SLR International Corporation
1 South Main Street, Waterbury, Vermont, 05676

May 30, 2025

Attention: Ian Albinson, Interim Town Administrator
Town of Bristol
townadmin@bristolvt.org

SLR Project No.: 146.14680.00004

RE: RFP – Mountain Street Stormwater Improvement Scoping Study

Dear Ian:

SLR International Corporation (SLR) is pleased to submit this proposal for the Mountain Street Stormwater Improvement Scoping Study to the Town of Bristol. Our team has completed several projects in Bristol and towns nearby, and through the preparation of this proposal, have already become familiar with the local landscape and hydrology of the Mountain Street project area. Based on our previous work in the town and extensive stormwater management experience, we believe that we are uniquely qualified for this project.

SLR's Waterbury, Vermont project team of water resource engineers and scientists have completed stormwater planning and retrofit design projects across Vermont. We have experience working on all stages for stormwater design from feasibility-level scoping studies up to final design, permitting, and construction. We have successfully completed several recent stormwater-related projects in nearby communities, including Hinesburg, Starksboro, Shelburne, and Charlotte. Our team is proud to work with clients, towns, landowners, and contractors to oversee the completion of our projects.

In addition to stormwater management, our team specializes in design and implementation projects that increase resiliency by integrating flood and erosion mitigation measures into our projects. We have worked with flood-prone communities to evaluate the impacts of flooding on a variety of projects, ranging from retrofits that address localized flooding and water quality issues on small scale sites, to large scale floodplain mitigation solutions that address town- or village-wide issues in areas where flooding and existing infrastructure and development intersect. Our team is experienced in performing hydrologic and hydraulic analyses to evaluate alternatives that are able to address multiple issues, then complete designs and assist towns with implementation to reach project goals and objectives.

We are excited for the opportunity to collaborate with the Town of Bristol to perform the scoping study. Please do not hesitate to contact us with any questions regarding this proposal.

Regards,

SLR International Corporation

Brian Cote, PE, CFM
Principal Water Resources Engineer
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W. Andrew Greene, PE
US Manager of Water Resources Engineering
agreene@slrconsulting.com

Project Understanding

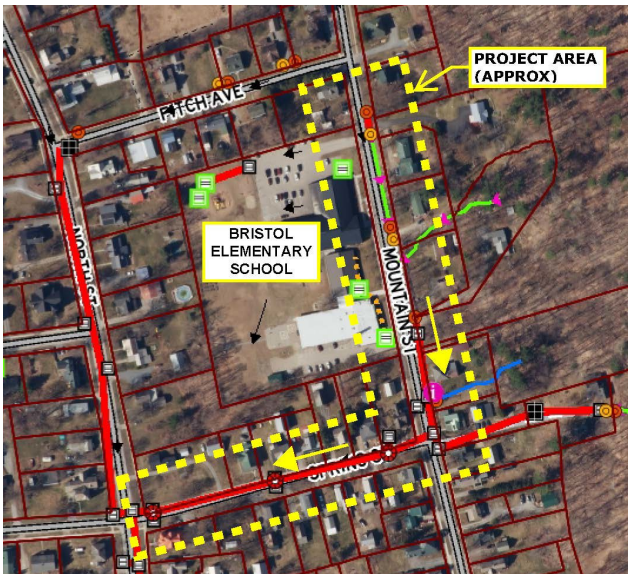


Figure 1: Mountain Street Project Area (Source: VT ANR Atlas)

The Town of Bristol is soliciting proposals for professional services to assess existing issues with stormwater runoff and develop alternatives for improving the drainage system located on Mountain Street and Spring Street. The project area is located in the eastern portion of downtown Bristol at the base of Hogback Mountain, and includes the Bristol Elementary School and numerous residential properties located nearby (Figure 1).

An initial site walk was conducted to learn more about the existing drainage system and to begin building an understanding of the issues being experienced along Mountain and Spring Street. The site walk was conducted after several days of rainy weather and concentrated stormwater runoff was observed flowing in various swales and ditches, as well as the existing enclosed drainage system.

Figure 2: Stormwater flowing onto Mountain Street

The existing drainage system consists of a series of swales and ditches that collect runoff generated along the western slope of Hogback mountain and direct flow to the Mountain Street enclosed system, generally found on the east side of the street. Flow was observed discharging from the east across from the school in what appeared to be an intermittent stream (Figure 2). Flow then turned southerly in a paved swale along Mountain Street that led to a 3-sided concrete structure (Figure 3), where flow entered the enclosed pipe network at a 24-inch reinforced concrete pipe (RCP) inlet. Once in the pipe, flow continues in a southerly direction on the east side of Mountain Street, collecting additional flow at several grated catch basins and additional inflow from drainage swales on neighboring properties to the east. At the intersection with Spring Street, the pipe network turns to the west and continues down Spring Street. Several more grated catch basins that capture stormwater runoff were observed before reaching the North Street drainage system at a catch basin located on the northeast side of the intersection.

Signs of overland flow, where components of the existing drainage system had been overwhelmed leading to bypass, were observed while on site. It appeared that bypass flow led to ponding in low points and excessive gutter flows along the roadway edges on both Mountain Street and Spring Street,

Figure 3: Concrete headwall structure with an 18" drop leading to a 24" RCP inlet to the enclosed system.

as well as flooding at nearby residential properties. Several locations where stormwater could potentially leave the street and enter private properties were observed within the project area (Figure 4).

Project Approach

SLR will draw on the extensive knowledge of the project team members selected for this project to assess existing conditions, which will include a hydrologic analysis to understand how much stormwater reaches the Mountain Street system during storm events of various magnitudes. Using field data collected at the site and available digital information (i.e., GIS data, aerial imagery, LiDAR, etc.) collected from various online sources, SLR will develop a hydraulic model of the existing drainage system to build an understanding of where capacity issues arise and use local knowledge gained from the Town and nearby residents to calibrate modeling results to known events. The goal during this first stage of the project is to build the background knowledge and tools needed for developing alternatives that address the drainage issues causing periodic flooding of Town and private property.

Figure 4: Catch basin inlet at end of Spring Street where recent swale reshaping has taken place.

The SLR project team will apply experience from numerous similar projects to interpret modeling results and assess site specific conditions to develop conceptual alternatives. For example, the SLR project team worked to develop and implement alternatives in a similar setting at the Moosilauke Ravine Lodge for Dartmouth College, where stormwater generated from the steep mountainside would collect in roadside drainage swales and, during heavy rain events, overwhelm the existing swales, culverts, and drainage structures. Once the capacity of the existing drainage system was exceeded, excess stormwater would flow overland causing erosion and damage to existing buildings, including the multi-million-dollar lodge. SLR developed a hydraulic model to simulate existing conditions and flow diversions, then designed drainage system improvements that included increasing the capacity of existing swales, culverts, and drainage structures, adding new drainage features to help protect against bypass flows, as well as modifying or protecting flow diversions to reduce erosion potential and avoid damage to existing buildings. The design elements proposed had to contend with site constraints that are very similar to the Mountain Street project, such as limited available space, varying terrain, and existing infrastructure to work around.

Alternatives evaluated for the Mountain Street project will be presented on conceptual sketches. Typical details will be provided where needed to convey design intent. A matrix table will be prepared to compare and contrast how well each alternative addresses project objectives such as meeting drainage improvement goals, reducing flooding, permit feasibility and constructability, and anticipated implementation costs. The analyses conducted, alternatives considered, and results of the feasibility study will be summarized and described in a project memorandum. Supporting calculations and documents as well as conceptual sketches will be provided as attachments to the design memo.

Close coordination with the Town and project stakeholders will be critical to a successful project. We anticipate beginning the project with a kickoff meeting with the Town, including Public Works and members of the Selectboard, to gather information and data about the project, as well as discuss project goals and objectives. We anticipate that a portion of the kickoff meeting will take place on site to discuss issues that have occurred in the past. We also anticipate gathering information related to nearby stakeholders that SLR can reach out to for additional information on the issues that are impacting the Mountain Street and Spring Street neighborhoods. SLR will present initial findings of existing conditions including project base mapping at a project update meeting with the Town before proceeding to the alternatives analysis. A draft project memo will be prepared and submitted to the Town for review and comment. SLR anticipates meeting with the Town to discuss the alternatives, receive feedback, and seek consensus on the preferred alternative. Final edits will be made to incorporate feedback and finalize the deliverables. In addition, we anticipate frequent phone calls, virtual meetings, and email communications throughout the project to provide progress updates and collaborate with the Town.

Scope of Services

The following proposed scope of services details the tasks needed to complete the project needs based on our initial understanding. All deliverables are underlined. We would be happy to discuss our approach to any of the scope tasks with you.

1.0 Project Initiation

1.1 Participate in an in-person project kickoff meeting to review the study area, project objectives, and review existing stormwater patterns and issues at the site with project team members and stakeholders. During this meeting, the project schedule will be reviewed. We anticipate that the Town will provide information about past stormwater flooding, a list of damages, and any associated repairs costs. Meeting summary notes will be prepared. Up to two SLR staff will attend the meeting.

2.0 Data Collection

2.1 Collect and review existing information, such as available Geographic Information System (GIS) data, aerial photography, high-resolution land cover data, existing impervious surface mapping, soils mapping, wetland mapping, watershed boundaries, LiDAR-derived topographic mapping, utility mapping, and parcel-specific mapping data pertinent to the project. It is assumed that the Town will provide any available stormwater drainage system information that is relevant to the project.

2.2 Conduct field reconnaissance at the project site to review existing conditions and document stormwater infrastructure. Field data collection activities will include tasks such as locating site features, utilities, and potential natural resource areas; photo documentation of the project site; and measurement of drainage infrastructure along Mountain Street and Spring Street. The equipment used for data collection will include a handheld GPS unit, laser range finder, transit, level, and stadia rod. Drainage areas boundaries, previously identified from GIS data, will also be verified in the field.

2.3 Develop a GIS project basemap from collected data and field measurements.

3.0 Existing Conditions Modeling

3.1 Prepare a hydrologic model for the existing stormwater drainage system using HydroCAD, HydraFlow Storm Sewers, HEC-HMS, HEC-RAS, or a combination of these software. Input data for the model will include land-use, soil type, time of concentration, rainfall depths and distributions, topographic data, and measured dimensions of drainage infrastructure.

3.2 Use the hydrologic model/s to develop stormwater runoff hydrographs and estimate peak flows for a range of rainfall events, including the 2-, 5-, 10-, 25-, 50-, and 100-year events. Rainfall data will be obtained from NOAA Atlas 14 and preliminary NOAA Atlas 15 precipitation frequency estimates.

3.3 Prepare a hydraulic model of the drainage system to assess existing conditions, as well as to identify the locations and potential causes of stormwater flooding along Mountain Street and Spring Street. Peak flow estimates developed with the hydrologic model will be used in the hydraulic analyses.

3.4 Perform model validation/calibration based on one (1) past stormwater flooding event at the project site. Use anecdotal and photograph information showing the extent of the flood to update model input parameters. It is assumed that information about past flooding will be provided by the Town and residents that live nearby.

4.0 Alternatives Analysis

4.1. Identify potential drainage improvement alternatives that address issues identified during project initiation, data collection, and the hydrologic and hydraulic (H&H) modeling of existing conditions. A range of project types may be considered, such as enlargement of stormwater drainage pipes, upgrades to the drainage system, drainage channel re-sizing, and the application of green infrastructure to promote stormwater treatment and runoff reduction. Existing stormwater infrastructure maintenance procedures will also be considered.

4.2. Evaluate flood mitigation and drainage improvement alternatives using the H&H model/s to determine which alternatives are feasible for the project site. Up to five (5) alternatives will be considered as part of this analysis.

4.3. Prepare an alternatives matrix summarizing feasible drainage improvement and flood mitigation alternatives for the Town to consider. A location map will be provided that identifies where proposed alternatives would be implemented.

4.4. Attend one (1) virtual meeting with Town representatives and other stakeholders to receive input about the list of initial alternatives and select the preferred alternatives for advancement to concept design. Meeting summary notes will be prepared.

5.0 Conceptual Design

5.1. Prepare conceptual-level design sketches for up to three (3) flood mitigation alternatives. The design sketches will contain the following components:

- Plan view of existing and proposed conditions
- Typical cross section of existing and proposed conditions, where needed
- Typical details, where necessary

5.2. Prepare an engineer's opinion of probable construction cost based on the conceptual design for each of the three alternatives.

5.3. Prepare a draft project memorandum that summarizes the data collection, modeling analysis results, alternatives analysis, and recommended alternatives. Detailed modeling results, conceptual design sketches, and cost opinions will be provided as attachments.

5.4. Attend one (1) in-person meeting with Town representatives, residents, and other stakeholders, to discuss the results of the study, present conceptual designs, and receive input from the Town and public. We anticipate that the Town will organize and advertise this meeting. Meeting summary notes will be prepared. Up to two SLR staff will attend the meeting.

5.5. Make one (1) round of edits to incorporate input from the Town and finalize the concept design sketches and project memorandum. Submit final deliverables.

Exclusions and Limitations

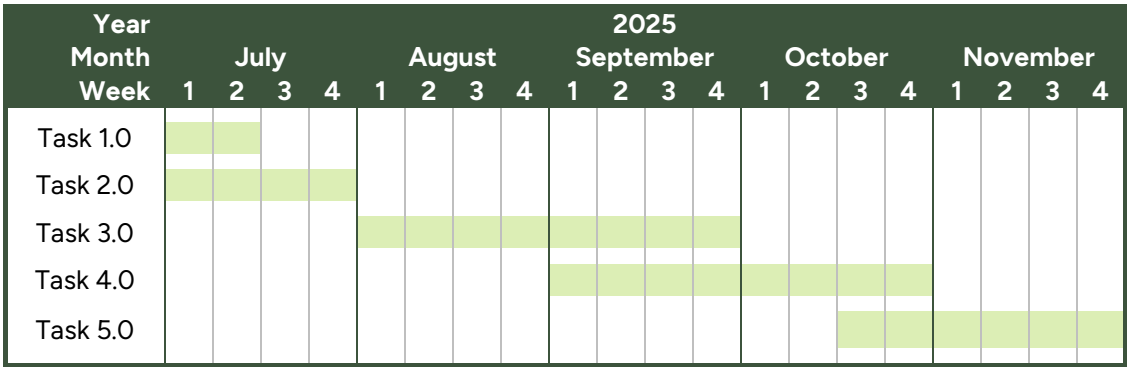
The following services are not included in this proposal:

1. Detailed topographic survey
2. Property boundary survey or property deed research
3. Final engineering design
4. Permitting
5. Environmental or cultural resource assessments or survey
6. Wetland delineation
7. Construction and/or bid phase services

Should any of the above items or any additional services be required, they can be provided on an hourly basis or for an agreed-upon lump sum fee or time and materials basis.

Proposed Schedule

SLR will proceed with the services under this agreement promptly and diligently in accordance with the above scope following acceptance of this proposal. It is understood that this work may be subject to delays due to weather, pandemics, stakeholder scheduling, strikes, or any other cause beyond the reasonable control of SLR. The schedule generally includes a five-month timeline for the project.



Professional Fees

SLR proposes to complete the above scope of services, including reimbursable expenses, on a lump sum basis. A breakdown of estimated fees by task is presented below:

Task	Description	Basis	Fee / Budget
1.0	Project Initiation	Lump Sum	$1,700
2.0	Data Collection	Lump Sum	$6,400
3.0	Existing Conditions Modeling	Lump Sum	$9,900
4.0	Alternatives Analysis	Lump Sum	$11,100
5.0	Conceptual Design	Lump Sum	$17,800
		Total Lump Sum Fee	**$46,900**

Working with students and school staff on stormwater master planning at CVU in Hinesburg, VT

Firm Qualifications

In the US, SLR has over 470 employees located in 32 offices that are strategically located to best serve our clients. Our team represents a diverse range of technical consulting services including engineering, planning, landscape design, permitting, environmental assessment, and resiliency services. We support our communities through all project stages - from the design concept to permitting to construction.

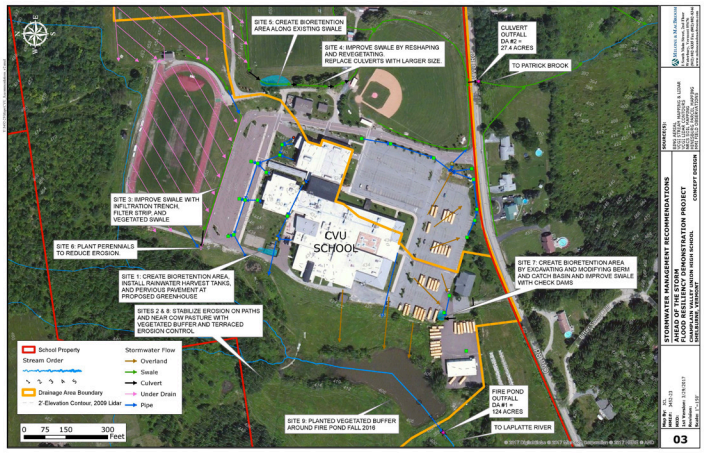
Our Northeast team provides niche expertise in the areas of planning, natural resources management, development of complete streets, and climate adaptation, effectively integrating engineering, landscape architecture, environmental science, and community planning. We work with communities to provide successful, creative, and sustainable solutions.

Our team has worked extensively on all aspects of stormwater management and engineering including all tasks covered under this request for proposals. Our staff specializes in water resource engineering and stormwater mitigation. We take great pride in the creative solutions that we have developed, working with our clients, the surrounding communities, and environmental regulators.

Stormwater Management

The firm has been a long-term advocate of watershed planning, integrating the management of stormwater quantity and quality with land use development and redevelopment. We have promoted watershed management in our projects, lectures, professional papers, and volunteer work. Proper watershed management has a direct relationship to the control of nonpoint pollutants and improvements in water quality. We have been active in stormwater management from both a planning and design perspective. The firm has designed many stormwater management, water quality control, and drainage projects including open channels, culverts, bridges, dams, detention basins,

sediment basins, storm drains, erosion control programs, and created or restored wetlands. We have also completed stormwater management studies for entire municipalities and watersheds including many Vermont school campuses. These studies have been used as a framework for developing stormwater regulations and best management practices and meeting regulatory requirements to protect water quality.



Example of a Stormwater Assessment Plan including existing conditions and stormwater recommendations at CVU campus in Hinesburg, VT

Stormwater Feasibility Study & Analysis – Our engineering staff has had the privilege to work with students and staff at numerous schools including elementary schools in Hinesburg, Charlotte, and Shelburne and high school students at Champlain Valley Union to complete stormwater master planning and concept designs for stormwater improvements on their campuses. Multiple opportunities for water quality improvement were identified that fit within the existing school uses. Concept designs were developed, and projects are in various stages of implementation working with community and school partners.

Vermont Agency of Natural Resources retained SLR to assist with a feasibility study and alternatives analysis to explore retrofit options to treat the municipal stormwater discharge from the Merchant's Row area in a riverfront park in Swanton Village, Vermont. The four outfalls from the village discharge directly to the Missisquoi River in a popular municipal park. The site has high social, cultural, and environmental value and designs needed to accommodate continued active recreation. Residential and commercial land uses are immediately adjacent to three sides of the park.

Stormwater Infrastructure Assessment and Planning – SLR was retained by the LaPlatte River Watershed Partnership/Lewis Creek Association to undertake a preliminary study of current and future stormwater management in the LaPlatte River watershed. Stormwater infrastructure was mapped for Hinesburg, Charlotte, and Shelburne, Vermont. Opportunities for treatment were identified to improve water quality. Roadside swales were mapped for the Town of Shelburne, Vermont, and recommendations were made across the town for improvement BMPs were identified for water quality improvements of the roadside conveyance systems.

Urban Stormwater Management Plan – SLR was retained by the Town of Hinesburg, Vermont, to perform hydrologic modeling to evaluate existing conditions at the subwatershed scale and to explore a full buildout scenario. The model covers the designated Hinesburg Village Growth Area and upstream contributing areas. The U.S. Army Corps of Engineers HEC-HMS hydrology model was used and required input data collected in the field and from GIS mapping. Existing conditions hydrographs were modeled showing the flow, volume,and timing during a range of floods.

The model results illustrated high runoff in the Village Growth Area, lower runoff to the east in forested areas, and moderate runoff to the west in agricultural areas. The six subwatersheds contributing the

highest peak runoff and the highest runoff depth are located in and immediately upstream of the Village Growth Area. This study led to a concept design to add bioretention to treat runoff from existing impervious surface at Hinesburg Community School.

Site data collection to inform bio-retention area design at Shelburne Community School, Shelburne, VT

Site and Soils Data Collection – Stormwater designs and especially retrofits are constrained by site conditions that we routinely evaluate as part of the engineering feasibility analysis in project development. Constraints include existing utilities, natural resources, and site uses that the landowner would like to retain. These constraints are identified and mapped and a master plan for runoff treatment options is developed. Existing soils mapping will give a general idea of what treatment options are appropriate, but site specific soils investigations are key to the design process. Once possible treatment areas are identified, our staff completes soils investigations including overseeing excavation of deep soil pits to record the soil profile and evaluate underground conditions to confirm the infiltration potential. Constraints are identified, including depth of seasonal high groundwater and bedrock. If infiltration is an option, then infiltration testing is completed to determine the infiltration rates to use in project design.

Wetland and Environmental Sciences – Our scientists routinely assess natural resources present in and around project sites using a wide range of resources. Wetland delineation and reporting is completed by Professional Wetland Scientists.

Stormwater Retrofit Analysis and Design – The Caledonia County Natural Resources Conservation District retained the services of SLR to evaluate and partially design two stormwater retrofits on Cherry Street and North Main Street in Hardwick, Vermont. The sites have been identified by the Vermont Clean and Clear Program as priorities for stormwater improvements, with the goal of the project to improve water quality in the Lamoille River and Lake Champlain.

Stormwater Permitting – SLR routinely evaluates the need for, prepares applications for, and obtains required permits on behalf of our clients. Operational and construction stormwater permits were recently obtained for the Hinesburg Garage redevelopment project under the 2017 Stormwater Management Rule. We work with regulators throughout a project to ensure that project components will meet or surpass regulations for all local, state, and federal permits. We recently helped the Town of Hinesburg with local, Act250, Army Corps, and stream alteration permits for a floodplain restoration project. We have assisted property owners in planning and compliance with the 3-acre stormwater permit.

Cost Estimating and Implementation Funding – Cost estimating is a key part of any design and helps lead to the next step of implementation. After cost estimating, we have worked with many clients to identify possible funding sources for implementation and contribute to grant applications. We recently worked with the Lewis Creek Association to help them obtain funding for grants from the VTDEC

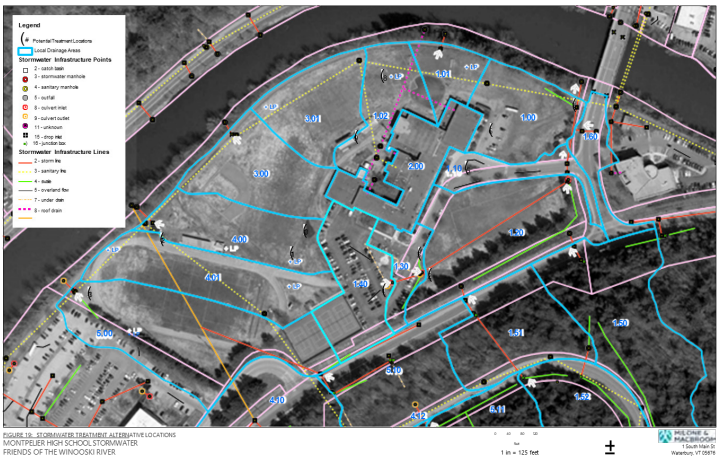
Ecosystem Restoration Program and Lake Champlain Basin Program to implement projects identified in the master planning we completed. We have also worked with multiple clients to complete Benefit Cost Analysis to apply for FEMA funding of various resilience projects.

Bid and Construction Services – We routinely help clients through the implementation process by preparing bid documents and required specifications, leading pre-bid meetings, and helping to evaluate received bids and contractor references. Our engineers are all experienced in construction oversight and work with clients, regulators, and contractors to ensure that projects are built correctly to satisfy project goals. These services have been provided on many projects and include post-construction documentation, often to meet grant requirements.

Public Outreach and Project Visualization – We believe that the presentation of materials and information is extremely important to the successful implementation of projects and craft materials and presentations to help communities understand projects. Our inhouse landscape architecture team provides services to help clients and community visualize project components. Renderings, photo-simulations, and other representations are routinely completed. These visualizations stakeholders understand project components and potential impacts.

Landscape Architecture – Our team of landscape architects works hand-in-hand with our water resources engineers to blend together creative and sustainable designs in a manner that are ecologically and financially viable as well as permittable under local, state, and federal programs. Many of our projects feature renderings, photosimulations, and conceptual plans that help to inform and educate our clients, the project partners, and the public. In addition, our landscape architects have worked on many of our wetland, coastal, and river restoration projects. Specific tasks include grading plans, planting plans, vegetation assessments, soil erosion and sediment control, handicap access, educational signs, boardwalks, and formal entryways. Our landscape architects are experts in designing environmentally oriented projects that are attractive, safe, and efficient for all user groups.

Water Quality and Watershed Education – Our project team bridges the gap between technical work and teaching. The engineers on our team have significant experience in teaching, training, and public outreach at many levels. This team has helped create the curriculum and taught the Vermont and Massachusetts River and Roads Trainings, which apply river science and geomorphology to practical implementable practices on the ground for road foreman, engineers, and planners. A watershed and water quality curriculum was created and piloted for the Chittenden County based Ahead of the Storm program for the Lewis Creek Association reaching community members and students.



Stormwater Master Plan alternatives at the Montpelier High School.

References

1. Chris Giard
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2. Chris Cole, PE
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3. Kate Kelly
Lewis Creek Association
(802) 488-5208
kate@lewiscreek.org

Project Organization

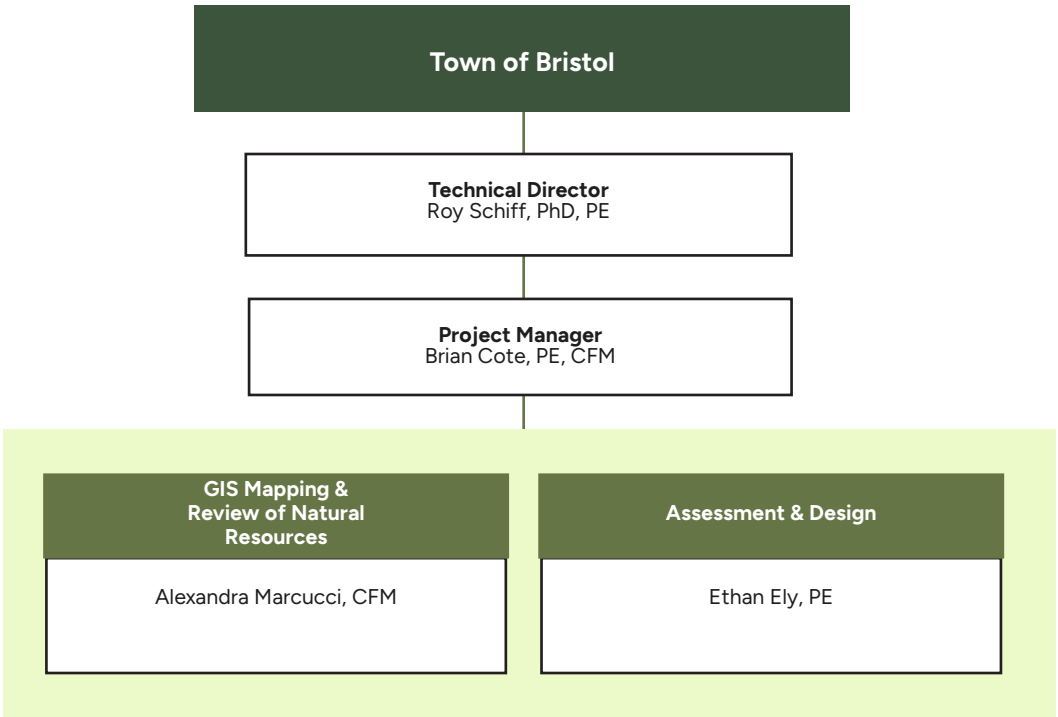
Brian Cote has been selected to lead and manage the project team, and will serve as the Primary Point of Contact for this project. Brian has worked on projects in Bristol and brings 20+ years of experience with assessment and design of stormwater management systems, including hydrologic and hydraulic analysis.

Roy Schiff will serve as the Technical Director and will provide technical guidance and quality control. Roy has 19+ years of experience in stormwater design, flood resiliency, and hydrology and hydraulics that will be valuable for this project.

Alexandria Marcucci has a background in Environmental Science and Geospatial Technologies, and will bring value to this project through review of natural resources and developing GIS mapping, as well as assisting with field work and stormwater management design.

Ethan Ely recently relocated to the Vermont office from New York and brings 7+ years of experience at SLR conducting hydrologic and hydraulic analyses. Ethan will apply his expertise to assess existing conditions and design stormwater management improvements, as well as perform field work tasks.

Resumes for each of the project team members are provided herein, followed by a select number of project sheets depicting experience relevant to this project.



PROJECT PROFILE

Montpelier High School Stormwater Master Plan & Design

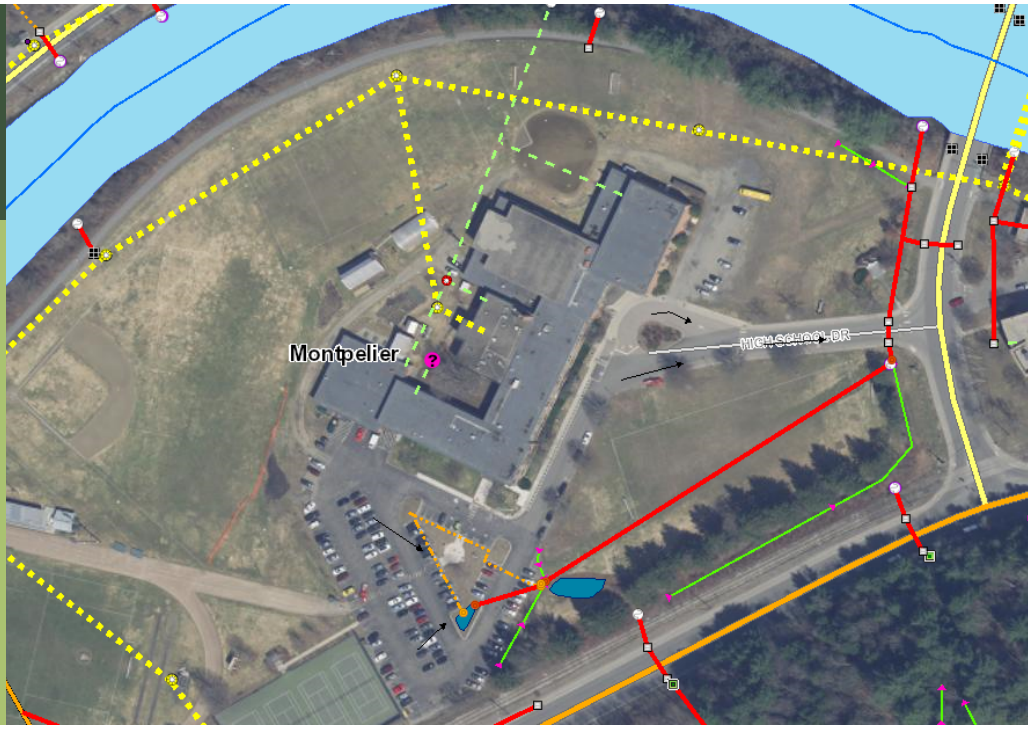
MONTPELIER, VT

CLIENT

Friends of the Winooski River

SERVICES

- Stormwater Management
- Sediment Management
- Engineering Design
- Permit Compliance
- Cost Estimating
- Public Outreach & Education



Montpelier High School includes 21-acres adjacent to the Winooski River, where most of the stormwater runoff from the property is discharged without treatment. Students, faculty, and staff have been thinking about stormwater treatment options for portions of the property for years and the Friends of the Winooski River is facilitating a master planning project. SLR worked with the school and school partner to complete stormwater master planning and designs for the campus.

SLR worked with school representatives to assess current conditions including existing impervious cover, stormwater flow patterns, and identification of problem areas. This information was used to inform and alternatives analysis and stormwater calculations to recommend stormwater best management practices (BMPs) that could be implemented in a stormwater master plan report. Three BMPs were chosen and SLR developed 100% designs and cost opinions with input from the school and partners.

Lincoln Hall at Hildene

MANCHESTER, VT

CLIENT

Friends of Hildene, Inc.

SERVICES

- Civil Engineering
- Landscape Architecture
- Stormwater Management / Analysis
- Geotechnical Engineering
- Wetland Assistance
- Permitting
- Construction Oversight & Bid Phase Services

SLR was retained by the Friends of Hildene, Inc. to provide professional services as part of the Lincoln Hall project on the historic Hildene, Lincoln Family Home property in Manchester, Vermont. The Lincoln Hall project consists of a new 13,738-square-foot building that will serve as a year-round special events facility and conference center with a concession area and outdoor seating for day guest and visitors. The new facility will replace the existing 3-season event tent and support facility located on the premises. The project also includes a new main entrance drive and drop-off, new service entrance drive and loading dock, new walkways through the site including adjacent to the historic mansion, new stormwater treatment measures, and retrofits to the existing stormwater management system.

Professional services included civil / site design, stormwater management analysis and design, geotechnical analysis and design, landscape design, and wetland assessment. SLR assisted with submitting and obtaining an amendment to the ACT 250 permit. Other permitting needs included a Construction General Permit (3-9020) that authorized a total of 3.74-acres during construction, as well as a Stormwater Discharge Permit (3-9050) that authorized discharges from approximately 2.5-acres out of 5-acres of new, existing, and redeveloped impervious surfaces.

SLR began design with field reconnaissance, site assessment, and data collection. Data collection included gathering available topographic data, site survey, and information related to the existing utilities and stormwater management system. Data was supplemented with additional field survey, wetland assessment, deep test pits, and soil infiltration testing. Data collected informed schematic design and alternatives. After review with the Hildene team and project partners, the project moved to design development based on feedback received followed by development of construction documents. SLR provided bid phase services and construction oversight to ensure that the project was built according to design and permit conditions.

Moosilake Ravine Lodge Stormwater Analysis

WOODSTOCK, NH

CLIENT

Dartmouth College

SERVICES

- Hydrologic Analysis
- Storm Drainage Design
- Permitting
- Construction Oversight

SLR was retained by Dartmouth College to conduct a hydrologic analysis, evaluate stormwater runoff patterns, and design drainage improvements at the college's Moosilauke Ravine Lodge facility. The Lodge had been recently renovated and was damaged by a large flood in October 2017. During the storm, a large volume of runoff flowed down the steep mountainside; overflowed existing drainage structures and undersized swales; filled existing culverts with water, sediment and woody debris; caused gullying in the access roads; and eroded access paths leading to damage at several buildings including the newly renovated Lodge. The primary goal of this project was to gain an understanding of the hydrology contributing to the site and provide design recommendations to protect the Lodge from future flood damage.

A hydrologic model was prepared using HydroCAD to compute flood hydrographs using rainfall data obtained through the Northeast Regional Climate Center and the National Oceanic & Atmospheric Administration. The model recreated the complex drainage patterns at the site that includes numerous channels and swales, cross culverts, inlet structures, and low points in the access roads that commonly overtop. The hydrologic analysis considered rainfall events ranging from the 2-year rainfall up to the 100-year event.

The model was developed to recreate the multiple flow paths that changed as stormwater runoff is diverted with increasing flow. Drainage improvements were designed to change existing flow patterns to reduce roadway overtopping and to redirect stormwater flow away from buildings. Clogging of drainage channels and structures was considered during design to determine how sediment could potentially change flow patterns.

A base map of existing conditions was prepared using survey and available GIS data. Field reconnaissance was conducted to verify drainage patterns, obtain critical data, and understand existing conditions. Design elements were overlain onto the base mapping to show proposed drainage improvements and details were provided to develop construction plans. Oversight was provided during construction to ensure that drainage improvements were implemented as designed.

PROJECT PROFILE

Stormwater Concept Design for Lewis Creek River Corridor & Ballfield Area

STARKSBORO, VT

CLIENT

Lewis Creek Association

SERVICES

- Stormwater Management
- River & Sediment Management
- Park Planning
- Riverbank Stabilization
- Engineering Design

The Cota Ballfields is a community park with soccer and baseball fields, a pavilion, river access, trails, and parking adjacent to the Lewis Creek. The Town of Starksboro, in partnership with Lewis Creek Association, has taken a proactive approach to improving the quantity and quality of runoff from the park. SLR provided stormwater master planning services and engineering design. The ballfields are located on lands adjacent to Lewis Creek and the Town has historically had issues with flooding of the property from the creek and stormwater management. There is currently no stormwater treatment infrastructure at the ballfields property and the fields have ponded water after heavy rain and seasonally in the spring, making them unusable during these times. Additionally, Lewis Creek is undergoing adjustments that have resulted in extensively eroding banks.

Engineers identified options to improve water quality, stormwater treatment, and flood resiliency as well as to improve usability of the playing fields. Treatments include riverbank stabilization with log weirs and vegetation, infiltration trenches in the ballfields, a bioretention area to treat parking lot runoff, and expanded riparian buffers. Tasks included attending project team meetings, collecting and reviewing existing data, making site visits, delineating wetlands, evaluating alternatives, preparing a concept design, assembling cost opinions, and drafting a project memo.

PROJECT PROFILE

Hinesburg Town Garage & Chittenden Solid Waste Management

HINESBURG, VT

CLIENT

Lewis Creek Association / Town of Hinesburg, VT

SERVICES

- Stormwater Management
- Sediment Management
- Hydrologic Analysis
- Cost Estimating
- Public Outreach

The Lewis Creek Association, in association with the Ahead of the Storm stewardship program, retained SLR to provide design services to improve water quality and flood resiliency at the Hinesburg Town Garage property. This site was selected as a demonstration project as part of Ahead of the Storm, a larger watershed-based project. The Town of Hinesburg plans to improve site use and conditions at their Town Highway Department garages; department offices; vehicle, equipment, and material storage sheds; an active gravel pit; and the Chittenden Solid Waste Management (CSWD) Drop-Off Center facility. The site is immediately adjacent to Beecher Hill Brook, a tributary of the LaPlatte River, that currently receives runoff and associated sediment from the site.

We designed Optimal Conservation Practices (OCPs) to protect ecosystem functions, specifically to naturalize the hydrology of the site and enhance flood resiliency and protect water quality in the receiving waters. A series of stormwater infiltration basins, swales, and a floodplain reconnection have been proposed to stabilize the site, reduce sediment migration, increase riprarian vegetation, and infiltrate stormwater.

Site redesign will naturalize the river corridor currently occupied by buildings, material storage, general operations, and berms to give the river space to stabilize and allow for a vegetated buffer to filter runoff before it enters Beecher Hill Brook.

This project was funded by a Vermont Department of Environmental Conservation Ecosystems Restoration Program Grant.

Roy Schiff, PHD, PE

Principal Water Resources Engineer & Scientist | Waterbury, VT

Roy Schiff specializes in river and floodplain restoration, geomorphic and habitat assessment, flood mitigation, hydrology and hydraulics, transportation resilience, and sediment transport analysis. In addition to applied restoration work such as channel creation, bank stabilization, and dam/levee removal, he has been involved in several research projects across Vermont and the region evaluating the economic impacts of living in floodplains, drafting best engineering practices to reduce future flood risks, improving protocols for habitat assessment, and creating guidelines for channel restoration. Other experience includes dam removal, dam failure analysis, culvert design, bridge scour analysis, floodplain management, and biomonitoring.

Years of Experience

19 years with the firm | 2 years with other firms

Professional Registrations

- Professional Engineer - VT
- Certified Soil Evaluator, University of Massachusetts

Education

- PhD, Stream Restoration & Aquatic Ecosystems, Yale School of Forestry & Environmental Studies
- MS, Environmental Science & Engineering, University of Washington
- BS, Engineering, University of Rochester

Project Experience

East Calais Post Office Stormwater Design, East Calais, VT
Assisted with design of stormwater treatment and gully stabilization.

Stormwater Mitigation and Gully Stabilization at The Health Center, Plainfield, VT
Assisted with design and construction oversight to improve stormwater treatment and stabilize an eroding gully along the Winooski River.

North Main Street Stormwater Treatment Final Design, Hardwick, VT
Assisted with data collection and design of an underground stormwater treatment system in a parking lot along the Lamoille River.

Moon Brook Pond Modification Final Design, Rutland, VT
Performed outreach program, alternatives analysis, and design to improve two dams and install a riparian buffer around two neighborhood ponds to improve water quality.

Municipal Roads Erosion Screening, Chittenden County, VT
Assisted with method development, field work, and concept designs to reduce road erosion and improve water quality.

Montpelier High School Stormwater Master Plan & Design, Montpelier, VT
Led stormwater master planning and design of BMPs to treat runoff now leaving the school campus and draining to the Winooski River.

Ahead of the Storm Project, Hinesburg & Charlotte, VT
The Lewis Creek Association and partners have spearheaded an intertown relationship to increase awareness and feasibility of site-specific Optimal Conservation Practices aiming to address both water quality and flood resilience. Assisted with project management, data collection, design, and implementation as well as evaluating alternatives for managing runoff and protecting water quality.

Brian M. Cote, PE, CFM

Principal Water Resources Engineer | Waterbury, VT

Brian Cote specializes in hydrologic and hydraulic analysis and design. His project experience includes design and analysis of stormwater management and treatment systems using traditional as well as green stormwater infrastructure and best management practices. Additional project experience includes detention/water quality basin design; floodplain management; site development and layout; Low Impact Development (LID) design; sediment and erosion control measures; hydraulic analysis of stream channels, culverts, and bridges; dam safety assessment, modification, and removal; as well as the development of construction plans and project specifications.

Years of Experience

27 years with the firm

Professional Registrations

- Professional Engineer - VT
- Certified Floodplain Manager (CFM)

Education

- BS, Civil & Environmental Engineering, University of Vermont

Project Experience

Lincoln Hall at Hildene, Manchester, VT
Served as the project manager for civil engineering and site design of a new event facility at the historic Lincoln Family Home. Led the design and analysis of the stormwater management system that required navigating challenging terrain, existing infrastructure, and historic features. Responsible for final design and permitting, developing construction documents, and construction oversight.

Montpelier High School, Montpelier, VT
Served as the Lead Design Engineer to develop stormwater management improvements to collect and treat runoff from areas on campus experiencing drainage issues. Responsibilities included field work and site assessment, developing a hydrologic model of the on- and offsite drainage areas, computing runoff volumes, developing alternatives, and hydraulic analysis of proposed stormwater retrofits. Project tasks included preparing a stormwater management master plan as well as developing final design plans, details, and specifications.

Moosilauke Ravine Lodge, Woodstock, NH
Led the hydrologic and hydraulic analyses performed to evaluate existing conditions and design drainage improvements of a complex, multi flow path system in a steep, mountainous setting. Project tasks included field reconnaissance, assessing existing conditions to verify drainage patterns, and developing alternatives to reduce stormwater diversions and damage to existing buildings and infrastructure. Tasks included preparing bid-ready final plans and specs and construction oversight.

Hinesburg Town Garage, Hinesburg, VT
Served as a technical advisor tasked with review of the hydrologic and hydraulic analysis and design of a new stormwater management system that included a catch basin and pipe collection system as well as stormwater treatment measures to address water quality.

Lincoln Road Stabilization, Bristol, VT
Project manager for a channel bank stabilization project along the New Haven River. Led the design team by preparing and analyzing alternatives, advancing to final design, securing permits, and providing bid- and construction-phase services.

Memberships and Associations

- Association of State Dam Safety Officials
- Association of State Floodplain Managers

Alexandra Marcucci, CFM

Associate Water Resources Scientist | Waterbury, VT

Alexandra Marcucci is an Associate Water Resources Scientist with a background in Environmental Science and Geospatial Technologies. She is a Certified Floodplain Manager and has received training and certification in Natural Shoreline Erosion Control and Wetland Delineation. Alex has experience conducting geospatial analyses using GIS for various natural resources related applications. Her work in the river science field has included conducting geomorphic, habitat, flow, biological, and water quality assessments of streams across New England. She has conducted hydraulic modeling of fluvial systems from small upland streams to large, dynamic rivers. In addition, Alex has conducted wetland delineations, natural resource inventories, watershed planning, and other tasks related to water resource projects.

Years of Experience

3 years with the firm | 10 years with other firms

Professional Registrations

- Certified Floodplain Manager (CFM)

Education

- BS, Environmental Sciences, University of Vermont

Project Experience

Charlotte Central School Stormwater Design, Charlotte, VT
Performed wetland delineation at Charlotte Central School, including preparation of Army Corps data forms. Stormwater treatment alternatives will be identified and located to minimize impacts to wetlands and their buffers.

Hinesburg Community School Stormwater Design, Hinesburg, VT
Performed wetland delineation at Hinesburg Community School. Prepared Army Corps data forms and made recommendations for locating potential stormwater treatment infrastructure to minimize impacts to wetlands and their buffers. Evaluated site constraints and assisted with engineering feasibility analysis.

McCabe's Brook Stormwater Master Plan, Charlotte & Shelburne, VT
Assisted with stormwater master planning for a combined urban and rural watershed in Charlotte and Shelburne. Attended site visits to evaluate potential stormwater and stream restoration projects within the McCabe's Brook watershed. Conducted GIS mapping of potential project sites. Prepared concept designs for highest priority projects.

Stormwater Concept Design for Lewis Creek River Corridor and Cota Ballfield, Starksboro, VT
Conducted stream geomorphic and habitat assessment for reach of Lewis Creek situated along a town park. Performed wetland delineation at the park and collected field data. Identified projects to improve water quality, geomorphic condition, and habitat of Lewis Creek and improve recreational usability of the park. Prepared concept designs for top priority projects.

Lyman Meadow Neighborhood Stormwater Design, Hinesburg, VT
Conducted GIS analysis of Hinesburg Neighborhood to assist with stormwater design and planning. Prepared Quality Assurance Project Plan (QAPP) for project and project maps. Identified and evaluated alternatives for stormwater treatment within neighborhood. Project will be used as a demonstration site for the Ahead of the Storm program.

Memberships and Affiliations

- Association of State Floodplain Managers
- Vermont Association of Wetland Science
- Women in GIS Northeast Chapter

Ethan Ely, PE

Associate Water Resources Engineer | Waterbury, VT

Ethan Ely is an Associate Water Resources Engineer who has worked on an assortment of projects involving flooding mitigation and analysis, stream restoration, culvert design, and stormwater management. His experience includes analyzing waterways and stream crossings using hydraulic and hydrologic modeling software.

Years of Experience

7 years with the firm | 3 years with other firms

Professional Registrations

- Professional Engineer - NY
- Remote Pilot License

Education

- MS, Civil Engineering with Concentration in Water Resources, University of New Hampshire
- BS, Environmental Engineering, University of New Hampshire

Project Experience

JCC Manhattan Camp Settoga, Pomona, NY
Analyzed site hydrology and helped develop a stormwater management plan which utilizes LID systems to maximize runoff volume reductions and ground water recharge.

Lewis Creek Flood Hazard Mitigation Study, Starksboro, VT
Performed photogrammetric survey of the stream channel and floodplain using UAS technology. Assisted in the development of a 2D hydraulic model for evaluation of flood mitigation alternatives for the Town of Starksboro.

Littlefield Lane Gully Stabilization Assessment and Concept Design, Shoreham, VT
Evaluated stabilization alternatives for a gully forming along a small tributary of Lake Champlain in Shoreham, VT. Developed concept design for recommended stabilization measures. Implemented bioengineering techniques to reduce erosion and limit construction costs.

Williams Dam Flooding Analysis, Londonderry, VT
Developed a 2D hydraulic model to evaluate how the removal of Williams Dam would affect flooding in the Town of Londonderry. Conducted a stream assessment of the West River to characterize channel morphology and determine potential changes related to dam removal.

Bellinger Brook, Herkimer, NY
Assisted with planning and engineering analysis along Bellinger Brook in the town and village of Herkimer. Duties included analysis of hydrologic conditions for the purpose of evaluating the impact of impervious surfaces and potential for detention in the watershed, and evaluation of hydraulic conditions along an unnamed tributary to assess likely causes of flooding.

Additional Training

- 2D Hydraulic Modeling
- Ecological Restoration