FINAL REPORT

NEIWPCC Job Code:	0357-002-001
Project Code:	LS-2021-072
Contractor:	PMNRCD
Prepared By:	Hilary Solomon, Sophia Milkowski
Project Period:	10/25/2021 to 09/30/2023
Date Submitted:	August 25, 2023
Date Approved:	August 29, 2023

Castleton Main Street Drainage Scoping and Alternatives Study

CONTACT INFORMATION

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This is a Lake Champlain Basin Program funded project.

This project was funded by an agreement awarded by the Environmental Protection Agency to NEIWPCC in partnership with the Lake Champlain Basin Program

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EXECUTIVE SUMMARY

The *Castleton Main Street Drainage, Scoping and Alternatives Study,* which took place between October 2021 and August 2023, included an assessment of the drainage and stormwater infrastructure in downtown Castleton. The project was structured with a set of six tasks which included hiring a consultant, engaging with local stakeholders, conducting field observations and desktop analysis, writing a scoping statement, creating conceptual designs for two stormwater projects, and reporting. This project was carried out by Poultney Mettowee Natural Resources Conservation District (PMNRCD) in partnership with the Town of Castleton and the Rutland Regional Planning Commission, with the appointment of Dan Monette of Fuss & O'Neill as the project consultant.

This project was intended to identify and develop projects to mitigate runoff-induced flooding and drainage issues along Castleton's Main Street. Our aim was to address hazardous conditions and intervene in the flow of polluted stormwater entering the Castleton River. The scoping study entailed the assessment of existing conditions, appraisal of existing stormwater infrastructure, evaluation of runoff infiltration opportunities, development and evaluation of alternatives for improvements, the collection of public input, and the selection of preferred alternatives.

Prior to beginning our field observations and analysis, we met with community members to collect information about drainage concerns in the project area. Project partners undertook field observations throughout the summer and fall, including during a rain event, to observe drainage patterns and collect soils information. On February 16, 2023, we presented five alternatives, including a "no build" option to the project team. Two selections were chosen to be pursued as future projects and developed to a 30% design. The two selections were made because they exhibited the most potential for meaningful stormwater treatment.

The first selection (Alternative 2) includes the addition of an infiltration basin on the south side of Main Street (west of Glenbrook Road) with the installation of two 100-foot-long treatment swales and a small detention pond at 949 Main Street, if the landowner is amenable. The second selection (Alternative 4) includes the placement of subsurface infiltration chambers and two manholes to redirect existing stormwater at Castleton Elementary School. (Images of the preliminary project designs are included below).

Due to delays that prevented prompt RSVP responses from local community members, the final meeting had to proceed regardless of their attendance. To compensate for this, 31 letters were mailed out on August 7th, 2023, to local landowners, detailing the findings and final outcomes of the study.

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1. PROJECT SYNOPSIS

Castleton Main Street Drainage Scoping and Alternatives Study began with the execution of the project contract on October 25th, 2021 and was concluded with the completion of this final report on August 25, 2023 (with an official end date of September 30th, 2023). The project was structured with a set of six tasks that corresponded to various stages of progress in our timeline. Tasks included:

1) **Develop Request For Proposal and Hire Consultant with Partners** (January - March 2022),
2) **Stakeholder Engagement** (March - June 2022),
3) **Conduct Field Work and Desktop Analysis** (May 2022 - March 2023),
4) **Write Preliminary Scoping Statement** (March - May 2023),
5) **Project Design and Final Scoping Study Statement and Site Plan** (June - Sept 2023),
6) **Quarterly Reports** (December 2021, March 2022, June 2022, September 2022, December 2022, March 2023, and June 2023); and this **Final Report** (August 25, 2023).

This project was executed to mitigate consistent runoff-induced flooding and drainage issues along Castleton's Main Street. Our aim was to address hazardous conditions and intervene in the flow of polluted stormwater entering the Castleton River. The scoping study entailed the assessment of existing conditions, appraisal of existing stormwater infrastructure, evaluation of runoff infiltration opportunities, development and evaluation of alternatives for improvements, the collection of public input, and the selection of preferred alternatives. This project was carried out by Poultney Mettowee Natural Resources Conservation District (PMNRCD) in partnership with the Town of Castleton and the Rutland Regional Planning Commission, with the appointment of Dan Monette of Fuss & O'Neill as the project consultant.

Prior to beginning our field observations and analysis, we met with community members on June 15, 2022, to collect information about drainage concerns in the project area. Project partners conducted field work throughout the summer and fall, including during a rain event, to observe drainage patterns and collect soils information. On February 16, 2023, we presented five alternatives, including a "no build" option to the project team. Two selections were chosen to be pursued as future projects and developed to a 30% design. The two selections were made because they exhibited the most potential for meaningful stormwater treatment.

The first selection (Alternative 2) will be the addition of an infiltration basin on the south side of Main Street (west of Glenbrook Road) with the installation of two 100-foot-long treatment swales and a small detention pond at 949 Main Street, if the landowner is amenable. The second selection (Alternative 4) will be the placement of subsurface infiltration chambers and two manholes to redirect existing stormwater at Castleton Elementary School. (Images of the preliminary project designs are included below).

Due to delays that prevented prompt RSVP responses from local community members, the final meeting had to proceed regardless of their attendance. To compensate for this, 31 letters were mailed out on August 7th, 2023 to local landowners, detailing the findings and final outcomes of the study.

2. TASKS COMPLETED

This project consisted of six tasks in total. First, we had to develop an RFP and hire a consultant with partners. Our second task was the cultivation of stakeholder engagement. Our third task was conducting field observations and desktop analysis. Our fourth task was writing the preliminary scoping statement. Our fifth task entailed project design, the final scoping study statement, and the site plan. The sixth task of this project was the completion of quarterly and final reports.

Task 1: RFP and hire consultant:

Firstly, we held a kickoff meeting to introduce the project team and project partners on February 21st, 2022. The intention of this meeting was to initiate the project and review the RFP process and timeline. We developed a request for proposals to hire a consultant for the project's technical component. Then, we gathered quotes for services from three different candidates. On April 5th, 2022, the project team met again to select a consultant. After the selection was made, we held a third meeting on April 7th, 2022: the initial meeting between PMNRCD and the chosen consultant, Dan Monette (Fuss and O'Neill).

Task 2: Stakeholder engagement:

On June 1st, 2022, we mailed letters to 31 local community members inviting them to a public local concerns meeting. A remote option through Zoom was provided. This meeting occurred on June 15th, 2022, with a total of 10 attendees (photo left), including Castleton University facilities staff, library staff and trustees, and town officials. The aim for this public meeting was to outline the project and gain insight on additional issues and considerations associated with the project area. Community member input shared at this meeting further defined the area's needs and illuminated potential impacts, informing our subsequent conceptual design process and the improvements we recommended. Meeting notes were documented with partners and individual stakeholders.

On February 16th, 2023, Dan Monette (with Fuss and O'Neil) and Hilary Solomon (with PMNRCD) met with Castleton Department of Public Works (DPW) staff and Devon Neary (with the Rutland Regional Planning Commission) to discuss the potential projects identified. They selected two of these potential projects for conceptual designs.

Our final project meeting was held on June 29th, 2023. It was attended by Dan Monette (with Fuss and O'Neil) and Hilary Solomon (with PMNRCD) the Castleton Town Manager, Castleton DPW staff, Castleton University facilities and library staff and board members. We discussed the completed conceptual design plans of the projects selected at the February 16, 2023, planning meeting.

Lastly, on August 14th, 2023, we mailed 31 letters to the local landowners we invited to the local concerns meeting, detailing the findings and final outcomes of the study. This measure was a compensation for low community member attendance at the June 29th, 2023 meeting.

Task 3: Conduct fieldwork and desktop analysis:

PMNRCD staff met with the Castleton Town Manager and DPW staff on February 21, 2022, to outline the most obvious drainage issues along Main Street. PMNRCD staff followed up with site visits to these areas throughout the summer.

On September 30th, 2022, PMNRC and Fuss & O'Neill staff conducted fieldwork to evaluate runoff sources, drainage paths, potential storage areas, and soil conditions. Hilary and Dan spent time walking the entire project area. We were in the area during a thunderstorm and recorded many areas where water drains, pools, and might be treated. Dan took the information gleaned from this field work and developed recommendations for project implementation.

Desktop analysis was initiated on December 31st, 2022, utilizing field work notes to determine a few "best fit" locations for potential infiltration BMPs. Hydrology analysis was also completed for each of the locations identified. The hydrology allowed us to determine preliminary sizing based on the contributing watershed area.

By March 31st, 2023, the desktop analysis was completed, and Dan commenced creating conceptual designs to estimate water quality volume and potential phosphorus lb/kg treated.

Using support from an external funding source, on May 2, 2023, Castleton Road Crew collected water samples at eleven locations throughout the study area, and the following day PMNRCD staff delivered them to Endyne Laboratory in Williston for analysis.

Photo 1: Observing stormwater flow in Castleton.

Photo 2: Ponding along Elm Street.

Task 4: Write preliminary scoping statement:

Our site visit performed on September 9, 2022, informed the locations of the alternatives and drainage catchment areas. On December 31, 2022, base maps were created and Fuss and O'Neill started incorporating typical details for underground infiltration systems and rain gardens to reference in the future 30% design concepts. The preliminary alternatives, matrix, and recommended alternatives were presented to the project team (the town, RRPC, and PMNRCD staff) on February 16, 2023. Two selections were made (Alternatives 2 and 4) to be pursued as a future project and developed to a 30% design. The locations of these projects were also specified during this meeting: 949 Main Street and Castleton Elementary School, respectively.

Task 5: Project (conceptual) designs and final scoping statement or report:

The project conceptual designs and the scoping/alternatives report were completed and presented to the project partners on June 30th, 2023. Fuss and O'Neill staff made the final report available to partners shortly thereafter.

Task 6: Quarterly and final reports:

Reports on the project's progress were produced at their designated quarterly intervals, for a total of seven. These updates included summaries of project results, timelines, work anticipated for future quarters, challenges encountered, information gleaned from each task completed, and overall project status. The quarterly reports helped the project team stay on track as we moved through each phase of the project towards its completion. This final report was written after all other project tasks were completed.

3. METHODOLOGY

Task 1: RFP and hire consultant.

PMNRCD followed our procurement policy and worked with the Town of Castleton and the RRPC to evaluate the bids (see the related memo). The Project Team structured the RFP to follow the accepted methodology for scoping studies in Vermont developed by the VTRANS Municipal Assistance Bureau.

The steps outlined in the RFP for the consultant included their participation in the following:

a) Initial Meeting with Project Partners, b) Documentation of Existing Conditions, c) Local Concerns Meeting, d) Land Use Context in and surrounding the project area, e) Conceptual Alternatives Development, f) Identification of Utility Conflicts, g) Resource Impacts and Permitting Requirements, h) Best Alternatives/Projects Selection, i) Preliminary Cost Estimate, and k) Final Scoping Project Report.

The consultant selection process was done in collaboration between PMNRCD and the project team through an equitable review process.

Task 2: Stakeholder engagement.

The Town of Castleton used tax maps to identify landowners in the project area and created a list of 31 residential or business addresses for mailed communications. PMNRCD wrote and mailed letters to these landowners to announce the goals and results of the project.

Task 3: Conduct fieldwork and desktop analysis.

Field observations were conducted during wet and dry weather. Photographs were taken to document the site locations and water ponding and/or flow. Fuss & O'Neill staff used a soil auger to document soil types up to approximately three feet in depth and estimate permeability potential related to stormwater treatment BMPs. With support from an external funding source, we conducted phosphorus sampling on several locations located inside the watersheds analyzed on May 2nd, 2023. The lab samples were sent for testing at an Endyne Inc. facility, a report was formulated, and returned to the Town. The lab data shows multiple areas of high phosphorus levels of 0.12 mg/L and one sample on Elm Street with a reading

of 0.52 mg/L, whereas the typical level is assumed to be 0.044 mg/L based on the sample taken from Pond Hill Brook.

Task 4: Write preliminary scoping statement.

The partners utilized the current stormwater project prioritization guidelines developed by Jim Pease, Vermont DEC, for scoring potential stormwater projects. The components in this matrix include Water Quality Mitigation (nutrient reduction, sediment reduction, drainage area, impervious drainage, and connectivity to surface waters), Landowner Support, Operations and Maintenance Requirements, Cost and Constructability, and the associated Co-Benefits (chronic problem area, seasonal flooding, educational opportunity, high visibility, infrastructure conflicts, drains to connected infrastructure, reduces thermal pollution, improves BMP performance, and peak flow reduction).

Task 5: Project (conceptual) designs and final scoping statement or report.

Project descriptions, designs, and prioritization adhered to and reflected guidance and project funding opportunities related to the Clean Water Service Provider/Basin Water Quality Council (CWSP/BWQC) project development and implementation process meet the current Vermont Stormwater Management Manual criteria.

Task 6: Quarterly and final reports:

Quarterly reports were written by Hilary Solomon and submitted to the project team.

4. QUALITY ASSURANCE TASKS COMPLETED

N/A

5. DELIVERABLES COMPLETED

Deliverables for our first task (Develop RFP and Hire Consultant with Partners) include:

1) Bid process and contractor selection memo, below:

POULTNEY METTOWEE NATURAL RESOURCES CONSERVATION DISTRICT
PO BOX 209, POULTNEY, VT 05764; (802) 558-3515; INFO@PMNRCD.ORG; WWW.PMNRCD.ORG

Organization Name: Poultney Mettowee Natural Resources Conservation District

Date: June 16, 2022

Project Title: Castleton Main Street Drainage Scoping and Alternatives Study

Re: Contractor Selection Process

LCBP/NEIWPCC Contacts: Mae Kate Campbell and Heather Radcliff

The contractor selection process for the Castleton Downtown Stormwater Scoping Technical Project:

PMNRCD drafted a request for proposals and emailed it to a selection of highly-qualified contractors. Of these contractors, a subset of three, Fuss and O'Neill (FAN), Otter Creek Engineering (OCE), and Watershed Consulting Associates (WCA) submitted proposals.

The proposals were all very good and were notable in their similarity. Project partners felt comfortable that each could do a good job completing the project. Each partner was asked to review the proposals with respect to their area of expertise and a group meeting was held in early April to officially review the proposals.

The critique of the proposals was as follows:

Town of Castleton: While the proposals all look good, they preferred Otter Creek and Fuss and O'Neill to the application by WCA. They had former experience working with Otter Creek and Fuss and O'Neill and were currently working with Fuss and O'Neill on a sidewalk/pedestrian access project in the same area that the scoping project will occur. They thought that there would be cost savings and/or increased project materials/mapping/work that might arise from the use of the same contractor on two studies in the same area. They also wanted the two projects to remain closely connected as both will lead to implementation components. In their review, given that the proposals were very similar, were close in cost, and each application was high quality, they felt the tie-breaker was the current work with Fuss and O'Neill.

PMNRCD: PMNRCD has experience working Otter Creek and WCA on municipal projects and has seen both lead high-quality projects. The applications from Otter Creek and Fuss and O'Neill scored more highly than WCA in a number of areas, including cost per hour of the staff dedicated to the project and overall proposal organization.

Rutland RPC: Rutland RPC focused on the number of staff hours per task. WCA has noticeably fewer staff hours than the other two proposals. Rutland RPC was tied with Otter Creek and Fuss and O'Neill being the top choices.

Rationale for Choice of Fuss and O'Neil:

Given the high quality of the applications and the group's consensus that Otter Creek and Fuss and O'Neill had more staff time dedicated than WCA, those were the top choices. The town's desire to combine both projects and align the resulting work so that it was coordinated and considered the work in the other grant, resulted in the group chose to award the contract to Fuss and O'Neill.

2) The selection of our consultant, Dan Monette (Fuss & O'Neill), confirmed with a signed contract.

The contract will be included with the final report as a separate email attachment.

For our second task (Stakeholder Engagement), our deliverables include the following:

1. Letters mailed to local community members on June 1, 2022 and August 14, 2023. These letters, respectively, invited the recipients to attend a public meeting at the initial planning stage of the project to share concerns, questions, and community needs and informed recipients of the findings and outcomes of the project, including plans to

facilitate final design and implementation for two of the projects if the landowners are amenable.

2. Documented meeting notes with partners and individual stakeholders, one public 'concerns' meeting.

POULTNEY METTOWEE NATURAL RESOURCES CONSERVATION DISTRICT
PO BOX 209, POULTNEY, VT 05764; (802) 558-3515; INFO@PMNRCD.ORG; WWW.PMNRCD.ORG

June 1, 2022

Dear Community Member:

The Poultney Mettowee Natural Resources Conservation District (PMNRCD) and the Town of Castleton, in conjunction with Fuss & O'Neill, Inc., have begun a Scoping Study to assess Downtown Castleton's Stormwater Infrastructure including several noted stormwater drainage issues along Main Street near the library and surrounding area. The goal is to evaluate infiltration opportunities for stormwater treatment before it drains onto Main Street and potential upgrades or retrofits to the stormwater infrastructure along Main Street (VT Route 4A) between Ellis Orchard Road and South Street and focusing on inputs from Seminary Street, Elm Street, and the surrounding area. We will also be studying the storm drain outfall near the Castleton River.

Please join us for a Local Stakeholders Meeting, which will be held on Wednesday, June 15, 2022, from 2:30 – 4:00 P.M. at the Castleton Fire Station Community Room, 273 Route 30 North, Bomoseen, VT 05732.

This meeting is intended to give residents with property in the vicinity and interested parties the opportunity to provide input on potential improvements and impacts of this project. The purpose of this meeting is not to present solutions but to better define and understand the needs. Comments and concerns raised from this meeting will be considered in developing the Purpose and Need Statement for these projects and in the development of the proposed improvements.

Please join us in person if you feel comfortable. If you prefer to join remotely you may join us via Zoom: https://us02web.zoom.us/j/86485399419?pwd=RlhOY1I2QkxTeGs3Ylk1ZHBibiBKQT09

Join Zoom Meeting: 86485399419
Pass Code: 273169

We look forward to meeting you. Please call or email if you have any questions. If you can't make the meeting but would like to have a conversation about the study, please contact me.

Best,

Hilary Solomon, PMNRCD District Manager
(802) 558-3515 or hilary@pmnrcd.org

POULTNEY METTOWEE NATURAL RESOURCES CONSERVATION DISTRICT
PO BOX 209, POULTNEY, VT 05764; (802) 558-3515; INFO@PMNRCD.ORG; WWW.PMNRCD.ORG

August 7, 2023

Dear Community Member:

The Poultney Mettowee Natural Resources Conservation District (PMNRCD) and the Town of Castleton, in conjunction with Fuss & O'Neill, Inc. would like to inform you of the completion of the stormwater scoping study of Castleton, Vermont's Main Street.

This study's aims included appraisal of existing stormwater infrastructure, assessment of stormwater infiltration opportunities to mitigate runoff onto Main Street, development of designs for potential improvements to Main Street's stormwater infrastructure, and provision of recommendations for improved stormwater management in downtown Castleton. These goals were buoyed by the community: public input defined community needs and concerns, illuminated potential impacts, and informed our subsequent improvement recommendations.

After concluding our field work and analysis, we met with community members on June 15th 2022. In this local stakeholders meeting, we gathered your input and presented five alternatives, including a "no build" option. On February 16, 2023, these alternatives were presented to the project team. Two selections were chosen to be pursued as future projects and developed to a 30% design.

The final project selections were chosen because they exhibited the most potential for meaningful stormwater treatment. The first project (Alternative 2) will be the addition of an infiltration basin on the south side of Main Street (west of Glenbrook Road) with the installation of two 100-foot-long treatment swales and a small detention pond at 949 Main Street. The second project (Alternative 4) will be the placement of subsurface infiltration chambers and two manholes to redirect existing stormwater at Castleton Elementary School. Images of the preliminary project designs are included on the back of this letter.

Thank you for your engagement and interest in this study. Your contribution as a community member is very appreciated. Please contact us if you have any questions!

Best,

Hilary Solomon, PMNRCD District Manager
(802) 558-3515, hilary@pmnrcd.org

FUSS & O'NEILL

STAKEHOLDER MEETING NOTES

June 15, 2022

PROJECT NUMBER: 20220286.A10

PROJECT NAME: Castleton Downtown Stormater Retrofit/Infiltration Study

ATTENDEES:

Name	Company/Representing
Hilary Solomon	PMNRCD
Brent Clark	Castleton Highway Dept.
Mary Kearns	Castleton Library
Richard Combs	Castleton Select Board
Nancy Mark	Castleton Library
Patrick Keller	Castleton Library
Jonas Rosenthal	Castleton Zoning
Jake Rick	Castleton University
Chuck Lavoie	Castleton University
Dan Monette	Fuss & O'Neill

SUBMITTED BY:

Dan Monette

Began at 2:30 PM at the Castleton Fire Department

Introductions –

Dan: General overview of the project area and process outline for the project. Quick slide show of site, goals and end results. A timeline for the project was discussed.

Open floor discussions about drainage in the Downtown area -

- Hilary: wanted to make clear the project intentions and discussed possible perceived perceptions. This meeting is step one in stakeholder outreach. This will be our core decision-making group.
- Mary: Described the flooding at the library along both the path to the library from the library parking area and the brick path that runs perpendicular to the street. The parallel path floods every winter. The town added some rocks and now the parallel path is much better, but the brick path continues to flood. In addition the driveway and the entrance to the library washes out frequently. Library is in a low spot.
- Brent: The water flow path from the driveway entrance to library parking is not direct and water backs up. Silt from the driveway plugs the drain.
- Brent: The infrastructure is old (near Martha Polvey's house?), likely stacked slate stone culverts along a tree line west of the library and school.
- Brent: Seminary St drain doesn't take water. Worked for a while after shoveling it out. Need to observe infrastructure on Seminary St. (possible TV inspection)

- Patrick: Library is installing an ADA accessibility project including an elevator from near the area that ponds. Enman Kesselring did the engineering. Contact Nicole for the information. Look at a watershed map for the library courtyard.
- Jonas: Paving Route 4A in 2024 or 2025. Can we finish this project (implementation) before then? Any way to fast track the design so we can get funding?

C:\Users\pmnrc\Dropbox\PMNRCD\LCBP\LCBP 2021 Technical Castleton Scoping\Castleton-PMNRCD Stakeholder MEETING NOTES 6-15-22.docx

FUSS & O'NEILL

STAKEHOLDER MEETING NOTES
June 15, 2022
Castleton Downtown Stormwater Retrofit/Infiltration Study: PMNRCD
PAGE 15 OF 21

- Team needs to include snow plowing considerations in any project in this area. Make recommendations about locations for the snow storage.
- Chuck: Plans available for projects from the past 15 years. Dan will digitize them for CU if provided.
- Otter Creek Engineering is working on 3-ac green schools initiative for Castleton/VT State College. Just had introductory meeting.
- South St to Seminary St – soft shoulder – water doesn't make it to DI.
- Mechanic St. seems ok, DIs seem to work. DIs in parking lot of school may be from 1950's but also seem to work.
- The Auditorium on CU campus has roof discharge that is causing erosion.
- There is a potential water quality issue behind the railroad tracks at one of the outfalls. (Not specific).
- "Cressy" drain issue included water from S St/N St intersection and potentially CU parking lot.
- Old church (Farrow) with stream behind it (stream passes behind houses), crosses at Chris Cressy (or Cresley?) and entered a failing culvert. This was repaired but might warrant a look.

End Mtg 3:20 PM

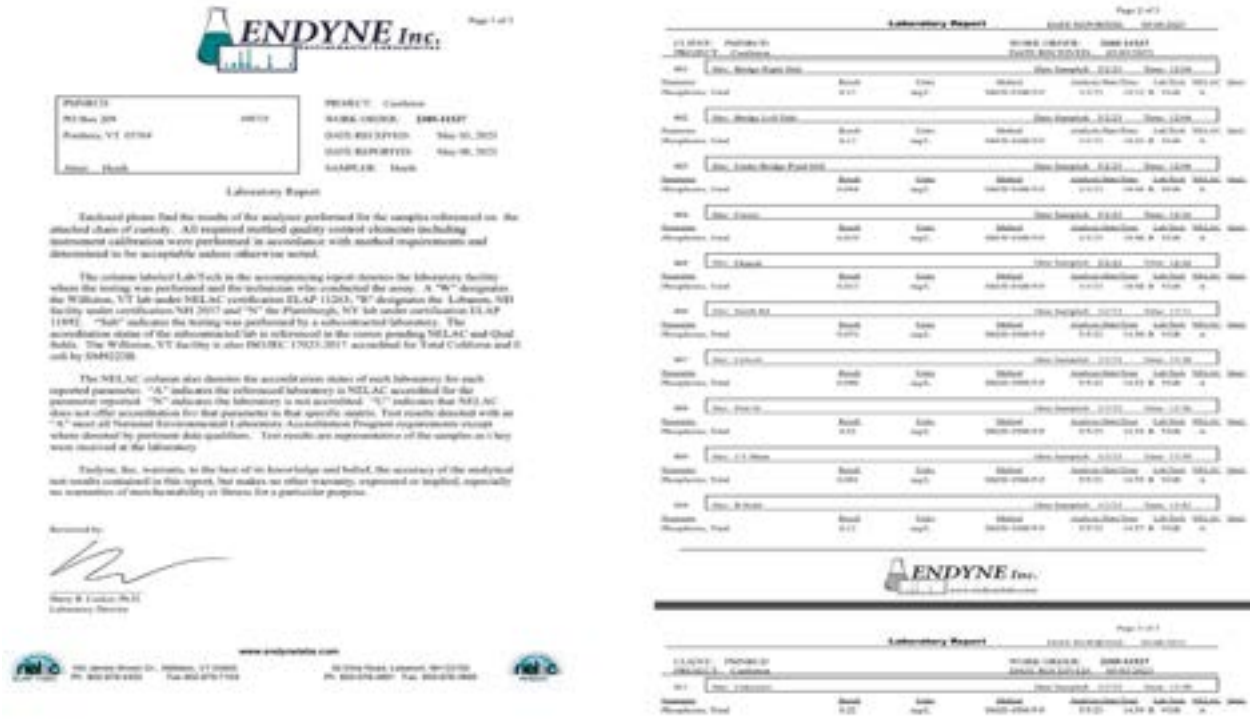
For our third task (Conduct Field Work and Desktop Analysis), we produced the following deliverables:

Field Work: Please see the appended final report from Fuss and O'Neill, which outlines field notes, provides maps, delineates a project list, documents existing conditions and provides land use context for the projects.

Desktop Analysis: Please see the appended final report from Fuss and O'Neill, which outlines drainage boundaries for the project area and the identified stormwater projects, considers soil

properties from both GIS layers and field borings, documents areas available for GSI projects and their ownership, and considers the impacts to the community.

The following items include the field sheet and laboratory results for stormwater samples collected by Town of Castleton employees during the project timeframe and from locations identified by Fuss and O'Neill and PMNRCD staff.



ENDYNE Inc.

Laboratory Report

Sample order

1	12:04 pm
2	12:04 pm
3	12:08
4	12:16
5	12:18
6	12:21
7	12:30
8	12:36
9	12:39
10	12:42
11	12:50

9/2/22 sample date
Castleton VT by Heath
bridge Right side
bridge left side
under bridge - pond hill rd
Cressy
Church
North Rd.
culvert
Elm St.
S/o main
R hold

Phosphorus lab test documentation and results

The following is an except from the Downtown Castleton Stormwater Scoping Report by Fuss and O'Neill, which illustrates the existing conditions section, as required by the LCBP and PMNRCD workplan.

2 Existing Conditions

2.1 Existing Conditions

The project is bounded by Ellis Orchard Road and South Street, focusing on inputs from Seminary Street, Elm Street, and the surrounding area. Stormwater runoff from Main Street and from side streets and their watersheds is collected in a closed drainage system that is antiquated, in poor condition, and likely undersized as evidenced by frequent flooding. Based on field observations, water flows from Seminary Street and other areas and pools on Main Street. This stormwater ultimately drains towards the Castleton River to an outfall designated for retrofit by Vermont DEC, meaning that DEC believes it could be improved to address water quality concerns. This neighborhood is underlain by glacial outwash associated with the Castleton River (Vermont Center for Geographic Information) and soils are indicated to be Windsor loamy sands. These soils are well suited for stormwater infiltration. A site walk was conducted during a rain event on September 20th, 2022. The field visit was conducted to gain a better understanding of the project area and surrounding water quality and safety issues. During the field visit, drainage infrastructure along Main Street, Seminary Street, and through Castleton University were identified as locations that have the most potential for improving stormwater management conditions in downtown Castleton. The rainstorm was severe, providing a unique opportunity to observe firsthand where stormwater runoff is directed and how the drainage system is handling rain events. Flooding was observed and prominent on Elm Street and Packing House Road. There was evidence of stone inlets and stone culverts on Elm Street. The condition and extent of this historic system are unknown.

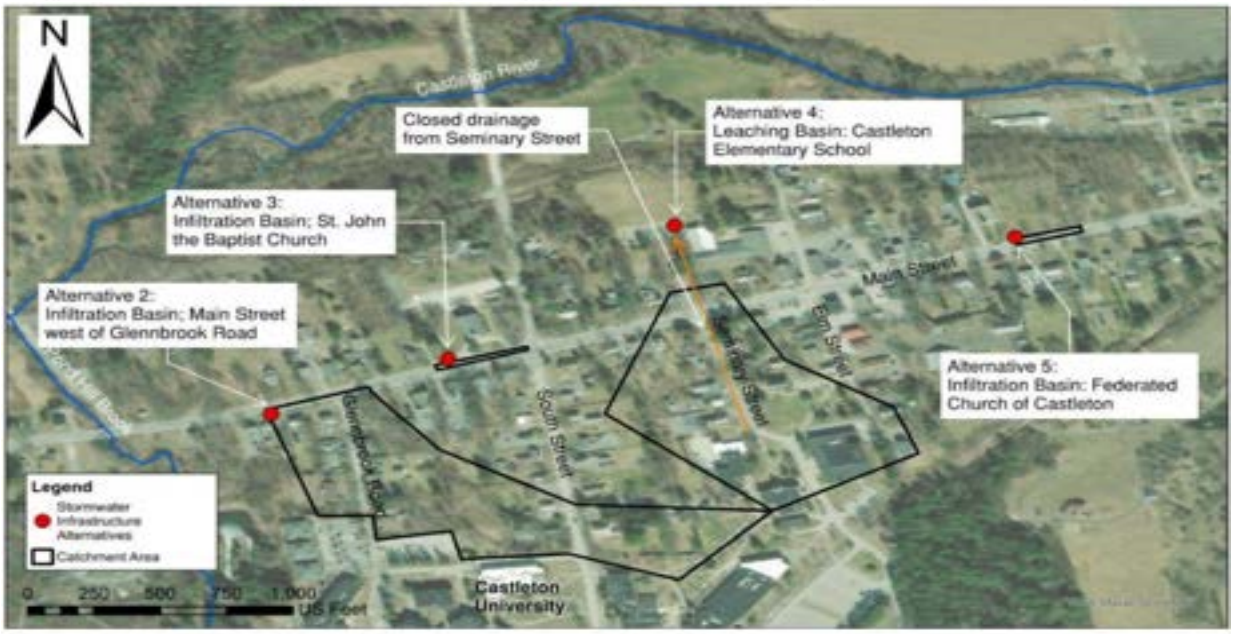
Flooding and Stone Inlet at 75 Elm Street

Seminary Street, South Street, and Glendbrook Road had drainage systems that were stone studows and appeared to be functioning. The condition of the pipes and structures was evaluated visually from the surface and compared to record drawings and other available information. Sources of siltation and untreated urban runoff were identified during the site walk. Elm Street terminates south at the gravel driveway for 114 Elm Street (Woodbridge Art Annex) which is a Castleton University owned parcel abutting the rail trail. The driveway was eroding and road runoff and ice runoff was observed to be turbid.

Documentation of existing conditions

For our fourth task (Write Preliminary Scoping Statement), the deliverables we produced include the preliminary scoping/alternatives report with identified project alternatives and a coinciding public stakeholder meeting.

Alternatives Evaluation Matrix					
	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
	No Build	Infiltration Basin; Main St West of Glennbrook Road	Infiltration Basin; St. John the Baptist Church	Infiltration Chamber; Castleton Elementary School	Infiltration Basin; Federated Church of Castleton
Impacts					
ROW	No	Yes	Yes	No	Yes
Utilities	No	Yes	Possible	Yes	Possible
Historic	No	Potential Impact to Setting	Potential Impact to Setting	Minimal	Potential Impact to Setting
Archeological	No	High Sensitivity	High Sensitivity	Low Potential	High Sensitivity
Wetlands	No	No	No	No	No
Hazardous Materials	No	No	No	No	No
Floodplain	No	No	No	No	No
Incorporated into New Sidewalk Construction	No	Yes	Yes	Potential to be incorporated	Yes
Benefits					
Meets Project Purpose	No	Yes	Yes	Yes	Yes
WQ_v Treated (acre-feet)	None	Moderate	Minimal	Significant	Minimal
Stormwater Practice Tier	N/A	Tier 1	Tier 1	Tier 1	Tier 1
Improve Closed Drainage	No	No	No	Yes	No
Operation					
Snow Removal	No	No Change	No Change	N/A	No Change
Parking	No	No Change	No Change	N/A	No Change
Maintenance	No	High	High	Moderate	High



Soil investigation areas and approximate catchment areas

Alternative 2: Infiltration Basin; Main Street West of Glennbrook Road

Alternative 2 is the installation of an infiltration basin in the right of way on the south side of Main Street, west of Glennbrook Road (see *Figure 1*). The existing area is grassed, with a contributing catchment area of approximately 10 acres. The site currently does not receive storm water runoff from Main Street due to curbing. Based on the test pit data, the soils in this location are primarily sandy loam and have an assumed minimum infiltration rate of 2 inches/hour. The proposed infiltration basin will capture stormwater runoff from the Castleton University grounds as well as from Main Street. The proposed design will include curb cuts to capture run off from Main Street, an outlet control structure to convey runoff above the design volume back into the existing closed drainage system, and pre-treatment measures (such as sediment forebay or filter strip) to be determined during 30% design. This proposed alternative has a potential Water Quality Volume (WQv) of 0.65 acre-feet. This site is within the ROW and coincides with the location of the proposed sidewalk on the south side of Main Street as part of the Castleton Pedestrian Scoping Study. This offers the possibility of incorporating stormwater management into the sidewalk and bike lane improvements on Main Street.

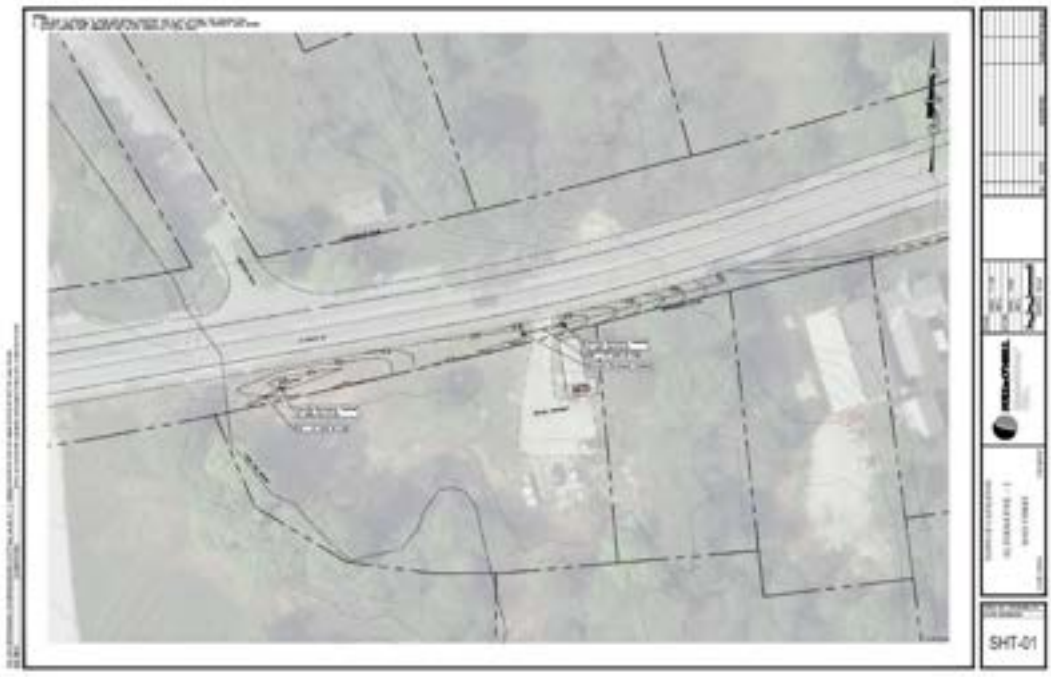
Alternative 4: Infiltration Chamber; Castleton Elementary School

Alternative 4 is the installation of an infiltration chamber behind Castleton Elementary School (see *Figure 1*). An infiltration chamber is an open bottomed, perforated, subsurface, structure surrounded by crushed stone and a layer of filter fabric. The basin temporarily stores stormwater before it infiltrates into subsurface soils. The existing area is a basketball court, with a contributing catchment area of approximately 10 acres. Based on the test pit data, the soils in this location are primarily a sandy loam and have an assumed minimum infiltration rate of 1.5 in/hr (NRCS Soil Survey). An infiltration chamber will be connected to closed drainage that runs along Seminary Street and crosses Main Street. This practice will capture stormwater runoff before it reaches the Castleton River. The proposed design will likely require a pre-treatment measure such as a separator row or bypass chamber with a deep sump. An infiltration chamber could be designed such that additional flow bypasses the basin once it reaches full capacity, or with an outlet connected back into the closed drainage system. This alternative will likely have the greatest impact on treating stormwater prior to it entering the Castleton River since it will treat stormwater already captured in closed drainage. Additionally, it will not be impacted by the construction of new sidewalks along Main Street and could be sized to treat stormwater from new sidewalks. This proposed alternative has a potential Water Quality Volume (WQv) of 0.82 acre-feet.

Deliverables for our fifth task (Project Design and Final Scoping Study Statement and Site Plan) include:

1) Two 30% design alternatives (pictures below)

2) The final scoping/alternatives report with utilities, resources, permits, budgets, and a plan for implementation



Our deliverables for the final, sixth task of this project are the completed and approved quarterly reports (December 2021, March 2022, June 2022, September 2022, December 2022, March 2023, and June 2023) and this final report.

6. CONCLUSIONS

This project was a great success: we completed every task we aimed to execute while adhering to our overall timeline. The project team identified a number of projects and evaluated the four most promising, making notes to return to the others at a later date. Two of the four projects will treat a significant amount of stormwater and were selected for the conceptual designs. The town is interested and motivated to move forward with the two projects, and we look forward to the forthcoming construction of the selected designs. One of the designs, Alternative 4, located at the Castleton Village School will need the watershed size to be field verified, possibly with cameras, as Elm Street drainage may be combined with Seminary Street drainage and would be treated in addition to the currently demarcated watershed boundary for the project. The other design, Alternative 2, will need a landowner agreement to proceed.

7. REFERENCES

Castleton Town Plan, 2018, 59 pp. https://www.castletonvermont.org/sites/g/files/vyhlif37 6 / f/uploads/current_town_plan_with_maps.pdf

FEA / PMNRCD, 2018, Castleton Headwaters Stormwater Master Plan with Appendices

FEA / PMNRCD, 2017, Lake Bomoseen Watershed Stormwater Master Plan with Appendices

VDEC, 2013, Castleton University Stormwater Infrastructure Mapping Project, Jim Pease and David Ainley, Watershed Management Division, Clean Water Initiative Program

VDEC, 2017, Vermont Stormwater Management Manual Rule and Design Guidance Document, accessed online at: https://dec.vermont.gov/sites/dec/files/wsm/stormwater/docs/Permit information/2017%20VSMM_Rule_and_Design_Guidance_04172017.pdf

VTRANS, Municipal Assistance Bureau, Variety of Guidance Documents routinely used as a basis for scoping and other projects by Vermont municipalities and partners. Information accessed at: https://outside.vermont.gov/agency/VTRANS /external/MAB-LP/SitePages/MAB-LP.aspx

8. APPENDICES

Appended Documents:

See attached.

Photos:

Photos to be submitted to LCBP.

Electronic Data:

Data available upon request.