







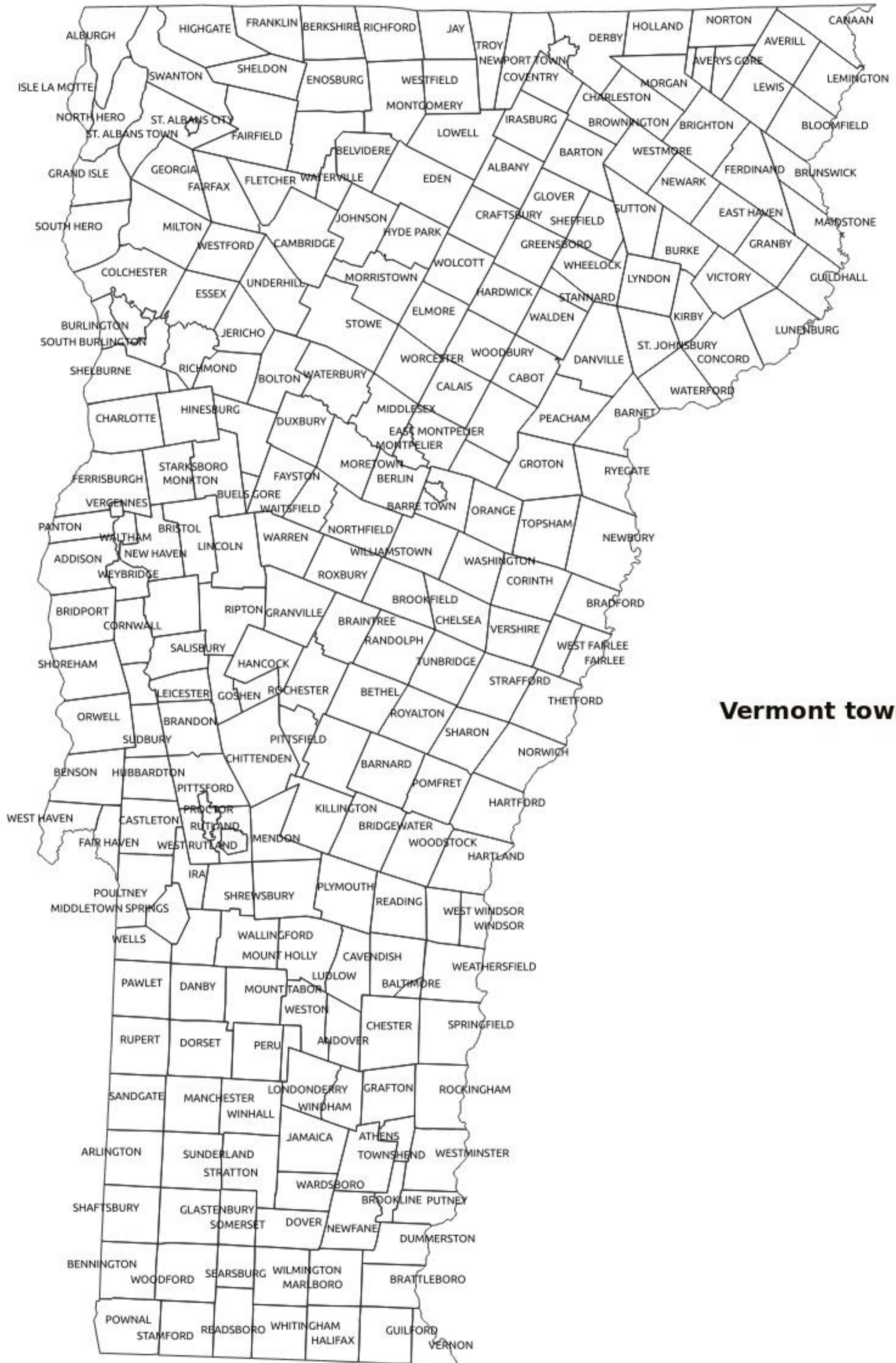
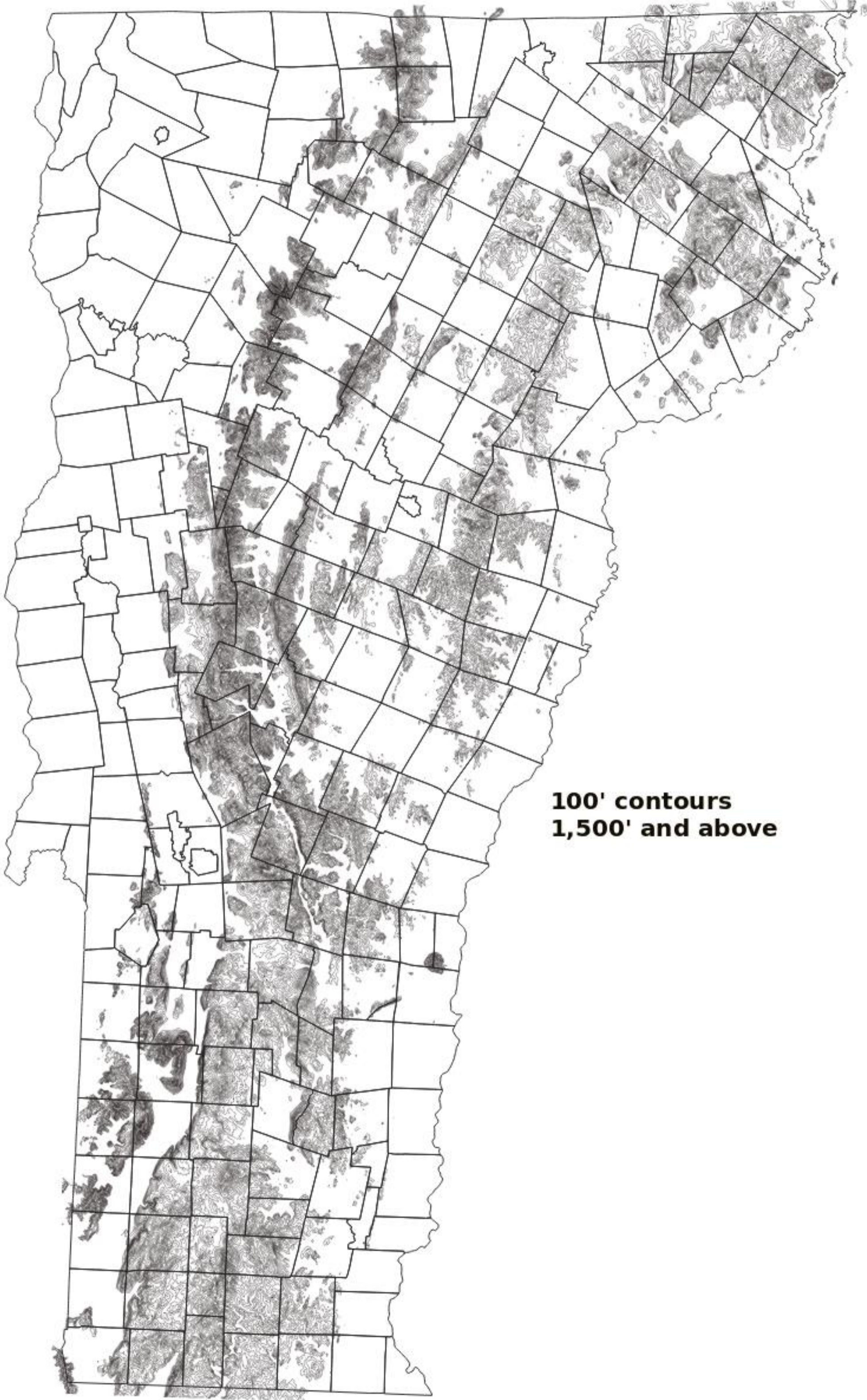


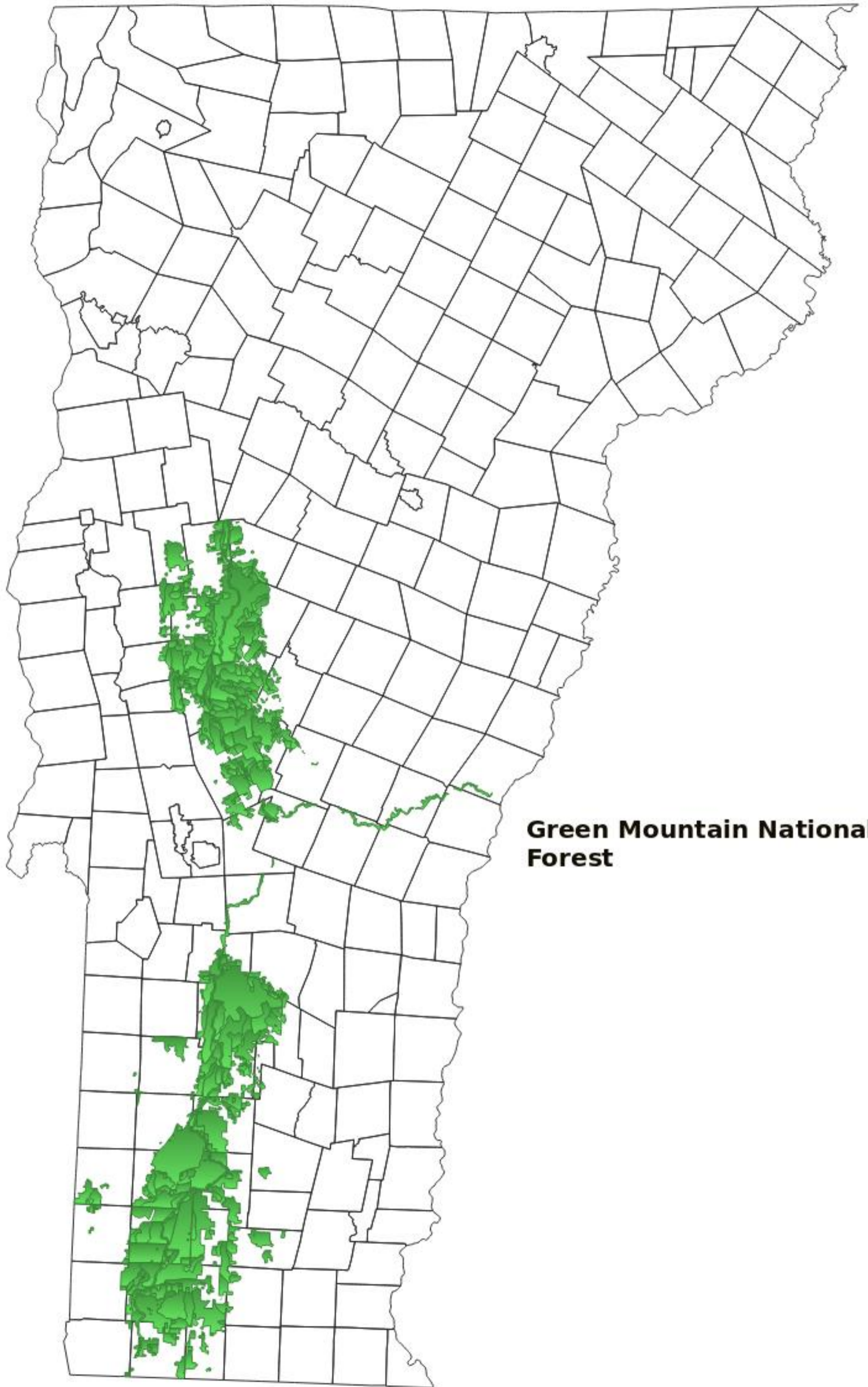
-  GMNF wildlife Mft area
-  County
- contours-100to2400
 -  100 - 560
 -  560 - 1020
 -  1020 - 1480
 -  1480 - 1940
 -  1940 - 2400
 -  2500' contour



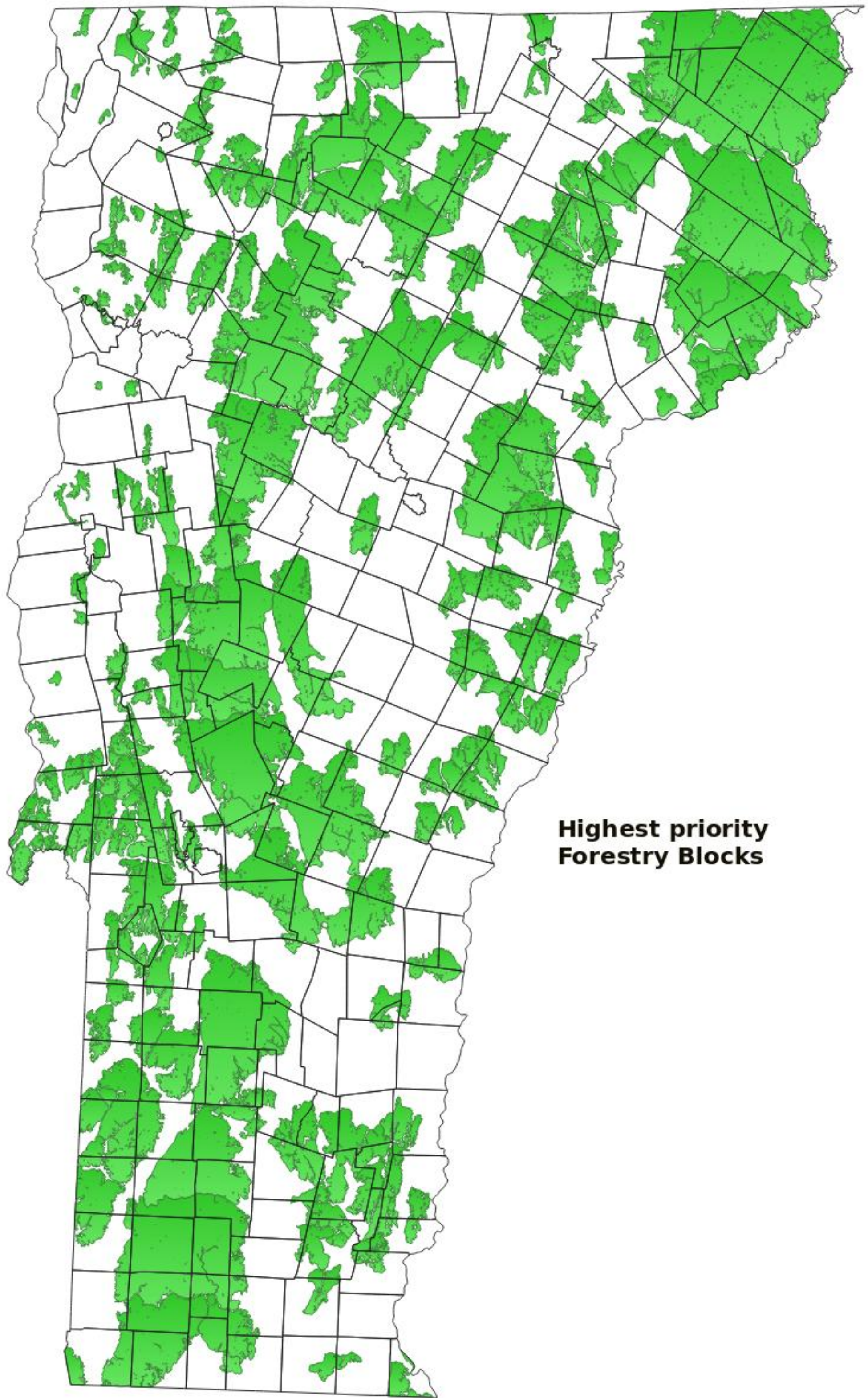
Vermont towns



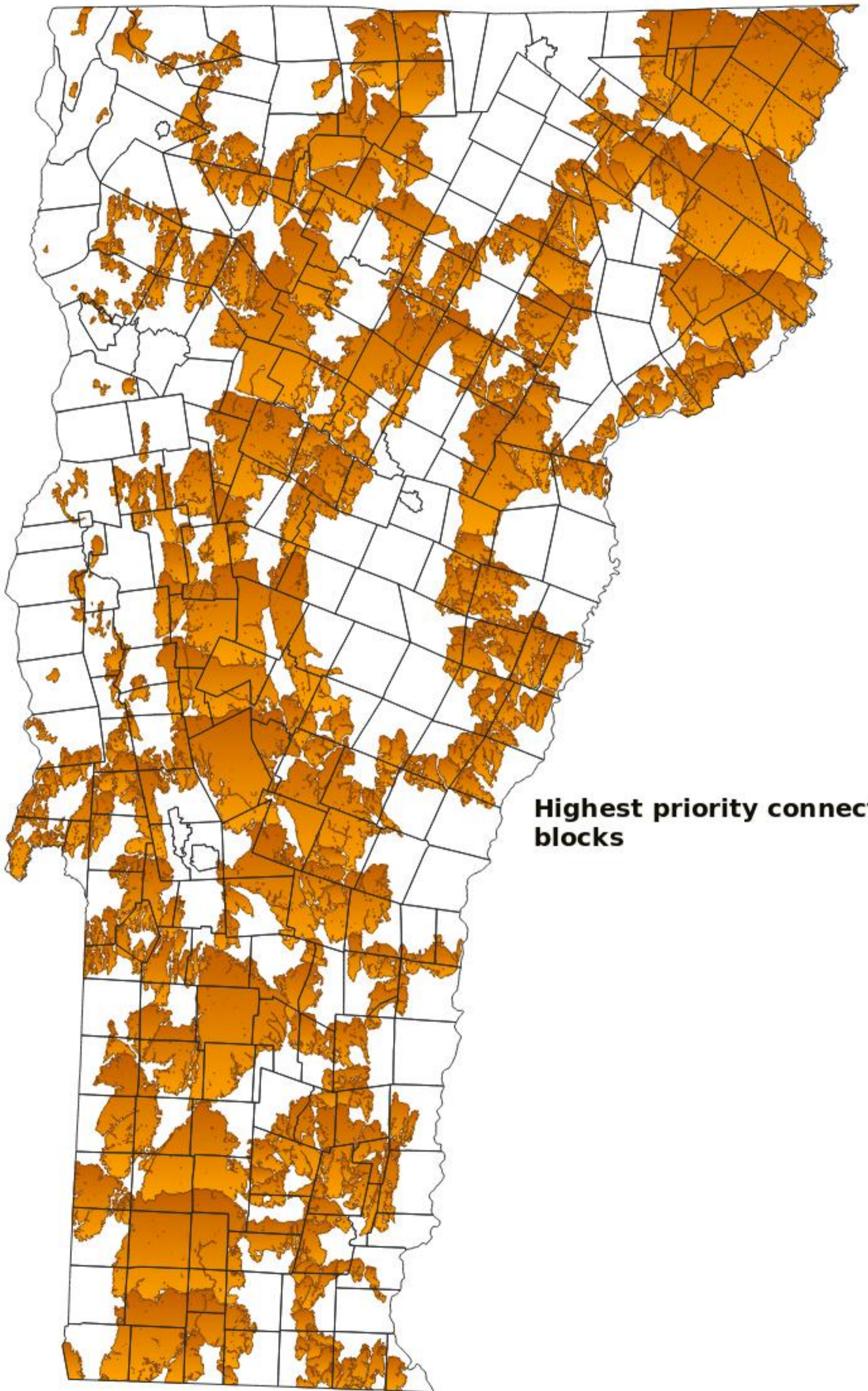
**100' contours
1,500' and above**



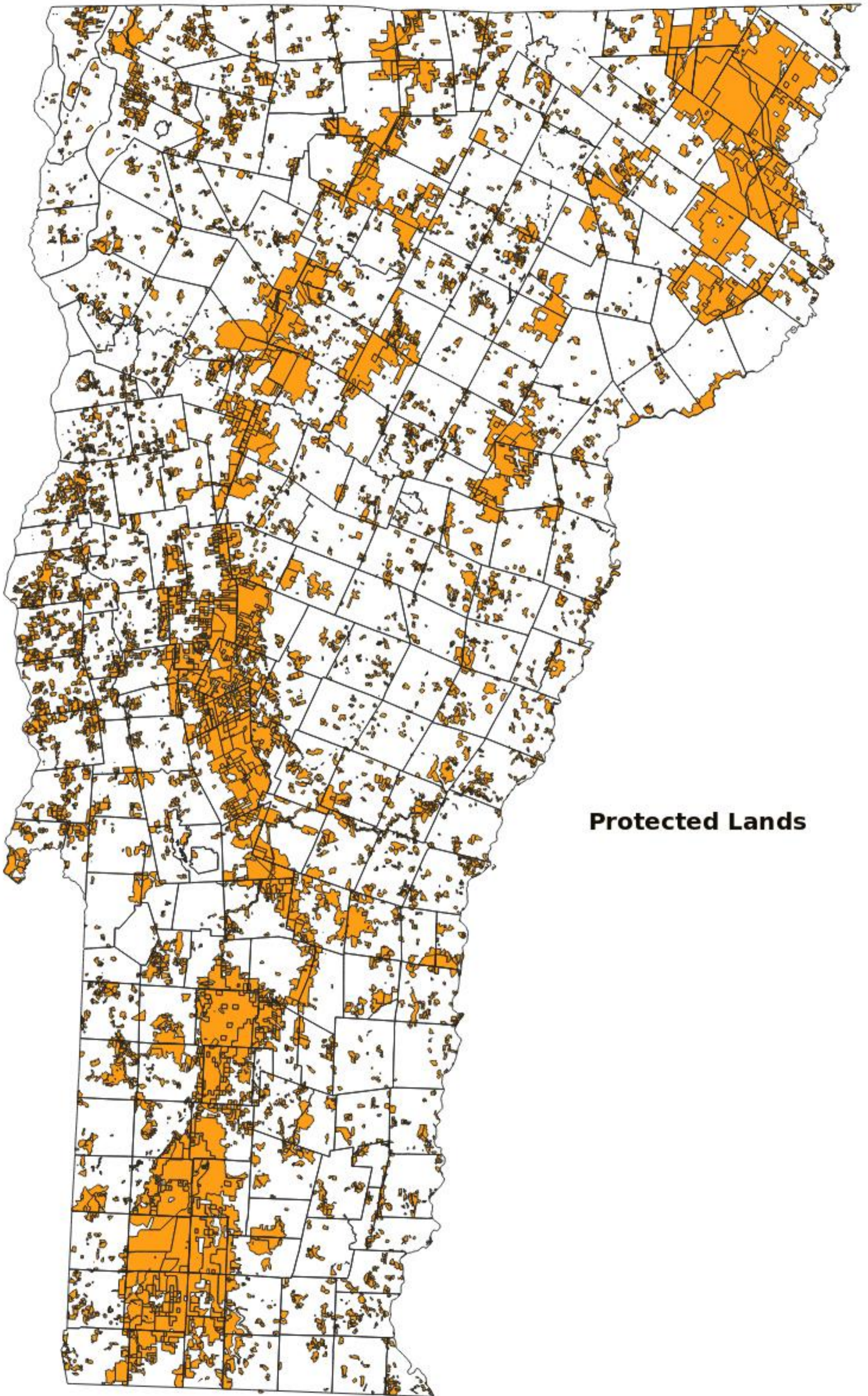
Green Mountain National Forest



**Highest priority
Forestry Blocks**



Highest priority connectivity blocks






Protected Lands

Protected Lands

The Vermont Protected Lands Database (VPLD) is a geospatial database, or GIS layer, of parcels that are currently protected from development through public ownership, private ownership, or protection mechanisms such as easements. The VPLD was designed to facilitate land-conservation planning and related efforts in Vermont. The second update to the Vermont Protected Lands Database (VPLD) "CadastralConserved_PROTECTEDLND" includes an additional 2,252 records over the previous 2017 release. A number of overlapping features have been reconciled while others remain to be resolved in future updates.

Highest Priority Forest Blocks

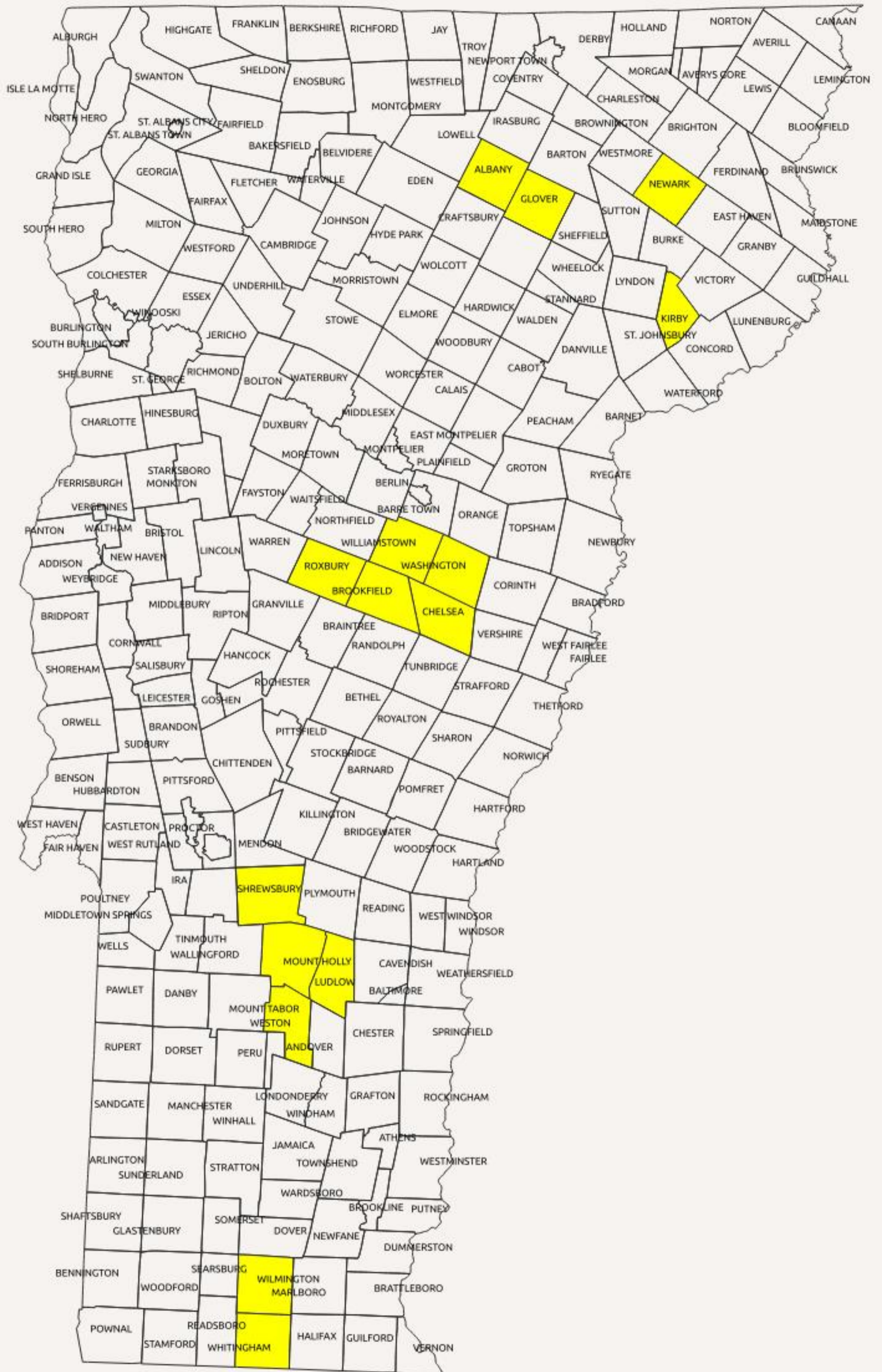
Act 174 requires plans to identify potential areas for the development and siting of renewable energy resources and areas that are unsuitable for siting those resources or particular categories or sizes of those resources. It furthermore requires that the standards address the potential generation from the potential siting areas. Lastly, it requires that  in order to receive an affirmative determination  regional plans allow for the siting in the region of all types of renewable generation technologies.  The Vermont Conservation Design Forest Block components identify areas of forest blocks that would be considered a possible constraint for renewable energy siting projects.

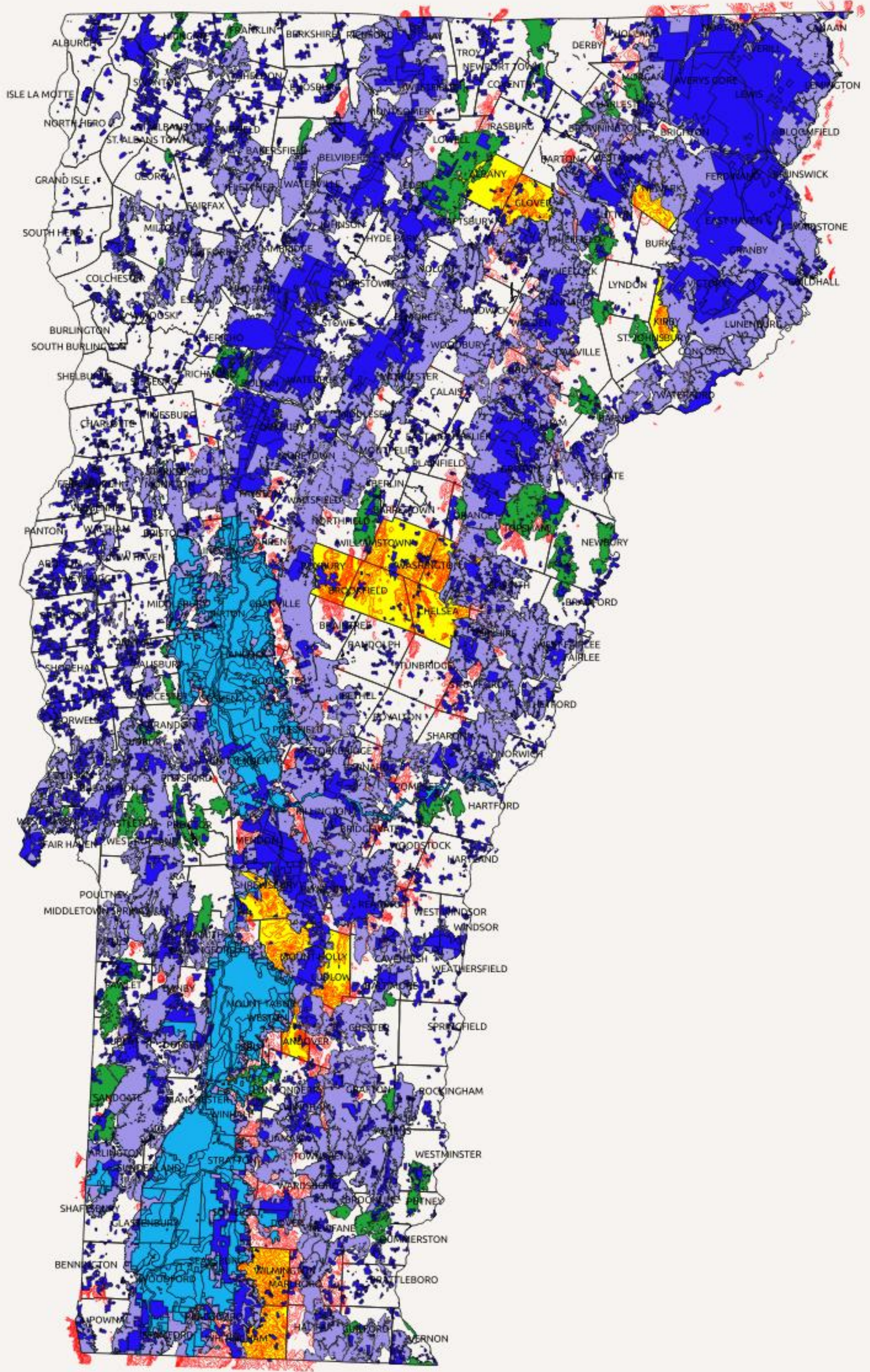
ElevationContours_CN100T

This metadata applies to contours derived from Quality Level 2 (QL2) Lidar 'collections' with a resolution (RESCLASS) of 0.7m. For an overview of the VCGI Lidar Program please see 'VCGI.VERMONT.GOV/LIDAR'. For original vendor metadata and reports containing specific details on each data collection, e.g., 'point cloud' flight dates, nominal pulse spacing, RMSEz and more, navigate to <http://tinyurl.com/VCGILidarReports>. NOTE: The QL2 (0.7m) collections FOCUS reports contain myriad collection details in report form. The equivalent for the older QL3 collections are generally the "Project Reports". NOTE - QL2 contours were produced from 5 source collections possessing slightly different datums. Their respective datums are as follows: 2017 Western VT - NAD 83 (2011); 2016 Mid-CT River VT - NAD 83 (2011); 2015 Windham VT - NAD 83 (NSRS 2007); 2014 'Eastern' VT - NAD 83 (2011); 2013 Rutland_VT_Lidar_Data - NAD 83. Refer to vendor based metadata for detailed coordinate reference information.

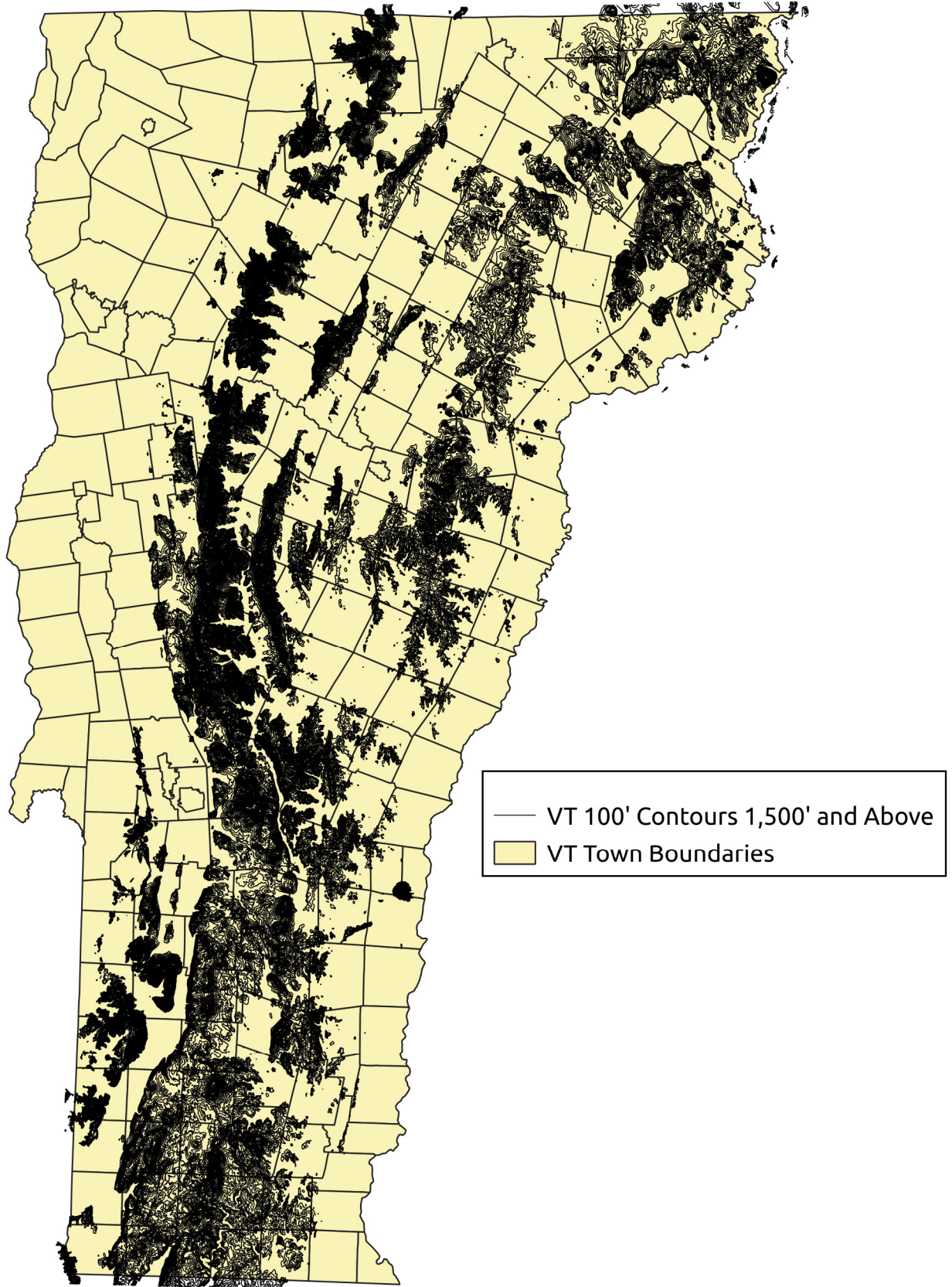
VT Green Mountain National Forest Mgmt Areas

The EnvironMangareas_MAREA2001 data layers includes management area boundaries administered by the Green Mountain National Forest and partner organizations. EnvironMangareas_MAREA2001 is an updated version of EnvironMangareas_MAREA2000 including all lands acquired as of 12/31/2000. Refer to ACQ_DATE field.

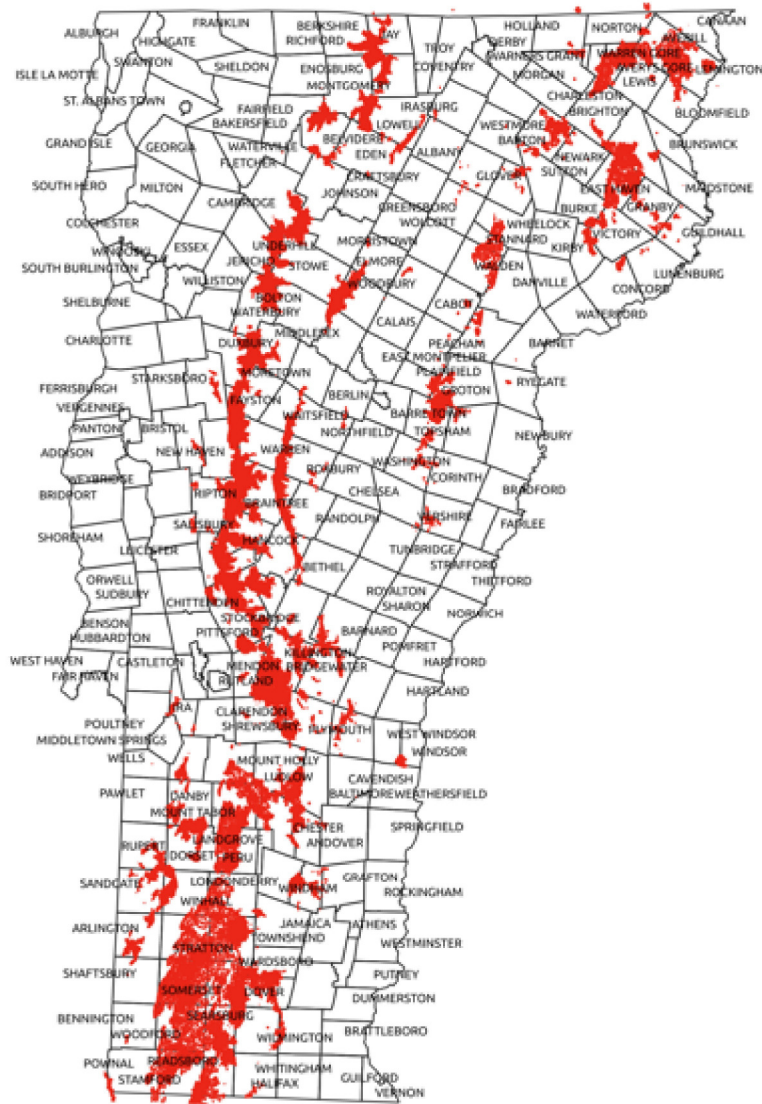




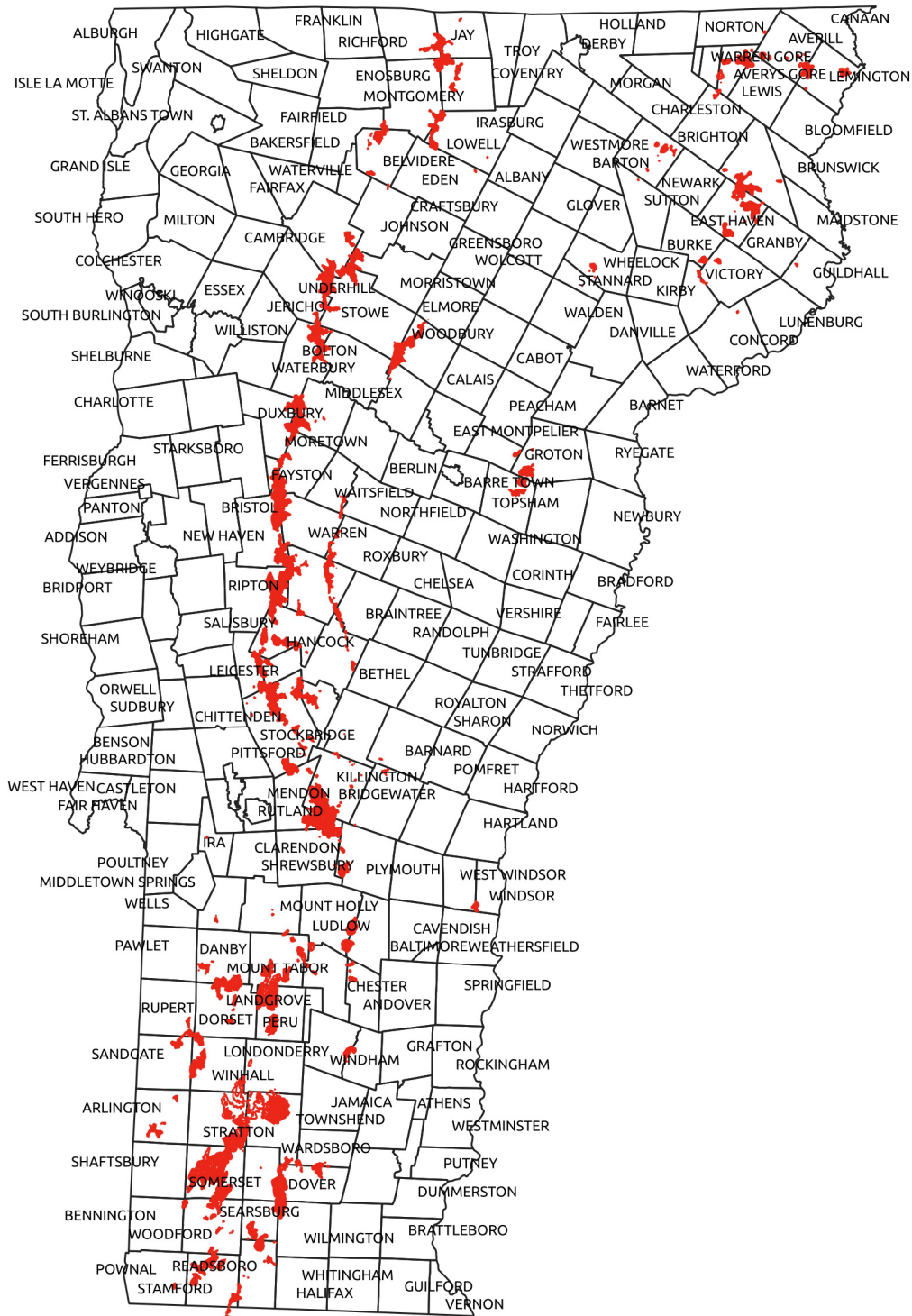
100 ft Contours 1,500 ft and above

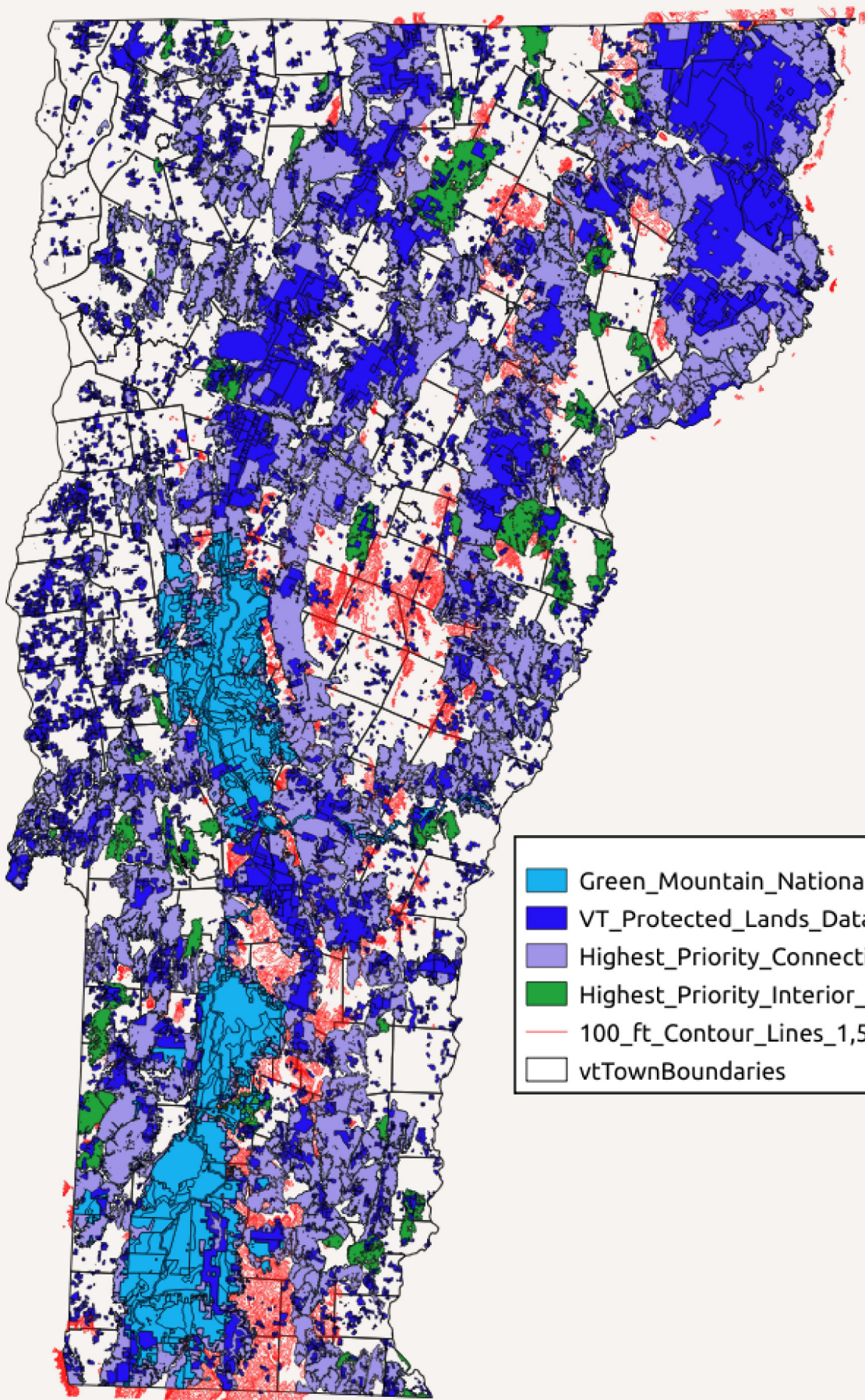


2,000 ft and above



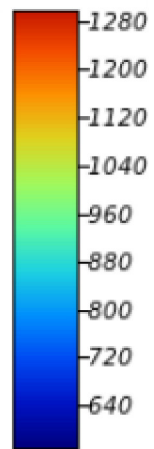
2,500 ft and above



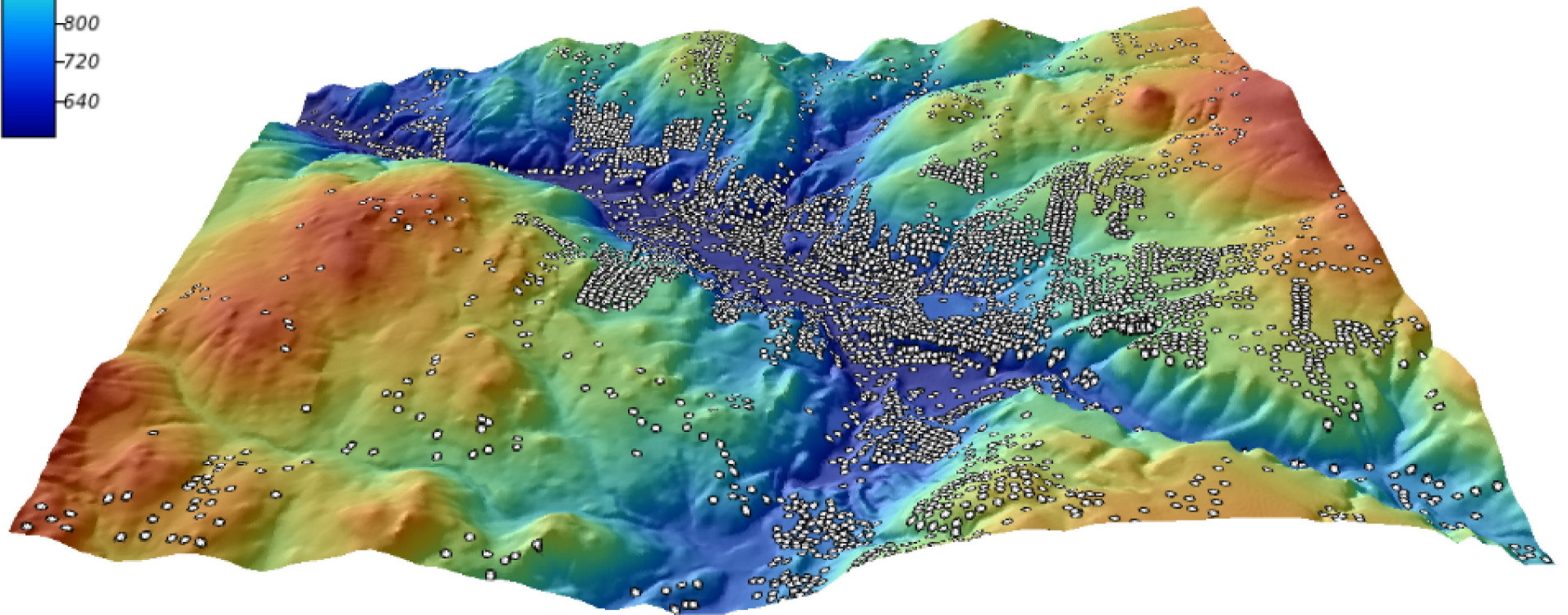


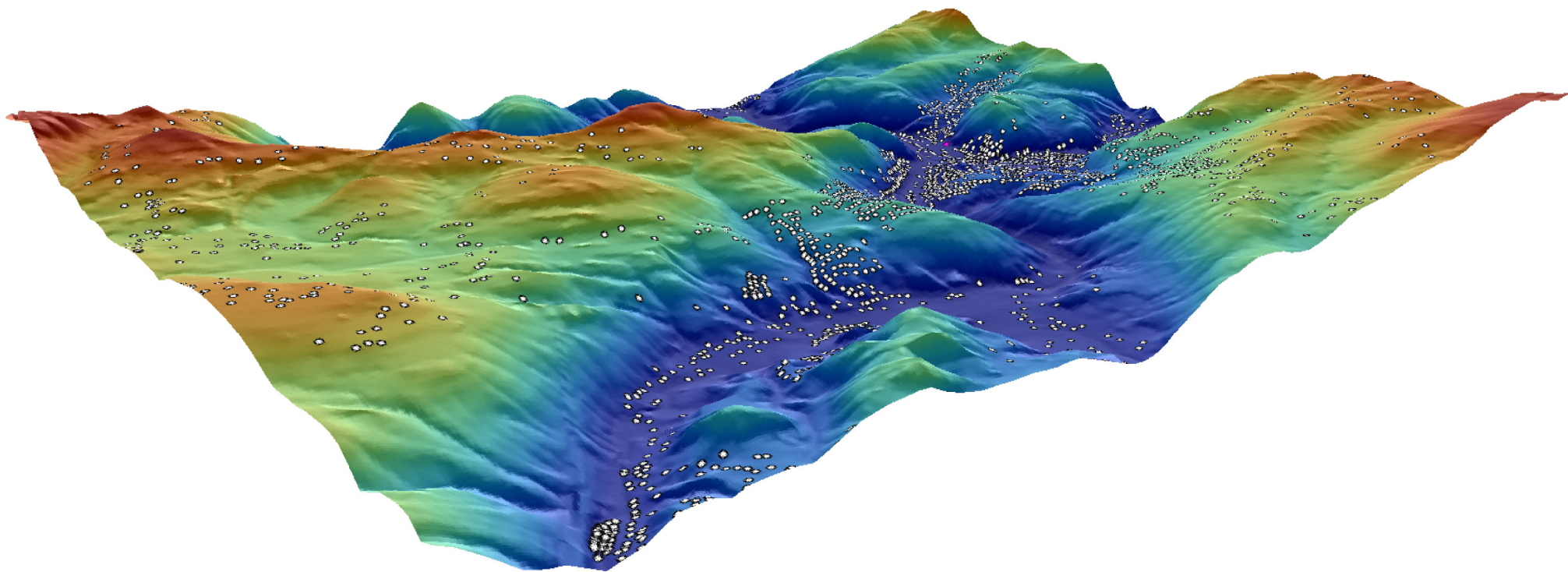
- Green Mountain National Forest
- VT Protected Lands Database
- Highest Priority Connectivity Blocks
- Highest Priority Interior Forest Blocks
- 100 ft Contour Lines 1,500' and above
- vtTownBoundaries

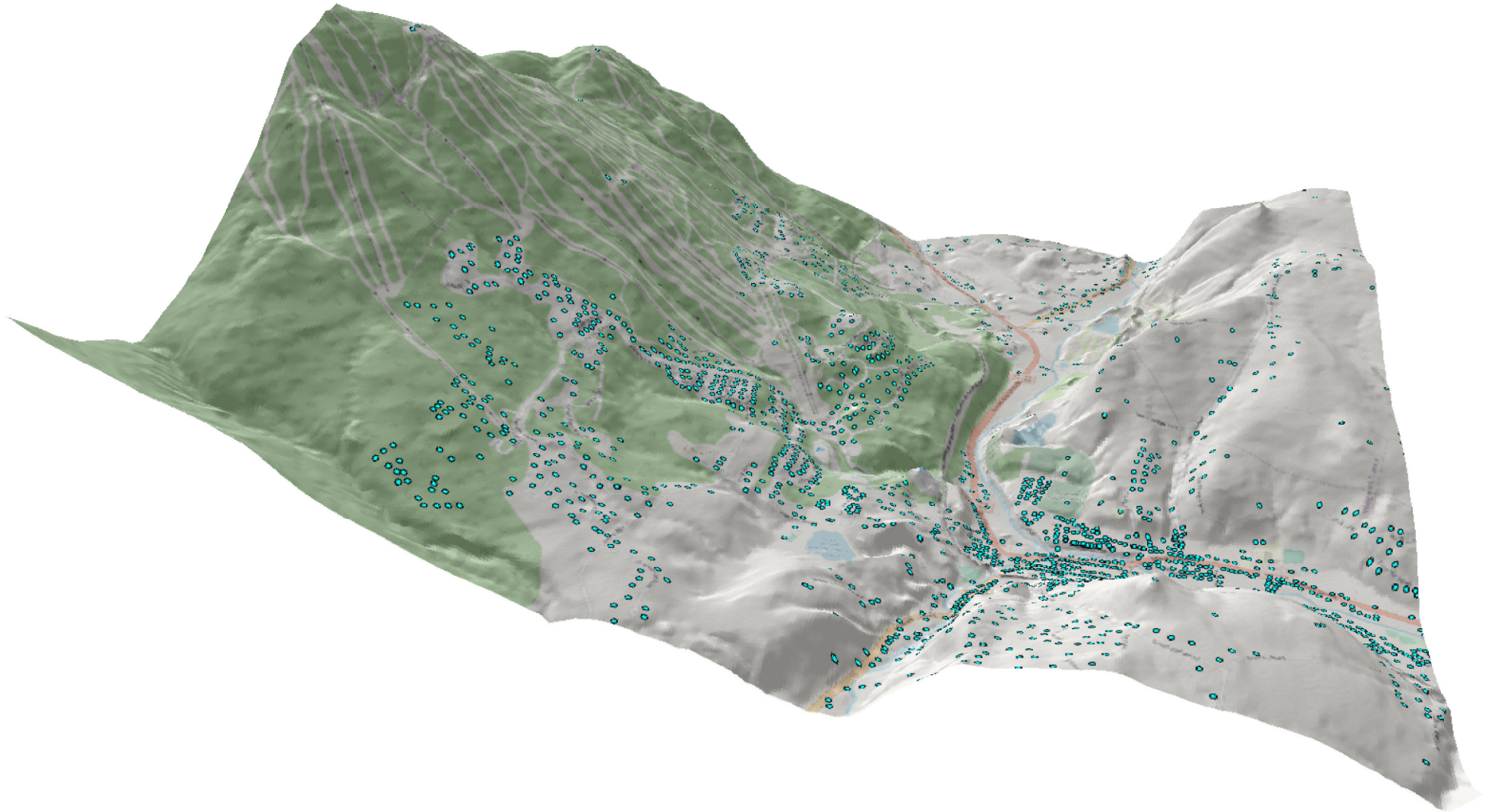
Barre3D

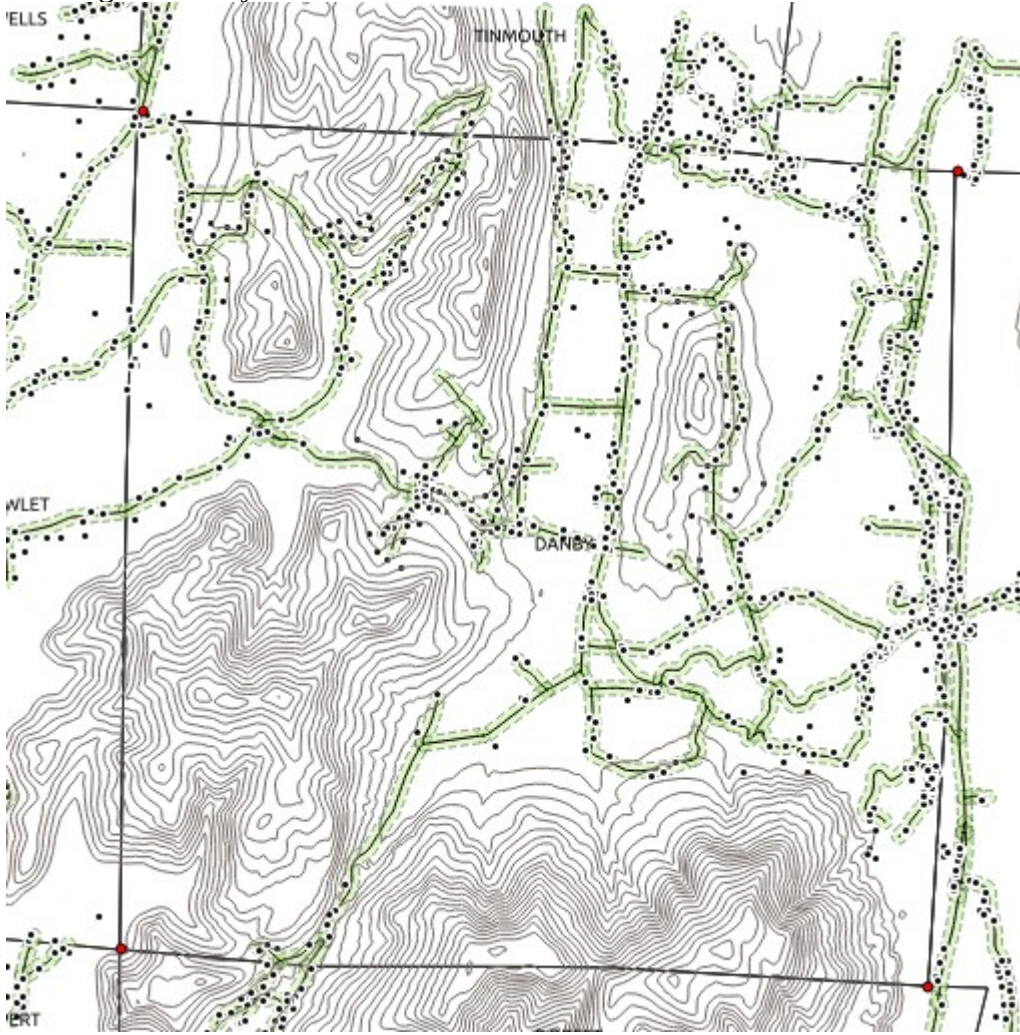


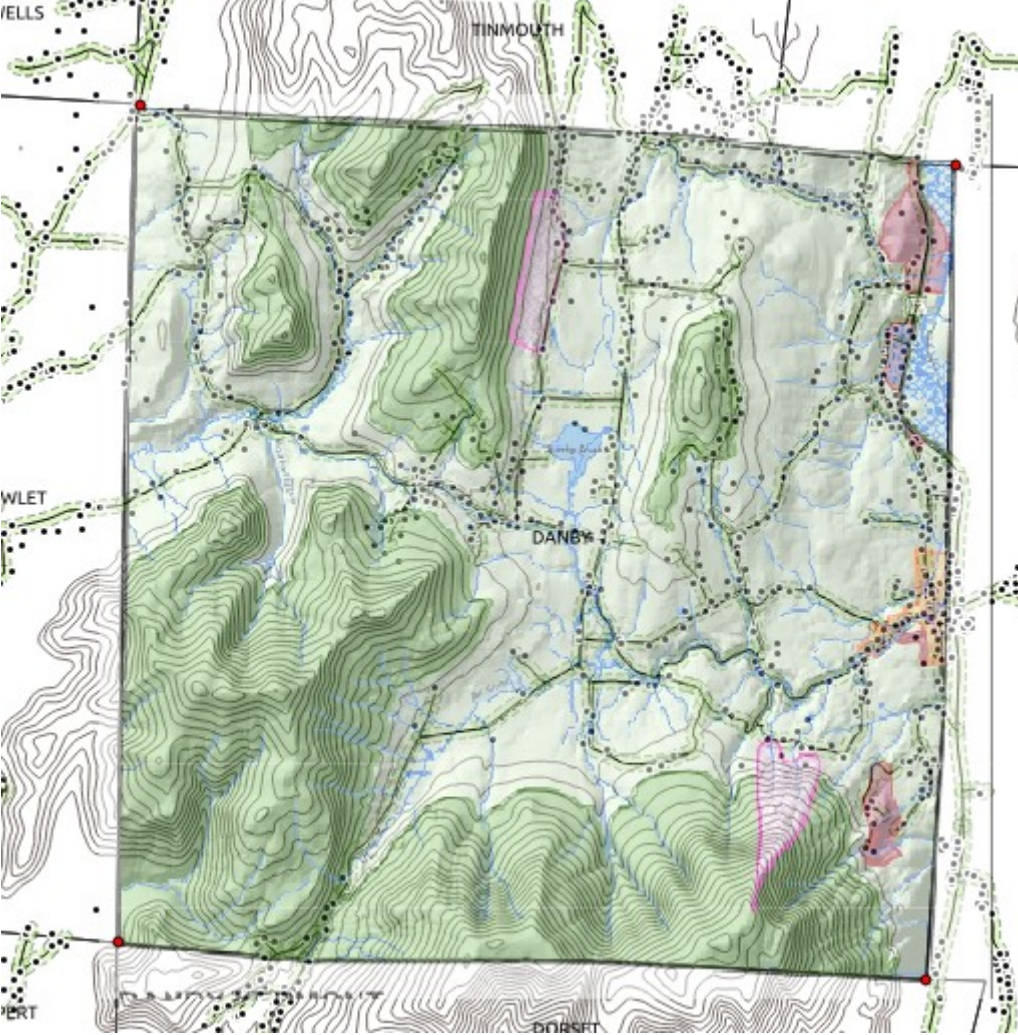
Barre, Vermont

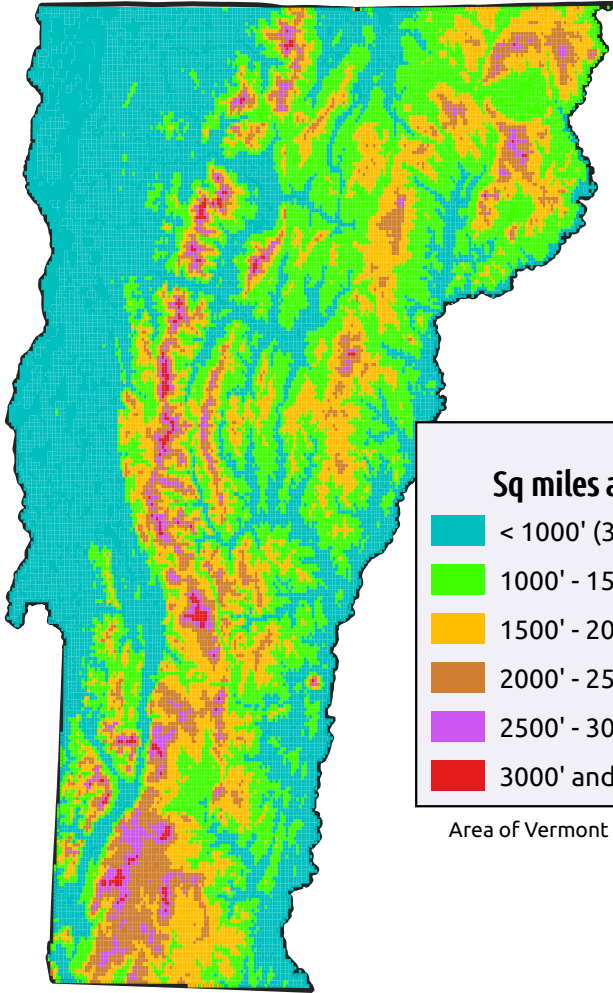


















Sq miles and % of total,	
	< 1000' (3684 mi ² , 38%)
	1000' - 1500' (3007 mi ² , 31%)
	1500' - 2000' (1828 mi ² , 19%)
	2000' - 2500' (786 mi ² , 8%)
	2500' - 3000' (243 mi ² , 2.5%)
	3000' and above (56 mi ² , 0.6%)

Area of Vermont = 9596 mi²

Vermonters for a Clean Environment

Annette Smith, Executive Director

Testimony to House Environment & Energy Committee

H.687, Feb. 20, 2024

VCE has limited experience with housing development cases in Act 250. Thomas Weiss's statistical evaluation of appeals of housing decisions shows that Act 250 is not an impediment to the development of housing.

VCE's experience with Act 250 has primarily been about quarries, including marble, aggregate, gravel, and slate quarries (exempt from Act 250), and the negative impacts on existing housing. Please do not exempt commercial and industrial uses from Act 250.

DISTRICT COMMISSIONS: Suggestion: The Governor shall publicize District Commission vacancies and seek applications from Vermonters with qualifications for District Commissioners.

Restore user friendly processes in the District offices that were dismantled over the last 7 to 10 years in order to actively assist small scale applicants per Act 250 Rule 51.

FOREST BLOCKS and CONNECTING HABITAT: Mitigating, Avoiding or Minimizing requirements, as defined in H.687, will enable the continued fragmentation of forest blocks and connecting habitat. Nowhere does the legislation provide the opportunity to deny a development. Change to: "will not have an undue adverse effect on forest blocks and/or connecting habitat," as is the standard for Ecosystem protection in (8).

RULEMAKING FOR FORESTS BLOCKS AND CONNECTING HABITAT: Delete. Not necessary. NRB has shown no capability for rule-making.

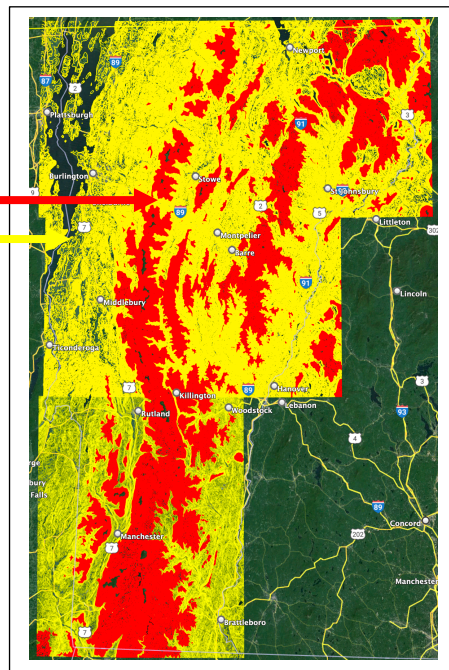
INTERIM FOREST BLOCK and CONNECTING HABITAT suggestion: Creation of two or more lots within 5 years on tracts of land over 1,500 feet in elevation will trigger Act 250 permitting. Allow this trial period to run with the downtown Act 250 exemptions granted last year and until the Resource Mapping is final.

RESOURCE MAPPING:

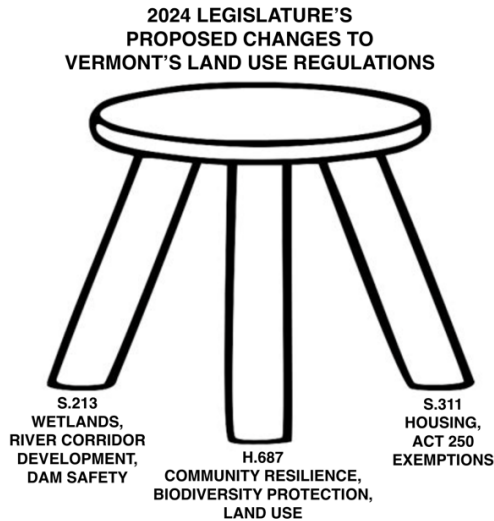
Prime Ag Soils maps are not accurate.

Red: Above 1500 feet

Yellow: Below 1500 feet



PLANNED GROWTH AREA DESIGNATIONS:



S.213 states that 70 - 80% of all flood-related damages occur within Vermont's river corridors, and that only 10 percent of Vermont municipalities have adopted full river corridor protections through the Department's model bylaws. It calls for DEC to amend the statewide river corridor base map to identify areas suitable for development that are located within existing settlements and that will not cause or contribute to increases in fluvial erosion hazards, by Jan. 1, 2026, with the issuance of a report Jan. 15, 2027.

H.687, p.51. Tier 1B allows a planned growth designation if it has a town plan, municipal zoning and subdivision by-laws, water and sewer capacity, adequate municipal staff, and an applicable regional plan, but does not require what is in Tier 1A which is, in addition to those elements, municipal flood hazard planning, flood hazard and river corridor bylaws, a capital budget and program, urban form bylaws for planned growth areas using smart growth principles, historic preservation bylaws and wildlife habitat planning.

H.687 allows for no permit or permit amendment for 50 units or fewer, located within a housing Tier 1B planned growth area designation.

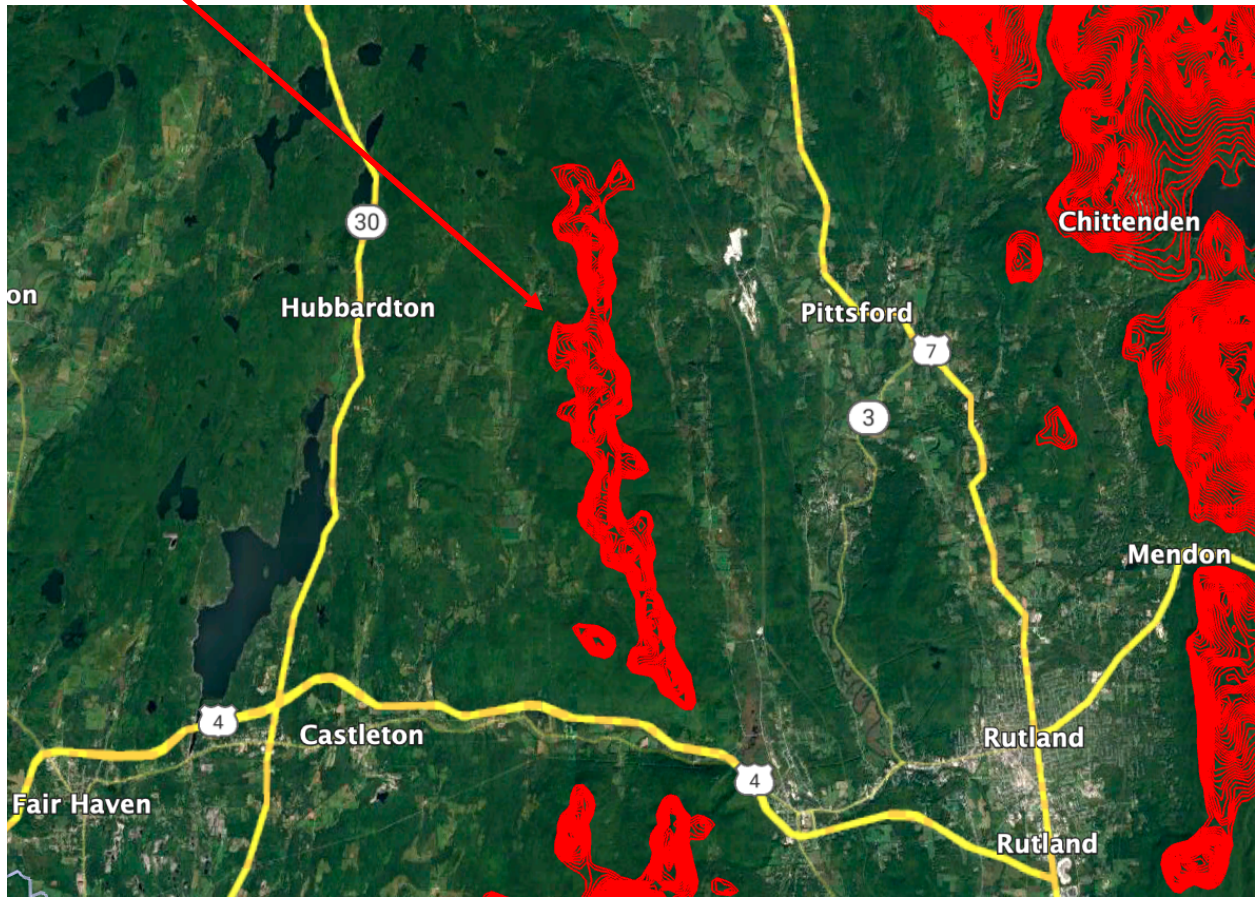
S.311 has the same exemption but for 75 units.

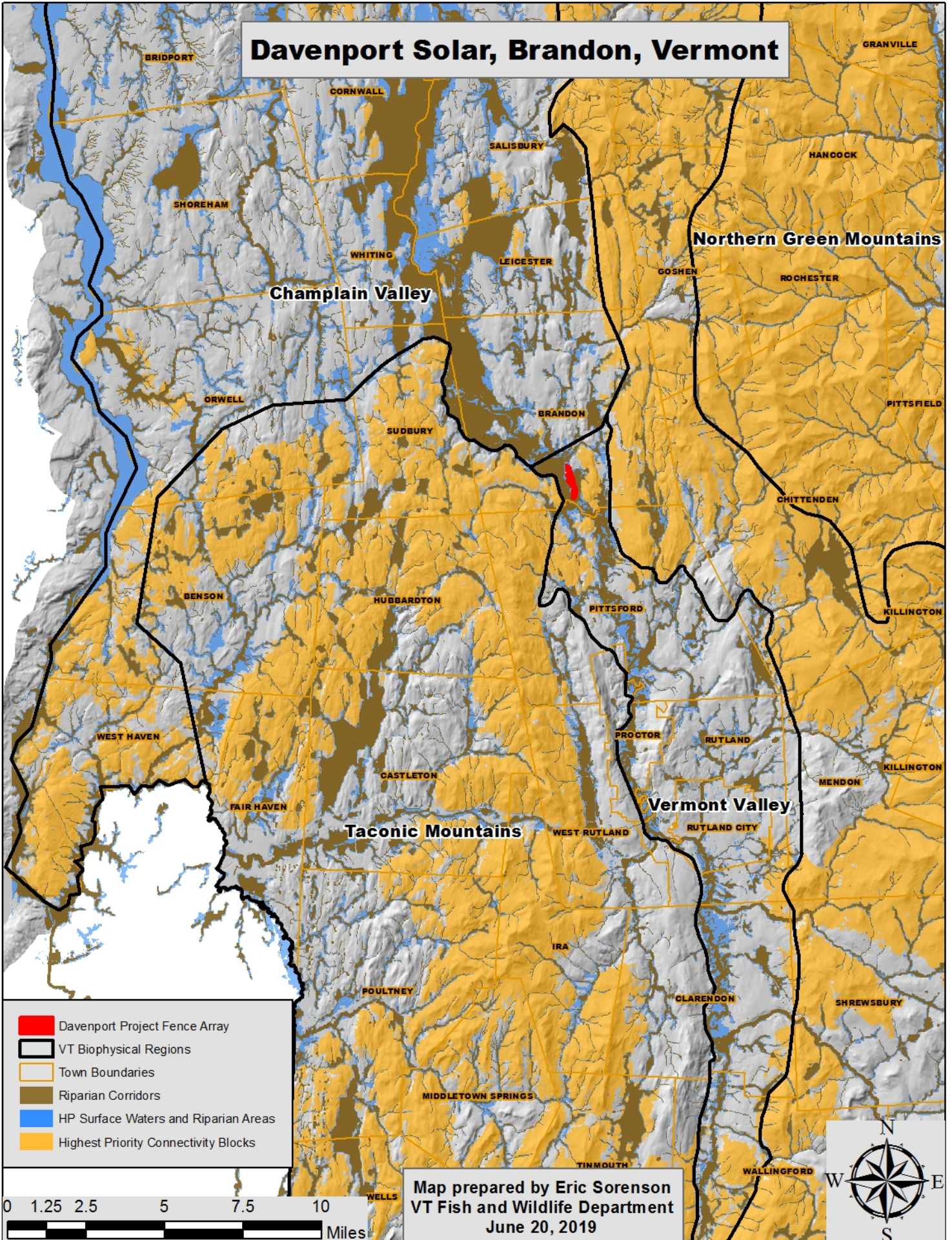
Why are planned growth designations with exemptions from Act 250 permitting being considered for municipalities that do not have flood hazard and river corridor bylaws?

ENFORCEMENT: Transferring environmental permitting from Act 250 to municipalities also transfers enforcement. The NRB's report on Act 250 (p. 17) anticipates significant loss of fee revenue. The report does not make any reference to enforcement. Shifting permitting to municipalities for Tiers 1A and 1B shifts costs associated with enforcement.

H.687 exemptions from Act 250 for Tiers 1A and 1B must contain requirements for municipalities to have enforcement capability.

Pittsford Ridge protections would be addressed by a 1500 foot elevation jurisdictional trigger





STATE OF VERMONT
PUBLIC UTILITY COMMISSION

Petition of Davenport Solar, LLC for a certificate)
of public good, pursuant to 30 V.S.A. § 248,)
authorizing the installation and operation of a 15) Case No. 18-3709-PET
MW solar electric generation facility in Brandon,)
Vermont)

PREFILED TESTIMONY OF ERIC SORENSON

On Behalf of the Vermont Agency of Natural Resources, Fish and Wildlife Department

Summary of Testimony

Mr. Sorenson is a natural community ecologist with the Fish and Wildlife Department of the Vermont Agency of Natural Resources. The purpose of his testimony is to discuss the significance of the Project site and surrounding area, the natural resource values associated with this area, and the modifications which have been made to the Project in order to reduce its impacts on the natural environment, in particular on ecological landscape connectivity.

1 **Introduction of Witness, Qualifications, and Purpose of Testimony**

2
3 **Q1. Please state your name, place of employment, and your occupation.**

4 A1. My name is Eric Sorenson. I am a natural community ecologist with the Vermont
5 Fish and Wildlife Department (VFWD) of the Vermont Agency of Natural Resources
6 (VANR) and work from the Barre district office.

7
8 **Q2. How long have you held your current position?**

9 A2. I have been in this position since 1996.

10
11 **Q3. What are your responsibilities in your current position?**

12 A3. In my position as ecologist with the VFWD, I am responsible for the
13 identification and classification of Vermont's upland and wetland natural communities. I
14 am the co-author of a book on Vermont's natural communities.¹ The majority of my
15 work is to inventory, map, and evaluate significant natural communities across Vermont
16 and to work with landowners on appropriate management and conservation. Both
17 working with the VFWD and in my previous position with the Vermont Department of
18 Environmental Conservation (VDEC), I have been responsible for evaluating the
19 significance of wetland and upland natural communities associated with the regulatory

¹ Thompson, E.H., Sorenson, E.R., and Zaino, R.J. *Wetland, Woodland, Wildland: A Guide to the Natural Communities of Vermont* (2nd ed.). 2019. Published by Vermont Fish and Wildlife Department, The Nature Conservancy, and Vermont Land Trust. Distributed by Chelsea Green Publishing.

1 process, including the Vermont Wetland Rules, wetland reclassification, Act 250, Section
2 248, and 401 Water Quality Certification. I have developed the VANR's position and
3 testified before District Environmental Commissions, the Environmental Board, the
4 Natural Resources Board (former Water Resources Board) in civil court settings, and I
5 have provided testimony to the Public Utility Commission (formerly Public Service
6 Board). Typically, the goal of my work in the regulatory arena is to identify significant
7 natural communities, important forest blocks, and ecological landscape connectivity, and
8 to work with applicants to avoid and/or minimize adverse effects on these natural areas.
9

10 **Q4. Please describe your educational background and relevant work experience.**

11 A4. I have a B.S. degree from the University of Michigan in Natural Resources and
12 Wildlife Ecology. I have an M.S. degree from the University of Maine in Botany and
13 Plant Ecology. Prior to my current position I worked from 1989 until 1996 as a wetland
14 ecologist with VDEC implementing the Vermont Wetland Rules. I also worked as a
15 wetland consultant in Massachusetts for two years and as an ecologist in Maine for one
16 year. I have included a copy of my resume with my testimony (**Exhibit ANR-ES-1**).
17

18 **Q5. Have you previously provided testimony to the Public Utility Commission?**

19 A5. Yes, I provided written testimony on behalf of VFWD regarding Docket 7373, the
20 VELCO Southern Loop project. I also provided written and oral testimony regarding
21 Docket 7508 Georgia Mountain Community Wind, LLC; Docket 7628 Kingdom
22 Community Wind in Lowell; Docket 7970 Addison County Natural Gas in Chittenden

1 and Addison Counties; and Docket 8601 Verizon RSA Limited Partnership and Cellco
2 Partnership.

3
4 **Q6. What is the purpose of your testimony in this proceeding?**

5 A6. The purpose of my testimony is to identify and discuss natural resource features
6 associated with the site of the proposed Davenport Solar project, located on Carver Street
7 in Brandon (“Project”). Specifically, I will discuss the importance of these features at the
8 Project site and their functions related to the site itself and the broader topic of **ecological**
9 **landscape connectivity**. The Project site is part of a regionally significant landscape and
10 wildlife connection between the Adirondack Mountains and the Green Mountains. I will
11 address the potential fragmenting effects of the Project as originally proposed as they
12 relate to structural and functional landscape connectivity. I will then discuss the
13 modifications made to the Project and the terms and conditions of the April 1, 2020
14 memorandum of agreement (“MOU”) between Davenport Solar and the Agency. Finally,
15 I will explain why those modifications are necessary in order to reduce the Project’s
16 fragmenting affects and impacts on ecological landscape connectivity to a level which is
17 acceptable and which meets the standard of no undue adverse effect on the natural
18 environment contained in 30 V.S.A. § 248(b)(5).

19
20 **Materials Reviewed**

21

1 **Q7. What materials have you reviewed that have been submitted to the Commission as**
2 **part of this proceeding?**

3 A7. I have reviewed the following:

- 4 i. Petition for a Certificate of Public Good dated October 26, 2018.
- 5 ii. The prefiled testimony of Ian Jewkes, dated October 26, 2018.
- 6 iii. The site plans prepared by Krebs and Lansing Consulting Engineers titled “Davenport
7 Solar, LLC; Proposed Solar Array”, dated 10/9/18, Sheets C-100 through C-109. (Exhibit
8 Petitioner IAJ-2)
- 9 iv. The site plan prepared by Krebs and Lansing Consulting Engineers titled “Davenport
10 Solar, LLC; Proposed Solar Array”, dated 10/9/18, Sheets C-100, revised 1-28-19
11 (update tree clearing)
- 12 v. The prefiled testimony of Daniel Herzlinger, dated October 26, 2018.
- 13 vi. The Natural Resources Assessment Report: Davenport Solar, LLC, prepared by TRC,
14 dated October 2018. (Exhibit Petitioner DJH-2)
- 15 vii. The Response of Petitioner to Agency of Natural Resources’ Information Requests on
16 Petitioner, dated February 8, February 14, and March 22, 2019.
- 17 viii. The amended and restated prefiled testimony of Ian Jewkes, dated April 10, 2020.
- 18 ix. The revised site plans prepared by Krebs and Lansing Consulting Engineers titled
19 “Davenport Solar, LLC, Carver Street, Brandon, Vermont”, dated 10/9/18, latest revision
20 3/18/2020, 14 Sheets, C-100 is the Site Plan, C-100A is the Detail of Southern Cobble.
21 (Exhibit Petitioner IAJ-2 Revised)
- 22 x. The amended and restated prefiled testimony of Daniel Herzlinger, dated April 10, 2020.

- 1 xi. The Natural Resources Assessment Report: Davenport Solar, LLC, prepared by TRC,
2 dated October 2018, revised April 2020. (Exhibit Petitioner DJH-2 Revised)
- 3 xii. The supplemental prefiled testimony of Jeremy Owens, dated April 10, 2020.
- 4 xiii. The Active Restoration Plan prepared by T.J. Boyle Associates, LLC, dated 3/11/2020.
5 (Exhibit Petitioner JBO-6)
- 6

7 **Q8. Have you conducted site visits to evaluate the Project site and surrounding areas?**

8 A8. I have visited the Project site on two dates: June 15, 2017 and May 15, 2019. My
9 site visits were concentrated on observations of natural community type, vegetation
10 composition, forest condition, fields, wetlands, and wildlife signs on the Project site. I
11 also walked and made observations of similar features along approximately 1.8 miles of
12 Carver Street and in the Otter Creek riparian area adjacent to and near the Project site.
13 From the open fields on the Project site, I also observed the greater landscape setting,
14 including the Southern Green Mountains to the east and the Taconic Mountains to the
15 west.

16

17 **Q9. Are there other tools that you have used to evaluate the Project site and its
18 significance for ecological landscape connectivity?**

19 A9. Yes, I have used and viewed data layers in ArcMAP (ESRI Geographic
20 Information Systems software) that are generally available from the Vermont Center for
21 Geographic Information (<http://vcgi.vermont.gov/>) or the VANR. These include: existing
22 records of state-significant natural communities and rare species (VFWD, Natural

1 Heritage Database); soils maps by the Natural Resources Conservation Service; wetland
2 maps; connectivity blocks, interior forest blocks, riparian areas, and wildlife road
3 crossings as mapped by the VFWD; and aerial photographs from various dates that show
4 land cover and land use. I have also used other available landscape analyses that I will
5 describe in more detail later in my testimony. These tools help to provide a broader
6 understanding of the landscape connectivity functions of the Project site and the Project's
7 potential effects on these functions and on the natural environment.

8
9 **Background and Terminology**

10
11 **Q10. Your introduction contains several words and phrases, for example “natural**
12 **communities,” “connectivity blocks,” “interior forest blocks,” “riparian areas,” and**
13 **“ecological landscape connectivity,” which may not be commonly understood.**
14 **Would you please elaborate on the meaning of these in the context of the work you**
15 **do and your testimony in this case?**

16 A10. Yes. As previously mentioned, much of my work as an ecologist is focused on the
17 appropriate management and conservation of Vermont's natural communities and the
18 ecological and physical landscape. It is important to understand both large landscape
19 scale features and more local scale features, such as natural communities and habitat, in
20 order to make informed land management and conservation decisions. There are many
21 important components at the landscape and natural community scales. In order to help
22 identify these components and understand their ecological functions in the landscape,

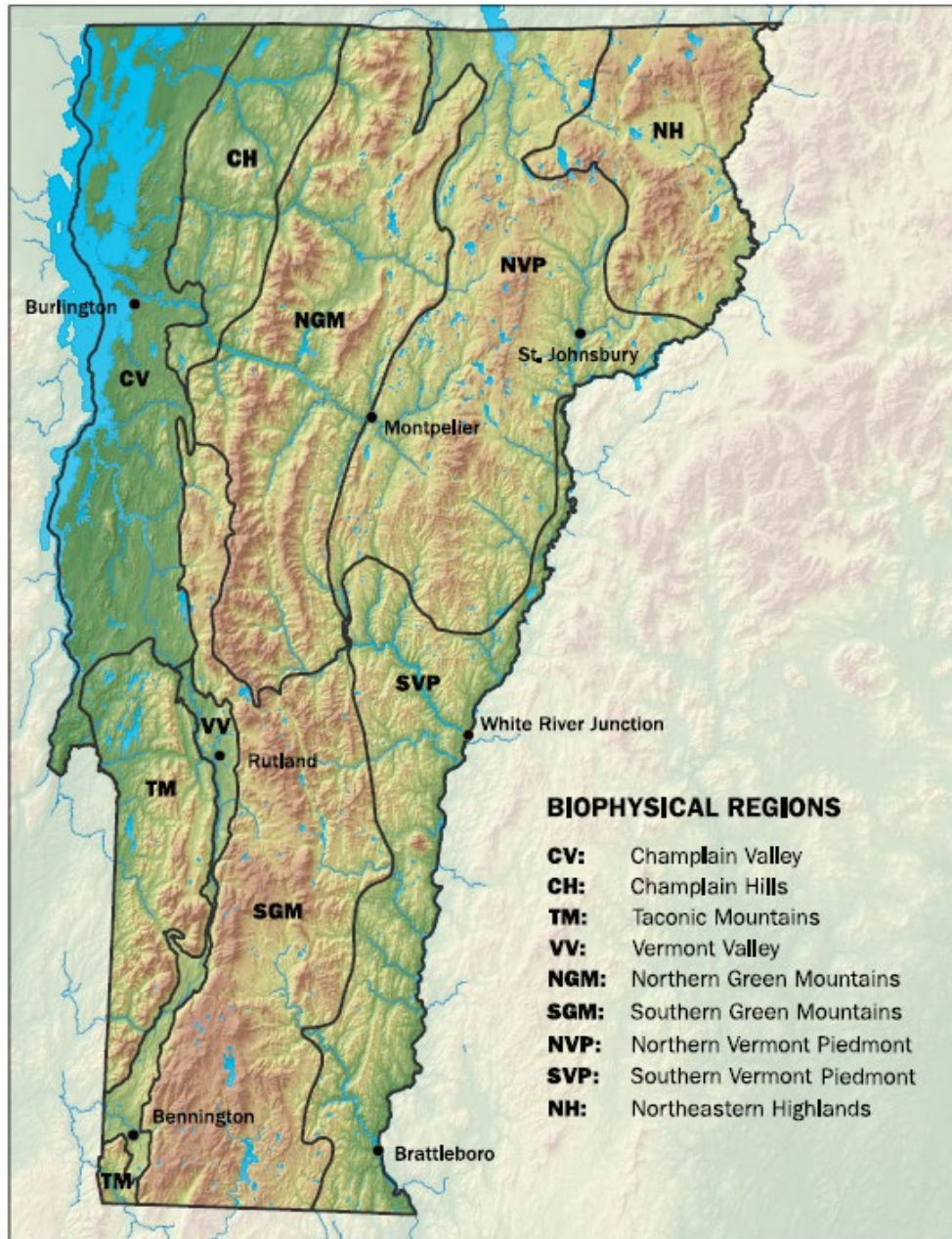
1 both individually and collectively, ecologists and other scientists working in related fields
2 use terms which have certain meaning in this type of work. A good place to start is with
3 the term **natural community**. A natural community is an interacting assemblage of
4 plants and animals, their physical environment, and the natural processes that affect them.

5 These interacting assemblages of plants and animals repeat across the landscape
6 wherever similar environmental conditions (such as bedrock, soils, slope, aspect, and
7 hydrology) exist. As a result, it is possible to describe these repeating assemblages as
8 distinct natural community types. In Vermont, we currently recognize 97 upland and
9 wetland natural community types. 47 of these are upland natural communities and 50 are
10 wetland natural communities. Natural communities provide ecologists and conservation
11 planners with a powerful tool for understanding and describing the landscape, developing
12 sound land management plans, identifying conservation priorities, and increasing our
13 understanding of the natural world.

14 Each natural community type is assigned a State Rank that describes the rarity of
15 that community type in Vermont. State Ranks range from S1 (extremely rare) to S5
16 (common and widespread) and are assigned based on the number of known occurrences
17 of the type, the total area occupied by the type, and the degree of threat to the type. The
18 VFWD conducts statewide inventories and maintains a database of natural communities
19 that are considered state significant. State-significant natural communities are those that
20 meet VFWD standards based on assessment of the size, current condition, and landscape
21 context in which the community occurs relative to other examples of that natural
22 community type in Vermont.

1 Vermont is separated into nine biophysical regions. A **biophysical region** is an
2 area of the state that has similar climate, geology, topography, soils, natural communities,
3 and human land use history, compared to other regions. Vermont's nine biophysical
4 regions are shown on the following map.² The Project site is located at the very northern
5 end of the Vermont Valley, at a narrow section of the Vermont Valley, with the Southern
6 and Northern Green Mountains biophysical regions to the east and the Taconic
7 Mountains biophysical region to the west.

² Thompson, E.H., Sorenson, E.R., and Zaino, R.J. *Wetland, Woodland, Wildland: A Guide to the Natural Communities of Vermont* (2nd ed.). 2019. Published by Vermont Fish and Wildlife Department, The Nature Conservancy, and Vermont Land Trust. Distributed by Chelsea Green Publishing.



1
2
3
4
5

A **forest block** (also called habitat block) is an area of contiguous forest and other natural habitats that are unfragmented by roads, development, or agriculture. Vermont’s forest blocks are primarily forests, but also include wetlands, rivers and streams, lakes

1 and ponds, cliffs, and rock outcrops. Forests included in blocks may be young, early-
2 successional stands, actively managed forests, or mature forests with little or no recent
3 logging activity. The defining factor is that there is little or no permanent habitat
4 fragmentation from roads, agricultural lands, and other forms of development within a
5 forest block. Vermont's forest blocks were identified and ranked for ecological values in
6 a study by VFWD and partners.³

7 A **connectivity block** is a forest block that has been identified in the Vermont
8 Conservation Design because it provides a significant contribution in maintaining
9 ecological landscape connectivity in Vermont. Collectively, connectivity blocks are the
10 network of forest blocks that together provide terrestrial connectivity at the regional scale
11 (across Vermont and to adjacent states and Québec) and connectivity between all Vermont
12 biophysical regions. The proximity of one forest block to another, the presence of riparian
13 areas, and the characteristics of the intervening roads, agricultural lands, or development
14 determine the effectiveness of the network of connectivity blocks in a particular area.⁴

15 **Interior forest blocks** are a set of forest blocks that have been identified in the
16 Vermont Conservation Design as the best for providing and maintaining interior forest
17 habitat. These are the largest and/or highest ranked forest blocks from all biophysical

³ Sorenson, E. and J. Osborne. 2014. Vermont Habitat Blocks and Habitat Connectivity: An Analysis using Geographic Information Systems. Vermont Fish and Wildlife Department, Montpelier, Vermont. 48 pp.

⁴ Sorenson, E., R. Zaino, J. Hilke, and E. Thompson. 2015. Vermont Conservation Design: Maintaining and Enhancing an Ecologically Functional Landscape. Part 1: Landscape Features Technical Report. Vermont Fish and Wildlife Department and Vermont Land Trust. Montpelier, Vermont. 24 pp.

1 regions that provide the foundation for interior forest habitat and associated ecological
2 functions.⁵

3 **Riparian corridors** are the naturally vegetated areas along rivers, streams, lakes,
4 and ponds that support geomorphic river processes and provide many important
5 ecological functions, such as shoreline stabilization, water quality protection, wildlife
6 habitat, wildlife movement corridors, and biological diversity.

7 **Ecological landscape connectivity** is the degree to which blocks of suitable
8 habitat are connected to each other across the landscape. In areas with high ecological
9 landscape connectivity, wildlife can move about freely to satisfy their habitat needs,
10 plants and animals can migrate in response to climate change, and ecological processes
11 such as predator-prey relations and genetic exchange between populations. In areas of
12 low ecological landscape connectivity, the movement of species is restricted, and many
13 ecological processes do not occur.

⁵ Sorenson, E., R. Zaino, J. Hilke, and E. Thompson. 2015. Vermont Conservation Design: Maintaining and Enhancing an Ecologically Functional Landscape. Part 1: Landscape Features Technical Report. Vermont Fish and Wildlife Department and Vermont Land Trust. Montpelier, Vermont. 24 pp.

1 **Discussion of Vermont Conservation Design and the Ecological Landscape**

2 **Connectivity Functions of the Project Site.**

3
4 **Q11. Are you familiar with the VFWD’s Vermont Conservation Design and the three**
5 **reports that describe the Vermont Conservation Design? Exhibit ANR-ES-2,**
6 **Exhibit ANR-ES-3, and Exhibit ANR-ES-4.**

7 A11. Yes, I am the lead author of two of these reports⁶ and I organized and led the
8 Vermont Conservation Design project, which was a collaborative effort between the
9 VFWD and many partner organizations, including the Vermont Land Trust, Vermont
10 Department of Forests, Parks and Recreation, The Nature Conservancy, and the
11 Northwoods Stewardship Center.

12
13 **Q12. Please describe what the Vermont Conservation Design is?**

14 A12. The Vermont Conservation Design is an analysis and mapping of the Vermont
15 landscape to identify what features are most important in order to maintain and enhance
16 an **ecologically functional landscape** into the future. Ecological function is the ability of

⁶ Sorenson, E. and R. Zaino. 2018. Vermont Conservation Design: Maintaining and Enhancing an Ecologically Functional Landscape. Summary Report for Landscapes, Natural Communities, Habitats, and Species. Vermont Fish and Wildlife Department and Vermont Land Trust. Montpelier, Vermont. 38 pp.

Zaino, R., E. Sorenson, Morin, D., J. Hilke, and K. Thompson. 2018. Vermont Conservation Design. Part 2: Natural Communities and Habitats Technical Report. Vermont Fish and Wildlife Department and Vermont Land Trust. Montpelier, Vermont. 72 pp.

Sorenson, E., R. Zaino, J. Hilke, and E. Thompson. 2015. Vermont Conservation Design: Maintaining and Enhancing an Ecologically Functional Landscape. Part 1: Landscape Features Technical Report. Vermont Fish and Wildlife Department and Vermont Land Trust. Montpelier, Vermont. 24 pp.

1 plants and animals to thrive, reproduce, migrate, and move as climate changes and the
2 ability of natural ecosystems to function under natural processes. Maintaining and
3 enhancing ecological function across the landscape is fundamental to conserving
4 biological diversity.

5 The ecologically functional landscape is one that includes a connected network of
6 large and intact forested habitat, healthy aquatic and riparian systems, and the full range
7 of physical features (bedrock, soils, elevation, slope, and aspect) on which plant and
8 animal natural communities depend.

9 The ecologically functional landscape also includes full representation of
10 Vermont's natural community types, all wetlands, grasslands, and old and young forests.
11 The alternative to an ecologically functional landscape is one in which fragmentation of
12 forests and the loss of landscape connectivity severely limit and restrict the ability of
13 plant and animal species to move across the landscape.

14 Maintaining landscape connectivity within and between forest blocks, and along
15 riparian areas is a key aspect of the ecologically functional landscape. Maintenance and
16 enhancement of this functional landscape will conserve much of Vermont's biological
17 diversity and the ability of most species to shift location in response to climate and land-
18 use changes over time.

19 In the past, conservation and management efforts have largely focused on
20 protecting the habitat needs of individual species. Although these protections have had
21 important benefits and it will always be necessary to address the specific habitat needs of
22 certain species that are especially vulnerable or rare, this traditional approach will not be

1 effective given the vast number of species (on the order of 40,000 in Vermont), the scale
2 of landscape alteration from climate and land use changes, and the limited resources we
3 have as a society to conduct conservation actions. Still, land acquisition efforts focused
4 on individual species have resulted in the protection of thousands of acres of plant and
5 wildlife habitat and helped secure the needs of many species.

6
7 **Q13. Please discuss the concept of ecological landscape connectivity and how it is used in**
8 **the context of the Vermont Conservation Design.**

9 A13. Ecological landscape connectivity (or more simply called landscape connectivity)
10 can be defined as the degree to which patches of suitable habitat are connected to each
11 other, and the degree to which these connections allow the movement of species among
12 and between suitable patches. Landscape connectivity occurs at many scales.

13 Within an unfragmented wetland, for example, connectivity for all resident
14 species is very high. Similarly, within an unfragmented stretch of naturally vegetated
15 riparian area or within an unfragmented forest block, landscape connectivity is also high.
16 Landscape connectivity within small wetlands or large forest blocks is facilitated by
17 natural vegetation and the lack of obstacles or barriers to movement. But features on the
18 landscape may also impede landscape connectivity. Features that are well-recognized as
19 impeding landscape connectivity include roads, residential and industrial development,
20 railroad tracks, and agricultural fields. These features are commonly referred to as
21 fragmenting features because they fragment the natural landscape, create interruptions in

1 landscape connectivity, and limit the ability of species to move between suitable habitat
2 patches.

3 However, the degree to which these fragmenting features impede or restrict
4 landscape connectivity varies considerably. For example, a small gravel road with little
5 traffic is much less of an impediment to the movement of species than is a four-lane
6 interstate highway with heavy traffic. The presence of wetlands or natural forest cover on
7 both sides of a road allows for better connectivity than a road with forest on one side and
8 agricultural land on the other. And the presence of a single house and yard adjacent to a
9 road creates an additional impediment to landscape connectivity, but not nearly as much
10 as multiple houses along the road, or larger developments that eliminate natural
11 vegetative cover and represent a physical barrier for many species. Landscape
12 connectivity may be entirely lost for most species in areas of dense development.

13 Landscape connectivity is a key component of the Vermont Conservation Design
14 and critical to maintaining an ecologically functional landscape. Landscape connectivity
15 is addressed by three features that are described and mapped in the Vermont
16 Conservation Design.

17 First, **Highest Priority Connectivity Blocks** are the network of forest blocks that
18 together provide terrestrial connectivity at the regional scale (across Vermont and to
19 adjacent states and Québec) and connectivity between all nine Vermont biophysical
20 regions. There is a high level of connectivity within individual forest blocks. The
21 proximity of one forest block to another, the presence of riparian areas, and the
22 characteristics of the intervening roads, agricultural lands, or development determine the

1 effectiveness of the network of forest blocks to provide landscape connectivity functions
2 in a particular area. The proximate forest blocks which form this network are referred to
3 as Connectivity Blocks, many of the larger of which are also identified and function as
4 Interior Forest Blocks. The Connectivity Blocks which are located at critical linkage
5 areas, such as “pinch points” in the network, as well as those Interior Forest Blocks
6 which form the core or backbone of the connected network are identified as Highest
7 Priority Connectivity Blocks.

8 Second, **Surface Waters and Riparian Areas** are the network of all lakes,
9 ponds, rivers, and streams, their associated riparian areas and river corridors in which
10 geophysical processes occur. Rivers, streams, lakes, and ponds provide vital habitat for a
11 rich assemblage of aquatic species. Naturally vegetated riparian areas adjacent to these
12 waters provide many significant ecological functions, including stabilizing shorelines
13 against erosion, storage of flood waters, filtration and assimilation of sediments and
14 nutrients, shading of adjacent surface waters that moderate water temperatures, and direct
15 contribution of organic matter to the surface water as food and habitat structure. Riparian
16 areas are also essential habitat for many species of wildlife that are closely associated
17 with the terrestrial and aquatic interface. The shorelines and riparian areas of rivers and
18 lakes support floodplain forests, several other rare and uncommon natural communities,
19 and many species of rare plants and animals. In addition to these ecological functions that
20 are tied to aquatic systems, the linear network of riparian areas provides a crucial element
21 of landscape connectivity for plant and animal movement in response to climate change.

1 A subset of the mapped Surface Waters and Riparian areas, **Wildlife Riparian**
2 **Corridors** are portions of the connected riparian network in which natural vegetation
3 occurs, providing natural cover for wildlife movement and plant migration. Maintaining
4 and restoring Wildlife Riparian Corridors are especially important for landscape
5 connectivity in the Champlain Valley and the Vermont Valley, biophysical regions in
6 Vermont which are both highly fragmented.

7 The Project site is located directly east of Otter Creek and at the northern end of
8 the narrow Vermont Valley, near where the Vermont Valley meets the broader
9 Champlain Valley extending to the north. Both of these biophysical regions are relatively
10 flat and have been mostly cleared for agricultural uses in the past. In contrast, the Taconic
11 Mountains biophysical region to the west of the Project site and the biophysical regions
12 of both the Southern and Northern Green Mountains to the east are mostly forested and
13 much less fragmented. At the Project site, the Vermont Valley is only 1.5 miles wide.
14 Areas where there is a combination of Wildlife Riparian Areas and Highest Priority
15 Connectivity Blocks provide the best available paths for landscape connectivity,
16 especially in highly fragmented regions such as the Vermont Valley and Champlain
17 Valley.

18 **Wildlife Road Crossings** are a third element of landscape connectivity identified
19 in the Vermont Conservation Design. Wildlife Road Crossings are sections of roads
20 located adjacent to forest blocks or within Surface Waters and Riparian Areas that have
21 suitable habitat on both sides and are more likely to allow wildlife movement and
22 dispersal of other species. Therefore, these sections of roads are critical components of

1 maintaining or enhancing an interconnected, ecologically functional landscape. The
2 landscape connectivity functions of these road segments can best be maintained by
3 protecting or restoring natural vegetation on both sides of the road and by avoiding or
4 minimizing roadside development that further impede wildlife movement and landscape
5 connectivity.

6
7 **Q14. Please explain the difference between what you have described as ecological**
8 **landscape connectivity and areas which are typically referred to as wildlife**
9 **corridors.**

10 A14. These two concepts are closely related. Wildlife corridors are lands and waters
11 that connect larger patches of habitat together within a landscape and allow the
12 movement, migration, and dispersal of animals. Wildlife corridors describe specific paths
13 along which animals move and migrate, usually providing connections between blocks of
14 suitable habitat across a dissimilar landscape matrix. Wildlife corridors are best identified
15 and described for the individual species that use them. For example, the expansive
16 network of wildlife corridors through forest blocks and across roads that may be used by
17 black bears are very different from the restricted wildlife corridors that may be used by
18 spotted salamanders to migrate from upland forests to vernal pools for breeding.

19 Ecological landscape connectivity is a broader concept that describes both the
20 permeability and the resistance of the landscape to the movement of plant and animal
21 species over time. Ecological landscape connectivity also incorporates the importance of
22 sustaining ecological processes, like predator-prey relations, genetic exchange among

1 populations, and shifting species ranges in response to climate change. Wildlife corridors
2 and wildlife movement are important aspects of landscape connectivity. The degree to
3 which wildlife can move across the landscape is one of the most visible components of
4 landscape connectivity. Being mobile, animals are also one of the important vectors for
5 carrying and moving plant seeds and other small biota across the landscape.

6
7 **Q15. Describe the features mapped in the Vermont Conservation Design that identify the**
8 **ecological landscape connectivity functions of the Project site.**

9 A15. The Vermont Conservation Design, and other regional conservation planning
10 tools I will describe later, all identify the Project site and nearby areas as being
11 exceptionally important for ecological landscape connectivity, both from a local and
12 especially a regional perspective. The three landscape-scale features of the Vermont
13 Conservation Design that identify the Project site's importance are the Highest Priority
14 Connectivity Blocks, the Highest Priority Surface Waters and Riparian Areas/Wildlife
15 Riparian Areas, and the Wildlife Road Crossings. I will discuss each of these features
16 separately, but first want to put the Project site in a regional perspective.

17 In Vermont, there is generally very good landscape connectivity between the
18 forest blocks that occur within the Taconic Mountains biophysical region. Similarly,
19 there is generally very good landscape connectivity between the forest blocks that occur
20 within both the Southern and Northern Green Mountains biophysical regions. This is
21 because, in Vermont, these three biophysical regions have many large forest blocks and
22 are relatively unfragmented by roads and development. In contrast, there is generally

1 much weaker landscape connectivity between forest blocks that occur within the
2 fragmented Champlain Valley and Vermont Valley (the Project is located at the northern
3 end of the Vermont Valley). This is because within these two biophysical regions there
4 has been much more development, more land converted to agricultural uses, and only
5 smaller forest blocks remain.

6 In order to maintain functional landscape connectivity across the state, it is critical
7 to maintain or restore connectivity both *within* biophysical regions and *between*
8 biophysical regions. The Project is proposed to be built in the best remaining landscape
9 connection in the Vermont Valley *between* the northern Taconic Mountains and the
10 Southern Green Mountains biophysical regions. The east-west oriented landscape
11 connection at this location is only approximately 2.45 miles long north to south, with the
12 proposed north-south oriented Project footprint located near its center. The exceptional
13 importance of the landscape connectivity functions of the Project site are due to this site's
14 location between two Highest Priority Connectivity Blocks, one located directly west of
15 Carver Street and one just east of the railroad tracks which border the eastern edge of the
16 Project site. The Project site relative to this regionally significant landscape connection
17 between the Taconic Mountains and Green Mountains is shown on attached maps
18 **(Exhibit ANR-ES-5 and Exhibit ANR-ES-6).**

19 **Highest Priority Connectivity Blocks:** The Project site is located directly
20 between two Highest Priority Connectivity Blocks. To the west of the Project site and
21 Carver Street is a 905-acre Highest Priority Connectivity Block that includes Otter Creek
22 and its riparian forests and wetlands and several limy cobbles. This forest block, in turn,

1 is connected to the 18,588-acre Blueberry Hill block, a Highest Priority Interior Forest
2 Block and Highest Priority Connectivity Block, that is one of the largest and most
3 significant forest blocks in the Taconic Mountains.

4 To the east of the Project site and the railroad tracks is a 1,056-acre Highest
5 Priority Connectivity Block that is mostly forested hills and some wetlands. This forest
6 block is connected to a 2,948-acre Highest Priority Connectivity Block, which, in turn, is
7 connected to the 77,101-acre Mount Carmel block, a Highest Priority Interior Forest
8 Block and Highest Priority Connectivity Block, that is one of the largest and most
9 significant forest blocks in the Green Mountains.

10 There are no forest blocks identified on the Project site by the Vermont
11 Conservation Design because the statewide forest block analysis conducted by Vermont
12 Fish and Wildlife Department⁷ used a practical cutoff of 20-acres for identifying and
13 ranking forest blocks. But it is the presence of Highest Priority Connectivity Blocks
14 adjacent to the Project site, and the existing features of the Project site, including the two
15 limy cobble forests, wetlands, Otter Creek riparian areas, and hayfields that make the site
16 so important for landscape connectivity.

17 **Highest Priority Surface Waters and Riparian Areas/Wildlife Riparian**

18 **Areas:** The Project site is directly east of Otter Creek, Vermont's longest river. The
19 Highest Priority Surface Water and Riparian Areas identified in Vermont Conservation
20 Design include almost all the Project site, based on the proximity of this area to Otter

⁷ Sorenson, E. and J. Osborne, 2014. Vermont Habitat Blocks and Habitat Connectivity: An Analysis using Geographic Information Systems. Vermont Fish and Wildlife Department.

1 Creek and the predominance of valley-bottom soils (alluvial and glacial-lacustrine
2 deposits). Only the two forested cobbles are not part of the Highest Priority Surface
3 Water and Riparian Areas, because these small hills are made of up marble and dolostone
4 bedrock, not water-deposited sediments. The Wildlife Riparian Area is the portion of
5 Highest Priority Surface Water and Riparian Areas that is naturally vegetated, and these
6 areas are especially important for their connectivity functions. On the Project site, this
7 includes all the wetlands and all forested areas near the river. Otter Creek and its
8 associated Wildlife Riparian Area/Highest Priority Surface Water and Riparian Areas are
9 exceptionally important for landscape connectivity in that they provide a linear, riparian
10 connection for approximately 30 miles through the Vermont Valley and Champlain
11 Valley (from Rutland north to Middlebury). This 30-mile section of Otter Creek and its
12 riparian areas includes Vermont's largest forested swamp system – Otter Creek Swamps
13 occupy approximately 9,000 acres and are biologically rich and regionally significant.
14 The Project site is near the southern end of the Otter Creek Swamps and near the middle
15 of the approximately 30-mile Wildlife Riparian Area. In addition to this north-south
16 connectivity function of the Otter Creek riparian area, on the Project site, all the wetlands
17 contribute to the regionally significant east-west connectivity across the narrow Vermont
18 Valley between the northern Taconic Mountains and Southern Green Mountains.

19 **Wildlife Road Crossings:** Highest Priority Wildlife Road Crossings are
20 identified for Carver Street along the entire west side of the Project's 1.0-mile north-
21 south extent. This 1.0-mile road segment and additional segments to the north and south
22 of the Project site are identified in the Vermont Conservation Design as Highest Priority

1 Wildlife Road Crossings because Highest Priority Connectivity Blocks, Wildlife Riparian
2 Areas, wetlands, and hayfields are adjacent to Carver Street in these areas. Although the
3 forests and wetlands adjacent to Carver Street in these segments provide the best wildlife
4 cover, Vermont Conservation Design also identifies hayfields as important for
5 connectivity.

6

7 **Q16. Are there other important features on the Project site that contribute to the**
8 **ecological landscape connectivity functions of this area?**

9 A16. Yes. I have observed the following features during my sites visits.

10 There are two forested, limy (calcium-rich marble and dolostone bedrock) cobbles on the
11 property. These two forested hills both support Dry Oak-Maple Limestone Forests, which
12 is considered an uncommon natural community type in Vermont by VFWD⁸. The
13 **northern cobble** supports a small, but state-significant example of Dry Oak-Maple
14 Limestone Forest, based on the natural community ranking specifications developed by
15 VFWD. This approximately 10-acre forest is dominated by sugar maple, white ash,
16 basswood, white oak, red oak, bitternut hickory, shagbark hickory, bur oak, slippery elm,
17 black cherry, hackberry, northern white cedar, and ironwood.

18 Due to the calcium-rich limestone bedrock, which is commonly exposed as small
19 cliffs and outcrops in the forest, the herbaceous vegetation is very diverse and includes
20 many spring ephemerals indicative of the limy conditions. These include maidenhair fern,

⁸ The Dry Oak-Maple Limestone Forest natural community type was formerly called Transition Hardwood Limestone Forest.

1 bloodroot, round-lobed hepatica, sharp-lobed hepatica, sweet cicely, and white snakeroot.
2 Ferns are abundant, including the lime-loving bulblet fern, walking fern, and maidenhair
3 spleenwort. I have also observed two uncommon plants in this forest: yellow oak and
4 purple clematis, both plants associated with calcium-rich bedrock. The Dry Oak-Maple
5 Limestone Forest on the northern cobble is in good condition, with little recent human
6 disturbance, some older trees, some downed trees that provide habitat and contribute to
7 soil development, and very few non-native invasive species.

8 In addition to its importance as a state-significant natural community, this Dry
9 Oak-Maple Limestone Forest on the northern cobble is important for landscape
10 connectivity in two ways. First, simply by being forest, it provides cover for wildlife
11 moving across the site. Although it is an island of forest cover surrounded by hayfields,
12 the hayfields are easily crossed in their current undeveloped state by many wildlife
13 species, and the forest cobble provides a “stepping-stone” of protective cover between the
14 Otter Creek wetlands and floodplain forests to the west and forests to the east of the
15 railroad tracks. Second, small, topographically and geologically diverse (especially
16 calcium-rich) forests have been identified as important stepping stones for plant
17 migrations between larger intact forest blocks.⁹ The good ecological condition of the Dry
18 Oak-Maple Limestone Forest on the northern cobble contributes to its function as a
19 stepping stone for plants shifting their ranges in response to climate change.

⁹ Beier, P. 2012. Conceptualizing and designing corridors for climate change. *Ecological Restoration* 30(4): 312-319.

1 The **southern cobble** also supports Dry Oak-Maple Limestone Forest, although
2 the forest on the southern cobble has mostly been cleared in the past and most of this
3 forest is young. This young forest supports many of the same species as on the northern
4 cobble, but also has many more non-native invasive species, especially common
5 buckthorn, bush honeysuckles, and barberries. The uncommon fern, blunt-lobed woodsia,
6 is present on dolostone outcrops on the southern cobble. On the western side of the
7 southern cobble is a small but **mature hackberry forest stand**. Hackberry is a tree found
8 in warmer regions of Vermont, typically associated with calcareous soils and river shores.
9 The small stand on the southern cobble has large trees, indicating a more mature forest,
10 and a diverse understory of calcium-loving plants. This mature hackberry forest stand is
11 part of the Dry Oak-Maple Limestone Forest but is in better ecological condition than
12 much of the southern cobble forest.

13 The forested southern cobble contributes to the landscape connectivity functions
14 of the site in similar ways as the northern cobble. It may provide better wildlife
15 connectivity functions than the northern cobble, as the forest on the southern cobble
16 extends to the edge of Carver Street for a length of approximately 800 feet, and there is
17 floodplain forest on the west side of Carver street for much of this distance. The southern
18 cobble likely also serves as a steppingstone for plant migration over time, but this
19 function is likely reduced by the young forest condition and abundance of non-native
20 invasive species in this forest. If left to mature without being cleared, I would expect the
21 forest condition to improve over time.

1 There are four **Otter Creek floodplain wetlands** on the Project site. All these
2 wetlands are hydrologically connected to Otter Creek by annual flooding of the river
3 and/or culverts under Carver Street. I will describe each of these wetlands briefly,
4 beginning at the northern end of the Project site. The northern wetland (north of the
5 Project's proposed northern array) includes both seasonally flooded hayfield with
6 scattered willow and buttonbush in the deepest water areas, and at the very north edge of
7 the Project property, Silver Maple-Sensitive Fern Floodplain Forest. The north-central
8 wetland (between the Project's proposed northern array and central array) is a mix of
9 Buttonbush Swamp (a rare natural community type in Vermont) closest to Otter Creek
10 and Carver Street and Maple-Green Ash Swamp (an uncommon natural community type)
11 to the northeast. The south-central wetland (between the Project's proposed central and
12 southern arrays) is a shrub swamp and sedge meadow dominated by willows, lake sedge,
13 and common cattail. The southern wetland (south of the Project's proposed southern
14 array) is mostly open water, but includes patches of willows, buttonbush, sedges, and
15 scattered maples.

16 These four Otter Creek floodplain wetlands all contribute to the landscape
17 connectivity function of the Project site, because they are primarily naturally vegetated,
18 extend from Carver Street across the Project site to the railroad bed and beyond, and
19 provide cover for wildlife movement. In addition, these wetlands provide spawning and
20 juvenile rearing habitat for fish that inhabit Otter Creek. Mowed hayfields currently
21 extend to the edge or into these wetlands. Restoring naturally vegetated buffers along the

1 edges of all these wetlands would both increase the ecological integrity of the wetlands
2 and improve the landscape and wildlife connectivity functions of the wetlands.

3 **Hayfields** occupy most of the Project site and are where the majority of the
4 proposed Project arrays would be located. Hayfields are not natural ecological systems,
5 but they do provide important habitat values, including flowering plants for many insects,
6 and grassland bird habitat. But hayfields also provide a wildlife connectivity function,
7 especially hayfields like those on the Project site that are surrounded by forests, wetlands,
8 and riparian areas. Many species of wildlife will move through hayfields, especially if
9 they are moving between areas of more secure cover habitat.

10 The Project site is directly adjacent to **Otter Creek and its floodplain forests,**
11 **wetlands, and riparian areas.** Riparian areas are well recognized as movement corridors
12 for many species of wildlife and the Otter Creek riparian areas from Rutland north to
13 Middlebury are exceptionally important, as described above. In addition, riparian areas
14 are recognized as corridors supporting plant species shifts in response to climate
15 change.¹⁰

16 Finally, although roads contribute to landscape fragmentation, **Carver Street** is a
17 relatively minor fragmenting feature compared to many larger and more travelled roads.
18 In the vicinity of the Project site, Carver Street is a narrow gravel road, it has little traffic,
19 it is seasonally flooded by Otter Creek, and it is surrounded by forests, Otter Creek,

¹⁰ Anderson, M.G., Barnett, A., Clark, M., Prince, J., Olivero Sheldon, A. and Vickery B. 2016. Resilient and Connected Landscapes for Terrestrial Conservation. The Nature Conservancy, Eastern Conservation Science, Eastern Regional Office. Boston, MA.

1 riparian areas, wetlands, and hayfields. There are currently no houses or other residential
2 or industrial development for 2.2 miles along Carver Street, including the 1.1-mile length
3 of the proposed Project. These attributes, along with the nearby Highest Priority
4 Connectivity Blocks, are why these sections of Carver Street are identified as Highest
5 Priority Wildlife Road Crossings in the Vermont Conservation Design.
6

7 **Q17. Elaborate on why there are no Highest Priority Connectivity Blocks mapped on the**
8 **Project site.**

9 A17. There are no forest blocks identified on the Project site because the statewide
10 forest block analysis conducted by Vermont Fish and Wildlife Department¹¹ used a
11 practical cutoff of 20-acres for identifying and ranking forest blocks. Forest blocks under
12 20 acres may provide wildlife, biological diversity, or connectivity functions, depending
13 on their location in the landscape, but they provide little interior forest habitat, and
14 interior forest habitat was a focus of the referenced statewide analysis. Removing forest
15 blocks under 20 acres also made it possible to focus this statewide analysis on the largest
16 and most significant interior forest blocks in all biophysical regions. The Project site is
17 one of those locations where small patches of forests, not mapped as forest blocks,
18 provide important functions. As stated above, it is the presence of Highest Priority
19 Connectivity Blocks adjacent to the Project site, and the existing features of the Project

¹¹ Sorenson, E. and J. Osborne, 2014. Vermont Habitat Blocks and Habitat Connectivity: An Analysis using Geographic Information Systems. Vermont Fish and Wildlife Department.

1 site, including the two limy cobble forests, wetlands, Otter Creek riparian areas, and
2 hayfields that make the site so important for landscape connectivity.

3
4 **Q18. What recommendations are made in the Vermont Conservation Design for**
5 **maintaining ecological landscape connectivity function at places like the Project**
6 **site?**

7 A18. There are two Highest Priority Connectivity Blocks identified by Vermont
8 Conservation Design directly adjacent to the Project site. The Vermont Conservation
9 Design provides “guidelines for maintaining ecological function” for Connectivity
10 Blocks that apply to the Project site. The report states:

11 “Similar to Interior Forest Blocks, it is important to maintain the interior forest
12 conditions in Connectivity Blocks by avoiding permanent interior forest
13 fragmentation resulting from development. Connectivity within forest blocks will
14 remain high if they remain unfragmented. For Connectivity Blocks it is also
15 critically important to maintain or enhance the structural and functional
16 connectivity that occurs on the margins of these blocks where they border other
17 blocks. This can be accomplished by **maintaining forest cover along the**
18 **margins and by limiting development in these areas of block-to-block**
19 **connectivity.” (emphasis added)¹²**

¹² Sorenson, E., R. Zaino, J. Hilke, and E. Thompson. 2015. Vermont Conservation Design: Maintaining and Enhancing an Ecologically Functional Landscape. Part 1: Landscape Features Technical Report. Vermont Fish and Wildlife Department and Vermont Land Trust. Montpelier, Vermont. 24 pp, see page 7.

1 The implications of this for the Project site are, that in order to maintain the landscape
2 connectivity functions of Connectivity Blocks, it is important to both maintain forest
3 cover along the road edges of the adjacent forest blocks and to limit development at these
4 forest edges and in the intervening area between the Connectivity Blocks.

5 The Vermont Conservation Design report also provides suggestions on how to
6 prioritize conservation for Connectivity Blocks, including the importance of prioritizing
7 “pinch points or bottle-necks in the connectivity network where animal movement or
8 connectivity is narrowed due to adjacent development or fragmentation.”¹³ As explained
9 above, the Project site is a *regionally important pinch point* for connectivity between the
10 Taconic Mountains and the Southern Green Mountains biophysical regions.

11
12 **Q19. Are there other studies or analyses that you relied on in forming your opinions and**
13 **which identify the state and regional importance of the Project site?**

14 A19. Yes, there are several analyses and studies that I have used. The Staying
15 Connected Initiative is a partnership of 59 organizations across New York, Vermont,
16 Massachusetts, New Hampshire, Maine, and Canadian provinces working to restore and
17 enhance landscape connectivity for the benefit of people and wildlife across the Northern
18 Appalachian/Acadian region of the eastern U.S. and Canada. The Staying Connected
19 partners include the state fish and wildlife and transportation agencies from the five

¹³ Sorenson, E., R. Zaino, J. Hilke, and E. Thompson. 2015. Vermont Conservation Design: Maintaining and Enhancing an Ecologically Functional Landscape. Part 1: Landscape Features Technical Report. Vermont Fish and Wildlife Department and Vermont Land Trust. Montpelier, Vermont. 24 pp, see page 8.

1 states, chapters of The Nature Conservancy for all five states, as well as the Vermont
2 Land Trust, University of Vermont, the National Wildlife Federation, and U.S. Fish and
3 Wildlife Service, and the Green Mountain National Forest of the U.S. Forest Service.
4 Information about the Staying Connected Initiative can be seen on their webpage:

5 <http://stayingconnectedinitiative.org/>.

6 The Staying Connected Initiative maps the Project site as part of the “Adirondack
7 Mountains to the Green Mountains Linkage” area. Linkage areas are defined by the
8 Staying Connected Initiative as “geographically defined places where—if landscape
9 connectivity is lost—bear, moose, bobcat and other wide-ranging mammals will be
10 limited in their ability to move between core habitat areas and across the region.” Nine
11 linkage areas are identified across the five state, three Canadian province Northern
12 Appalachian ecoregion, and six of these linkage areas are within Vermont, emphasizing
13 the high regional importance of maintaining landscape connectivity in Vermont. Two
14 maps showing the Staying Connected Initiative’s nine linkage areas and the Adirondack
15 Mountains to the Green Mountains Linkage area that includes the Project area are
16 attached (**Exhibits ANR-ES-7 and ANR-ES-8**).

17 I added a small red circle identifying the Project site to the Staying Connected
18 Initiative’s Adirondack Mountains to the Green Mountains Linkage area map attached as
19 **Exhibit ANR-ES-8**. This map shows the Project site to be near the center of the northern
20 landscape connection linking the Adirondack Mountains and the Green Mountains. While
21 the Staying Connected Initiative maps provide important regional perspective on the
22 importance of the Project site for landscape connectivity functions, it is my opinion that

1 the maps in Vermont Conservation Design provide more detailed characteristics of the
2 features on and adjacent to the Project site which are more useful for evaluating Project
3 impacts.

4 Landscape permeability mapping is another useful tool for evaluating the
5 importance of the Project site. Landscape permeability is the capacity of a landscape to
6 facilitate range shifts of terrestrial plant and animal species. The Nature Conservancy, led
7 by Mark Anderson of the Eastern Conservation Science office in Boston, has completed
8 several landscape analyses of Eastern North America that have made significant
9 contributions to our understanding of conservation in a fragmented landscape with
10 climate change pressure underway. Their work, most recently updated with a report and
11 data in 2016, identifies key landscape areas that are resilient to climate change and that
12 are important for landscape connectivity.¹⁴ One specific tool of interest is their modeling
13 of landscape permeability, which is described in a 2012 report¹⁵ as well as in the 2016
14 report.

15 The 2012 report defines landscape permeability more precisely as “the degree to
16 which regional landscapes, encompassing a variety of natural, semi-natural and
17 developed land cover types, will sustain ecological processes and are conducive to the
18 movement of many types of organisms.” One of the methods used in this work to
19 identify areas of landscape permeability is regional flow patterns, which models how

¹⁴ Anderson, M.G., Barnett, A., Clark, M., Prince, J., Olivero Sheldon, A. and Vickery B, Resilient and Connected Landscapes for Terrestrial Conservation (The Nature Conservancy, Eastern Conservation Science, Eastern Regional Office) (2016).

¹⁵ Anderson, M. and M. Clark, Modeling Landscape Permeability: A Description of Two Methods to Model Landscape Permeability (The Nature Conservancy, Eastern Conservation Science, Eastern Regional Office) (2012).

1 species will move across the landscape based on the spatial arrangements of cities, towns,
2 farms, roads, and natural lands. This model identifies areas of concentrated flow
3 (potential for species movement) in key linkages where flow accumulates or is channeled
4 through a pinch point. The Project site is identified as the best remaining area of regional
5 flow between the Taconic Mountains and the Southern Green Mountains. A map showing
6 the regional flow pathway between the Taconic Mountains and the Southern Green
7 Mountains in relation to the Project Site is attached (**Exhibit ANR-ES-9**).

8
9 **Discussion of the Project's Impacts and Measures to Avoid, Minimize and Mitigate**
10 **Such Impacts**

11
12 **Q20. Please describe aspects of the October 28, 2018 version of the Project you considered**
13 **in order to evaluate its potential fragmenting affects and impacts on ecological**
14 **landscape connectivity.**

15 A20. My first consideration was understanding the location of the proposed Project in
16 an area of regional significance for landscape connectivity. I have explained the
17 importance of Project site for landscape connectivity functions above, based on the
18 Vermont Conservation Design, the Staying Connected Initiative, The Nature
19 Conservancy's regional flow modeling, observations I have made using GIS tools and
20 layers, and my observations during site visits.

21 A second aspect is the sheer size of the Project developed area. The Project
22 components, including solar arrays, access roads, and ancillary facilities will occupy

1 approximately 65 acres. This is a very large area of industrial solar development in a
2 sensitive landscape connectivity area.

3 A third aspect of the Project site is its length from north to south. Mr. Jewkes, in
4 his response to the Agency's discovery requests, identified the north to south length of
5 the Project as 5,432 feet (1.03 miles). This 1.03-mile length of the Project represents a
6 fragmenting feature which will occupy approximately 42% of the 2.45-mile long (north
7 to south) regionally significant landscape connectivity area identified by the Vermont
8 Conservation Design connecting the Taconic Mountains and the Southern Green
9 Mountains. The Project is proposed near the center of this 2.45 mile stretch of regional
10 connectivity features.

11 A fourth aspect of the proposed Project that I considered relative to impacts to the
12 natural environment was the proposal to clear the forest on most of the southern cobble
13 and to clear or manage the height of trees on a significant portion of the northern cobble.
14 As previously indicated, the northern cobble supports a state-significant Dry Oak-Maple
15 Limestone Forest (an uncommon natural community type) which would have been
16 degraded by the proposed tree clearing. The loss of forest would both reduce the wildlife
17 connectivity function of the site and the landscape connectivity function of the site, as
18 explained above. The degree to which the forests are altered will greatly affect their
19 capacity to provide landscape connectivity functions. Mature forests operating under
20 natural disturbance processes will best support native species and landscape connectivity
21 now and in the future. In contrast, forests that are cleared of vegetation and soils, and the
22 underlying bedrock broken and smoothed will not provide landscape connectivity

1 functions, and long-term recovery of forests on these highly manipulated sites is
2 uncertain.

3 A fifth aspect of the Project is the proposal to fence and convert approximately 65
4 acres of hayfields to solar arrays and infrastructure. This fencing and conversion will
5 reduce and restrict the ability of wildlife to move across the Project site between the
6 forest blocks located east and west of the project. As explained above, wildlife corridors
7 and wildlife movement are important aspects of landscape connectivity.

8
9 **Q21. Do you have an opinion as to whether the Project which was proposed on October**
10 **28, 2018 would result in an undue adverse effect on the natural environment?**

11 A21. Yes. It is my professional opinion that the Project as proposed on October 28,
12 2018 would have resulted in an undue adverse effect on the natural environment due to
13 its fragmenting affects and impacts on ecological landscape connectivity. This conclusion
14 is based on several factors. First, and foremost, the existence of a large, industrial-scale
15 solar development in the central portion of a regionally significant landscape connection
16 between the Taconic Mountains and the Southern Green Mountains creates a fragmenting
17 feature. The aspects of the Project referenced above show that the Project, as originally
18 proposed, would have resulted in many changes to the Project site that would have
19 significantly reduced the ecological landscape connectivity functions of the site and the
20 regional landscape connection, of which the Project site is an integral part. Landscape
21 connectivity is a critical element of the ecologically functional landscape upon which the
22 biological diversity of Vermont and the region depend as climate changes.

1 Undue adverse impacts would have resulted not just from the construction and
2 operation of the then proposed Project during its lifetime, but also from the long-term
3 effects of the Project on the site, especially from the extensive forest clearing and
4 grading. Areas of forest that are cleared with the underlying bedrock significantly
5 disturbed would not recover intact forested natural communities for decades or centuries,
6 compromising the ecological landscape connectivity function over the long term.

7 The footprint of the proposed project is large and its long orientation from north
8 to south maximizes fragmentation of the regional landscape connection identified by
9 Vermont Conservation Design and other regional studies. Loss and degradation of forests
10 as originally proposed on the two cobbles would have reduced ecological function, both
11 in the short term and long term. Loss of ecological function on the cobbles would mean
12 that current and future biological diversity (plant and animal species and ecological
13 processes) would be compromised. This would have also restricted the ability of plant
14 and animal species to move across the landscape, during the life of the Project and well
15 into the future.

16 Alteration of the forest on the northern cobble and nearly surrounding the
17 northern cobble with Project infrastructure, as originally proposed, would have reduced
18 the quality of the state-significant Dry Oak-Maple Limestone Forest. In addition to the
19 negative impact to the state-significant natural community, this would also reduce the
20 function of this limy cobble as a steppingstone for plants shifting their ranges in response
21 to climate change, both during the life of the Project and into the future as the site slowly
22 recovered some degree of ecological integrity.

1 Finally, the site disturbance, especially forest clearing and management on the
2 northern and southern cobbles, without measures to prevent introduction of, and monitor
3 and control over the life of the Project, non-native invasive species, would be expected to
4 increase the abundance of non-native invasive species on the site. Increased abundance of
5 non-native invasive species on these cobbles, and especially in the state-significant Dry
6 Oak-Maple Limestone Forest on the northern cobble will reduce the ecological integrity
7 of this forest and its function as a landscape connectivity steppingstone.

8 All of these aspects of the version of the Project that was proposed on October 28,
9 2018 would have resulted in additional fragmentation of the Project site and the
10 regionally significant landscape connection. Fragmentation of the landscape has been
11 shown to slow species dispersal and reduce successful colonization of new habitat by
12 creating resistance to species' movements across the landscape. Given the uncertainty
13 over the specific pressures on biological diversity from climate change, but
14 acknowledging the scientifically agreed-upon importance of landscape connectivity for
15 allowing plants and animals to shift their ranges over time, requires that we take a
16 precautionary and protective stance on a clearly identified, regionally-recognized linchpin
17 in the landscape connectivity network such as exists on the Project site and the rest of this
18 regional connection between the Taconic and Green Mountains.

19
20 **Q22. Are you familiar with the April 1, 2020 Memorandum of Understanding (“MOU”)**
21 **between Davenport Solar, LLC and the Agency?**

1 A22. Yes. I was very much involved in developing the terms and conditions which are
2 contained in the MOU, and I have read and understand them.

3

4 **Q23. Have you reviewed the modifications to the Project which are depicted and**
5 **described in the testimony and exhibits which Davenport Solar, LLC filed with the**
6 **Commission on April 10, 2020.?**

7 A23. Yes. I have reviewed the revised Project site plan along with the testimony of Mr.
8 Jewkes, Mr. Herzlinger, and Mr. Owens.

9

10 **Q24. Please identify and discuss the terms and conditions of the MOU and the Project**
11 **modifications which have been made to address the Project's impact on the natural**
12 **environment, specifically its fragmenting affects and impacts on ecological**
13 **landscape connectivity.**

14 A24. As originally proposed, the Project would have resulted in an undue adverse
15 impact to the natural environment. However, the following steps have been taken to
16 avoid, minimize, and mitigate impacts to reduce them to a level which, while still
17 adverse, is acceptable and meets the Section 248(b)(5) standard as it applies to the natural
18 environment.

19 1. **Avoiding impacts to the forested northern cobble.** Under Section 1.1 of the
20 MOU, alteration of the forests on the northern cobble have been minimized so that this
21 forest will be left in its natural state and condition. The only exception is that hazard tree
22 management will allow for cutting trees that threaten the Project area in a narrow strip

1 along the south and southwest side of the northern cobble. This hazard tree management
2 area is shown on the Project site plan. Hazard trees that are felled will be left in the
3 hazard tree management zone so that their decay contributes to the forest soils on the
4 northern cobble.

5 **2. Minimizing and mitigating impacts to the forested southern cobble.** Under
6 Section 1.3 of the MOU, several steps have been taken to reduce Project impacts on the
7 southern cobble forest. The reduction in impacts to the southern cobble and forest are
8 identified as specific zones of vegetation removal and site preparation (“VRSP”), with
9 details of what activities will occur in each. By this approach, the extent of the potentially
10 most damaging practices, such as rock-ripping and grubbing, are minimized within VRSP
11 1. In VRSP 2, large trees and shrubs will be removed, but small shrubs, herbs, and native
12 soil will be left in place. Similarly, in VRSP 3, small shrubs, herbs, and native soil will be
13 left in place, as will smaller cut tree limbs so that their decay contributes to the forest
14 soils. Native shrubs and brush will be allowed to regrow in VRSP 3 to a height of 10 feet
15 during project operation. The locations of the three VRSPs are identified on the Detail of
16 the Southern Cobble site plan. The combination of these steps minimizes the severity of
17 alteration to the southern cobble during the life of the Project and will facilitate
18 ecological restoration of the site after decommissioning.

19 **3. Avoiding impacts to the mature hackberry forest on the southern cobble.**

20 Under Section 1.2.2 of the MOU, alteration of the hackberry forest on the southern
21 cobble have been minimized so that this forest will be left in its natural state and
22 condition. The only exception is that hazard tree management will allow for cutting trees

1 that threaten the Project area along the edge of the hackberry forest. This hazard tree
2 management area is shown on the on the Detail of the Southern Cobble site plan. Hazard
3 trees that are felled will be left in the hazard tree management zone so that their decay
4 contributes to the forest soils of the southern cobble.

5 **4. Wetland and buffer zone restoration.** Under Section 2 of the MOU, with only a
6 few exceptions for locations in which there is project infrastructure, passive restoration of
7 native vegetation will be encouraged on all the 50-foot wetland buffers and upland
8 hayfield outside the Project fence. Passive restoration is allowing natural succession to
9 occur through growth of trees, shrubs, and herbs from the existing seed sources at the
10 site. In addition, active restoration of native trees and shrubs will occur in six locations of
11 wetland buffer and upland field to the east and south of the southern cobble. The
12 locations of the passive and active restoration areas are shown on the project site plans,
13 and details of the active restoration, including the native trees and shrubs to be planted,
14 are shown on the Active Restoration Plan prepared by T.J. Boyle Associates, LLC
15 (Exhibit Petitioner JBO-6). Together, these passive and active restoration actions will
16 help mitigate impacts to wildlife movement across the site, by increasing vegetation
17 cover and will facilitate overall site restoration over the long term.

18 **5. Non-native invasive species monitoring and control.** Under Section 4 of the
19 MOU, Davenport Solar will develop best management practices to reduce the
20 introduction of non-native invasive species (NNIS) during Project construction and
21 operation. Davenport Solar will also develop and implement a NNIS Monitoring and
22 Control Plan to be used during the operational life of the Project. The MOU identifies

1 which NNIS will be addressed, the Resource Mitigation Areas (RMAs) in which NNIS
2 monitoring and control will be implemented, and the timing and reporting for the
3 monitoring and control efforts. These long-term steps to control non-native invasive
4 species on the project site will help to maintain the ecological integrity of the site during
5 its operation and will facilitate restoration efforts after Project decommissioning.

6 **6. Project decommissioning and site restoration.** Under Section 5 of the MOU,
7 the Project will be decommissioned no later than 40 years from the date at which the
8 Project commences operation. As part of decommissioning, an approved site restoration
9 plan will be implemented to restore the site to pre-development conditions to the extent
10 that is practical (fields restored to fields, forest allowed to regenerate). Establishing a set
11 date for decommissioning and site restoration is a critical element for ensuring that
12 ecological landscape connectivity functions can be restored to the site in the future.

13 **7. Permanent land conservation.** Under Section 6 of the MOU, the two parcels on
14 which the Project is located, totaling 316 acres, will be acquired in fee simple by
15 Davenport Solar prior to commencement of Project site preparation or construction. Most
16 importantly, permanent conservation will be accomplished by conveyance of the two
17 parcels in fee simple interest to the VFWD within 180 days of Project decommissioning.
18 Fee ownership is necessary to ensure that the most appropriate management of the
19 properties can be determined by VFWD based on current conditions and scientific
20 understanding at the time of Project decommissioning. In addition to permanent
21 conservation, Section 6.1.2. of the MOU specifies that the remainder of the two parcels
22 shall remain in their natural state with natural ecological processes predominating and

1 driving successional direction during the operational life of the Project, except for those
2 portions of the 316 acres that contain the Project infrastructure, are subject to active and
3 passive restoration plans, or subject to grassland bird management regimes. This
4 provision for permanent land conservation is one of the most important in mitigating
5 impacts of the Project. Ecological landscape connectivity is a function that is critical for
6 conserving biological diversity over long time periods – decades, centuries, and
7 millennia. Although the Project will have an adverse impact on ecological landscape
8 connectivity during its operational life, the permanent conservation of these two parcels
9 and conveyance to VFWD for ecological and wildlife management in perpetuity means
10 that ecological landscape connectivity and other functions of these lands can be restored
11 and enhanced over the long term.

12 In summary, the combination of all the steps described above and specified in the
13 MOU and on current Project site plans will avoid, minimize, and mitigate the originally
14 proposed Project's undue adverse impacts to the natural environment to the extent that
15 the impacts are simply adverse. It is my professional opinion that although all of the
16 above steps are important in mitigating the Project's impacts on the natural environment,
17 it is the provision requiring long term conservation of the 316 acres, and future
18 management of these lands by VFWD for ecological goals, that provides me with greatest
19 confidence that the regionally significant ecological landscape connection between the
20 Taconic Mountains and Green Mountains will be maintained over the long term.

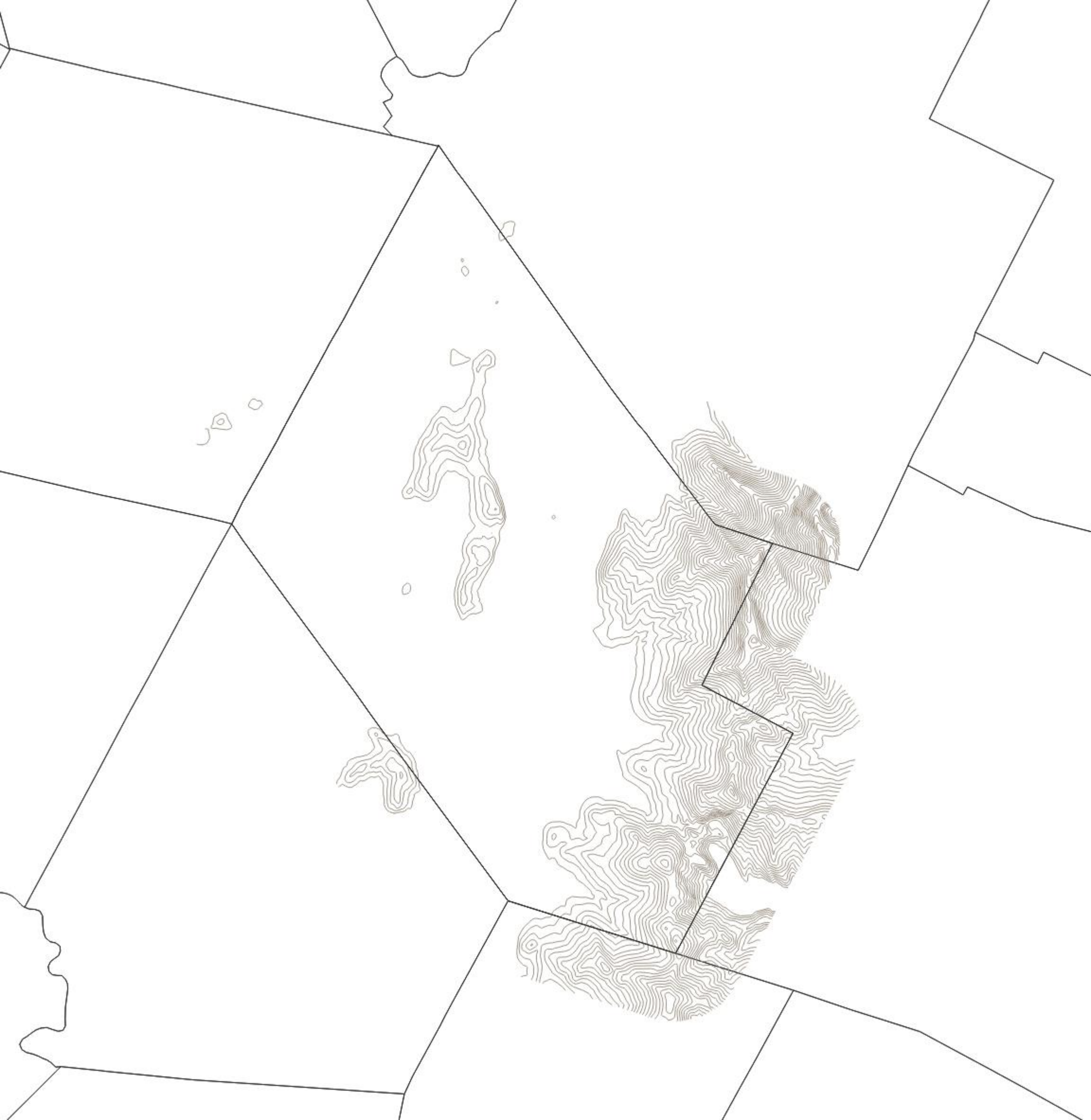
21

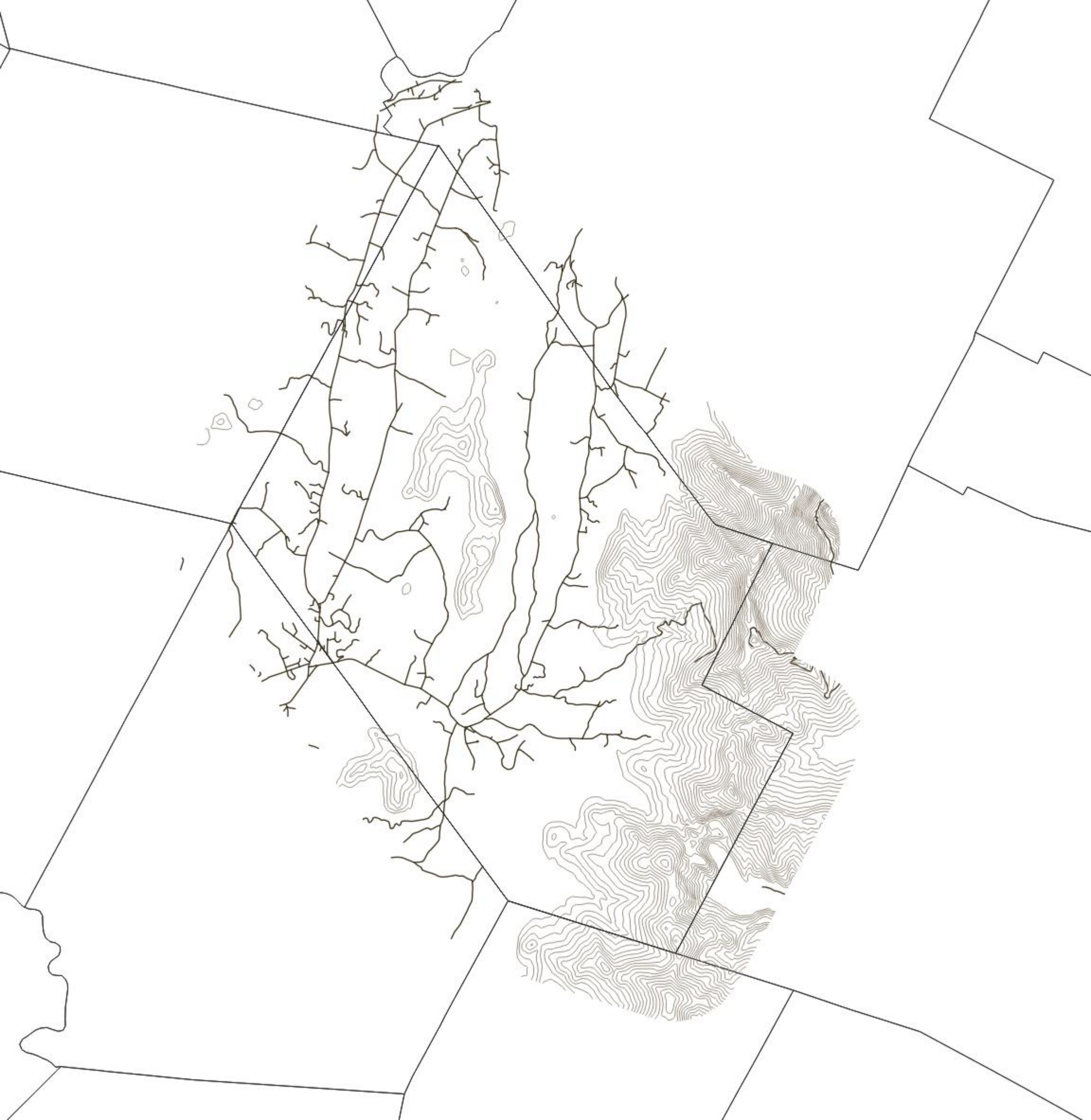
1 For these reasons, it is my recommendation that the Commission condition any
2 approval of the Project on compliance with all the terms and conditions of the April 1,
3 2020 MOU between Davenport Solar, LLC and the Agency.

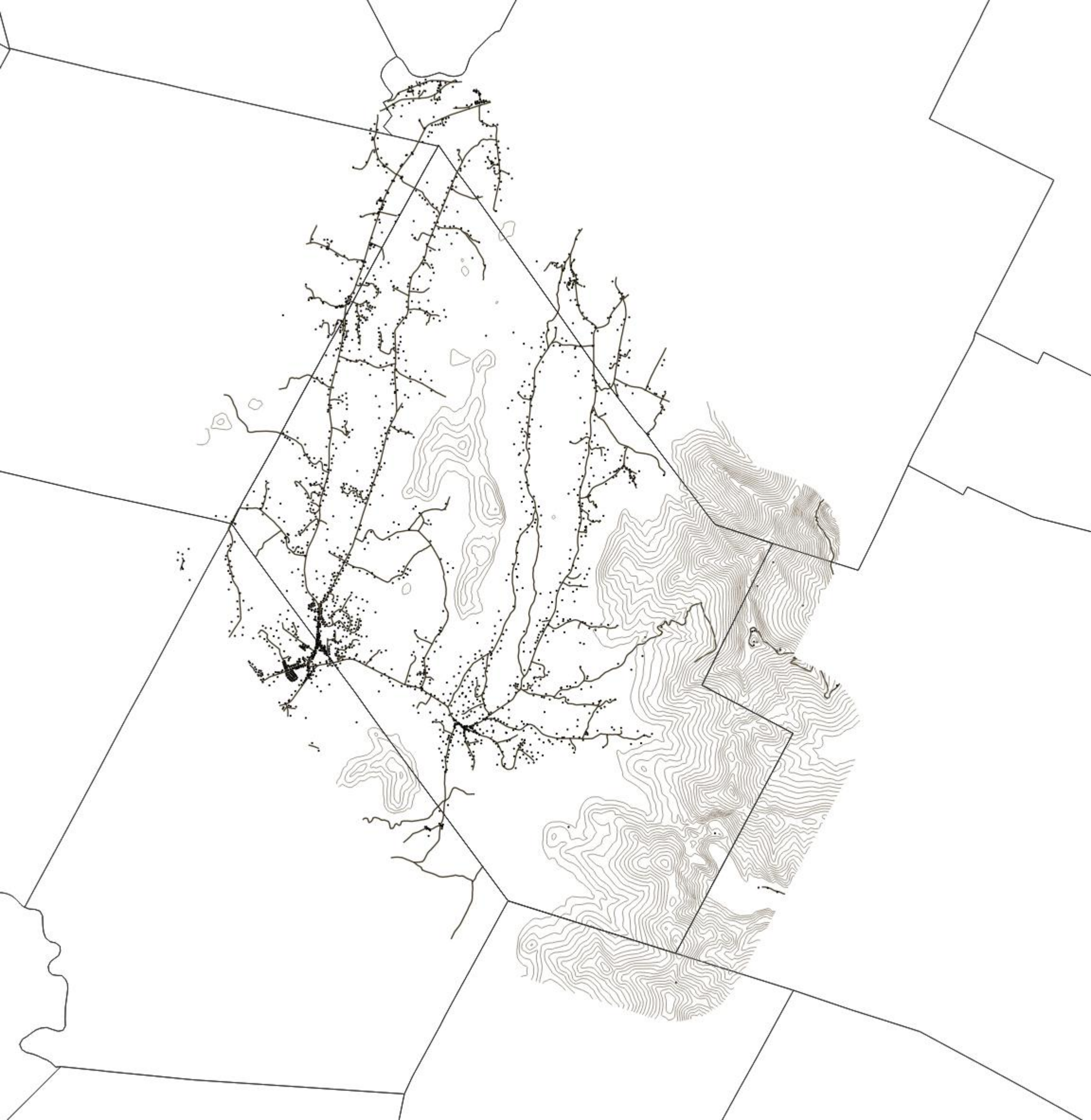
4

5 **Q25. Does this conclude your testimony?**

6 A25. Yes, it does.

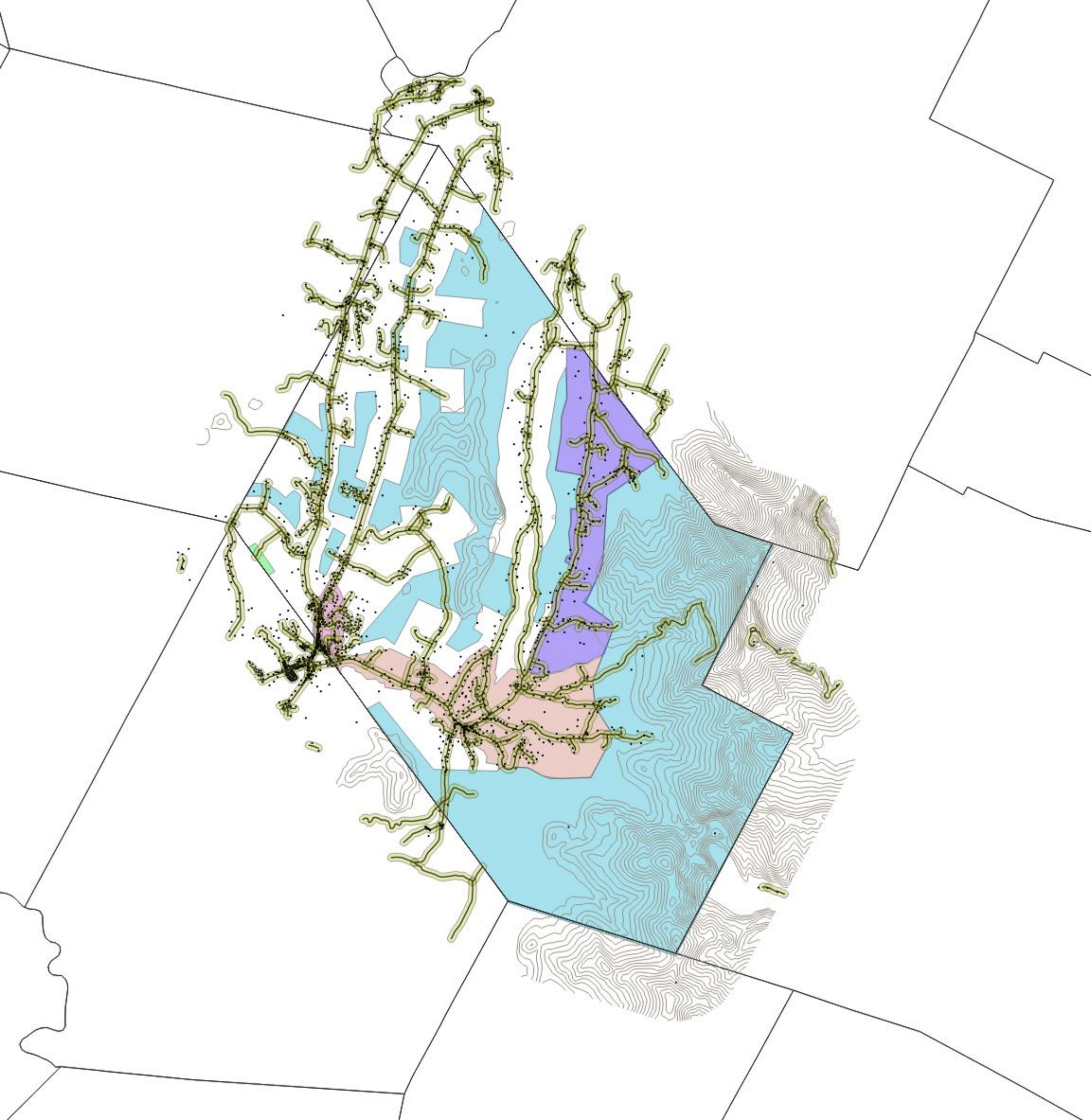


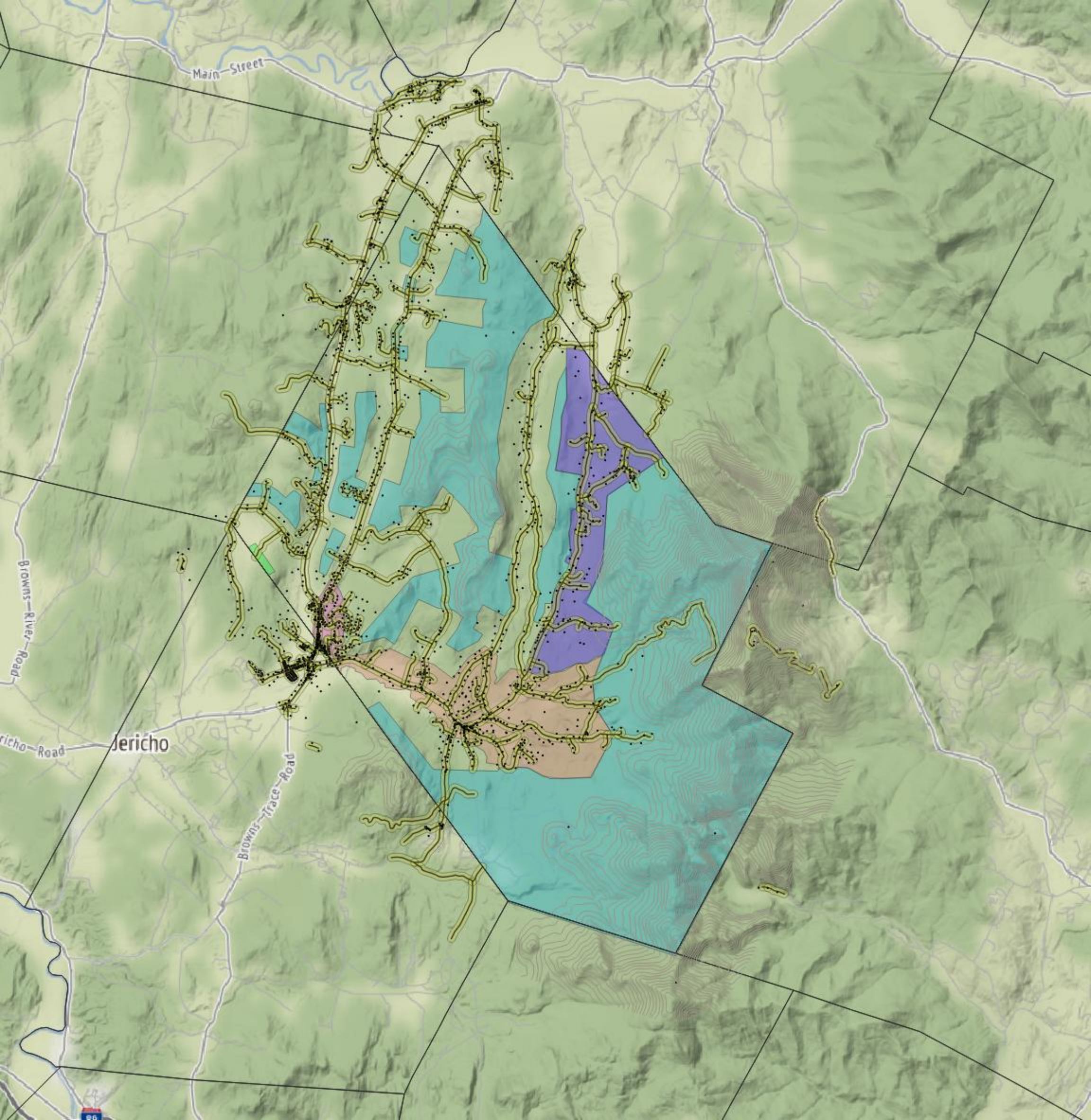












Main Street

Browns River Road

Jericho

Browns Trace Road

90

Vermonters for a Clean Environment
Annette Smith, Executive Director
House Environment & Energy Committee

Feb. 20, 2024

Testimony Links

Underhill Map

<https://map.ccrpcvt.org/underhillmapviewer/>

Danby Town Plan Future Land Use Map, p. 16

https://www.danbyvt.org/_files/ugd/f9b078_2ede4f36e02e4df6b2bd488cc4acf15c.pdf

Act 174 Constraint Layers

[https://vcgi.maps.arcgis.com/home/webmap/viewer.html?
layers=bbbff1931ade4391aa19281e5d2bdaae](https://vcgi.maps.arcgis.com/home/webmap/viewer.html?layers=bbbff1931ade4391aa19281e5d2bdaae)

ACCD Planning Atlas

<http://maps.vermont.gov/ACCD/PlanningAtlas/index.html?viewer=PlanningAtlas>

Vermont Population by Town 8 years ago

<https://www.youtube.com/watch?v=jleP3lq2tNE>

VCE Presentation on High Elevation Developments, Forests, Stormwater, Wetlands, Wildlife to House Natural Resources, Fish & Wildlife Committee, Feb. 14, 2019

[https://legislature.vermont.gov/Documents/2020/WorkGroups/House%20Natural/Bills/
19-0040/Written%20Testimony/Organization%20Recommendations/
W~Annette%20Smith~19-0040,%20Presentation%20on%20High%20Elevation%20Dev
elopments,%20Forests,%20Stormwater,
%20Wetlands%20and%20Wildlife~2-14-2019.pdf](https://legislature.vermont.gov/Documents/2020/WorkGroups/House%20Natural/Bills/19-0040/Written%20Testimony/Organization%20Recommendations/W~Annette%20Smith~19-0040,%20Presentation%20on%20High%20Elevation%20Developments,%20Forests,%20Stormwater,%20Wetlands%20and%20Wildlife~2-14-2019.pdf)

Frank's 3D map of Ludlow

<https://mfs2.github.io/Ludlow/>

Maps of Montpelier and Barre are included in the files, though I didn't show them. They are very interesting to study development patterns as they relate to flooding.