Memorandum

To: Kate Kelly, Program Manager, Lewis Creek Association

From: Jessica Louisos, PE, and Claire Nauman, SLR

Date: February 8, 2021, Revised 12/21/2022

Subject: Planning / Prioritization for Stormwater Projects in the McCabe's Brook Watershed
Project Prioritization Summary
SLR # 13452.00038

PROJECT IDENTIFICATION AND PRIORITIZATION METHOD

An initial project identification table and map were compiled based on existing reports, mapping, and project team meetings. Data sources and initially identified projects were summarized in a November 1, 2021 memo. SLR water resource engineers visited potential project sites and completed a windshield survey of the watershed to review possible projects in November and December 2021. Possible project areas were visited to review existing information, confirm project type, and determine feasibility (Appendix A). Observations and existing mapping were used to inform the project prioritization.

Farm based projects are still under development and as additional information and projects are identified they can be added to the prioritization. Meetings with partners and landowners related to agricultural land are scheduled for the next few months. An initial meeting was held January 10, 2021 with possible farm practice partners at Vermont Land Trust who holds easements on multiple properties adjacent to McCabe's Brook.

UNIFIED SCORING PRIORITIZATION

The Vermont DEC has developed guidelines for stormwater master planning along with a Unified Scoring Prioritization for Stormwater Master Plans table to provide standardized scoring for projects (VTDEC, 2019, Appendix B). The projects identified for a GSI treatment volume are described and prioritized in the Unified Scoring Prioritization Table (Appendix B).

BMP Unit Costs and Adjustment factors were derived from stormwater master plans completed by Watershed Consulting Associates (2018) based on research and Vermont construction costs (Table 1). Costs were adjusted to include an 8% total inflation adjustment based on the Consumer Price Indicator Inflation Calculator. Multipliers for site type and permitting and engineering required are also applied (Tables 2 & 3, Watershed Consulting Associates (2018)).

Table 1: BMP Unit Costs

BMP Type	**Cost/ft$_3$ Treatment Volume**
Constructed Wetland	9.49
Dry Pond	4.87
Grass Conveyance Swale	4.32
Rain Garden (no underdrain)	16.72
Rain Garden (with underdrain)	16.72
Sand Filter	19.37
Subsurface Infiltration	6.76
Surface Infiltration	6.75
Underground Chamber	7.34
Wet Pond	7.35

Table 2: Site Type Cost Adjustment

Site Type	**Cost Multiplier**
Existing BMP retrofit	0.25
New BMP in undeveloped area	1.00
New BMP in partially developed area	1.50
New BMP in developed area	2.00

Table 3: Permitting and Engineer (P&E) Cost Adjustment

Level of P&E Required	**Cost Multiplier**
None	1.00
Low	1.20
Moderate	1.25
High	1.35

NON-UNIFIED SCORING PRIORITIZATION

Not all projects identified fit within the structure of the Unified Scoring Matrix when the primary recommendation is not stormwater treatment with a GSI method. A Non-Unified Scoring method was used that was developed by Fitzgerald Environmental Associates (2021). Projects were assigned several numerical scoring metrics that are weighted to assist in prioritizing each project based on water quality benefits, project feasibility, maintenance requirements, costs, and any additional benefits. The maximum possible score is 30. Each category is described and includes a description of the scoring for each criterion (Appendix C). Final evaluation criteria summarized in the Non-Unified Prioritization Project Table (Appendix C).

OTHER PROJECTS

The initial project identification included some projects that have not carried through to the prioritization projects. These potential projects are described in Appendix D. Some projects on this list have benefits that are not primarily water quality improvements and may be implemented outside of a water quality focused project. Other areas were explored and no project was identified or the feasibility is so low that it was removed from the project list. These projects are documented here for the team to understand why each was not included in the prioritization.

PROJECT SELECTION

The initial project identification was reviewed by the project team at a meeting February 14, 2022. A follow up field trip was taken by project team members to investigate potential top project sites on May 2, 2022. The Ridgefield Road location was eliminated from the top projects based on presence of wetlands during the site visit. A combined prioritization matrix with group implementation rankings and notes is in Appendix E.

The following sites were selected for concept design during this project:

- Depot Road Erosion
- Davis Avenue BMP
- Harbor Road Swirl Separator

REFERENCES

Fitzgerald Environmental Associates, LLC., 2021. Cambridge / Jeffersonville Stormwater Project Prioritization, dated March 1, 2021, produced for Lamoille County Planning Commission & Villages of Cambridge and Jeffersonville.

Watershed Consulting Associates, LLC., 2018. Stormwater Master Plan for the Town of Berlin, Vermont. Final Report, January 17, 2018. Prepared for the Central Vermont Regional Planning Commission.

VTDEC, 2019. Vermont Stormwater Master Planning Guidelines, Agency of Natural Resources, Department of Environmental Conservation, Clean Water Initiative Program, revised December 12, 2019.

APPENDIX A:

PROJECT LOCATION MAPS

Project Locations
SGA Segment
SGA Phase 1 Stream Reaches
McCabe's Brook Watershed
3-Acre Sites from VTANR Oct 2021
Town Owned and TNC Conservation
Vermont Land Trust Easement
Property Boundaries, VCGI

New Village Farm BMP
Depot Road Erosion
Turtle Lane Floodplain - 3
Turtle Lane Floodplain - 2
Turtle Lane Retrofit
Turtle Lane Floodplain - 1
Turtle Lane Floodplain - 4
Turtle Lane Wetland Concept
SCS Stream Restoration
Davis Park Filter
Train Station BMP
Davis Avenue BMP
Municipal Complex Fire Department BMP
Church Street Village Green BMP
Tracy Lane Wetland
Fletcher Lane Outfall Stabilization
Heritage Lane Wetland
Limerick Road Pond
T1.04 Corridor

PROJECT LOCATIONS - DOWNSTREAM

MCCABE'S BROOK

LEWIS CREEK ASSOCIATION

0 500 1,000
Feet

1 in = 350 feet

N

SLR
1 South Main Street, 2nd Floor
Waterbury, Vermont 05403
(802) 882-8335

Date Saved: 2/8/2022

Document Path: Y:\134520038\Maps\Prioritization Maps\Mccabes ProjectID V4 Mid-Watershed.mxd

Project Locations
SGA Segment
SGA Phase 1 Stream Reaches
McCabe's Brook Watershed
3-Acre Sites from VTANR Oct 2021
Town Owned and TNC Conservation
Vermont Land Trust Easement
Property Boundaries, VCGI

Route 7 Erosion

Teddy Bear GSI/Shelburne South CP Retrofit

Route 7 Culvert

Ridgefield Runoff

Teddy Bear Floodplain Restoration

Teddy Bear and Mack Floodplain Restoration

T1.07 Corridor

Dam Removal

PROJECT LOCATIONS - MID-WATERSHED

MCCABE'S BROOK

LEWIS CREEK ASSOCIATION

0 500 1,000
Feet

1 in = 350 feet

N

SLR
1 South Main Street, 2nd Floor
Waterbury, Vermont 05403
(802) 882-8335

Date Saved: 2/8/2022

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Project Locations
SGA Segment
SGA Phase 1 Stream Reaches
McCabe's Brook Watershed
3-Acre Sites from VTANR Oct 2021
Town Owned and TNC Conservation
Vermont Land Trust Easement
Property Boundaries, VCGI

T1.07 Corridor

Dam Removal

Dam Removal and Ford Improvement

T1.08 Floodplain Restoration

T1.08 Corridor

Congregational Church AOTS Concept

T1.08 Corridor

CCS AOTS Concept

T1.09

PROJECT LOCATIONS - UPSTREAM

MCCABE'S BROOK

LEWIS CREEK ASSOCIATION

0 500 1,000
Feet

1 in = 350 feet

N

SLR
1 South Main Street, 2nd Floor
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APPENDIX B:

UNIFIED SCORING PRIORITIZATION

Stormwater Projects in McCabe's Brook Watershed
Unified Scoring Prioritization Matrix
July 27, 2022

Town	Stream Segment	Name	Project Description	Total Drainage Acreage	Impervious Acreage in Drainage Area	BMP Type	Phosphorus/Nutrient Reduction - Calculated (kg/yr)	WQv (cu ft)	Total Water Quality Score	Total Feasibility Score	Total Co-benefits Score	Overall Score
Shelburne	T1.03	Depot Road Erosion	Install gravel wetland along Depot Road to treat flows from field with tile drain, Limerick Road, and Depot Road	80	1	Wet Pond	5.11	17787	13	15	5	33
Shelburne	T1.02	Turtle Lane Retrofit	Turtle Lane Municipal Complex, Retrofit existing dry pond to a wet pond, in PCP	5.83	1.1	Wet Pond	0.99	4652	13	18	2	33
Shelburne	T1.05	Teddy Bear GSI/Shelburne South CP Retrofit	Teddy Bear Factory/Shelburne South Commercial Park-retrofit existing dry pond to a wet pond, in PCP. Erosion control at outlet.	32.3	9.47	Wet Pond	4.33	36801	14	16	3	33
Shelburne	T1.03	Davis Avenue BMP	Davis Avenue infiltration at end of existing stormdrains, if only swirl separator P reduction 0.98. Needs soil testing.	28.2	5.9	Subsurface Infiltration	6.0	24394	15	13	3	31
Charlotte	T1.08	CCS AOTS Concept	Construct stormwater projects at CCS identified by Ahead of the Storm. Gravel wetland and infiltration trenches.	2.7	1.2	Gravel wetland	1.4	4410	13	13	4	30
Charlotte	T1.08	Congregational Church AOTS Concept	Construct stormwater projects at Congregational Church identified by Ahead of the Storm including bio-retention areas, disconnection, and swale improvements.	7.8	0.72	Rain Garden / Bioretention (no underdrain)	1.62	3768	11	12	5	28
Shelburne	T1.03	Harbor Road Swirl Separator	Davis Park Manufactured settling and capture system collecting from Harbor Road main stormater line. Possible units: StormTrap SiteSaver, Contech Vortechs, Contech CDS - sized for inflow rate (cfs).	101.2	33.96	Separator	4.39	129301	10	15	0	25
Shelburne	T1.05	Ridgefield Runoff	Bio-retention at outfall along Route 7 near sign to treat runoff from Ridgefield neighborhood.	61.3	5.69	Rain Garden / Bioretention (no underdrain)	10.5	29715	13	10	2	25
Shelburne	T1.03	Municipal Complex Fire Department BMP	Gravel wetland at northwest corner of baseball fields behind fire department	1.26	0.69	Gravel wetland	0.39	2483	9	11	3	23
Shelburne	T1.03	Heritage Lane Wetland	Heritage Lane gravel wetland at end of existing stormdrains, in PCP	10.29	1.88	Gravel wetland	1.11	8010	9	12	2	23
Shelburne	T1.03	Turtle Lane Wetland Concept	Gravel wetland concept design for runoff from WWTP area	2.06	0.72	Gravel wetland	0.52	2726	8	11	1	20
Shelburne	T1.03	Davis Park Filter	Sand Filter concept design for runoff from SCS and neighborhoods	21.36	7.56	Sand Filter	4.61	28575	12	3	1	16
Shelburne	T1.03	Train Station BMP	Convert a few parking spaces to bio-retention to treat surface runoff from tram station parking lot	0.3	0.3	Gravel wetland	0.19	1035	9	4	3	16
Shelburne	T1.03	Tracy Lane Wetland	Tracy Lane gravel wetland at end of existing stormdrains, in PCP	1.9	0.74	Gravel wetland	0.46	2762	6	7	2	15

Name	Project Description	Sediment Reduction Score	Phosphorus/Nutrient Reduction - Score	Impervious Area Managed	Percent of WQv & CPv Treated	Percent of Recharge Criteria Met - Score	Streambank/gully erosion mitigation	Green Infrastructure Opportunity	Total Water Quality Score	Public or Private Landowner Support	Project and Permitting Complexity	Infrastructure Conflicts	Total Estimated Project Cost	Project efficiency-Score	Ease of O&M and ease of access for O&M	Total Feasibility Score
Depot Road Erosion	Install gravel wetland along Depot Road to treat flows from field with tile drain, Limerick Road, and Depot Road	4	3	2	1	1	2	0	13	2	2	1	$ 144,058	8	2	15
Turtle Lane Retrofit	Turtle Lane Municipal Complex, Retrofit existing dry pond to a wet pond, in PCP	3	2	3	3	2	0	0	13	3	2	1	$ 20,674	10	2	18
Teddy Bear GSI/Shelburne South CP Retrofit	Teddy Bear Factory/Shelburne South Commercial Park-retrofit existing dry pond to a wet pond, in PCP. Erosion control at outlet.	4	3	4	1	2	0	0	14	0	1	1	$ 49,114	12	2	16
Davis Avenue BMP	Davis Avenue infiltration at end of existing stormdrains, if only swirl separator P reduction 0.98. Needs soil testing.	3	4	3	1	3	1	0	15	3	1	1	$ 185,900	8	0	13
CCS AOTS Concept	Construct stormwater projects at CCS identified by Ahead of the Storm. Gravel wetland and infiltration trenches.	3	2	3	2	2	0	1	13	3	1	1	$ 83,631	7	1	13
Congregational Church AOTS Concept	Construct stormwater projects at Congregational Church identified by Ahead of the Storm including bio-retention areas, disconnection, and swale improvements.	2	2	2	2	2	0	1	11	2	2	1	$ 124,898	6	1	12
Harbor Road Swirl Separator	Davis Park Manufactured settling and capture system collecting from Harbor Road main stormater line. Possible units: StormTrap SiteSaver, Contech Vortechs, Contech CDS - sized for inflow rate (cfs).	2	3	4	1	0	0	0	10	3	2	0	$ 100,000	8	2	15
Ridgefield Runoff	Bio-retention at outfall along Route 7 near sign to treat runoff from Ridgefield neighborhood.	3	4	3	0	2	0	1	13	0	1	0	$ 250,800	8	1	10
Municipal Complex Fire Department BMP	Gravel wetland at northwest corner of baseball fields behind fire department	2	1	2	2	1	0	1	9	3	2	1	$ 56,940	4	1	11
Heritage Lane Wetland	Heritage Lane gravel wetland at end of existing stormdrains, in PCP	3	2	2	0	1	0	1	9	2	1	1	$ 71,175	7	1	12
Turtle Lane Wetland Concept	Gravel wetland concept design for runoff from WWTP area	1	1	2	2	1	0	1	8	3	1	1	$ 49,196	5	1	11
Davis Park Filter	Sand Filter concept design for runoff from SCS and neighborhoods	4	3	4	1	0	0	0	12	0	0	1	$ 868,190	2	0	3
Train Station BMP	Convert a few parking spaces to bio-retention to treat surface runoff from tram station parking lot	2	1	1	2	2	0	1	9	0	1	1	$ 43,472	1	1	4
Tracy Lane Wetland	Tracy Lane gravel wetland at end of existing stormdrains, in PCP	1	1	1	1	1	0	1	6	0	1	0	$ 47,450	5	1	7

Name	Project Description	Education and/or recreational benefits	Natural Habitat Creation/Protection	Infrastructure Improvement (Culvert Replacement)	Outfall Erosion Control	Connected to Receiving Water	Flood Mitigation (Known Problem)	Existing Local Concerns	Total Co-benefits Score	Overall Score
Depot Road Erosion	Install gravel wetland along Depot Road to treat flows from field with tile drain, Limerick Road, and Depot Road	0	0	0	1	2	1	1	5	33
Turtle Lane Retrofit	Turtle Lane Municipal Complex, Retrofit existing dry pond to a wet pond, in PCP	0	0	0	0	2	0	0	2	33
Teddy Bear GSI/Shelburne South CP Retrofit	Teddy Bear Factory/Shelburne South Commercial Park-retrofit existing dry pond to a wet pond, in PCP. Erosion control at outlet.	0	0	0	1	2	0	0	3	33
Davis Avenue BMP	Davis Avenue infiltration at end of existing stormdrains, if only swirl separator P reduction 0.98. Needs soil testing.	0	0	0	0	2	0	1	3	31
CCS AOTS Concept	Construct stormwater projects at CCS identified by Ahead of the Storm. Gravel wetland and infiltration trenches.	1	0	0	0	3	0	0	4	30
Congregational Church AOTS Concept	Construct stormwater projects at Congregational Church identified by Ahead of the Storm including bio-retention areas, disconnection, and swale improvements.	1	0	0	0	3	0	1	5	28
Harbor Road Swirl Separator	Davis Park Manufactured settling and capture system collecting from Harbor Road main stormater line. Possible units: StormTrap SiteSaver, Contech Vortechs, Contech CDS - sized for inflow rate (cfs).	0	0	0	0	0	0	0	0	25
Ridgefield Runoff	Bio-retention at outfall along Route 7 near sign to treat runoff from Ridgefield neighborhood.	0	0	0	0	2	0	0	2	25
Municipal Complex Fire Department BMP	Gravel wetland at northwest corner of baseball fields behind fire department	0	0	0	0	3	0	0	3	23
Heritage Lane Wetland	Heritage Lane gravel wetland at end of existing stormdrains, in PCP	0	0	0	0	2	0	0	2	23
Turtle Lane Wetland Concept	Gravel wetland concept design for runoff from WWTP area	0	0	0	0	1	0	0	1	20
Davis Park Filter	Sand Filter concept design for runoff from SCS and neighborhoods	0	0	0	0	1	0	0	1	16
Train Station BMP	Convert a few parking spaces to bio-retention to treat surface runoff from tram station parking lot	0	0	0	0	3	0	0	3	16
Tracy Lane Wetland	Tracy Lane gravel wetland at end of existing stormdrains, in PCP	0	0	0	0	2	0	0	2	15

APPENDIX C:

NON-UNIFIED SCORING PRIORITIZATION

Stormwater Projects in McCabe's Brook Watershed
Non-Unified Scoring Prioritization Matrix
July 27, 2022

Town	Stream Segment	Name	Project Description	Project Type	Nutrient Reduction Effectiveness	Sediment Reduction Effectiveness	Drainage Area	Impervious Drainage	Connectivity to Surface Waters	Landowner Support	O&M Requirements	Cost and Constructability	Additional Benefits, Score	Additional Benefits, See List	Total Score
Shelburne	T1.03	Turtle Lane Floodplain - 1/2	Plant stream buffer/restore flood plain and remove berm at the Shelburne Town Garage and Wastewater Treatment Facility - 0.5 - 1.0 acres behind WWTP	Floodplain Restoration	3	3	1	3	3	1	2	4	5	3,4,6,7,9,10	**25**
Shelburne	T1.03	Turtle Lane Floodplain - 3	Plant stream buffer/restore flood plain at the Shelburne Town Garage and Wastewater Treatment Facility - 0.5 acres at storage piles of gravel and rock	Floodplain Restoration	3	3	1	3	3	1	2	3	4	6,7,9,10	**23**
Shelburne	T1.03	Turtle Lane Floodplain - 4	Plant stream buffer/restore flood plain at the Shelburne Town Garage and Wastewater Treatment Facility - 0.5 - 3.5 acres if WWTP moves, buildings and tank removed	Floodplain Restoration	3	3	1	3	3	1	2	2	4	6,7,9,10	**22**
Shelburne	T1.05B/A	Route 7 Erosion	Reconnect stream to floodplain, stabilize toe of mass failures and revegetate. Total length of mass failures is 640 ft. Total length of stream reconnection/stabilization length is 0.4 miles. 0.5 - 3.5 acres reconnected.	Floodplain Restoration	3	3	1	3	3	0	1	3	5	1,4,5,6,7,9,10	**22**
Shelburne	T1.03	SCS Stream Restoration	Day light 130 feet and restore 450 feet of tributary at school	Floodplain Restoration	2	2	1	3	2	1	1	4	5	3,4,6,7,9,10	**21**
Shelburne	T1.05B	Teddy Bear and Mack Floodplain Restoration	Floodplain reconnection and planting upstream of Teddy Bear Crossing at Vermont Day School, extends onto Robert Mack Farm. 2-3 acres reconnection and tree planting on downstream portion and 5-6 acres tree planting in upstream portion.	Floodplain Restoration	3	3	1	3	1	0	2	4	4	6,7,9,10	**21**
Shelburne	T1.03	Fletcher Lane Outfall Stabilization	Stabilize bank and outfall of culvert that conveys School Street area runoff where outfall freefalls onto gully erosion.	Bank/Outfall Stabilization	1	3	1	3	2	1	1	6	0		**18**
Shelburne	T1.04B	T1.04 Corridor	Protect corridor to allow the river to reach equilibrium and become attenuation asset. Tree planting complete on Meach Cove. Plant trees at Shelburne Museum	Floodplain Protection	1	2	1	1	1	0	2	6	3	3,7,10	**17**
Charlotte	T1.08	T1.08 Corridor	Protect wetland and river corridor. Plant stream buffers	Floodplain Protection	2	2	1	1	1	0	2	4	3	7,9,10	**16**
Shelburne	T1.05B	Route 7 Crossing	Replace Route 7 culvert where constriction is contributing to mass failures	Culvert Replacement	1	2	1	3	3	1	1	1	2	1,5	**15**
Charlotte	T1.07B/A; T1.06B	T1.07 Corridor	Work with landowners to secure specific protections for the forested river corridor. VLT has easement and has recently planted trees.	Floodplain Protection	1	1	1	1	1	0	2	6	2	7,10	**15**
Charlotte	T1.08	T1.08 Floodplain Restoration	Remove road and mowed lawn adjacent to straightened channel to restore floodplain and channel on two rural residential properties.	Floodplain Restoration	2	2	1	1	1	0	2	3	3	7,9,10	**15**
Shelburne	T1.04	Limerick Road Pond	Investigate field drain and pond issues.	Agricultural BMPs	2	2	1	1	1	1	1	4	1	3	**14**
Shelburne	T1.02	New Village Farm BMP	Assess agricultural BMP needs for diverse farmstead north of Harbor Rd	Agricultural BMPs	2	2	1	1	2	0	0	3	2	3,10	**13**
Charlotte	T1.07B; T1.08	Dam Removals and Ford Improvement	Remove partially breached dam, breached dam, and consider improvements to ford.	River Restoration	1	2	1	1	1	0	2	3	2	7,10	**13**

	Additional Benefits List
1	**Chronic Problem Area**
2	**Seasonal Flooding**
3	**Educational**
4	**High Visibility**
5	**Infrastructure Conflicts**
6	**Drains to Connected Stormwater Infrastructure**
7	**Reduces Thermal Pollution**
8	**Improves BMP Performance**
10	**Enhances Natural Communities**

NON-UNIFIED SCORING PRIORITIZATION SCORING

A Non-Unified Scoring method was used that was developed by Fitzgerald Environmental Associates (2021). Projects were assigned several numerical scoring metrics that are weighted to assist in prioritizing each project based on water quality benefits, project feasibility, maintenance requirements, costs, and any additional benefits. The maximum possible score is 30. Each category is described below and includes a description of the scoring for each criterion. Final evaluation criteria summarized in the Non-Unified Prioritization Project Table are described below:

Nutrient Reduction Effectiveness (4 points) – Degree of nutrient removal potential with project implementation, this accounts for both the existing nutrient loads and the removal efficiency and capacity of the proposed treatment. Nutrient loading was quantified based on the watershed size, the land cover types, and percent impervious surfaces, and the effectiveness was based on the treatment efficacy of the potential mitigation options appropriate for the space and location of the treatment area.

- 0 points – No nutrient source and/or no increased treatment
- 1 point – Minor nutrient source and/or minor increase in treatment
- 2 points – Moderate nutrient source with some increase in treatment
- 3 points – Moderate nutrient source with significant increase in treatment
- 4 points – Major nutrient source with significant increase in treatment

Sediment Reduction Effectiveness (4 points) – Degree of sediment removal potential with project implementation, this accounts for both the existing sediment loads and the removal efficiency and capacity of the proposed treatment. Sediment loading was quantified based on the watershed size, the land cover types, and percent impervious surfaces, and the effectiveness was based on the treatment efficacy of the potential mitigation options appropriate for the space and location of the treatment area.

- 0 points - No sediment source and/or no increased treatment
- 1 point – Minor sediment source and/or minor increase in treatment
- 2 points – Moderate sediment source with some increase in treatment
- 3 points – Moderate sediment source with significant increase in treatment
- 4 points – Major sediment source with significant increase in treatment

Drainage Area (1 point) – Approximate drainage area to site is greater than 2 acres

Impervious Drainage (3 points)– Approximate area of impervious surfaces draining to the site.

- 0 points – Area of impervious surfaces is less than 0.25 acres
- 1 point – Area of impervious surfaces is 0.25-0.5 acres
- 2 points – Area of impervious surfaces is 0.5-1.0 acres
- 3 points – Area of impervious surfaces is >1.0 acres

Connectivity to Surface Waters (3 points)

- 0 points – All stormwater infiltrates on site

- 1 point – Stormwater receives some treatment before reaching receiving waters
- 2 points – Stormwater drains into drainage infrastructure that directly outlets to receiving waters (assumes no erosion or additional pollutant loading to discharge point)
- 3 points – Stormwater drains directly into receiving waters (typically stormwater draining directly into a large wetland is assigned 2 points)

Landowner Support (2 points)

- 0 points – Project is located on private property, no contact with landowner
- 1 point – Project is on Town or State property with no contact
- 2 points – Project has been discussed and is supported by landowner

Operation and Maintenance Requirements (2 points)

- 0 points – Project will require significant increased maintenance effort
- 1 point – Project will require some increased maintenance effort
- 2 points – Project will require no additional maintenance effort

Cost and Constructability (6 points) – This score is based on the overall project cost (low score for high cost) and accounts for additional design, permitting requirements, and implementation considerations, such as site constraints and utilities, prior to project implementation.

Additional Benefits (5 points total) – Description of other project benefits, total score is roughly a count of the number of additional benefits. Additional benefits considered in the prioritization are as follows:

1. **Chronic Problem Area** – The site requires frequent maintenance and/or is an ongoing problem affecting water quality
2. **Seasonal Flooding** – The site is affected by or contributes to seasonal flooding
3. **Educational** – The site provides an opportunity to educate the public about stormwater treatment practices
4. **High Visibility** – The site is highly visible and will benefit from aesthetically designed treatment practices
5. **Infrastructure Conflicts** – The stormwater problem area is increasing erosion or inundation vulnerability of adjacent infrastructure (i.e. roads, buildings, etc.)
6. **Drains to Connected Stormwater Infrastructure** – The site drains into a larger stormwater conveyance system that is less likely to receive downstream treatment
7. **Reduces Thermal Pollution** – Project implementation will reduce the risk of thermal loading from runoff to receiving surface waters
8. **Improves BMP Performance** – Project implementation will improve the performance of existing stormwater treatment practices that receive runoff from the site
9. **Peak Flow Reduction** – Project implementation will significantly reduce stormwater peak flows leaving the site
10. **Enhances Natural Communities** – Project implementation will promote a native vegetated lakeshore buffer and/or provide wildlife habitat along the lakeshore or river.

APPENDIX D:

OTHER PROJECTS

Stormwater Projects in McCabe's Brook Watershed
Projects Initially Identified and Not Included on Unified and Non-Unified Prioritization Tables
July 27, 2022

Town	Stream Segment	Name	Update from Project ID Phase	Source
Shelburne	T1.02	T1.02 Corridor	Significant protections were put inplace when this area was classified as a Class I wetland, which covers the river corridor area.	MMI, 2012b
Shelburne	T1.03	Athletic Drive BMP	Project not feasible- storm drainage invert too low for flows to enter and exit a BMP. Also limited space due to adjacent wetlands.	MMI, 2010; MMI 2019
Shelburne	T1.03	School Street GSI	Broken out into several projects	VTANR, 2015; MMI, 2010c
Shelburne	T1.03	Shelburne Village BMP	Broken out into several projects:	VTANR, 2015; SCRW, 2016a; MMI, 2010c
Shelburne	T1.04B	Private Trail Crossing - Meach Cove, Shelburne Museum	Future project. Not scored. Replace culverts blocking aquatic organism passage in the future.	VTANR, 2015; SCRW, 2016a; VTANR 2021
Shelburne	T1.05	Vineyard Erosion	No project. Investigated stormwater at bank failure. Stormwater does not run over bank failure. If Route 7 runoff is redirected in the future it could flow to the top of a mass failure.	VTDEC, 2020; VTANR, 2021
Shelburne	T1.05	Teddy Bear Crossing	Future project. Not scored. Replace culverts blocking aquatic organism passage in the future.	VTANR, 2015; MMI, 2010b; MMI, 2012b; MMI, 2012c
Shelburne	T1.05	Teddy Bear GSI	Deleted and merged with Shelburne South CP Retrofit. This was the same project with different names. No additional treatment options identified at Teddy Bear.	SCRW, 2016a; MMI, 2010c; VTDEC, 2021
Shelburne	T1.05	Shelburne South CP Retrofit	Deleted and merged with Teddy Bear GSI	FEA, 2021
Shelburne	T1.05	Snow Deposition Site	No project. There do not appear to be issues to fix. Site to maintain berm between snow disposal area and McCabe's to ensure that there are no breaks and repair silt fencing as needed.	Group Meeting, 2021
Shelburne	T1.05	Farm Pond	No project. Pond has had recent upgrades to reduce erosion and exclude animals. Tree planting downstream of farm pond included in T1.05 Floodplain Restoration.	Group Meeting, 2021
Shelburne	T1.05	Railroad Crossing	Future project. Not scored. Replace culverts blocking aquatic organism passage in the future.	VTANR, 2015; MMI, 2010b; MMI, 2012b; MMI, 2012c
Shelburne	T1.05/A	Bostwick Road Crossing	Future project. Not scored. Replace culverts blocking aquatic organism passage in the future.	VTANR, 2015; MMI, 2012b
Charlotte	T1.08	Mutton Hill Road Runoff	No project. Neighborhood has low density and lots of disconnection. Swales and wet pond are in place. No erosion.	Group Meeting, 2021
Charlotte	T1.06	Lime Kiln Road Culvert	Investigate culvert to determine issues and treatments needed.	VTANR, 2015; MMI, 2012b; VTANR, 2022
Shelburne	T1.03	Church Street Village Green BMP	Gravel wetland at existing yard drain in Village Green lawn at corner	VTANR, 2015; SCRW, 2016a; MMI, 2010c

APPENDIX E:

PRIORITIZATION WITH IMPLEMENTATION RANKINGS

Stormwater Projects in McCabe's Brook Watershed
Combined Prioritization Matrix with Priorities
December 21, 2022

Town	Stream Segment	Name	Project Description	Total Drainage Acreage	Impervious Acreage in Drainage Area	BMP Type	Phosphorus/Nutrient Reduction - Calculated (kg/yr)	WQv (cu ft)	Percent of WQv Treated	Overall Score	Scoring Table	Partner Priority	Selection Notes
Shelburne	T1.03	Depot Road Erosion	Install erosoin control and settling areas along Depot Road to treat flows from field with tile drain, Limerick Road, and Depot Road	80	1	Wet Pond	5.11	17787	71%	33	**Unified**	2.5	**Selected for Concept Design**
Shelburne	T1.03	Davis Avenue BMP	Davis Avenue end of existing stormdrains swirl separator. Soil type eliminated infiltration options.	28.2	7.37	Separator	1.1	29198	45%	31	**Unified**	3	**Selected for Concept Design**
Shelburne	T1.03	Harbor Road Swirl Separator	Swirl Separator on Harbor Road at WWTP. Underground system has lower removal efficiency, but large drainage area	114.7	36.09	Separator	4.79	138734	100%	25	**Unified**		**Selected for Concept Design**
Shelburne	T1.05	Ridgefield Runoff	Bio-retention would need two treatment areas to capture entire drainage area, either side of entrance drive. Locations to be investigated further.	61.3	5.69	Rain Garden / Bioretention (no underdrain) x 2	10.5	29715	27%	25	**Unified**	3	East side of road wetland, difficult to build in VTRANS ROW on west side of road
Shelburne	T1.05B	Teddy Bear and Mack Floodplain Restoration	Floodplain reconnection and planting upstream of Teddy Bear Crossing at Vermont Day School, extends onto Robert Mack Farm. 2-3 acres reconnection and tree planting on downstream portion and 5-6 acres tree planting in upstream portion.			Floodplain Restoration				21	**Non-Unified**	2	Identified for additional project development under separate funding source. LCA to spearhead.
Charlotte	T1.08	T1.08 Corridor	Protect wetland and river corridor. Plant stream buffers			Floodplain Protection				16	**Non-Unified**	2	
Charlotte	T1.08	T1.08 Floodplain Restoration	Remove road and mowed lawn adjacent to straightened channel to restore floodplain and channel on two rural residential properties.			Floodplain Restoration				15	**Non-Unified**	2	
Charlotte	T1.08	Congregational Church AOTS Concept	Construct stormwater projects at Congregational Church identified by Ahead of the Storm including bio-retention areas, disconnection, and swale improvements.	7.8	0.72	Rain Garden / Bioretention (no underdrain)	1.62	3768	110%	28	**Unified**	1	
Shelburne	T1.05B/A	Route 7 Erosion	Reconnect stream to floodplain, stabilize toe of mass failures and revegetate. Total length of mass failures is 640 ft. Total length of stream reconnection/stabilization length is 0.4 miles. 0.5 - 3.5 acres reconnected.			Floodplain Restoration				22	**Non-Unified**	1	Move forward with VTrans when Route 7 culvert constriction is taken care of. LCA informed VTrans of the issue.
Shelburne	T1.04B	T1.04 Corridor	Protect corridor to allow the river to reach equilibrium and become attenuation asset. Tree planting complete on Meach Cove. Plant trees at Shelburne Museum			Floodplain Protection				17	**Non-Unified**	1	
Charlotte	T1.08	CCS AOTS Concept	Construct stormwater projects at CCS identified by Ahead of the Storm. Gravel wetland and infiltration trenches.	2.7	1.2	Gravel wetland	1.4	4410	107%	30	**Unified**	1	Underway as part of Green Schools Initiative
Shelburne	T1.02	Turtle Lane Retrofit	Turtle Lane Municipal Complex, Retrofit existing dry pond to a wet pond, in PCP	5.83	1.1	Wet Pond	0.99	4652	202%	33	**Unified**		Likely pursued as part of Town PCP plan implementation

Stormwater Projects in McCabe's Brook Watershed
Combined Prioritization Matrix with Priorities
December 21, 2022

Town	Stream Segment	Name	Project Description	Total Drainage Acreage	Impervious Acreage in Drainage Area	BMP Type	Phosphorus/Nutrient Reduction - Calculated (kg/yr)	WQv (cu ft)	Percent of WQv Treated	Overall Score	Scoring Table	Partner Priority	Selection Notes
Shelburne	T1.05	Teddy Bear GSI/Shelburne South CP Retrofit	Teddy Bear Factory/Shelburne South Commercial Park-retrofit existing dry pond to a wet pond, in PCP. Erosion control at outlet.	32.3	9.47	Wet Pond	4.33	36801	61%	33	**Unified**		Likely pursued as part of Town PCP plan implementation
Shelburne	T1.03	Turtle Lane Floodplain - 1/2	Plant stream buffer/restore flood plain and remove berm at the Shelburne Town Garage and Wastewater Treatment Facility - 0.5 - 1.0 acres behind WWTP			Floodplain Restoration				25	**Non-Unified**		To be considered during future Town WWTP site planning.
Shelburne	T1.03	Municipal Complex Fire Department BMP	Gravel wetland at northwest corner of baseball fields behind fire department	1.26	0.69	Gravel wetland	0.39	2483	101%	23	**Unified**		
Shelburne	T1.03	Heritage Lane Wetland	Heritage Lane gravel wetland at end of existing stormdrains, in PCP	10.29	1.88	Gravel wetland	1.11	8010	37%	23	**Unified**		
Shelburne	T1.03	Turtle Lane Floodplain - 3	Plant stream buffer/restore flood plain at the Shelburne Town Garage and Wastewater Treatment Facility - 0.5 acres at storage piles of gravel and rock			Floodplain Restoration				23	**Non-Unified**		To be considered during future Town WWTP site planning.
Shelburne	T1.03	Turtle Lane Floodplain - 4	Plant stream buffer/restore flood plain at the Shelburne Town Garage and Wastewater Treatment Facility - 0.5 - 3.5 acres if WWTP moves, buildings and tank removed			Floodplain Restoration				22	**Non-Unified**		To be considered during future Town WWTP site planning.
Shelburne	T1.03	SCS Stream Restoration	Day light 130 feet and restore 450 feet of tributary at school			Floodplain Restoration				21	**Non-Unified**		
Shelburne	T1.03	Turtle Lane Wetland Concept	Gravel wetland concept design for runoff from WWTP area	2.06	0.72	Gravel wetland	0.52	2726	106%	20	**Unified**		
Shelburne	T1.03	Fletcher Lane Outfall Stabilization	Stabilize bank and outfall of culvert that conveys School Street area runoff where outfall freefalls onto gully erosion.			Bank/Outfall Stabilization				18	**Non-Unified**		Town to address as part of maintenance work.
Shelburne	T1.03	Davis Park Filter	Sand Filter concept design for runoff from SCS and neighborhoods	21.36	7.56	Sand Filter	4.61	28575	77%	16	**Unified**		
Shelburne	T1.03	Train Station BMP	Convert a few parking spaces to bio-retention to treat surface runoff from tram station parking lot	0.3	0.3	Gravel wetland	0.19	1035	101%	16	**Unified**		
Shelburne	T1.03	Tracy Lane Wetland	Tracy Lane gravel wetland at end of existing stormdrains, in PCP	1.9	0.74	Gravel wetland	0.46	2762	72%	15	**Unified**		
Shelburne	T1.05B	Route 7 Crossing	Replace Route 7 culvert where constriction is contributing to mass failures			Culvert Replacement				15	**Non-Unified**		
Charlotte	T1.07B/A; T1.06B	T1.07 Corridor	Work with landowners to secure specific protections for the forested river corridor. VLT has easement and has recently planted trees.			Floodplain Protection				15	**Non-Unified**		
Shelburne	T1.04	Limerick Road Pond	Investigate field drain and pond issues.			Agricultural BMPs				14	**Non-Unified**		
Shelburne	T1.02	New Village Farm BMP	Assess agricultural BMP needs for diverse farmstead north of Harbor Rd			Agricultural BMPs				13	**Non-Unified**		
Charlotte	T1.07B; T1.08	Dam Removals and Ford Improvement	Remove partially breached dam, breached dam, and consider improvements to ford.			River Restoration				13	**Non-Unified**		
Shelburne	T1.03	Heritage Lane Swale Improvements	Install check dams and reshaping in eroding swale to reduce erosion. Needs more investigation			Swale/Gully Erosion					**Non-Unified**		

Memorandum

To: Kate Kelly, Lewis Creek Association

From: Jessica Louisos, PE and Alex Marcucci, SLR International Corporation

Date: January 30, 2023

Subject: McCabe's Brook Stormwater Planning
Concept Design & Implementation Plan Memo
SLR # 13452.00038

INTRODUCTION

The Lewis Creek Association (LCA) retained SLR in 2021 to complete stormwater planning within the McCabe's Brook watershed. McCabe's Brook is a tributary to the LaPlatte River, flowing into the river just before its mouth at Lake Champlain in Shelburne Bay. The McCabe's Brook watershed has an area of approximately 6 square miles split between the Towns of Charlotte and Shelburne. There are numerous Three-Acre sites located within the watershed.

SLR identified over 30 potential projects focused on stormwater management, water quality, and ecological restoration within the watershed. Working with LCA and other project partners, potential projects were prioritized and three were selected to move to the concept design phase.

Initially, projects at the Ridgefield Road neighborhood and Vermont Teddy Bear Factory were selected as potential projects for concept design. Site visits in late spring 2022 at the Ridgefield site determined that site constraints limit stormwater treatment options. Class II wetlands were observed east of Route 7 at the site where potential treatment was planned. Due to potential impacts at the site, a different project was selected for concept design. LCA is pursuing the Vermont Teddy Bear floodplain restoration project through a separate grant and the project is not included in these concept designs.

Concept designs were prepared for the following three projects: stormwater treatment at Depot Road, swirl separator on Davis Avenue, and swirl separator on Harbor Road. The sites and concept designs are described below.

DEPOT ROAD - SITE CONDITIONS

Depot Road is a dead-end road located off of Harbor Road in Shelburne Bay. This location was identified by the Town of Shelburne as an area where stormwater management is a challenge. According to Town personnel, stormwater runoff has caused repeated erosion of a roadside stone-lined swale along Depot Road and flooding and washout of the road. There is a water line that runs between the swale and the road, which is a constraint to expanding the roadside swale capacity.

Existing stormwater infrastructure at the Depot Road site is shown on the attached map. Upgradient of the site to the west of Limerick Road, there is a large parcel of agricultural land (Figure 1). Runoff from this area is concentrated into an agricultural ditch, which is piped under Limerick Road to a standpipe just east of the intersection of Limerick Road and Depot Road. The standpipe was installed approximately 20 years ago to try to slow down the large amount of water that was exiting the broken pipe at this location. From the standpipe, water flows easterly through another section of pipe and outlets approximately 150 feet east of the standpipe and 25 feet south of Depot Road. The clay pipe is broken at the outfall and there is erosion surrounding the broken pipe.

The roadside swale collects water from Limerick Road, the end of Depot Road, and agricultural fields to the north. A stone-lined swale along Depot Road is turned out into the flow path from the standpipe, combining the runoff from both areas, approximately 20 feet below the outfall as shown in Figure 2. At the end of the pipe significant erosion stone has been placed in the fashion of a large splash pad to try to slow down water and prevent further erosion. The stone is not large enough, is washing downstream, and does not eliminate erosion at the site.

The upstream drainage area to this point is 80 acres (Figure 3). One acre is impervious surface. Runoff may be carrying nutrients. Most of the drainage area is agricultural, with an altered hydrology.

East of this point, the concentrated flow forms a small intermittent stream channel with a streambed and banks (Figure 4). This narrow channel carries flow easterly into an emergent/scrub-shrub wetland (likely Class II) (Figure 5). As the channel flows into the wetland, flow disperses and a stream channel is no longer present. The length of the section of intermittent stream is approximately 100 to 150 feet. A formal wetland delineation has not been completed at the site and would need to occur prior to implementation.

Figure 1. Ditch on agricultural lands west of Limerick Road.

Figure 2. Outfall of standpipe and stone-lined swale turnout.

Figure 3. Depot Road drainage area (black line) and impervious cover (grey shade).

Figure 4. Intermittent stream below convergence of stone-lined swale and standpipe.

Figure 5. Wetland along Depot Road.

A grass-lined roadside swale captures water from the wetland and channelizes it along Depot Road and Harbor Road through a series of short culverts and longer sections of swale (Figure 6). The swale drains to McCabe's Brook just upstream of the Harbor Road Bridge. Most of the swale is wide, vegetated, and shallow, but there are areas that are deeper and eroding. The flow path of runoff from along Depot Road does not exhibit stream characteristics anywhere except for the short section below the standpipe outfall.

Figure 6. Grass-lined swale along Harbor Road.

Soils at the site are primarily hydrologic group D, with a small section of C/D along McCabe's Brook. Lands immediately adjacent to McCabe's Brook are within both the Vermont river corridor and the FEMA 100-year floodplain. No work will be proposed in the river corridor or regulatory floodplain.

DEPOT ROAD - CONCEPT DESIGN & IMPLEMENTATION

The selected alternative involves the construction of a series of settling basins with filter berms to treat stormwater runoff at the site (Appendix A). The primary water quality issue at this location is the velocity and erosion of the concentrated flow picking up and carrying sediment downstream. The runoff from upstream is relatively clean, as it is primarily runoff from vegetated surfaces managed for pasture, hay, and woods. Infiltration is not possible due to D soils and constraints due to bedrock. Treatment options are limited at the site due to the presence of exposed ledge in the woods south of Depot Road and a water line located between the existing stone-lined swale and Depot Road. Due to constraints related to available space, soil type, and watershed characteristics, this project has taken a non-standard approach to treating stormwater and erosion.

Settling basins will slow down water and dissipate energy, allowing sediment to settle out. Filter berms will further remove sediment from runoff during periods of higher flows. The existing standpipe and broken pipe would be removed and runoff from the agricultural ditch, grassed swale along Limerick Road, and culvert under Limerick Road would be directed into the settling basins for treatment. Upstream vegetation and swales provide filtering of nutrients that may be carried from the 1 acre of impervious surface that is present within the 80-acre drainage area.

These settling areas do not have enough space to store and/or infiltrate the full water quality volume of 17,787 cubic feet. The basins have on the order of 3,000 – 4,500 cubic feet storage available, 17-25% of the water quality volume. According to the VTANR Stormwater Treatment Practice Calculator this practice could reduce phosphorus to McCabe's Brook by 3.3 to 6.6 kg/year. It is expected that the large volume of runoff would be able to expand into the vegetated basins behind the armored filter berms and slow down before reaching the series of existing roadside grass swales downstream leading to McCabe's. The main goals here are to reduce the ongoing erosion and reduce flooding of the road surface and washing of gravel into the water resources.

SLR consulted with regulators for initial feedback on the proposed design. Based on this correspondence, the following permit needs have been identified:

- The project will not require a Vermont stream alteration permit.
- The project will not require a Vermont Construction General permit, disturbance is 0.3 acres.
- The project will require a general permit from the Army Corps of Engineers, with all impacts to the piped portion of the site as well as the intermittent stream counted for the permitting. There will also be requirements around tree cutting.
- In order to determine whether a Vermont wetland permit will be required, a formal delineation of wetlands needs to be performed at the site. A wetland (likely Class II) is present downstream of the proposed project area and its exact boundary is not known. No work is proposed within the wetland. Following the completion of a wetland delineation, the design may be altered to avoid or minimize impacts to the wetland buffer. If impacts cannot be avoided, a non-reporting general permit (GP 3-9026) would likely be required.

Swale maintenance work is recommended to be completed by the Town as part of their regular roadside swale maintenance program including installation of a culvert outlet splash pad and widening of a section of vegetated swale that is narrower than the nearby swales, increasing velocities.

The concept design likely has enough details for the Town or other project partners to move forward without significant additional design. The results of the wetland delineation and feedback from regulators during permitting may require adjustment to the design elements prior to construction.

A ballpark opinion of probable project cost has been prepared for the concept design (Appendix A). The estimate includes some time to assist with a bid process that would be led by the Town and part-time construction oversight. Some grant sources may require meetings or reporting that are not currently included in the cost estimate.

DAVIS AVENUE – SITE CONDITIONS

The Davis Avenue site is located upstream in the McCabe's Brook watershed from the Depot Road site in a residential neighborhood just south of the Shelburne Community School. The site has a total drainage area of 28.2 acres with 7.37 acres of impervious surface (Figure 7). Davis Avenue intersects School Street and Fletcher Lane and is situated in a mix of residential and forested lands. Existing stormwater infrastructure at the site includes a storm main below the road that outlets into an eroding swale just west of the end of Davis Avenue (Figure 8). The swale flows directly into McCabe's Brook.

There are no wetlands at the site. The swale is located within the regulatory floodplain (FEMA 100-year and floodway) as well as the Vermont river corridor. The existing storm main collects runoff from Davis Avenue and Stokes Lane as well as portions of Fletcher Lane, School Street, and Tracy Lane. The outfall and swale to McCabe's Brook are located on a parcel owned by the Town of Shelburne that is partly open space and partly forested (Figure 9).

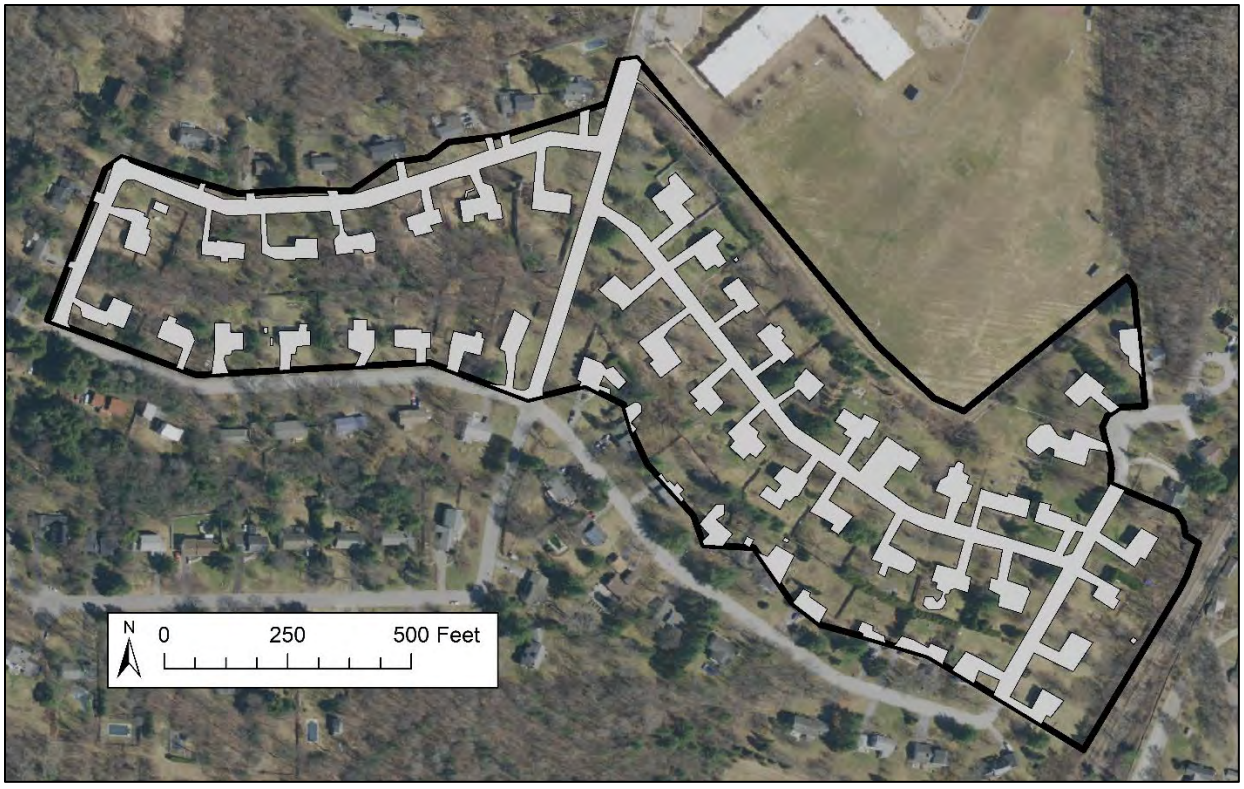


Figure 7. Davis Avenue drainage area (black line) and impervious cover (gray shade).

Figure 8. Eroding swale below outfall from Davis Avenue.

Figure 9. Town-owned land at the end of Davis Avenue.

DAVIS AVENUE – CONCEPT DESIGN & IMPLEMENTATION

Initially, the project team identified this site as a potential candidate for a bioretention stormwater treatment practice. SLR scientists collected survey data at the site during summer 2022 and discovered that the existing stormwater main is nearly ten feet below the ground surface at the end of Davis Avenue. In order to intercept flow from the existing line for treatment, the selected practice would need to be located at a similar elevation. This ruled out the potential for a surface feature such as a bioretention basin or gravel wetland. Town personnel noted that soils in the area are likely clay based on nearby testing, confirmed with exposed clay at the stormwater outfall. DigSafe did not identify any underground utilities at the proposed location in August 2022.

The selected design for the site incorporates an underground swirl separator to treat runoff from the neighborhood before discharging to the existing swale to McCabe's Brook. A swirl separator unit has been specified for the Davis Avenue site (Appendix B). Water quality volume reaching the Davis Avenue site is 29,198 cubic feet and water quality flow is 6.1 cubic feet per second (cfs). The recommended unit is a Contech CS-8 Cascade separator, rated to treat 7.2 cfs. Based on VTANR Stormwater Treatment Practice Calculator, implementation of this practice could reduce phosphorus to McCabe's Brook by 1.06 kg/year.

In addition to the swirl separator, SLR recommends the maintenance of the outlet swale by the Town. This could include a stone splash pad or stone check dams in the swale below the outfall to prevent further erosion.

Town of Shelburne Zoning Bylaws (effective June 14, 2022) regulate activities within the FEMA 100-year floodplain and floodway. The bylaws also regulate activities within 37 feet of the 100-year floodplain and within 100 feet of the centerline of McCabe's Brook. The existing swale and storm main outfall are located within these zones. Prior to construction the Zoning Administrator should be consulted to confirm that the outfall stabilization would not be classified as development under the regulations pertaining to the flood hazard zones. Vermont wetlands and stream alteration permits and US Army Corps permit are not anticipated for the project.

A ballpark opinion of probable project cost has been prepared for the concept design (Appendix B). The estimate includes some time to assist with a bid process that would be led by the Town and part-time construction oversight. Some grant sources may require meetings or reporting that are not currently included in the cost estimate.

Operation and Maintenance would include checking the unit for clogs, unblocking outlets, and measuring sediment depth. When sediment reaches the level needed for cleanout the removal of sediment accumulation is done using a vactor truck to suck sediment from sediment sump areas. It is anticipated that cleanout of sediment may occur annually.

HARBOR ROAD – SITE CONDITIONS

A stormwater main under Harbor Road drains an extensive network of stormwater pipes serving the Village of Shelburne, Shelburne Community School, and Shelburne Museum and discharges directly to McCabe's Brook. Land use within the contributing drainage area is a mix of residential, commercial, recreational, and forest (Figure 10). A project is located at the Shelburne wastewater treatment facility on Harbor Road (Figure 11). The property is owned by the Town and is situated at the intersection of Harbor Road and Turtle Lane between McCabe's Brook to the west and the Town baseball fields to the east. The westernmost portion of the parcel the wastewater treatment facility is situated on is within the Vermont river corridor and FEMA 100-year floodplain and floodway. There are Class I wetlands along the McCabes's Brook, delineated in 2018 by SLR, more than 100 feet from the project location.

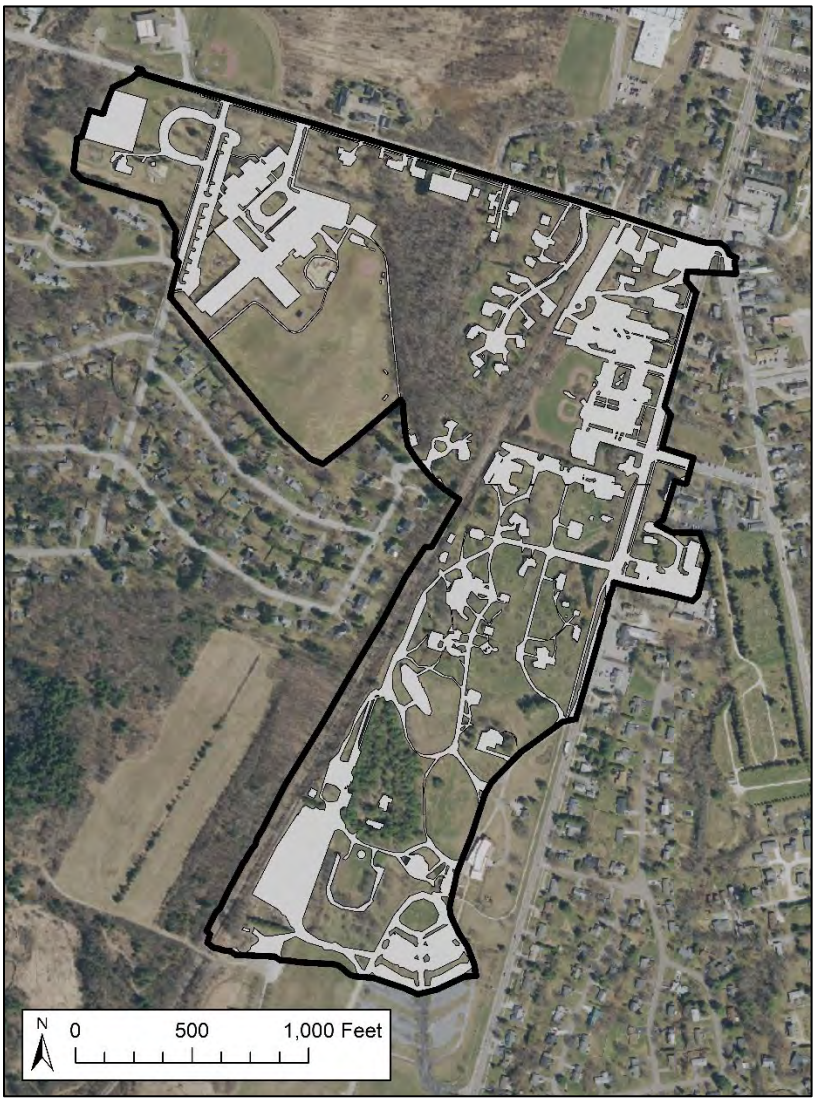


Figure 10. Harbor Road drainage area (black outline) and impervious cover (gray shade).

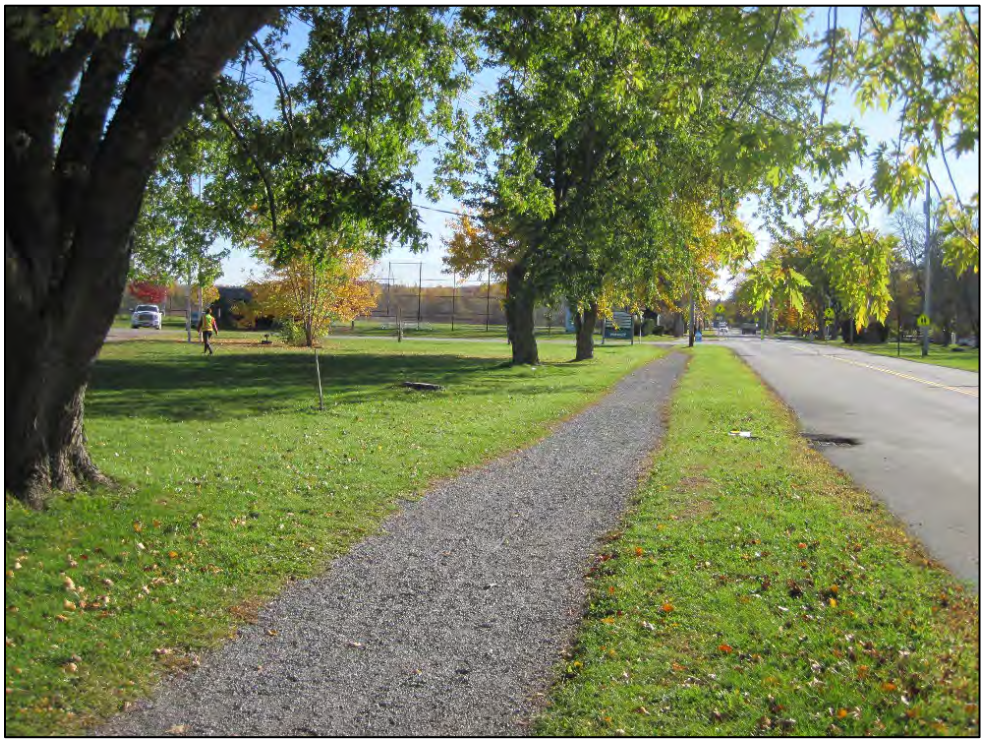


Figure 11. Harbor Road site.

HARBOR ROAD – CONCEPT DESIGN & IMPLEMENTATION

The area that drains to this site is large – nearly 115 acres with 36 acres of impervious surface. The water quality volume reaching the site is 138,734 cubic feet. Soil borings were completed by the Town at the site during August 2022 and documented clay to a depth of 22 feet. There is an existing catch basin on Harbor Road in front of the wastewater treatment facility with a depth of over eight feet between the ground surface and the inlet and outlet pipes. These factors make surface treatment and infiltration infeasible.

A swirl separator unit has been specified for the Harbor Road stormwater main site (Appendix C). Water quality flow is 23.2 cubic feet per second (cfs). This flow rate is higher than individual separator units can handle. The recommended configuration is a series of four Contech CS-8 Cascade separators, each rated to treat 7.2 cfs. A section of the main trunk pipe will be replaced with a level pipe manifold with a manhole with weir on the downstream end to backup water evenly into a series of four separators. Based on VTANR Stormwater Treatment Practice Calculator, implementation of this practice could reduce phosphorus to McCabe's Brook by 4.79 kg/year.

Two large maple trees along Harbor Road would be removed if the system is installed in the location shown on the concept design. Alternative locations may be considered along the Harbor Road stormwater main that may be preferrable to the Town. A mirrored design could be installed in Davis Park or just east of the trail parking lot entrance.

No permits are anticipated as part of the project.

Minor additional design is anticipated to bring the concept design to construction ready. Design elements include sizing pipes, assigning pipe inverts, determining the correct bedding material to support the structures in the clay soils, and restoration details for the road, path, and lawn.

A ballpark opinion of probable project cost has been prepared for the concept design (Appendix C). The estimate includes final design, some time to assist with a bid process that would be led by the Town, and part-time construction oversight. Some grant sources may require meetings or reporting that are not currently included in the cost estimate.

Operation and Maintenance would include checking the unit for clogs, unblocking outlets, and measuring sediment depth. When sediment reaches the level needed for cleanout the removal of sediment accumulation is done using a vactor truck to suck sediment from sediment sump areas. It is anticipated that cleanout of sediment may occur annually.

APPENDIX A

DEPOT ROAD

Date Saved: 1/18/2023

Document Path: Y:\13452.00038\Maps\Mccabes_DepotRdSite_ExCond.mxd

DEPOT ROAD SITE - EXISTING CONDITIONS & SWALE RECOMMENDATIONS

MCCABE'S BROOK WATERSHED STORMWATER PLANNING
LEWIS CREEK ASSOCIATION

0 50 100 200
Feet

1 in = 120 feet

N

SLR
1 SOUTH MAIN ST
WATERBURY, VT 05676
802.882.8335

Date Saved: 1/17/2023

Document Path: Y:\13452.00038\Maps\Mccabes_DepotRdSite_Proposed.mxd

MAP NOTES:
1. SURVEY CONTOURS AND UTILITIES FROM SITE SURVEY COMPLETED BY CIVIL ENGINEERING ASSOCIATES, INC IN JUNE 2022.
2. APPROXIMATE WETLAND LINE BASED ON LIMITED FIELD OBSERVATIONS AND REMOTE SENSING DATA. FORMAL WETLAND DELINEATION NOT COMPLETED.
3. CONTOURS FROM LIDAR DATA COLLECTED IN 2017 COMBINED WITH SURVEY CONTOURS OF ROADWAY AND RIGHT-OF-WAY FROM 2022.

Legend
- Fire Hydrant

Stormwater Line Feature
- Storm line
- Swale
- Approximate Wetland Location
- Road
- white line
- Parcel Boundary
- LiDAR & Survey Contours

CONTINUOUS ROADSIDE SWALE, SHALLOW TO AVOID WATER PIPES

REMOVE STANDPIPE, REMOVE BROKEN TILE PIPE, AND INSTALL STONE SPLASH PAD AT END OF INFLOW PIPES

STONE-LINED SWALE THROUGH VEGETATED SETTLING BASIN

SETTLING BASIN

FILTER BERM

INTERMITTENT STREAM

DEPOT RD

LIMERICK RD

wetland

135 130 135 140 125 130 125 120 140 135 130 125 145

VCGI

DEPOT ROAD SITE - PROPOSED

MCCABE'S BROOK WATERSHED STORMWATER PLANNING
LEWIS CREEK ASSOCIATION

0 25 50
Feet

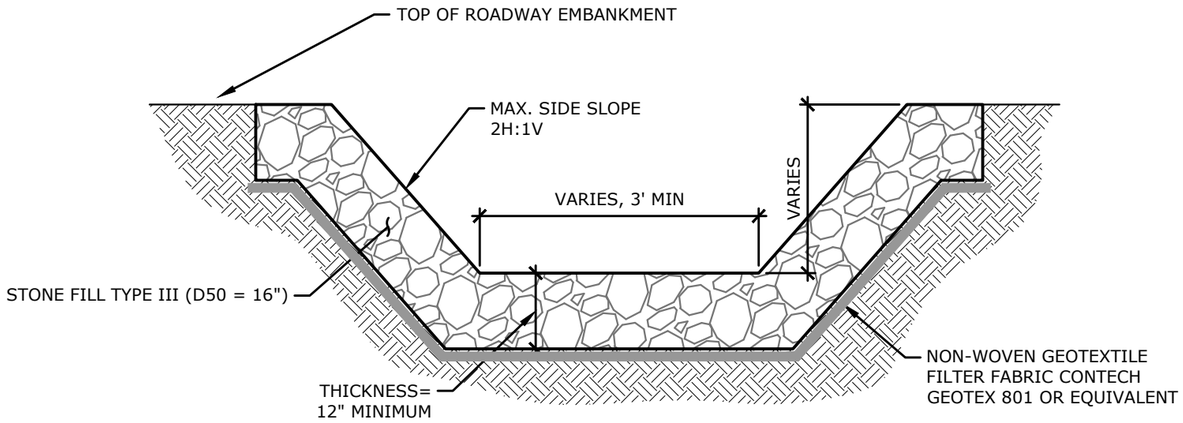
1 in = 25 feet

N

SLR
1 SOUTH MAIN ST
WATERBURY, VT 05676
802.882.8335

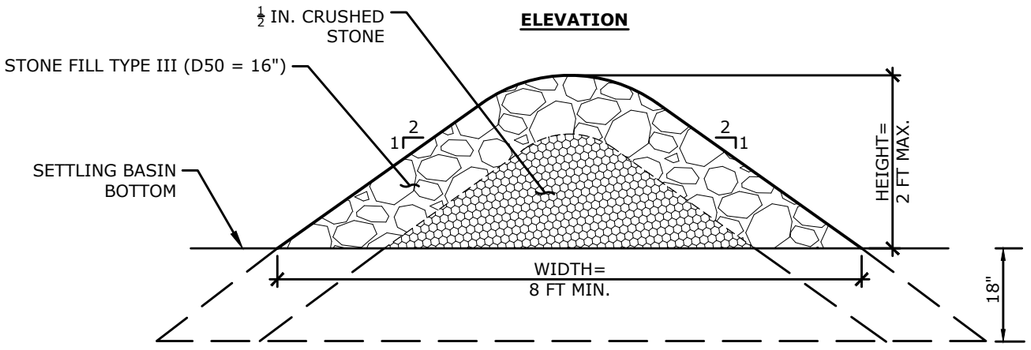
OPERATION AND MAINTENANCE NOTES

1. THE CONCEPTUAL STORMWATER PLAN HAS BEEN DESIGNED TO MINIMIZE MAINTENANCE TO THE SYSTEM AND ONLY REQUIRE MAINTENANCE THAT CAN EASILY BE COMPLETED.
2. PERIODICALLY, INCLUDING AFTER LARGE STORMS AND REGULARLY DURING THE FALL, REMOVE LEAVES AND DEBRIS ACCUMULATED AT THE CULVERT AND AT FILTER BERMS.
3. INSPECT FOR EROSION PATHS OR CONCENTRATED FLOW OVER FILTER BERMS, AS NEEDED REDISTRIBUTE STONE TO REMOVE CONCENTRATED FLOW PATHS.
4. THE ACCUMULATION OF SEDIMENT WITHIN THE SETTLING BASINS SHOULD BE MONITORED AND INSPECTED A MINIMUM OF ONCE ANNUALLY. REMOVE SEDIMENT AFTER APPROXIMATELY 12 INCHES OF SEDIMENT HAS ACCUMULATED.
5. SWALES ARE EXPECTED TO REQUIRE RESHAPING AND REMOVAL OF SEDIMENT APPROXIMATELY EVERY 5 TO 10 YEARS.
6. THE SETTLING BASINS, FILTER BERMS, AND SWALES CAN BE MOWED OR BRUSH-HOGGED AT THE END OF EACH GROWING SEASON.
7. MAINTENANCE OF THE SYSTEM SHOULD ONLY OCCUR DURING LOW FLOW AND IN THE GROWING SEASON AFTER SPRING RUNOFF.
8. RESEEDING OF THE SPECIFIED SEED MIX SHOULD OCCUR AFTER REMOVAL OF SEDIMENT FROM THE SETTLING BASINS OR RESHAPING OF SWALES.



STONE LINED SWALE

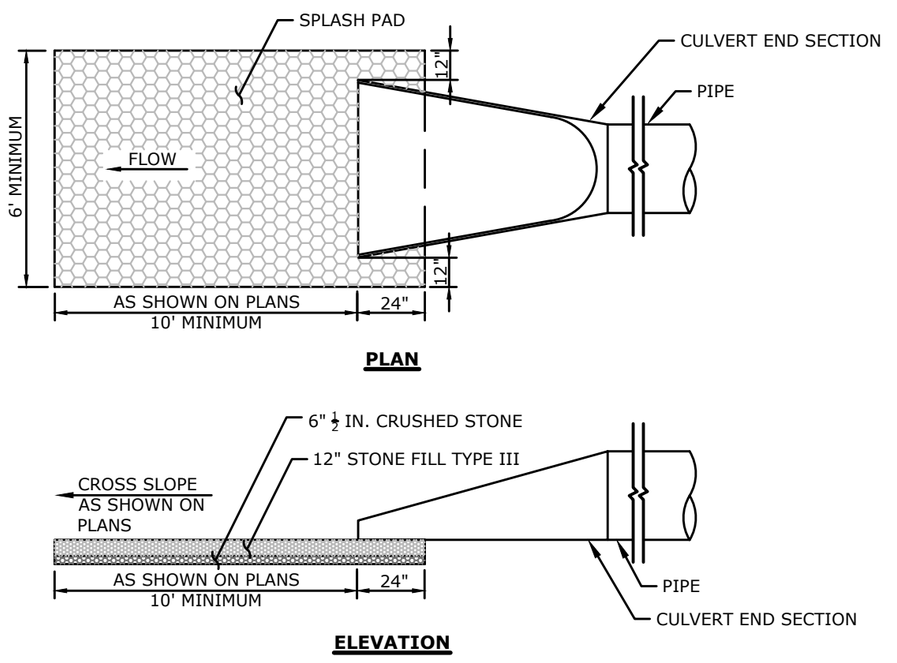
NOT TO SCALE



NOTES:
EXTEND THE STONE A MINIMUM OF 18 INCHES INTO BANKS AND BOTTOM TO PREVENT CUTTING AROUND THE ENDS OR UNDER THE FILTER BERM.

STONE FILTER BERM

NOT TO SCALE



FLARED END SECTION WITH RIPRAP SPLASH PAD

NOT TO SCALE

SLR
1 SOUTH MAIN STREET
WATERBURY, VT 05676
802.382.3335
SLRCONSULTING.COM

REVISIONS

DETAILS

MCCABE'S BROOK STORMWATER PLANNING
LEWIS CREEK ASSOCIATION

DEPOT ROAD
SHELBURNE, VERMONT

JCL	AOM	JCL
DESIGNED	DRAWN	CHECKED

SCALE: NOT TO SCALE
DATE: JANUARY 17, 2023
PROJECT NO.: 13452.00038
SHEET NO.: DET-1

Drawing: W:\CAD\DESIGN\13452.00038-DEC\CAD\DETAILS\MCCABES_DEPOT_DETAILS.DWG Layout: Tab:11X17
Plotted by: AMARCUCCI On this date: Wed, 2023 January 18 - 1:40pm

BALLPARK OPINION OF PROBABLE CONSTRUCTION COST
MCCABE'S BROOK STORMWATER PLANNING
DEPOT ROAD - SETTLING BASINS AND EROSION CONTROL
Shelburne, Vermont
13452.00038
January 17, 2023

ITEM/DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	COST
CONSTRUCTION LABOR				
Labor	HR	80	$55	$4,400
CONSTRUCTION EQUIPTMENT				
Excavator / Operator	HR	80	$140	$11,200
Haul Materials (assume 1 hr round trip)	HR	80	$95	$7,600
CONSTRUCTION MATERIALS				
Stone for swales, filter berms, and splash pads	CY	300	$50	$15,000
Crushed Stone	CY	60	$22	$1,320
Culvert End Sections	EA	2	$450	$900
CONSTRUCTION MISCELLANEOUS				
Mobilization/ Demobilization	LS	1	$3,000	$3,000
Site Restoration	LS	1	$5,000	$5,000
CONSTRUCTION SUBTOTAL (ROUNDED)				**$48,000**
FINAL DESIGN & PERMITTING				$8,000
CONSTRUCTION PHASE SERVICES				$8,000
CONSTRUCTION CONTINGENCY (10%)				$4,800
TOTAL (ROUNDED)				**$69,000**

APPENDIX B

DAVIS AVENUE

Date Saved: 1/17/2023

Document Path: X:\13452.00038\Maps\Mccabes DavisAveSite Survey.mxd

8.41 FT

STABILIZE EXISTING OUTFALL WITH STONE

19.08 FT

20 FT

20.13 FT

PROPOSED SEPARATOR LOCATION
DRAINAGE AREA: 28.17 AC
IMPERVIOUS COVER: 7.37 AC
WATER QUALITY VOLUME: 29,198 CUFT
WATER QUALITY FLOW: 6.1 CFS

CB#1
GRATE: 19.74 FT
INLET 1 INV: 14.79 FT
INLET 2 INV: 10.79 FT
OUTLET INV: 10.64 FT

CB#2
GRATE: 19.39 FT
INLET 1 INV: 14.49 FT
INLET 2 INV: 12.59 FT
OUTLET INV: 12.54 FT

CB#3
GRATE: 19.20 FT

DAVIS AVE

FLETCHER LN

115 120 125 125 125 125

Legend

- Survey Point
- Telephone Line
- Tree Line
- Tree

Stormwater Point Feature

- Catch Basin
- Outfall

Stormwater Line Feature

- Storm line
- Swale
- VHD Stream
- Parcel Boundary
- ANR River Corridor

FEMA Flood Hazard Zone

- Floodway
- 100-Year Floodplain
- 1ft LiDAR Contour

VCGI

DAVIS AVENUE

MCCABE'S BROOK STORMWATER PLANNING
LEWIS CREEK ASSOCIATION

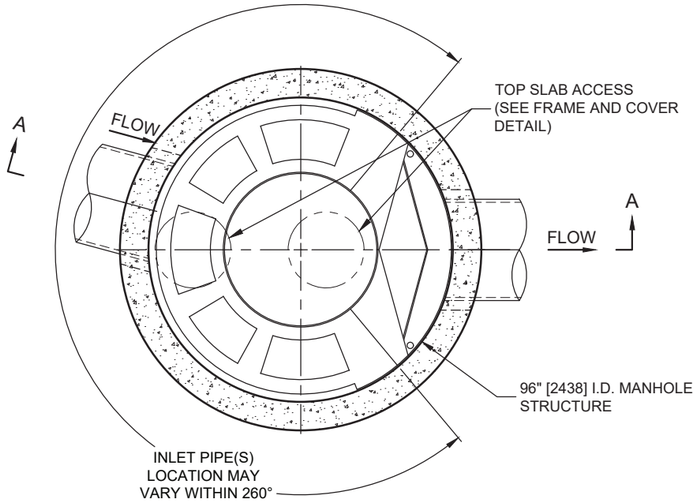
Notes:
Survey point elevations are relative and do not represent actual elevation above sea level. Relative elevations collected by SLR 8/30/2022, accuracy +/- 0.5 feet.
Other spatial data obtained from VCGI.

0 5 10 20 30 40 50
Feet

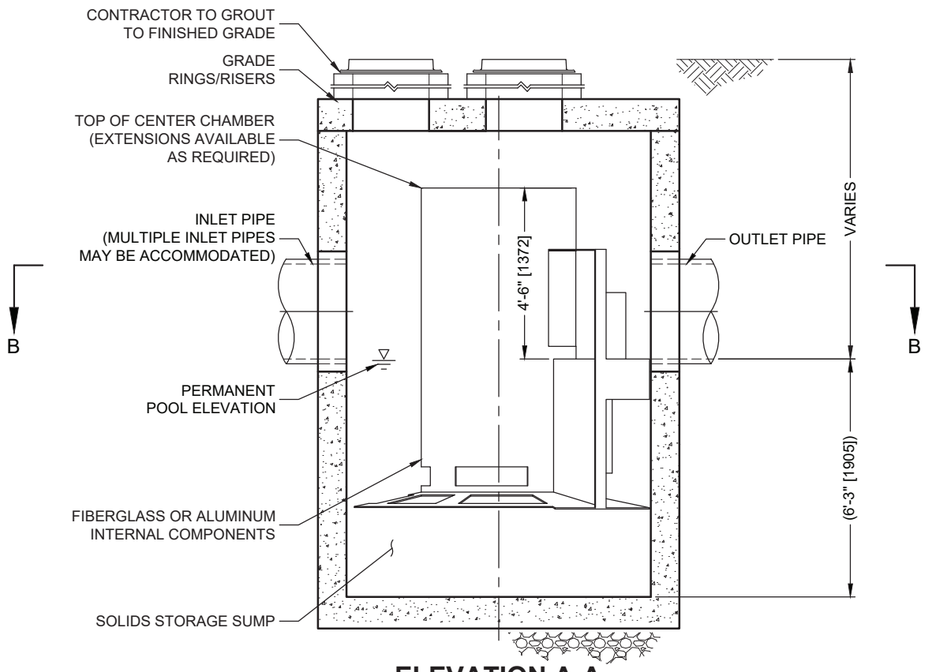
1 in = 25 feet

N

SLR
1 SOUTH MAIN ST
WATERBURY, VT 05676
802.882.8335



PLAN VIEW B-B
NOT TO SCALE



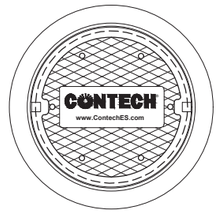
ELEVATION A-A
NOT TO SCALE

CASCADE
separator™

CASCADE SEPARATOR DESIGN NOTES

THE STANDARD CS-8 CONFIGURATION IS SHOWN. ALTERNATE CONFIGURATIONS ARE AVAILABLE AND ARE LISTED BELOW. SOME CONFIGURATIONS MAY BE COMBINED TO SUIT SITE REQUIREMENTS.

CONFIGURATION DESCRIPTION
GRATED INLET ONLY (NO INLET PIPE)
GRATED INLET WITH INLET PIPE OR PIPES
CURB INLET ONLY (NO INLET PIPE)
CURB INLET WITH INLET PIPE OR PIPES



FRAME AND COVER
(DIAMETER VARIES)
NOT TO SCALE

SITE SPECIFIC DATA REQUIREMENTS

STRUCTURE ID			
WATER QUALITY FLOW RATE (cfs [L/s])			6.1 cfs
PEAK FLOW RATE (cfs [L/s])			
RETURN PERIOD OF PEAK FLOW (yrs)			
RIM ELEVATION			20 ft
PIPE DATA:	INVERT	MATERIAL	DIAMETER
INLET PIPE 1	10.1 ft	HDPE	18 in
INLET PIPE 2			
OUTLET PIPE	9.9 ft	HDPE	18 in

NOTES / SPECIAL REQUIREMENTS:

GENERAL NOTES
1. CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
2. FOR SITE SPECIFIC DRAWINGS WITH DETAILED STRUCTURE DIMENSIONS AND WEIGHT, PLEASE CONTACT YOUR CONTECH ENGINEERED SOLUTIONS LLC REPRESENTATIVE. www.ContechES.com
3. CASCADE SEPARATOR WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING. CONTRACTOR TO CONFIRM STRUCTURE MEETS REQUIREMENTS OF PROJECT.
4. CASCADE SEPARATOR STRUCTURE SHALL MEET AASHTO HS20 LOAD RATING, ASSUMING EARTH COVER OF 0' - 2' [610], AND GROUNDWATER ELEVATION AT, OR BELOW, THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION. CASTINGS SHALL MEET AASHTO M306 AND BE CAST WITH THE CONTECH LOGO.
5. CASCADE SEPARATOR STRUCTURE SHALL BE PRECAST CONCRETE CONFORMING TO ASTM C478 AND AASHTO LOAD FACTOR DESIGN METHOD.
6. ALTERNATE UNITS ARE SHOWN IN MILLIMETERS [mm].

INSTALLATION NOTES
A. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
B. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE CASCADE SEPARATOR MANHOLE STRUCTURE.
C. CONTRACTOR TO INSTALL JOINT SEALANT BETWEEN ALL STRUCTURE SECTIONS AND ASSEMBLE STRUCTURE.
D. CONTRACTOR TO PROVIDE, INSTALL, AND GROUT INLET AND OUTLET PIPE(S). MATCH PIPE INVERTS WITH ELEVATIONS SHOWN. ALL PIPE CENTERLINES TO MATCH PIPE OPENING CENTERLINES.
E. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO ASSURE UNIT IS WATER TIGHT, HOLDING WATER TO FLOWLINE INVERT MINIMUM. IT IS SUGGESTED THAT ALL JOINTS BELOW PIPE INVERTS ARE GROUTED.

CONTECH ENGINEERED SOLUTIONS LLC
www.contechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

CS-8
CASCADE SEPARATOR
STANDARD DETAIL

BALLPARK OPINION OF PROBABLE CONSTRUCTION COST

MCCABE'S BROOK STORMWATER PLANNING

DAVIS AVENUE - SWIRL SEPARATOR

Shelburne, Vermont

13452.00038

January 17, 2023

ITEM/DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	COST
CONSTRUCTION LABOR				
Labor	HR	80	$55	$4,400
CONSTRUCTION EQUIPTMENT				
Excavator / Operator	HR	24	$140	$3,360
Crane / Operator	LS	1	$7,000	$7,000
Haul Fill Off Site (1 hr round trip)	HR	8	$95	$760
Haul Materials to Site (assume 1 hr round trip)	HR	8	$95	$760
CONSTRUCTION MATERIALS				
Contech CS-8 Swirl Separator	EA	1	$45,000	$45,000
Pipe, Bedding, Riser Rings	LS	1	$5,000	$5,000
Stone Outfall Stabilization	LS	1	$2,000	$2,000
CONSTRUCTION MISCELLANEOUS				
Mobilization/ Demobilization	LS	1	$3,000	$3,000
Site Restoration	LS	1	$3,000	$3,000
CONSTRUCTION SUBTOTAL (ROUNDED)				**$74,000**
CONSTRUCTION PHASE SERVICES				$7,000
CONSTRUCTION CONTINGENCY (10%)				$7,400
TOTAL (ROUNDED)				**$88,400**

APPENDIX C

HARBOR ROAD

MAPPING NOTES

1. SITE SURVEY COMPLETED BY GRENIER ENGINEERING IN NOVEMBER 2018.
2. UTILITY LOCATIONS ARE SHOWN AS APPROXIMATE AS PROVIDED BY TOWN OF SHELBURNE, CHITTENDEN COUNTY REGIONAL PLANNING COMMISSION, AND MARKED BY DIG SAFE IN AUGUST 2018.
3. LOCATION OF EXISTING UTILITIES HAS BEEN BASED UPON AVAILABLE INFORMATION AND MAY BE INCOMPLETE. CALL "DIG SAFE VERMONT", 811.

DESIGN NOTES

1. AVOID OVERHEAD UTILITIES.
2. REMOVE STUMP ADJACENT TO SEPARATOR LOCATION.
3. REPLACE GRAVEL WALK ALONG HARBOR ROAD FOLLOWING COMPLETION OF CONSTRUCTION.

0' 10' 20'
0 1/2" 1"

NEW MANHOLE

REMOVE TREE

REMOVE TREE

INSTALL FOUR CASCADE SEPARATORS
DRAINAGE AREA: 114.74 AC
IMPERVIOUS COVER: 36.09 AC
WATER QUALITY VOLUME: 138,734 CUFT
WATER QUALITY FLOW: 23.2 CFS

NEW MANHOLE WITH WEIR OUTLET TO EXISTING STORM LINE

NEW PIPE MANAFOLD SET LEVEL TO DISTRIBUTE FLOW TO CS UNITS

TIE MANAFOLD INTO EXISTING CATCH BASIN

B1

B2

STUMP

20" MAPLE

20" OAK

GRAVEL WALK

HARBOR ROAD

PAVED ROAD

CB #6
RIM: 114.18
INV IN(S): 107.98
INV IN(E): 106.23
INV OUT: 106.13

CB #7
RIM114.27
INV IN: 106.07 24"HDPE
INV OUT: 106.02 24"HDPE

CB #9
RIM: 113.24
INV OUT: 108.24

115

116

SLR
1 SOUTH MAIN STREET
WATERBURY, VT 05676
802.282.2335
SLRCONSULTING.COM

REVISIONS

HARBOR ROAD
MCCABES BROOK STORMWATER PLANNING
LEWIS CREEK ASSOCIATION
SHELBURNE, VERMONT

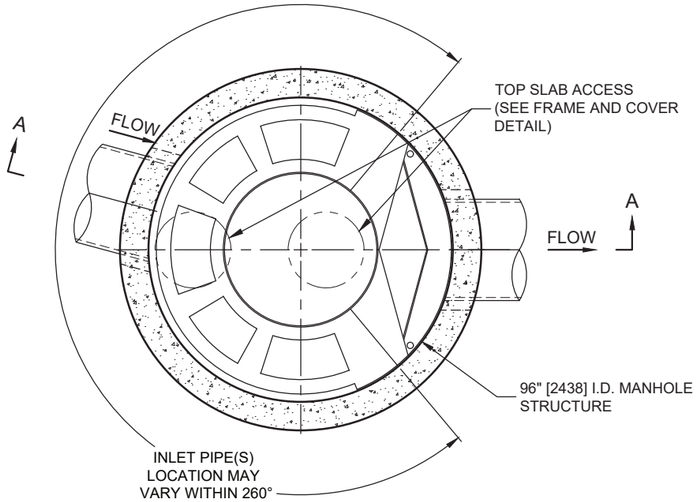
JCL	AOM	JCL
DESIGNED	DRAWN	CHECKED

1"=20'
SCALE

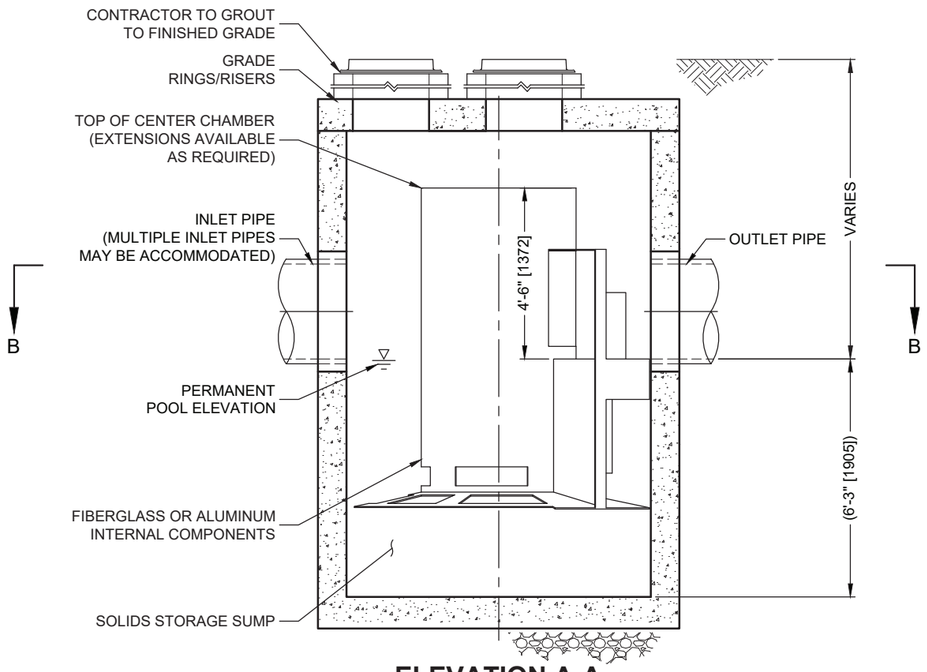
JANUARY 18, 2023
DATE

13452.00038
PROJECT NO.

PR-1
SHEET NO.



PLAN VIEW B-B
NOT TO SCALE



ELEVATION A-A
NOT TO SCALE

CASCADE
separator™

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GRATED INLET WITH INLET PIPE OR PIPES
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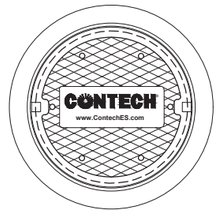

FRAME AND COVER
(DIAMETER VARIES)
NOT TO SCALE

SITE SPECIFIC DATA REQUIREMENTS

STRUCTURE ID			
WATER QUALITY FLOW RATE (cfs [L/s])			23.2 cfs
PEAK FLOW RATE (cfs [L/s])			
RETURN PERIOD OF PEAK FLOW (yrs)			
RIM ELEVATION			114.27 ft
PIPE DATA:	INVERT	MATERIAL	DIAMETER
INLET PIPE 1	106.02 ft	HDPE	24 in
INLET PIPE 2			
OUTLET PIPE	106.02 ft	HDPE	24 in

NOTES / SPECIAL REQUIREMENTS:

GENERAL NOTES
1. CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
2. FOR SITE SPECIFIC DRAWINGS WITH DETAILED STRUCTURE DIMENSIONS AND WEIGHT, PLEASE CONTACT YOUR CONTECH ENGINEERED SOLUTIONS LLC REPRESENTATIVE. www.ContechES.com
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CONTECH
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9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

CS-8
CASCADE SEPARATOR
STANDARD DETAIL

BALLPARK OPINION OF PROBABLE CONSTRUCTION COST

MCCABE'S BROOK STORMWATER PLANNING

HARBOR ROAD - SWIRL SEPARATOR

Shelburne, Vermont

13452.00038

January 17, 2023

ITEM/DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	COST
CONSTRUCTION LABOR				
Labor	HR	120	$55	$6,600
CONSTRUCTION EQUIPTMENT				
Excavator / Operator	HR	40	$140	$5,600
Crane / Operator	LS	1	$10,000	$10,000
Haul Fill Off Site (1 hr round trip)	HR	16	$95	$1,520
Haul Materials to Site (assume 1 hr round trip)	HR	8	$95	$760
CONSTRUCTION MATERIALS				
Contech CS-8 Swirl Separator	EA	4	$45,000	$180,000
Storm Manholes	EA	2	$5,000	$10,000
Pipe, Bedding, Riser Rings	LS	1	$10,000	$10,000
CONSTRUCTION MISCELLANEOUS				
Mobilization/ Demobilization	LS	1	$3,000	$3,000
Clearing	LS	1	$3,000	$3,000
Site Restoration	LS	1	$5,000	$5,000
CONSTRUCTION SUBTOTAL (ROUNDED)				**$235,000**
DESIGN SERVICES				$3,000
CONSTRUCTION PHASE SERVICES				$8,000
CONSTRUCTION CONTINGENCY (10%)				$23,500
TOTAL (ROUNDED)				**$270,000**