in federal standards have led to a reduction in per household and per employee energy consumption of electricity and natural gas and have provided significant energy savings and economic benefits to the state and County. Reduction in energy consumption directly results in a reduction in energy bills. The Home Performance with ENERGY STAR® guidelines and building/renovating to the State's Building Energy Code are two programs which assist Vermonters with reducing energy consumption from heating and electricity in homes and businesses.

- The Affordable Heat Act of 2023 establishes a possible market mechanism to be implemented in 2026 that will incentivize the delivery of cleaner energy options so these options can become increasingly available and affordable for Vermonters. This is intended to accelerate weatherization and switching to clean fuels in the thermal sector.

Fuel Switching and Electrification

- **Electric Grid Evolution.** Vermont's energy future includes a transition to beneficial electrification in the heating and transportation sector. Beneficial electrification is a term for replacing fossil fuel powered appliances and vehicles with heat pumps, electric vehicles, energy storage and smart appliances to reduce emissions and energy costs. However, increased electricity demand coupled with renewable energy generation and storage may create challenges for the electric grid and for homes. Homes and businesses may need costly upgrades to electric service to ensure adequate amperage for increased-load electrical appliances like EV charging and cold climate heat pumps. Finally, the cost of electricity itself, which is relatively high in Vermont compared to other states, is another barrier to electrification. Therefore, innovative programs and education are needed to ensure that low income and BIPOC communities are not particularly burdened by the transition to electrification, Smart Grid technology coupled with education, behavior change, price signaling (e.g., time of use rates), and load control technologies can help reduce peak demand and defer substation upgrades, which can result in substantial cost saving.

- **Transportation.** To prepare for Vermont's CEP goal of electric / zero-emission vehicles accounting for 100% of light-duty vehicle sales by 2035, electric vehicle charging station equipment (EVSE) should be installed as part of new development or redevelopment to ensure charging is available. Most EV owners do their charging at home. However, public charging at key locations and workplace charging may offer benefits for businesses, employees, and customers. Although, the CEP goal only references light-duty vehicle sales be electric/zero-

emission, planning and education is needed on electric heaty duty vehicles to ensure this sector of the vehicle fleet is also transitioning to cleaner fuel sources.

Retrofitting existing residential multi-unit dwellings (MUDs) with EVSE and the necessary electric service amperage is imperative to ensure that electric vehicle adoption is equitable, and all drivers have adequate access to charging infrastructure. MUD residents in apartments and condominiums often have more challenges in gaining access to home EV charging due to parking issues and cost. Renters in MUDs have additional barriers to long-term investments in charging infrastructure for shorter-term housing. In addition, policies, and pricing structures to encourage off peak charging need to be considered to mitigate grid constraints associated with electric vehicle charging. Refer to CCRPC's EV Charging Equipment Location Prioritization Technical Report for specific priority locations for EVSE.

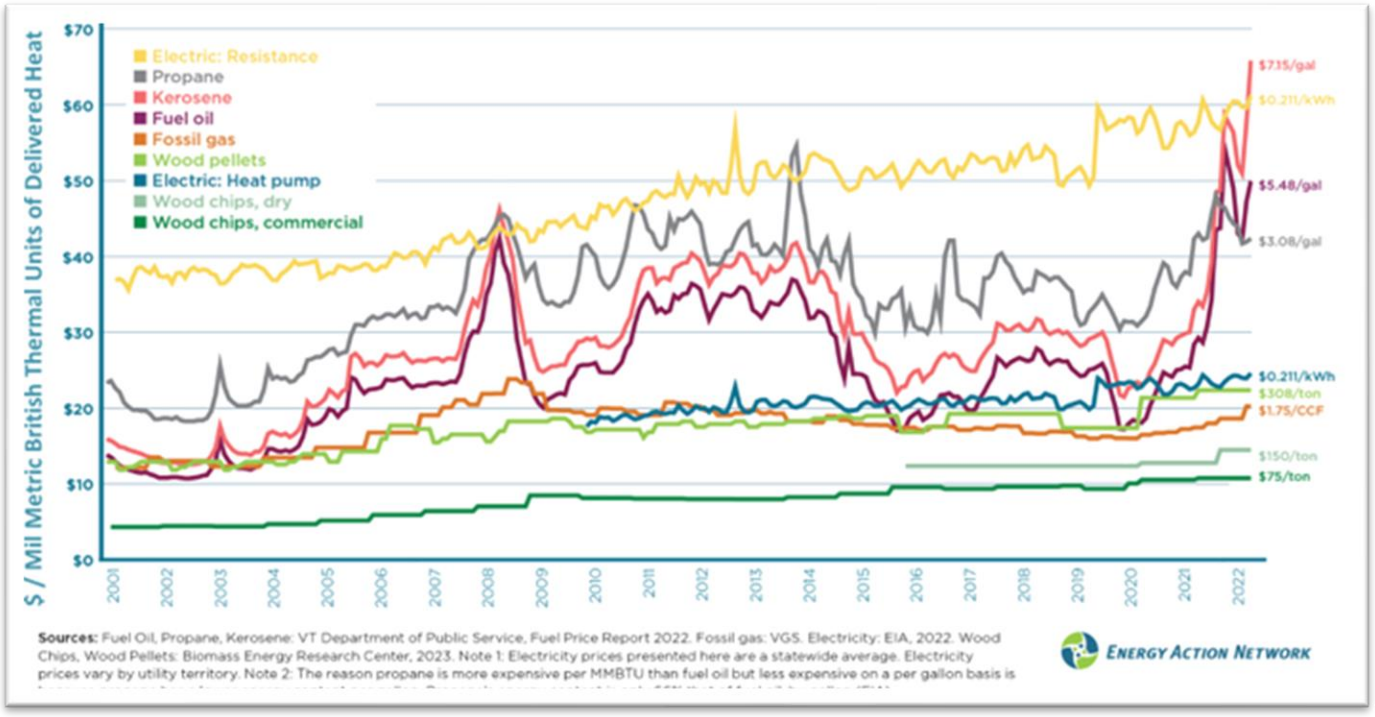
- The 2023 Metropolitan Transportation Plan (MTP) anticipates increases in transit ridership, significant mode shift from driving to biking or walking, including the use of electric bikes (e-bikes) to reduce energy and emissions from transportation. See the MTP for additional information.

- **Heating.** The Affordable Heat Act of 2023 establishes a regulatory framework for the heating sector to shift away from fossil fuel use. Promoting air source and ground source heat pumps (powered by a renewable electric grid), in addition to using sustainably harvested wood/biomass systems, biogas and networked geothermal, are key steps to meeting the Global Warning Solutions Act requirements and the 2022 CEP goals.
  - However, low income, BIPOC, and renter households are likely to experience barriers and be burdened by the cost of transitioning to heat pump technology or any technology because of the cost of upfront investments to retrofit buildings.
  - Incentive programs specifically designed for impacted or burdened populations are necessary to ensure the transition to heat pumps is equitable and accessible. However as noted in the 2022 Vermont Energy Action Network Annual Report (Figure X), the cost of natural gas ($15.67 per MMBTU) is less than electric-powered air source heat pumps ($22.44 per MMBTU), so customers are not likely to save money on their energy bills by replacing existing natural gas heating systems with heat pumps and is an impediment to advancing the State's energy and decarbonization goals. However, buildings switching from fuel oil or propane to a heat pump system will save customers money and protect customers from price volatility as the cost of electricity is less than fuel oil or propane and is less susceptible to price fluctuations. Even so, there may be structural challenges to fuel switching for some buildings, particularly for mobile homes since the design of their underbelly utility systems requires more heating in winter to prevent frozen pipes than heat pump technology can currently achieve.

  - Net-zero buildings and heat pumps as the primary fuel source in new buildings will help the region meet its goal of shifting the heating sector away from fossil fuels. Additionally, key partners in the energy transition are making progress towards becoming more renewable in the thermal sector. These are described in the bullets below.
    - The City of Burlington is pursuing a district heating system from McNeil Generation Station's waste heat to be a source of renewable thermal energy for University of Vermont and University of Vermont Medical Center. When constructed, this heat source will replace natural gas demand and help the region meet its thermal energy targets. Additionally, the city has adopted a Net Zero Energy Roadmap to reduce and eliminate fossil fuel use from heating.
    - VGS's comprehensive strategy for NetZero by 2050, with an immediate goal of reducing GHG emissions for customers by 30% by 2030, is critical to achieving the State's energy and climate goals. Expanding renewable natural gas to make up 20% of the supply mix by 2030 and is also part of VGS's strategy. Moreover,

VGS is exploring networked geothermal for its customers with a priority focus on affordable housing and low to middle income communities which will ensure that lower income households have access to an equitable way to transition off fossil fuels for heating and the burden is not placed on them to bear the responsibility of making the transition.

Figure X: Cost Comparison of Different Heating Fuel Options Over Time (Source: EAN 2022 Annual Progress Report, p. 27)



- Net-zero buildings and heat pumps as the primary fuel source in new buildings will help the region meet its goal of shifting the heating sector away from fossil fuels. Additionally, key partners in the energy transition are making progress towards becoming more renewable in the thermal sector. These are described in the bullets below.
    - The City of Burlington is pursuing a district heating system from McNeil Generation Station's waste heat to be a source of renewable thermal energy for University of Vermont and University of Vermont Medical Center. When constructed, this heat source will replace natural gas demand and help the region meet its thermal energy targets. Additionally, the city has adopted a Net Zero Energy Roadmap to reduce and eliminate fossil fuel use from heating.
      VGS's comprehensive strategy for NetZero by 2050, with an immediate goal of reducing GHG emissions for customers by 30% by 2030, is critical to achieving the State's energy and climate goals. Expanding renewable natural gas to make up 20% of the supply mix by 2030 and is also part of VGS's strategy. Moreover, VGS is exploring networked geothermal for its customers with a priority focus on affordable housing and low to middle income communities which will ensure that lower income households have access to an equitable way to transition off fossil fuels for heating and the burden is not placed on them to bear the responsibility of making the transition.

- **Biomass.** Biomass in the form of cordwood and wood chips is one of the most affordable sources of heating in Vermont. In addition, wood residuals (wood recovered from waste streams or timber processing) and low-grade wood (produced from chipping tops and branches of trees felled for other purposes) are used to generate electricity at Burlington's McNeil Plant.[lxxiii] However, as noted in other sections of this plan, their use must be balanced with the need to maintain ecological values and carbon sequestration and storage.
    - Harvesting of low-grade wood is sustainable when it does not exceed the net growth rate of low-grade wood in forests. The state's Net Available Low-Grade (NALG) wood has increased since 2010; though NALG may decrease in the short-term due to fluctuations in the rates of forest growth and demand for low-grade wood, the long-term outlook allows for use of low-grade wood for both heating and electricity generation at current or slightly higher levels (see Supplement 6 for further analysis).
    - Carefully planned harvesting of mature trees (particularly those useful as low-grade wood or lumber) through the practice of uneven-aged management will increase overall tree growth and carbon sequestration rates while restoring the health and diversity of Vermont's forests. It will also provide an important source of local and renewable fuel and building materials that avoids pushing our impacts elsewhere and provides economic value to retaining forests as they are rather than converting them to non-forest uses.[xxvi] Additionally, using thermal energy sourced from wood fuel creates an opportunity for jobs in the biomass and wood energy market in Vermont, although an aging forestry workforce is a current concern in the forestry economy. [xxiv]
    - Given this, CCRPC continues to support use of low-grade wood provided that is sourced through forest management practices that prioritize maintaining long-term ecological health, carbon sequestration and storage rates, and regenerative economic value from forests.

Renewable Electricity Generation

- As of 2022, Chittenden County generates 606,554 MWh annually (a 19% increase from 511,242 in 2017) of renewable energy from a range of non-fossil fuel based, renewable energy production sites owned by utilities, private parties, and municipalities. Reliable, cost effective, and environmentally sustainable energy availability is critical to support the economy and natural resources of Chittenden County.

- **Equitable Access to Renewables.** The environmental and cost saving benefits of renewable energy generation are not always equally accessible. Impacted communities may be left out or burdened by renewable energy generation programs because of not owning homes or living in multi-unit buildings that are not well suited for installing their own systems. Community solar (a solar project in which the benefits flow to multiple customers) is one way to increase ownership access to renewable energy generation because energy generated at one site can be shared with many people who may not own a suitable site for solar energy generation. Community solar participation also provides savings on electricity expenses which is especially helpful for lower income households.

- **Peak Loads and Resilience.** Grid resilience is valued by both residents and business. Vermont's weather and landscape patterns make the state vulnerable to power outages. Therefore, coupling distributed energy generation with battery storage systems and microgrids (groups of buildings that can operate in isolation when the grid is unavailable) will help to improve grid resilience. Moreover, as the region electrifies the heating and transportation sectors with solar and wind generation sources, energy storage systems will be necessary to manage peak loads and turn intermittent sources into relatively consistent sources of energy.

- **Renewable Energy Standard**. Act 56 of 2015 established a renewable energy standard (RES) which requires Vermont's electric utilities to source 55% of their retail electricity from renewable sources by 2017, 75% by 2032, and 90% by 2050.
    - Among the four electric utilities that operate within Chittenden County, Green Mountain Power's supply is now 100% carbon free; it is also currently 78% renewable and will be 100% renewable by 2030. Burlington Electric Department's portfolio is also 100% renewable. Both utilities claim these achievements post renewable energy credit sales (RECS). Vermont Electric Co-op plans to meet or exceed its RES obligations by 2030. GlobalFoundries was recently approved to operate its own electric utility subject to the RES and is exploring substantial renewable energy and storage technologies to be located on its campuses in Essex Junction and Williston.
    - While the region's baseline electricity consumption overwhelmingly comes from carbon-free and even renewable sources, during peak demand times energy from renewables is not sufficient. To meet the demand, peak electricity is mostly provided by natural gas generation, which is a source of greenhouse gas emissions.
    - The RES requires electric utilities to work with customers to reduce fossil fuel use and decrease carbon emissions from transportation and thermal heating by offering new innovative programs and services to their customers. For example, electric utilities serving the region are offering incentives for electric vehicles, charging equipment and heat pumps to meet the statute and deliver innovation.

- Vermont's rural nature offers challenges for the transmission and distribution of energy. It is important to maintain and develop an energy production, transmission, and distribution infrastructure in Chittenden County that is efficient, reliable, cost-effective, and environmentally responsible. The Vermont Electricity Power Company (VELCO) is Vermont's electricity transmission utility. VELCO's 2021 Long-range Transmission Plan notes that the regional transmission system serving West Central Vermont adequately serves current needs, yet may require substantial upgrades in future years, particularly as more local electricity generation occurs. Several of the principal electricity distribution utilities serving the region, including Burlington Electric, Green Mountain Power, Washington Electric Coop, and Vermont Electric Coop, all have areas with significant system constraints where future system upgrades may be needed.

- The cost of electricity is impacted by the distance it travels. When electricity is transmitted over long distances a significant amount of electricity is lost. Locating generation near electric loads reduces transmission losses and may result in more cost-effective retail electricity rates.

Energy and Land-Use Planning

- **Compact Development Patterns**. The most impactful way to reduce greenhouse gas emissions is to enable more compact walkable neighborhoods in the region's areas planned for growth. Chittenden County, perhaps more so than other regions of the State, can achieve great energy efficiency and GHG benefits because of development density and infill development goals.

- **Energy Efficiency.** Compact walkable neighborhoods encourage smaller building footprints with lower heating and cooling needs, promote efficient travel that is less dependent on cars and provide more opportunity for walking, biking, and transit.

- **Conservation for Carbon.** Compact development also decreases development pressure on Vermont's working and natural landscapes. This preserves land for carbon sequestration and storage.

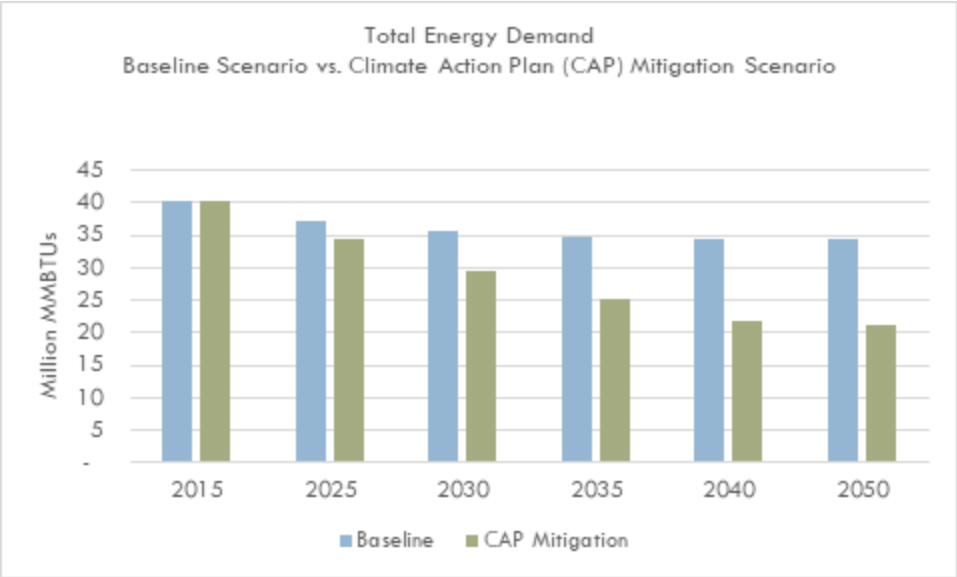
- **Electric Load Efficiency**. Dense population centers make distributed generation easier because energy can be produced near significant numbers of customers and load. Additionally, the county's dense land use pattern may enable innovative energy solutions, such as district heating and microgrids.

- **Enhanced Energy Planning.** In 2016, the Vermont Legislature enacted Act 174 to improve energy planning and to give town and regional plans greater weight or "substantial deference" in Public Utility Commission (PUC) proceedings. As of 2022, Bolton, Burlington, Charlotte, Colchester, Essex Junction, Hinesburg, Huntington, Jericho, Richmond, Shelburne, Underhill, Williston, Winooski, and Westford have adopted enhanced energy plans. Enhanced energy plans may also be used to qualify municipalities and the region for funding to implement energy goals.
    - **Development Constraints**. The Act 174 enhanced energy planning standards involve identifying and mapping constraints to development. These constraints must be applied equally to renewable electricity generation projects as well as other forms of development. CCRPC should coordinate with the Public Utility Commission (PUC) and the Agency of Natural Resources to better balance development of renewable energy generation to meet climate goals with potential adverse impacts on natural resources.

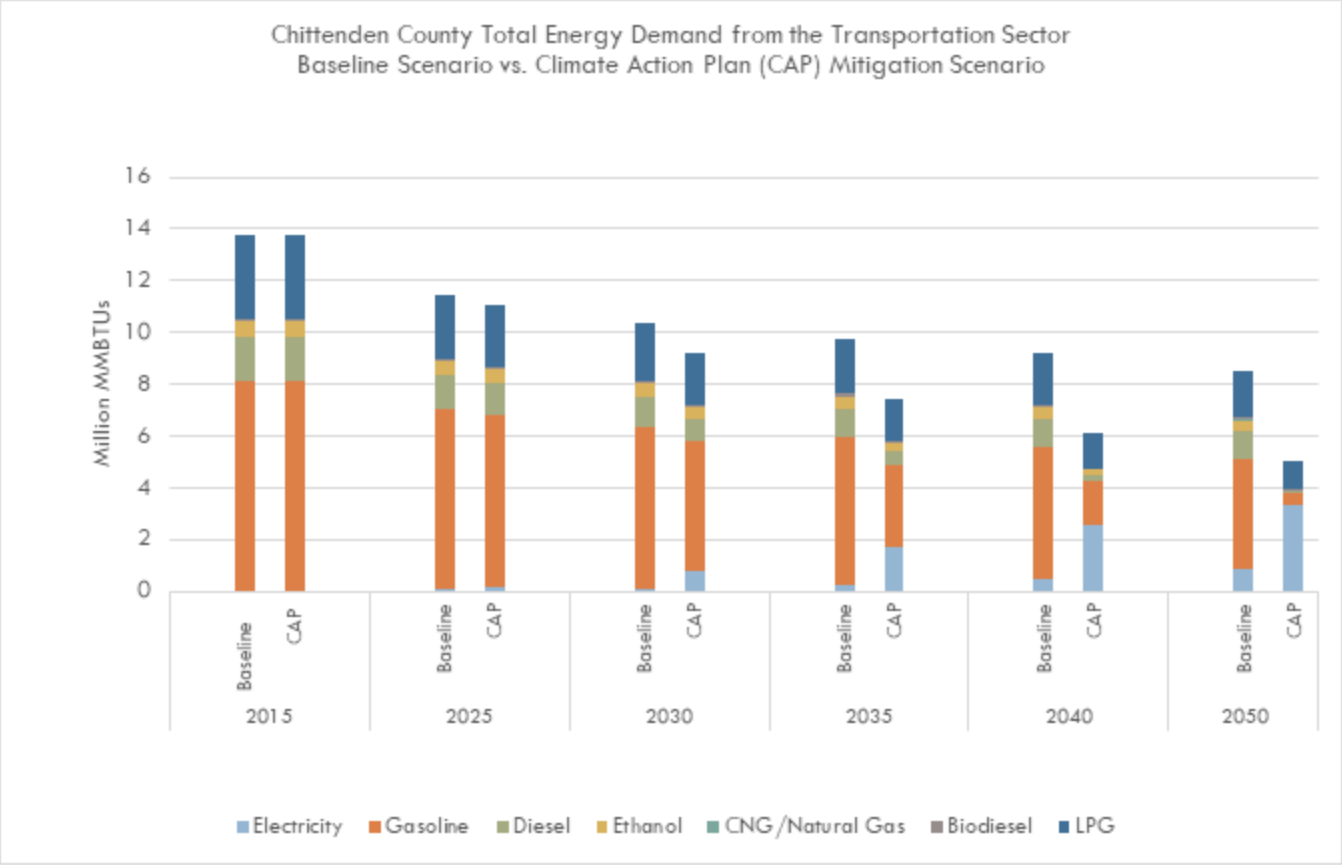
Energy Analysis and Targets

- **Low Emissions Analysis Platform (LEAP).** The Department of Public Service developed a scenario model of Vermont's energy consumption to construct pathways to align with Vermont's Comprehensive Energy Plan (CEP) and Climate Action Plan (CAP) and to meet statutory greenhouse gas (GHG) reduction obligations under the state's Global Warming Solutions Act (GWSA). This scenario is referred to as the Central GWSA Mitigation or CAP Mitigation scenario. A second, baseline, scenario was also developed to estimate Vermont's energy demand given business as usual conditions. The model was built with the Low Emissions Analysis Platform (LEAP), a software tool for energy system modeling and emissions accounting. The following charts below represent the magnitude of change needed in the commercial, industrial and transportation sectors to meet state energy and climate goals in Chittenden County. The targets needed to meet the energy planning standards are derived from the CAP scenario and are contained in the ECOS Plan's supplement 6.

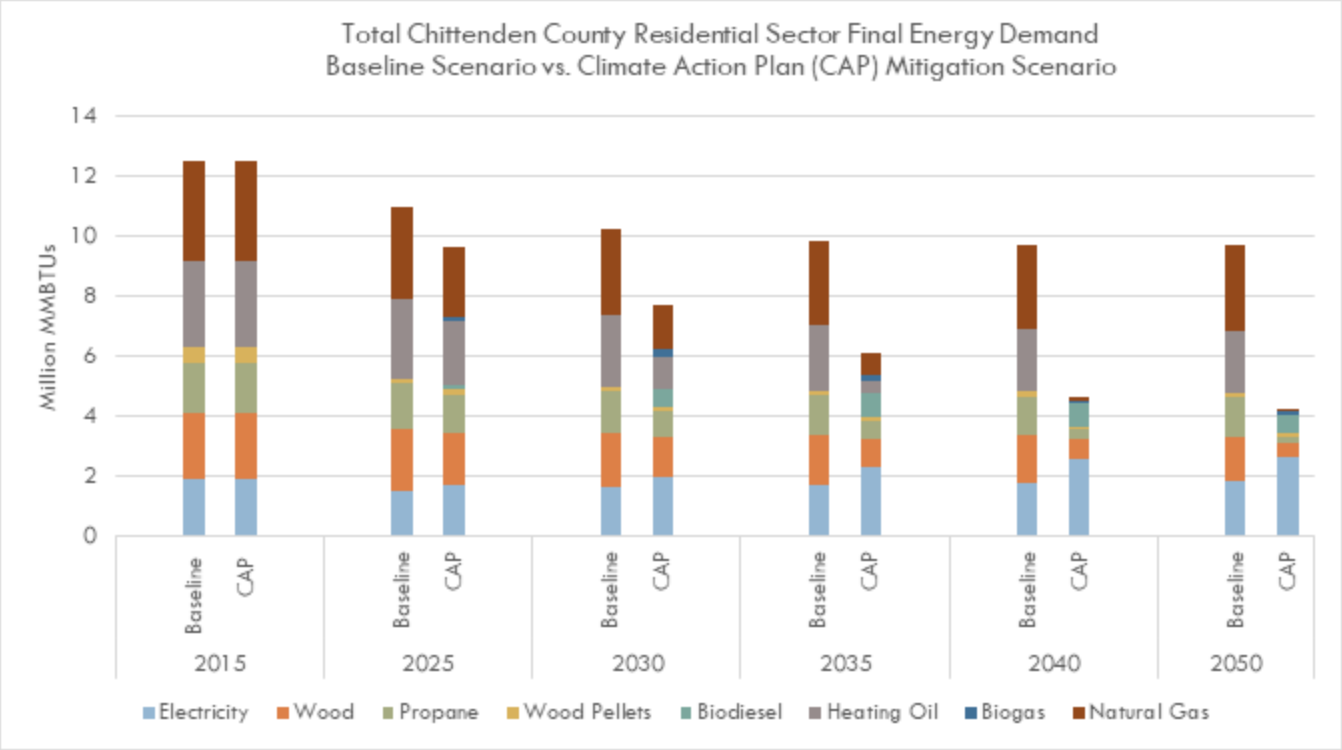
- **Total Energy Demand.** As the region strives to meet renewable energy and decarbonization goals, the region will see a decrease in total energy demand (inclusive of the transportation sector) as buildings and vehicles become more efficient through weatherization and fuel switching. In addition, energy use will move away from fossil fuel consumption towards electricity from renewable sources (see chart below). Based on the comparison of total energy demand in the baseline scenario and the CAP mitigation scenario, Chittenden County's total energy demand will be 48% less in the year 2050 than it was in the year 2015 with the implementation of the policies that were modeled in the CAP mitigation scenario.



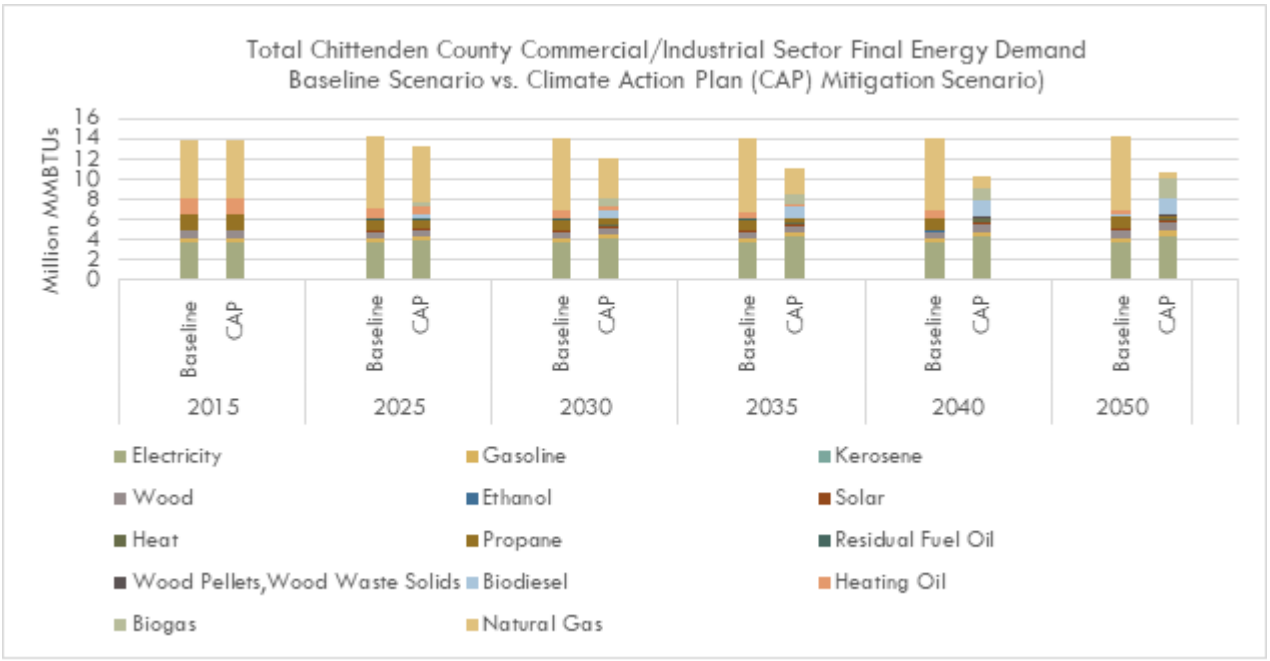
- **Transportation.** The CEP includes a goal of having zero-emission vehicles account for 100% of light duty vehicle sales in Vermont by 2035 and calls for the transportation sector to meet 10% of energy needs from renewable energy by 2025, and 45% by 2040. As the county transforms the transportation sector to meet these goals, electricity as a fuel source in the transportation sector will increase (see chart below). As a result, it is estimated that Chittenden County will need to have 28,950 electric vehicles by 2030 and 145,754 electric vehicles by 2050 in the passenger and light duty sectors. In comparison, Chittenden County has 3,183 EVs registered as of 2022.



- **Heating.** The use of energy for heating in Chittenden County homes is projected to decrease by 64% from 2025 to 2050. Electricity demand will need to increase by 140% between 2025 and 2050. Natural gas, fuel oil, and propane will virtually be eliminated, per the CAP scenario. Residential buildings will use less energy for space heating due to an increase in the percentage of buildings that are weatherized and the greater efficiency in heating technology.



- **Industrial and Commercial Energy Use.** Chittenden County's energy demand in the thermal commercial/industrial sector will need to be reduced by 19% from 2025 levels to meet future energy, carbon reduction and renewable energy source goals. This will primarily be achieved through weatherization of commercial buildings and the use of more efficient heating technologies (e.g. cold climate heat pumps powered by renewable electrification). By 2050, the LEAP model targets the region to have 64,790 new heat pumps installed in commercial buildings. Natural gas demand is estimated to decrease by 63% from 2025 to 2050 and the demand for heating oil and propane will be eliminated.



- **Electricity Generation Targets.** CCRPC supports the generation of new renewable energy in the County to meet Vermont's Global Warming Solutions Act (GSWA), Climate Action Plan (CAP) and Comprehensive Energy Plan (CEP) goal of using 90% renewable energy by 2050, in a manner that is equitable, cost effective and respects the natural environment.
    - Specifically, Chittenden County needs to generate, at minimum, a total of 954,833 MWh (Megawatt hours) of energy annually (a 57% increase over 2022) to meet energy and climate goals set by the CAP and CEP. Table XX sets progressive milestones to reach this goal, including the amount of additional generation that must be brought into production after accounting for existing renewables. These targets are based on the average of the county's share of statewide population and land area, a method that attempts to balance siting of generation close to where electricity consumed while ensuring homes are located close to employment in a compact pattern and respecting development constraints. These also represent minimum targets; additional generation above the targets will further advance the goals of the CAP and CEP.
    - While the county has sufficient land to build new renewable electricity generation projects to reach the 2050 generation targets, the electric transmission and distribution system will likely need upgrades to be able to move electricity from generation to demand.
    - The targets are technology neutral, meaning that they can be met with any mix of solar, wind, hydroelectric, biomass, or other sources of renewable electricity. CCRPC has completed an analysis of areas suitable for solar and wind energy generation to determine our ability to meet the 90% renewable by 2050 and decarbonization goals and has determined that the region has sufficient land to meet its targets by relying on wind and solar energy generation.
    - The current PUC's sound rule for wind generation makes developing new wind generation unfeasible because the PUC Rule 5.700 imposes standards and requirements on wind energy that have the effect of prohibiting its development. CCRPC supports regulatory changes to make wind power more viable for several reasons. First, it is complementary to solar in terms of its generation profile. Second, it can provide local low-cost electricity for Vermont rate payers. Host communities benefit from increased property taxes and jobs. Wind generation in Vermont can also reduce Vermont's strong dependence on external electricity providers, such as Hydro Quebec, to supply our electric needs in an increasingly electrified world.
    - CCRPC's renewable energy generation facility siting policies are detailed in Strategy 4, Action 2 and will inform CCRPC's preferred sites policy.

Table XX: Chittenden County Renewable Electricity Generation & Targets (MWh / year)

Year	2018*	2022	2032	2040	2050
Total Renewables Target	N/A	N/A	648,475	857,945	954,833
Existing Renewables	501,196	606,554	606,554	606,554	606,554
New Renewables Target	N/A	N/A	41,922	251,391	348,279
*As reported in 2018 ECOS Plan based on data from Vermont Community Energy Dashboard					

Key Indicators

Additional indicators can be found on the ECOS Scorecard.

Indicators	Location
Annual Natural Gas Consumption	Scorecard
Annual Electricity Consumption	Scorecard
Percent of Electricity Saved	Scorecard
Renewable Energy Capacity Sited in Chittenden County	Scorecard

See Supplement 6 for the complete Act 174 Energy Planning Analysis and Targets

XX. TRANSPORTATION

Transportation Goal: Provide a transportation system that is safe, efficient, reliable, and resilient; provides for interconnected and sustainable mobility choices for livable, equitable, and healthy communities; supports regional and municipal land use goals; addresses the climate crisis; and strengthens the economy of the region.

Key Issues/Trends/Insights

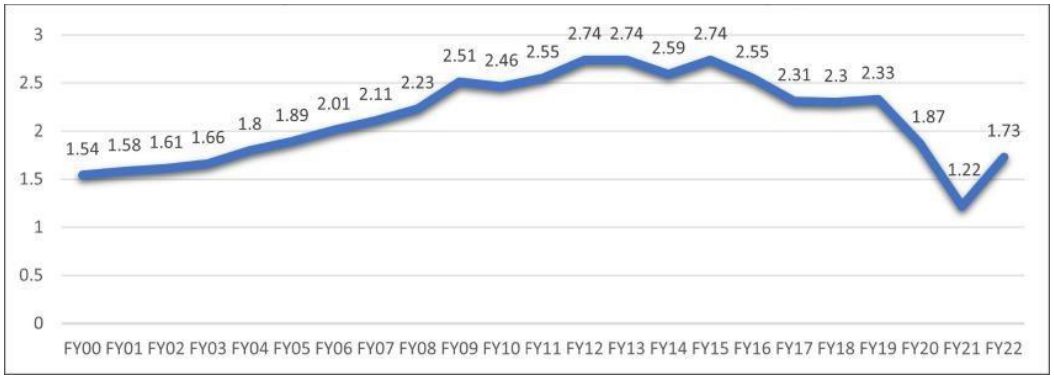
Transportation System

- **Road Network:** Highways are classified as Interstate Highways, Principal Arterials, Minor Arterials, Major Collectors, and Minor Collectors. The classification system is organized as a hierarchy of facilities based on the degree to which the roadway facility serves mobility and access to adjacent land uses. Interstates and Arterials make up just under 19% of County road mileage yet carry 69% of all vehicle miles traveled (VTrans 2020 VMT data). While not specifically addressed in this plan, local roads are also an important part of the road network in Chittenden County. Local roads are owned and maintained by the municipality in which they are located in are generally not eligible for federal transportation funding.

  The overall pavement condition of the interstate and arterial highways in Chittenden County has improved significantly since 2013. In 2013, over 50% of Chittenden County arterials were rated poor or worse in terms of pavement condition; by 2021 that figure dropped to only 26%. There are 180 bridge structures greater than or equal to 20 feet in length in Chittenden County; 85 of these bridges are owned by the State and the remaining 95 by local governments. Since 2010, there has been a marked improvement in the number of bridges with a sufficiency rating below 50, down to 5 from 18, a 72% improvement.

- **Active Transportation Facilities:** Active transportation facilities create opportunities to increase physical activity, support healthy communities, enhance economic development, and promote environmental sustainability. Furthermore, communities that support walking and biking provide transportation access to all residents regardless of age, gender, or socioeconomic status. Chittenden County has a range of dedicated transportation facilities to accommodate bicyclists, pedestrians, and other physically active forms of transportation. Facilities dedicated to non-motorized uses (such as sidewalks, bike lanes, and shared use paths) are concentrated in and around the metropolitan core. Non-dedicated facilities where non-motorized users share the road with motorized users are located throughout the county. In recent years there has been an increase in sidewalk and shared use path mileage and a concerted effort to improve the system to entice more users to walk, bike, and roll but more needs to be done.

Figure X: Total Yearly GMT Riders in Chittenden County (Millions)



- **Public Transit:** Public Transit is a viable alternative to vehicle travel in urban/suburban areas of the county. According to the 2020 VTrans Public Transit Route Performance Report, 46% of all public transit trips in Vermont originated in Chittenden County. While access to public transit has improved in the greater Burlington area, some suburban and most rural populations lack access to transit. GMT ridership has steadily increased from 2000 to 2015, followed by the downward trend starting in 2015. This trend matches the overall national trend, due in large part to lower gasoline prices.

  As with most national transit operations, the COVID-19 pandemic had a dramatic impact on GMT's operations with a 48% decrease in ridership at the height of the pandemic. By 2022, ridership bounced back from pandemic lows for most routes with the commuter LINK services lagging behind mainly due to changes in commuting patterns and increase in teleworking.

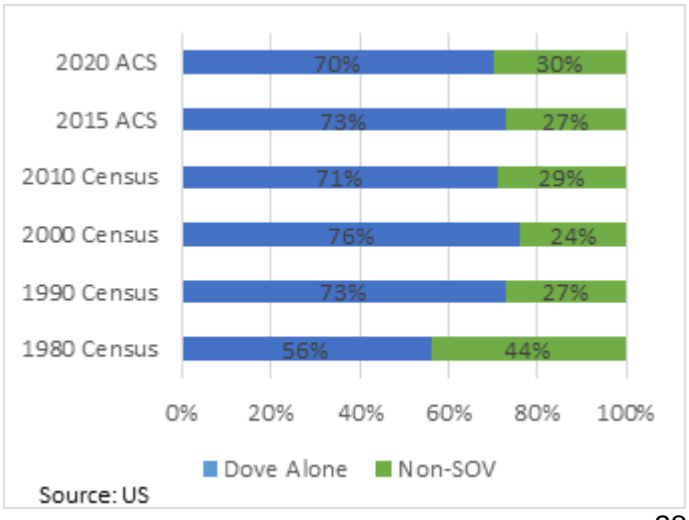
  GMT has been operating "fare free" since 2020 in response to the COVID-19 pandemic, but this ended in January 2024. How this impacts ridership should be monitored. CCRPC will be studying alternative approaches to funding public transit in Vermont in 2024 and 2025 as a part of the RAISE grant from the US Department of Transportation. This study may assess if it is possible to maintain free fares, or low fares, which are essential to maintaining access to public transportation for all. Alternative funding models may also enable GMT to extend service to municipalities that currently do not help fund GMT operations and do not have GMT routes.

Regional Travel Characteristics

- **Roadway Capacity:** In general, the roadway system in Chittenden County has enough capacity to handle the current traffic demand, except for specific segments of the interstate and arterial system during peak hours of travel. Even with enough capacity, congestion still exists on our roadways. Like many thriving metropolitan areas, the urban core of our county has significant congestion, mainly at intersections, during the morning and evening commute (peak) hours. Capacity improvements might be needed at specific intersections throughout the county to address severe traffic congestion and safety issues arising from these conditions. Increases in congestion during peak travel times has worsened due to the gradual increase of the number of people living outside of and commuting into Chittenden County for work which is correlated with the increased cost and lack of available and affordable housing in the county.

- **Single Occupancy Vehicles:** Between 1980 and 2020, the rate of driving alone to work (commuting in a single occupancy vehicle, or SOV) in Chittenden County increased from 56% to 70%, according to the latest American community Survey (ACS) 5-Year Estimate. When comparing data from the 2015 and 2020 AcS 5-year estimates, the percent of workers commuting alone fell from 73% to 70%, primarily due to increased teleworking opportunities, improved bike and pedestrian facilities in the county, and the effect of the COVID 19 pandemic.

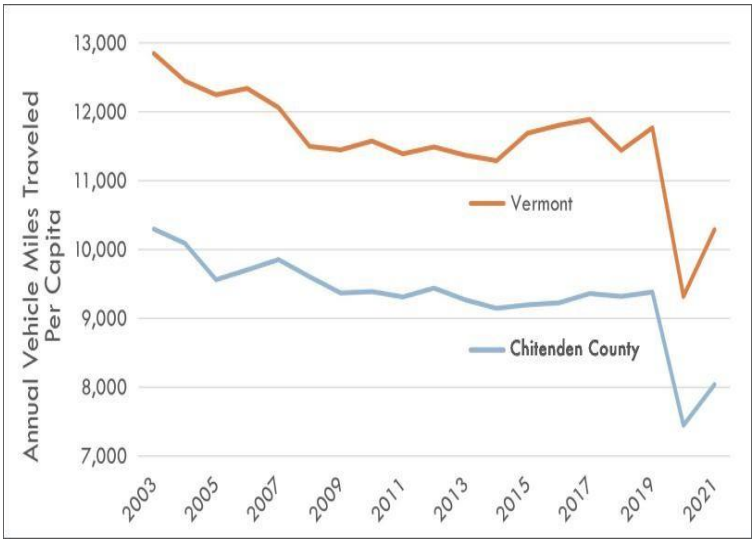
Figure X: Single Occupancy Vehicle



- **Vehicle Miles Travelled (VMT):** VMT per person in the county declined drastically between the early 2000s until 2009. Between 2010 and 2019, VMT leveled off, with only minor fluctuations. A number of factors may have influenced

the VMT decline in the early 2000s, including increased safe and connected bike facilities and sidewalks; expanded transit services; increase in compact, mixed-use land use developments; and general economic conditions in the region and beyond. In 2020, VMT per capita collapsed as a result of the COVID-19 pandemic. Post-pandemic, we have seen a slow increase in VMT that at some locations are reaching pre-pandemic levels.

Figure X: Vehicle Miles Traveled



- **Safety:** Improving safety for all users of our transportation system is a fundamental goal of the CCRPC. Through the Vermont Agency of Transportation's (VTrans) programs such as the Highway Safety Improvement Program (HSIP), Systemic Local Road Safety (SLRS) and Road Safety Audits (RSA), the CCRPC is assisting member municipalities to improve safety for high crash locations as well as looking at systemic approaches to reducing hazards and improving safety. VTrans collects crash data statewide and shares it with their partners, regional planning commissions, municipalities, and the public. The historical crash data is helpful in identifying trends and risk factors to use in scoping and planning studies to develop alternatives that improve safety for all modes of transportation.

Transportation and Climate, Health, and Equity

- **Emissions.** In Vermont, the largest contributor of greenhouse gas (GHG) emissions is the transportation sector – mostly carbon dioxide (CO2) coming from the combustion of petroleum-based fuels, like gasoline and diesel in internal combustion engines. Transportation's 40% statewide contribution to GHG emissions is closely mirrored by our 48% Chittenden County estimate and is substantially higher than the nationwide share of 27% from transportation according to the 2020 EPA Greenhouse Gas Emissions data.[xxvii]

  Transportation's higher contribution is mainly due to the rural nature of Vermont and the higher annual Vehicles Miles Traveled (VMT) per Capita in the state (11,680) compared to the nationwide VMT per Capita (9,630) according to the 2017 Vermont Transportation Energy Profile. Transportation planning looks at climate change from two perspectives: 1) How to mitigate climate changes through policies, programs, and technologies, and 2) How to adapt transportation infrastructure and services to the coming climate changes.

- **Health and Equity.** The impact of transportation on health and equity is well established, particularly with regard to safety/injury, air quality, physical activity, equitable access to opportunities, and noise.

  The degree to which individuals in a community are physically active is directly dependent on transportation opportunities, infrastructure and community design. The health benefits of physical activity and its role in reducing the risk for chronic disease has numerous positive societal impacts. Most risk factors for chronic disease do not occur randomly but are closely linked to the characteristics of neighborhoods in which people live, work, and play.

The lack of safe and convenient alternatives to automobile travel disproportionately affects vulnerable populations and limits personal options. This forces trade-offs in money or time, thereby compromising equitable choice. A number of population segments throughout Chittenden County, including youth, elderly, low-income, new American, and historically underserved and excluded populations, lack access to viable public and private transportation.

The high costs of owning and operating a vehicle also disproportionally affect low-income and rural Vermonters that rely on vehicles to get to work, shop, follow through on medical appointments, and attend social gatherings.

Walkable communities with a reliable transit network generally have a lower dependence on automobiles and encourage physical activity. Hybrid commutes, (trips completed using several modes) are an effective option when distance and lack of transit service are barriers to a more active commute, such as walking or biking. With few exceptions, proximity to public transit stops is linked to higher transit use and higher levels of physical activity among adults.

As the population of Chittenden County increases over the coming decades, bolstering the transit system, creating a contiguous infrastructure for active modes of transportation, and focusing on dense development patterns that encourage non-motorized trips will help to preserve with mutable goals of the ECOS Plan.

Key Indicators

At the regional level, the CCRPC developed a number of regional transportation indicators to assist in tracking progress towards transportation goals and objectives. The transportation indicators were expanded and updated annually since the 2013 ECOS/MTP Plan was adopted. These are listed below and posted on the ECOS Scorecard site with numerous other regional indicators (https://app.resultsscorecard.com/Scorecard/Embed/8502).

Indicators	Location
Drive Alone to Work	Scorecard
Daily Vehicle Miles Traveled Per Person	Scorecard
Walking/Biking Infrastructure	Scorecard
Sustainable Funding, System Preservation by Fiscal Year	Scorecard
CarShare VT Membership	Scorecard
Electric Vehicle Registrations	Scorecard
GMT Ridership per Fiscal Year	Scorecard
Number of Vehicle Crashes Per Million Annual Vehicle Miles Traveled	Scorecard
Number of reported vehicle crashes involving bicycles or pedestrians	Scorecard
Number of trips provided by the Special Services Transportation Agency	Scorecard

At the federal level, Performance Management has become part of the Department of Transportation's Performance Management program which is a strategic initiative implemented to achieve national transportation performance goals. The intent is to measure progress against the national goals through a reliable data-driven process.

Federal Highway Administration (FHWA) has established measures in the following areas:

- Safety
- Infrastructure Condition
- Congestion
- System Reliability

- Freight
- Greenhouse Gas (GHG) Emissions

Federal Transit Administration (FTA) established measures in the following areas:

- Safety
- Transit Asset Management

The CCRPC as a federally designated Metropolitan Planning Organization (MPO) has an agreement with VTrans and GMT that describes our intent to work collaboratively to develop targets for the FHWA and FTA established measures. For more information on the measures and targets please go to the adopted MTP.

XX. ECOLOGICAL SYSTEMS

Ecological Systems Goal: Conserve, protect and improve air quality, water quality and quantity, and the health of native species and habitats.

Key Issues/Trends/Insights

[Data for this section drawn from Natural Systems Analysis Report, VT Parcelization Website and Lake Champlain Basin Program's State of the Lake Reports]

Climate change is expected to bring a range of new challenges to both human society and ecological systems in Vermont. Climate change is driven by increases in atmospheric carbon dioxide through combustion of fossil fuels and through human disturbance of ecosystems that both releases carbon dioxide from plant and soil material and reduces the uptake of carbon dioxide by plants. Therefore, maintaining forests, wetlands, agricultural lands and vegetated spaces is important for ensuring current and future carbon storage since plants remove carbon dioxide from the atmosphere and store it in biomass and soils. Vegetated landscapes, especially in urban areas, are also important for moderating extreme heat, natural absorption of stormwater, reducing runoff and the potential for flooding. Finally, reducing fragmentation of forest blocks and riparian areas will help limit the effects of climate change on native species. Maintaining a connected network of lands and waters to allow for both regular and climate-driven migration is one of the most important climate change adaptation strategies. By concentrating development, and including green infrastructure in areas planned for growth, we can avoid further exacerbating the impacts of climate change on our ecological systems.

Wildlife, Forests and Native Species

- **Habitat Health & Fragmentation:**

    - **Forest Cover.** Vermont's forest cover was as low as 35% in the mid to late 1800's; reforestation brought it back to 74% and it is the third most forested of the lower 48 states. However, in the 2000s the State began experiencing an overall loss of forest cover. This is concerning because of the resulting habitat loss and fragmentation, increase in non-native species, reduction in productive forest land and carbon sequestration, and diminished resiliency especially in the face of a rapidly changing climate. While these issues are of concern in Chittenden County as well, here forest cover has remained steady at around 52% between 2001 and 2019.[xxviii]

    - **Fragmentation.** Despite retention of forest cover overall, we still experience incremental development outside areas planned for growth that breaks up forest habitats. The most significant change is the pattern of the forest cover and relative connectedness of forest blocks to each other and riparian areas. The Agency of Natural Resources' BioFinder map shows that forest blocks in Chittenden County are getting smaller and more isolated from other forest blocks, surface waters and riparian areas. This limits the ability of plants and animals to move between isolated islands of habitat to meet their needs and contributes to losses in biodiversity. Development outside planned areas for growth has had a visible (and ecological) impact on the pattern of forests and forest cover. These trends speak to the broader concept of the pattern of forest cover versus focusing on core forest areas. Increasing land parceling and subsequent habitat conversion due to the lack of local regulations that adequately protect wildlife habitat and due to the construction of transportation infrastructure (including roads and trails) continue to adversely impact forest and habitat integrity. In addition, acid deposition from air pollution, migration of invasive species including destructive insect species, and climate change continues to threaten native forest plant and animal habitat.

    - **Wetlands**. Though limiting forest fragmentation remains a challenge, there has been success in protection of wetlands. Between 2011-2019, Chittenden County lost only .04% of its

wetlands.[xxxii] This is due to robust protections at the state and sometimes municipal level to limit impacts of development on wetlands and provide mitigation options to offset any impacts.

- **Community Resilience and Biodiversity Protection Act (Act 59).** In 2023, the Vermont Legislature set a goal of conserving 30% of the state's land area by 2030 and 50% by 2050, in alignment with the state's Climate Action Plan. Currently-conserved land will be inventoried by 2024 and a conservation plan will be established by 2025 with strategies and recommendations to achieve the conservation targets and address many of the key issues identified in this section.

- **Working Lands**. As noted in Section XX (Working Lands & Land Based Industries), the economic value of maintaining productive working farms and forests is crucial to preventing their conversion to other uses and maintaining production of food and materials in addition to ecosystem services such as wildlife habitat, water quality, and carbon storage and sequestration. This is one path to supporting long-term, sustainable management of conserved land as defined in the Community Resilience and Biodiversity Protection Act of 2023.

- **Urban Forest Health**. In urban areas, trees are crucial to maintaining air quality, mitigating stormwater impacts, cooling buildings and sidewalks, providing wildlife habitat, increasing property values, and improving public health and wellbeing.[xxxiii] These benefits provided by trees not only create more vibrant places to live, but also increase resilience to the impacts of climate change. CCRPC works closely with the Vermont Urban & Community Forestry Program to assist municipalities in urban forestry planning and management, which includes coordinating funding for tree planting and maintenance and providing education on tree pests and diseases.

Water Quality

- **Trends and Challenges.** Vermont water bodies continue to face mounting pressures from unsustainable development, farm practices and logging activities. Cumulative impacts from these land use activities have degraded water quality, aquatic habitat and altered the stability of river corridors and lakeshores. Issues that predominate in the County include increasing impervious surfaces, steady high pollutant loads (mainly from nonpoint sources such as unmanaged stormwater), that result in nutrient enrichment and sedimentation, as well as other impairments. In addition, aquatic nuisance species continue to enter our waterways, contributing to the degradation of both habitat and recreational opportunities.

- **Stormwater Management.** Concentrating development in areas planned for growth and proper management of stormwater in our developed areas have and will continue to improve water quality measures. Support of water quality improvement has been an ongoing effort of the Vermont Agency of Natural Resources (ANR) through numerous initiatives since 2012, including: updates of Lake Champlain Watershed Basin Plans within Chittenden County; update the Municipal Roads General Permit (MRGP) and the Stormwater General Permit 3-9050; and most recently the Municipal Separate Storm Sewer System (MS4) permit for urbanized areas.

    - **MRGP and MS4 Permits.** Under the latest MS4 permit requirements, nine Chittenden County municipalities are implementing various measures to reduce the impacts of non-source runoff and help meet the total maximum daily load requirements for impaired streams, rivers, and Lake Champlain. These include Municipal Roads General Permit (MRGP) which requires improvements to municipal roads that drain to waterways. Nine other municipalities in the County also must implement their MS4 Stormwater Management Plans which include several elements namely six Minimum Control Plans, Flow Restoration Plans for impaired streams, and Phosphorus Control Plans for municipal owned roads, rights-of-ways and properties. These permits require additional public investment in storm water facilities or investments as well as increased municipal inspection of private construction sites' minimum control measures. However, this has created some confusion for developers because the ANR still holds

jurisdiction over those sites' individual stormwater permits. Greater integration of municipal MS4 permits and state stormwater permits, as well as coordination between agencies, will help clarify requirements and reduce runoff into our waterways.

- **Clean Water Service Providers.** In 2022 the Department of Environmental Conservation prepared phosphorus reduction budgets by sector and by watershed. These budgets have informed next steps in phosphorus reduction needs through both regulatory and non-regulatory programs. Clean Water Service Providers have been established to address these non-regulatory reductions. CCRPC is the Clean Water Service Provider for the Northern Lake Champlain Basin.

- **Road Erosion Mapping and Data.** The Vermont Agency of Transportation (VTrans) has developed the Vermont Transportation Resilience Planning Tool, a web-based application that identifies bridges, culverts, and road embankments that are vulnerable to damage from floods, estimates risk based on the vulnerability, and criticality of roadway segments, and identifies potential mitigation measures based on the factors driving the vulnerability. The TRPT combines river science, hydraulics and transportation planning methods and is applied at a watershed scale. Another tool under development to identify problem locations is the VTrans Repeat Damage Tool for roads and bridges that needed repair after two or more Governor-declared events.

- **River Corridors.** River corridor resilience is also critical to the health of our ecological systems as well as protection of nearby infrastructure. Channelization of streams and rivers, reduction and alteration of natural floodplains, river corridor encroachment, stormwater runoff and reduction and elimination of vegetative buffers are practices that lead to river corridor instability causing excessive erosion of river channels, pollution and additional fluvial erosion hazards. Of the river miles assessed in Vermont, 74% have become confined to deeper, straighter channels and no longer have access to historic floodplains essential to stable streams and sustainable water quality management. River Corridor means the land area adjacent to a river that is required to accommodate the dimensions, slope, planform, and buffer of the naturally stable channel and that is necessary for the natural maintenance or natural restoration of a dynamic equilibrium condition, as that term is defined in 10 V.S.A. §1422, and for minimization of fluvial erosion hazards. A River Corridor includes the meander belt *and* the area to maintain a riparian buffer (defined as 50 feet from the meander belt). These areas are mapped in the 2022 update of the *Chittenden County Multi-Jurisdictional Hazards Mitigation Plan,* and its associated municipal Annexes. There are 776 structures located in the River Corridor in Chittenden County. River Corridor protection is a goal in statute for municipalities, regions and state agencies. Important incentives such as the Emergency Relief Assistance Fund (see the Public Safety, Criminal Justice & Hazard Mitigation Section for more information) are available to communities protecting river corridors.

- **Regulations.** There is a disconnect between the vision for natural riparian systems as expressed in municipal plans, and the development regulations that implement those plans. This is due to a lack of local expertise and capacity to enforce effective floodplain and river corridor regulations, most of which are administered by volunteers or staff with many other responsibilities and who are not trained in floodplain and river corridor management. In addition, while local bylaws protect the majority of River Corridors in the County with stream setbacks and floodplain inundation regulations from new development, regulations may vary significantly by municipality even within the same watershed, and many development regulations have vague review standards that complicate enforcement and open the town to legal challenges. Finally, agriculture and forestry practices are exempt from local review, and historically State enforcement of accepted agricultural practices has been inconsistent and uncoordinated between agencies with jurisdiction. These issues point to a need for regulatory reform for river corridors and floodplains and perhaps a single statewide standard and administrative body..

- **Groundwater.** As of 2015, 30,713 residents of Chittenden County (19% of the 2015 population) relied on *groundwater* sources for their drinking water[xxxv]. Protection of groundwater resources from failing septic systems and petroleum spills/leaks is critical.

Air Quality

- **Outdoor air pollution** in significant concentrations can raise aesthetic and nuisance issues such as impairment of scenic visibility; unpleasant smoke or odors; and can also pose human health problems, especially for more sensitive populations like children, asthma sufferers, and the elderly. While Chittenden County's air quality meets current National Ambient Air Quality Standards (NAAQS), we are close to the limits for ground-level ozone. The attainment level for ozone is .070 ppm and levels should not exceed this.[35] While ozone levels in Chittenden County have been continuously decreasing for the last twenty years, the 2021 ozone level measured .057 ppm. Particulate matter is well below the attainment level of 12.0 ppm. Chittenden County's level in 2021 measured 6.7 ppm. We are also subject to pollution from the mid-west that we cannot control. If the NAAQS are revised to be more stringent – or air pollutant levels increase – so that we exceed the NAAQS, additional and costly environmental regulations will apply to our region (Source: http://dec.vermont.gov/air-quality).

Key Indicators

- **Chittenden County Land Cover Losses (Source: USGS 2001 and 2019 National Land Cover Data):**
  - According to the national land cover data in 2019, 59% of Chittenden County is forested (204,173 acres).
  - Between 2011 and 2019, 428.8 acres (0.16% of Chittenden County) was converted to development. This includes the conversion of barren land, deciduous forest, evergreen forest, mixed forest, shrub, grassland, woody wetlands, and emergent herbaceous wetlands. These land cover categories are used by CCRPC as a surrogate for wildlife habitat since there is currently a lack of more accurate data.

- **Phosphorus level concentrations.** The overall Lake Champlain Total Maximum Daily Load requires a total phosphorus load reduction of 212 metric tons per year by 2038. The state is tracking progress on this goal, and the details are outlined in the Vermont Clean Water Initiative 2022 Performance Report. As of June 2022, an estimated 39.9 metric tons of phosphorus reduction has been achieved in Vermont's Lake Champlain Basin. This represents 19 percent of the reduction required to achieve VT's water quality goals.[xxxvi].

Additional indicators can be found on the ECOS Scorecard.

Indicators	Location
Acreages of Wildlife Habitat Lost to Development	Scorecard
Percent of Impaired Stream Miles	Scorecard
Phosphorus Load to Lake Champlain from Vermont	Scorecard
Ozone	Scorecard
Particulate Matter	Scorecard

XX. INFRASTRUCTURE & FACILITIES

Infrastructure & Facilities Goal: Ensure adequate infrastructure and facilities (i.e. water supply, wastewater treatment, stormwater treatment, broadband coverage and solid waste recovery and recycling) to support areas planned for growth while conserving resources.

Key Issues/Trends/Insights

[Data for this section and more information can be found in the: the Ecological Systems section of this Supplement for water quality; Broadband Action Plan; Stormwater websites: rethinkrunoff.org/ and https://www.ccrpcvt.org/our-work/environment-natural-resources/water-quality/; and other sources listed below.]

- **Drinking Water.** The majority of the residents in the County get their drinking water from Lake Champlain, via two utilities: the Champlain Water District and the City of Burlington's DPW Water Division. Both Champlain Water District and the City of Burlington's DPW Water Division utilities have received Phase III Director's Awards from the USEPA's Partnership for Safe Water Program; and Champlain Water District was the first in the United States to receive the Phase IV Excellence in Water Treatment Award in 1999 and is one of 11 in the US to presently maintain this award status following required annual reviews. In addition, Richmond, Hinesburg, Huntington, Underhill, and Jericho have smaller public water supply utilities – some of which are working to overcome capacity and water quality challenges (e.g. Hinesburg).

- **Wastewater.** Currently, there are 12 municipal wastewater treatment plants in the County; together they have a treatment capacity of 28.54 million gallons per day (MGD) As of 2022, the average annual flow of wastewater was 11.05 MGD (see Waste Water Average Annual Flow indicator below).[xxxvii] While these figures indicate that there is sufficient sewage treatment capacity to absorb anticipated growth in housing and employment county-wide, this does not account for location specific limitations or limitations based on other environmental reasons (e.g. phosphorus control).

- **Stormwater.** Management of our stormwater is critically important to maintaining and improving water quality throughout the County. Stormwater treatment is challenging in both urban and rural areas of the County for a variety of reasons: existing urban areas need to retrofit old infrastructure, financing new infrastructure in areas planned for growth when development is incremental, and impacts from agriculture and forestry practices that don't follow best management practices. Stormwater is managed at a variety of levels including EPA's National Pollutant Discharge Elimination System (NPDES) permits; VT's discharge permits; and some municipalities have additional stormwater regulations and programs. VT's discharge permits are structured to address site level development for new or redevelopment projects that disturb over with ½ acre; Most municipalities regulate stormwater through local development regulations. In addition, nine municipalities and three public entities are subject to MS4 (Municipal Separate Storm Sewer System) permits issued by Vermont DEC under authority from NPDES in Chittenden County: Burlington, Colchester, Essex, Essex Junction, Milton, Shelburne, South Burlington, Williston, Winooski, Burlington International Airport, UVM and VTrans). A new MS4 permit was issued by the State in July 2018 which included two additional requirements: each permittee/municipality must develop and implement a Flow Restoration Plan (FRP) for the stormwater impaired waters within their jurisdiction (current estimates for restoration of individual impaired streams ranges in the millions); and each municipality must develop and implement a Phosphorus Control Plan for municipally-owned developed land.

- **Broadband and Telecommunications.** Information technology is increasingly integral to fulfilling the personal, economic, educational, and health services needs in the region, a trend

accelerated by the COVID pandemic. The 2012 ECOS Competitive Assessment Analysis Report identifies quality and costs of telecommunications services as the weakest utility infrastructure based on the Employer Survey. While improvements have been made since then, there is still a need to upgrade infrastructure in the region. Ideally all homes and businesses would be served by 100 download Mbps/100 upload Mbps fiber service as is the goal of the state. As of December 2021: ~ 1% of all residential and non-residential structures are lacking in at least 4/1 Mbps; 3% of all residential and non-residential structures are served by 4/1 Mbps; 71% of all residential and non-residential structures are served by 25/3 Mbps; and 25% of all residential and non-residential structures are served by 100/100 speeds.[xxxviii] The current level of service for the majority of structures in the County, 25/3 Mbps, is commonly understood to be inadequate given expected future demands on the system. It is imperative that Chittenden County work to achieve 100/100 Mbps service for all residents and businesses and to not fall behind the rest of the state on this regard. Eight municipalities in Chittenden County created the Chittenden County Communications Union District (CCCUD) in 2022 including: Essex Town, Essex Junction, Jericho, Shelburne, South Burlington, Underhill, Westford, and Williston. The CCCUD intends to plan, contract, build, and manage the infrastructure that will provide high speed internet to areas of the County that have not been served because it's expensive and hasn't proven financially feasible to providers. The Vermont Community Broadband Board received $229 million from the Federal government in June 2023 to fund broadband expansion in state including Chittenden County. The County is generally well-served with telecommunications services including 5G service by some carriers in urban areas. However, there are pockets of little to no cell phone service in rural areas.

- **Solid Waste.** A sustainable society minimizes the amount and toxicity of the waste it generates, reuses materials, recycles, and composts. The Chittenden Solid Waste District (CSWD) is responsible for the management of solid waste in Chittenden County. The system in the County is a combination of public, private, and public/private programs. CSWD has established a range of programs and facilities to manage waste through reduction, diversion, and proper disposal. CSWD also has identified the need for a regional landfill site. The amount of municipal solid waste (waste from the general public) as well as construction and demolition debris generated in Chittenden County that is landfilled or incinerated has decreased since 2019.[xxxix] The amount of materials recycled or composted has increased over time, and while rates of recycling have increased, rates of composting have decreased. In 2021 CSWD estimated that of the municipal solid waste sent to the landfill, 15% was comprised of recyclable materials (including special materials like e-waste) and 27% was comprised of organic materials that could be composted.[xl] A State law passed in 2012 (Act 148) bans disposal of certain recyclables (effective July 1, 2015), yard debris and clean wood (effective July 1, 2016), and food scraps (phased in over time and completely in 2020) from disposal. Residents and businesses in CSWD have been required to separate yard debris and recyclables from waste destined for disposal since 1993 and clean wood since 2015. CSWD has also banned non-asbestos asphalt shingles, unpainted/unstained plywood, and unpainted/unstained oriented strand board from disposal (2016). The additional bans on food scraps and construction materials are having a significant impact on waste diversion in Chittenden County; however, continued education and new strategies will be needed to maximize use of diversion programs. In 2022, Chittenden County voters approved a new, $22 million recycling sorting facility for CSWD to be located in Williston.

- **Municipal Facilities.** As can be seen on the ECOS Map Viewer, there are the following government/administrative facilities in the County: 13 police stations, 21 post offices, 2 courthouses, 18 municipal offices, 29 fire/rescue stations, and 1 state correctional facility. Larger municipalities such as Burlington, Winooski, Colchester, Essex, Essex Junction, Milton, Shelburne, South Burlington and Williston have a variety of government and school facilities and provide a wide range of municipal services such as planning and zoning, recreation, highways, libraries, water, sewer, fire, rescue and police. In contrast, small rural municipalities such as

Bolton, Buel's Gore, and St. George support only a few part-time employees such as a municipal clerk and road foreman, and often contract for other services. Municipal government in the remaining communities commonly consists of a few full-time employees such as a municipal clerk, an administrative aide for the selectboard and a highway foreman and small crew, supplemented by part-time or seasonal employees for activities such as recreation programs or the municipal library.

- **Emergency Services.** Almost every municipality has a locally-based fire department (with the exception of Buel's Gore and St. George), half have police departments, and fewer have their own emergency medical services. Many of the smaller municipalities receive primary police services from the Vermont State Police (VSP) on an "as-needed" basis, but must "rent" traffic enforcement services from the Chittenden County Sheriff's office, the VSP or neighboring communities. Many of the municipalities have reciprocal agreements for assistance in fire and rescue services. Most of these fire and rescue departments rely on volunteers; and recruitment and retention of these volunteers is a challenge. For more information see the Public Safety, Criminal Justice & Hazard Mitigation section in this Supplement, the All Hazards Mitigation Plan and its Municipal Annexes and the Local Emergency Management Plans for each municipality (particularly Section 5.2 provides the specific services, volunteers and personnel for each operation). Discussions around consolidation of some municipal services, such as dispatch, continue to achieve greater efficiency. Five municipalities have formed a Public Safety Authority and are working together on an emergency communications center that will be responsible for dispatching police, fire and medical resources. It is unclear when regional dispatch center is expected to be operational.

- **Medical Facilities.** Chittenden County's community hospital is the University of Vermont Medical Center, also Vermont's only academic medical center, serving in this role for patients from across the state and the upper northeast corner of New York. The UVM Medical Center provides a full range of tertiary-level inpatient and outpatient services, provides primary care services at 11 Vermont locations, operates the region's only Level I Trauma Center, and is home to the University of Vermont Children's Hospital. As some of the inpatient facilities are 50 to 70 years old, the Medical Center has a Master Facilities Plan to address the long-term health needs of our region, focusing on single rooms for inpatients and more space for providers and the equipment they need to provide high quality health care, while striving for LEED certification for healthy, efficient, and sustainable building design. The UVM Medical Center completed construction on a new 128 bed inpatient building in 2019; the Miller Building.[xli] Through the Master Planning efforts, UVMMC is looking at all older primary care sites to ensure they are adequately sized and equipped to meet all their patients' needs. Other health care facilities in Chittenden County include 53 primary care sites; the Community Health Centers of Burlington (the local Federally Qualified Health Center, or FQHC); Howard Center (the local designated agency that provides mental health, developmental, and substance abuse services); two home health agencies (Visiting Nurse Association of Chittenden and Grand Isle Counties and Bayada Home Health Care); 6 Nursing Homes; 13 residential care homes; and 4 assisted living facilities.

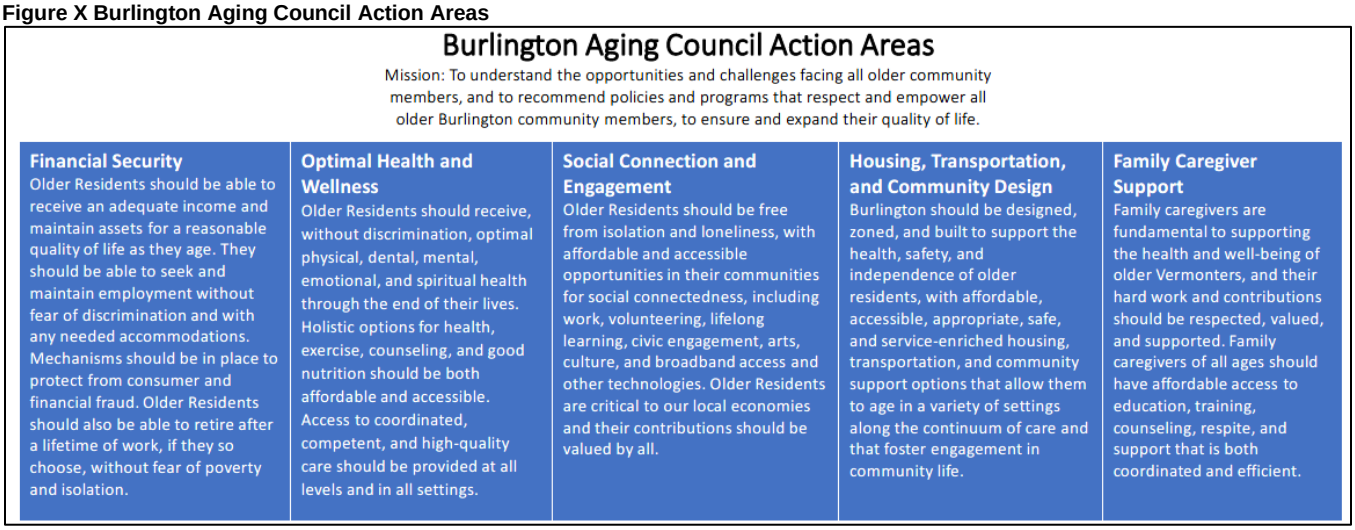
- **Demographic Changes.** The shift in our demographics is important when analyzing what facilities and services are needed. In 2010, 11% of the Chittenden County population was 65 years old and older; and this increased to 15.87% in 2020 (2020 Census). This age cohort is expected to increase. According to the 2020-2024 Vermont Housing Needs Assessment (Vermont Housing Finance Agency) between 2020 and 2025, the number of households between the ages of 65 and 74 will increase the most, adding 2,038 households during this time. Overall, Chittenden County will add a projected 2,174 households age 55 and older between 2020 and 2025. Changes in specific age cohorts is shown here:

TABLE 33 CHITTENDEN COUNTY POPULATION PROJECTIONS FOR 60 YEARS AND OLDER[xlii]

Chittenden County Population Projections for 60 Years and Older								
Age Cohort	2010 Census	2010 % of Total Population	2020 Census	2020 % of Total Population	% Change of 2010-2020 Growth	2026 ESRI Estimates	2026 % of Total Population	% Change of 2020-2026 Growth
60-64	8,220	5.25%	11,152	6.63%	35.67%	11,155	6.40%	0.03%
65-69	5,609	3.58%	9,087	5.40%	62.01%	10,798	6.20%	18.83%
70-74	3,823	2.44%	6,954	4.13%	81.90%	8,492	4.90%	22.12%
75-79	3,099	1.98%	4,672	2.78%	50.76%	6,437	3.70%	37.78%
80-84	2,563	1.64%	2,878	1.71%	12.29%	3,783	2.20%	31.45%
85+	2,591	1.66%	3,114	1.85%	20.19%	3,615	2.10%	16.09%
Total 60+	**25,905**	**16.5%**	**37,857**	**22.49%**	**262.81%**	**44,280**	**25.50%**	**126.29%**

- Not only is this a major demographic change, the needs of people within these age cohorts have changed with greater desire on aging in place and emphasis on providing home based care. While the State has had some success in addressing these needs, there is a long way to go and the demand is expected to increase. Expansion of the Vermont Respite House and use of technology in medical services (i.e. the Visiting Nursing Association of Vermont has tele-monitors to conduct daily in-home check-ins with patients remotely) are two examples of how Vermont is responding to these growing and changing needs. Also, the State has shown progress in the Choices for Care program and are currently serving those that qualify in the highest needs category (long-term care program that assists with care and support for older Vermonters and people with physical disabilities whether they are at home, an enhanced residential care setting, or a nursing facility. Participants in Choices for Care must qualify for Level II nursing home placement and meet financial eligibility criteria). However, the Visiting Nurses Association (VNA) has a significant number of clients who are clinically eligible for the highest needs Choices for Care program but don't qualify because their Medicaid eligibility has not yet been established. The VNA considers this delay a major factor in preventing them from serving a vulnerable population. In addition, VNA is currently experiencing a waiting list of over 250 people for the Moderate Needs (homemaking services) and their ability to serve the people on this list is limited by a lack of funding.

Figure X Burlington Aging Council Action Areas



Key Indicators

- **Current Wastewater Capacity v. Capacity Needed for Growth Projections in Areas Planned for Growth** Source: ANR and CCRPC Municipal Growth Projections. Chittenden County has the capacity to treat an additional 14 million gallons per day of wastewater. In 2035, it is estimated that the anticipated demand will be 7 MGD which is adequate capacity to accommodate 80% of the future development within the various sewer service areas (based on a CCRPC 2002 study). However, capacity varies for each treatment plant and some facilities may have a narrow margin of additional capacity.
- There are 1,465 stormwater permits and 127 pending stormwater permits in Chittenden County. Source: ANR VTDEC stormwater permits & pending permits data, 2022.
- **56% of the impervious area in Chittenden County is covered by the Municipal Separate Storm Sewer System Permit (MS4).** Source: MS4 Boundary, ANR's 2016 Impervious Surface Layer derived from 2016 Vermont Land Cover

Additional indicators can be found on the ECOS Scorecard.

Indicators	Location
Storm Water Management	Scorecard
Drinking Water Capacity And Reserve for Large Water Utilities	
Waste Water Average Annual Flow	Scorecard
Pounds per capita per day for Municipal Solid Waste	Scorecard
Pounds per capita per day for Construction Debris	Scorecard

STRATEGIES AND ACTIONS

2. LAND USE: STRIVE FOR 90% OF NEW DEVELOPMENT IN AREAS PLANNED FOR GROWTH, WHICH AMOUNTS TO 15% OF OUR LAND AREA.

The areas planned for growth are defined as the Center, Metro, Suburban, Village, and Enterprise Planning Areas (all but Rural) as displayed on the Future Land Use Map. This strategy mimics the development patterns we've seen in the recent past. A Transit Oriented Development (TOD) overlay planning area has been added to depict and encourage a higher concentration of growth within walking distance to bus routes to reduce transportation energy consumption, carbon emissions, and preserve our natural and working landscapes. This overlay is within the areas planned for growth.

Increasing investment in denser, mixed use growth areas will improve economic opportunities, housing options, transportation options and improve community health. Focusing growth in the appropriate planning areas is also a cost-effective approach to increasing the supply of affordable housing and using existing infrastructure efficiently. Also, this pattern of growth reduces energy consumption for transportation. Homes are in closer proximity to jobs and other services, making trips shorter and making travel by walking, biking, transit and car sharing more feasible.

Actions

1. **Invest in Areas Planned for Growth** –

    a. Invest in wastewater, water and stormwater infrastructure, energy systems (e.g. transmission, distribution, storage, and generation), urban forestry, and transportation infrastructure (prioritizing bicycles, pedestrians and public transit) in areas currently developed and/or planned for growth.
    b. Target reuse, rehabilitation, redevelopment, infill, and brownfield investments to areas planned for growth.
    c. Retrofit existing buildings to reduce energy use and greenhouse gas emissions while adaptively reusing historic buildings for housing, advancing economic development, serving as community gathering spaces, or holding cultural significance to our communities.
    d. Improve walkability and streetscape design in high density areas through a complete streets approach.

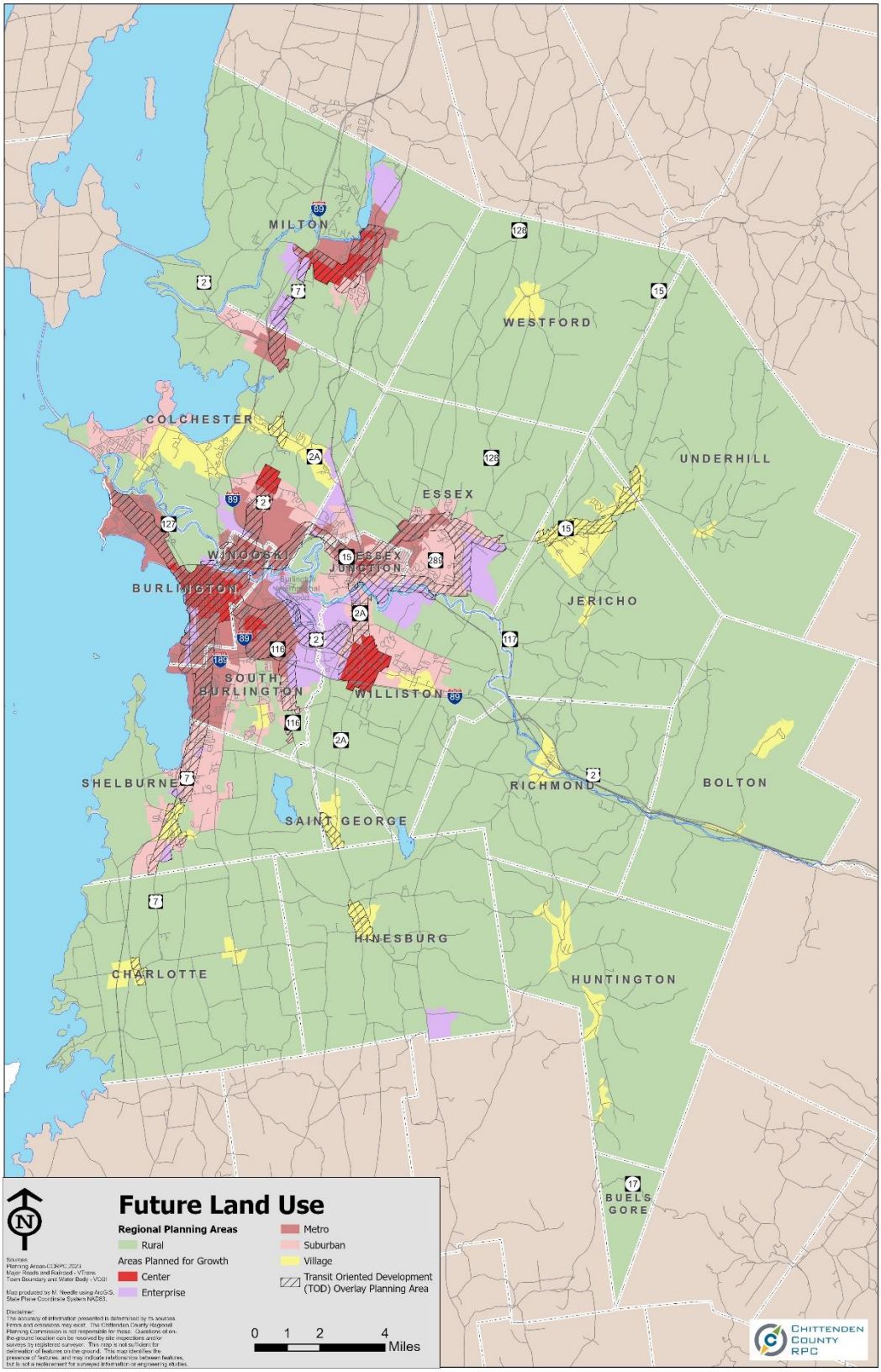
2. **Municipal Planning and Zoning** – Strengthen and direct development toward areas planned for growth through infill development and adaptive reuse of existing buildings through municipal plan and bylaw revisions and state designation programs.

    a. Work with municipalities to revise development regulations to develop places with affordable housing, a mix of land uses, opportunities for shared parking, and access to a variety of services (for example restaurants, grocery stores, parks, entertainment) via public transit and active transportation modes.
    b. Integrate capital planning and budgeting in municipal planning efforts to provide the right mix of infrastructure over time. Work with municipalities to develop official maps which can be a powerful tool to drive infrastructure improvements in the areas planned for growth.
    c. Empower local officials through trainings and education on strategies to achieve the above through municipal plan and development regulation amendments and implementation. This could include how to effectively analyze development costs and benefits and how to select appropriate multi-modal congestion mitigation measures.

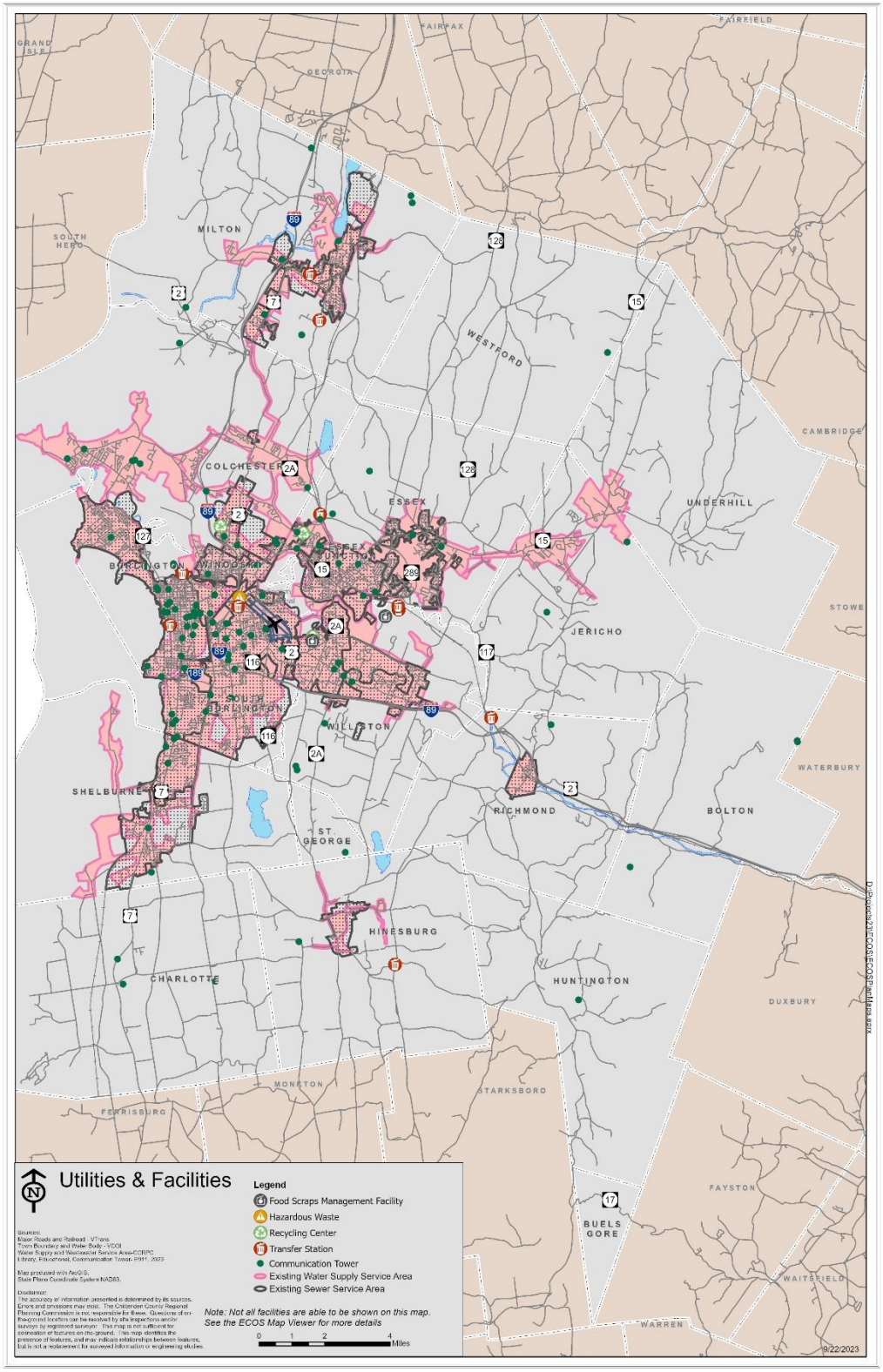
3. **Broadband** – Coordinate with the VT Community Broadband Board, municipalities and the Chittenden County Communications Union District to ensure all unserved and underserved locations have access to high-speed internet.

4. **State/Local Permitting Coordination & Improvement** – Support changes to the local and state permitting process to make them more coordinated and effective at addressing state, regional, and local land use goals.
    a. Collaborate with legislators, state agencies, municipalities, and partner organization to improve Act 250 and the State's development review process generally, particularly to have development in areas planned for growth and to prevent development outside of those areas. This could include integrated or expedited state and local permitting processes for projects in areas that are: a) designated for growth; and b) where a community has a robust plan, regulations and staff capacity. In conjunction with a reduction of permit review redundancies in areas planned for growth it may be appropriate to develop more stringent standards and thresholds for development review in rural areas.
    b. Collaborate with stakeholders, including the Vermont Zoning Atlas project, to ensure local and state regulations, bylaws and plans encourage transparency, predictability, equity, and timely review of development applications.
    c. Support the establishment of a state position to help those wishing to start businesses in Vermont understand and navigate the state permitting process.
    d. Develop a transportation assessment process that supports existing and planned land use densities and patterns in Center, Metro, Suburban, Village, and Enterprise Planning Areas to allow for more congestion and greater mode choice than allowed by current standards. Collaborate with the Vermont Agency of Transportation (VTrans), the Natural Resources Board, and other state and local stakeholders to develop this process.
    e. Policies and planning studies that are adopted as part of this ECOS Plan and subsequent amendments will guide CCRPC's position in permit proceedings.

MAP 2 – FUTURE LAND USE



MAP 3 – EXISTING UTILITIES AND FACILITIES



3. HOUSING: BUILD NEW HOMES (1,000 HOMES PER YEAR), WITH 25% OF THEM AFFORDABLE (250 HOMES PER YEAR). NEW HOMES SHOULD BE PRIMARILY LOCATED IN AREAS PLANNED FOR GROWTH (SEE STRATEGY #2).

Actions

1. **Policy and Regulatory Changes** – Support policies that encourage growth and investment in the housing sector and remove barriers to constructing affordable housing.

    a. **Reduce regulatory redundancies –** End duplication of review between Act 250, State agencies, and municipalities in areas planned for growth.
    b. **Regulatory reform -** Improve the process to increase certainty for well-planned projects in areas planned for growth. Increase housing choice and density in areas planned for growth considering community character and design. Eliminate the ability to deny applications for housing development at the municipal level based on the "character of the area" criterion in 24 V.S.A. §4414. Encourage rehabilitation and maintenance of existing housing stock.
    c. **Reduce permit fees** – At the state and municipal levels consider fee waivers or other development review process incentives for projects that include affordable housing.
    d. **Infrastructure investment -** Target government funding to infrastructure that will support housing development in areas planned for growth. Revise infrastructure requirements with a goal of reducing costs for developers.
    e. **Inclusive communities** – Integrate a variety of housing types for all income levels for all new/infill housing projects throughout the County to provide for different incomes and access to jobs and services. Adopt inclusionary zoning requirements, or other incentive programs, to serve all needs.
    f. **Climate.** Target policies to lower income households, including rentals, for weatherization and installation of cold climate heat pumps. Also, work towards electric vehicle charging station equipment especially for multi-family housing.
    g. **Rental Registry.** Support a statewide rental housing safety inspection process and rental registry; while retaining existing municipal rental registry programs as is.
    h. **Student Housing**. Continue to work with the University of Vermont and Champlain College and to develop specific plans to increase the percentage of students who reside in dedicated student housing on-campus.

2. **More Capital for Affordable Housing** – Maintain or increase local and state resources that fund additional affordable housing, maintain existing affordable housing, and make housing more affordable. These actions include:
    a. By 2026 utilize current State and local American Rescue Plan Act (ARPA) funds for housing. Also, secure new federal financial resources such as the Infrastructure Investment and Jobs Act, and the Build Back Better Bill to support, convert, and construct new housing.
    b. The State should fully fund the Vermont Housing and Conservation Board. This funding should be used to increase the stock of permanently affordable housing in Chittenden County. Also, sustain State bonding investment for capital and infrastructure investments in service of more housing; work with institutions, businesses and philanthropy to invest in housing for working families; and create avenues for social investment financing.
    c. The State should fully fund the Regional Planning Commissions, Municipal Planning Grants and the Vermont Center for Geographic Information with property transfer tax revenue to the levels outlined in existing state statute 24 V.S.A. § 4306(2) to assist in reaching housing goals (as well as other state planning goals).
    d. Advocate for BIPOC specific financing for homeownership and/or the creation of a State program to support this type of financing.

e. Encourage the use of municipal housing trust funds to assist in the financing of affordable housing.
f. Support first time homebuyer financial support programs.
g. Take steps to preserve existing affordable housing from being converted to market rate housing; and continue to encourage shared equity for new owner homes.

3. **Education and Advocacy** – Work together to move toward a regional housing market that serves people of all backgrounds and incomes, increases the persistent low rate of homeownership among Black Vermonters, supports business needs and economic growth, helps people to retain their homes, and reduces homelessness. These actions include:
   a. Build cross-sector and public support for housing development in areas planned for growth. Provide the public with the most accurate and up-to-date data to explain the region's critical needs and the measurable benefits behind new sustainable development.
   b.
   c. Provide educational resources for municipalities, employers, and other stakeholders to assist with increasing housing access to the BIPOC community.
   d. Train municipal officials and staff, the public, developers, banks, and real estate agents to promote better development practices that achieve a higher level of density with quality design.
   e. Increase capacity for essential tenant supports, such as the CVOEO Vermont Tenants hotline and educational programs for renters.
   f. Engage the media to ensure continued coverage of the housing crisis.

3. **Fair Housing** – Increase compliance with fair housing requirements to better address housing equity in the County, as described in the Vermont Fair Housing Action Plan from 2017 (or as amended) and the Burlington Assessment of Fair Housing.
   a. Increase fair housing education and outreach for landlords, property managers, real estate professionals, and anyone involved in the sale, rental or finance of housing. Work with the Vermont Refugee Resettlement Program, the Association of Africans Living in Vermont, Opportunities Credit Union, and other organizations to develop strategies for new Americans to quickly develop credit history. Create educational materials that encourage landlords to use alternative criteria for new Americans and other groups traditionally excluded from housing opportunity that don't penalize them for a lack of credit or rental history.
   b. Provide fair housing and land use planning training for land use professionals and municipal officials throughout the County.
   c. Identify gaps in municipal implementation of State Fair Housing laws and ADA compliance (including but not limited to municipal bylaws should include language that explicitly permits officials to make reasonable accommodations for people with disabilities without delay or public input).
   d. Increase enforcement and testing capacity of fair housing organizations such as Vermont Legal Aid, particularly for classes protected only under Vermont law: marital status, age, sexual orientation, gender identity, receipt of public assistance, and victims of abuse.

4. CLIMATE/ENERGY: TRANSFORM THE REGION'S ENERGY SYSTEM TO MEET VERMONT'S ENERGY AND GREENHOUSE GAS REDUCTION GOALS WHILE AVOIDING UNFAIR IMPACTS ON MARGINALIZED GROUPS AND MAINTAINING ECOLOGICAL HEALTH, ECONOMIC VITALITY, AND EQUITABLE ACCESS TO AFFORDABLE ENERGY.

1. **Vermont Energy and Climate Goals.** Reduce energy consumption, increase renewable energy generation and decrease greenhouse gas emissions to support the State's energy goals in the 2022 Vermont Comprehensive Energy Plan and the Global Warming Solutions Act as incorporated by reference in this plan including:
   - Reduction of greenhouse gas emission (26% from 2005 levels, 40 from 1990 levels by 2030, 80% from 1990 levels by 2050).
   - Weatherization of 120,000 Vermont homes by 2030 (relative to the 2008 baseline)
   - Meeting 25% of total energy needs across all sectors from renewable sources by 2025, 45% by 2035, and 90% by 2050.
   - Meeting 10% of transportation energy needs from carbon-free resources by 2032, with at least 75% of those energy needs coming from renewable energy. Zero-emission vehicles will account for 100% of light-duty sales in Vermont by 2035.
   - Meeting 30% of thermal energy needs from renewable energy by 2025 and 70% by 2042.
   - Creating an electric sector that is 100% decarbonized and at least 75% renewable by 2032.
   - Achieving net-zero ready construction for all newly constructed buildings by 2030.

2. **Municipal Technical Assistance**
   a. Provide technical assistance to municipalities when requested to enhance comprehensive plans to be consistent with Act 174 standards to enable municipalities to gain substantial deference in the Certificate of Public Good Section 248 process. This assistance will include working with municipalities to identify natural, cultural, historic, or scenic resources to be protected from all development types and to identify preferred locations for renewable energy generation facilities.
   b. Provide technical assistance to municipalities to implement their energy plans, including securing grant funding to do so, and encourage municipalities to lead by example with respect to energy efficiency for buildings, transportation and the deployment of renewable energy.
   c. Provide technical assistance to municipalities that wish to require fuel switching for off-road equipment such as lawnmowers to clean and non-fossil fuels.
   d. Provide municipalities with guidance from the CCRPC Climate Change & Land Use guide on how to amend their land use regulations to limit low density sprawl, enable compact walkable neighborhoods, and protect the working and natural landscape to ensure climate change resilience and mitigation.

3. **Thermal Sector Partnerships**
   a. Continue partnerships with VGS, Burlington Electric Department, Efficiency Vermont and the Champlain Valley Office of Economic Opportunity Weatherization Assistance Program to promote weatherization and energy efficiency programs and incentives for homes and businesses.
   b. Transition the thermal sector away from fossil fuels by working with partners such as Green Mountain Power, VGS, Efficiency Vermont, Burlington Electric Department, and other

energy service providers to educate developers, businesses, and homeowners about cold climate heat pumps, heat pump hot water heaters, wood heating, biofuels, and geothermal systems.

c. Advocate for the State, utilities, and workforce/business development organizations to address weatherization workforce challenges identified in the 2021 Weatherization Workforce Report. Promote the expansion of current workforce training programs that are effective, such as ReSOURCE's weatherization and HVAC 101 training programs.
d. Coordinate with state and local stakeholders on building energy code requirements and compliance to encourage consistency and accelerate net zero building practices and electric vehicle charging infrastructure. The state must ensure that energy efficient construction is accessible to and does not unfairly burden communities of color and lower income households.
e. Support VGS and other organizations efforts to install networked geothermal in Chittenden County.

4. **Renewable and Resilient Electricity**
   a. Support a wide variety of renewable energy generation types, including storage, sustainable uses of biomass for heating, passive solar building design, bio-digesters for electricity generation, photovoltaic solar, wind turbines, and optimizing the energy potential for existing hydro-electric dams.
   b. Coordinate with transmission and distribution utilities to resolve electric grid constraints to enable the region to achieve Chittenden County's renewable energy generation target needed for the electrification of the heating and transportation sector.
   c. Support in-place upgrades of existing facilities, including existing renewable energy generation, storage, transmission lines, distribution lines, substations, microgrids, and energy storage as needed to reliably serve municipalities and the region with a resilient and low-carbon electric grid that supports a growing renewable electricity economy and low electricity costs. The existing law (30 V.S.A. 218c and PUC Docket 7081) does not sufficiently enable VELCO with the authority needed to effectively plan for grid modernization that meets the state's energy and climate goals. To plan for the transmission constraints that our State and our region are facing, the State should enable VELCO to design and fund a transmission system to address grid constraints in an equitable and proactive manner.

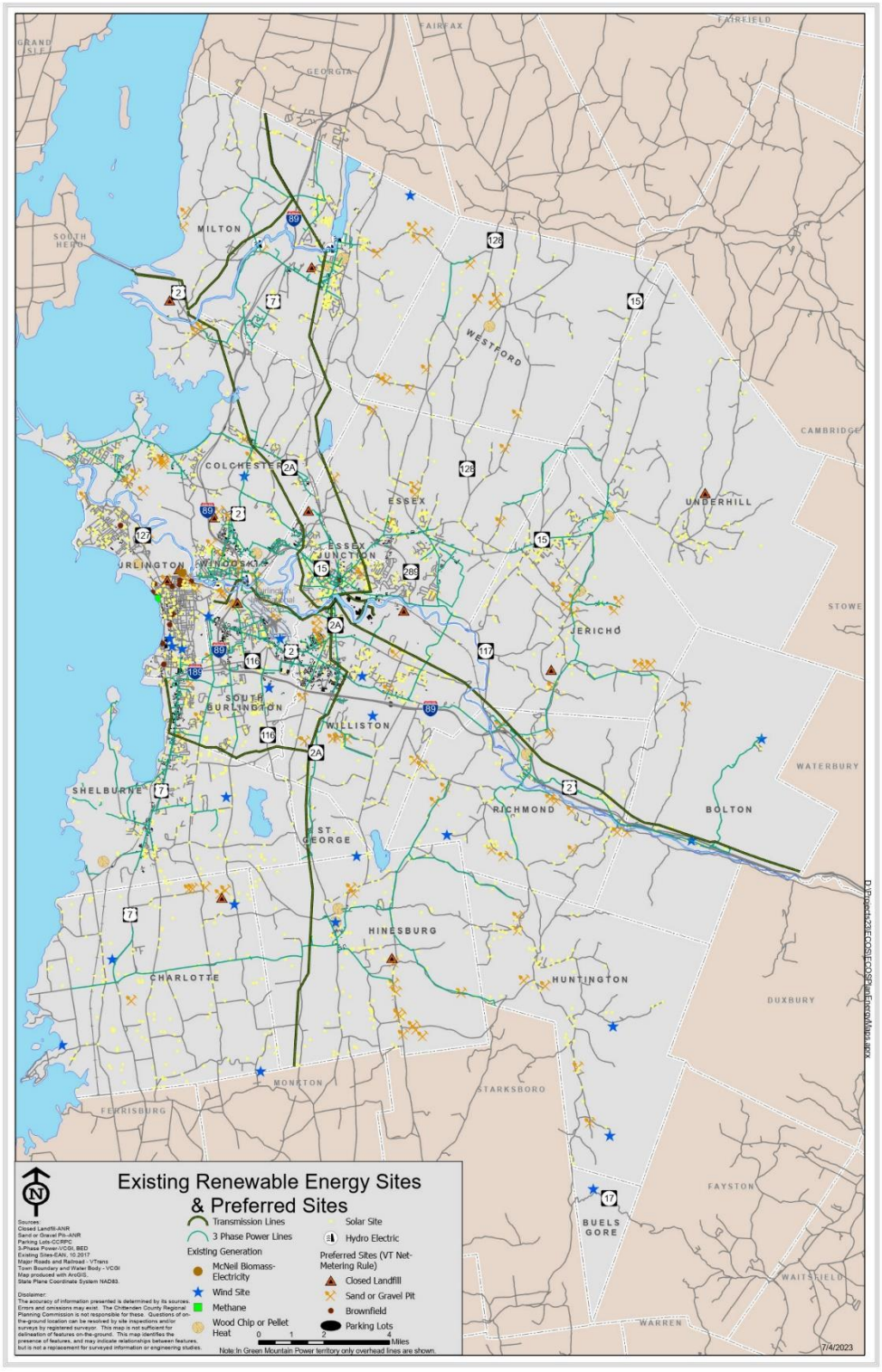
5. **Statewide Renewable Energy Generation Regulation**
   a. Support changes in federal, state, and local policies to achieve the state of Vermont Comprehensive Energy Plan, Climate Action Plan goals, and to ensure burdens are shifted away from impacted communities while increasing participation by those communities in the renewable energy industry.
   b. Support changes to the Renewable Energy Standard to prioritize in-state generation over electricity imports to avoid externalizing both environmental and societal costs and benefits.
   c. Increase the maximum size of net-metered projects and establish a tiered system for net-metering rates in which utilities pay a lower rate to facilities over a certain size (such as 500kW) to increase net-metering participation and reduce the energy burden for public and non-profit entities.
   d. Increase the maximum size of net-metered projects (currently 500kW) for public, and non-profit, and community ownership entities to encourage them to maximize development of renewable energy sources.

e. Request that the Public Utility Commission to open the rule making process on Rule 5.700, Sound Levels from Wind Generation Facilities, to reassess existing sound standards with the intent of allowing all sizes and scales of wind energy generation possible in Chittenden County.

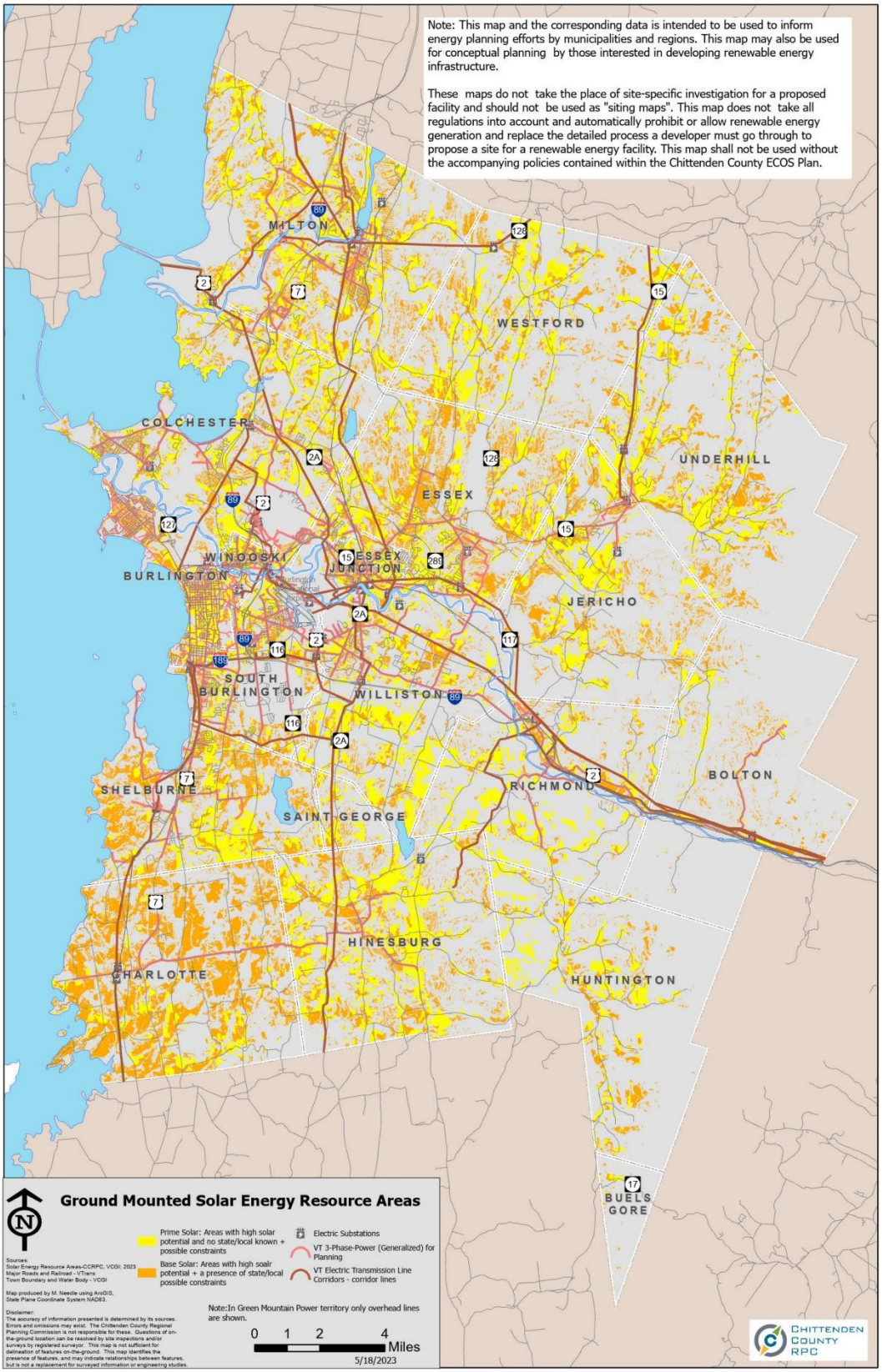
6. **Renewable Energy Generation Siting and Suitability Policies**
   a. **Renewable Energy Generation Goal.** CCRPC supports the generation of new renewable energy in the County to meet Vermont's Global Warming Solutions Act requirements and the Comprehensive Energy Plan's goal of using 90% renewable energy by 2050, in a manner that is cost effective, respects the natural environment, and does not unfairly burden low-income communities with the impact of development. Specifically, Chittenden County currently generates 606,554 MWh of renewable energy annually. The 2050 target is a total of 954,833 MWh (Megawatt hours) of energy generated annually (a 348,279 MWh, or 57%, increase from 2022). The target is technology neutral, meaning the target can be met with any mix of technologies.
   b. **Siting and Suitability Policies.** Ground mounted renewable energy generation is constrained in certain areas due to state and local restrictions on development. Additionally, different levels of suitability exist for different scales and types of renewable energy generation depending on the location within the County. The following statements are CCRPC's renewable energy generation facility siting policies and will inform CCRPC's preferred sites policy. CCRPC recommends the location of renewable energy generation facilities in accordance with the relevant guidelines below. Inability to meet these guidelines does not necessarily preclude the ability to develop renewable energy generation development:
      i. Site renewable energy generation to avoid state and local known constraints and to minimize impacts to state and local possible constraints, as defined in Strategy 6, Action 1. F, and Strategy 7, Action 1. F, and Action 2 e. Renewable energy generation sited on existing structures or parking lots complies with this policy.
      ii. Site ground-mounted solar development in accordance with setback standards as defined in 30 V.S.A. §248(s) and municipal screening requirements adopted in accordance with 30 V.S.A. §248(b)(B).
      iii. Locate energy generation proximate to existing distribution and transmission infrastructure with adequate capacity and near areas with high electric load (See Green Mountain Power's Solar Map and Burlington Electric Department's Distributed Generation Map.
      iv. Locate renewable energy generation in areas designated by a municipality in an adopted plan for such use, including specific preferred sites for net-metering, in accordance with PUC rule 5.1, rule pertaining to construction and operating of net-metering systems. State preferred sites are mapped on Map 5.
      v. Locate solar generation (including but not limited to net metering) on previously impacted areas (such as, parking lots, previously developed sites, brownfields, State regulated landfills with post-closure certification, gravel pits/quarries, or on or near existing structures).
      vi. Locate ground-mounted solar larger than 15 kW AC (except for parking lot canopy solar installations) and wind turbines with a hub height larger than 30 meters (98 ft.) outside of state designated village centers, growth centers, downtowns, new town centers, neighborhood development areas, and historic districts on the State or National Register.

vii. To mitigate load growth, integrate renewable energy generation facilities in a manner that allows infill to be the priority within areas planned for growth, but outside designated area mentioned above.
viii. Locate wind generation in areas with high wind potential, such as the prime and base wind potential areas shown on Map 7.

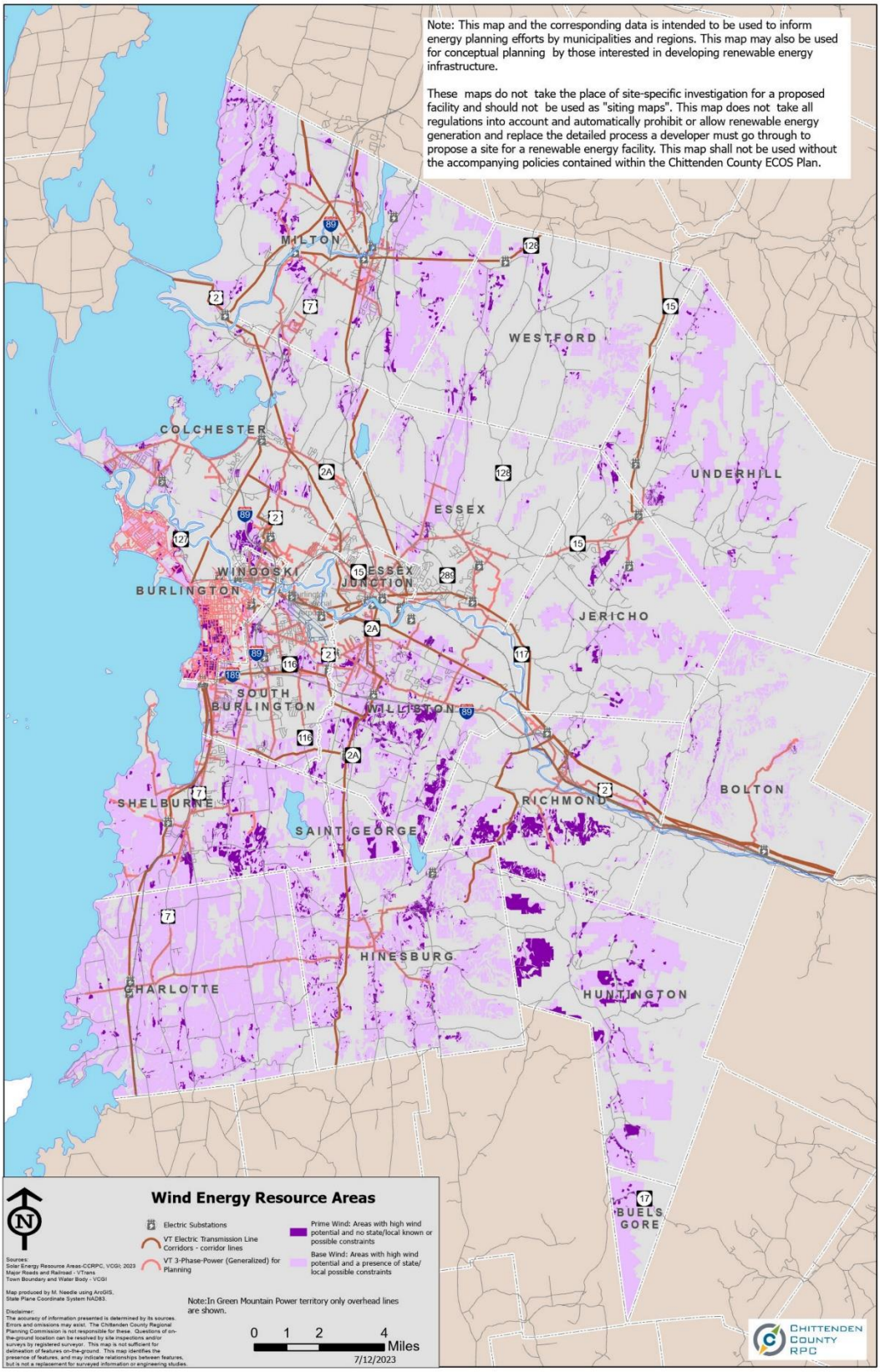
MAP 5 – STATE PREFERRED SITES FOR SOLAR GENERATION + EXISTING RENEWABLE ENERGY GENERATION SITES



MAP 6 – SOLAR GENERATION POTENTIAL



MAP 7 – WIND GENERATION POTENTIAL



5. TRANSPORTATION: INVEST IN INFRASTRUCTURE AND PROGRAMS THAT REDUCE VMT; IMPROVE SAFETY FOR ALL USERS; SUPPORT LIVABLE AND HEALTHY COMMUNITIES; IMPROVE MOBILITY AND EFFICIENCY FOR ALL USERS REGARDLESS OF THEIR TRANSPORTATION MODE; IMPROVE RESILIENCY; SUPPORT THE ECONOMY OF THE REGION; AND MAINTAIN THE EXISTING SYSTEM.

Meeting the state and regional transportation and climate goals will require a multipronged approach. This includes major shifts in transportation investments and policies to facilitate significant increases in people walking, biking, taking transit and other non-auto modes thus reducing VMT and GHGs; supporting compact developments (90% of new growth) in areas planned for growth; electrification of the entire fleet (90% by 2050); instituting a mileage-based fee for all vehicles; and increasing the cost of parking in downtown and village areas.

Actions

1. Adequately maintain and improve our existing transportation system including roads, bridges, culverts, rail, transit, walking/biking, park-and-ride facilities, and transportation demand management (TDM) programs.
2. Invest in our transportation system by addressing safety and localized congestion issues on our roadways.
3. Work with federal, state, and local partners to find new sources for transportation funding; shift from gas tax to more sustainable sources such as a mileage-based fee.
4. Expand the deployment of Intelligent Transportation Systems (ITS) to facilitate efficient flow of traffic on the roadway system which will improve safety, reduce delays and congestion, decrease transportation energy use, and minimize the need for major roadway expansion projects.
5. Implement the identified MTP and Transportation Improvement Program (TIP) projects.
6. Future transportation investments will support our areas planned for growth and reduce fossil fuel consumption to mitigate climate changing emissions by facilitating a shift away from single occupancy vehicle (SOV) trips by focusing on the following areas and programs:
    a. Triple transit use by 2050 – feasibility of this strategy will be explored in a FY24 study
        i. Increase investment in GMT transit services in the County and explore microtransit opportunities in the County.
        ii. Identify new, sustainable, and stable sources to finance public transit.
        iii. Work with GMT to identify opportunities for transit expansion. Integrate park-and-ride facilities with transit routes.
        iv. Invest in transit signal priority technology in partnership with GMT, VTrans, and municipalities.
        v. Maximize ridership for public school buses and minimize use of private vehicles for student transport.
    b. Expand walking and biking infrastructure to support active transportation and improve interconnection with the region's transit system.
        i. Implement the strategies, projects and priorities identified in the 2022 Chittenden County Active Transportation Plan to provide safe and efficient facilities to connect common origins and destinations.
        ii. Work with municipalities to update municipal road standards to reflect complete streets principles.

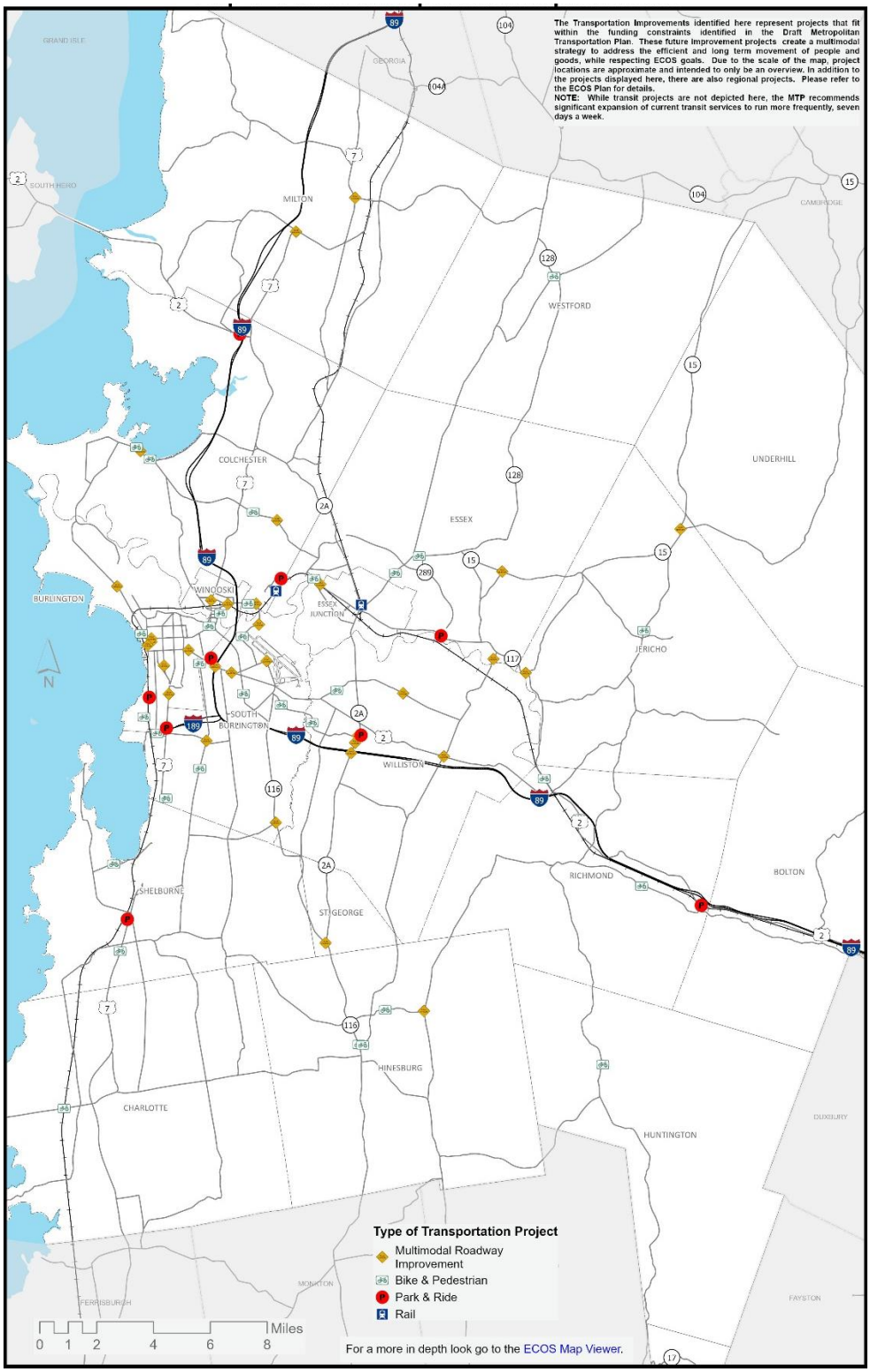
iii. Review state and municipal transportation projects to ensure that complete streets principles are implemented.
iv. Ensure that site plans include adequate bike and pedestrian infrastructure and safety measures, through participation in the Act 250 hearing process.
v. Assist municipalities with scoping future bike and pedestrian facilities to improve safety, accessibility, and continuity of the system. Municipalities could use the outcomes of the scoping studies to apply for various VTrans implementation grants.

c. Promote Transportation Demand Management and Car Sharing programs
   i. Promote and support the Go! Vermont program that links travelers to a variety of transportation resources and choices.
   ii. Support the continued development and expansion of Chittenden County park-and-ride facilities as recommended in the 2022 Regional Park-and-Ride Plan.
   iii. Work with the Chittenden Area Transportation Management Association (CATMA) to support employer programs to encourage telecommuting, carpooling, vanpooling, walking, and biking for employee commute trips.
   iv. Support CarShare Vermont's programs.
d. Promote a shift away from gas/diesel vehicles to vehicles powered by lower/no carbon renewable fuel sources
   i. Work with the Clean Cities Coalition and municipalities to encourage municipal fleets to switch to lower emission heavy-duty vehicles and install charging for electric vehicles.
   ii. Work with municipalities and relevant stakeholders to plan for local renewable transportation refueling networks and infrastructure, such as Level 2 and Level 3 electric vehicle recharging and hydrogen refueling. Ensure that these networks support both commuting and regional destinations (e.g., downtowns, villages, resorts, tourist sites, transportation hubs, major employers, and multi-unit housing) and that they are planned along major regional transportation routes per the National Electric Vehicle Infrastructure (NEVI) Plan.
   iii. Work with local employers, municipalities, and other energy advocates to encourage broader adoption of electric vehicles by providing free or reduced parking costs for EVs and fuel-efficient vehicle owners and preferential access to parking spaces limited in supply.
   iv. Promote the Drive Electric Vermont webpage, which connects users to financial incentives, types of available electric vehicles, and charging stations for EVs.
   v. Increase awareness of the benefits of and access to EVs and lower emission vehicles, in partnership with Drive Electric Vermont, Vermont Clean Cities Coalitions and other entities.
   vi. Collaborate with electric utilities to educate and promote incentives to increase EV and hybrid adoption and build awareness of charging opportunities as part of their strategy for complying with the state's Renewable Energy Standard.
   vii. Seek grants to fund the installation of DC fast-charging infrastructure at strategic locations along major travel corridors and in transit hubs and along the Interstate 89 Alternative Fuels Corridor (I-89 from New Hampshire to the Canadian border).
   viii. Collaborate with VTRANS and Drive Electric Vermont on the implementation of the Vermont 2022 State National Electric Vehicle Infrastructure Plan.

ix. Provide technical assistance to municipalities implementing the VT Department of Housing and Community Development Local Electric Vehicle Charging Station Regulation Guide, especially at multi-unit housing properties, businesses, and key public locations.

7. Support and enhance our rail infrastructure for both passenger and freight and promote the upgrade of the Essex Junction to Burlington line (Winooski branch). Where needed, provide additional rail infrastructure for the support of more efficient and safe movement, handling, and storage of goods.

MAP 4 – FUTURE TRANSPORTATION IMPROVEMENTS



6. WATER QUALITY: IMPROVE THE SAFETY, WATER QUALITY, AND HABITAT OF OUR RIVERS, STREAMS, WETLANDS AND LAKES IN EACH OF OUR WATERSHEDS.

While striving toward all the ECOS strategies, and particularly Strategy #2 – 90% of growth in 15% of our land area, it is essential to do so in such a way that we do not impair our essential water resources (including potable water) and that we prepare ourselves for the impacts of a changing climate.

Actions

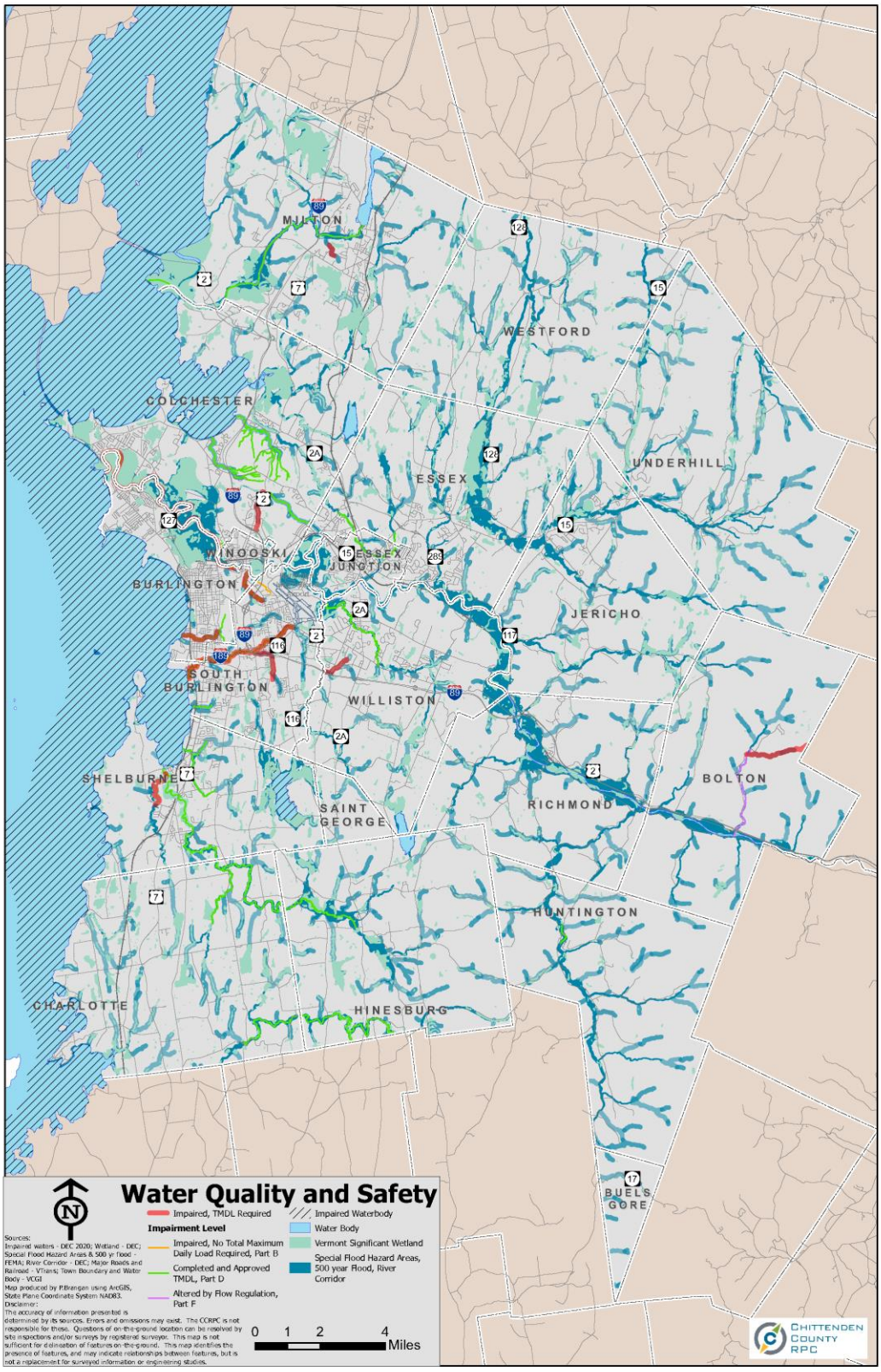
1. **River Hazard Protection.** Develop and implement adaptation strategies to reduce flooding and fluvial erosion hazards. While supporting planned growth, ensure that growth is evaluated in terms of preparedness for a changing climate. Chittenden County will continue its efforts, along with the municipalities, to avoid development in particularly vulnerable areas such as floodplains, river corridors, wetlands, lakeshore and steep slopes; protect people, buildings and facilities where development already exists in vulnerable areas to reduce future flooding and erosion risk; plan for and encourage new development in areas that are less vulnerable to future flood & erosion events (see Strategy 2); and implement stormwater management techniques to slow, spread and sink floodwater (see the Non-Point Source Pollution section below).
    a. **Mapping and Data.** Use mapping and data tools to prioritize and address road erosion issues, including the VTrans Transportation Resilience Planning, VT Culverts, and the Reducing Repeat Damage tools.
    b. **Revise bridge/culvert designs.** Help revise municipal public works standards and zoning ordinances with culvert and bridge design specifications that allow for wildlife passage and movement of floodwater and debris during high intensity events. Implement culvert and bridge designs that produce stable structure in river channels (i.e. fluvial geomorphology).
    c. **Continue non-regulatory protection of river corridors** including measures such as conservation and/or preservation of vulnerable areas through public and land trust investments, stream re-buffering, river corridor easements on agricultural lands, river corridor restoration and culvert and bridge improvements.
    d. **Protect river corridors through regulation.** Existing municipal development regulations protect most River Corridor areas with stream setbacks and floodplain regulations. Work with municipalities and ANR to improve bylaws to protect the River Corridor Areas not currently protected and enforce these bylaws. Assess the need for a state-administered River Corridor permit and/or floodplain permit to improve consistency and enforcement of River Corridor and floodplain development standards statewide.
    e. **Increase flood resilience.** Support non-regulatory efforts to reduce damage from future floods, including identifying repetitively damaged structures and providing of technical and financial assistance to elevate, relocate or buy out structures, and identifying where flood storage capacity may be restored and conserved.
    f. **Tactical Basin Planning.** Participate in the development and implementation of the Lamoille (Basin 7), Winooski (Basin 8) and Northern Lake Champlain Direct Drainages (Basin 5) Tactical Basin Plans. CCRPC will work with the State, municipalities, and other partners to address river hazard protection, flood resiliency and water quality through these Plans – including prioritizing projects for funding.
    g. **Avoid Development Constraints.** To protect water quality, development should be located to avoid state and local known constraints that have been field verified, and to minimize impacts to state and local possible constraints that have been field verified.
        i. Known State and Local Constraints, as protected by municipalities and State agencies, are shown on Map 9 and include the following: DEC River Corridors, FEMA Floodways, and Municipal Water Quality Setbacks, Local Known Constraints – see constraint tables under the description of Map 9 in Supplement 3.

ii. Possible State and Local Constraints are shown on Map 9 and include the following: FEMA Special Flood Hazard Areas and hydric soils, Local Possible Constraints – see constraint tables under the description of Map 9 in Supplement 3.

2. **Non-point Source Pollution.** Non-point sources are still contributing pollutants to our water bodies.
   a. **Assemble data**. Work from existing data collected and further identify the locations that are contributing to water pollution such as flow, sediment, pathogen and nutrient. Where needed, conduct on-the-ground inventories of water quality and biological assessments (in-stream), wetlands, sub-watersheds, river corridors (buffered or not) and geomorphology. Map the existing and new data on one regional map.
   b. **Revise and Enforce Plans and Bylaws.** Incorporate the above data into municipal plans; establish specific statements that protect these resources; develop clear standards for how to protect these resources within development regulations; and initiate on-going enforcement of the regulations. Encourage Low Impact Development (LID) policies and Green Stormwater Infrastructure (GSI) techniques, and shared storm water control programs to maximize land development in areas planned for growth. Incentivize best management practices for agricultural uses; and encourage the Agency of Agriculture to better enforce their required agricultural practices.
   c. **Implement non-regulatory approaches.** Identify and implement non-regulatory approaches to nutrient, pathogen and sediment pollution management especially projects implemented through the Clean Water Services Provider framework authorized under Act 76. Support the work of watershed organizations.
   d. **Implement permits.** CCRPC will work with the municipalities and other partners to implement the Municipal Roads General Permit, Stormwater General Permit 3-9050 for Developed Lands (with 3 or more acres of impervious surface), and integrate phosphorus reduction into the existing MS4 permit. See Chittenden County's Work Plan and the 2022 Chittenden County Multi-Jurisdictional Hazards Mitigation Plan for more detail on these actions. CCRPC will also advocate for better coordination of municipal and state regulatory oversight of individual stormwater permits for private development projects.

3. **Wastewater Treatment Plant Upgrades**. Non-point pollution sources have been identified as the largest contributors of phosphorus to Lake Champlain, and therefore Vermont's August 2015 *Draft* Lake Champlain Phosphorus TMDL Phase I Implementation Plan does not allocate any additional phosphorus reductions to wastewater treatment plants in the Lake Champlain basin. However, the 2015 EPA *Draft* Phosphorus TMDLs for Vermont Segments of Lake Champlaindoes include reductions at some of the County's wastewater treatment plants.[xliv] These treatment plants are listed in the ECOS/CEDS Project List (in Supplement 4).

MAP 8 – WATER QUALITY & SAFETY



7. ECOLOGICAL SYSTEMS & WORKING LANDS: INCREASE INVESTMENT IN AND DECREASE SUBDIVISION OF WORKING LANDS AND SIGNIFICANT WILDLIFE HABITATS, AND SUPPORT LOCAL FOOD SYSTEMS TO ADAPT TO A CHANGING CLIMATE.

Actions

1. **Habitat Preservation.** Protect forest blocks, wildlife connectivity resources and crossings, surface waters, riparian areas and other significant habitats (e.g. wetlands) from development and fragmentation and promote vegetative landscaping in urban areas to maintain natural habitats, natural stormwater management, water quality, air quality, carbon sequestration and cultural heritage. This work should focus on the broader concept of the pattern of forest cover versus focusing on core forest areas because forest blocks in Chittenden County are getting smaller and more isolated from other forest blocks, surface waters and riparian areas. Leaving isolated forest blocks contributes to losses in biodiversity.
    a. **Inventory and Planning.** Map 10 provides a starting point for regionally important forest blocks and wildlife habitat and is the basis for this Plan's compliance with Act 171 of 2016 (Forest Integrity). The map includes Vermont Conservation Design's highest priority and priority resources defined as two scales: Landscape Scale (e.g. forest blocks and connectivity resources) and Species and Community Scale (e.g. rare, threatened and endangered species and other specific habitat sites). This data and the component layers are located on the State's BioFinder website. Over the coming years CCRPC will work with municipalities to be compliant with this new statutory requirement as well as the conserved lands inventory and conservation plan being developed under the Community Resilience and Biodiversity Protection Act of 2023 by:
        i. Assisting with surveys and inventories of forest blocks, wildlife crossings, natural communities (i.e. special features within the forest blocks and surface water and riparian areas), and other significant habitats (e.g. wetlands), scenic resources and locations of invasive species and map this information.
        ii. Incorporating this data into municipal and regional plan text and maps and by establishing specific policies that address and protect these resources.
        iii. Aggregating locally important forest blocks, wildlife habitat and associated resources into a regionally significant map so that we can see these resources across municipal boundaries and work with local, State, and Federal partners to protect them.
    b. **Municipal Development Review Regulations**. Help municipalities develop clear development regulations and definitions for ecological and habitat resources to be protected, such as limiting intrusions to interior forest and connectivity blocks or maintaining vegetative cover and larger culverts around wildlife road crossings.
    c. **Education**. Educate engineers, developers, real estate professionals, planners and the public regarding resources and methods for restoration and protection.
    d. **Non-regulatory Protection**. Support non-regulatory conservation and/or preservation efforts conducted through public and land trust investments in alignment with guidance of conservation targets and plans established under the Community Resilience and Biodiversity Protection Act of 2023.
    e. **Invasive Species.** Help municipalities establish invasive plant removal management plans, implement the plans and include long-term monitoring. Also help municipalities plan for and

manage invasive tree diseases and pests such as emerald ash borer that threaten both urban and rural forests.

f. **Development Constraints.** To protect significant habitats, development should be located to avoid state and local known constraints that have been field verified, and to minimize impacts to state and local possible constraints that have been field verified.
   i. Known State and Local Constraints, as protected by municipalities and State agencies, are shown on Map 9 and include the following: State -significant natural communities and rare threatened and endangered species, vernal pools (confirmed), FEMA floodways, DEC River Corridors, and Class 1 and Class 2 Wetlands, Local Known Constraints: see constraint tables under the description of Map 9 in Supplement 3.
   ii. Possible State and Local Constraints, as protected by municipalities and State agencies, are shown on Map 9 and include the following: Protected Lands (state lands in fee simple ownership and privately conserved land), agricultural soils, Act 250 agricultural soils mitigation areas, deer wintering areas, potential vernal pools, the Agency of Natural Resources Vermont Conservation Design Highest Priority Forest Blocks and Surface Water/Riparian Areas: see constraint tables under the description of Map 9 in Supplement 3.

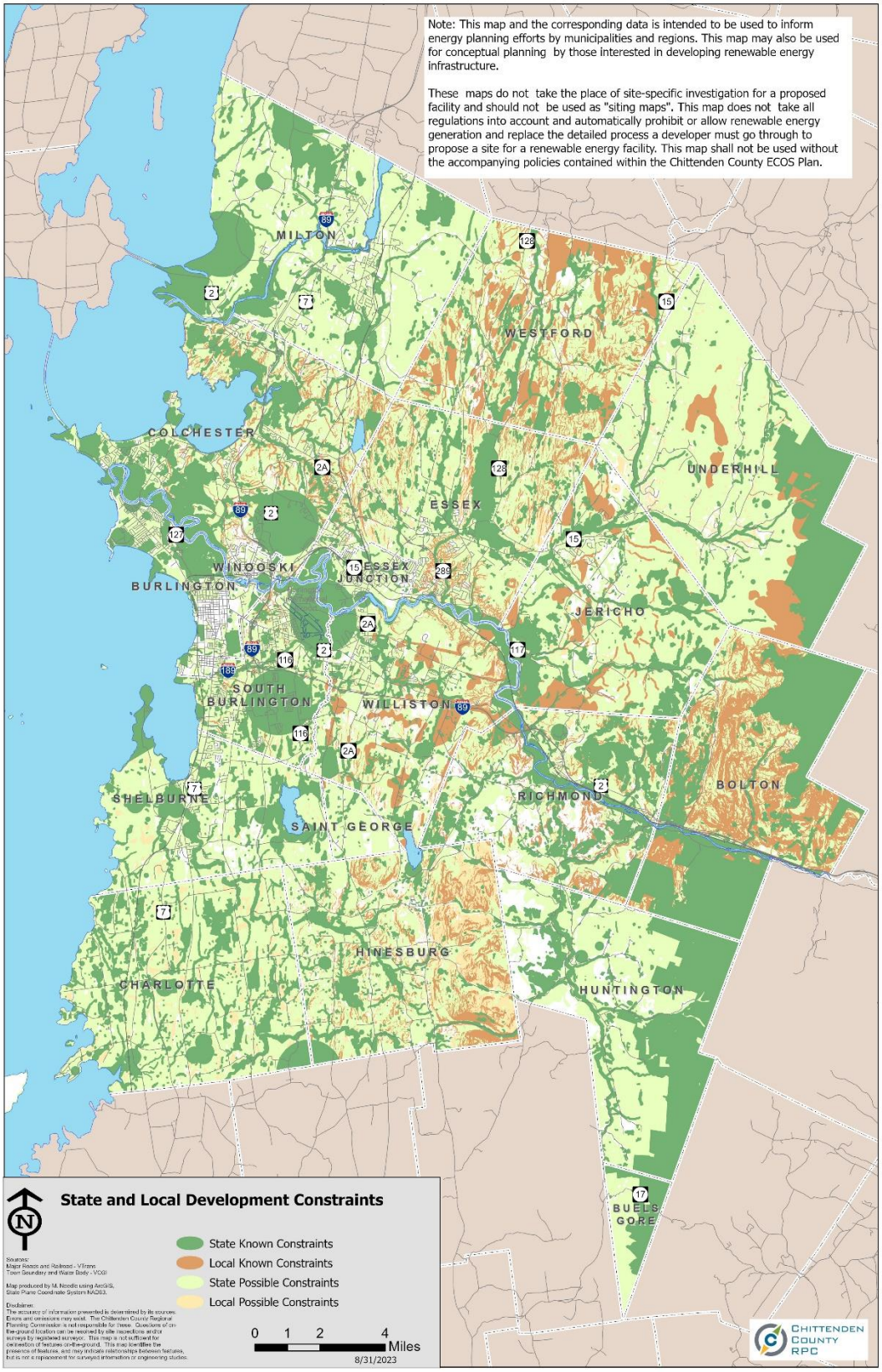
2. **Working Lands Implementation** – To preserve the soul of Vermont, as well as move forward into the future with resiliency, Vermont needs to protect the farmland and forestland we have and support existing and new operations.
   a. **Farm to Plate**. Cooperate with stakeholders to implement projects identified in the 2021-2030 Vermont Agricultural and Food Systems Strategic Plan (Vermont Farm to Plate) that will support continued growth of the local farm, food, and forestry economy within the region.
   b. **Outdoor Recreation.** Collaborate with the Vermont Outdoor Recreation Economic Collaborative, Vermont Trails and Greenways Council, and regional recreation collaboratives led by the regional planning commissions to further the economic interests of the outdoor recreation economy.
   c. **Forest Economy**. Cooperate with stakeholders to implement projects and actions intended to strengthen the forest economy as identified in the 2017 Vermont Forest Action Plan and the Vermont Forest Sector Systems Analysis.
   d. **Municipal Development Regulations**. Help municipalities develop clear development regulations and definitions of working lands to be protected. Maintain access to and scale of working lands to ensure viability after subdivision in the rural landscape This may include protection of log landings of previously logged forested parcels, zoning techniques such as fixed area ratios which separate lot size from residential density, and conservation zoning and homeowners association bylaws that allow for farming on the open space lots and in urban spaces.
   e. **Farmland Access.** Work with the Vermont Housing Conservation Board, Vermont Land Trust, and other similar organizations to increase access to farmland for black, indigenous, and people of color. At the same time, promote urban agriculture in areas planned for growth to cultivate a land ethic, improve resilience of our food systems, and increase food access particularly in areas of high poverty and food insecurity.
   f. **Biomass Energy Potential** – Support the continued sustainable harvesting of biomass in Chittenden County for uses including wood heating and electricity production, which will support the viability of the forestry industry and move the region towards the energy goals discussed in Strategy 4.

g. **Development Constraints.** To preserve working lands, development should be located to avoid state and local known constraints that have been field-verified, and to minimize impacts to state and local possible constraints that have been field-verified.
    i. Possible State or Local Constraints, as protected by municipalities and State agencies, are shown on Map 9 and include the following: Agricultural soils and Act 250 agricultural soil mitigation areas, and local constraints listed in the constraint tables under the description of Map 9 in Supplement 4.
h. **Climate Action.** Collaborate with the Vermont Agency of Natural Resources' Climate Action Office to help implement the strategies and actions in the Vermont Climate Action Plan related to natural and working landscapes.

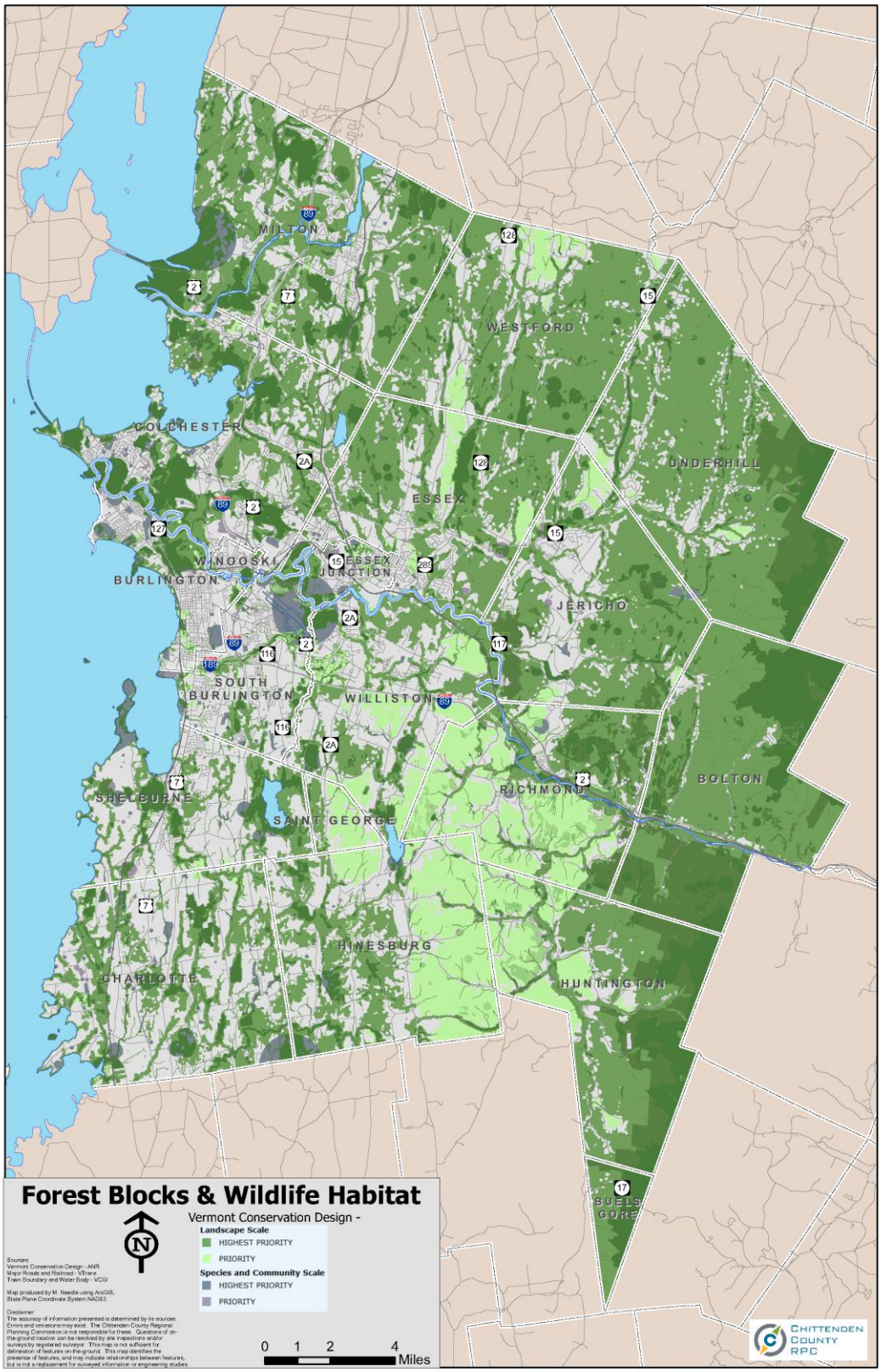
3. **Earth Resources Extraction -** Mineral extraction and processing facilities, including smaller private extraction operations existing to support agricultural operations, should be planned, constructed, and managed, in accordance with State and local regulations, to:

a. Not place an excessive or uneconomic burden on local and state highways and bridges – including but not limited to a burden to the function and safety of existing roads and bridges serving the project site, strain from heavy loads on roadbeds and bridges, conflicts with pedestrians or bicyclists and increased heavy traffic in dense residential areas; and
b. Minimize adverse effects on water quality, fish and wildlife habitats, and adjacent land uses; and
c. Plan for their eventual rehabilitation so that slopes are stable, and the surface is revegetated with a variety of native species to support a wide range of biodiversity. Topsoil should not be removed from sites and excavations should stop early enough so that stable slopes can be established on the property; and
d. Extraction sites should be screened to the extent practical if topography and vegetation allow.

MAP 9 – NATURAL SYSTEMS/DEVELOPMENT CONSTRAINTS



MAP 10 – FOREST INTEGRITY



[i] Baker, Jenny et al. "Equity in Zoning Policy Guide." (2022). *American Planning Association*. Retrieved 9/21/2023 from https://planning-org-uploaded-media.s3.amazonaws.com/publication/download_pdf/Equity-in-Zoning-Policy-Guidev2.pdf.

[ii] ibid.

[iii]

[iv] Source: State of Vermont Municipal Planning Data Center Designated Areas: https://accdmaps.vermont.gov/MunicipalPlanningDataCenter/DesignatedAreas
[vi] Vermont Environmental Research Tool. https://anrweb.vt.gov/DEC/ERT/Brownfields.aspx.

[viii] U.S. Census Bureau: American Community Survey 5-year estimates (Table B25070, B25091) 2019. Cost burden | HousingData.org - Directory of affordable rental housing
[ix] U.S. Census Bureau: American Community Survey 5-year estimates (Table B25070, B25091) 2021.

[x] US Census Bureau: American Community Survey 5-year estimates (Table B25034, B25036), 2017-2021.

[xii] 2020-2024 Vermont Housing Needs Assessment, by Vermont Housing Finance Agency
[xiii] U.S. Census Bureau. Decennial Census, Table DP1. (2020).

[xiv] Chittenden County Homeless Alliance. "2023 Point In Time Count." Retrieved 9/21/2023 from https://www.cchavt.org/point-in-time-count-of-homelessness/

[xvi] U.S. Census Bureau: American Community Survey 5-year estimates (Table B25003A-G). 2019
[xvii] Vermont Business Magazine. "Study: Vermont has 2nd lowest rental vacancy rate." August 17, 2022. https://vermontbiz.com/news/2022/august/17/study-vermont-has-2nd-lowest-rental-vacancy-rate.

[xviii] Allen, Brooks, and Minor Report, June 2023

[xix] AirDNA short-term rental listings. AirDNA aggregates listings from several popular rental platforms, including Airbnb and HomeAway (includes VRBO). Short-term rentals | HousingData.org - Directory of affordable rental housing. Resource: https://www.airdna.co/airdna-data-how-it-works
[xx] Megan Sullivan: Vermont's future depends on an equitable housing market - VTDigger
[xxiv] Hoag, F., Raimondi, S., Zencey, D., 2021. Recreation and Tourism. In Galford, G.L., Faulkner, J. et al. (Eds), The Vermont Climate Assessment 2021. Burlington, Vermont: Gund Institute for Environment at the University of Vermont. DOI: 10.18125/kowgvg.

[xxv] https://vtdigger.org/2023/07/31/the-flood-waters-disproportionately-hit-vermonts-affordable-housing-stock-at-the-worst-time/

[xxvi] Kosiba, Alexandra. "An Introduction to Forest Carbon." *Northern Woodlands*, Spring 2023, pp. 44-49.

[xxvii] CCRPC. "Creating a Climate for Resilience." https://www.ccrpcvt.org/wp-content/uploads/2016/01/Chittenden-County-Climate-Action-Guide-2014.pdf

[xxviii] 2019-2011 National Land Cover Data
[xxxii] Multi-resolution Land Characteristics Consortium National Landcover Data EVA Tool

[xxxiii] VT Urban & Community Forestry Program. "Benefits of Trees." https://vtcommunityforestry.org/tree-care/benefits-trees

[xxxv] Estimated Use of Water in the United States County-Level Data for 2015, USGS
[xxxvi] Vermont Agency of Administration. (2022). Vermont Clean Water Initiative 2022 Performance Report. https://dec.vermont.gov/sites/dec/files/WID/CWIP/Vermont%20Clean%20Water%20Initiative%202022%20Performance%20Report.pdf

[xxxvii] Vermont Agency of Natural Resources, Department of Environmental Conservation, Watershed Management Division, Year 2022
[xxxviii] Vermont Department of Public Service
[xxxix] Chittenden Solid Waste District, 2021 Waste Diversion & Disposal Report. https://cswd.net/wp-content/uploads/CSWD-2021-Waste-Diversion-Disposal-Report_FINAL.pdf
[xl] Chittenden Solid Waste District, FY 2021 Annual Report. https://cswd.net/wp-content/uploads/CSWD-FY22-Annual-Report-FNL_v4.pdf
[xli] Source: UVM Medical Center
[xlii] Source: 2019 American Community Survey Table S0101, US Census Bureau 2010 Census Summary File 1, Esri forecasts for 2021 and 2026
[xliv] EPA's Phosphorus TMDLs for Vermont Segments of Lake Champlain, August 14, 2015, page 31, Table 9