Landslide Susceptibility Maps for Addison County, Vermont
2016

Reference

Van Hoesen, J, Anderson, O., and Duncan, J., 2016, Final Report summarizing the efficacy of GIS-based modeling of landslide susceptibility, Addison County, Vermont: Vermont Geological Survey Technical Report VGTR2016-1.

Copies of this report are available to download from the VGS web site at http://dec.vermont.gov/geological-survey/publication-gis/tech

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Final Report Summarizing the Efficacy of GIS-Based Modeling of Landslide Susceptibility Addison County, Vermont

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1.0 – Executive Summary

During the spring and summer of 2016 we used the protocol developed by Clift and Springston (2012) to model landslide susceptibility for Addison County using historical and recently acquired LIDAR. We used the results of these modeling efforts to identify and digitize areas representing potential landslide hazards but referred to as sensitive areas because many of the identified locations represent gullying or talus slope activity. A total of 766 sensitive locations were identified and 57 of those sites were visited to differentiate between landslides, gullying or talus slopes. The remaining 709 sites still need to be visited and evaluated to improve our understanding of landslide hazard within the county. However we recommend prioritizing site visits at locations closer to population centers and infrastructure.

2.0 – Background

The primary aims of this project were to provide information and guidance necessary for Vermont to meet its goals for mitigation and avoidance of natural hazards, particularly the geologic hazards of landslides, drought and earthquakes, all of which are identified in the 2013 State Hazard Mitigation Plan (HMP).

The HMP Statement of Work contains proposals and actions to:

1) Produce a Phase 1 landslide hazard map for the State of Vermont within a 5 year time frame, a goal which allows towns and regions to quickly implement landslide hazard mitigation in their planning process as defined in the 2013 State Hazard Mitigation Plan.
2) Integrate stream erosion hazard data in the landslide hazard map and produce multi-hazard maps for towns for planning purposes and risk avoidance.
3) Continue to monitor landslide sites in Jeffersonville and Cambridge (Smugglers Notch) Vermont as part of disaster avoidance and monitoring of an existing hazardous site.
4) Coordinate with State drought task force on groundwater issues.

All aspects of this study are commensurate with the goals, strategies and objectives outlined in the HMP and seek to reduce loss of life and property and increase disaster resilience. HMP priorities include (1) serving as a source of information and guidance for local jurisdictions and include detailed information which towns can use in their plans, (2) preparing for impacts related to climate change; and (3) develop public and private partnerships. Landslides and rockfalls were ranked 8 out 18 in a vulnerability assessment based on previous incidents and therefore a more comprehensive inventory of these risks is necessary to help inform the HMP.

A multi-phase protocol for landslide hazard mapping was developed by Clift and Springston (2012) that offers one approach to creating detailed maps highlighting areas sensitive to landslides. The completion of Phase 1 on a statewide basis would allow for identification of existing and historic hazard sites within a reasonable timeframe, allow towns to develop a set of priorities for more detailed work if necessary, and allow more rapid incorporation of landslide data in a town planning process. Phase 1 involves selection of the area of interest, creation of the project in ArcGIS, initial data collection, creation of a landslide database for the site area, photo interpretation, field reconnaissance, and creation of landslide polygons. Bare-earth LIDAR is an integral tool in this process, allowing the hazard analysis to progress more rapidly on a county-wide/statewide basis.

3.0 – Methodology

Using digital mapping, GIS-based modeling and traditional field mapping we completed a Phase 1 landslide hazard mapping assessment described in the *Protocol for Identification of Areas Sensitive to Landslide Hazards in Vermont* (Clift and Springston, 2012) and the Vermont State Hazard Mitigation Plan. These protocols were used to inform LIDAR-based GIS modeling and coupled with photo interpretation of high-resolution imagery NAIP imagery to identify site locations, develop a county-wide landslide database and detailed maps for areas sensitive to landslides within Addison County. These landslide sensitivity maps were also combined with flood hazard data to produce multi-hazard maps for three towns in Addison County including: Bristol, Middlebury and Vergennes. This report summarizes the results of both GIS-based landslide hazards modeling and subsequent field visits within Addison Count and Table 1 summarizes the activities completed and resulting deliverables.

Table 1: Summary of project activities and deliverables.

Performance Measure	Deliverable
▪ Produced a phase 1 prototype landslide map for Addison County following protocols described in the State Hazard Mitigation plan. ▪ Assembled layers and conducted preliminary computer analyses in preparation for field studies and ground-truthing of hazard maps. ▪ Conducted fieldwork to verify preliminary hazard mapping. ▪ Integrated flood hazard information for three towns in Addison County. ▪ Produced final county-wide landslide hazard map as prototype for future work. ▪ Produced three town-scale maps as prototypes for future work.	▪ Progress report on landslide map, database creation and preliminary modeling. ▪ Prototype landslide hazard map for Addison County. ▪ Multi-hazard map for three towns. ▪ GIS for all projects

3.1 – Landslide Hazard Modeling

The GIS modeling occurred during the spring of 2016 to produce preliminary hazard maps and were refined during summer of 2016 following the protocols of **Clift and Springston (2012)**. The preliminary maps needed to be updated because high-resolution LIDAR was only available for approximately 50% of the county until June of 2016. Therefore the final modeling made use of LIDAR data with resolutions of 1.6 meter, 0.7 meter and 10 meter pixels divided into east, central, and west regions (Figure 1). This approach helped address long data processing associated with high-resolution data and also helped differentiate the data based on regions with similar topography. Processing in each region produced six layers characterizing landslide potential that were then reclassified with three categories to aggregate areas of low (values between 0-22), medium (values between 22-27), and high (values between 27-44) landslide risk. The final outputs were used to create a map for each town in Addison County. Maps incorporating LIDAR with different resolutions have appropriate labeling.

The resulting maps were also used in tandem with the LIDAR and high-resolution NAIP imagery to identify and digitize suspected landslide-related features. These polygons were then used to create a map for each town in Addison County, which ultimately informed the subsequent field site visits and the creation of a preliminary county-wide landslide database.

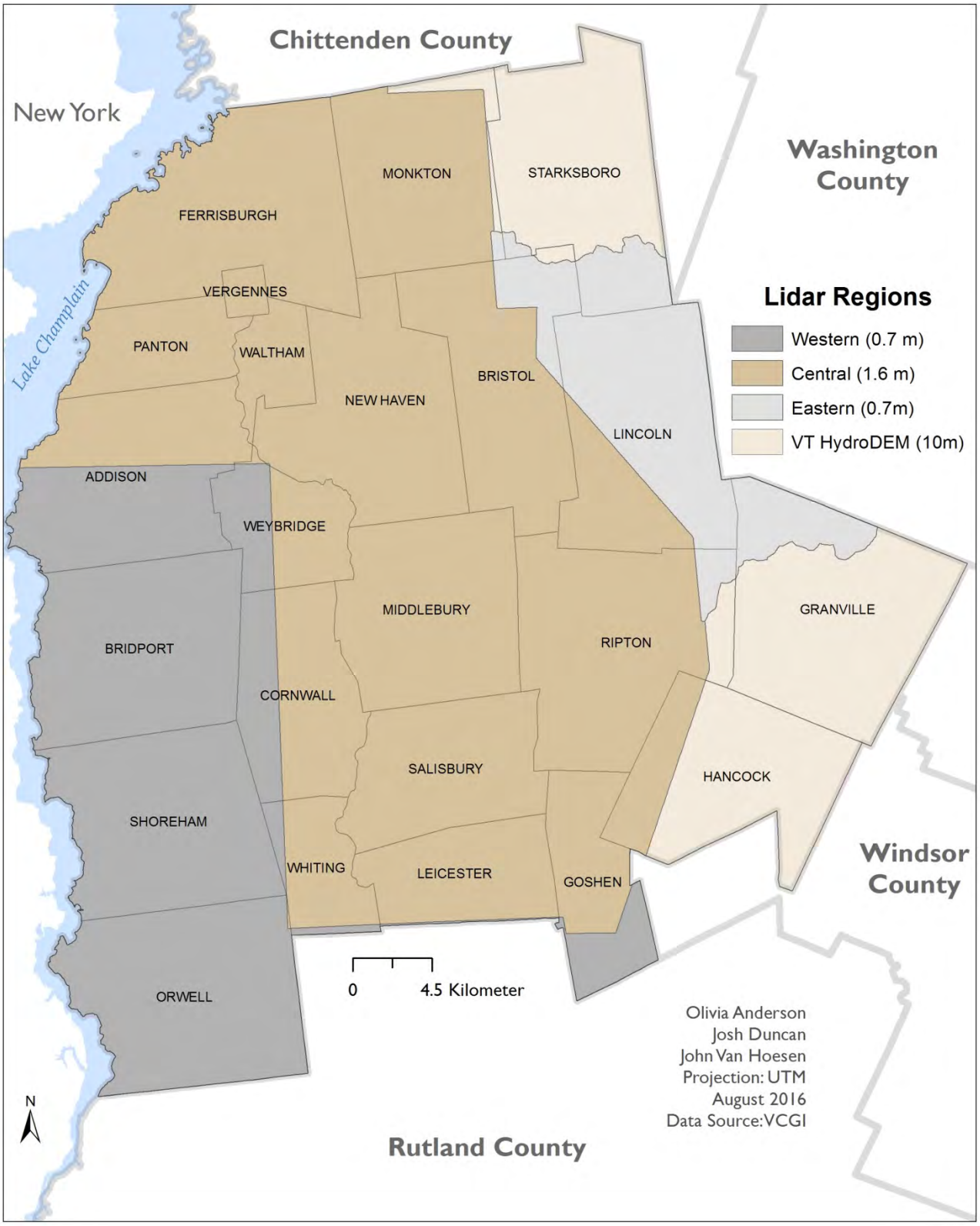


Figure 1: Simplified map depicting the regions used to expedite processing and improve the frequency analysis ratio analysis with corresponding LIDAR resolution.

3.2 – Field Techniques

Field visits throughout the county were determined by the results of the modeling efforts and resulting polygons identifying landslide features. We created a data dictionary using FulcrumApp and translated the Slope Stability Data Sheet developed by Clift and Springston (2012) into a mobile field application (Figure 2). This application helped expedite data collection at the 57 sites visited throughout Addison County (Figure 3). In addition to following the established protocol for quickly evaluating each site, each site was ranked based on whether it presented low, moderate or high risk to transportation or building infrastructure to help prioritize slope failure mitigation.

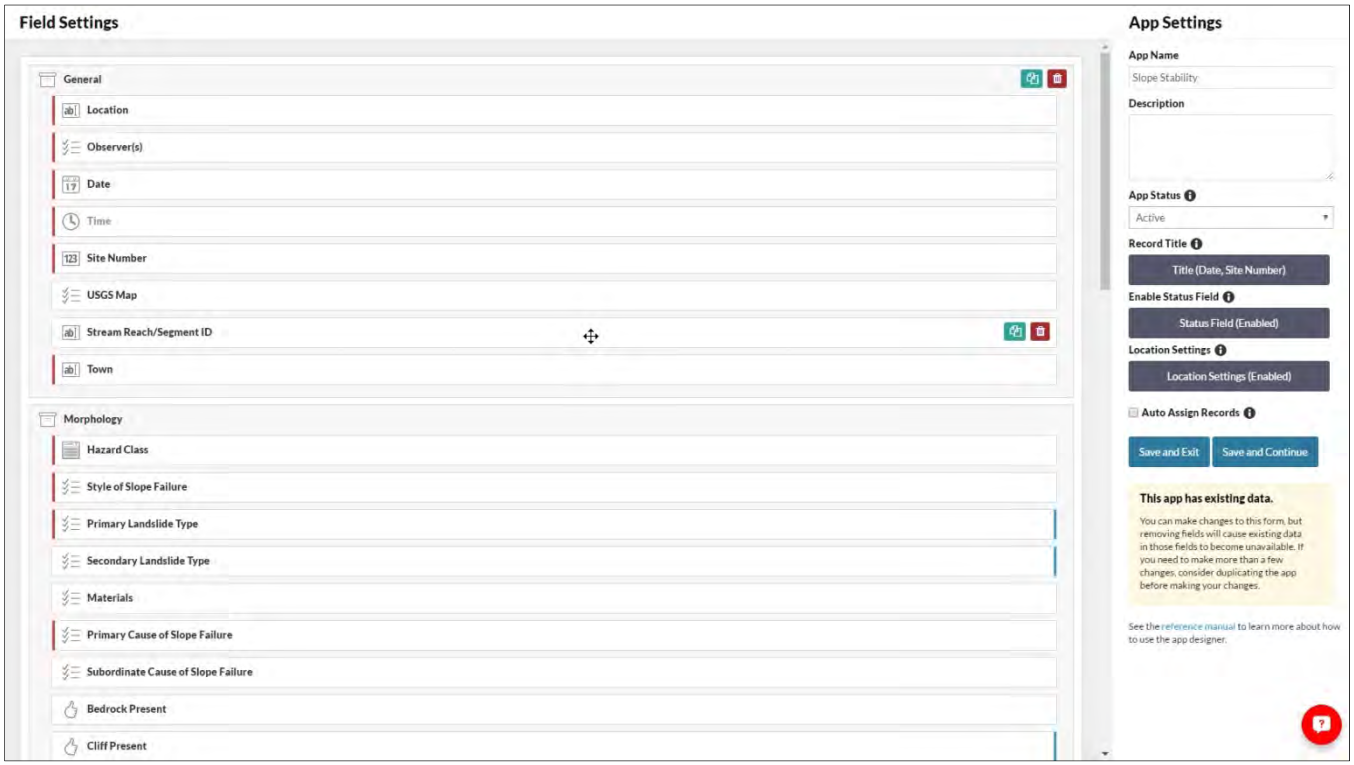


Figure 2: Screenshot of the mobile application created using the FulcrumApp platform.

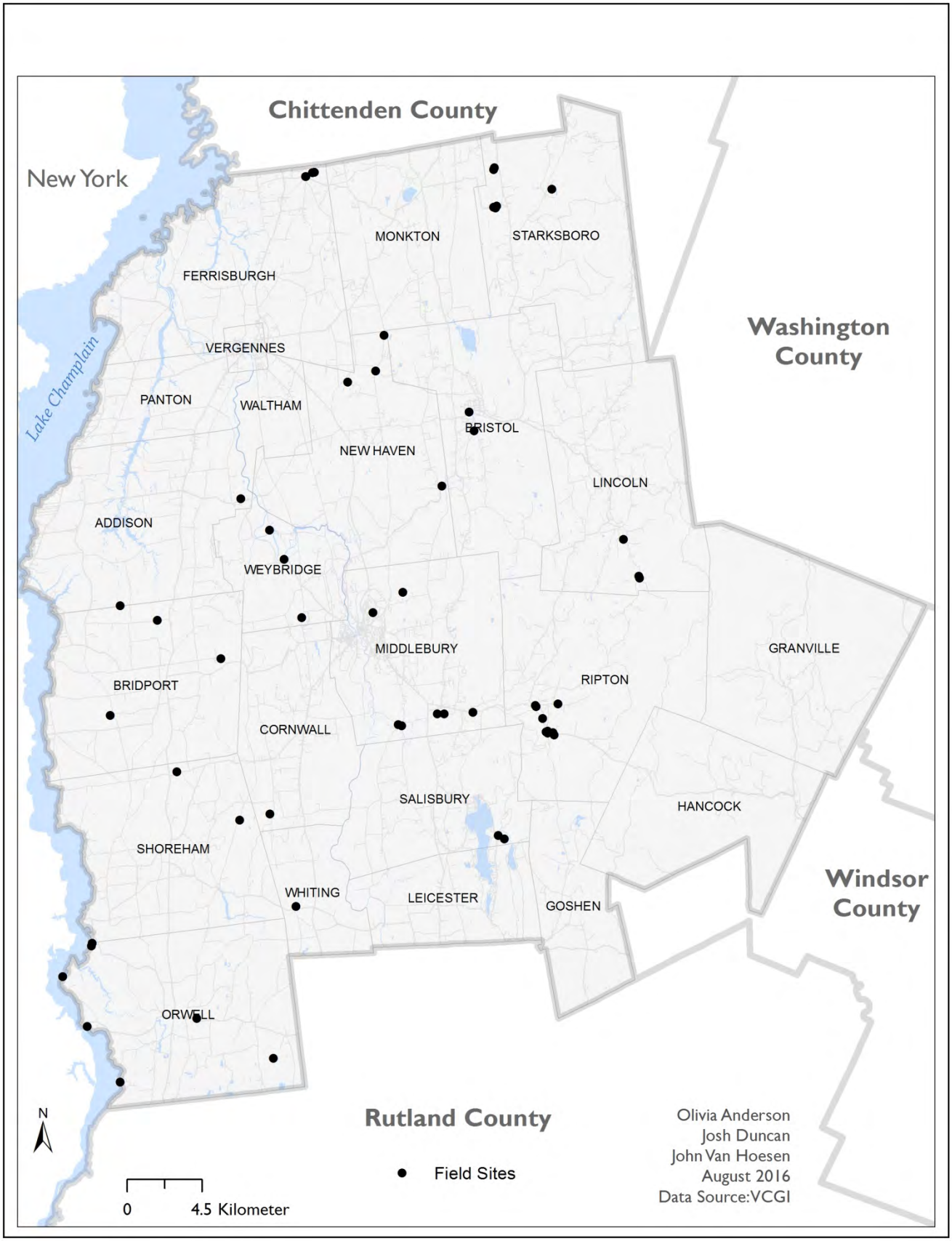


Figure 3: Simplified map of Addison County, VT illustrating field site visits.

3.3 – Frequency Ratio Analysis (FRA)

Following the methodology described by Clift and Springston (2012), layers representing slope, TWI, roughness, hydrologic group, soil type, and distance to streams were created for each region (i.e. - central, east, and west) and masked using the layer depicting identified landslides, including those landslides not visited. Following Phase 3 of the protocol the FRA technique was performed using classifications – summarized in Appendix 8.1 – calculated for each region.

4.0 – Results

4.1 – Landslide Hazard Modeling & Location Mapping

The modeling applied to each region of Addison County produced a continuous raster layer depicting high, moderate and low potential for landslide sensitivity, which was used to help prioritize efforts to digitize 766 polygons interpreted as being susceptible or sensitive to landslide activity (e.g. – Figures 5 and 6). Table 2 summarizes the results of these efforts and Appendix 7.2 and 7.3 include the resulting maps for all towns in Addison County.

4.2 – Landslide Site Visits

Conducting site visits resulted in a preliminary database containing information about 57 landslide localities in Addison County (Figure 4). The most common types of failure were classified as landslides exposed through streambank erosion and gullying and numerous talus slopes (Figures 7 - 10). The most common types of landslides were classified as translational slides, rotational slumps and then fall/topple. Table 2 also includes a hazard class ranking that prioritizes each feature based on the likelihood of affecting transportation or building infrastructure.

Observer(s)	Date	Site Number	USGS Map	Stream Reach/Segment ID	Town	Hazard Class	Style of Slope Failure	Primary Landslide Type	Secondary Landslide Type	Materials	Primary Cause of Slope Failure
Josh Duncan	2016-08-18	1			Lincoln	1	Landslide	Rotational Slump		Earth	Stream Erosion
Josh Duncan, Olivia Anderson	2016-07-27	7			Ripton	0	Landslide	Translational Slide		Earth	Stream Erosion
Josh Duncan, Olivia Anderson	2016-07-27	6			Ripton	3	Landslide	Translational Slide		Earth	Stream Erosion
Josh Duncan, Olivia Anderson, John Van Hoesen	2016-08-10	1			Weybridge	2	Landslide	Translational Slide		Earth	Stream Erosion
Josh Duncan, Olivia Anderson, John Van Hoesen	2016-08-10	3			We bridge	0					
Josh Duncan, Olivia Anderson	2016-07-29	2			Lincoln	1	Landslide	Translational Slide		Earth	Excavation at Toe or on Slope
Josh Duncan, Olivia Anderson	2016-07-29	1			Lincoln	1	Landslide	Translational Slide	Rotational Slump	Rock, Earth	Stream Erosion
Josh Duncan, Olivia Anderson	2016-07-11	1			Addison	2	Landslide-Gully Complex			Earth	Stream Erosion
Josh Duncan, Olivia Anderson	2016-07-27	5			Ripton	0	Landslide	Translational Slide		Rock, Earth	Stream Erosion
Josh Duncan, Olivia Anderson	2016-07-27	4			Ripton	1	Landslide	Translational Slide		Rock, Earth	Stream Erosion
Josh Duncan, Olivia Anderson	2016-07-27	3			Ripton	0	Landslide	Translational Slide		Earth	Stream Erosion
Josh Duncan, Olivia Anderson	2016-07-27	1			Ripton	0	Streambank Erosion (Low bank)			Debris, Earth	Stream Erosion
Josh Duncan, Olivia Anderson	2016-07-27	3			Ripton	0	Streambank Erosion (Low bank)			Rock, Earth	Stream Erosion
Josh Duncan, Olivia Anderson	2016-07-27	2			Ripton	0	Gullying			Debris	Stream Erosion
Josh Duncan, Olivia Anderson	2016-07-27	8			Ripton	0					
Josh Duncan, Olivia Anderson	2016-07-07	1			Starksboro	2	Gullying			Rock, Debris, Earth	Heavy Rainfall

Figure 4: Screenshot of a portion of the resulting database created using the mobile application modeled after the slope stability datasheet.

Table 2: Summary of results from modeling, digitizing and field observations						
Town	**# of Sites Identified**	**# of Visited and Ranked Landslides**	**Hazard Class**			
			No Risk	Low Risk	Moderate Risk	High Risk
Addison	32	2	2	0	0	0
Bridport	40	3	2	0	1	0
Bristol	75	2	0	1	1	0
Cornwall	24	1	1	0	0	0
Ferrisburgh	49	5	0	3	0	**2**
Goshen	20	0	0	0	0	0
Granville	10	10	0	0	0	0
Hancock	7	2	0	0	0	0
Leicester	28	0	0	0	0	0
Lincoln	44	3	3	0	0	0
Middlebury	96	7	1	4	2	0
Monkton	12	0	0	0	0	0
New Haven	26	4	1	2	1	0
Orwell	63	7	6	1	0	0
Panton	5	0	0	0	0	0
Ripton	76	9	7	1	0	**1**
Salisbury	46	2	0	1	1	0
Shoreham	36	2	2	0	0	0
Starksboro	29	6	3	2	1	0
Vergennes	18	0	0	0	0	0
Waltham	6	0	0	0	0	0
Weybridge	24	3	2	0	1	0
Whiting	7	1	0	1	0	0

4.3 – Frequency Ratio Analysis

The FRA provided insight into which ratio class for each parameter was most common with the landslide areas. These parameters included: distance to streams, hydrologic group, roughness, slope, topographic wetness index and soil type. The county was divided into three sections corresponding to the LIDAR coverage depicted in Figure 1, resulting in subtle variations in the most common ratio class. Overall, roughness, distance to streams, and slope appear to be the most effective at isolating those regions susceptible to landslide activity. Table 3 summarizes the most common ratio class for each parameter within each region.

Table 3: Summary of most common ratio classes for each variable used in the FRA

Parameter	Western Region	Central Region	Eastern Region
Distance to Streams	550-750 meters	0-30 meters	0-30 meters
Hydrologic Group	Type B	Type A	Type B
Roughness	18-36	4-7	6-10
Slope	40-50 degrees	50-90 degrees	50-90 degrees
Topographic Wetness Index	12-30	1-3	0-2
Soil Type	Co = Cobbly alluvium	Co = Cobbly alluvium	Ps = Peru sandy

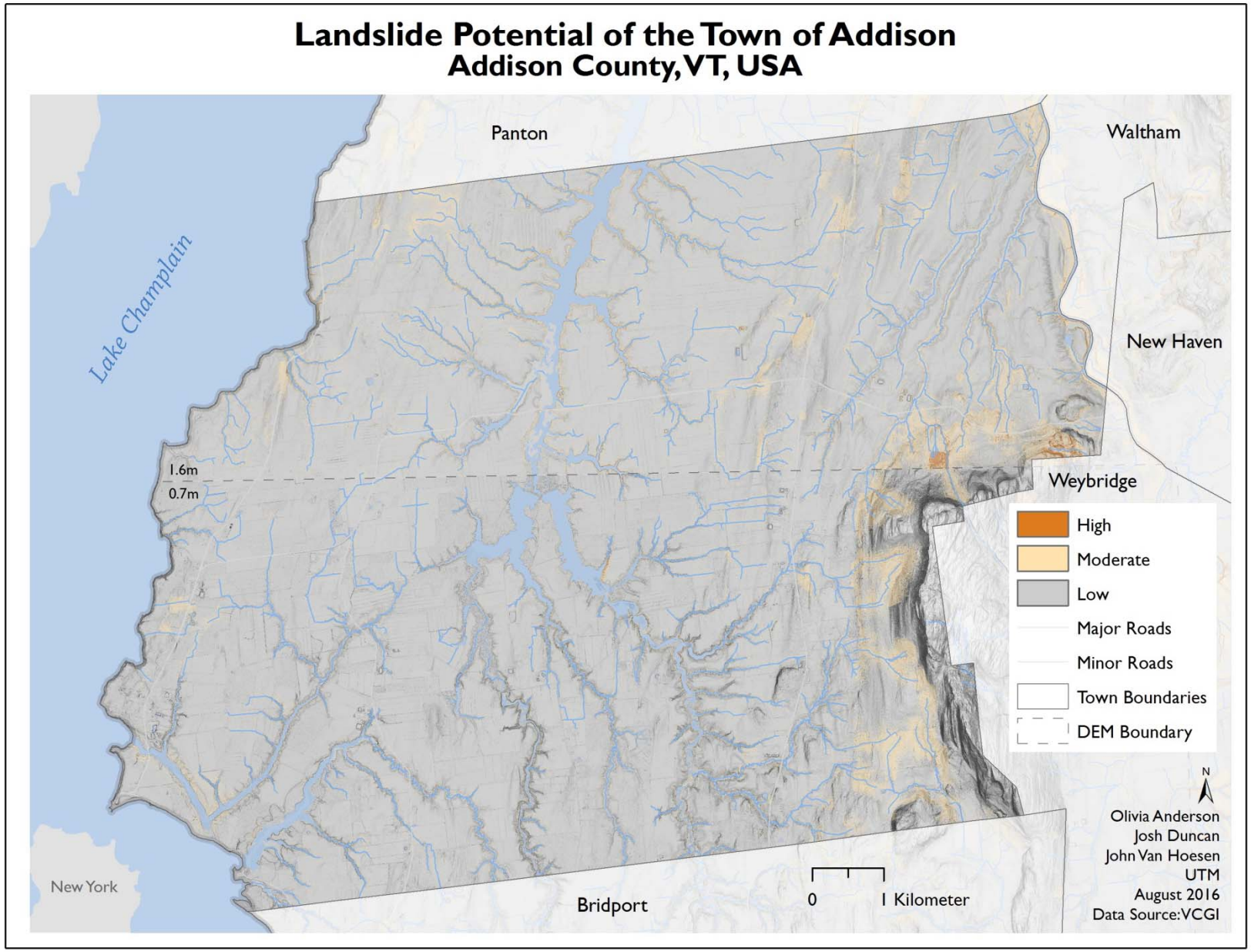


Figure 5: Example map creating through the landslide sensitivity modeling.

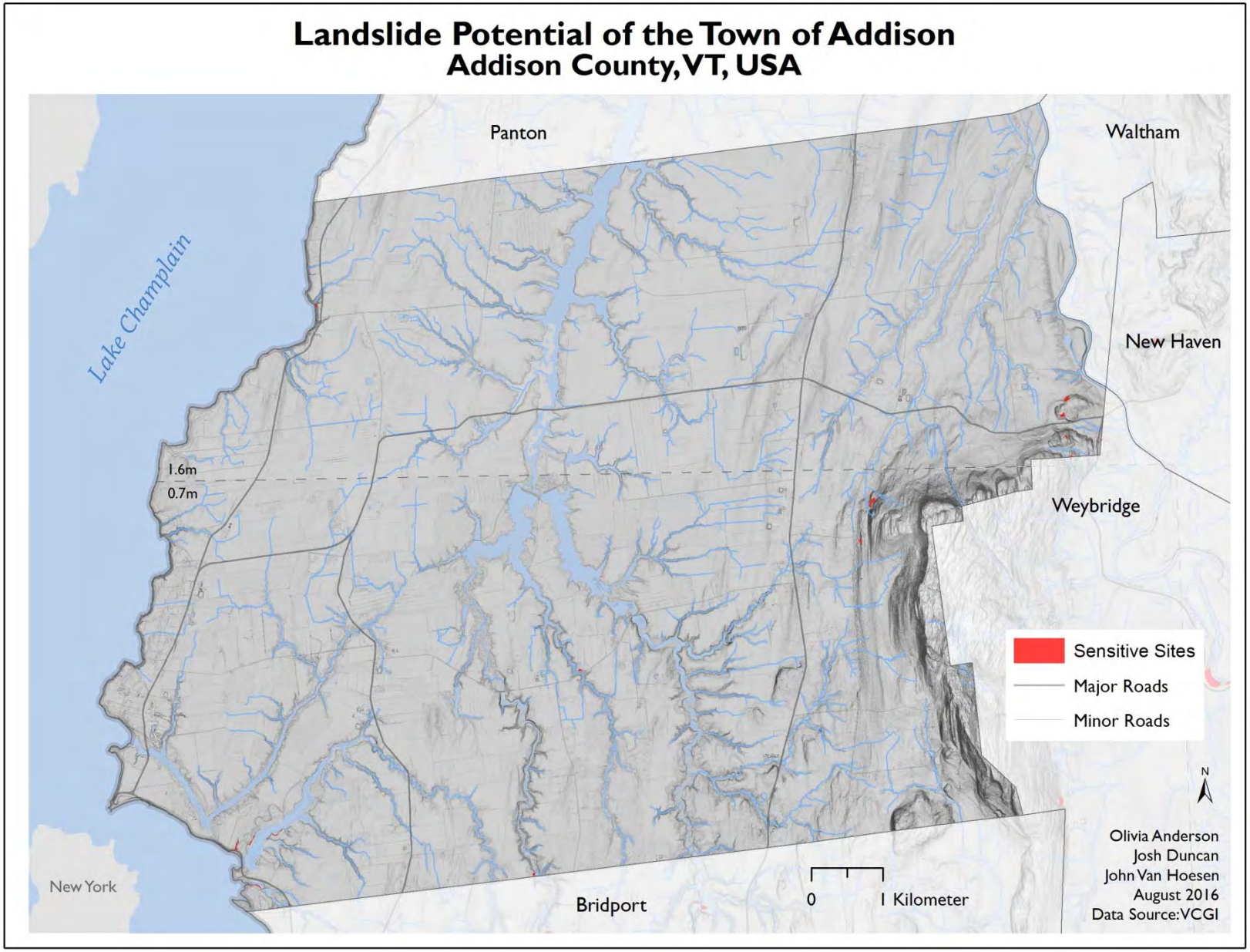


Figure 6: Example map creating through the landslide identification and digitizing efforts.

Figure 7: Example of streambank erosion exposing Quaternary alluvium over clay deposited in Glacial Lake Vermont along the Middlebury River in East Middlebury, VT.

Figure 8: Example of streambank erosion exposing an approximately 40 foot thick section of Quaternary alluvium along the Little Otter Creak in New Haven, VT.

Figure 9: Streambank erosion of remnant ice-contact deposit (~100' high) exposed along the New Haven River in Lincoln, VT.

Figure 10: Example of streambank erosion encroaching on private driveway along the Otter Creek in Weybridge, VT.

5.0 – Discussion

5.1 – Landslide Hazard Modeling & Location Mapping

We found the Clift and Springston (2012) protocol was effective at identifying most areas susceptible to mass failure & gullying. There are a few towns that contain low angle failures at some distance from streams that were not identified. However we recommend its continued use as a rapid assessment tool followed up with reconnaissance site visits. This particular project made use of digital elevation data with three resolutions of 0.7, 1.6 and 10 meters – the latter being too coarse for identifying landslide features. The 0.7 and 1.6 meter LIDAR provided the necessary resolution for calculating slope, TWI, and roughness and producing a derivative slopeshade layers used to identify individual landforms. Alternating between the slopeshade layers and both panchromatic and color aerial imagery – available from VCGI – also helped identify and digitize sensitive areas. We chose to use sensitive or susceptible rather than

5.2 – Site Visits

It is important to clarify that not all the digitized polygons were visited and it is likely that many of the unvisited locations are false positives, suggesting additional fieldwork should be conducted to determine whether they actually represent a susceptible location. Similarly the site visits were conducted using a rapid assessment walking survey approach to increase the number of site visits and improve the spatial distribution of field visits throughout the county. We believe our approach using the Fulcrum mobile application helped expedite data collection in the field and ensure consistency in attribute information within the resulting database.

5.3 – Frequency Ratio Analysis

The topographic wetness index indicates that pixels with similar TWI values should become saturated under similar moisture conditions since they have similar contributing area and slope characteristics. This index also provides a relative way of estimating when individual pixels will become saturated relative to one another. Meaning those pixels with higher values are likely to become saturated before cells with a lower TWI value. The TWI results in this study make sense except in the central region of Addison County where there are a number of cells with negative values (in fact most cells are negative). This is often a function of how TWI is calculated in areas with very steep slopes and is likely an issue with the TWI equation applied to these regions, not the underlying data.

6.0 – References

Clift, A.E. and Springston, G., 2012, Protocol for Identification of Areas Sensitive to Landslide Hazards in Vermont. Report prepared for the Vermont Geological Survey, 102p.

State of Vermont State Hazard Mitigation Plan, 2013, prepared by the Vermont Department of Public Safety, Division of Emergency Management and Homeland Security.

7.0 – **Appendices**

7.1 – Frequency Ratio Analysis Characteristics

Highlighted = highest frequency ratio class for each parameter

Addison County - (East)										
Parameter	**Class #**	**Classes**	**# of pixels in class within landslide areas**	**Total # of landslide pixels within site area**	**% of class pixels within site area**	**# of pixels within class within site area**	**Total # of pixels in site area**	**% of class pixels in site area**	**Frequency Ratio**	**Rounded**
Distance to Stream	1	0 - 30	40257	104526	38.51	43236397	307896201	14.04	2,742.66	2743
	2	30 - 70	33801	104526	32.34	48287865	307896201	15.68	2,061.92	2062
	3	70 - 110	24567	104526	23.50	39774518	307896201	12.92	1,819.40	1819
	4	110 - 150	3391	104526	3.24	33750278	307896201	10.96	295.96	296
	5	150 - 190	892	104526	0.85	29110181	307896201	9.45	90.26	90
	6	190 - 230	138	104526	0.13	24859168	307896201	8.07	16.35	16
	7	230 - 270	1480	104526	1.42	20365771	307896201	6.61	214.06	214
	8	270 - 310	0	104526	0.00	16686005	307896201	5.42	0.00	0
	9	310 - 350	0	104526	0.00	13520078	307896201	4.39	0.00	0
	10	350 - 600	0	104526	0.00	34322036	307896201	11.15	0.00	0
	11	600 - 900	0	104526	0.00	3816271	307896201	1.24	0.00	0
	12	900 - 1100	0	104526	0.00	167633	307896201	0.05	0.00	0
Hydrologic Group	1	A	6823	104513	6.53	27576886	292844925	9.42	693.26	693
	2	B	79371	104513	75.94	142436852	292844925	48.64	1,561.37	1561
	3	C	0	104513	0.00	6951602	292844925	2.37	0.00	0
	4	D/Water	18319	104513	17.53	115879585	292844925	39.57	442.96	443

Addison County - (East)										
Parameter	**Class #**	**Classes**	**# of pixels in class within landslide areas**	**Total # of landslide pixels within site area**	**% of class pixels within site area**	**# of pixels within class within site area**	**Total # of pixels in site area**	**% of class pixels in site area**	**Frequency Ratio**	**Rounded**
Roughness	1	6 - 10	573	104526	0.55	488816	314023899	0.16	3,521.66	3522
	2	5 - 6	3823	104526	3.66	5678391	314023899	1.81	2,022.63	2023
	3	4 - 5	3239	104526	3.10	6266658	314023899	2.00	1,552.79	1553
	4	3 - 4	6049	104526	5.79	13631678	314023899	4.34	1,333.13	1333
	5	2 - 3	12022	104526	11.50	30605032	314023899	9.75	1,180.11	1180
	6	10 - 32	23424	104526	22.41	66806468	314023899	21.27	1,053.37	1053
	7	1 - 2	35204	104526	33.68	115377609	314023899	36.74	916.66	917
	8	0 - 1	20192	104526	19.32	75169247	314023899	23.94	807.01	807
Slope	1	50 - 90	5718	104526	5.47	525339	313882247	0.17	32,684.88	32685
	2	40 - 50	12485	104526	11.94	2708500	313882247	0.86	13,842.10	13842
	3	30 - 40	47662	104526	45.60	15943470	313882247	5.08	8,977.01	8977
	4	20 - 30	24670	104526	23.60	56638343	313882247	18.04	1,307.98	1308
	5	10 - 20	9465	104526	9.06	107466786	313882247	34.24	264.48	264
	6	0 - 10	4526	104526	4.33	130599809	313882247	41.61	104.07	104
TWI	1	8 - 10	4	104099	0.00	261689	303143710	0.09	44.51	45
	2	6 - 8	845	104099	0.81	4829336	303143710	1.59	509.53	510
	3	4 - 6	1836	104099	1.76	12739100	303143710	4.20	419.70	420
	4	2 - 4	7544	104099	7.25	40027209	303143710	13.20	548.84	549
	5	15 - 30	23991	104099	23.05	84195720	303143710	27.77	829.77	830
	6	10 - 15	52074	104099	50.02	117618001	303143710	38.80	1,289.29	1289
	7	0 - 2	17434	104099	16.75	43360245	303143710	14.30	1,170.87	1171
	8	-4 - 0	371	104099	0.36	112410	303143710	0.04	9,611.05	9611

Addison County - (East)										
Parameter	Class #	Classes	# of pixels in class within landslide areas	Total # of landslide pixels within site area	% of class pixels within site area	# of pixels within class within site area	Total # of pixels in site area	% of class pixels in site area	Frequency Ratio	Rounded
Soil Type	1	Ad	0	104526	0.00	1053008	313865940	0.34	0.00	0
	2	Am	0	104526	0.00	225853	313865940	0.07	0.00	0
	3	As	0	104526	0.00	476881	313865940	0.15	0.00	0
	4	Be	0	104526	0.00	10635237	313865940	3.39	0.00	0
	5	Bs	22228	104526	21.27	1.29E+08	313865940	41.20	516.13	516
	6	Ca	0	104526	0.00	1475558	313865940	0.47	0.00	0
	7	Cb	0	104526	0.00	19511582	313865940	6.22	0.00	0
	8	Cl	0	104526	0.00	519832	313865940	0.17	0.00	0
	9	Cn	0	104526	0.00	14209	313865940	0.00	0.00	0
	10	Co	0	104526	0.00	472463	313865940	0.15	0.00	0
	11	Ct	0	104526	0.00	7373534	313865940	2.35	0.00	0
	12	Da	0	104526	0.00	1413728	313865940	0.45	0.00	0
	13	Ds	0	104526	0.00	48141	313865940	0.02	0.00	0
	14	Fa	0	104526	0.00	83668	313865940	0.03	0.00	0
	15	Gp	0	104526	0.00	57993	313865940	0.02	0.00	0
	16	Hh	0	104526	0.00	9447	313865940	0.00	0.00	0
	17	Le	0	104526	0.00	794594	313865940	0.25	0.00	0
	18	Lf	0	104526	0.00	82398	313865940	0.03	0.00	0
	19	Lm	0	104526	0.00	1393471	313865940	0.44	0.00	0
	20	Lx	10714	104526	10.25	67130732	313865940	21.39	479.24	479
	21	Mn	0	104526	0.00	208035	313865940	0.07	0.00	0
	22	Mv	0	104526	0.00	2143486	313865940	0.68	0.00	0
	23	Na	0	104526	0.00	447959	313865940	0.14	0.00	0

24	Nd	0	104526	0.00	281964	313865940	0.09	0.00	0
25	Pe	0	104526	0.00	4932981	313865940	1.57	0.00	0
26	Ps	7550	104526	7.22	25186508	313865940	8.02	900.12	900
27	Ra	0	104526	0.00	58449	313865940	0.02	0.00	0
28	Rk	13	104526	0.01	20488734	313865940	6.53	1.91	2
29	Sa	57143	104526	54.67	1549022	313865940	0.49	110,770.80	110771
30	St	6103	104526	5.84	13423223	313865940	4.28	1,365.23	1365
31	W	55	104526	0.05	369467	313865940	0.12	447.00	447
32	Wa	720	104526	0.69	2169907	313865940	0.69	996.35	996
33	Wo	0	104526	0.00	515362	313865940	0.16	0.00	0

Addison County - (Central)										
Parameter	**Class #**	**Classes**	**# of pixels in class within landslide areas**	**Total # of landslide pixels within site area**	**% of class pixels within site area**	**# of pixels within class within site area**	**Total # of pixels in site area**	**% of class pixels in site area**	**Frequency Ratio**	**Rounded**
Distance to Stream	1	0 - 30	33306	62753	53.07	61665290	422404019	14.60	3,635.59	3636
	2	30 - 70	17118	62753	27.28	69536906	422404019	16.46	1,657.03	1657
	3	70 - 120	4874	62753	7.77	71920016	422404019	17.03	456.17	456
	4	120 -180	1918	62753	3.06	66452735	422404019	15.73	194.28	194
	5	180 -250	2518	62753	4.01	54906871	422404019	13.00	308.69	309
	6	250 - 330	1618	62753	2.58	40102634	422404019	9.49	271.58	272
	7	330 - 420	1401	62753	2.23	26562568	422404019	6.29	355.03	355
	8	420 - 520	0	62753	0.00	15405133	422404019	3.65	0.00	0
	9	520 - 630	0	62753	0.00	7952883	422404019	1.88	0.00	0
	10	630 - 750	0	62753	0.00	4060862	422404019	0.96	0.00	0
	11	750 - 1000	0	62753	0.00	3101902	422404019	0.73	0.00	0
	12	1000 - 1400	0	62753	0.00	736219	422404019	0.17	0.00	0
Hydrologic Group	1	A	8774	55637	15.77	42008434	401816259	10.45	1,508.43	1508
	2	B	14652	55637	26.33	102167351	401816259	25.43	1,035.73	1036
	3	C	6217	55637	11.17	49224890	401816259	12.25	912.14	912
	4	D/Water	25994	55637	46.72	208415584	401816259	51.87	900.76	901

Addison County - (Central)										
Parameter	**Class #**	**Classes**	**# of pixels in class within landslide areas**	**Total # of landslide pixels within site area**	**% of class pixels within site area**	**# of pixels within class within site area**	**Total # of pixels in site area**	**% of class pixels in site area**	**Frequency Ratio**	**Rounded**
Roughness	1	7 - 18	34	62753	0.05	12331	422524339	0.00	18,565.12	18565
	2	4 - 7	5252	62753	8.37	1756822	422524339	0.42	20,128.63	20129
	3	2 - 4	13092	62753	20.86	9024782	422524339	2.14	9,767.57	9768
	4	18 - 33	21443	62753	34.17	37433056	422524339	8.86	3,856.98	3857
	5	1.5 - 2	7298	62753	11.63	28792880	422524339	6.81	1,706.62	1707
	6	1 - 1.5	7762	62753	12.37	55034894	422524339	13.03	949.63	950
	7	0.5 - 1	6157	62753	9.81	119203816	422524339	28.21	347.77	348
	8	0 - 0.5	1715	62753	2.73	171265758	422524339	40.53	67.42	67
Slope	1	50 - 90	1893	62753	3.02	482818	422524175	0.11	26,398.80	26399
	2	40 - 50	3335	62753	5.31	1603130	422524175	0.38	14,006.97	14007
	3	30 - 40	8026	62753	12.79	6740972	422524175	1.60	8,016.66	8017
	4	20 - 30	13757	62753	21.92	22456166	422524175	5.31	4,124.82	4125
	5	10 - 20	16604	62753	26.46	64708021	422524175	15.31	1,727.71	1728
	6	0 - 10	19138	62753	30.50	326533068	422524175	77.28	394.63	395
TWI	1	9 - 11	165	59119	0.28	1148730	384350552	0.30	933.83	934
	2	7 - 9	704	59119	1.19	6491909	384350552	1.69	705.02	705
	3	5 - 7	673	59119	1.14	15047542	384350552	3.92	290.77	291
	4	3 - 5	2115	59119	3.58	52678581	384350552	13.71	261.02	261
	5	15 - 33	8343	59119	14.11	143438971	384350552	37.32	378.14	378
	6	11 - 15	28940	59119	48.95	149024256	384350552	38.77	1,262.53	1263
	7	1 - 3	17938	59119	30.34	16480176	384350552	4.29	7,076.40	7076
	8	-2 - 1	241	59119	0.41	40387	384350552	0.01	38,795.01	38795

Addison County - Central)										
Parameter	Class #	Classes	# of pixels in class within landslide areas	Total # of landslide pixels within site area	% of class pixels within site area	# of pixels within class within site area	Total # of pixels in site area	% of class pixels in site area	Frequency Ratio	Rounded
Soil Type	1	Ad	869	62753	1.38	3795068	430081988	0.88	1,569.34	1569
	2	Am	0	62753	0.00	3776800	430081988	0.88	0.00	0
	3	As	0	62753	0.00	5093092	430081988	1.18	0.00	0
	4	Be	822	62753	1.31	6007015	430081988	1.40	937.84	938
	5	Bs	9226	62753	14.70	77386567	430081988	17.99	817.08	817
	6	Ca	0	62753	0.00	385585	430081988	0.09	0.00	0
	7	Cb	191	62753	0.30	8674854	430081988	2.02	150.90	151
	8	Cn	0	62753	0.00	1251258	430081988	0.29	0.00	0
	9	Co	2527	62753	4.03	195492	430081988	0.05	88,591.70	88592
	10	Ct	4281	62753	6.82	14112432	430081988	3.28	2,079.03	2079
	11	Cv	6	62753	0.01	3276554	430081988	0.76	12.55	13
	12	Cw	148	62753	0.24	41299936	430081988	9.60	24.56	25
	13	Da	973	62753	1.55	854303	430081988	0.20	7,805.80	7806
	14	Dc	0	62753	0.00	588734	430081988	0.14	0.00	0
	15	Ds	0	62753	0.00	194132	430081988	0.05	0.00	0
	16	El	2969	62753	4.73	5285626	430081988	1.23	3,849.73	3850
	17	Fa	4409	62753	7.03	22294942	430081988	5.18	1,355.35	1355
	18	Fd	0	62753	0.00	579312	430081988	0.13	0.00	0
	19	Fn	0	62753	0.00	1714407	430081988	0.40	0.00	0
	20	Fw	0	62753	0.00	1340371	430081988	0.31	0.00	0
	21	Gp	0	62753	0.00	192253	430081988	0.04	0.00	0
	22	Hh	1932	62753	3.08	1843933	430081988	0.43	7,180.90	7181
	23	Le	768	62753	1.22	2705927	430081988	0.63	1,945.19	1945

24	Lf	589	62753	0.94	2508084	430081988	0.58	1,609.50	1609
25	Lh	99	62753	0.16	7515642	430081988	1.75	90.28	90
26	Lk	720	62753	1.15	2774557	430081988	0.65	1,778.51	1779
27	Lm	0	62753	0.00	79941	430081988	0.02	0.00	0
28	Lx	320	62753	0.51	13508702	430081988	3.14	162.35	162
29	Ma	0	62753	0.00	282390	430081988	0.07	0.00	0
30	Mn	0	62753	0.00	1969055	430081988	0.46	0.00	0
31	Mr	2184	62753	3.48	5070934	430081988	1.18	2,951.76	2952
32	Mv	0	62753	0.00	19427158	430081988	4.52	0.00	0
33	Na	0	62753	0.00	599489	430081988	0.14	0.00	0
34	Nd	0	62753	0.00	676456	430081988	0.16	0.00	0
35	Ne	0	62753	0.00	6510800	430081988	1.51	0.00	0
36	Ns	1315	62753	2.10	5601305	430081988	1.30	1,608.99	1609
37	Pe	0	62753	0.00	535593	430081988	0.12	0.00	0
38	Ps	1569	62753	2.50	16988851	430081988	3.95	632.96	633
39	Qu	0	62753	0.00	70861	430081988	0.02	0.00	0
40	Ra	0	62753	0.00	5136555	430081988	1.19	0.00	0
41	Rk	4589	62753	7.31	19607132	430081988	4.56	1,604.06	1604
42	RL	0	62753	0.00	18889	430081988	0.00	0.00	0
43	Sa	0	62753	0.00	443800	430081988	0.10	0.00	0
44	St	2243	62753	3.57	3079535	430081988	0.72	4,991.84	4992
45	Sw	108	62753	0.17	8138980	430081988	1.89	90.94	91
46	Vg	17156	62753	27.34	93886784	430081988	21.83	1,252.36	1252
47	Vr	61	62753	0.10	1173902	430081988	0.27	356.14	356
48	W	2134	62753	3.40	7294587	430081988	1.70	2,004.98	2005
49	Wa	408	62753	0.65	1540889	430081988	0.36	1,814.70	1815

	50	Wo	137	62753	0.22	2792524	430081988	0.65	336.23	336

Addison County - (West)

Parameter	Class #	Classes	# of pixels in class within landslide areas	Total # of landslide pixels within site area	% of class pixels within site area	# of pixels within class within site area	Total # of pixels in site area	% of class pixels in site area	Frequency Ratio	Rounded
Distance to Stream	1	0 - 30	51061	153642	33.23	141696170	975355311	14.53	2,287.62	2288
	2	30 - 70	15663	153642	10.19	162837913	975355311	16.70	610.62	611
	3	70 - 110	9820	153642	6.39	138657106	975355311	14.22	449.60	450
	4	110 - 150	10110	153642	6.58	117450464	975355311	12.04	546.45	546
	5	150 - 190	15156	153642	9.86	97181015	975355311	9.96	990.05	990
	6	190 - 230	12644	153642	8.23	78768234	975355311	8.08	1,019.03	1019
	7	230 - 270	10216	153642	6.65	62437300	975355311	6.40	1,038.70	1039
	8	270 - 310	5604	153642	3.65	48157694	975355311	4.94	738.73	739
	9	310 - 350	2661	153642	1.73	36877159	975355311	3.78	458.08	458
	10	350 - 550	16647	153642	10.83	79344002	975355311	8.13	1,331.91	1332
	11	550 - 750	3828	153642	2.49	10558297	975355311	1.08	2,301.61	2302
	12	750 - 1400	232	153642	0.15	1389957	975355311	0.14	1,059.59	1060
Hydrologic Group	1	A	536	140666	0.38	18795284	946365705	1.99	191.86	192
	2	B	21074	140666	14.98	81064754	946365705	8.57	1,748.98	1749
	3	C	12017	140666	8.54	73496103	946365705	7.77	1,100.02	1100
	4	D/Water	107039	140666	76.09	773009564	946365705	81.68	931.59	932

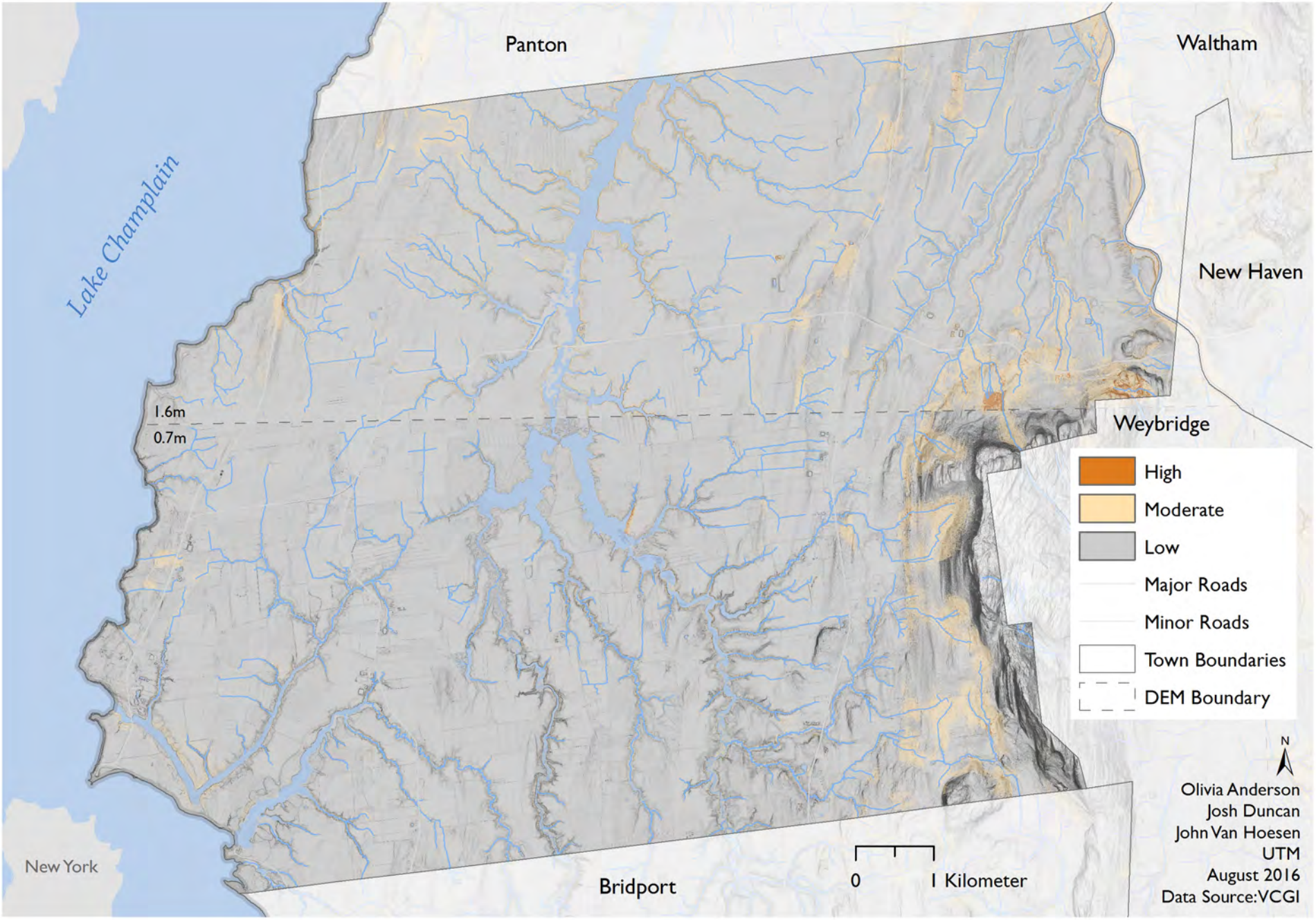
Addison County - (West)										
Parameter	**Class #**	**Classes**	**# of pixels in class within landslide areas**	**Total # of landslide pixels within site area**	**% of class pixels within site area**	**# of pixels within class within site area**	**Total # of pixels in site area**	**% of class pixels in site area**	**Frequency Ratio**	**Rounded**
Roughness	1	18 - 36	83	153642	0.05	15833	978707106	0.00	33,393.17	33393
	2	7 - 18	7419	153642	4.83	3328035	978707106	0.34	14,200.39	14200
	3	4 - 7	21585	153642	14.05	20736302	978707106	2.12	6,630.76	6631
	4	2 - 4	52345	153642	34.07	118398775	978707106	12.10	2,816.25	2816
	5	1.5 - 2	23330	153642	15.18	96940400	978707106	9.90	1,533.04	1533
	6	1 - 1.5	25300	153642	16.47	171952113	978707106	17.57	937.25	937
	7	0.5 - 1	19057	153642	12.40	340311987	978707106	34.77	356.71	357
	8	0 - 0.5	4523	153642	2.94	227023661	978707106	23.20	126.91	127
Slope	1	50 - 90	3613	153640	2.35	604524	978432592	0.06	38,061.07	38061
	2	40 - 50	11490	153640	7.48	1854267	978432592	0.19	39,461.57	39462
	3	30 - 40	22253	153640	14.48	10458598	978432592	1.07	13,550.08	13550
	4	20 - 30	43124	153640	28.07	40108721	978432592	4.10	6,847.10	6847
	5	10 - 20	41585	153640	27.07	134581188	978432592	13.75	1,967.79	1968
	6	0 - 10	31575	153640	20.55	790825294	978432592	80.83	254.27	254
TWI	1	12 - 30	493	145849	0.34	83117	885931126	0.01	36,029.11	36029
	2	10 - 12	28610	145849	19.62	67615938	885931126	7.63	2,570.19	2570
	3	8 - 10	67392	145849	46.21	388557353	885931126	43.86	1,053.54	1054
	4	6 - 8	34172	145849	23.43	258255596	885931126	29.15	803.74	804
	5	4 - 6	10373	145849	7.11	112445411	885931126	12.69	560.35	560
	6	2 - 4	3506	145849	2.40	39644910	885931126	4.47	537.18	537
	7	0 - 2	806	145849	0.55	13168511	885931126	1.49	371.79	372
	8	-3 - 0	497	145849	0.34	6160290	885931126	0.70	490.06	490

Addison County - West)										
Parameter	**Class #**	**Classes**	**# of pixels in class within landslide areas**	**Total # of landslide pixels within site area**	**% of class pixels within site area**	**# of pixels within class within site area**	**Total # of pixels in site area**	**% of class pixels in site area**	**Frequency Ratio**	**Rounded**
Soil Type	1	Ad	536	153641	0.35	606086	978297057	0.06	5,631.11	5631
	2	Am	0	153641	0.00	4391680	978297057	0.45	0.00	0
	3	As	133	153641	0.09	3978475	978297057	0.41	212.86	213
	4	Be	0	153641	0.00	303427	978297057	0.03	0.00	0
	5	Bs	0	153641	0.00	24632448	978297057	2.52	0.00	0
	6	Ca	0	153641	0.00	151712	978297057	0.02	0.00	0
	7	Cb	0	153641	0.00	1035065	978297057	0.11	0.00	0
	8	Cn	0	153641	0.00	37186	978297057	0.00	0.00	0
	9	Co	0	153641	0.00	61337	978297057	0.01	0.00	0
	10	Ct	0	153641	0.00	3368863	978297057	0.34	0.00	0
	11	Cv	13458	153641	8.76	20514434	978297057	2.10	4,177.19	4177
	12	Cw	727	153641	0.47	1.22E+08	978297057	12.47	37.94	38
	13	Da	0	153641	0.00	32745	978297057	0.00	0.00	0
	14	Dc	0	153641	0.00	5879537	978297057	0.60	0.00	0
	15	Ds	0	153641	0.00	10805190	978297057	1.10	0.00	0
	16	El	4798	153641	3.12	3836923	978297057	0.39	7,962.34	7962
	17	Fa	20227	153641	13.17	65836987	978297057	6.73	1,956.25	1956
	18	Fd	4833	153641	3.15	23549569	978297057	2.41	1,306.76	1307
	19	Fn	2036	153641	1.33	3224574	978297057	0.33	4,020.40	4020
	20	Fw	1219	153641	0.79	4524579	978297057	0.46	1,715.49	1715
	21	Gp	0	153641	0.00	25912	978297057	0.00	0.00	0
	22	Hh	0	153641	0.00	333309	978297057	0.03	0.00	0

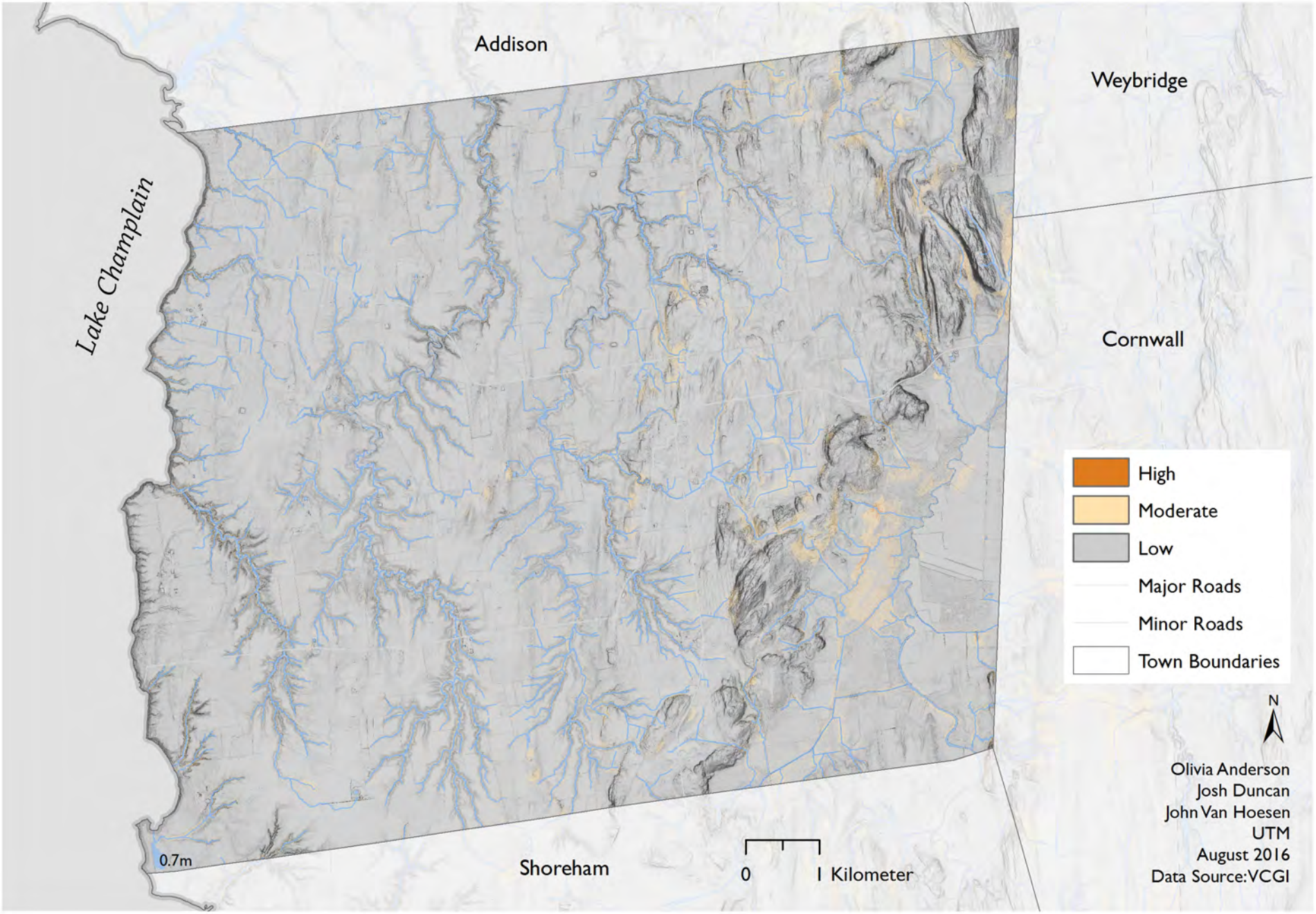
23	Le	0	153641	0.00	637193	978297057	0.07	0.00	0
24	Lf	0	153641	0.00	429022	978297057	0.04	0.00	0
25	Lh	0	153641	0.00	7762174	978297057	0.79	0.00	0
26	Lk	1677	153641	1.09	15245371	978297057	1.56	700.42	700
27	Lx	0	153641	0.00	5569859	978297057	0.57	0.00	0
28	Ma	0	153641	0.00	1118958	978297057	0.11	0.00	0
29	Mn	0	153641	0.00	1199283	978297057	0.12	0.00	0
30	Mr	0	153641	0.00	5292127	978297057	0.54	0.00	0
31	Mv	0	153641	0.00	13389668	978297057	1.37	0.00	0
32	Na	0	153641	0.00	5551642	978297057	0.57	0.00	0
33	Nd	0	153641	0.00	25108509	978297057	2.57	0.00	0
34	Ne	0	153641	0.00	23236924	978297057	2.38	0.00	0
35	Ns	21074	153641	13.72	14807704	978297057	1.51	9,061.98	9062
36	Pe	0	153641	0.00	31186	978297057	0.00	0.00	0
37	Ps	0	153641	0.00	3135056	978297057	0.32	0.00	0
38	Qu	0	153641	0.00	32924	978297057	0.00	0.00	0
39	Ra	0	153641	0.00	207523	978297057	0.02	0.00	0
40	Rk	11756	153641	7.65	27286597	978297057	2.79	2,743.30	2743
41	St	0	153641	0.00	1075135	978297057	0.11	0.00	0
42	Sw	398	153641	0.26	6281395	978297057	0.64	403.45	403
43	Vg	69319	153641	45.12	5.08E+08	978297057	51.93	868.86	869
44	Vr	0	153641	0.00	2798807	978297057	0.29	0.00	0
45	W	1272	153641	0.83	10267822	978297057	1.05	788.81	789
46	Wa	0	153641	0.00	322787	978297057	0.03	0.00	0
47	Wo	178	153641	0.12	564253	978297057	0.06	2,008.68	2009

7.2 – Maps of Modeled Landslide Susceptibility

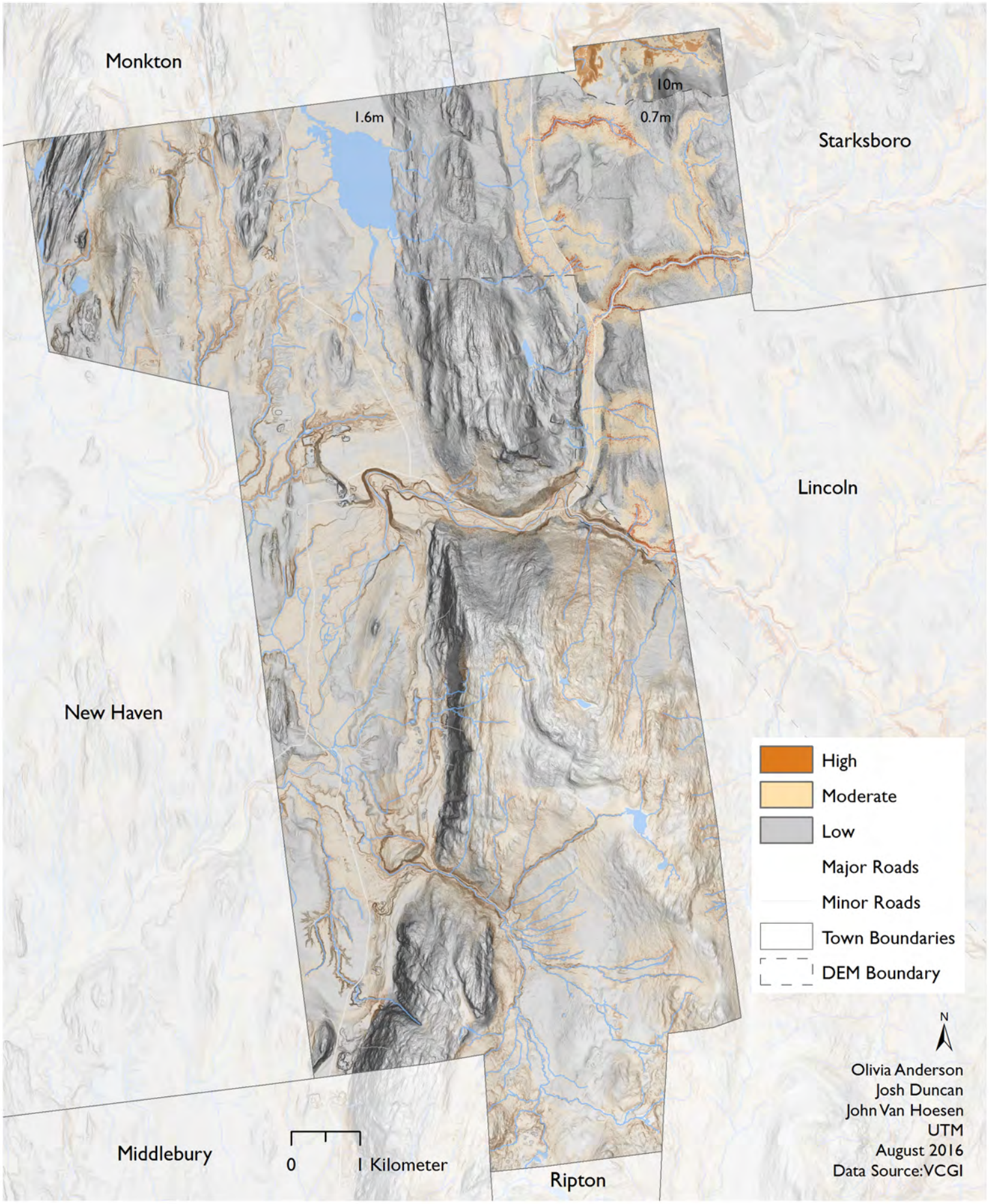
Landslide Potential of the Town of Addison
Addison County, VT, USA



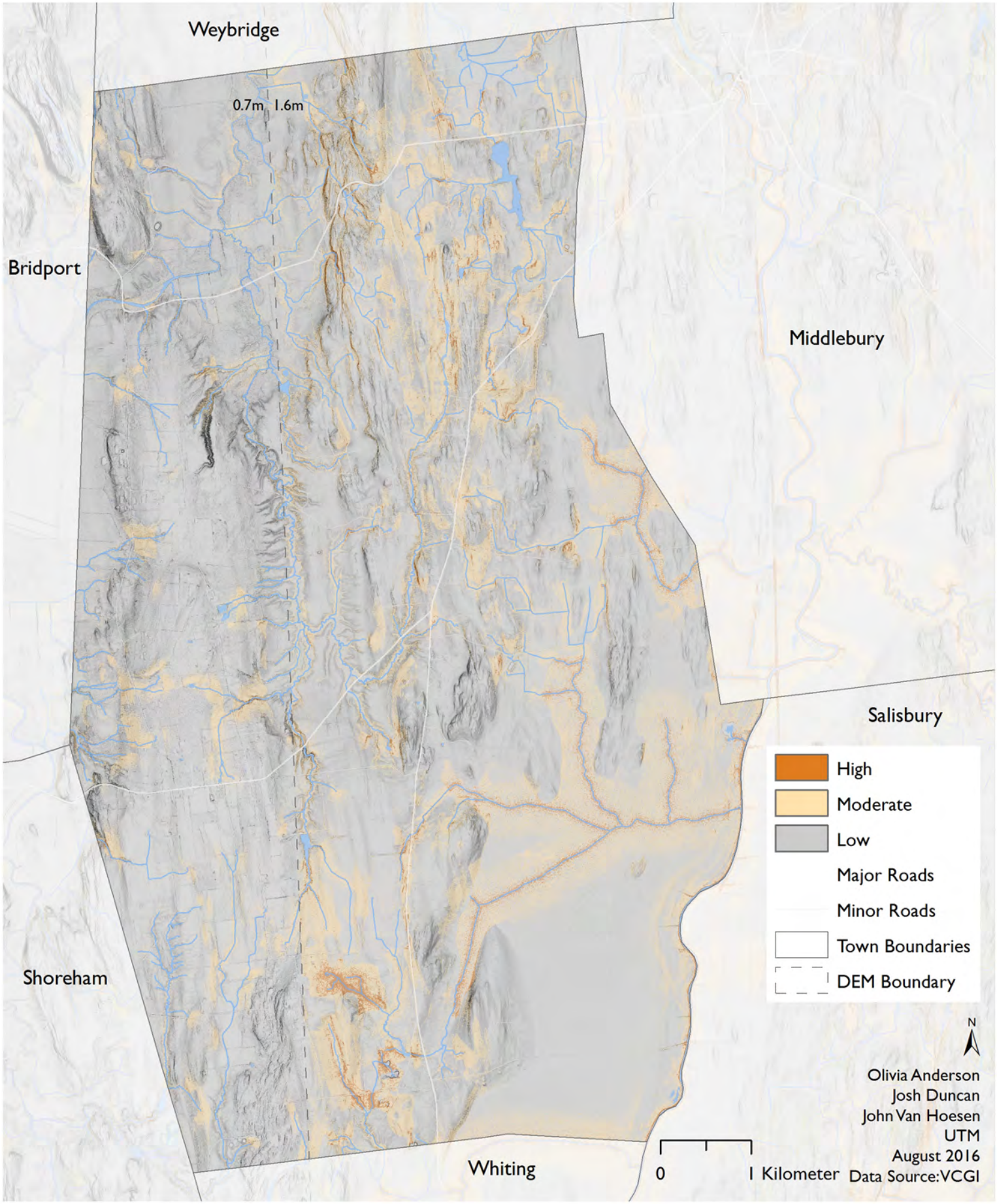
Landslide Potential of the Town of Bridport
Addison County, VT, USA



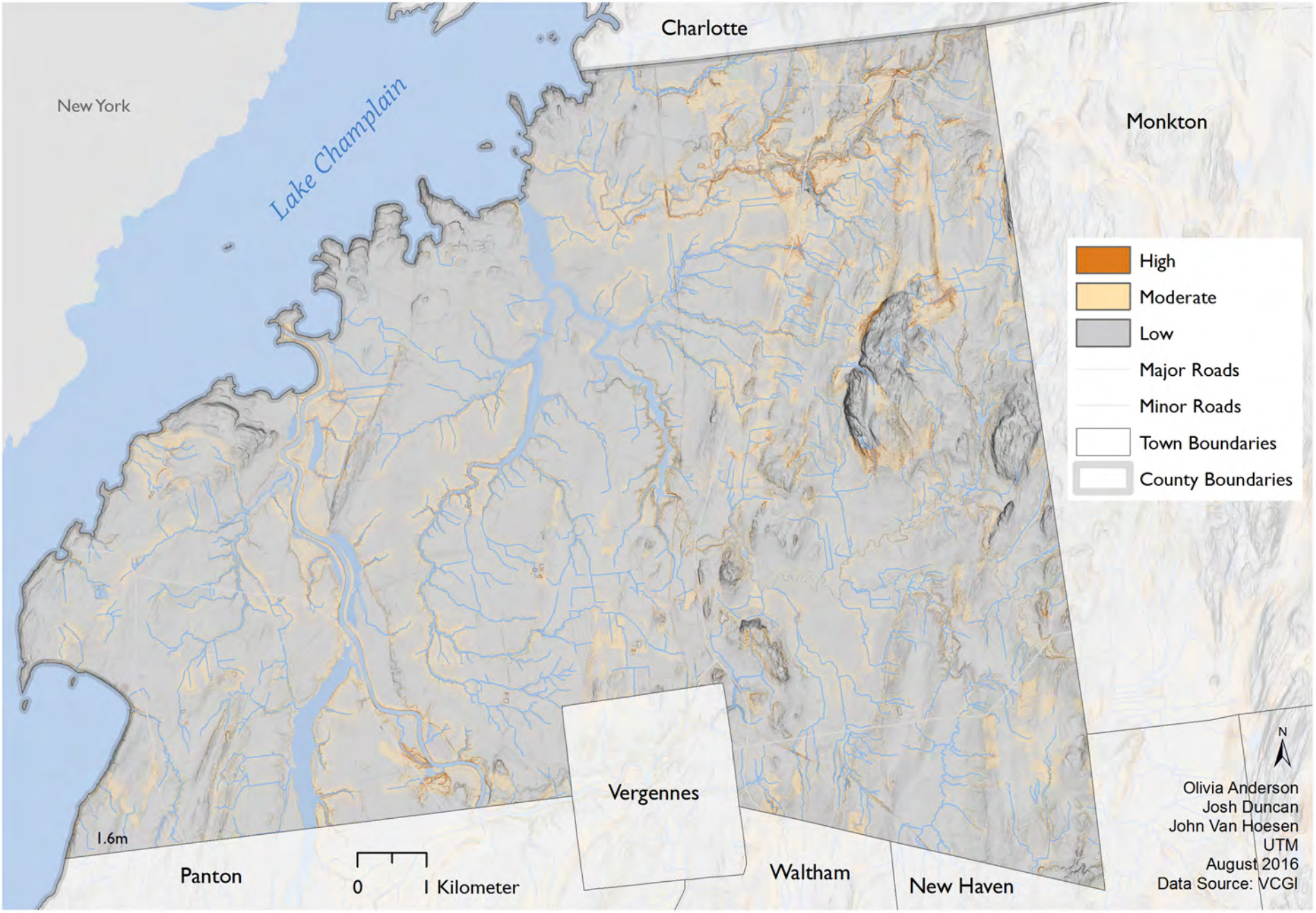
Landslide Potential of the Town of Bristol
Addison County, VT, USA



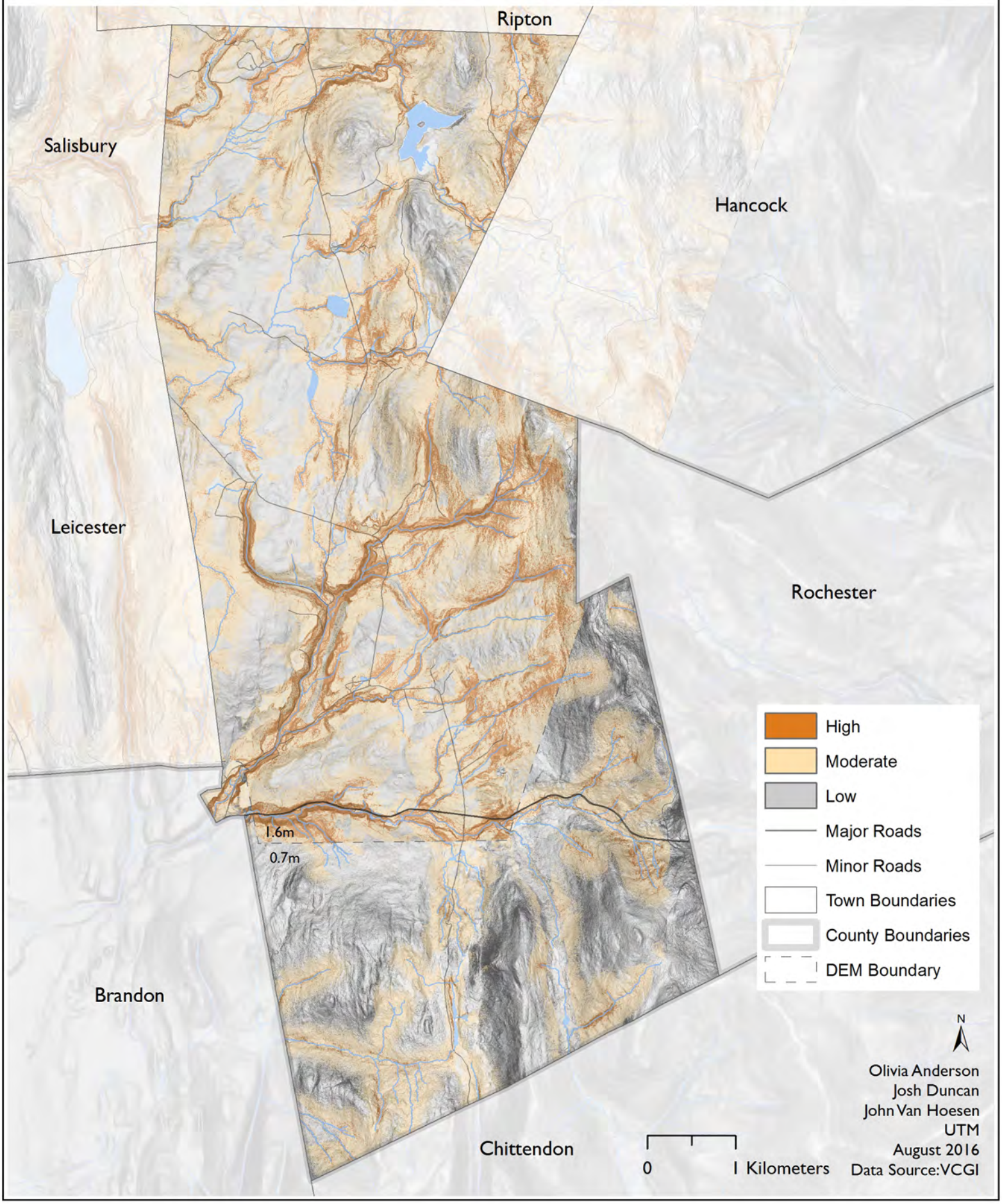
Landslide Potential of the Town of Cornwall
Addison County, VT, USA



Landslide Potential of the Town of Ferrisburgh
Addison County, VT USA

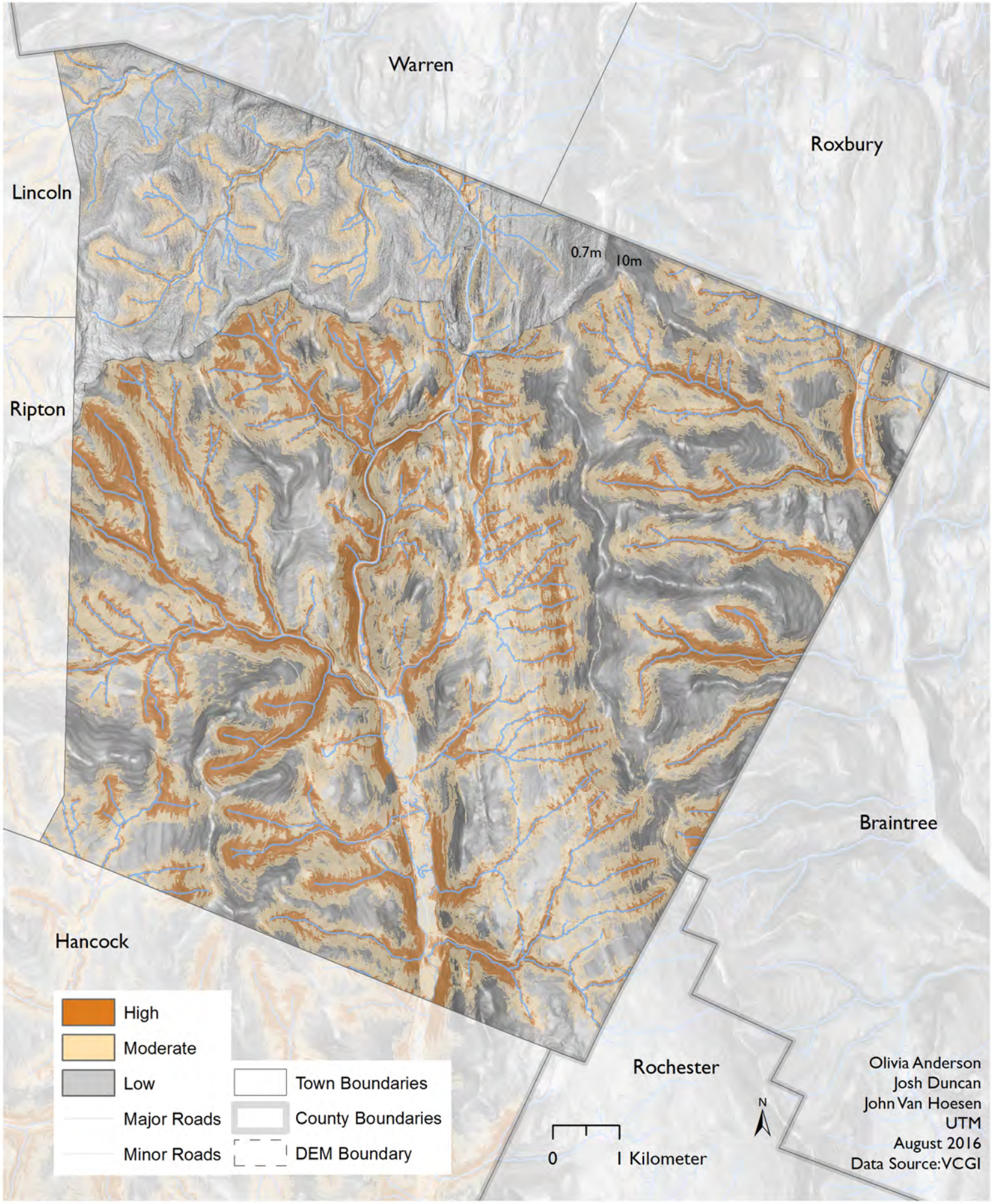


Landslide Potential of the Town of Goshen
Addison County, VT, USA

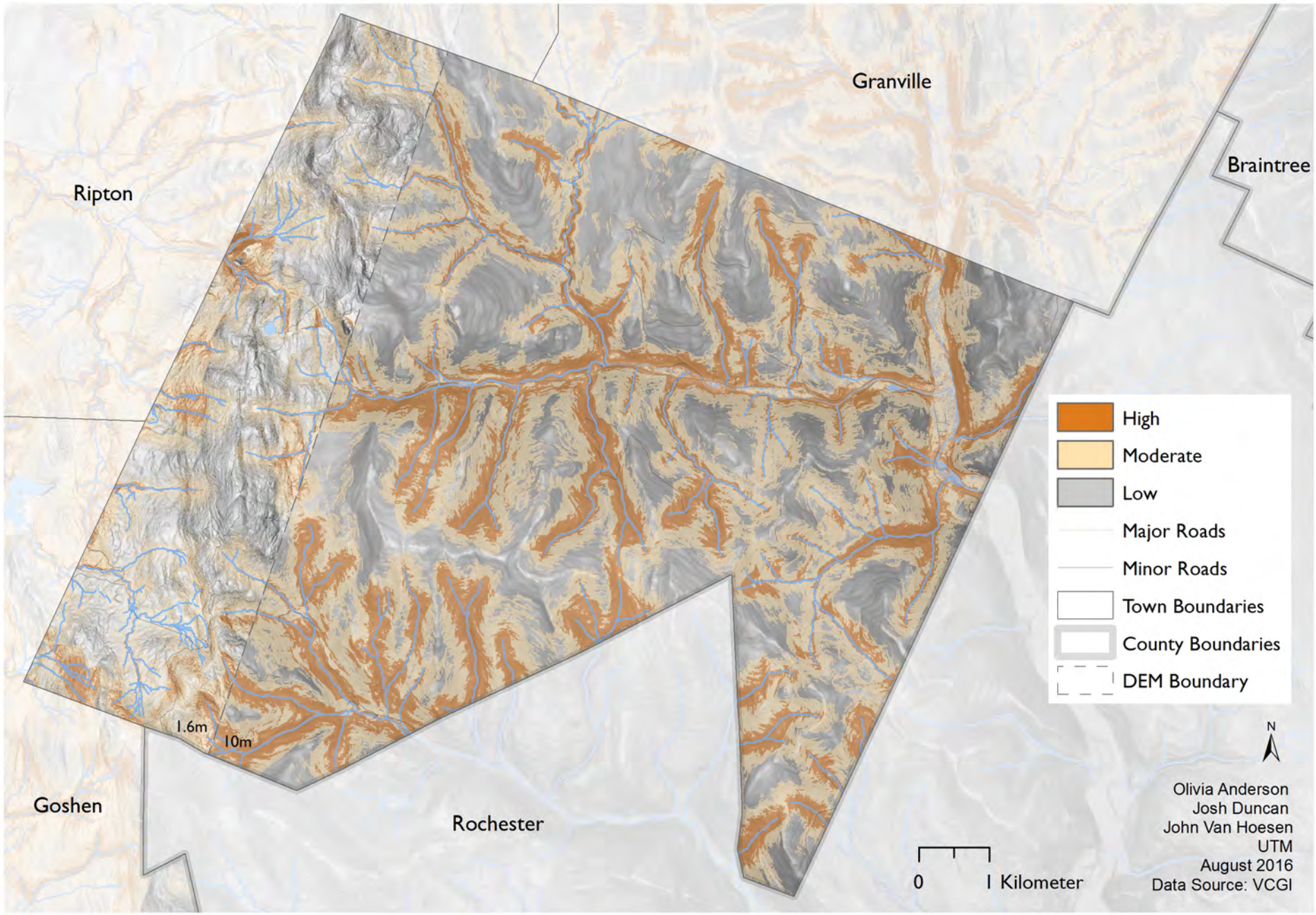


Olivia Anderson
Josh Duncan
John Van Hoesen
UTM
August 2016
Data Source: VCGI

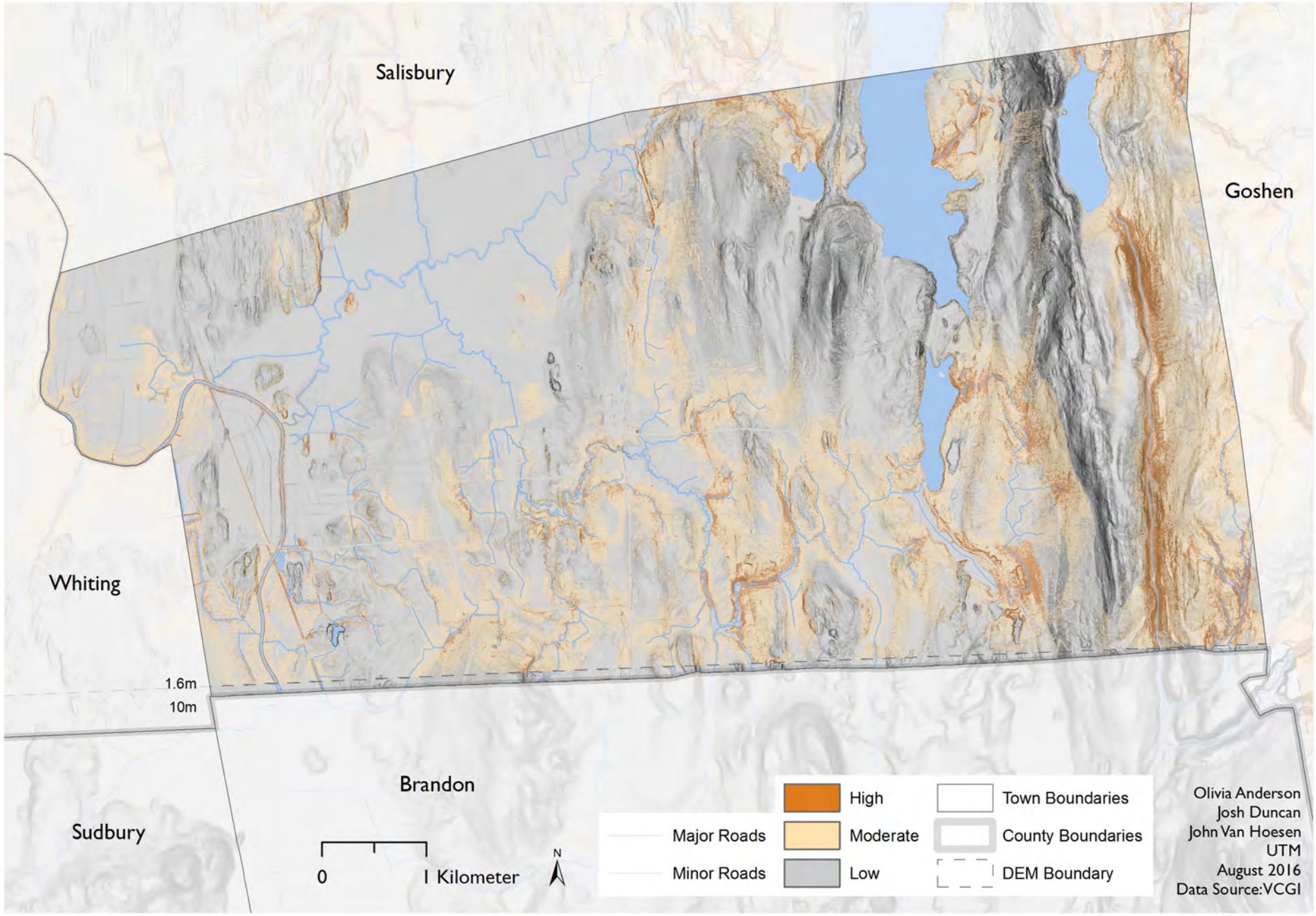
Landslide Potential of the Town of Granville
Addison County, VT, USA



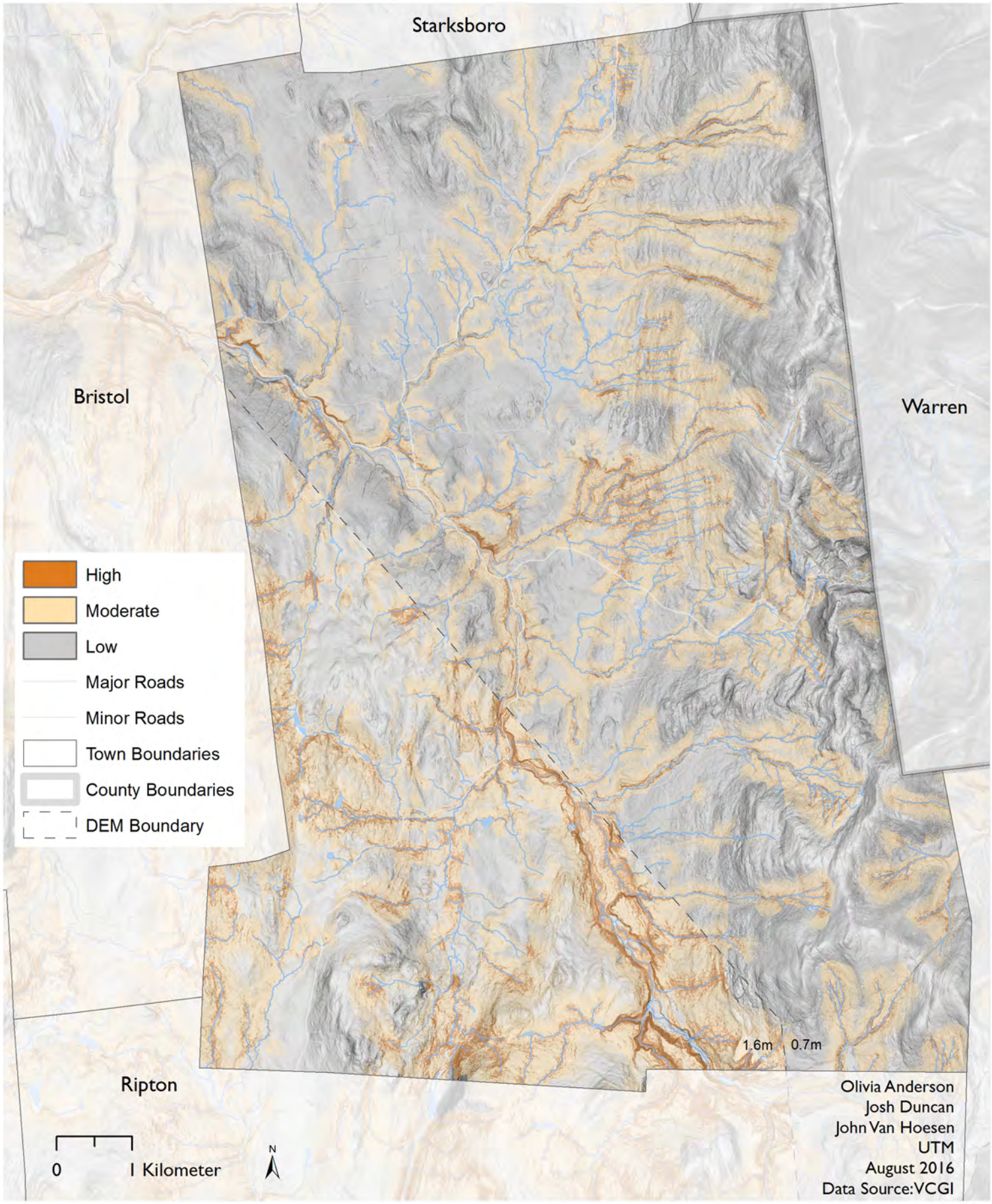
Landslide Potential of the Town of Hancock
Addison County, VT, USA



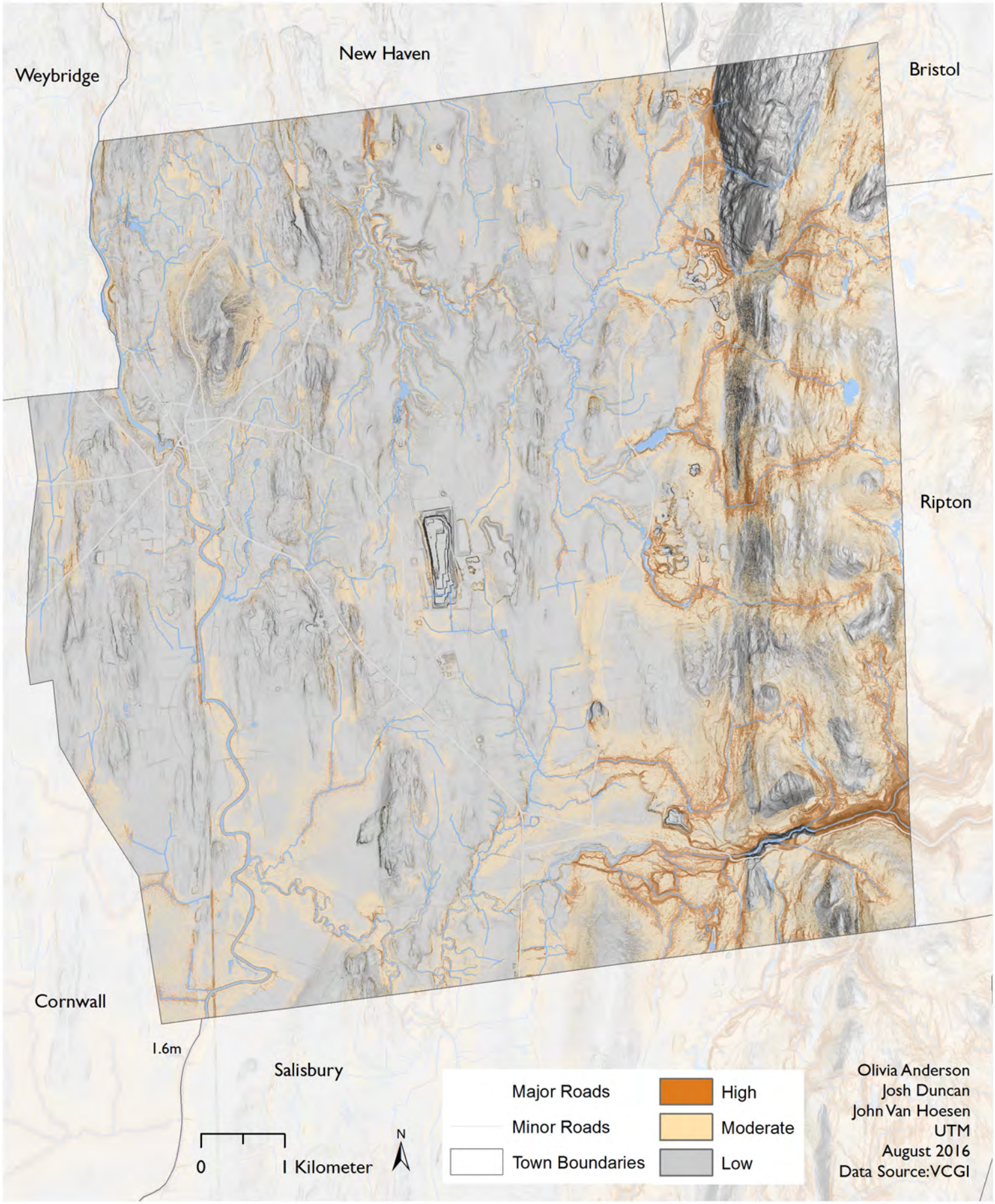
Landslide Potential of the Town of Leicester
Addison County, VT, USA



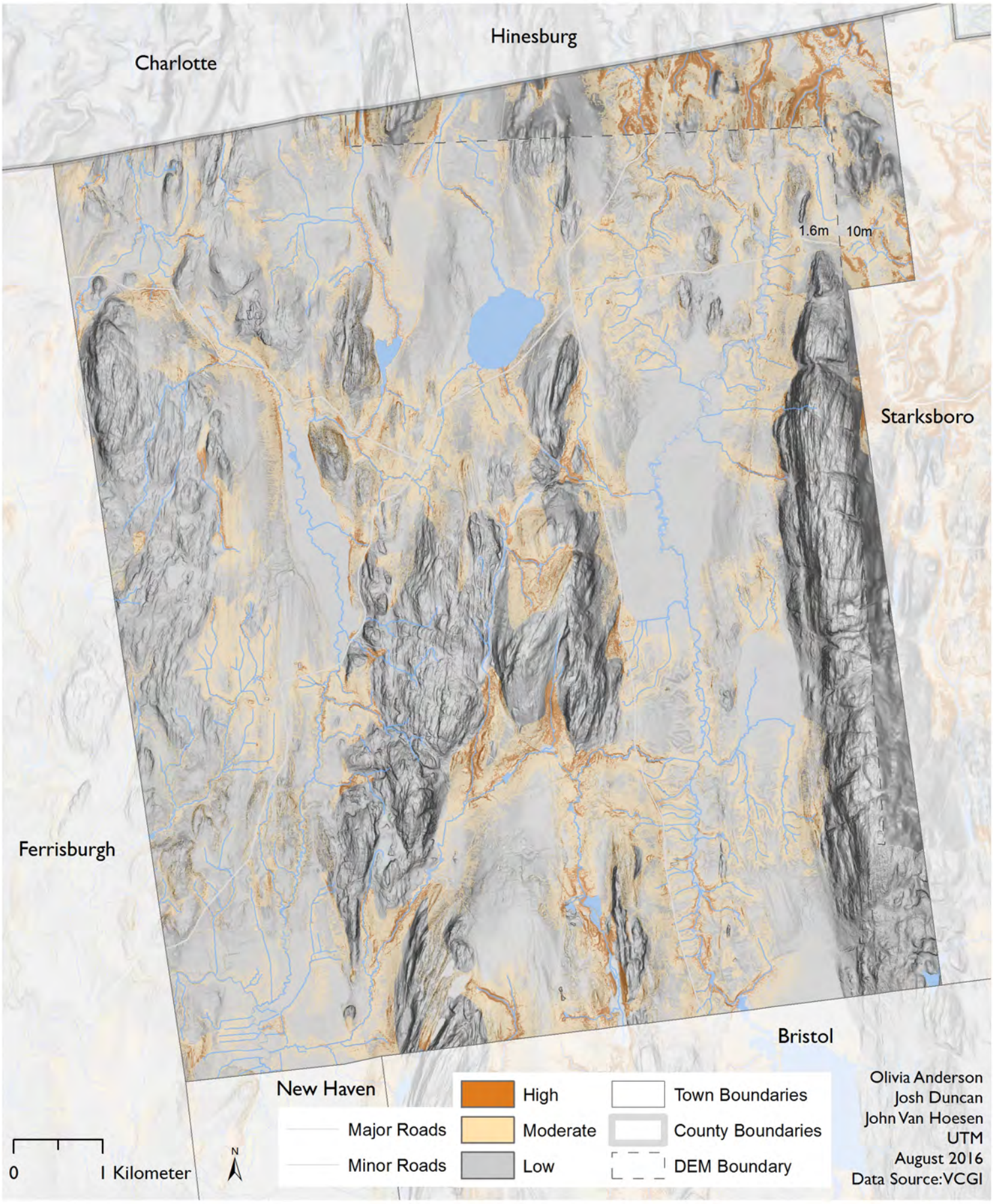
Landslide Potential of the Town of Lincoln
Addison County, VT, USA



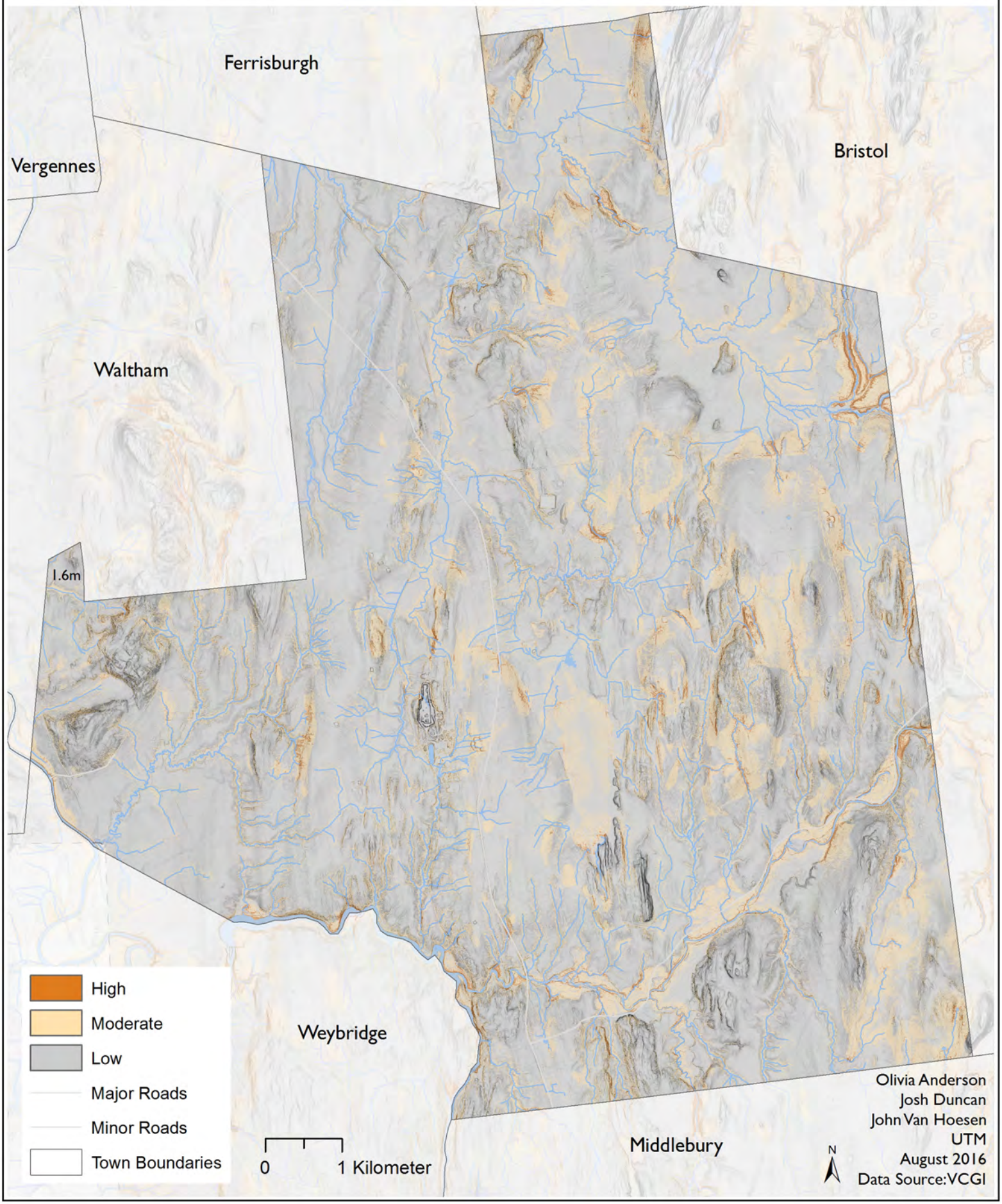
Landslide Potential of the Town of Middlebury
Addison County, VT, USA



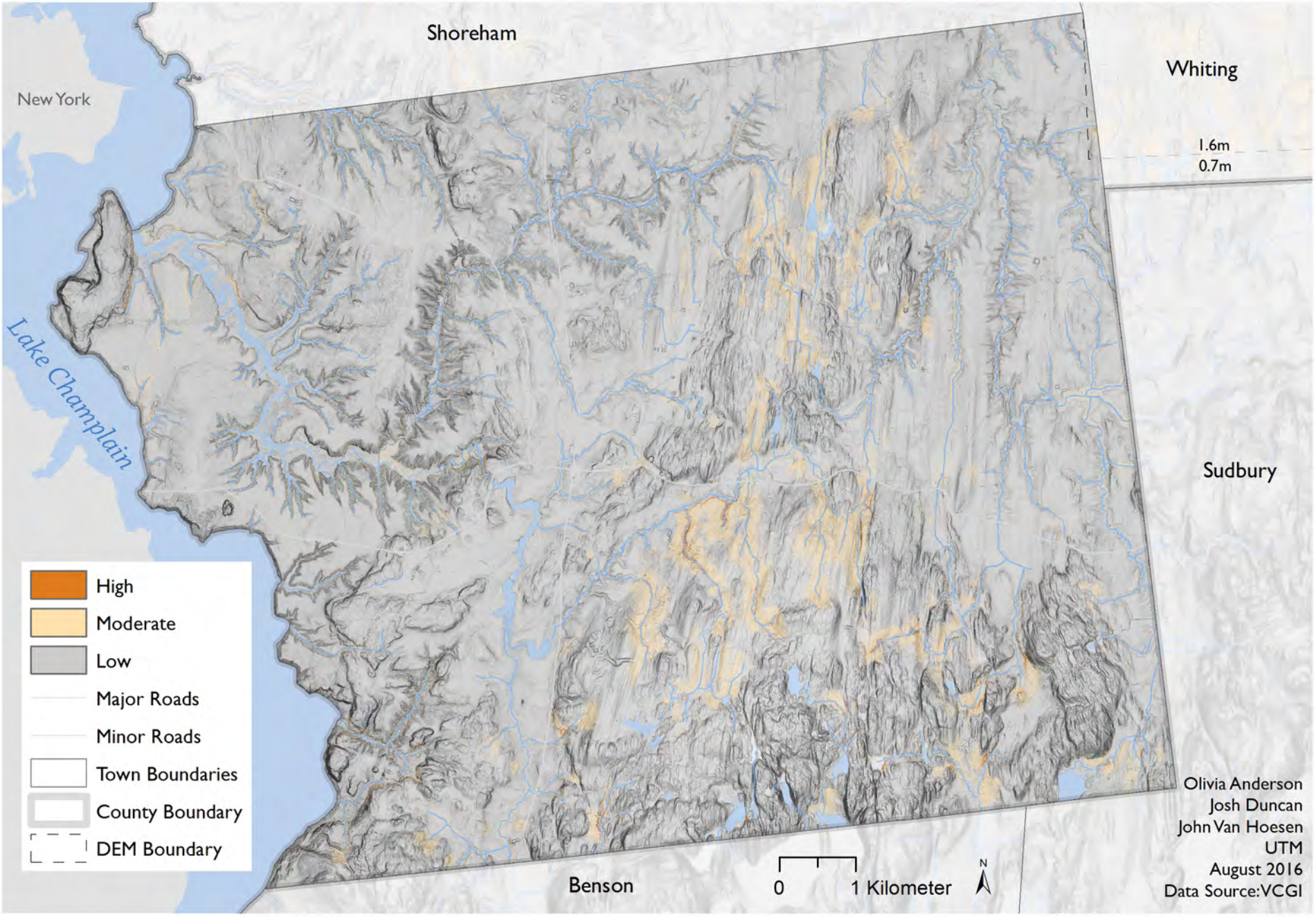
Landslide Potential of the Town of Monkton
Addison County, VT, USA



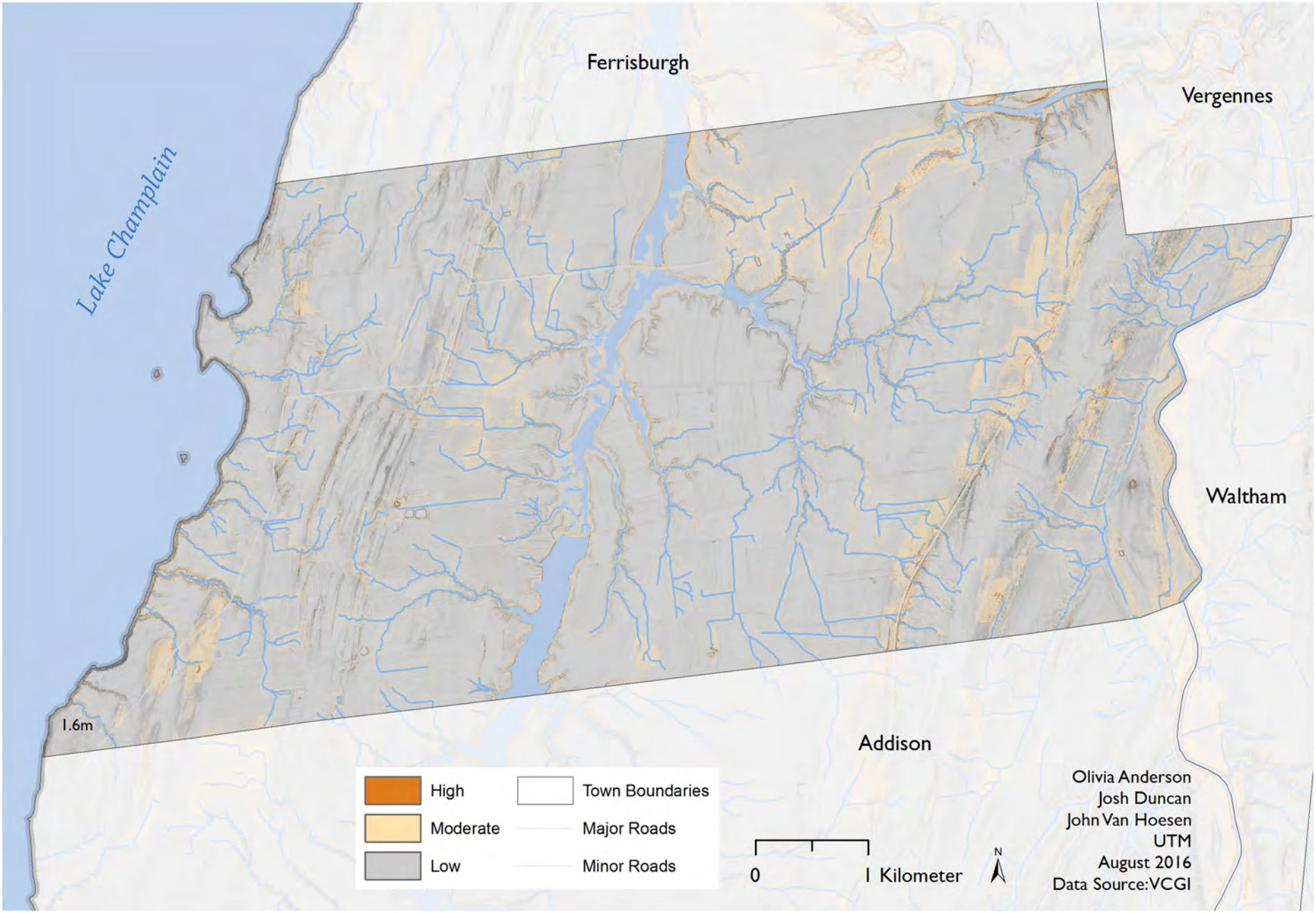
Landslide Potential of the Town of New Haven
Addison County, VT, USA



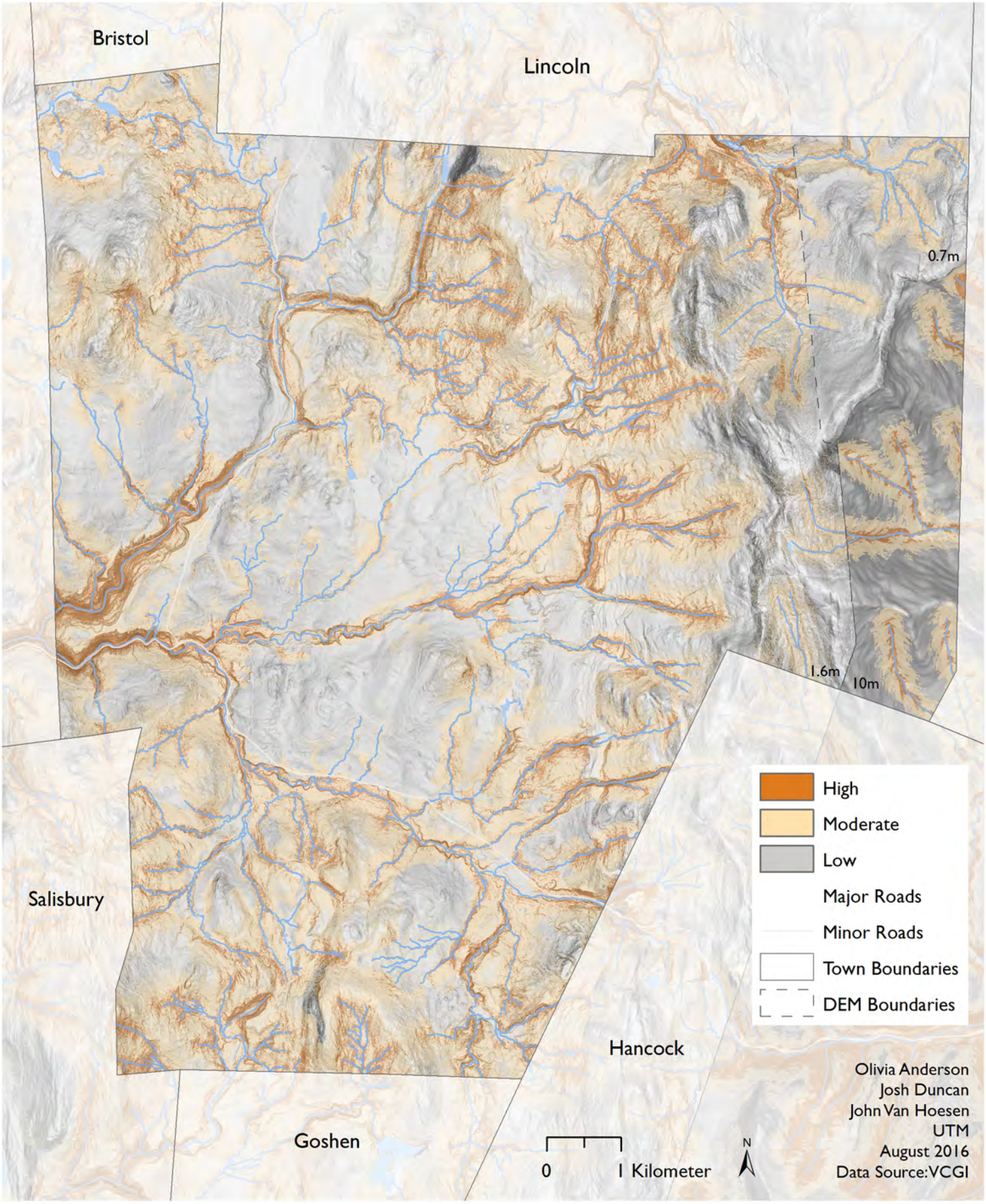
Landslide Potential of the Town of Orwell
Addison County, VT, USA



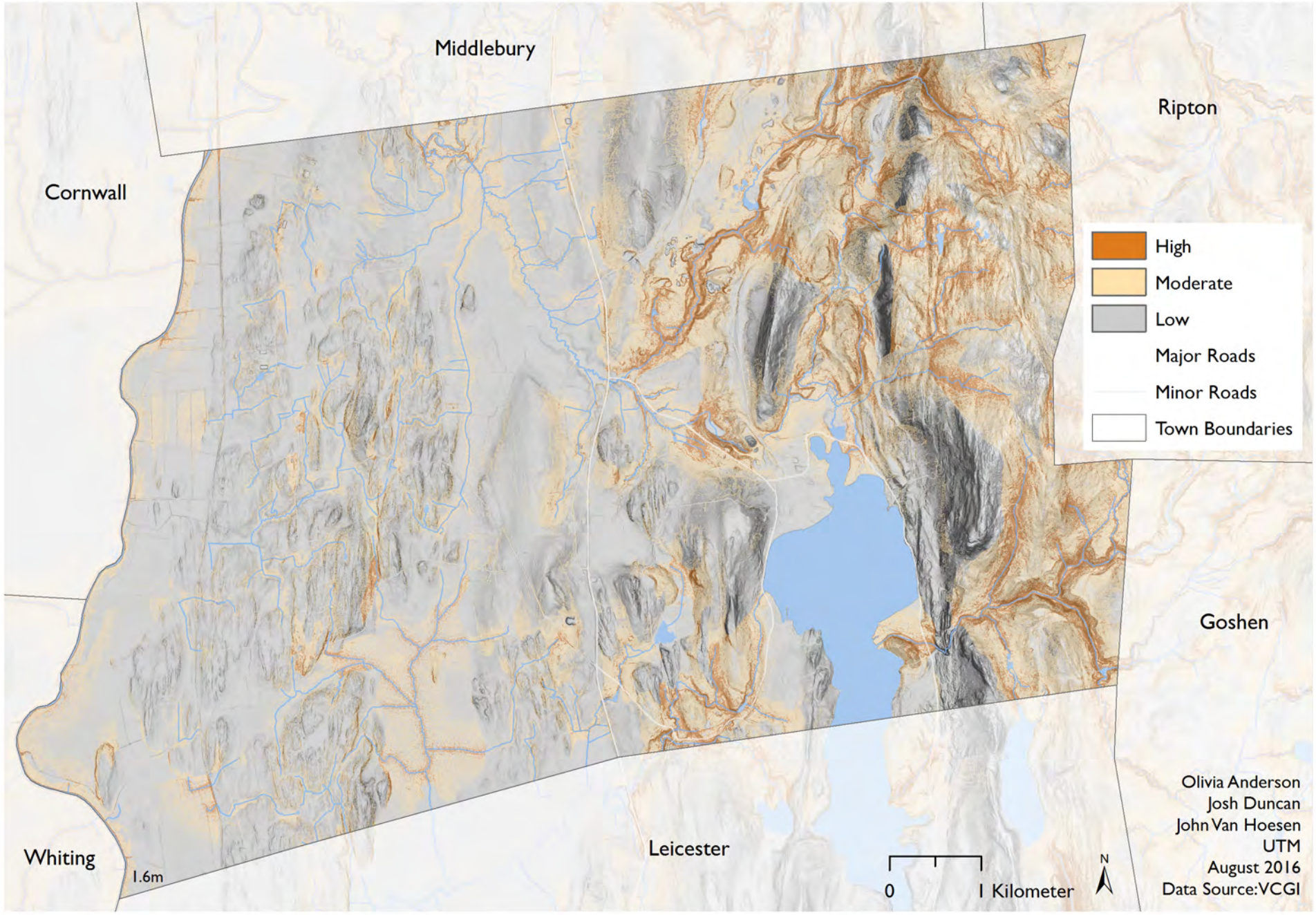
Landslide Potential of the Town of Panton
Addison County, VT, USA



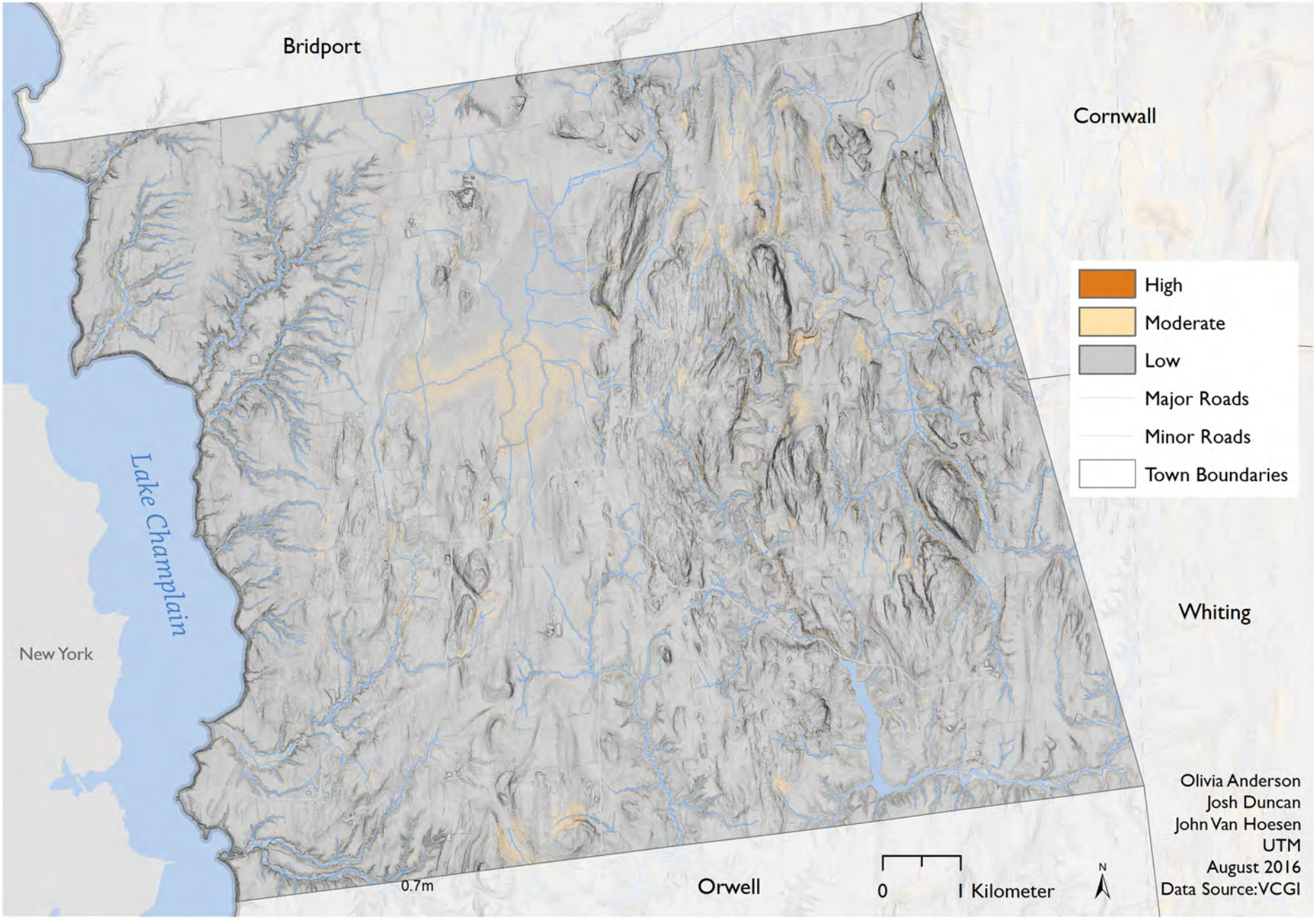
Landslide Potential of the Town of Ripton
Addison County, VT, USA



Landslide Potential of the Town of Salisbury
Addison County, VT, USA

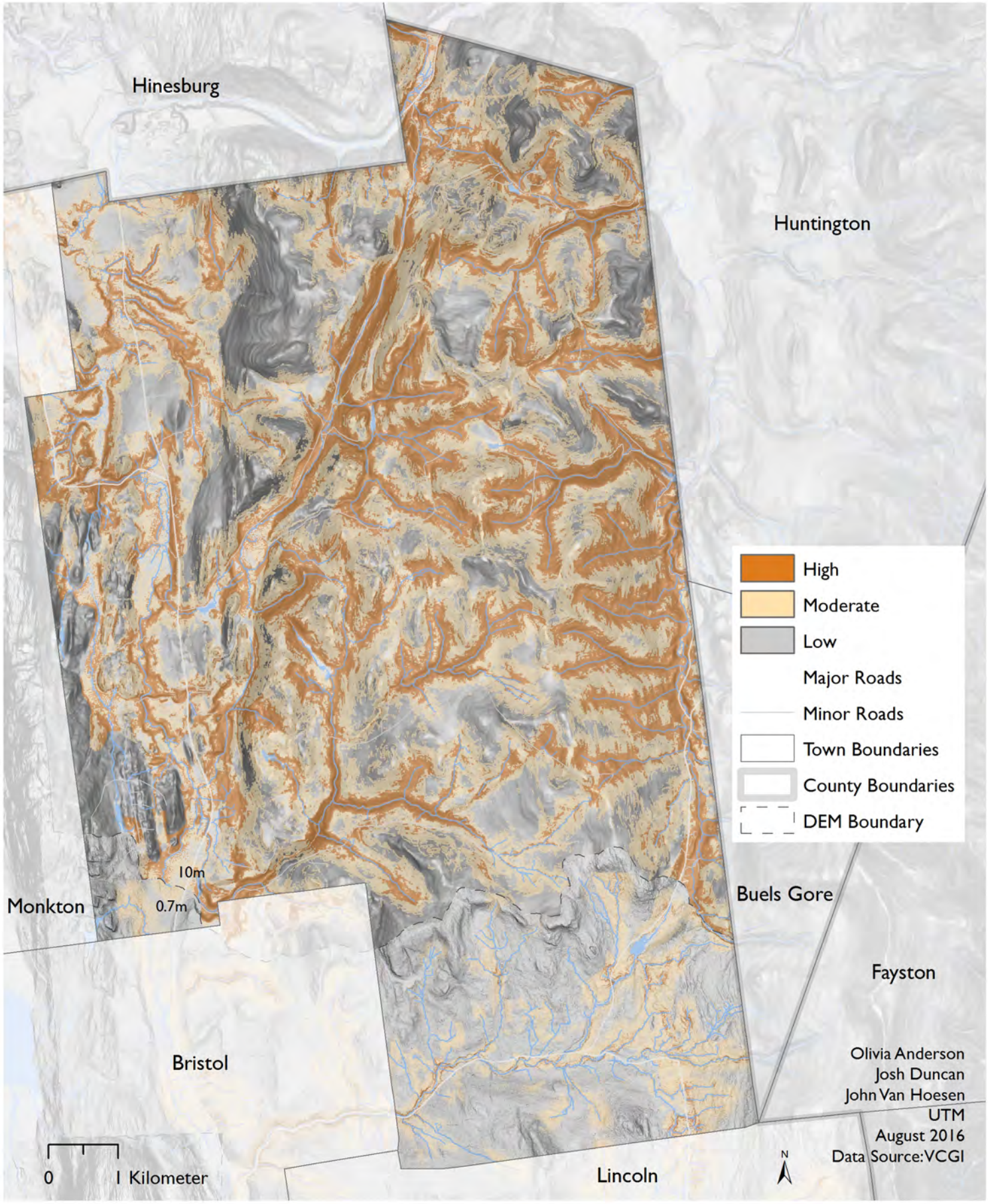


Landslide Potential of the Town of Shoreham
Addison County, VT, USA

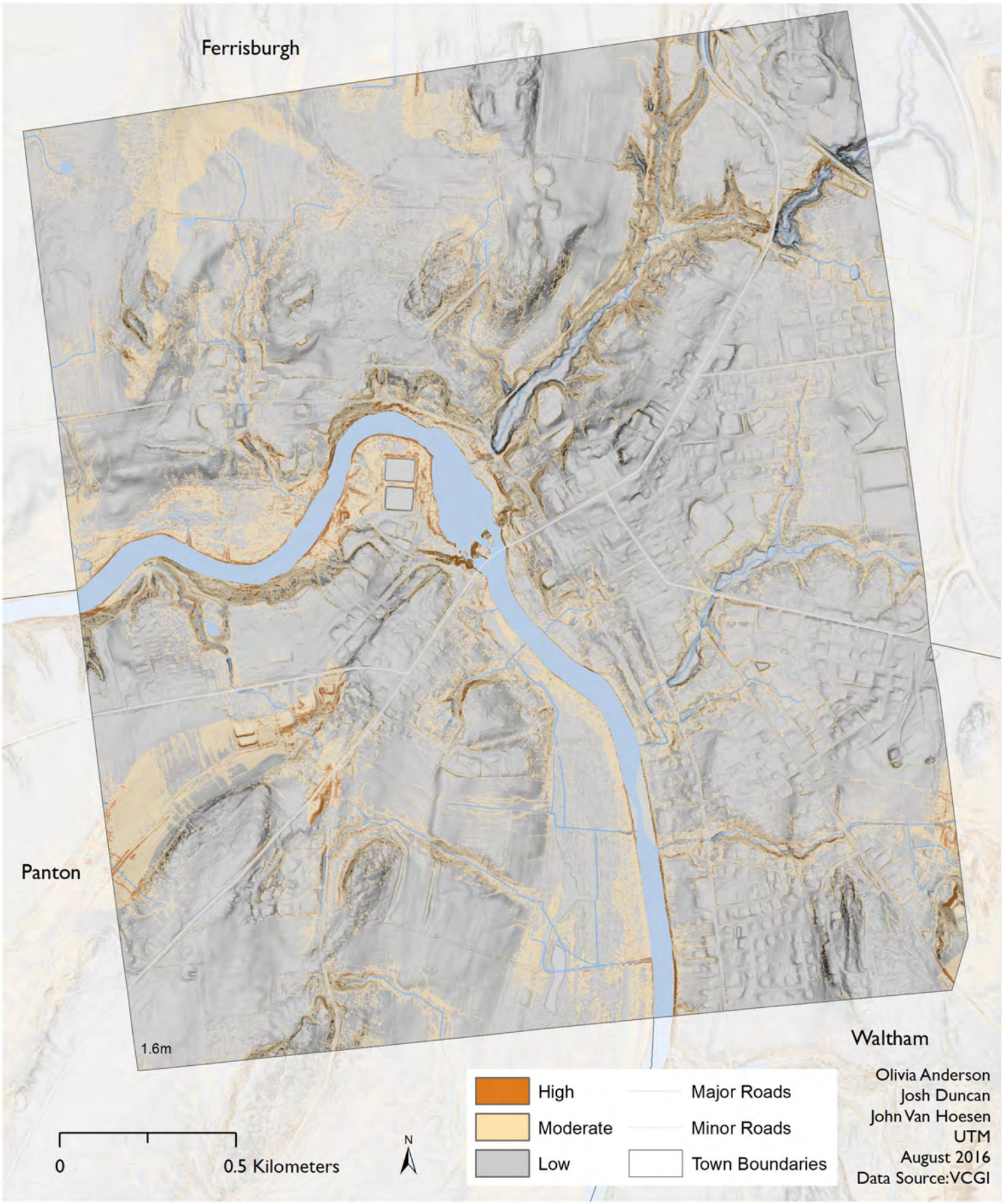


Olivia Anderson
Josh Duncan
John Van Hoesen
UTM
August 2016
Data Source: VCGI

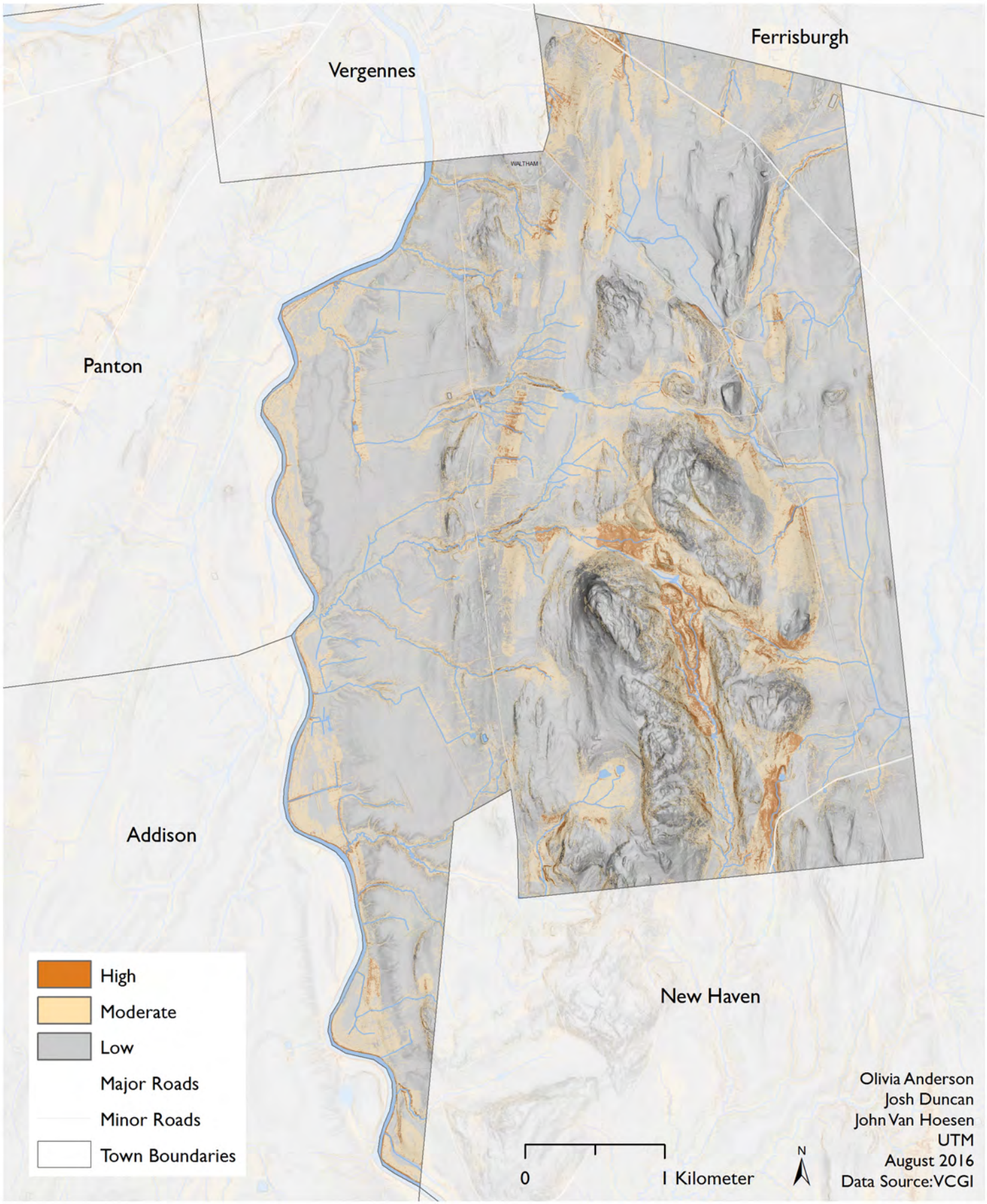
Landslide Potential of the Town of Starksboro
Addison County, VT, USA



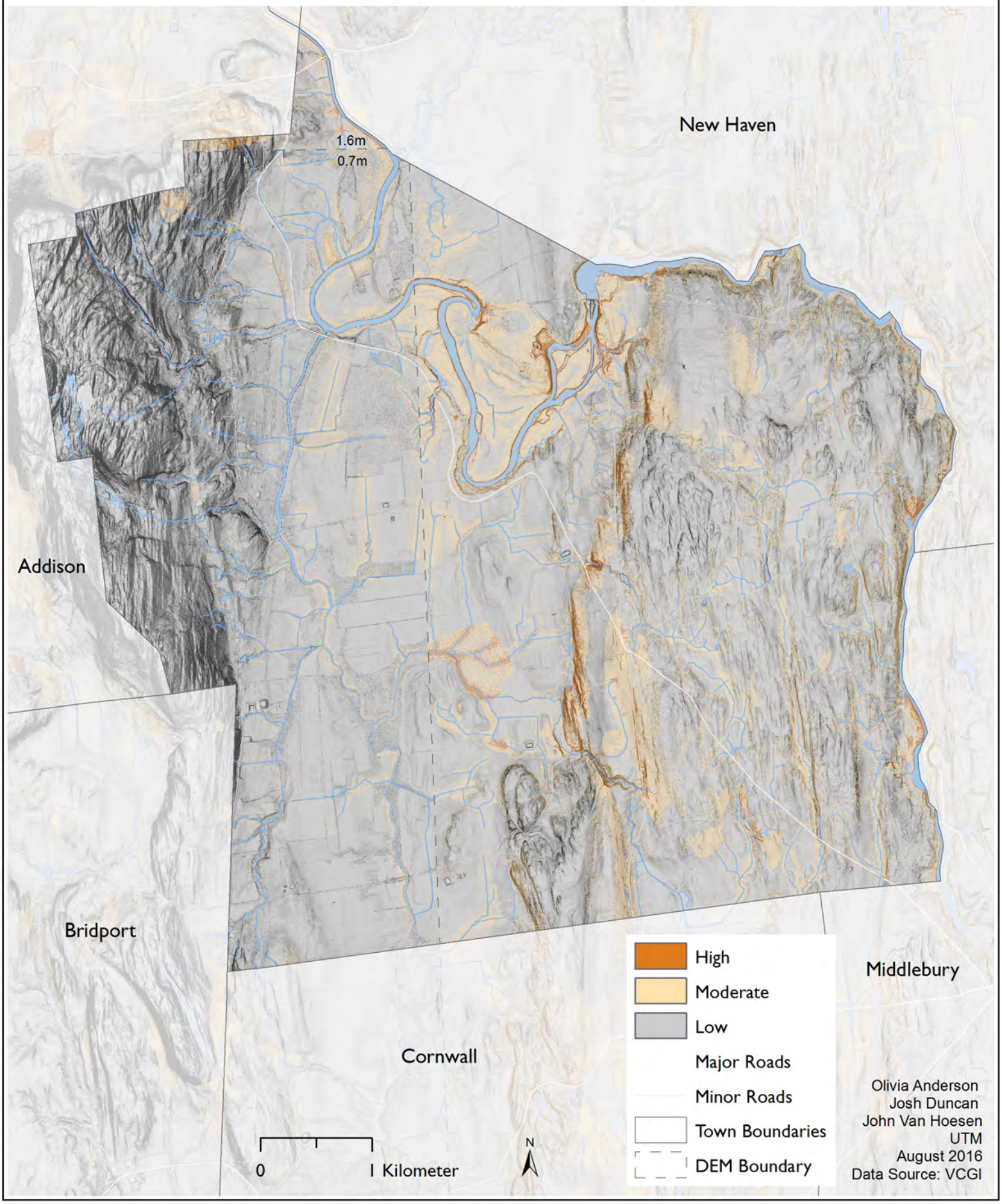
Landslide Potential of the Town of Vergennes
Addison County, VT, USA



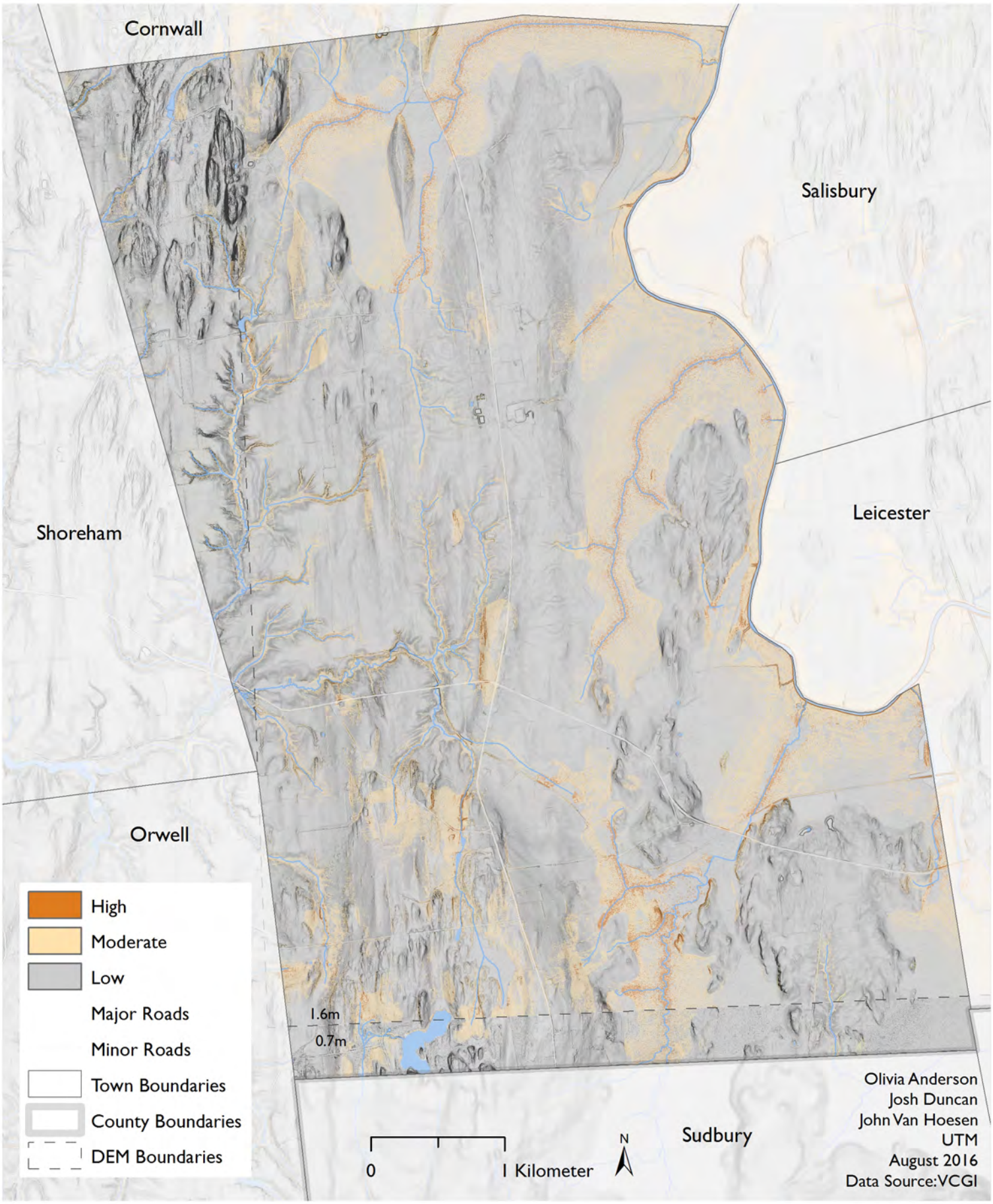
Landslide Potential of the Town of Waltham
Addison County, VT, USA



Landslide Potential of the Town of Weybridge
Addison County, VT, USA

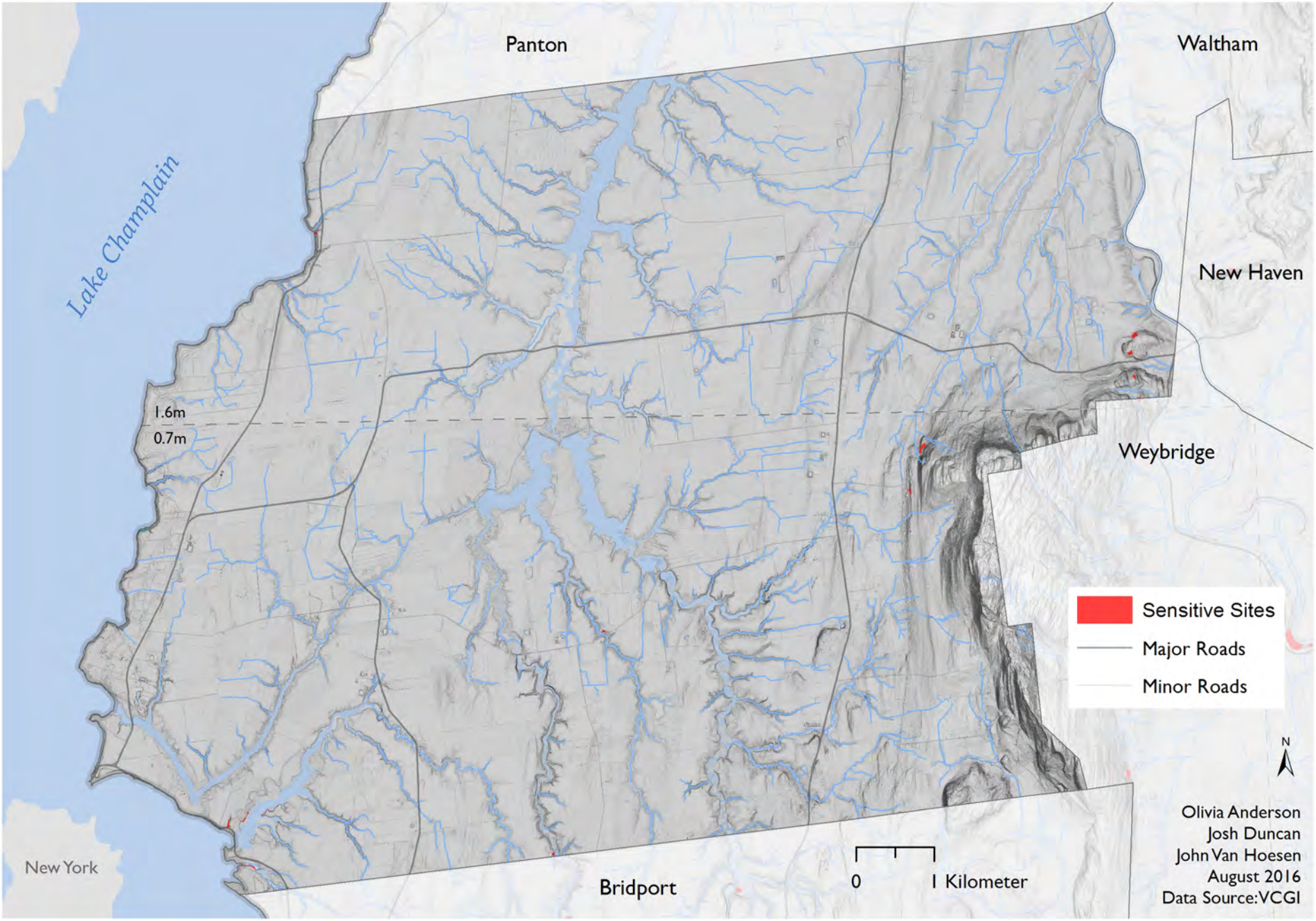


Landslide Potential of the Town of Whiting
Addison County, VT, USA

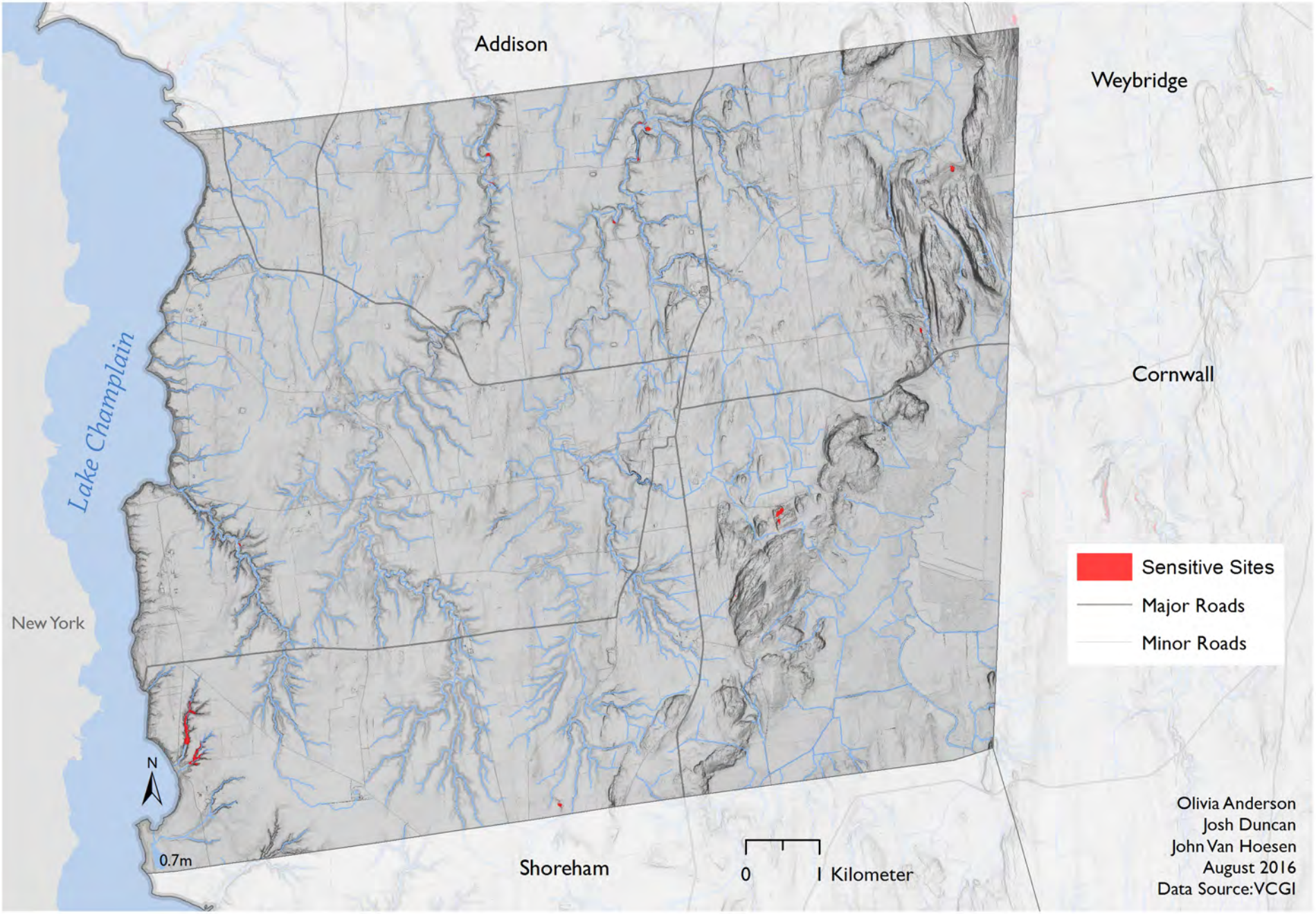


7.3 – Maps of Digitized Sensitive Locations

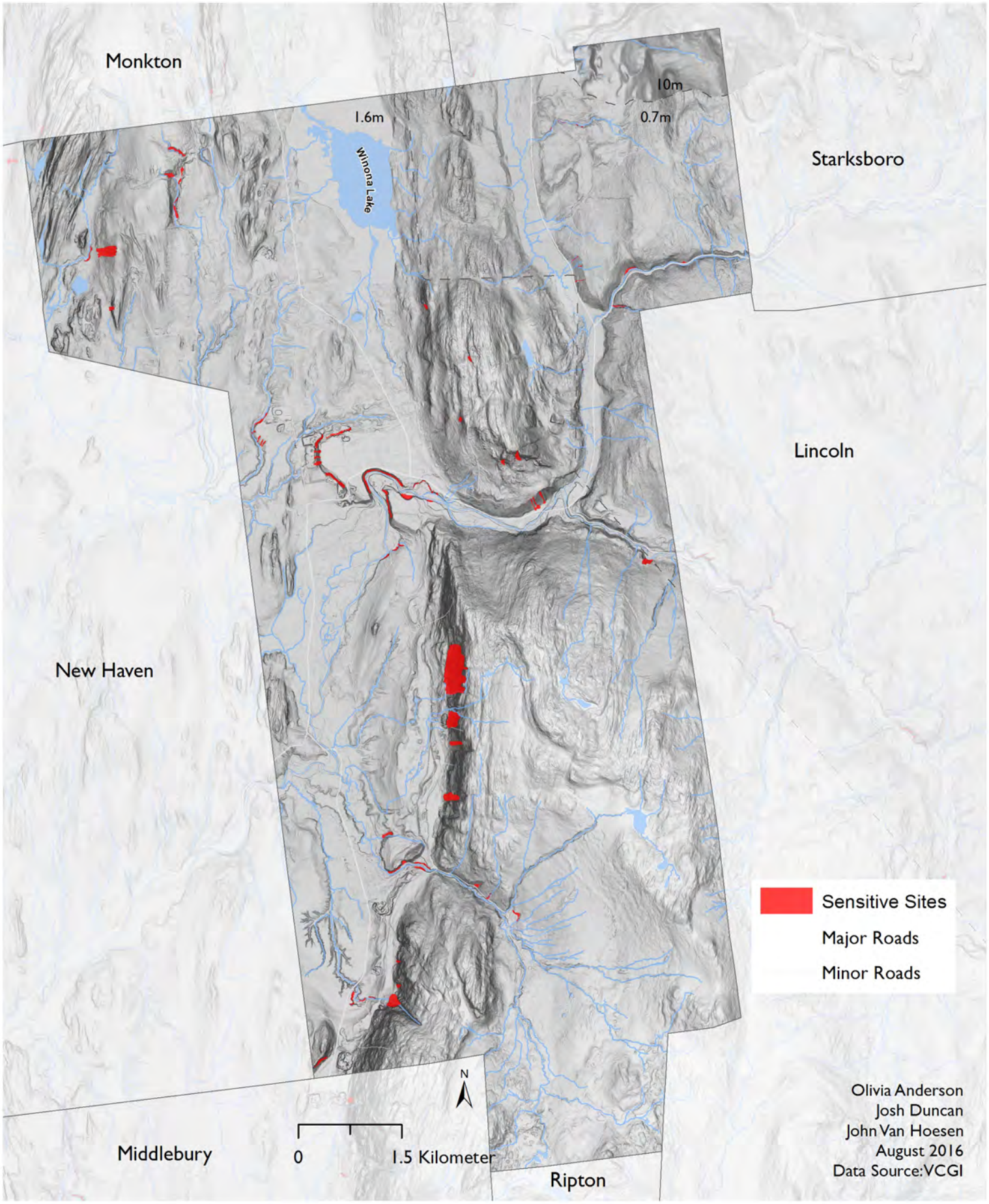
Landslide Potential of the Town of Addison
Addison County, VT, USA



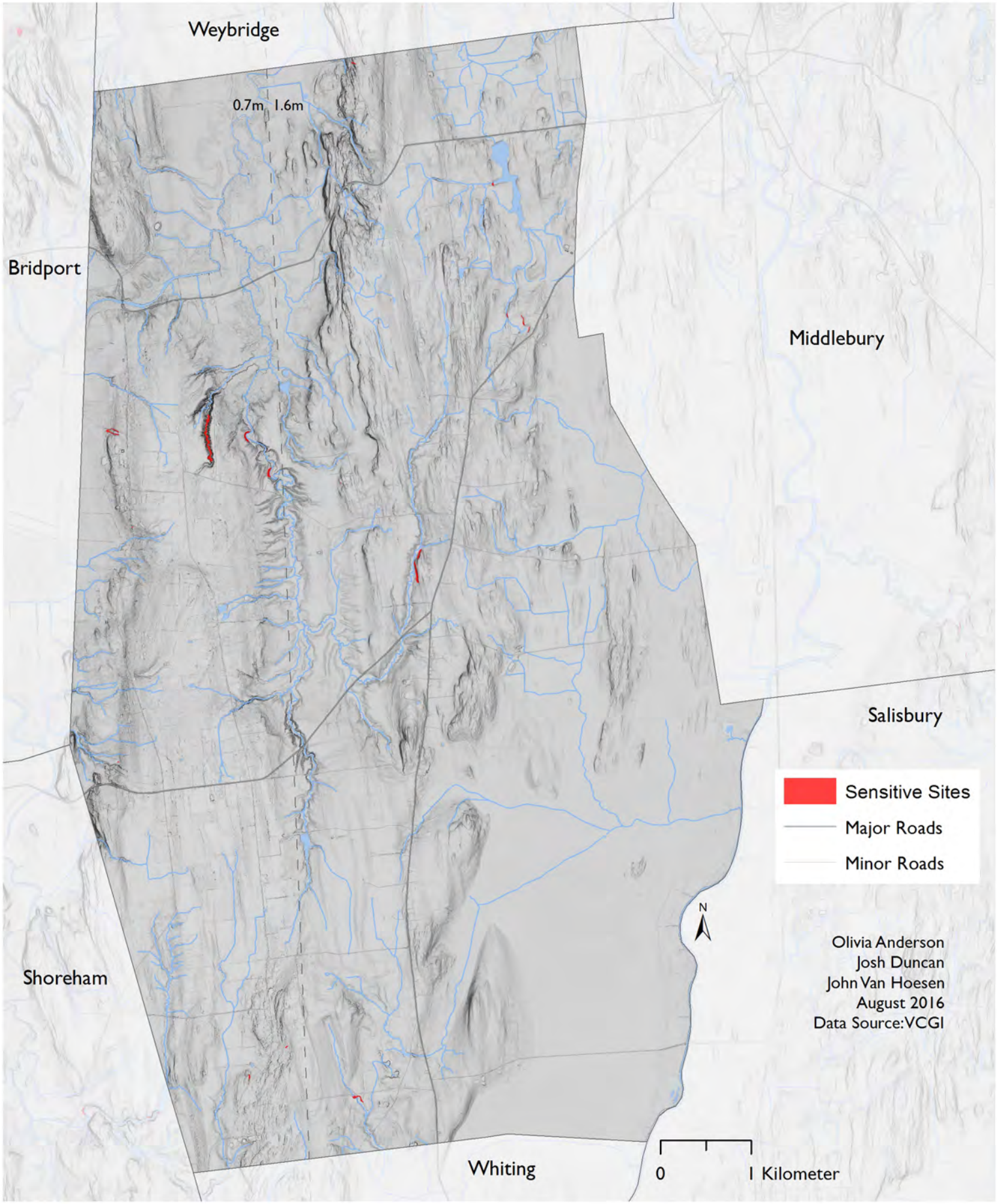
Landslide Potential of the Town of Bridport
Addison County, VT, USA



Landslide Potential of the Town of Bristol
Addison County, VT, USA

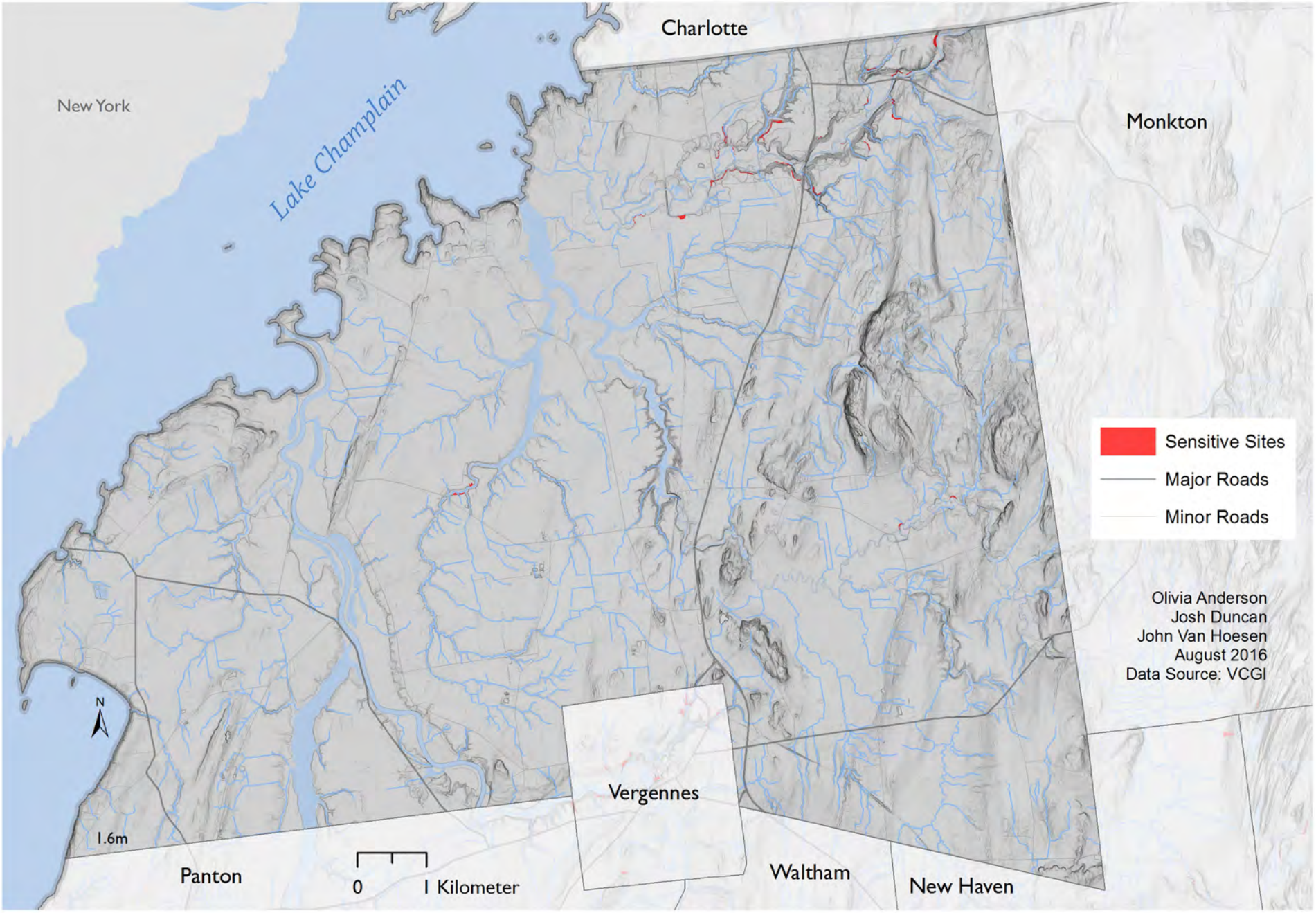


Landslide Potential of the Town of Cornwall
Addison County, VT, USA

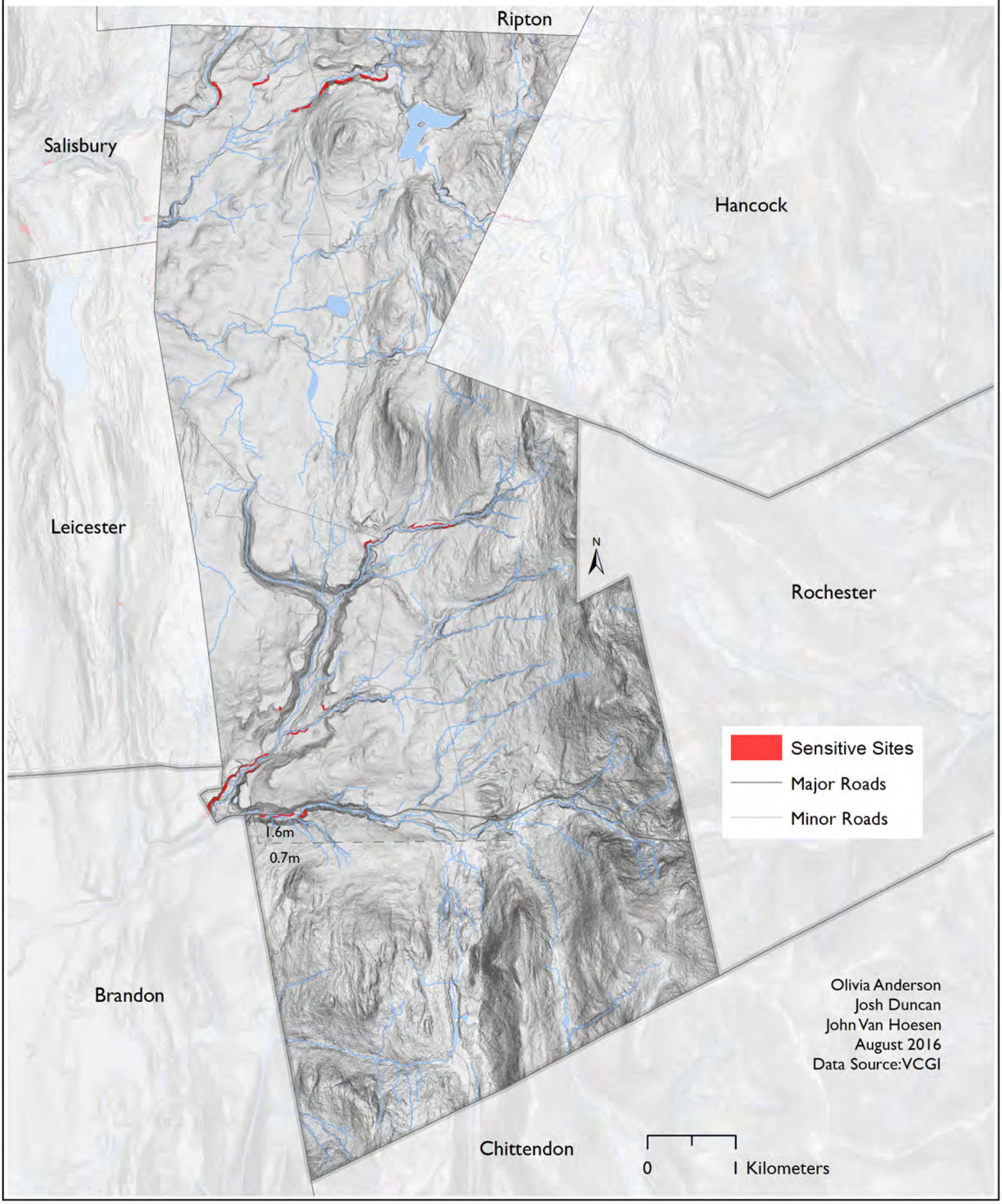


Olivia Anderson
Josh Duncan
John Van Hoesen
August 2016
Data Source: VCGI

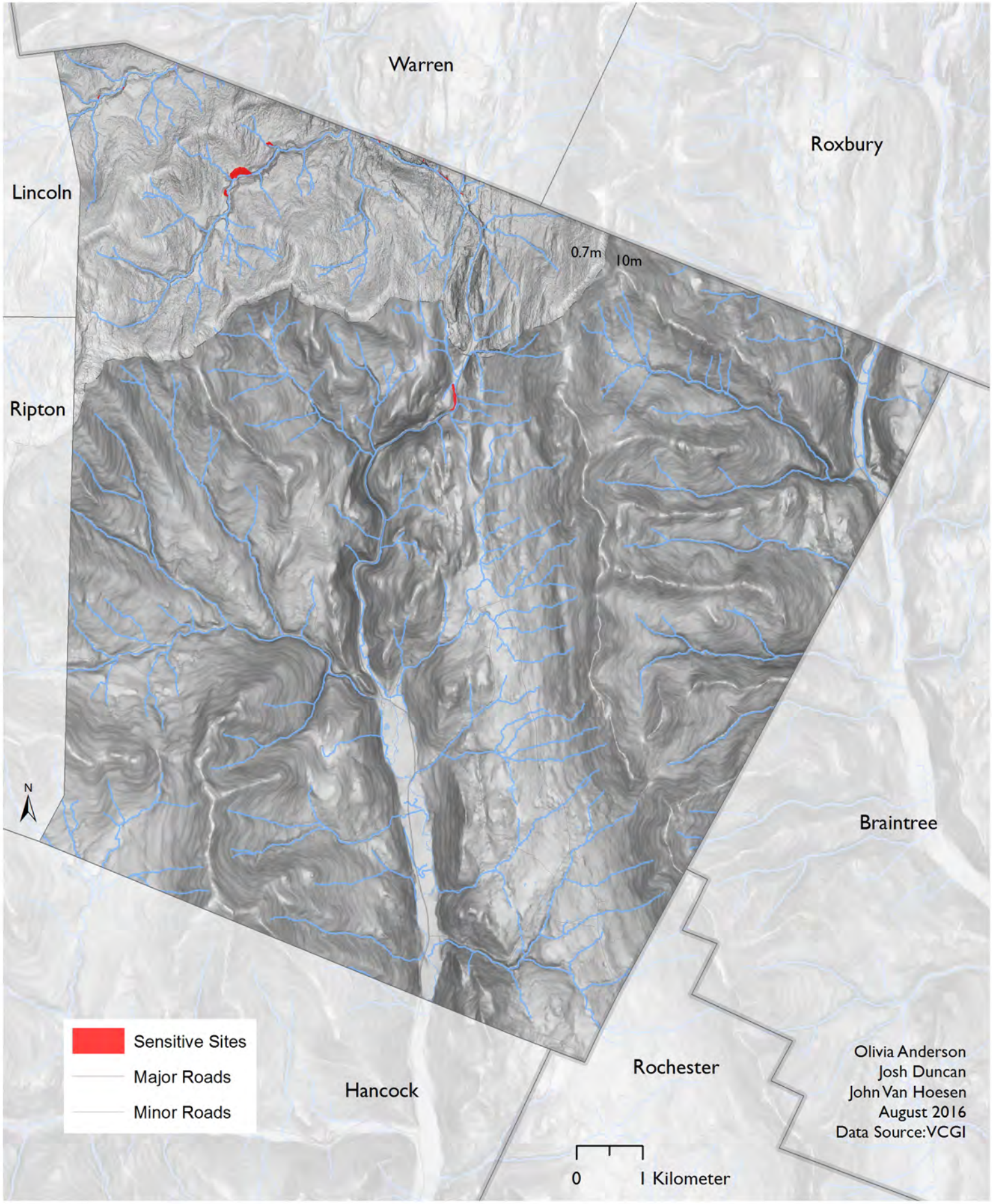
Landslide Potential of the Town of Ferrisburgh
Addison County, VT, USA



Landslide Potential of the Town of Goshen
Addison County, VT, USA

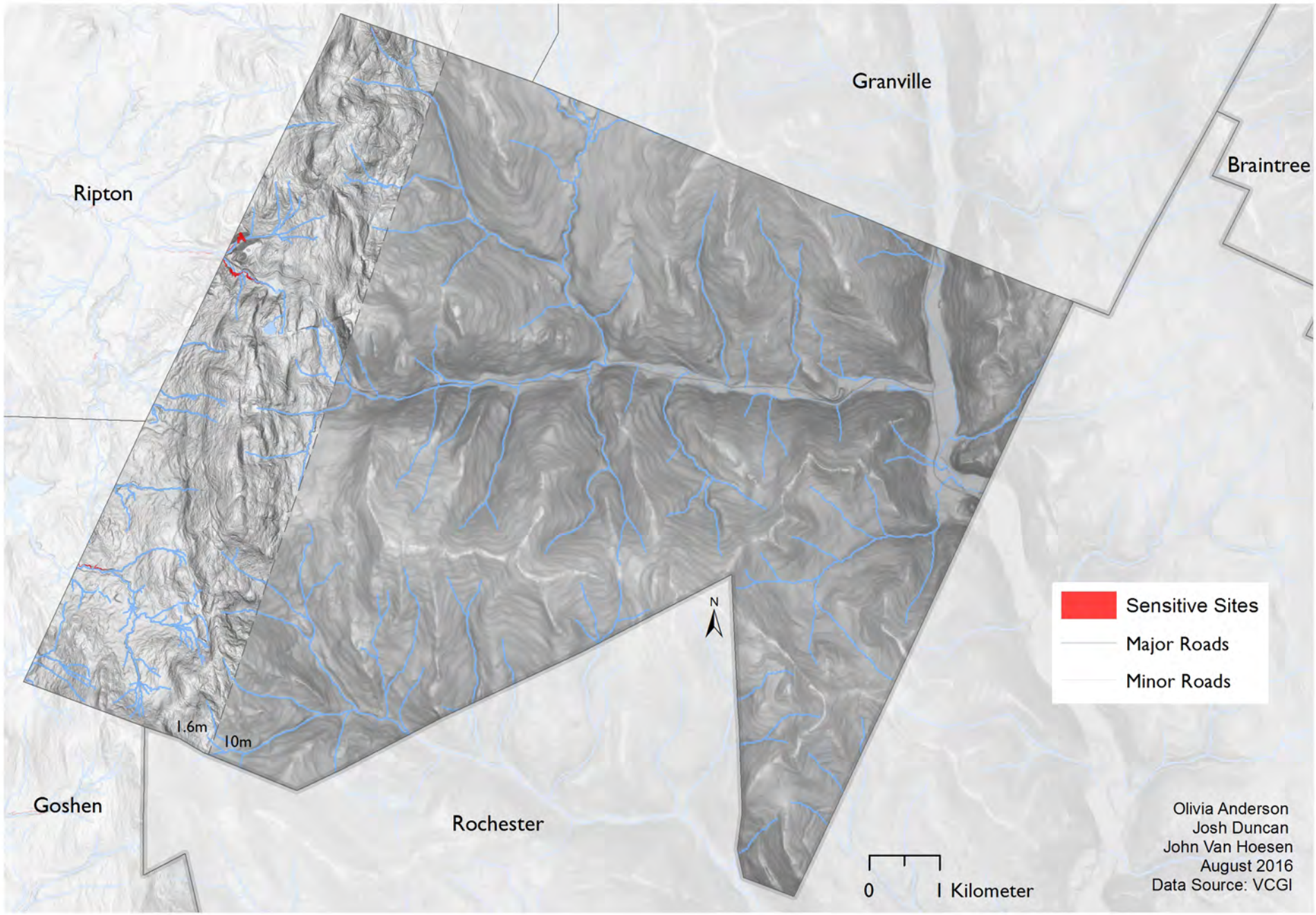


Landslide Potential of the Town of Granville
Addison County, VT, USA

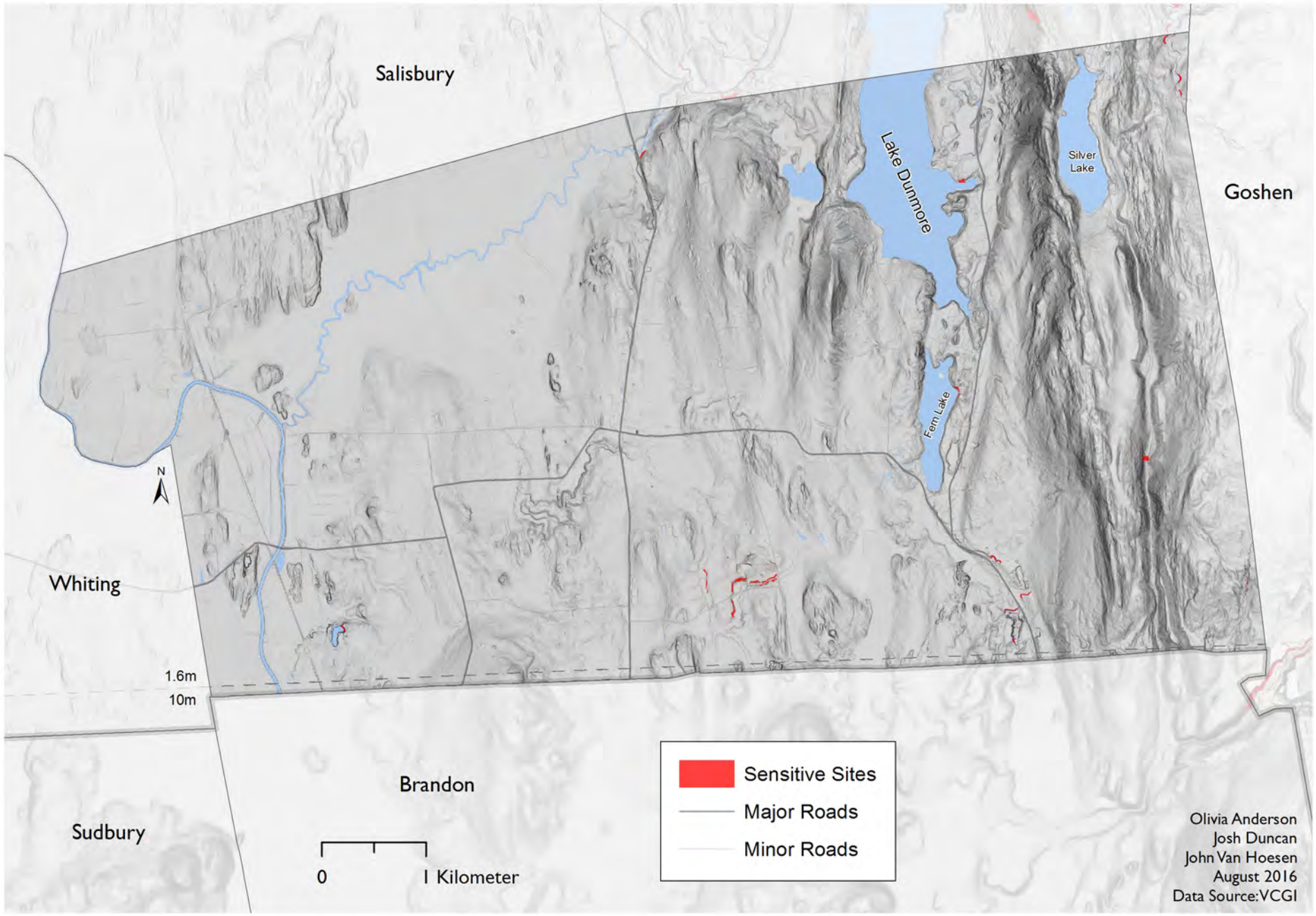


Olivia Anderson
Josh Duncan
John Van Hoesen
August 2016
Data Source: VCGI

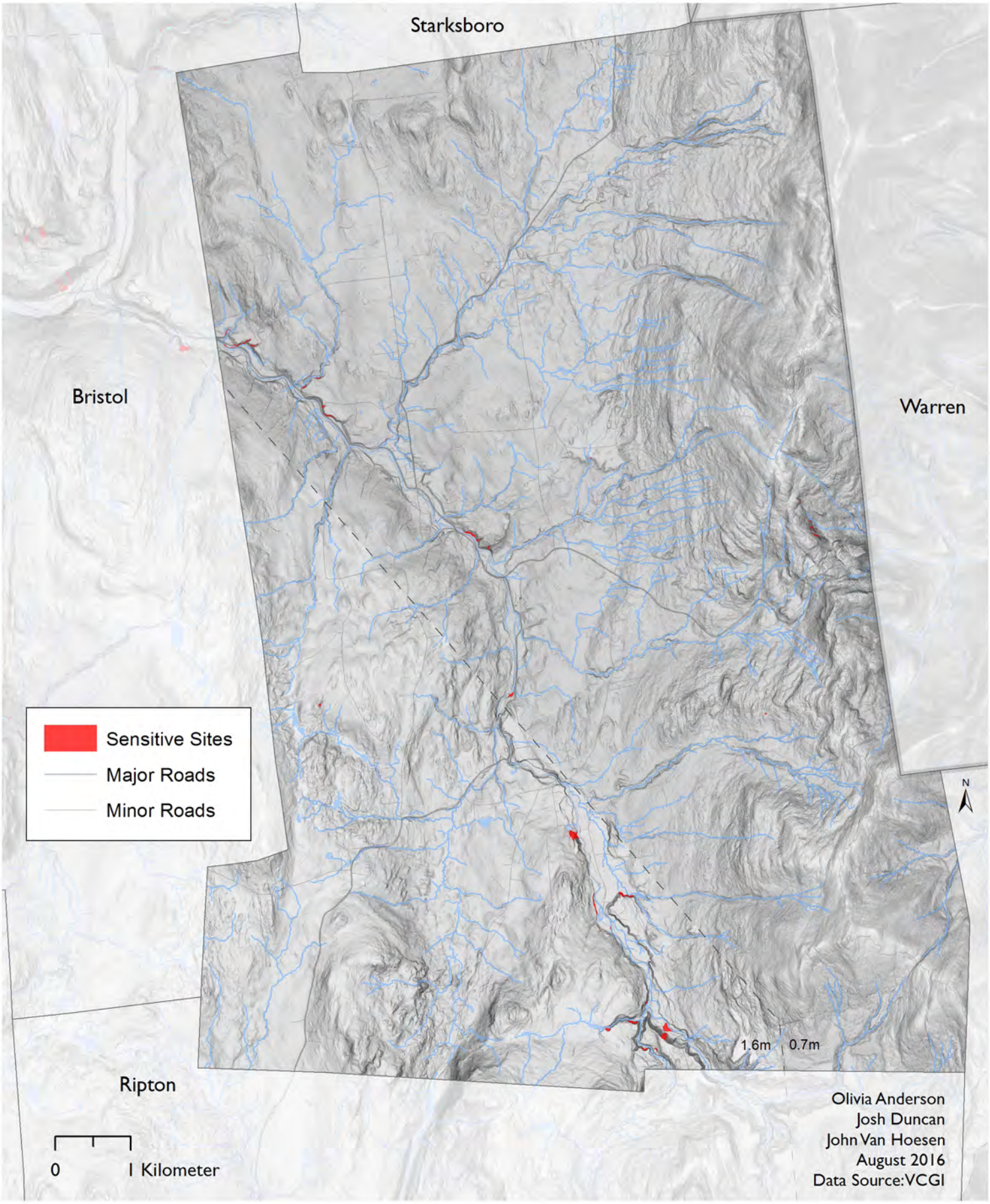
Landslide Potential of the Town of Hancock
Addison County, VT, USA



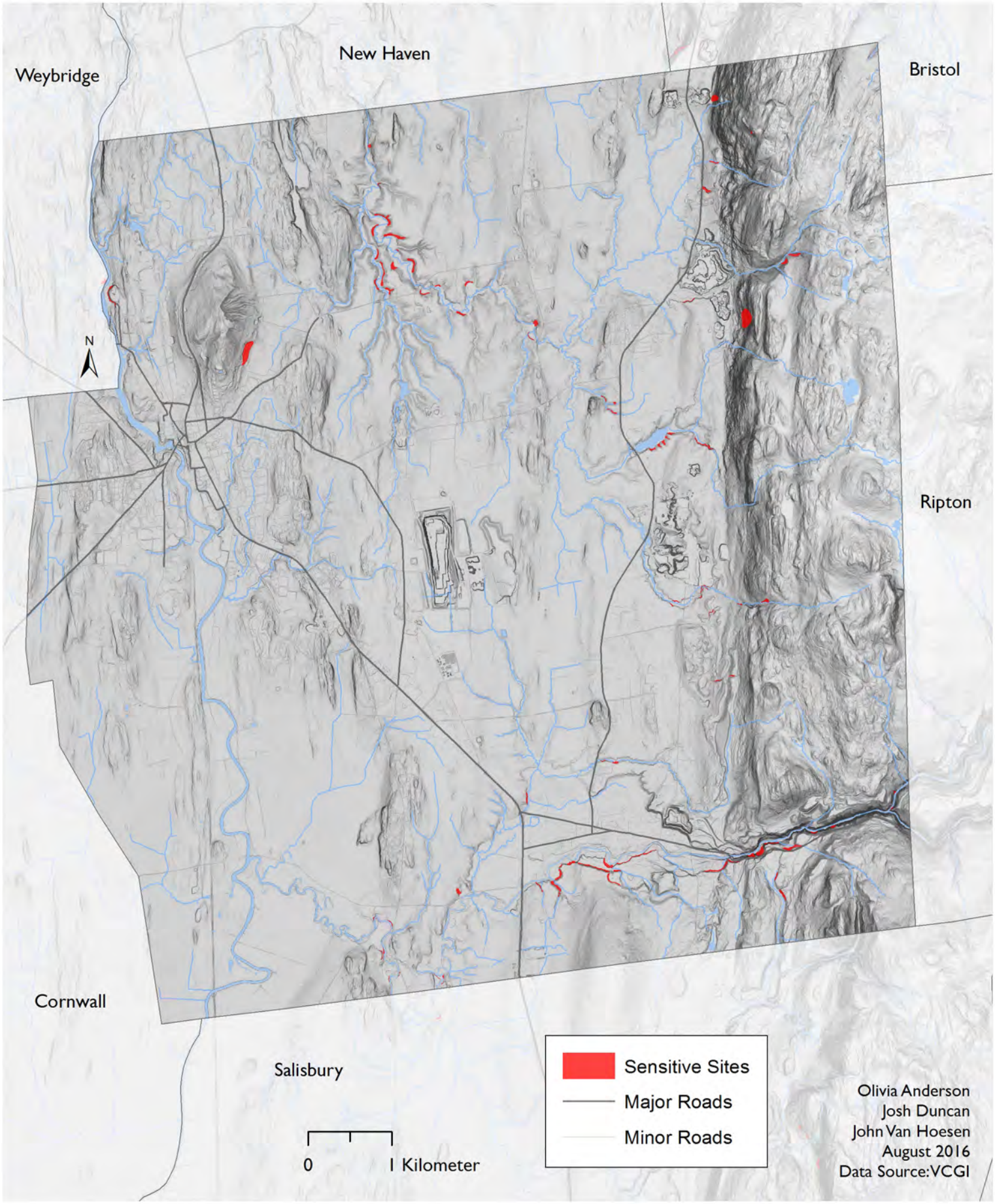
Landslide Potential of the Town of Leicester
Addison County, VT, USA



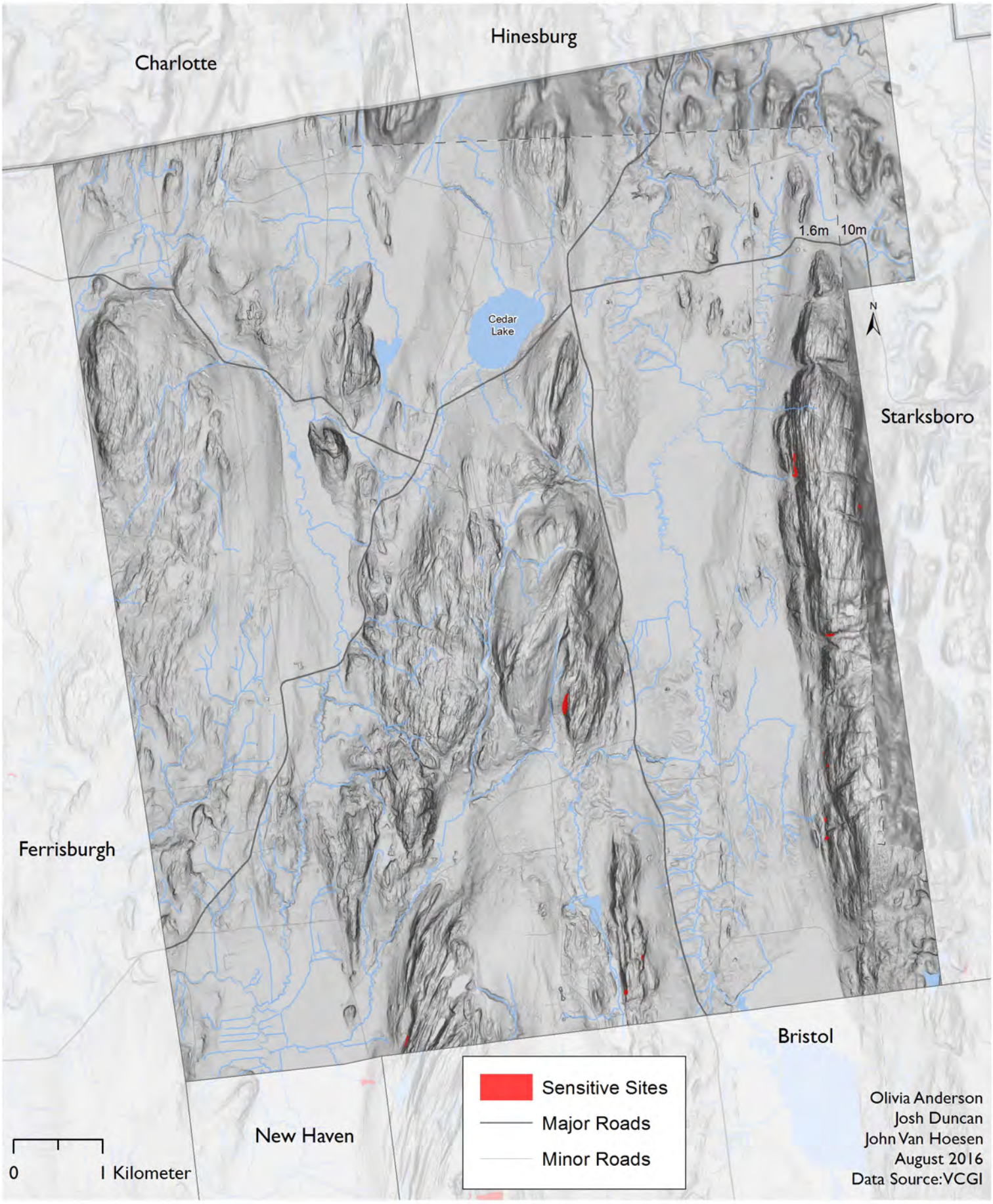
Landslide Potential of the Town of Lincoln
Addison County, VT, USA



Landslide Potential of the Town of Middlebury
Addison County, VT, USA

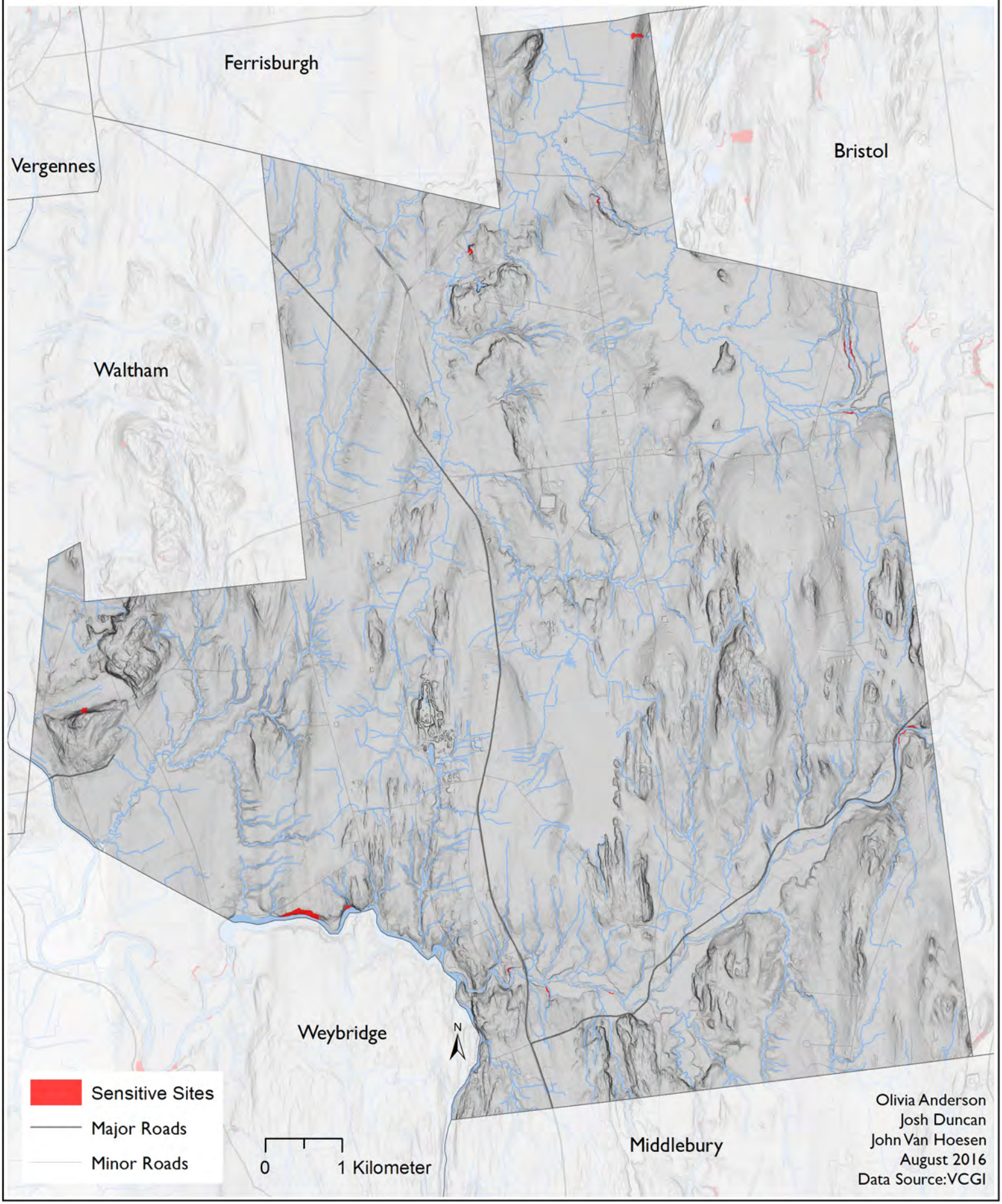


Landslide Potential of the Town of Monkton
Addison County, VT, USA



Olivia Anderson
Josh Duncan
John Van Hoesen
August 2016
Data Source: VCGI

Landslide Potential of the Town of New Haven
Addison County, VT, USA



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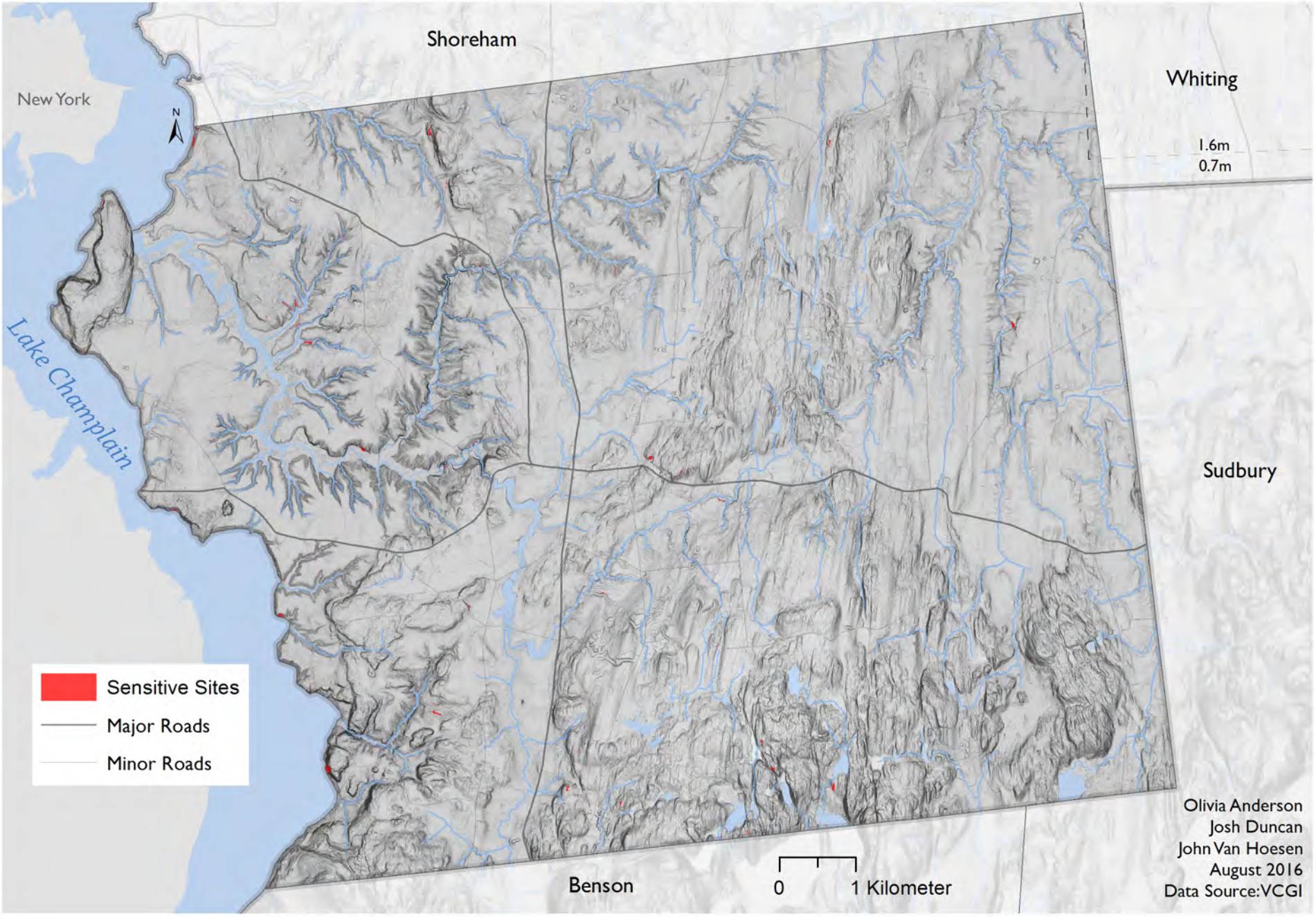
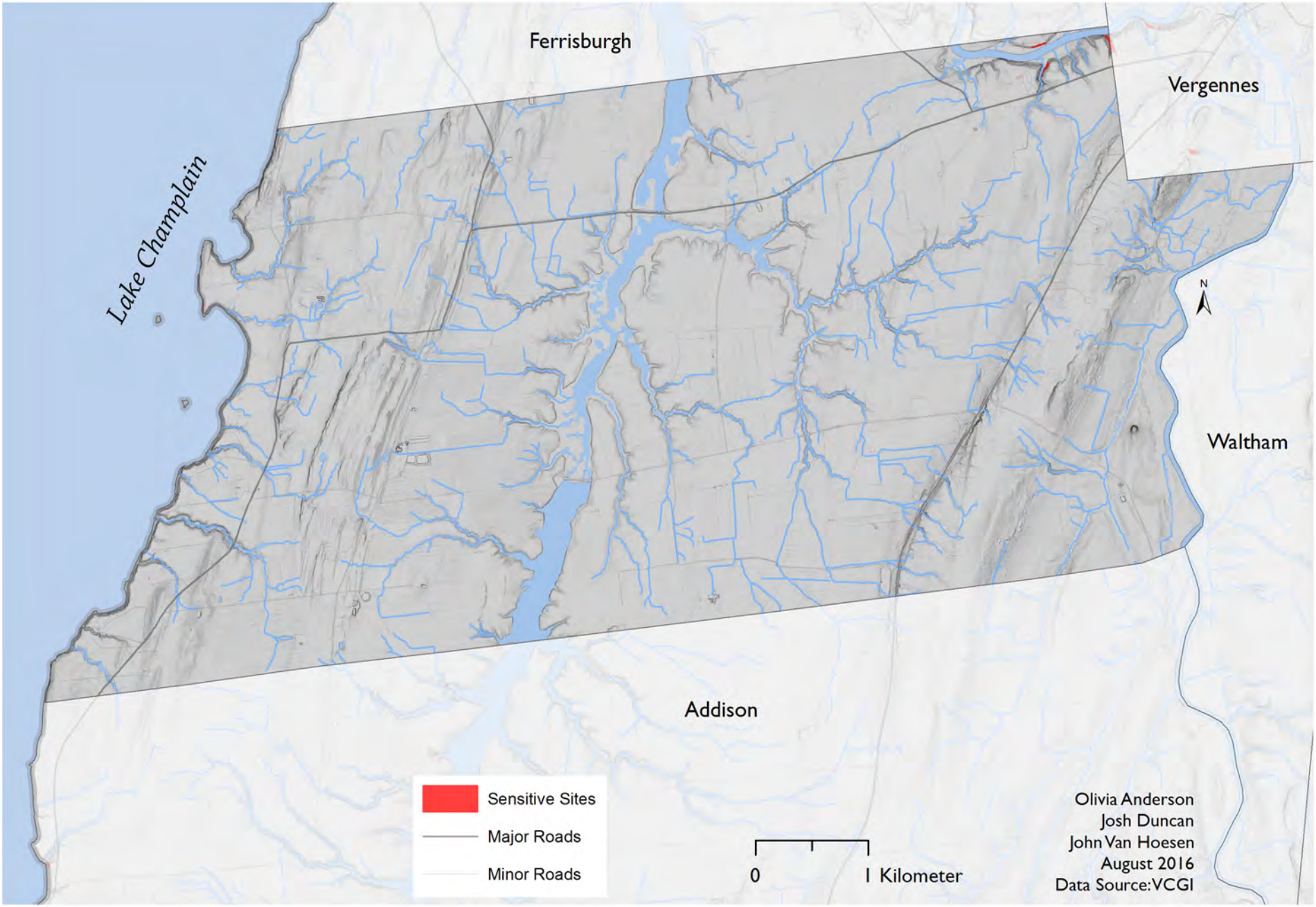
Josh Duncan
John Van Hoesen
August 2016
Data Source: VCGI

Landslide Potential of the Town of Orwell
Addison County, VT, USA

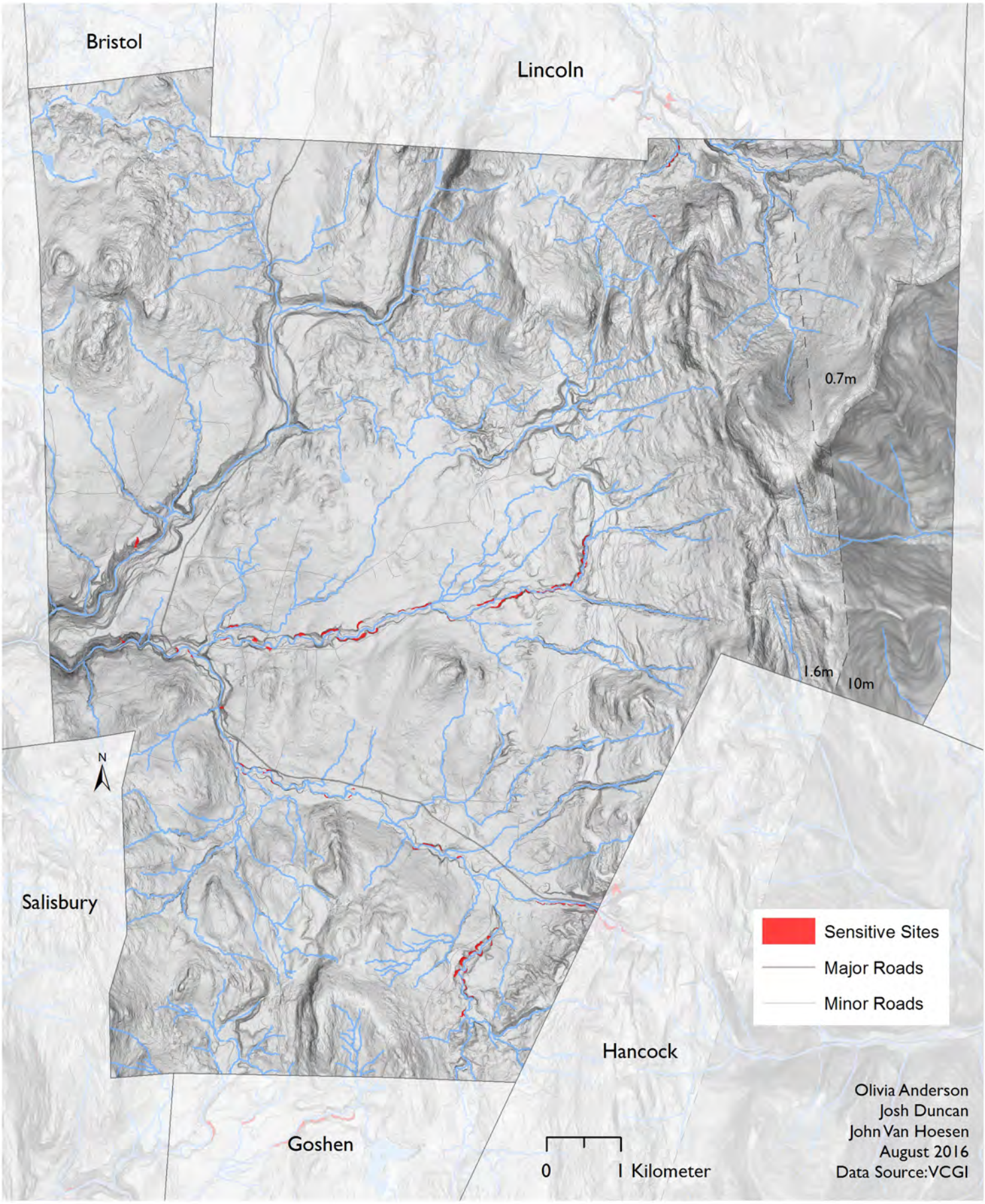


Olivia Anderson
Josh Duncan
John Van Hoesen
August 2016
Data Source: VCGI

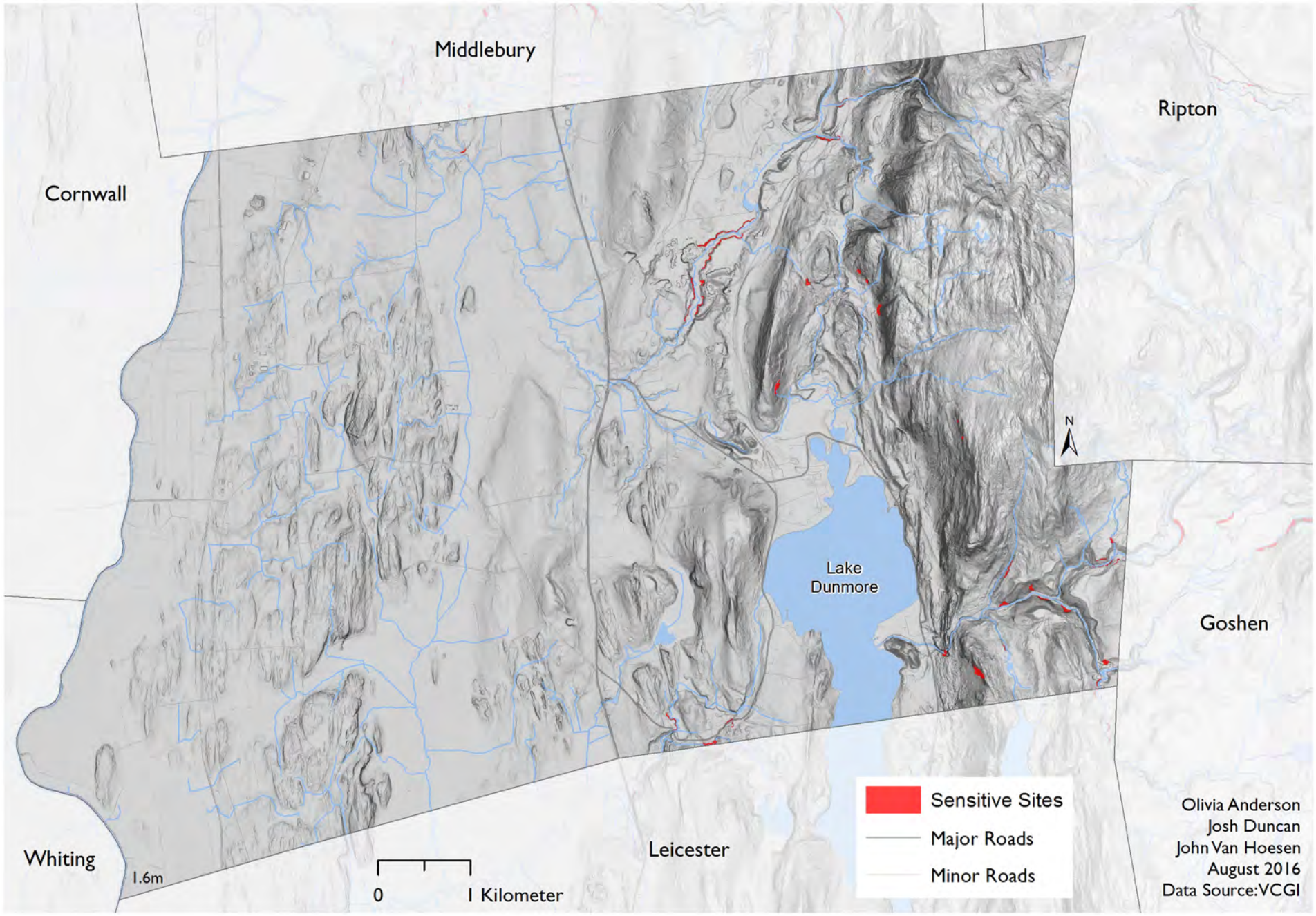
Landslide Potential of the Town of Panton
Addison County, VT, USA



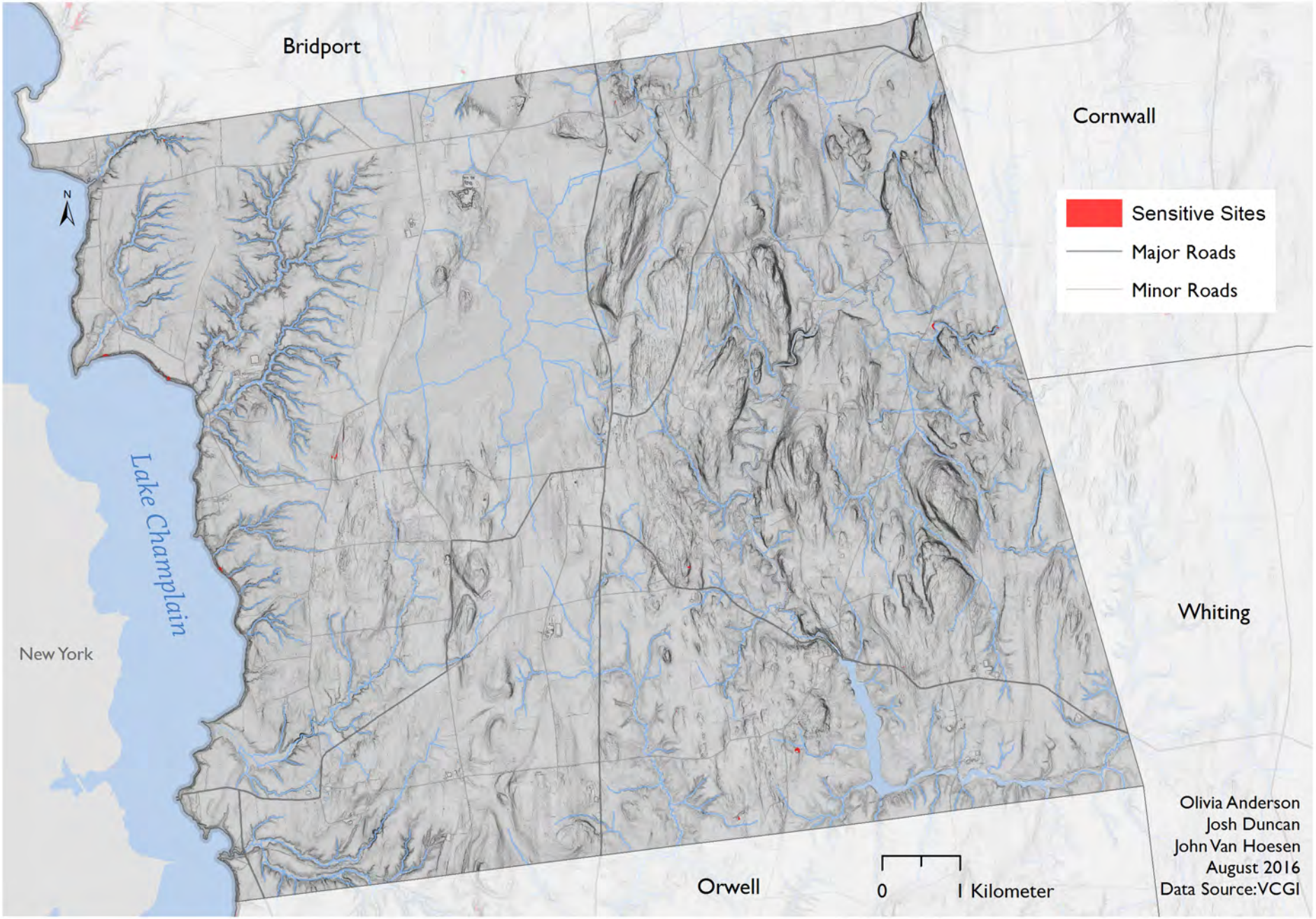
Landslide Potential of the Town of Ripton
Addison County, VT, USA



Landslide Potential of the Town of Salisbury
Addison County, VT, USA

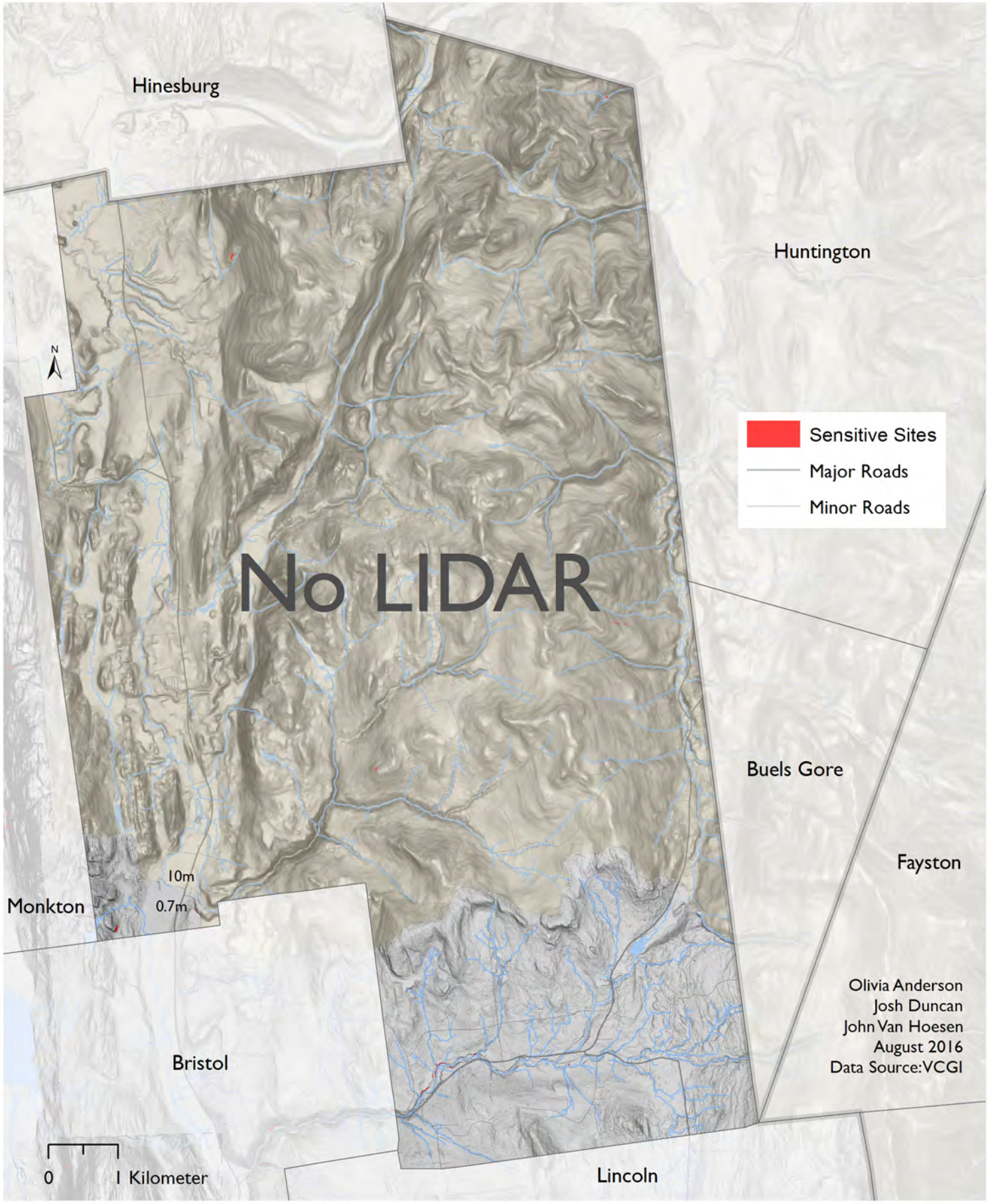


Landslide Potential of the Town of Shoreham
Addison County, VT, USA



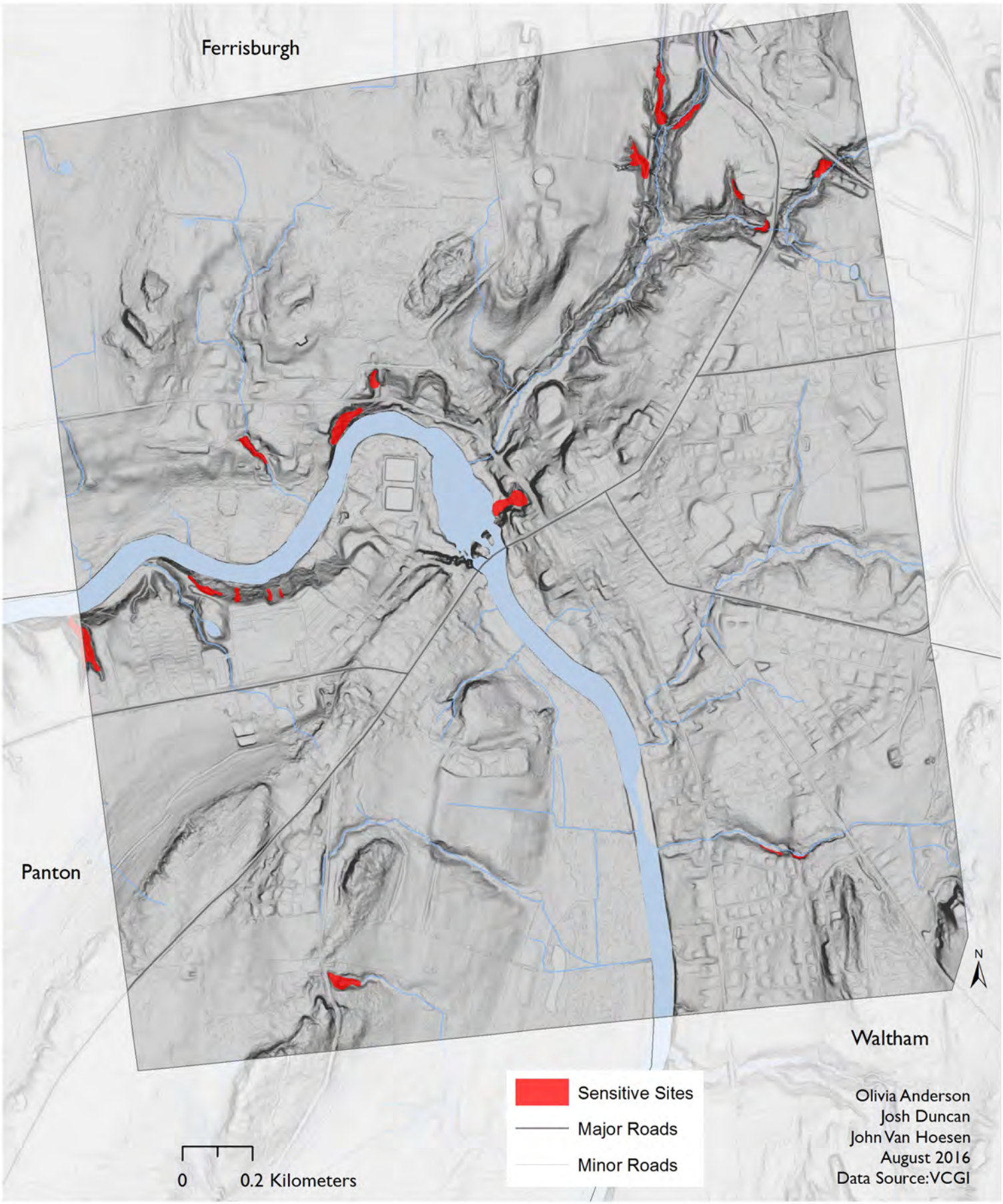
Olivia Anderson
Josh Duncan
John Van Hoesen
August 2016
Data Source: VCGI

Landslide Potential of the Town of Starksboro
Addison County, VT, USA

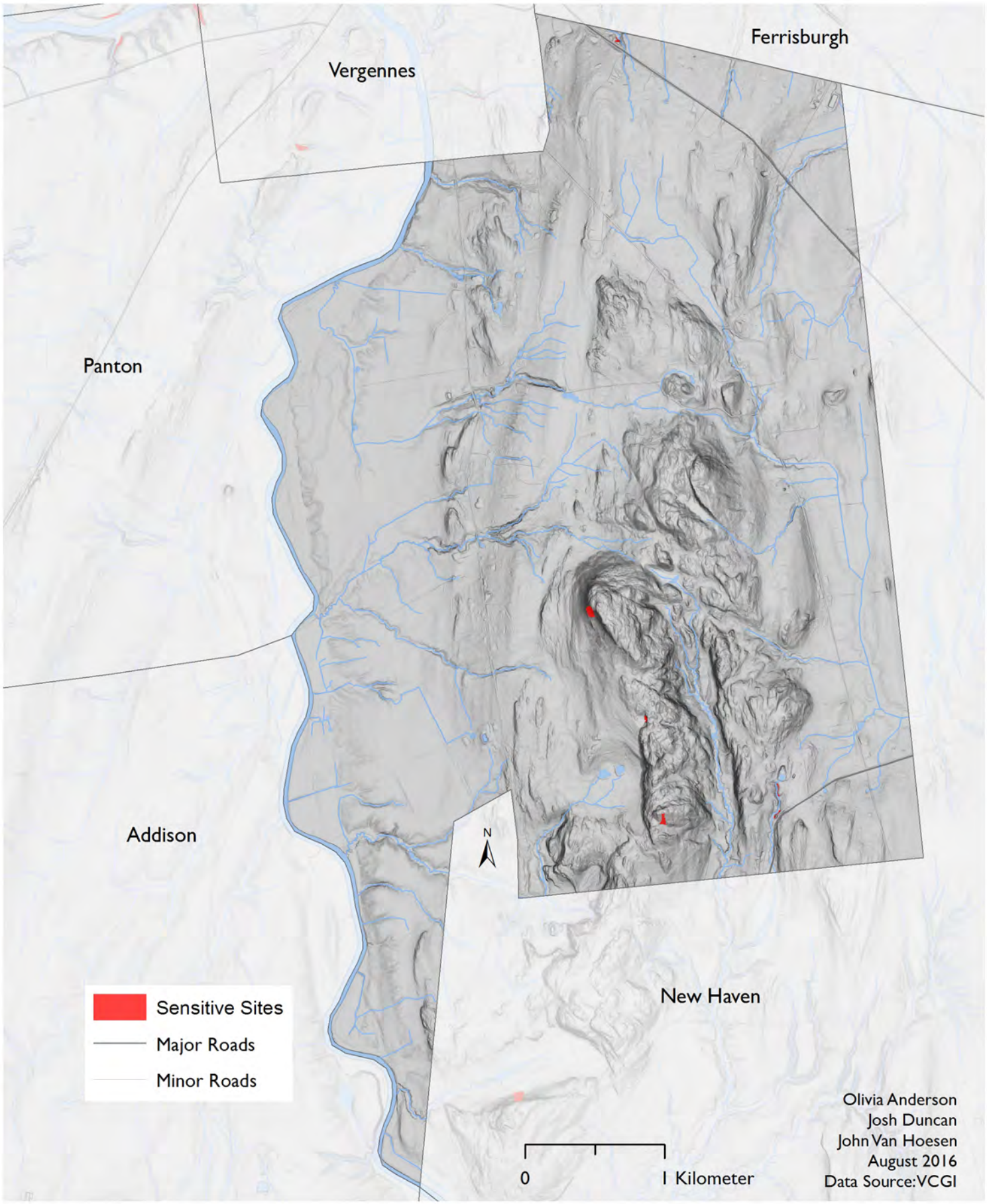


Olivia Anderson
Josh Duncan
John Van Hoesen
August 2016
Data Source: VCGI

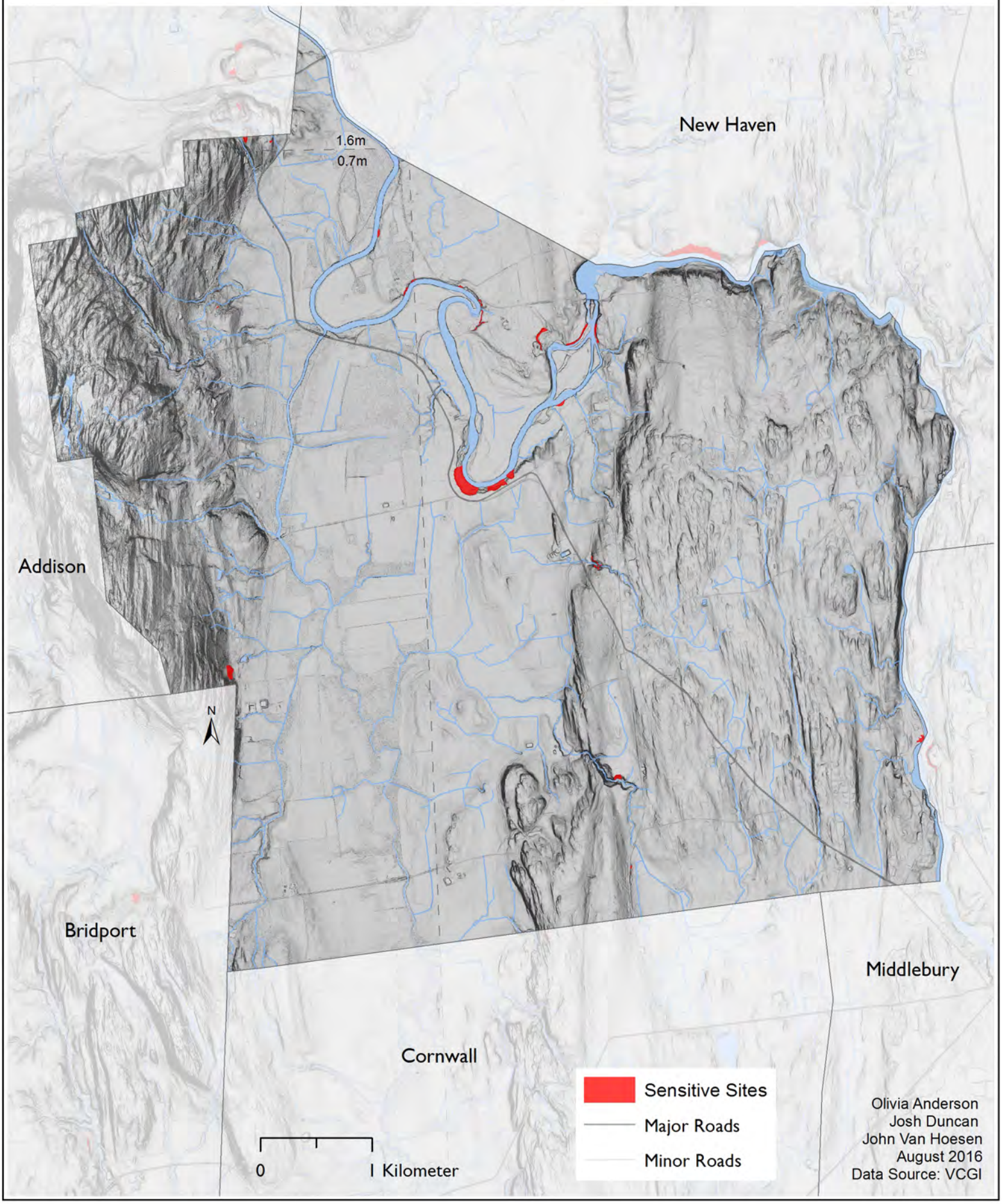
Landslide Potential of the Town of Vergennes
Addison County, VT, USA



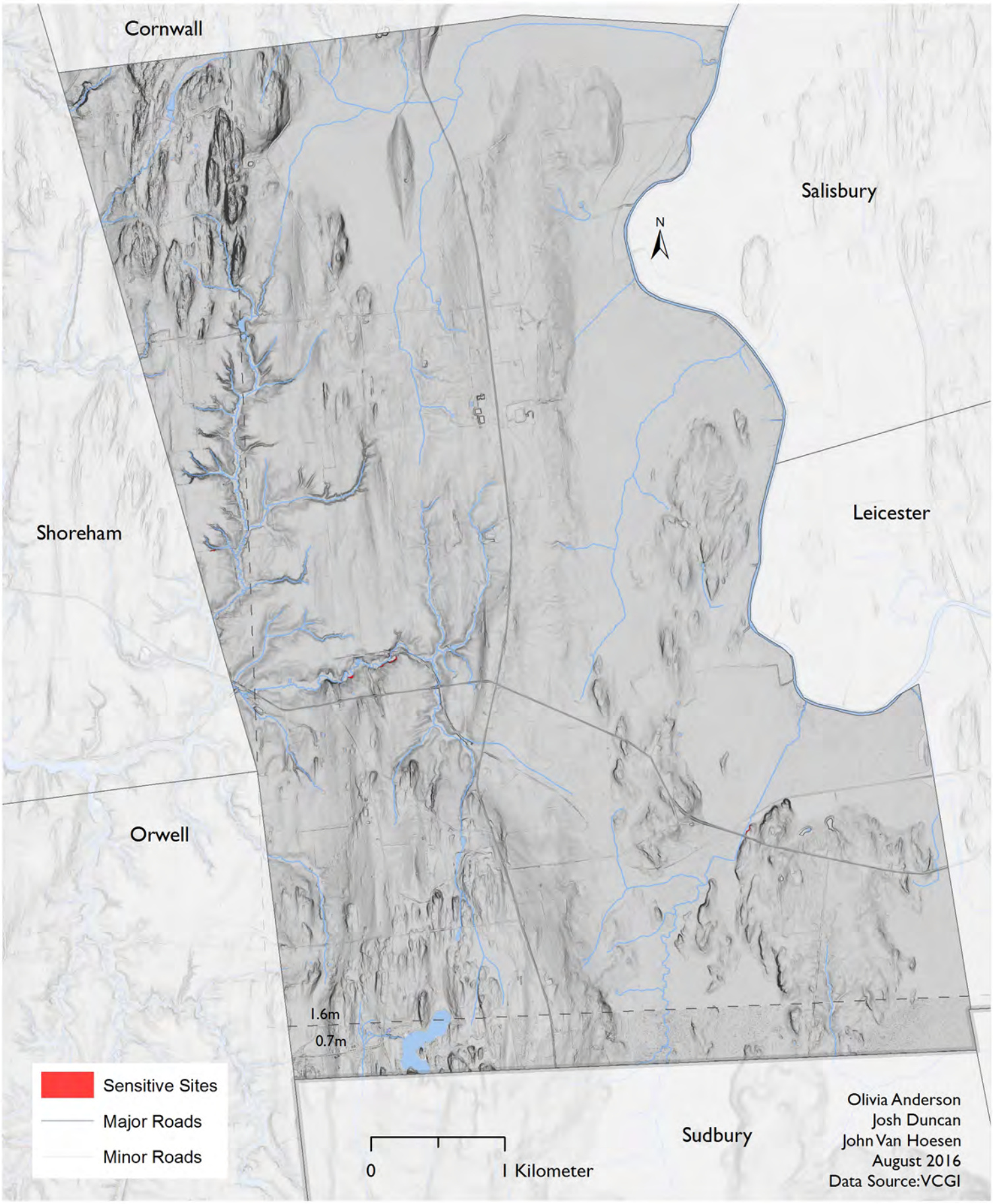
Landslide Potential of the Town of Waltham
Addison County, VT, USA



Landslide Potential of the Town of Weybridge
Addison County, VT, USA

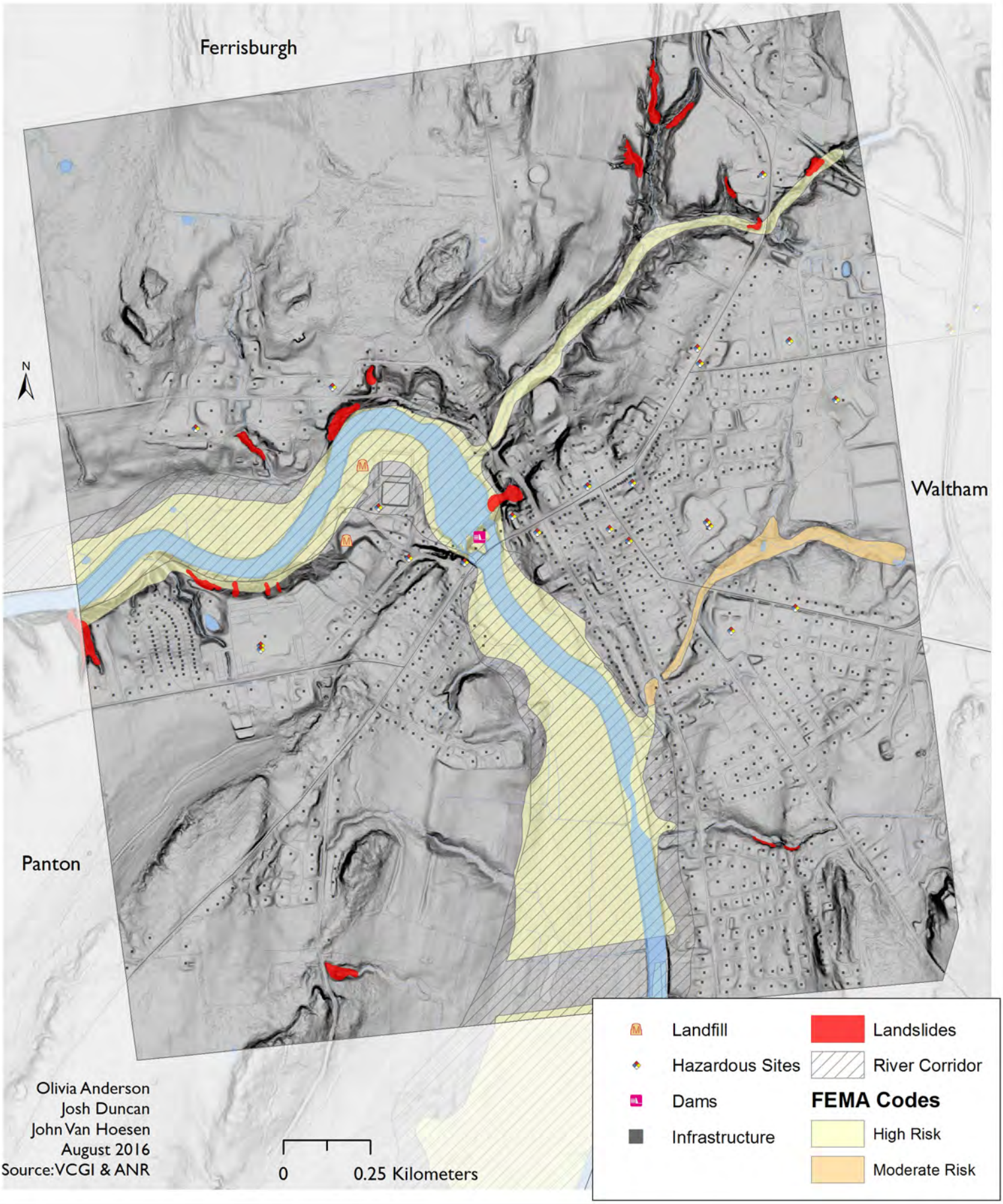


Landslide Potential of the Town of Whiting
Addison County, VT, USA



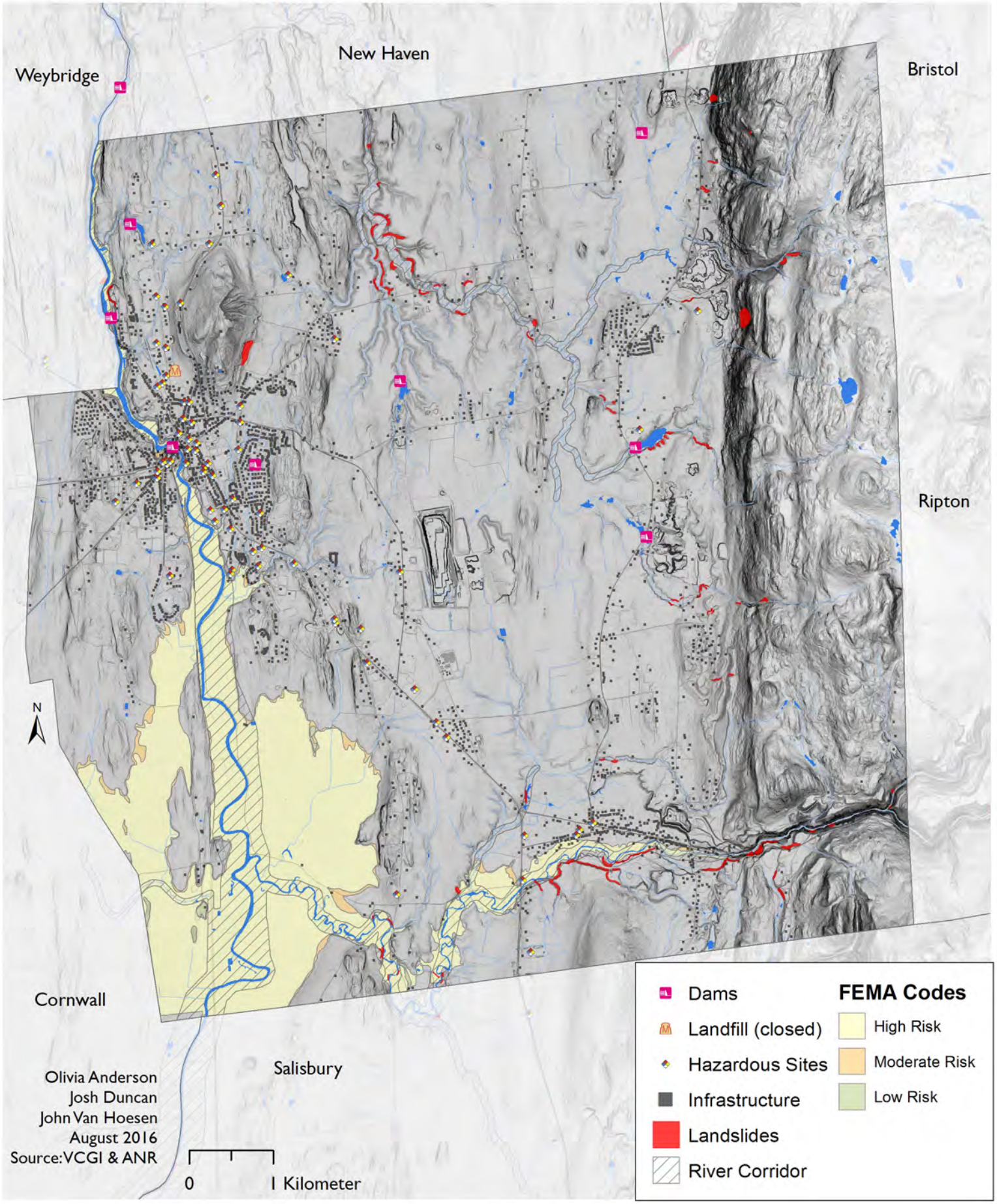
7.4 – Multi-hazard Mapping Results

Multi-hazard Map for Town of Vergennes
Addison County, VT, USA



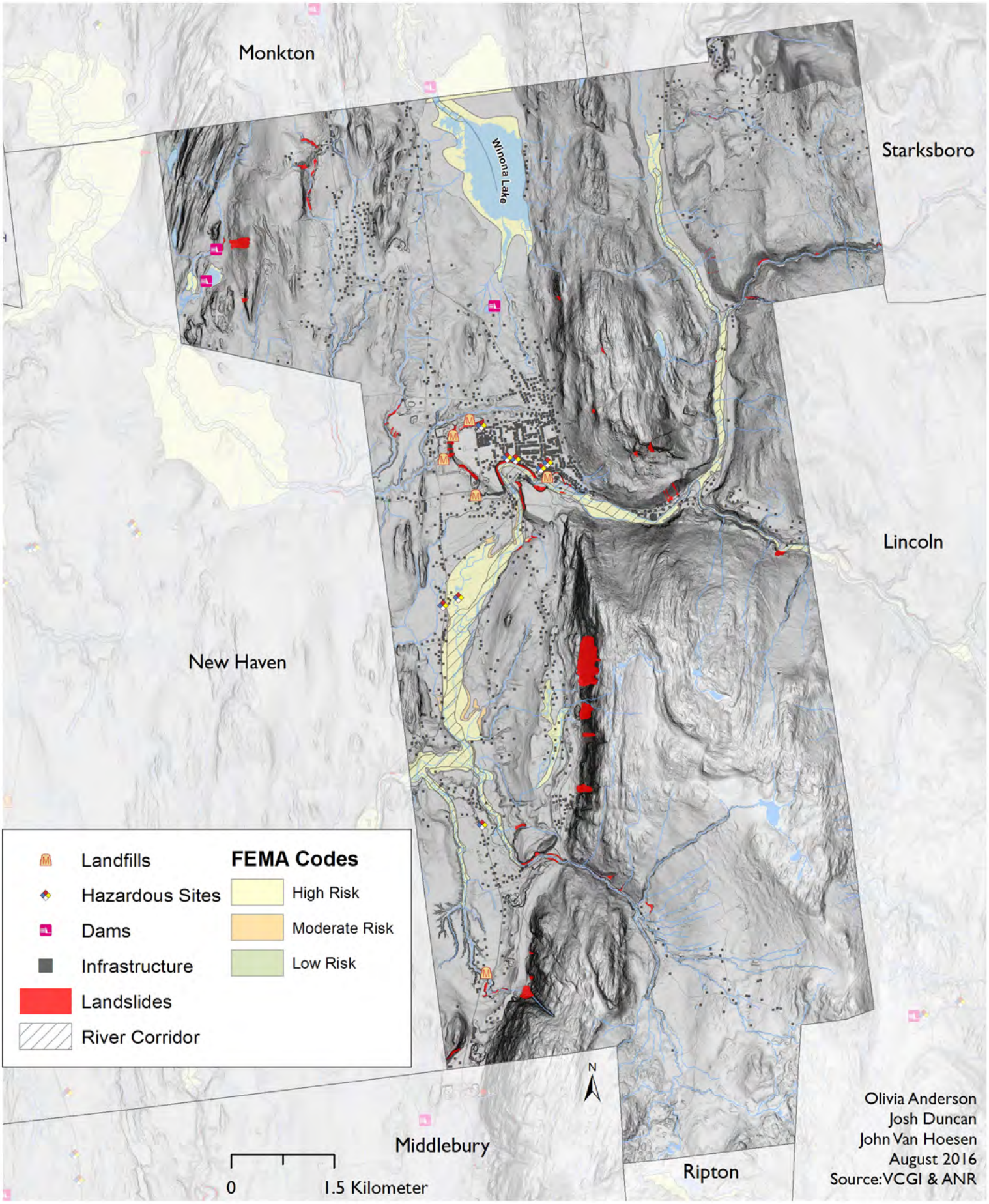
Olivia Anderson
Josh Duncan
John Van Hoesen
August 2016
Source: VCGI & ANR

Multi-hazard Map for Town of Middlebury
Addison County, VT, USA



Olivia Anderson
Josh Duncan
John Van Hoesen
August 2016
Source: VCGI & ANR

Multi-hazard Map for Town of Bristol
Addison County, VT, USA



7.5 – Field Site Characteristics

Town	**ID** (LndsId_ID)	**Type** (if visited)	**Area** (sq. m.)	**Identified Hazard** (if visited) (3=high)	**Hazard Potential** Based on Raster Calculation	**Hazard Potential** Based on Frequency Ratio
Addison	66		3,469.65	5	Moderate/Low	Low/Moderate little high
Addison	67		185.95	5	Moderate	Moderate/High
Addison	68		2,487.01	5	Low little moderate	Low/Moderate
Addison	69		4,810.30	5	Moderate little high	High/Moderate/Low
Addison	70		1,585.76	5	Moderate/Low little high	High/Low little moderate
Addison	71		1,143.16	5	Moderate little high	Moderate/Low little high
Addison	127		263.32	5	Moderate/High	High/Low little moderate
Addison	128		1,042.82	5	Low/Moderate	Moderate/High/Low
Addison	129		824.50	5	Low/Moderate	High little moderate
Bridport	50		2,071.09	5	Low little moderate	High/Moderate/Low
Bridport	53		401.28	5	Moderate little low	High/Moderate little low
Bridport	54		580.54	5	Moderate	High/Moderate little low
Bridport	59		119.86	5	Low little moderate	High little moderate
Bridport	61		3,753.17	5	Moderate/Low little high	High/Moderate/Low
Bridport	62		3,047.94	5	Low little moderate	Low/High/Moderate
Bridport	63	Landslide-Gully Complex	977.62	2	Moderate	High/Moderate
Bridport	64		1,260.63	5	Low/Moderate	Moderate/Low little high
Bridport	65		2,212.82	5	Moderate	Low/Moderate/High
Bridport	130		99.77	5	Low/Moderate	High/Moderate
Bridport	131		622.95	5	Moderate/Low	High/Moderate/Low
Bridport	135		304.34	5	Moderate	High
Bridport	136		854.87	5	Moderate little high	High/Moderate/Low
Bristol	13	Translational Slide	348.79	2	High	Moderate
Bristol	14	Translational Slide	1,860.34	1	High	Moderate/High little low
Bristol	15		158.49	5	High	Moderate
Bristol	16		1,885.16	5	High	Moderate/Low

Bristol	126		383.58	5	High/Moderate/Low	Low/Moderate little high
Cornwall	46		707.42	5	Low	Moderate/Low/High
Cornwall	55		129.68	5	Moderate	High/Moderate/Low
Cornwall	56		2,407.56	5	Moderate	High/Moderate
Cornwall	57		148.55	5	Low little moderate	Low little moderate
Cornwall	58		614.43	5	Moderate little high	Low little moderate
Cornwall	60		604.06	5	Moderate little high	Moderate/Low little high
Cornwall	137		2,761.07	5	Moderate	High/Moderate/Low
Ferrisberg	1	Translational Slide	279.60	1	High/Moderate	High/Moderate
Ferrisberg	2	Translational Slide	251.42	1	High/Moderate	Mostly low then moderate then high
Ferrisberg	3		343.37	5	High	Low/Moderate
Ferrisberg	4		1,123.36	5	High/Moderate	Moderate/Low
Ferrisberg	5		1,560.92	5	Moderate/High	Moderate/Low
Ferrisberg	6		1,639.48	5	Moderate/High	Moderate/Low
Ferrisberg	7		1,786.04	5	Moderate/High	Moderate/Low small high
Ferrisberg	30	Translational Slide	75.96	3	High	Moderate/High
Ferrisberg	31	Translational Slide	46.44	3	High	Moderate/High
Ferrisberg	147		1,768.25	5	Moderate little high	Low/Moderate
Ferrisberg	148		4,946.54	5	Moderate/High	Moderate/Low little high
Goshen	73		1,323.24	5	High little moderate	Moderate little high
Goshen	75		1,941.74	5	High	Low little moderate
Granville	116		749.35	5	Low/Moderate	Moderate/High
Granville	117		3,730.94	5	High/Moderate	Moderate/High/Low
Granville	118		659.49	5	High/Moderate	Moderate/High
Granville	119		1,040.29	5	High little moderate	Moderate/High
Granville	121		4,506.54	5	Moderate/High	Moderate/High
Granville	122		32,335.32	5	Moderate/High	High little moderate
Lincoln	76		7,678.51	5	Low little moderate	High
Lincoln	77	Translational Slide	477.21	1	Low little high/moderate	High little low/moderate
Lincoln	78		378.49	5	High	Moderate little high
Lincoln	105		131.89	5	Moderate	Low/Moderate

Lincoln	107		151.21	5	Low	High/Moderate
Lincoln	108		482.50	5	Low little moderate	High little moderate
Lincoln	109		382.79	5	Moderate	High
Lincoln	110		1,272.73	5	Moderate	High
Lincoln	111		1,112.79	5	Moderate	High
Lincoln	112		278.90	5	High	Moderate
Lincoln	113		593.78	5	Low little moderate	Low little moderate
Lincoln	114		2,385.62	5	High little moderate	Moderate little high
Lincoln	115		803.72	5	Moderate	Moderate/Low
Lincoln	120		10,029.80	5	High/Moderate	Moderate/High
Lincoln	154	Translational Slide	937.97	1	Low	High
Middlebury	19		1,296.93	5	High little moderate	Moderate/Low
Middlebury	20	Translational Slide	429.55	1	High	Moderate little low
Middlebury	21	Streambank Erosion	890.60	1	Moderate little high	Moderate/Low
Middlebury	22	Translational Slide	4,827.81	2	High little moderate	Low/Moderate little high
Middlebury	23	Fall	2,517.34	1		High/Moderate
Middlebury	24	Translational Slide	2,634.08	2	High/Moderate	Moderate/Low little high
Middlebury	150		506.49	1	High	Moderate
New Haven	10	Rotational Slump	1,554.78	2	High	Moderate/High
New Haven	9		1,921.34	1	Moderate/high	High/Moderate
New Haven	11	Gullying	7,428.37	1	High	Moderate/Low little high
New Haven	17		3,082.63	5	Moderate/HIgh	Low/Moderate
New Haven	18		1,035.13	5	Moderate/High	Moderate/Low little high
Orwell	32		2,209.32	5	Low/High little moderate	
Orwell	33		381.91	5		Low/Moderate little high
Orwell	34		1,593.59	5	Low little moderate	Moderate/Low little high
Orwell	35		1,498.71	5		High/Moderate
Orwell	36		2,257.87	5	Moderate little low	High/Moderate/Low
Orwell	37		113.86	5		High/Moderate little low
Orwell	38		116.53	5	Low	High/Moderate

Orwell	39		96.86	5	Low	High little moderate
Orwell	40		3,473.48	0	Low	High/Moderate/Low
Orwell	41		1,991.07	5	Low	Low/Moderate little high
Orwell	72		390.07	5	Low	Moderate/Low/High
Orwell	144		630.56	5	Moderate	High/Moderate
Orwell	145		5,728.09	5	Low	High/Moderate/Low
Orwell	146		2,804.72	5	Low	High/Moderate/Low
Panton	12		298.48	5	Moderate	Moderate/Low little high
Ripton	74		4,830.61	5	High/Moderate	Moderate little high
Ripton	79	Streambank Erosion	647.43	0	High	Low little moderate
Ripton	80		85.07	0	Moderate little high	Moderate/Low
Ripton	81		290.31	5	High	Moderate/Low
Ripton	82		503.64	5	High	Moderate
Ripton	83	Translational Slide	1,120.81	3	High	Moderate/High
Ripton	84	Translational Slide	886.90	0	High	High/Moderate
Ripton	85		929.79	5	High	Moderate/Low
Ripton	86		831.66	5	High/Moderate	Moderate
Ripton	87		617.10	5	High	Low/Moderate
Ripton	88		1,499.41	5	High/Moderate	Low little moderate
Ripton	89		2,770.50	5	Moderate little high	Moderate/Low little high
Ripton	95	Gullying	742.99	0	High	Moderate/Low little high
Ripton	96	Translational Slide	1,263.12	0	Moderate little high	Moderate/Low
Ripton	97	Streambank Erosion	304.73	0	High	Moderate little high
Ripton	98	Translational Slide	1,171.65	1	High	Moderate little High
Ripton	99	Translational Slide	768.10	0	High	Moderate/High
Ripton	123		811.73	5	High little moderate	Low/Moderate
Salisbury	25		1,025.22	5	High	High/Moderate
Salisbury	26		2,720.12	5	High	Moderate little high
Salisbury	27	Topple	1,725.72	1		High/Moderate
Salisbury	28	Fall	7,228.47	2		Moderate/High
Shoreham	42		2,424.48	5	Low little moderate	High/Moderate

Shoreham	43		269.57	5	Low/Moderate	High/Moderate little low
Shoreham	44		504.58	5	Low	High/Moderate
Shoreham	45		214.92	5	little moderate	High/Moderate
Shoreham	47		359.42	5	High	High/Moderate
Shoreham	48		431.94	5	Moderate little High	High/Moderate
Shoreham	49	Translational Slide	1,662.19	0	Moderate	High/Moderate
Shoreham	51		181.29	5	Moderate/Low	High/Moderate
Shoreham	52		361.51	5	Moderate/Low	Moderate/Low/High
Shoreham	92		1,990.20	5	Low little moderate	High/Moderate
Shoreham	141		1,339.61	5	Low little moderate	High/Moderate
Shoreham	142		595.93	5	High/Moderate	Low/Moderate
Shoreham	143		1,775.72	5	Low	High/Moderate
Starksboro	124		684.40	5	High/Moderate	Moderate/High
Starksboro	125		331.62	5	Moderate/High	Moderate
Starksboro	151	Translational Slide	251.04	1	High	N/C
Starksboro	152	Gullying	357.39	2	High	N/C
Starksboro	153	Translational Slide	117.92	0	High	N/C
Weybridge	8		2,253.32	5	High	Moderate/Low
Weybridge	90		8,795.17	5	Moderate little high	Moderate/Low
Weybridge	91		3,944.44	5	Moderate little high	Low/Moderate little high
Weybridge	93		27,339.08	5	Moderate/Low little high	Low/Moderate little high
Weybridge	94		1,732.53	5	Moderate/High	Moderate/Low little high
Weybridge	101		262.34	5	Low little moderate	Low/Moderate/High
Weybridge	102		5,755.86	5	Low	Low/Moderate/High
Weybridge	103		2,508.66	5	Moderate little high	Moderate little high
Weybridge	104		327.82	0	Moderate	Low little moderate
Weybridge	106		439.04	5	Low little moderate/high	Low little moderate
Weybridge	132	Translational Slide	712.59	2	High/Moderate	High/Moderate/Low
Weybridge	133		674.62	5	Moderate	High little moderate
Weybridge	134		480.56	5	Moderate	High/Moderate/Low
Weybridge	138		1,251.15	5	Moderate little high	High/Moderate/Low

Weybridge	149		525.39	5	High	Moderate little high
Weybridge/ Addison	100		2,074.66	5	High	Moderate/High
Whiting	29	Streambank Erosion	438.43	1	Moderate/High	Moderate/Low
Whiting	140		177.72	5	High little moderate	High/Low