

VERMONT

Vermont Geological Survey

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INTRODUCTION

The VGS, a Division in the Department of Environmental Conservation (DEC) in the Agency of Natural Resources, is guided by the Department mission to protect human health and safety. We provide, through service, research, publications and educational outreach, high quality, objective geologic information integral to the health, safety and well-being of Vermonters. Activities are guided by statute that designates the State Geologist as the Director of the Division of Geology and Mineral Resources. Statutory activities include:

- Conduct surveys and research related to the geology and mineral resources of the State.
- Give aid and advice relating to the development and working of rock and mineral deposits suitable for building, road making and economic purposes.
- Provide information and education to government, industry, other institutions and organizations and to citizens regarding geology, mineral resources and topography of the State.
- Provide technical information and advice regarding the management of mineral resources on state-owned lands, and cooperate where possible by providing geologic expertise and advice to persons conducting regulatory programs for the State.
- Provide geological services to the Natural Gas and Oil Resources Board.
- Maintain records of old and new information relating to the geology, mineral resources and topography of the State.
- Prepare and publish reports on the geology, mineral resources and topography of the State.

Since the completion of the 2011 Bedrock Geologic Map of Vermont, the VGS has focused on geologic mapping, geologic hazards, groundwater quality and quantity, and the geologic basis of certain health concerns. Groundwater in fractured bedrock, radioactivity and arsenic issues, landslide hazard mapping and monitoring, and geochemical landscape are topics of current studies conducted with our university and sister agency partners.

The newly-formed Science Advisory Committee for the Agency of Natural Resources is co-chaired by the State Geologist and includes members from all three departments: Fish and

Wildlife, Forest, Parks and Recreation, and Environmental Conservation. The committee charge is to strengthen science, monitoring and data functions in the Agency and to support the Agency need to integrate science with policy and decision making.

In terms of operations, the DEC implemented a process of results-based accountability (RBA) and performance measures which measure our positive impacts and products developed for the State. As a group of two geologists, plus one funded position at Norwich University, our challenge is to maintain and build capacity to do valuable geologic work for Vermont. We accomplish our work through federal funds and partnerships with towns, universities and other organizations who provide the necessary in-kind match.

GEOLOGIC MAPPING

Bedrock and surficial maps are used to address such issues as radioactivity and arsenic in groundwater, groundwater recharge potential and to mitigate landslide hazards. The VGS involves communities at a grassroots level and addresses issues specific to town and state needs while maintaining the quadrangle mapping structure. This year our town partners provided in-kind match (GIS services and field assistance) for STATEMAP, a valuable cooperative mapping program for the Survey. The funds were further leveraged through student interns who spent time in the field and later completed projects ranging from water chemistry to tectonics. Maps are posted on the VGS web site for easy access for Vermont communities.

The following maps and Open File reports, funded in part by the STATEMAP program, were released in 2015:

Kim, J. and Springston, G., 2015, Report on aquifer and aquifer recharge mapping in the Town of Bristol, Vermont: Vermont Geological Survey Open File Report VG2015-1, 8 plates, scale 1:24,000

Kim, J., Gale, M., Springston, G., Koteas, C., Defelice, C., and Saitta, N., 2015, Bedrock geologic map of the southern two-thirds of the Woodbury quadrangle, Washington County, Vermont: Vermont Geological Survey Open File Report VG2015-2, 1 plate, scale 1:24,000

Springston, George, Thomas, E., and Kim, J., 2015, Surficial geologic map of the southern two-thirds of the Woodbury quadrangle, Washington County, Vermont: Vermont Geological Survey Open File Report VG2015-3, 1 plate, scale 1:24,000

GROUNDWATER AND HEALTH

In 2015, the VGS and our Norwich University partner completed bedrock and surficial geologic maps of the Woodbury Quadrangle. These maps provided the geologic framework for assessment of the groundwater resources and geochemistry which will be completed in the coming months. Groundwater resource maps were also completed for Bristol and included wells and borings, depth to bedrock, hydrogeological

classification of surficial materials, surficial aquifer potential, bedrock well yield, and recharge, discharge and generalized groundwater flow directions.

Dr. Jon Kim (VGS) and the Vermont Dept. of Health (VDH) advised the Spring 2015 Middlebury College Environmental Studies Senior Seminar (ENV 401), "Radon and Environmental Health", on the role that geology plays in the statewide distribution of radon. The service-learning class used the existing "Compilation and Assessment of Radioactivity in Vermont" to assess the geologic and geophysical factors that are the most useful in predicting areas where elevated radon (10,000+ tests in the VDH database) is likely to occur. The data generated by this class will be integrated with the analysis of radon and geology being conducted by the VGS and VDH through funding by a VDH Tracking Grant.

The VGS also conducted detailed studies of nitrates in private and public drinking water supplies and an analysis of groundwater recharge and supply in the town of Hinesburg. These projects were made possible through an informal groundwater consortium which includes the VGS, Middlebury College, University of Vermont, SUNY Plattsburgh and many students

Dr. John Van Hoesen and students at Green Mountain College developed the GIS data set of projected groundwater use from 2005 to 2020 by census block. The raw data originated from a water use study conducted by USGS in 2010. The data contribute to our on-going studies of groundwater and water budgets at a statewide scale and were identified as priority data in the groundwater mapping synthesis conducted in 2014. The maps are posted on the ANR Natural Resource Atlas.

In coordination with other DEC divisions, we received a non-competitive grant from the US Geological Survey Water Use Data and Research program to assess and inventory the current state of water withdrawal and consumptive use data collected in Vermont and to investigate, based on priorities, how to develop collection efforts to produce at least Tier 1 baseline data. The VGS seeks better quality water withdrawal and consumptive use data to apply towards water budget analyses and towards identification of geographic areas in need of detailed groundwater and hydrogeological information. Vermont's Regional Planning Commissions requested our assistance in defining areas at higher risk during drought and in understanding groundwater availability. The long-term (multi-year) grant objective is to improve availability, quality, compatibility and delivery of water-use data. This addresses one of our strategies to build framework data sets for groundwater characterization and collect baseline data useful for evaluating sustainable water use in Vermont.

HAZARDS

Landslide hazard mapping is a performance measure for the VGS. Landslide hazard mapping, first response to landslides, and monitoring of landslide and rockfall sites were major activities of the hazard program. Outreach efforts were directed towards regional planning commissions and implementation of landslide mapping protocols. A Phase One landslide hazard map for Addison County following protocols which use LiDAR with some field verification is funded through EMPG.

A landslide hazard mapping project in Highgate, funded through the Local Hazard Mitigation Grant Program (LHMPG) was initiated

in 2015. The mapping is part of a phased project in which hazards are mapped and at-risk areas are identified. The findings of the hazard assessment report will be used to identify potential mitigation projects and will be incorporated in the Town's Local Hazard Mitigation Plan (LMHP). The goal of the project is to reduce public exposure to these physical hazards.

The Northeast States Emergency Consortium (NESEC) and the VGS are working to develop technical information applicable to earthquake mitigation in Vermont. The work is focused on an evaluation of critical facilities using ROVER (Rapid Observation of Vulnerability and Estimation of Risk) and the potential response to seismic events. NESEC determined that a cost and labor effective alternative to building site visits was to use the map and street views in Google Earth to obtain baseline data. This was a significant time-saver and required only a brief meeting with the National Guard to verify the data. The project is on schedule for completion in February 2016.

Other activities included groundwater mapping projects and drought, seismic hazard mitigation and outreach to critical facilities managers in northwest Vermont, and several public presentations.

EDUCATION, OUTREACH, AND PRESENTATIONS

Survey staff is active in education and outreach through school visits, field trips for towns and local officials, lectures, and the web site. Presentations at professional meetings such as the National Groundwater Association and the Northeast Geological Society of America are important venues for maintaining our geologic expertise and contributing to the science community. We also gave numerous presentations to other government agencies and non-profit organizations.

The web site was completely re-designed and will go live in early 2016.

MILESTONES

On March 13, 2015 the House and Senate adopted S.C.R. 10 honoring the work and contributions of Laurence R. Becker as Vermont State Geologist from 1995-2014.



The crest of the Green Mountain Anticlinorium, looking north from Camels Hump to Mt. Mansfield.