Town of Middlebury

Shard Villa Road Improvements Project
Technical & Cost Proposal

January 8, 2018

Submitted to
Town of Middlebury
Public Works Department
1020 South Rt. 7
Middlebury, VT 05753

DuBois & King inc.

DuBois & King INC.

224188X
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Public Works Department
1020 South Rt. 7
Middlebury, VT 05753

RE: Shard Villa Road Improvements Project

In response to your Request for Proposal, DuBois & King (D&K) is pleased to submit our qualifications for roadway improvement engineering assistance to the Town of Middlebury (Town). D&K will provide all services for this project using our in-house staff with expertise in roadway engineering, hydraulic evaluation, permitting, survey, and construction phase services. Our firm has a strong history of successful road improvement projects in the area. Staff assigned to this project regularly work with municipalities, property owners, and regulatory agencies to select appropriate structures for construction.

Please consider some of the strengths the D&K team will bring to the Town:

- Our proposed project team has experience with the assessment, design, and construction of slope repairs in a variety of conditions, including multiple locations in Addison County.
- I am a Middlebury property owner and the manager of D&K's Brandon Office. I have a thorough understanding of the Town as a local engineer. Another member of our Brandon office on the project team, Michael Mainer, EI, is a resident of Middlebury. Our project team's local presence will provide the flexibility to be on-site during the planning, design, and construction of the project, providing the Town with a high degree of service.
- Our local office is supported by the substantial technical resources of a 100-person, multidisciplined engineering firm with several offices in Vermont and New Hampshire.

On behalf of the D&K team, we look forward to the opportunity to assist you with this project. If you have any questions or would like to discuss our submittal in further detail, please do not hesitate to contact me at (802) 465-8396 or jashley@dubois-king.com.

Sincerely,
DuBois & King, Inc.

Jonathan B. Ashley, PE
Project Manager

Project Understanding

The Town of Middlebury (Town) is requesting engineering services for road milling and recycling improvements to Shard Villa Road, and repair of an adjacent slope between the road and the Middlebury River. Movement of an approximately 210-foot-long section of the slope has been causing damage to the road shoulder and adjacent areas of Shard Villa Road along the west side of the road.

The road recycling project begins at the bridge over the Middlebury River and continues south for 2,700 feet. The Town recently improved drainage along the proposed road recycling project area, including ditching and a new RCP culvert. There are recent square-cut repairs in the asphalt near the slope repair area and at the recent RCP culvert replacement. These areas were repaired to a depth of 24 inches. Driveway aprons and field entrances will be paved to the same Town of Middlebury specification as the road. There are two entrances that will need longer paved approaches to minimize damage to the roadway, and there is gravel pull-off used as parking for swimming hole access just south of the bridge over the Middlebury River.

Important components of the project include meeting and reviewing slope stabilization alternatives with Town officials and the Public Works Committee to select a repair option that best fits the Town's objectives, as well as periodic meetings to guide decision-making during the project's design.

Scope of Services

The scope of services for this project was prepared following the scope outlined in the Town's Request for Proposal (RFP) BID NUMBER 12-08-07. D&K will perform the following tasks for the project:

Task 1: Identify Permitting for the Project. D&K will identify permit(s) that will be required for the project. Based on our understanding of the project, we anticipate the following permit requirements:

- An Army Corps of Engineers permit will be required.
- A site visit will be required with a Vermont River Management Engineer, and depending on the proposed slope repair alternative selected, a Stream Alteration Permit may be required.
- It is assumed that the milling and recycling project will be conducted in a manner that does not require a Stormwater Construction General Permit, and the disturbance for the slope repair project will be less than 1 acre; as such, Stormwater Construction General permitting is not included, but can be provided as an additional service if requested.
- Because the project will not create new impervious areas, it is assumed that no Stormwater Discharge Permit will be required.

Task 2: Complete Survey. D&K's in-house survey team will establish a control system for both horizontal and vertical control within the project area. The control system will include traverse points and temporary benchmarks and will be based on Vermont State Plane Coordinate System. D&K will conduct a topographic survey of the slope failure project area including the assumed existing street rights-of-way (formal boundary research not included), edges of pavement and shoulder gravel, trees, and other important surface features.

Based on our experience with similar slope failure assessments and repair designs, river bottom elevations will also be needed in at least three transects at, upstream of, and downstream of the failure area. The topographic survey will be used to create base maps at a scale of 1 inch is equal to 20 feet (1"=20') with 1-foot contours.

For the road milling and paving project, D&K will survey edges of pavement and centerline along the proposed project area. No survey will be completed outside the paved width because it is assumed that the road width will not be changed and that the existing drainage for the road is adequate.

Task 3: Borings Coordination and Oversight. D&K will coordinate and provide oversight for four (4) road borings spaced along the 2,700 section and three (3) shoulder borings in the area of the bank stabilization to assess subsurface conditions. Shoulder borings will be at least 15 feet deep or to refusal, and the Town will pay for the boring service directly. The borings will be completed by a qualified drilling contractor capable of collecting the necessary samples and performing the needed testing to evaluate slope stability conditions. To assist the Town with selection of a driller, D&K will provide the boring, sampling, and testing requirements to up to three qualified drilling contractors. It is assumed that the Town will evaluate the drilling proposals and select the drilling contractor, with concurrence review from D&K.

D&K has experienced geotechnical and geological staff to oversee and log the drilling operations. We will document the drilling operations for the development of boring logs, recording blow counts, observations of the water table, and making selections of sampling intervals. If appropriate, vane shear testing will be performed and will follow the procedures outlined in AASHTO T223. The Vane Shear Test is used mainly to determine the in situ undrained shear strength and the sensitivity of a saturated cohesive soil. It is limited to fine grained soils which can retain water content during the testing. It is assumed that shear testing and analysis of any other soil mechanics samples collected for modeling the slope stability will be in the drilling contractor's scope, and therefore the costs are not included in this proposal.

Task 4: Prepare Estimate of Construction Cost and Schedule. Based on the 90% design plans, D&K will prepare an opinion of probable construction costs and estimated time frame for the project, which will be updated based on the final design.

Task 5: Meetings with Town Staff. D&K will participate in three (3) meetings with Town staff for pre-design (2) and final design (1). The first pre-design meeting will include review of the findings of the boring investigation and potential causes of the apparent slope instability. Two to three potentially suitable slope repair options concepts will also be presented to the Infrastructure Committee.

After the preferred alternative is selected, a preliminary design for the slope repair will be reviewed with the Infrastructure Committee. The final design meeting will include review of the construction plans and technical specifications for the slope repair and road reclamation projects.

Task 6: Prepare Contract Documents and Construction Plans. Using the information obtained in Tasks 1 through 4, D&K will prepare contract documents and construction plans for the proposed improvements. For the slope repair project, the design process is expected to proceed as follows:

- Review boring logs and soil mechanics testing results.
- Develop a slope stability model for the project using Slope/W 2012 software from Geostudio using soil properties estimated from the soil borings and presumptive values.
- Using the Slope/W model, evaluate the contributing factors causing the failure.
- Identify possible repair alternatives, potentially including gabion baskets, rip rap armor, subsurface or surface drainage, use of plantings to improve stability above the water line, or some combination thereof.
- Review pros and cons of potential repair options and meet with the Town to select a preferred option to proceed with design.

The design will include researching local quarries to ensure adequate supply of the proper materials for the project, particularly if the project includes a rip rap-based slope repair.

The contract documents will include an Advertisement for Bid, Information for Bidders, Bid Schedule, General Conditions, Special Conditions and Technical Specifications for the project. Two (2) copies of the contract documents and contract drawings will be submitted to the Town for their review. Upon completion of the Town's review, comments will be addressed and incorporated into the contract documents and drawings. D&K will also submit one (1) paper copy and a PDF file of the final construction plans to the Town.

Task 7: Prepare Permit Applications. D&K will prepare the necessary permit applications for the permits identified for the project. Any application fees will be paid directly by the Town. The proposed budget for permit applications is based on the permitting assumptions described in Task 1.

Task 8: Prepare and Submit Advertisement for Bid to Town. D&K will prepare an Advertisement for Bid and submit it to the Town for distribution. During the bid phase, D&K will conduct a pre-bid meeting, to answer questions posed by contractors, issue addenda and attend the bid opening. This project shall be ready for bid by April 13, 2018, or sooner.

D&K will prepare a bid tabulation and award recommendation to the Town. Upon acceptance of a contractor by the Town, D&K will provide three (3) copies of conformed contract documents and drawings for agreement execution by the Town and the successful contractor.

Task 9: Construction Administration Service. D&K will provide construction administration services during the construction of the proposed improvements. Construction administration will include:

- Review of Shop Drawing and/or Material Submittals
- Attendance at Contractor Meetings
- Review of Pay Requests
- Issuing of Change Orders
- Providing substantial and final completion certification.

Based on our experience on similar projects, we anticipate that the slope repair project will require three (3) weeks of full-time construction review, and three (3) weeks of part-time construction review will be required between the slope repair project and the road milling and recycling work. Our budget for construction administration is based on this anticipated six week construction period.

Task 10: Construction Review Services. D&K will also provide Construction Review Services through completion of the project. Construction Review will include:

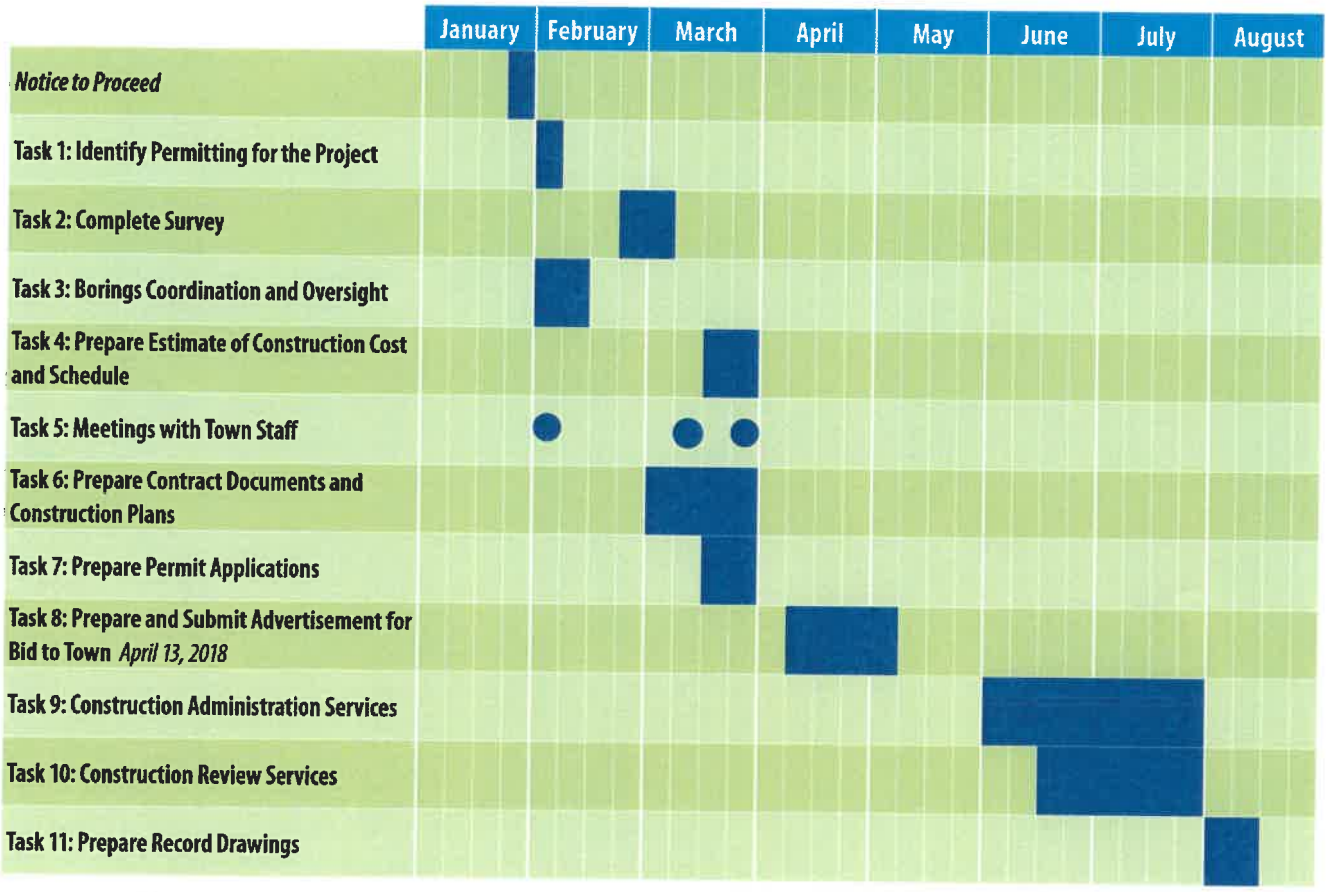
- Full-time construction inspection for the slope repair. Part-time construction inspection for milling and recycling, general clean-up and other miscellaneous items. Verification of testing requirements.
- Provide photographic documentation of the stabilization area.
- Substantial and Final Completion walkthrough.
- Preparation of punch lists.
- Contact with adjacent property owners when necessary.

As described in Task 9, our proposed budget assumes three (3) weeks of full time construction review and three (3) weeks of part-time construction review.

Task 11: Prepare Record Drawings. D&K will prepare record drawings for only the area of bank stabilization. Record drawings will include the centerline elevation of the road surface, road asphalt edge, road shoulder, and rock or other stabilization materials to the water's edge. D&K will provide a PDF of the record drawings to the Town and submit two (2) paper copies of record drawings to the Town.

Project Schedule

Our proposed schedule for Tasks 1 through 11 is provided below, and incorporates the request to have the project ready to bid by April 13, 2018.



KEY: ● Meeting

Cost Proposal

The following is the basis for payment for the items listed in the Scope. The engineering firm shall submit hourly rates. We have included a breakdown of hours per each task (by team member) on the next page.

Items	Fee Estimate	Basis for Payment
Task 1 through 6	$20,136	Lump Sum
Task 7	$2,174	Lump Sum
Task 8	$3,158	Lump Sum
Task 9	$4,129	Lump Sum
Task 10	$13,571	Hourly (156 hours)
Task 11	$2,001	Lump Sum
Total	**$45,169**	

Town of Middlebury
Shard Villa Road Slope Stabilization and Milling/Reclamation Project
Project No.: 224188X

DuBois & King inc.

Project Phases & Tasks	Labor Categories									
	Geotech. Engineer/ QA/QC	Project Manager/ Senior Engineer	Project Engineer	Field Naturalist	Staff Engineer	Registered Land Surveyor	Designer/ Tech.	Two Person Survey Crew	Admin. Support	Total Hours
1. Permit Scoping		0.5	3	6						9.5
2. Topographic Survey		0.5	2			1	10.5	18		32
3. Borings Coordination and Oversight (Including Dig Safe)	3		22							25
4. OPCC, Schedule		1	8							9
5. Three Meetings	3	4	9							16
6. Design										
A. Stability Model, Conceptual Alternatives	6	2	8		16					32
B. 60% Design	2	2	8		16					28
C. Final Design	1	3	12		12		12			40
D. Specifications, Contract Documents	1	3	8		10				6	28
7. Permit Applications		2	12	8					2	24
8. Bid Phase	2	4	18		4				8	36
9. Construction Administration (assuming 6 weeks constr.)		12	24						9	45
10. Construction Review (3 weeks FT, 3 weeks PT)			108		48					156
11. Record Drawings	1	2	6		12				3	24
Total Hours:	19	36	248	14	118	1	22.5	18	28	505

Project Resources

Firm Overview

Founded in 1962, DuBois & King is a multidisciplined consulting firm providing planning, design, and construction services to local, state, and federal clients from offices in Brandon, Randolph, South Burlington, and Springfield, Vermont, and Bedford, Keene, and Laconia, New Hampshire. The firm employs 100 engineers, scientists, planners, designers, surveyors, technicians, permitting specialists, and support personnel. D&K staff assist clients with projects involving water and natural resources, water supply, wastewater, transportation, and facilities. The individuals assigned to this team are familiar with the hydrological, hydraulic, physical, and other natural characteristics of the area. Resumes of project team members are included at the end of this document.

For the Town's Creek Road Reconstruction project, Jon Ashley, PE, served as Senior Project Manager and provided stormwater permitting assistance, gravel wetland design, and bid and construction administration assistance.

Jonathan Ashley, PE, Project Manager/Senior Engineer, has 25 years of environmental and civil engineering experience. He has completed the design of road reconstruction, drainage improvements, and several slope stabilization projects in Addison County and brings significant experience in the state and federal permitting requirements associated with those projects. Jon will be responsible for direct supervision and management of the D&K project team.

Andy Hoak, PE, PG, Geotechnical Engineer, has 24 years of experience providing planning, engineering, and permitting for a variety of civil/site projects. The manager of D&K's Water Resources group, Andy's experience encompasses hydrology and hydraulics, erosion and sedimentation control, drainage, geologic investigation, soils characterization, and permitting. His recent projects include senior engineer oversight and quality control for a roadway realignment project along Gilman Road in Royalton. Andy will provide geotechnical evaluation of the slope stability and repair options and senior-level oversight of permit preparation and will review plans and specifications.

Mike Mainer, EI, Project Engineer/Construction Observation, has six years of experience in a wide range of residential, commercial, industrial and municipal water, wastewater and stormwater infrastructure, land development, and environmental site investigation/remediation projects. Mike provided design and permitting for a slope stabilization in Huntington to reduce further landslide risks to water supply infrastructure of 40 households. For this assignment, Mike will provide project engineering design, as well as construction related services, providing important continuity for the project. Mike is a resident of the Town of Middlebury.

Charlotte Brodie, CWS, Field Naturalist, is an interdisciplinary field scientist with 30 years of experience trained in environmental evaluation, interpretation, and monitoring. As a naturalist, she integrates information on the biotic and abiotic components of ecosystems for site descriptions, inventories, criterion-based evaluations, and impact evaluations. She specializes in wetlands analysis and has a thorough knowledge of state and federal regulations pertaining to wetlands and other waters of the United States. Charlotte will support the project with wetland review and assistance with Army Corps permitting.

Charlie Johnston, EI, Staff Engineer, has three years of experience with public and private projects, including site design, water and wastewater, road reconstruction, construction review, state permitting, and hazardous waste/brownfield site investigation and remediation. He has provided engineering support on projects including a retaining wall reconstruction at One Taylor Street along the Winooski River in Montpelier. Charlie will assist with data collection, preparation of design plans, specifications, permitting, bid documents, cost estimates, and a support role for construction review for the project.

Randall Otis, LS, Licensed Surveyor, will serve as Survey Party Chief. Randy has 15 years of survey experience on a wide range of municipal, state and federal transportation projects. Randy will manage the firm's survey services for this project including topographic survey, basemapping, and research. Randy brings 15 years of experience supporting water resource, culvert, and municipal infrastructure projects throughout Vermont.

Representative Project Experience

D&K is providing design, survey, and construction observation for water/sewer/stormwater utility DuBois & King's experience on similar bank stabilization projects is summarized below and on the attached individual resumes.

Embankment Protection and Roadway Reconstruction, VT 125, VTrans, Ripton, VT

Through a current Roadway and Safety Engineering Services Retainer Contract with VTrans, D&K completed design and construction services in 2017 for multiple slope stabilization sites, drainage improvements, construction vehicle access to a river channel, guardrail improvements and traffic control phasing on VT 125 in Ripton. D&K designed construction documents to reclaim the existing roadway, correct superelevation deficiencies, drainage improvements, replace small culverts, guardrail, and intersection improvements.

Existing conditions

Dewey Streambank Stabilization, Natural Resource Conservation Service, Randolph, VT

D&K provided survey, design, plans and specifications, permitting, and construction inspection for the stabilization of approximately 675 feet of riverbank on the Third Branch of the White River to protect residential infrastructure. D&K's design included a new sweeping bend pushed approximately 40 feet away from the existing eroded bank, stone rip rap keyed into the river bottom along the new bank, and a bench between the former and new river bank vegetated with native riparian plants. The project went from conception through construction, including permitting and bidding, in a mere four months. Major tasks included:

- Screening-level geomorphic assessment to determine channel dimensions and alignment

- Hydraulic modeling with HEC-RAS to determine water surface elevations and to compute probable scour depth and size of required rip rap and gravel bedding
- Permitting including State Stream Alteration and Construction-Phase Stormwater permits, and Federal Dredge and Fill Permit
- Plans, specifications, and cost estimates
- Construction phase services including pre-construction and weekly construction meetings, daily inspection and reports, and a final completion report with engineer's certification.

James Road Reconstruction, Town of Weybridge, VT

Project Manager Jon Ashley designed road reconstruction, drainage improvements, and slope stabilization to repair a Town road damaged by slope movement. The project was funded by VTrans and won an Engineering Excellence Award for innovation in using lightweight foam blocks to rebuild the road, taking weight off the weak clay slope.

Pearson Road Reconstruction, New Haven, VT

Project Manager Jon Ashley designed road reconstruction, drainage improvements, and slope stabilization measures to repair a Town road damaged by significant flooding. The FEMA-funded project included topographic surveying, conceptual design, cost opinions, coordinating underground utility relocation, final design, and construction review.

Streambank Protection along Lilliesville Brook, Natural Resources Conservation Service, Bethel, VT

Survey, design, plans and specifications, permitting, and construction inspection for streambank stabilization at three separate sites on Lilliesville Brook. The work, funded by the NRCS Emergency Watershed Protection Program, was in response to severe bank erosion following a storm of record that threatened homes and septic leach fields at the three sites. DuBois & King's design included stone riprap keyed into the river bottom with a vegetated bank above. At one site immediately upstream of a bridge, the bank was realigned to improve the approach into the bridge opening. The designs at all three sites maintained or restored bankfull channel dimensions. Professional services included:

Completed reconstruction of Streambank

- Screening-level geomorphic assessment to determine appropriate channel dimensions and alignment
- Hydrologic and Hydraulic analyses to compute water surface elevations and scour depths and to compute size of required riprap and gravel bedding
- Permitting including State Stream Alteration and Federal Dredge and Fill Permit
- Plans, Specifications, and Cost Estimates
- Construction-phase services including pre-construction meetings, periodic inspection and reports, and a final completion report with engineer's certification.

Existing Conditions of Streambank

Route 53 Road Reconstruction, Salisbury, VT

Jon Ashley, PE, served as project Director and Engineer-of-Record for design, permitting, bid and construction of road reconstruction work to address issues with shoreline erosion, drainage, poor road subbase material, slope instability, and banking. The project included gabion baskets for protection of shoreline from erosion, and timber guardrails to fit into the rural setting. Assisted the Town with securing state funding, and with project administration related to VTrans highway and structures grants during construction.

West Street Stabilization and Reconstruction, Randolph, Braintree, Brookfield, VT

D&K provided an alternatives analysis to determine the best option for reconstruction or relocation of a 1.3-mile portion of West Street, which was partially destroyed by flooding. Alternatives included closing the road permanently, reconstructing on the existing alignment, and relocating on one of three different alignments. Developed preliminary engineering, final design, and contract documents for the preferred alternative, which was to reconstruct the road on the existing alignment. The scope of services included field survey, development of line and grade, partial relocation of the adjacent stream, streambank stabilization, coordination with VTANR and USACOE, design of a new precast concrete box culvert, and quantity and cost estimates. The project was considered an emergency action and was cost-shared between the towns, the state, and FEMA. Professional services for this project included:

Completed reconstruction of West Street.

Existing Conditions on West Street.

- Alternatives Analysis
- Hydraulic and Hydrologic Study
- Preliminary Engineering
- Culvert Design
- Topographic Survey
- Conceptual, Preliminary, and Final Design
- Stream Relocation/Stabilization
- Construction Observation
- Permitting
- Final Design
- Bid Phase Services
- Contract Documents

Field Days and Gooseneck Bend Roads, Weybridge, VT

Jon Ashley, PE, investigated and designed slope stabilization solutions for two roads that were significantly damaged due to slope failures. Designed drainage improvements and road relocation, assisted the Town with negotiating needed easements, relocating utilities, and procuring needed funding for Field Days Road. *The project was funded by FEMA and won an Engineering Excellence Award.*

Realignment and Stabilization, Gilman Road, Royalton, VT

Approximately 400 linear feet of the Town Highway 35 (Gilman Road) embankment along the White River failed as a result of flooding. The vertical height of the failed riverbank was approximately 80 feet. The road embankment was eroded away, and the resulting slope was unstable and vulnerable to further damage. On behalf of the town, D&K managed Federal Emergency Management Agency (FEMA)-funded projects, including the realignment, reconstruction and stabilization. D&K prepared an alternatives analysis that compared the scope and cost to repair and stabilize the existing riverbank with relocation of the roadway. Firm engineers provided engineering (hydrologic and hydraulic, fluvial geomorphologic, and geotechnical) to develop a basis of design of the required repairs, a new roadway alignment and cross section, and permitting. Services provided included:

Reconstructed slope, Gilman Road, Royalton.

Existing Conditions on Gilman Road, Royalton.

- An alternatives analysis comparing the scope and cost to repair and stabilize the existing riverbank with relocation of the roadway
- Engineering (hydrology, fluvial geomorphology, and geotechnical) to develop the basis of design of the required repairs, a conceptual alignment, and a roadway cross section
- Construction phase services

Brandon Brook, Slope Stabilization/Stream Restoration, Vermont Agency of Transportation, Rochester, VT

Design and construction services for emergency river and roadway reconstruction at several intersections of Brandon Brook and Route 73 following Tropical Storm Irene. Initial road reconstruction, as well as the flood itself resulted in significant channel instability and complete loss of habitat in three locations totaling approximately 2,900 feet. Channel stabilization design features included 13 stone weirs to create habitat and raise the channel bottom to increase channel width. Channel stabilization also restored floodplain access and reduced the potential for undermining of the new riprap on the roadway embankment. Rehabilitation included stone veins to direct flow away from the roadway and to restore habitat. Channel was seeded with hundreds of randomly-placed boulders to provide habitat shelter and structure for natural growth. Prepared hand-drawn plans for contractors' use and provided on-site (in-river) direction.

- River inspection
- Geomorphic assessment
- Restoration plans
- Construction direction

Marsh Brook Road, Streambank and Embankment Stabilization, Rochester, VT

D&K designed slope stabilization measures to approximately 225 feet of streambank / roadway embankment along Marsh Brook Road in Rochester. The toe of this 50-ft high embankment failed due to undermining of the toe during Tropical Storm Irene. D&K was retained by the Town of Rochester to develop construction documents, assist with permitting and bid phase as well as conduct several site inspections during construction. The design included a riprap slope with a keyway along the toe, installation of a new underdrain along the upgradient side of the road, reconstruction of a portion of the roadway that failed and new guardrail. D&K prepared final plans, bid documents, quantity take off and cost estimates and project close out as required by FEMA.

Route 140 Road Improvements, Middletown Springs, VT

D&K was contracted to make recommendations and design drainage and slope stabilization improvements along Route 140. This stretch of road was experiencing side slope erosion, inadequate drainage, and an inordinate amount of maintenance problems.

D&K was responsible for the survey, design, and construction inspection for approximately 1,805 feet of roadway. Project elements included slope stabilization, profile and superelevation recommendations, ditching, and drainage improvements. Project included replacement of several cross culverts and the creation of stone lined ditches and rip rap slopes.

One Taylor Street Reconstruction and Stormwater Demonstration Project, Montpelier, VT

Soil Extraction on Taylor Street.

D&K is leading roadway, sidewalk, utilities, lighting, and stormwater design; survey; and hazardous materials coordination for a 425 LF roadway reconstruction project. The $1M project serves as a green stormwater demonstration project and significantly improves motor vehicle and pedestrian connectivity between the new transit center and State Street. D&K staff coordinated Taylor Street reconstruction design with the ongoing design of the transit center, the reconstruction of State Street, the extension of the Montpelier Bike Path, and the reconstruction of an at-grade railroad crossing. The project is funded by a variety of federal grants. Project elements include: Pervious pavement and stormwater infiltration systems; Rain gardens, and street trees; Groundwater infiltration analysis for an adjacent, leaking fuel tank; Water and sewer line improvements; Streetlights.

Black Brook Naturalized, Streambank Stabilization, Manchester, NH

Stabilization and restoration of 200 feet of streambank designed to mimic the appearance of a natural streambank and the performance of a more traditionally armored bank. The project is located upstream of a dam that was removed in 2009 leaving the channel to naturally develop through more than a century of deposited sediment. The channel moved approximately 50' in this location in the two years following dam removal, and further movement would threaten adjacent sewer and gas lines.

Rather than traditional stone riprap, this design used two tiers of large sub-angular boulders to provide bank stability and protection. Vegetation was planted between the boulders to provide near-shore riparian cover, enhanced aesthetics, and additional erosion protection. Professional services included:

- Site inspection and evaluation
- Topographic Survey
- Hydrologic and Hydraulic Evaluations
- Evaluation of Alternatives
- Preliminary and Final Design
- Permitting
- Construction Cost Estimating
- Coordination with NHDES, US F&W, NH Fish & Game, Local Agencies
- Construction Observation

High Street Slope Stabilization, Greenville, NH

A landslide occurred on a steep slope between High Street and Otis Falls Hydro impoundment on the Souhegan River following a prolonged period of heavy rain. High Street and one private residence were threatened by the potential for continuing slope failure. DuBois & King performed final slope stabilization design to include a sheet pile retaining wall at the top of the failure scarp and stabilization of the lower slope with rock riprap. D&K provided bidding assistance to the Town. Professional Services included:

Completed slope stabilization

- FEMA Grant Application
- Data and field investigations
- Geotechnical investigations
- Survey
- Wetland mapping
- Consultation with sheet pile contractor
- Utility coordination
- Environmental permitting
- Coordination with nearby landowners and oversight agencies
- Preparation of easement plans
- Construction phase administration

During construction

Jonathan B. Ashley, PE

Project Manager

EDUCATION

B.S. Environmental Engineering, Rensselaer Polytechnic Institute, 1992

M.S. Course, Advanced Hydrology, Kansas State University, 2001

M.S. Course, Physical and Chemical Hydrogeology, University of Massachusetts, Lowell, 1996

M.S. Courses, Wastewater Treatment and Engineering; Open Channel Hydraulics, University of New Haven, Connecticut, 1994-95

REGISTRATIONS

Professional Engineer: VT 7350
Environmental Engineer: NH 9709
Professional Engineer: NY 79818
Certified VT Class 2 Public Water System Operator
40-hour OSHA HAZWOPER Course
8-hour OSHA HAZWOPER Course
Firefighter I Certification

Mr. Ashley has 25 years of environmental and civil engineering experience including planning, management and design of water/sewer main design, pumping and treatment, hazardous waste and brownfield remediation, and site/civil development projects for municipal, state, local and private clients. He has supported environmental documentation and permitting for infrastructure and site projects and maintains positive working relationships with regulatory officials. Jon also provides engineering and management for roadway and slope projects.

Churchville Road and Bridge, Town of Hancock, VT. Project Manager for the design, permitting, bid, and construction of road and bridge repairs and river and stream channel stabilization associated with Tropical Storm Irene. Prepared a public presentation for the Town and coordinated the work with Vermont Agency of Transportation (VTrans) and FEMA.

Tucker Brook Road Slope Repair, Hancock, VT. Project Manager for design, bid, and construction of bank stabilization and road repairs for a slope failure that caused a lane closure of a Class 3 road.

Plank Road Box Culvert, New Haven, VT. Project Manager for design, permitting, bid, and construction of a concrete box culvert for a Class 2 road crossing of a river under a VTrans structures grant, including design elements for fish passage.

Natural Turnpike, Ripton, VT. Project Manager for design, permitting, bid, and construction of an arch culvert for a Class 3 road stream crossing under a VTrans structures grant.

Dewey Avenue, West Rutland, VT. Project Manager for the assessment, design, permitting, bid, and construction of a rip rap armor and selective fill repair of a slope failure caused by toe erosion from the adjacent stream. The project also included reconstruction of the damaged road section.

James Road Reconstruction, Town of Weybridge, VT. Designed road reconstruction, drainage improvements, and slope stabilization to repair a Town road damaged by slope movement. The project was funded by VTrans and won an Engineering Excellence Award for innovation in using lightweight foam blocks to rebuild the road, taking weight off the weak clay slope.

Pearson Road Reconstruction, New Haven, VT. Designed road reconstruction, drainage improvements, and slope stabilization measures to repair a Town road damaged by significant flooding. The FEMA-funded project included topographic surveying, conceptual design, cost opinions, coordinating underground utility relocation, final design, and construction review.

Lower Plains Road and Cross Street Bridge Projects, Town of Middlebury, VT. Project Manager for topographic surveying and coordination of boundary surveying for two Middlebury design-build bridge projects (one new bridge and one destroyed by flooding). One of the projects also included replacement design for a damaged water main.

Route 53 Road Reconstruction, Salisbury, VT. Project Director and Engineer-of-Record for design, permitting, bid and construction of road reconstruction work to address issues with shoreline erosion, drainage, poor road subbase material, slope instability, and banking. The project included gabion baskets for protection of shoreline from erosion, and timber guardrails to fit into the rural setting. Assisted the Town with securing state funding, and with project administration related to VTrans highway and structures grants during construction.

Field Days and Gooseneck Bend Roads, Weybridge, VT. Investigated and designed slope stabilization solutions for two roads that were significantly damaged due to slope failures. Designed drainage improvements and road relocation, assisted the Town with negotiating needed easements, relocating utilities, and procuring needed funding for Field Days Road. The project was funded by FEMA and won an Engineering Excellence Award.

MacDonough Drive Slope Stabilization Study, Vergennes, VT. Completed a slope stabilization study and report for the MacDonough Drive neighborhood where landsliding had been causing damage to roads, private property, utilities, and historic structures. Provided rapid design and construction review services for a critical section of road that slumped approximately one foot due to an adjacent slope failure during the study. Also corrected drainage issues that contributed to the slope failure. *This project received an ACEC Engineering Excellence Award.*

Andrew T. Hoak, PE, PG, CPESC Geotechnical Engineer

EDUCATION

Hydrogeology, Clemson University, 1994
B.A., Geology, Environmental Studies, Alfred University, 1993

REGISTRATIONS

Professional Engineer: VT 8929
Professional Geologist: NH 388
Certified Professional in Erosion and Sediment Control
Certified Wastewater Site Technician Type B: VT 487
Class IV Public Water System Operator: VT #2644
Grade 2 Domestic Wastewater Operator: VT #1421
OSHA 40-Hour HAZWOPER Certificate
OSHA 8-Hour Supervisor Certificate

Mr. Hoak has 24 years of experience in the design of water quality projects, with specialties in hydrogeology and environmental engineering. Andy has successfully completed a wide variety of related projects, including environmental investigations and remediation, water supply development and protection, decentralized wastewater disposal, site development and land use planning. He has a proven track record of developing innovative stormwater management controls and advanced sediment and nutrient treatment methods, as well as extensive experience in stormwater permitting.

Gilman Road Reconstruction Project, Royalton, VT. Senior Engineer/Quality Control Review for the realignment of Gilman Road and flood resilient channel protection on the White River. Tropical Storm Irene caused significant erosion at the toe of the 80-ft-tall road embankment, which forms the south bank of the river. The slope is composed of fine material, which continuously erodes, threatening the roadway. Identified road alignment and river stabilization alternatives, and developed design. The selected alternative involved armoring the lower portion of the river bank and moving the road away from the river. Responsible for quality control review of final design and construction drawings, and construction phase assistance.

Perley Farm Road Reconstruction Project, Royalton, VT. Senior Engineer/Quality Control Review for the design of a road reconstruction and flood resilient channel protection on the White River. High river stages during TS Irene destroyed a 500-ft-long section of road, which ran along the north bank of the river. Project objectives included design of a road alignment to fit existing site conditions, and armoring the bank to improve flood resiliency. Responsible for review of design of road alignment and bank stabilization and hydrologic and hydraulic evaluation related to river bank armoring.

Subdivision and Site Improvements, Highlander Planned Unit Development, Jeffersonville, VT. Project Manager for the creation of the Highlander Planned Unit Development. The Highlander Motel served vacationers at Smugglers Notch Resort for a number of years before being converted to efficiency units serving seasonal workers at the resort. Assisted the site owner with subdividing the property and creating additional residential units, a fitness center and automotive repair facility. Designed and permitted a decentralized community wastewater disposal system, improved water supply facilities and shared stormwater infrastructure.

Site Investigation, Streetscape Improvement Project, St. Albans, VT. Environmental Engineer called to investigate several areas of contamination during construction. Due to the proximity of the sites to each other, detailed site investigations were performed to determine the limits of contamination and source location. Because areas of contamination were discovered in the vicinity of new or replacement water mains, use of Viton rubber gaskets and bentonite plugs was recommended to minimize the potential risk to the public drinking water system distribution system. Contaminated soils generated as part of the project were temporarily stockpiled at an off-site location for eventual disposal as Alternative Daily Cover (ADC) at a licensed landfill, while contaminated groundwater was pumped to a frac tank for temporary storage and treatment prior to disposal to the municipal wastewater facility.

Groundwater Mounding Analysis, Taylor Street, Montpelier, VT. Completed a groundwater mounding analysis for a proposed infiltration system collecting stormwater flows from approximately 12,000 ft2 of impervious surface. The analysis included an evaluation of the effects from the infiltration system in relation to nearby soil and groundwater contamination. The Vermont Stormwater Manual restricts the use of infiltrating practices at hotspot land uses that generate elevated concentrations of hydrocarbons, metals or other toxicants that are not typically found in stormwater runoff. The analysis determined that groundwater elevations would increase approximately 0.5 to 2 inches in the vicinity of the plume and would have minimal impact on contaminant fate and transport. VT DEC agreed with the findings of the analysis and determined that infiltrating chambers would be an acceptable stormwater treatment practice in this area.

Stormwater System Evaluation, Arrowhead Industrial Park, Georgia, VT. Served as Senior Project Manager to determine whether an existing stormwater collection and infiltration system would support additional flows from a planned expansion and new redirected connections. The calculations included a determination of 1 00-year stormwater flows using the TR-55 model and infiltration rates based on in-situ percolation testing. Results of the investigation demonstrated that adequate stormwater capacity was available with the addition of infiltration trenches for the planned expansion.

Michael J. Mainer, EI

Staff Engineer

EDUCATION

B.S., Environmental Engineering, University of Vermont, 2010 (Cum Laude)

REGISTRATIONS

Engineer Intern: VT 017.0063416
OSHA 40-Hour HAZWOPER certification
Vermont Class B Water Supply and Wastewater Disposal System Designer: 152.0126951

Mr. Mainer has seven years of experience in a wide range of civil/environmental engineering work, including surveying, site investigation, design, permitting and construction inspection on site/civil, water, wastewater, and environmental remediation projects. Mike has provided aquatic organism passage (AOP) evaluation and prepared retrofit designs. Mike previously led the collection of field data and final design for a large culvert replacement on a tributary in the Browns River (Jericho) and design of a new 14-foot precast box culvert on Manlin Road in Fayston. Mike led the preparation of conceptual plans and opinion of probable construction costs for sewer and stormwater collection system replacements for the Proctor Ormsbee Avenue project.

Huntington Fire-District No. 1, Huntington, VT. Provided design and permitting services to replace landslide-damaged source and distribution lines. Conducted additional design work to economically reduce further landslide risks to water supply infrastructure using a combination of drainage improvements and slope stabilization techniques, including live-stake revegetation. Services were provided under an emergency time-frame to restore safe and reliable water services to 40 households.

Vernon and Phillips Street Stormwater Separation and Sewer Design in the Tenney Brook Watershed, NRCS, Rutland, VT. Project Engineer for HydroCAD modeling and feasibility analysis of alternatives for disconnection of neighborhood stormwater from a combined sewer collection system. Developed a comparison of three alternatives for stormwater separation. Prepared basis of design documents and summary comparisons of alternatives and identified the most cost-effective and efficient approach for recommendation to the City.

Raceway Road Culvert Replacement, Jericho, VT. Oversaw field data collection, conducted hydraulic & hydrologic analysis, prepared a final design and assisted with permitting for a large culvert replacement on a tributary to the Browns River. The existing culvert was undersized and heavily deteriorated. The proposed 38' x 10' precast concrete bottomless structure will offer a high level of aquatic organism passage and geomorphic compatibility on this complex site while reducing flooding risks upstream.

Manlin Road Culvert Replacement, Fayston, VT. Assisted in field data collection, design and permitting to replace an existing undersized, deteriorated structure. The new 14' x 6' precast box structure made use of channel simulation to achieve a high level of aquatic organism passage and restore sediment transport.

Browns River Aquatic Organism Passage Evaluations, Underhill and Jericho, VT. Conducted an evaluation of four structures in the Browns River watershed for aquatic organism passage. Conducted field data collection, hydrologic & hydraulic analysis, AOP evaluation and prepared retrofit designs. Subsequently prepared construction drawings for retrofit of existing structures to improve aquatic organism passage, promote geomorphic stability and reduce scour problems.

Stormwater Stream Crossings, The 4x4 Center Driving School, Bolton, VT. Provided a wide range of civil and environmental consulting and design services for a unique off-road driving school in extremely mountainous terrain. Services included stormwater management evaluation & design, site planning & design, siting & design of stream crossings, bank stabilization and erosion prevention & sediment control planning. Worked extensively with regulatory personnel to overcome significant site constraints and protect a wide variety of environmental resources.

VAOT Biological Services Subconsulting, Maidstone Slide, Maidstone, VT. Assisted in development of measures to reduce costs and environmental impacts associated with repair/stabilization of a very large bank failure on the Connecticut River.

Champlain Elementary School, Burlington, VT. Completed site analysis, developed site design and prepared construction documents for comprehensive site improvements. Site improvements included reclamation and rehabilitation of pavements and subbase, drainage and underdrainage improvements, stormwater management and improved pedestrian and vehicle circulation.

Village Hill, Huntington, VT. Designed multiple shared water supplies, storage reservoirs and distribution systems to serve a planned residential development project. Design required layout of water system components around multiple potential sources of contamination (PSOCs) as well as careful design of system components to reduce sanitary risks to these non-public, non-chlorinated systems.

Charlotte W. Brodie, CWS

Field Naturalist

EDUCATION

M.S., Botany, Field Naturalist Program, University of Vermont, 1988

B.S., Biology, Smith College, 1978

REGISTRATIONS

Certified Wetlands Scientist: NH 244

Ms. Brodie is an interdisciplinary field scientist trained in environmental evaluation, interpretation, and monitoring. As a naturalist, she integrates information on the biotic and abiotic components of ecosystems for site descriptions, inventories, criterion-based evaluations, and impact evaluations. Her training and experience incorporate geology and geomorphology, soils chemistry, botany, vertebrate and invertebrate zoology, and hydrology. She specializes in wetlands analysis and has a thorough knowledge of state and federal regulations pertaining to wetlands and other waters of the United States. The quality of her work has been recognized by the US Environmental Protection Agency, which requested her services for a northwestern Vermont project aimed at early identification and protection of wetlands in areas subject to heavy development pressure.

Maxwell Pond Dam Removal/Black Brook Restoration, Manchester, NH. Wetlands Scientist for dam removal and stream channel restoration project intended to eliminate a fish passage barrier and enhance local aquatic habitat. Responsible for wetland field delineation and preparation of State Dredge and Fill application.

Engineering and Construction Management for Tropical Storm Irene Related Repair Projects, Royalton, VT. Wetlands Scientist for Master Services Agreement with Town of Royalton to provide engineering to replace and repair storm damaged infrastructure, including bridges and structures, roadway embankments and slopes. D&K services included design for slope stability, hydrologic and hydraulic analysis and reports, preparation of engineering plans, wetland identification, and delineation documentation.

Maple Street Roadway Reconstruction, Weathersfield, VT. Wetland scientist for project to provide design and permitting services for roadway reconstruction. Project includes assessing pavement condition and making recommendations regarding reconstruction or reclamation, investigating options to improve sight distance at the intersection of Maple Street and VT Route 106, improving the roadway alignment at a knoll/curve in the road, and drainage improvements. Project is funded with a Public Lands Highway Discretionary Program Funds grant, is administered through VTrans Municipal Assistance Bureau (MAB). Delineated wetlands, obtained confirmation of state wetlands allowed use, and prepared NEPA Categorical Exclusion document.

East Lake Road Stormwater Improvements, Eastman Community Association, Grantham, NH. Wetlands Scientist responsible for delineating wetlands within the project area. The project is comprised of assessment of including stormwater patterns, drainage infrastructure, erosion areas, roadway conditions and subsurface conditions to evaluate stormwater quality, erosion and roadway improvements to mitigate water quality impact from a private residential development to Eastman Lake. Supported D&K's close coordination with the community, NHDES regulators, and maintenance personnel to develop a study summarizing existing conditions and recommended improvements.

Prescott Road Reconstruction and Bridge Replacements, Brentwood, NH. Certified Wetlands Scientist to provide wetland permitting assistance, rare, threatened and endangered species research and support for the NH DES Dredge and Fill permit. The project includes two bridge replacements, a 2,800 LF roadway realignment, right of way acquisition, slope easement identification, and intersection improvements.

Wetland Delineation, J.P. Carrara & Sons, Middlebury, VT. Wetland delineation on 27-acre parcel on Exchange Street.

Otter View Park, Middlebury Area Land Trust, Middlebury, VT. Wetland Scientist for creation of 17-acre public-use park. Project included field survey and wetland delineation, design of trail network, elevated boardwalk over wetland, parking lot, municipal sewer and water connections, and stormwater treatment facility. Project also included construction cost estimates and preparation of bid documents and technical specifications. Coordinated with federal, state, and local agencies for access and permit approval.

Runway and Taxiway Extensions, Middlebury State Airport, VTrans, Middlebury, VT. Certified Wetland Scientist responsible for completing and submitting wetlands permit application and wetland delineation for construction of a 700-ft runway and parallel taxiway extension; the reconstruction and widening of 2,500 LF of the runway and parallel taxiway; and obstruction removal. Environmental issues included erosion control monitoring and compliance, bat habitat, aquifer protection, agricultural soils, and evidence that the project would not cause a net increase in phosphorus loading to Lake Champlain.

Charles W. Johnston, EI

Staff Engineer

EDUCATION

B.S. Civil Engineering,
Geotechnical Concentration, Rensselaer
Polytechnic Institute (RPI), Troy, NY, 2014

REGISTRATIONS

Engineer Intern: State of Vermont: 017.0115698
OSHA 40-Hour HAZWOPER Certificate
Class A Wastewater Designer

Mr. Johnston has a range of experience with public and private projects including site design, water and wastewater, road reconstruction, construction review, state permitting, and hazardous waste/ brownfield site investigation and remediation. His responsibilities include AutoCAD design, permit preparation and submissions, written reports, budgeting, probable construction estimation, contractor selection, communication between clients and contractors, and meetings with clients.

Creek Road Reconstruction and Sidewalk, Middlebury, VT. Staff Engineer for design support for road reconstruction, stormwater and drainage improvements, stormwater treatment, and sidewalk construction project funded through VTrans' Local Transportation Facilities (LTF) program. Services included plan preparation, traffic control plan, cost estimating, permit applications, bid document preparation, regular communication with VTrans, and assistance with final design and bid authorization approvals.

Middlebury East Community Stormwater Improvements, Middlebury, VT. Staff Engineer for redesign of stormwater system, services included providing assistance for topographic survey, stormwater design, and details.

Construction Review, One Taylor Street, VTrans, Montpelier, VT. Resident Engineer for a federally-funded, VTrans MAB-led project, including a new 4-story Transit Center, bike path and pedestrian bridge, intersection with Main Street, and coordination with regulatory agencies for the redevelopment of a brownfield site. D&K conducted independent technical reviews of engineering plans and cost estimates; organized/led project meetings for design; coordinated utility issues; and managed ROW acquisition services, including appraisals, property surveys, prepared ROW documents (plans, easement descriptions, takings, relocations, etc), and coordinated with VTrans ROW officials.

Construction Review, One Taylor Street Wall Reconstruction, Montpelier, VT. Resident Engineer for a federally funded, granite retaining wall reconstruction project that includes environmental remediation, site preparation for future development, and and coordination with regulatory agencies for the redevelopment of this brownfield site. Responsible to conduct sampling and characterization of contaminated soils, organize and lead project meetings, and manage zoning permitting for floodway.

Prospect and Elm Streets Roadway and Utilities Reconstruction, Randolph, VT. Staff Engineer assisted with CAD design of new water, sewer, and stormwater utilities. Resident Engineer for construction observation of water/sewer/ stormwater utility improvements and reconstruction of 7,600 LF of roadway in two neighborhoods. Designed sewer pump station and force main to replace two shallow sewer services. Observed potholing of existing water main and developed alternatives analysis to replace shallow water main.

Franklin, Fales, Summer, School Street Water Improvements and Road Reconstruction, Randolph, VT. Resident Civil Engineer for a water line replacement and road reconstruction project. This project involved replacement of water mains and services on Franklin and Summer Street and full depth road reconstruction of Summer Street.

Crescent Connector, Village of Essex Junction, VT. Staff Engineer for $6.5 million Federal Highway Administration (FHWA) funded Crescent Connector Road project, a bypass around the Five Corners intersection in the village. The project is administered through the VTrans Municipal Assistance Bureau. Designed stormwater infrastructure collection and treatment system and assisted with State of Vermont Stormwater Discharge and Construction Permits.

King Street Water System Improvements, Northfield, VT. Staff Engineer for design support including plan preparation using AutoCAD, cost estimating, permit preparation, and record drawings. Provided full-time resident engineering services including quantity tracking, processing contractor pay requests, and weekly project meetings. The project consisted sidewalks, 2,800 linear feet of waterline replacement on King St., East St., and Turkey Hill Rd and road reconstruction.

EDUCATION

A.S., Survey and Applied Science,
Paul Smith's College of Arts and Sciences, 2002

REGISTRATIONS

Land Surveyor: VT 60852
OSHA 40-Hour HAZWOPER Certification

Vermont Society of Land Surveyors – attended meetings
Vermont Society of Engineers, Board Member
GIS Advisory Board - for Board of Survey

Mr. Otis is a licensed land surveyor and senior party chief with 15 years of experience in boundary and topographic surveying. The head of DuBois & King's Survey Department, Randy has performed survey services for municipal, state, private, and public clients throughout New England and New York. His specific experience includes performing topographic and boundary surveys, right of way determination, monumentation, stakeout, boundary research and plats, and deed preparation and research.

Market Street, South Burlington, VT. Survey Party Chief for reconstruction of Market Street. Responsible for data collection, traverses, deed preparation and research, and topographic survey.

Crescent Connector, Village of Essex Junction, VT. Survey Party Crew Chief for $6.5 million Federal Highway Administration-funded Crescent Connector Road project, a bypass around the east side of the Five Corners intersection for traffic that is traveling between Maple Street, Main Street, and Park Street. Project consisted of deed research on 15 parcels and 3 State Highways. Field survey required location of existing conditions of 3 highways, 1 active railway, and all private lands abutting the 1,800 ft proposed route. Record documents were compared with existing monuments to establish both private and public boundaries. Plans were drafted identifying all existing and proposed boundaries. Project is administered through the VTrans Local Transportation Facilities Section.

Survey Services, Vermont Agency of Transportation, Various Locations, VT. Survey services on project-by-project basis to conduct wide range of survey operations in support of Route Survey Unit mission on assignments throughout State. Specific assignments include:

- **Pittsford, VT.** Survey Party Chief for historic right-of-way determination for US 7 segments 1 and 2 and side streets in village. Performed review of Town record research for road survey before and after 1850 and compiled and analyzed VTrans data, parcel abstracts, and Secretary of State and other State and county records. Produced right-of-way plans, Town Road Report of surveys before 1850, and a Project Report to explain and defend historic right-of-way determination. Set monumentation on US 7 and adjoining side street right of way limits.

Great Streets BTV, Burlington, VT. Survey Party Chief for existing conditions of roadway, pedestrian facilities, and utilities supporting the redesign of City Hall Park and two blocks of Main Street/US 2 in downtown Burlington. Completed a detailed survey of the sidewalks, roadways, paint markings, building party walls, utilities, tree type and size. Record documents were compared with existing utilities to establish locations that could not be built on, as well as establish both private/public boundaries.

One Taylor Street Retaining Wall, Montpelier, VT. Survey Party Chief to oversee the survey of river cross sections to support repairs to a retaining wall supporting the development of a new transit center, parking lot, and bike path. The stone retaining wall runs along the Winooski River.

Flood Study of the Mad River Area, Central Vermont Regional Planning Commission, Fayston, Waitsfield, Warren, Moretown, and Waterbury, VT. Chief of Survey to develop cross sections serving a flood study of the Mad River, Thatcher Brook and Graves Brook. Survey cross sections supported the development of high-quality hydraulic models of the streams using HEC-RAS software and prepare inundation maps for flows ranging from the 2- to 500-year flood flows—used to identify the vulnerable infrastructure. Deliverables included a summary report of mitigation actions on the three most vulnerable sites per town, including inundation maps. The project was funded through a Community Development Block Grant for disaster recovery and builds on the work of a previous study led by D&K. Managed field and desktop survey services. Helped evaluate and plan for shooting of cross sections with complex access conditions.