



2016

# Wildcat Shale Pit Remediation Project, Petite Rivière Watershed, Lunenburg County, NS

RRFB Research & Development  
Project No. RD-R6-15-03



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BLUENOSE COASTAL ACTION FOUNDATION

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## Project Introduction and Organization Background

### Organization Mandate and Background

Bluenose Coastal Action Foundation (Coastal Action) is a community-based charitable organization with a mandate to address environmental concerns along the South Shore of Nova Scotia. Coastal Action's goal is to promote the restoration, enhancement, and conservation of our ecosystem through research, education, and action.

The organization has been an established member of the Lunenburg County community since its inception in December 1993. Over the past 20 plus years, Coastal Action has successfully completed a vast number of projects within the South Shore region of the province. One of Coastal Action's greatest ongoing concerns is healthy watersheds and, as such, the organization has experience in successfully conducting several fish habitat and water quality projects.

### Project Overview

Wildcat Brook is a stream found within the Petite Rivière watershed and located in Wileville, Lunenburg County, Nova Scotia. Through Coastal Action's monthly water quality monitoring throughout the Petite Rivière watershed, Wildcat Brook has been identified as having abnormally low pH levels, causing highly acidic waters. The presence of low pH is presumed to be due to the exposed pyritic slate bedrock resulting from past pit mining activities within the catchment area of Wildcat Brook.

The three shale pits adjacent to the Wildcat Brook contain small acidic ponds resulting from pooling rainwater with an average pH of 4.20. In heavy rainfall events the pooling waters within the shale pits discharge into the nearby Wildcat Brook causing acidic episodic shocks to the stream system, which can be detrimental to aquatic life.

The Petite Rivière watershed is home to the last remaining wild population of the globally endangered Atlantic whitefish (*Coregonus hunstmani*); an endangered fish species federally listed through the *Species at Risk Act*, and is also the drinking water reservoir for the Town of Bridgewater.

Coastal Action, along with partners East Coast Aquatics Incorporated, has developed and executed a shale pit remediation and wetland expansion plan for one of these abandoned shale pits. This plan was to be executed by capping the exposed bedrock in the remediation site with organic material, such as provincial compost, limiting the runoff of acidic waters into the adjacent Wildcat Brook.

This restoration project has promoted the use of municipal compost in an innovative way and supports the goals of the RRFB's Solid Waste Strategy in bettering the environment and creating new opportunities for the use of provincial compost.

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## Site Description Pre-restoration

The proposed shale pit remediation site consists of bare rock with very minimal amount of soil and sparse shrub vegetation. The site is surrounded by a mix-wood forest stand. Western and Eastern sides of the remediation site (Figure 1) are lacking of any larger vegetation and have collected rainwater in small, low lying pools. The pools all had low acidity readings (average pH of 4.2) and lack aquatic vegetation growth within them. The Central and Northern end of the site is at a higher elevation and larger vegetation is present. This larger vegetation has likely only been established for approximately 10 to 15 years. White Pine (*Pinus strobus*) and Gray Birch (*Betula populifolia*) are the dominant species and appear sickly and yellow in colour. This is likely caused by the lack of nutrients in the soil found in these areas.



Figure 1. Aerial view of Wildcat Shale Pit Remediation site shaded grey with adjacent Wildcat Brook depicted with blue line.

## Research & Methods

The 1.10-hectare restoration site was first surveyed for existing wildlife and vegetation. Pre-restoration water quality testing, benthic invertebrate sampling, and electrofishing were all completed in the adjacent Wildcat Brook prior to the start of the actual physical restoration work (i.e., any spreading of organic material on site). These surveys were completed to document a baseline of information as to the conditions prior to any restoration activity.

Results from the “Ground-Truthing & Wildlife Survey” as well as the “Vegetation Survey” can be found in the Results section below and in more detail within the attached Appendix A and Appendix B respectively. These surveys involved documenting the presence of all flora and fauna that existed at the work site

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during pre-restoration conditions. The vegetation surveys included recording a list of all vegetation found to determine the diversity of plant life. These surveys were conducted under the guidance of Nova Scotia plant expert, Dr. Ruth Newell. Density measurements were determined using a randomized 1 m<sup>2</sup> transect in four different sections of the shale pit.

The 1.10-hectare shale pit was capped by adding and spreading approximately 2600 m<sup>3</sup> of organic soil and vegetation to cover the exposed pyritic slate preventing it from oxidizing. The bulk spreading of organics occurred using East Coast Aquatics' excavator and frontend loader tractor. These soils were sourced from development projects in the area that were excavating and removing wetland/organic soils. The low-lying areas (Lower Pit) of the remediation site are flooded and vegetated with native wetland vegetation to encourage the formation of wetland habitat.

Approximately 400 m<sup>3</sup> of municipal compost material was used in the higher elevated areas (Upper Pit) of the restoration site. The nutrient-rich organic soil will encourage and support a healthy growth of vegetation in the high-lying areas of the restoration site, while the low lying areas are nutrient depleted. The high-lying areas will support larger types of vegetation such as large trees and shrubs rather than the wetland grasses, sedges, reeds, and flowers proposed for the lower lying areas. The areas covered with compost material have been seeded with a native reclamation grass mixture and already have young tree development.

Weirs were built on the Western and Eastern sides of the remediation site acting as a border between the restoration site and Wildcat Brook. These weirs were built using gibbon rock and clay and are used for controlling the flow of water in and out of the site in order to keep the soils flooded in the low lying areas. Limestone was also added near the outflow of the pit in order to increase pH readings of the water flowing into Wildcat Brook.

Water quality monitoring has occurred throughout the project under the direction of wetland experts, East Coast Aquatics. Point photos, macroinvertebrate sampling, vegetation surveys, wildlife surveys, and electrofishing surveys were conducted pre-restoration and will also occur post-restoration in the fall of 2016 to monitor any habitat improvements in Wildcat Brook. This same post-monitoring will continue for the next three years at a minimum.

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Figure 2. Conducting Ground-Truthing & Wildlife Survey with Reg Newell, Wildlife Biologist.



Figure 3. Vegetation density measurements taken with 1x1 square grid.



Figure 4. Dumping load of municipal compost.



Figure 5. Conducting electrofishing survey in Wildcat Brook.



Figure 6. Spreading and landscaping with excavator in Western side of Wildcat Shale Pit Remediation Site.



Figure 7. Hand spreading of compost in Northern end of Wildcat Shale Pit Remediation site.

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## Results

Due to the nature of this project the results are in a preliminary stage. Vegetation in the Central and Northern end of the Shale Pit Remediation site will continue to grow up and fill in. These changes will be documented through point photos and observing vegetation growth. Photos below illustrate the Northern end of the remediation site prior to the spreading of compost and after the spreading of compost over exposed pyritic slates.



*Figure 8. Northern end of Shale Pit Remediation site on May 3, 2016.*



*Figure 9. Northern end of Shale Pit Remediation site on August 12, 2016 after compost material had been spread.*

Results from the pre-remediation Wildlife Survey proved that there is wildlife existing in the surrounding area that would benefit from the creation of wetland habitat. The hope is that future surveys will show that the new wetland habitat will bring about and support a more diverse and larger amount of wildlife.

Results of the pre-remediation vegetation density measurements indicated that only approximately 25% of the site was covered by vegetation. This low percentage is likely due to the lack of nutrient rich soil within the remediation site. This lack of soil also limits the type of vegetation that is able to grow in these conditions. The first and second sections where vegetation density measurements were taken have an average percent vegetation of 12%. These locations represent an area that consisted of more exposed rock which was lacking in smaller vegetation cover. These sections represent the higher elevations found within the pit where municipal compost was spread. The third and fourth sections have a higher average percentage of vegetation with 38%. These areas contained wetter conditions and the perimeters were observed to have more soil. These sections represent the low-lying areas of the remediation site. In all four sections, a total of 103 plants were identified and recorded when conducting the pre-restoration vegetation survey.

This restoration site will continue to be monitored for three years (minimum) using various habitat measurements including macroinvertebrate sampling, vegetation surveys, wildlife surveys, water quality testing, and electrofishing surveys.

## Discussion & Future Work

The success of this project will be significant at improving the water quality of Wildcat Brook and the overall health of the surrounding environment, while creating a new highly productive wetland environment.

The use of municipal compost has also created an opportunity for future use in other restoration projects that wish to promote the growth of healthy vegetation. This project will demonstrate the fertility of the municipal compost that will be documented by point photos and vegetation surveys.

As previously mentioned, there are two other larger shale pits adjacent to Wildcat Brook that are of interest to both Coastal Action as well as project partners, the Bridgewater Public Service Commission (PSC). Coastal Action and the PSC would like to continue with the shale pit remediation efforts into both of these pits as well. Remediating all three of the pits will ensure water quality improvements in the adjacent Wildcat Brook as well as create a network of wetland habitat for wildlife. These projects would be much larger in scale compared to the one just completed, with the largest pit being just over 7 ha. This project would require significantly more organic soil in order to cover the exposed bedrock adequately.

## Appendix A. Ground-Truthing & Wildlife Survey

### Wildcat Shale Pit Remediation & Wetland Expansion Project

#### Ground-Truthing & Wildlife Survey: April 28, 2016

**Team** **Coastal Action Staff:** Emma Kinley, Sam Reeves, Shauna Barry, Melissa Rafuse, and Alisha Kelly  
**Volunteers:** Reg Newell (DNR, Wildlife Biologist) and Elijah Sawler (student from NSCC Natural Resources Environmental Technology Program)

#### Site Description & Result of the One-hectare Shale Pit Wildlife Survey

**Current Land Use:** Abandoned shale pit mining site – abandoned approximately 20 years ago.

**Current Landscape Features:** Pit area consists of bare rock with very minimal amount of soil and sparse shrub vegetation. Lower lying areas, that likely have been excavated in the past, pool with rain water. Pools all read low acidity and lack aquatic vegetation growth which duck species rely on for shelter when young and for food. Surrounding the pit area is a mixture of softwood and hardwood forest varying in age, but majority of growth around 20-30 years old. Shale pit site is adjacent to the near by Wildcat Brook. Standing mixed wood forest consisting of eastern white pine, red maple, eastern hemlock, white birch, grey birch, black spruce, balsam fir, and tamarack. Ground vegetation consisting of wild raisin, speckled and green alders, lambkill, leather leaf, bog cranberry, reindeer moss, straw berry, and dew berry. Regeneration vegetation consisting of balsam fir, red spruce, oak, and eastern white pine.

**Habitat types present:** Mixed wood forest (surrounding pit), riparian zone habitat (edge of stream), bare rock (within pit area) – snakes, turtles, and insects like to draw heat from, wet marsh/wetland habitat (edge of pit), old trees – cavities used for wildlife nests/downfall for cover/great for insects, and pond habitat – lacking vegetation, but sighting of tad poles and frog eggs.

#### Wildlife Present/Actual Sightings:

- Black Capped Chickadee – sighting
- Pileated wood Pecker hole
- Mallard duck – sighting
- Beaver stump
- Tad poles – sighting
- Hare scat
- Mustelidae family tracks and scat (scat found in larger pit)
- Raccoon tracks
- Fish bones
- Coyote scat and tracts (found in larger pit)

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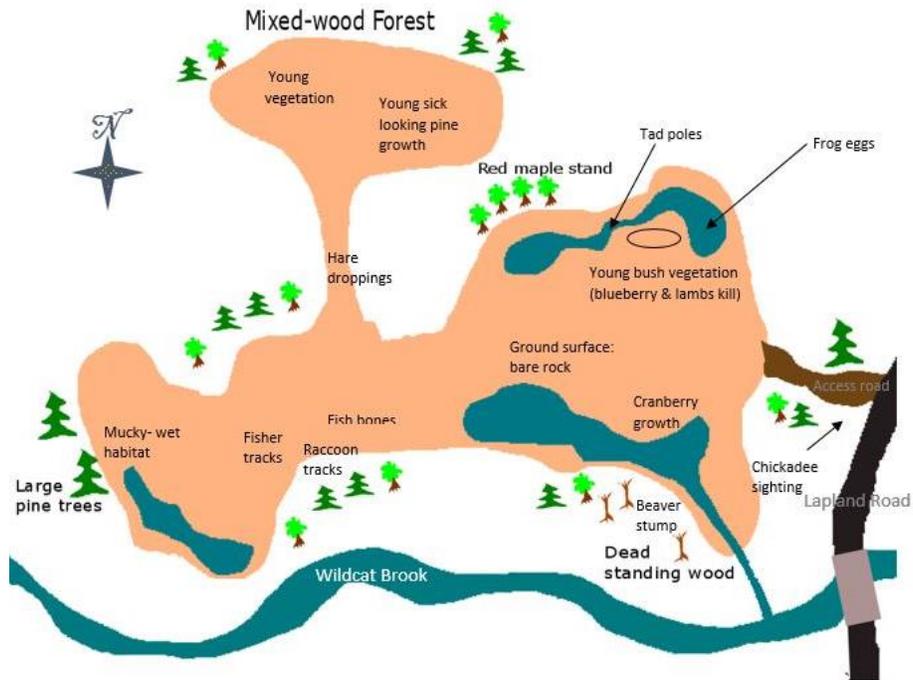
- Deer tracks (found in larger pit)
- Unknown yellow bird – sighting
- Bird egg lining
- Insect damage on some old trees

**Other Possible Species:**

- The large white pine serves as good habitat for red tailed hawk nesting and other raptor nesting, as well as barred owls, possibly great horned owl, and saw-whet owl.
- Smaller mammal species: shrews, red back moles included
- Bobcat, coyote, fox (likely not fox if coyotes are present)
- Pine grosbeak could be present during winter
- Deer could be present during winter, not the best feeding habitat during summer (little shrub vegetation to feed on)
- Warblers (like mixed forest)
- Grosbeak
- Woody, downy, and pileated wood peckers
- Wood ducks
- Kinglets
- Goshawks
- Porcupines
- Fisher (possible tracks spotted in pit)
- Snakes
- Dragonflies
- Short tailed shrew (poisonous)

**Other Landscape Features:** The area is absent of any “built” structures within the surveyed area. However, there is an ATV trail running through the Western end of the pit and the access point to the pit on the Eastern end is off of the Lapland Road. This rural roadway has low residential traffic as well as some logging and other heavy machinery traffic. There are two other larger pits in the surrounding area. The closest of the two (7 ha) is positioned on the other side of Wildcat Brook and was also visited on the same day as the survey. This pit has more diversity in vegetation and better soils allowing for more vegetation growth.

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## Appendix B. Vegetation Surveys – Density Measurements & Vascular Plant List

### Density Measurements

**Conducted by Coastal Action staff:** Emma Kinley & Shauna Barry

**Method:** Remediation site was split into four sections (1-lower right, 2-upper right, 3-upper left, and 4-lower left) with each section sampled five times using a 1x1 square grid to measure randomized locations for percent of vegetation. *These measurements do not account for large vegetation such as trees.*

### Results:

Section	Quadrant	1	2	3	4	5	% Vegetation Average (s)
1	Q1	0	30	15	5	3	8.50%
	Q2	0	20	10	5	1	
	Q3	0	25	15	3	3	
	Q4	1	20	10	3	1	
2	Q1	2	15	75	5	3	15.60%
	Q2	1	7	60	3	2	
	Q3	1	10	20	1	2	
	Q4	2	5	75	20	3	
3	Q1	50	85	15	10	0	31.58%
	Q2	75	30	35	10	0	
	Q3	55	65	10	10	0.5	
	Q4	80	70	20	10	1	
4	Q1	5	10	80	95	60	43.55%
	Q2	5	5	65	75	70	
	Q3	2	7	50	80	50	
	Q4	2	10	50	80	70	
<b>Total Average:</b>							<b>24.80%</b>

**Vascular Plant List** for Large Shale Pit adjacent to Shale Pit Restoration Site Wileville, Nova Scotia – Completed on *August 15, 2016*. This list gives a baseline understanding of the diversity of existing plant life pre-restoration and their current status.

**Team:** **Coastal Action Staff:** Emma Kinley, Blaire Slaunwhite, Shauna Barry, and Nicolas Wentzell

**Volunteers:** Ruth Newell (Professional Botanist), Reg Newell (DNR, Wildlife Biologist), and Zackery Zwicker (Amateur Botanist)

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	Latin Name	Common Name	Nova Scotia General Status Rank
1	<i>Abies balsamea</i>	Balsam Fir	4 Secure
2	<i>Acer rubrum</i>	Red Maple	4 Secure
3	<i>Agrostis scabra</i>	Rough Bent Grass	4 Secure
4	<i>Anaphalis margaritacea</i>	Pearly Everlasting	4 Secure
5	<i>Anthoxantum odoratum</i>	Sweet Vernal Grass	7 Exotic
6	<i>Anus incana</i> ssp. <i>rugosa</i>	Speckled Alder	4 Secure
7	<i>Symphyotrichum lateriflorum</i>	Calico Aster	4 Secure
8	<i>Betula populifolia</i>	Grey Birch	4 Secure
9	<i>Bidens frondosa</i>	Devil's Beggarticks	4 Secure
10	<i>Brasenia screberi</i>	Water Shield	4 Secure
11	<i>Calopogon pulchellus</i>	Grass Pink	
12	<i>Carex canescens</i>	Hoary Sedge	4 Secure
13	<i>Carex lurida</i>	Shining Sedge	4 Secure
14	<i>Carex scoparia</i>	Broom Sedge	4 Secure
15	<i>Centaurea nigra</i>	Knapweed	
16	<i>Chamaedaphne calyculata</i>	Leatherleaf	4 Secure
17	<i>Comptonia peregrina</i>	Sweet Fern	4 Secure
18	<i>Cypripedium acaule</i>	Pink Lady's-slipper	4 Secure
19	<i>Danthonia compressa</i>	Flattened Oat Grass	4 Secure
20	<i>Danthonia spicata</i>	Poverty Oat Grass	4 Secure
21	<i>Dennstaedtia punctilobula</i>	Hay-scented Fern	4 Secure
22	<i>Drosera intermedia</i>	Spoon-leaved Sundew	4 Secure
23	<i>Drosera rotundifolia</i>	Round-leaved Sundew	4 Secure
24	<i>Dulichium arundinacium</i>	Three-way Sedge	4 Secure
25	<i>Eleocharis acicularis</i>	Needle Spikerush	4 Secure
26	<i>Eleocharis tenuis</i>	Slender Spikerush	4 Secure
27	<i>Epigaea repens</i>	Mayflower	4 Secure
28	<i>Epilobium ciliatum</i>	Northern Willowherb	4 Secure
29	<i>Erechtites hieraciifolia</i>	Fireweed	4 Secure
30	<i>Erigeron strigosus</i>	Rough Fleabane	4 Secure
31	<i>Eriophorum virginicum</i>	Tawny Cottongrass	4 Secure
32	<i>Euthamia graminifolia</i>	Narrow-leaved Goldenrod	4 Secure
33	<i>Fragaria virginiana</i>	Wild Strawberry	4 Secure
34	<i>Gaultheria hispidula</i>	Creeping Snowberry	4 Secure
35	<i>Gaultheria procumbens</i>	Teaberry	4 Secure
36	<i>Gaylussacia baccata</i>	Huckleberry	4 Secure
37	<i>Glyceria obtusa</i>	Atlantic Manna Grass	4 Secure
38	<i>Hieracium kalmii</i>	Kalm's Hawkweed	5 Undetermined
39	<i>Hieracium</i> sp.	A hawkweed	7 Exotic

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	Latin Name	Common Name	Nova Scotia General Status Rank
40	<i>Hypericum canadense</i>	Canada St. John's-wort	4 Secure
41	<i>Hypericum perforatum</i>	Common St. John's-wort	7 Exotic
42	<i>Iris versicolor</i>	Blue Flag	4 Secure
43	<i>Juncus brevicaudatus</i>	Narrow-panicled Rush	4 Secure
44	<i>Juncus canadensis</i>	Canada Rush	4 Secure
45	<i>Juncus militaris</i>	Bayonet Rush	4 Secure
46	<i>Juncus pelocarpus</i>	Brown-fruited Rush	4 Secure
47	<i>Juncus effusus</i>	Soft Rush	4 Secure
48	<i>Juncus tenuis</i>	Slender Rush	4 Secure
49	<i>Kalmia angustifolia</i>	Sheep Laurel	4 Secure
50	<i>Kalmia polifolia</i>	Bog Laurel	4 Secure
51	<i>Larix laricina</i>	Larch	4 Secure
52	<i>Lechea intermedia</i>	Pinweed	4 Secure
53	<i>Ledum groenlandicum</i>	Labrador-tea	4 Secure
54	<i>Leontodon autumnalis</i>	Fall dandelion	7 Exotic
55	<i>Lobelia inflata</i>	Indian Tobacco	4 Secure
56	<i>Lycopodiella inundata</i>	Northern Bog Clubmoss	4 Secure
57	<i>Lysimachia terrestris</i>	Swamp Candle	4 Secure
58	<i>Melampyrum lineare</i>	Cow wheat	4 Secure
59	<i>Muhlenbergia uniflora</i>	Bog Muhly Grass	4 Secure
60	<i>Myrica gale</i>	Sweet Gale	4 Secure
61	<i>Nuphar variegata</i>	Cow Lily	4 Secure
62	<i>Nymphaea cordata</i>	Water Lily	4 Secure
63	<i>Oenothera biennis</i>	Common Evening Primrose	4 Secure
64	<i>Oenothera perennis</i>	Perennial Evening Primrose	4 Secure
65	<i>Oxalis dillenii</i>	Slender Yellow Wood Sorrel	7 Exotic
67	<i>Dichanthelium depauperatum</i>	Starved Panic Grass	4 Secure
68	<i>Panicum lanuginosum</i>	Woolly Panic Grass	4 Secure
69	<i>Phalaris arundinacea</i>	Reed Canary Grass	4 Secure
70	<i>Picea mariana</i>	Black Spruce	4 Secure
71	<i>Picea rubens</i>	Red Spruce	4 Secure
72	<i>Pinus strobus</i>	White Pine	4 Secure
73	<i>Plantago major</i>	Common Plantain	7 Exotic
74	<i>Poa compressa</i>	Canada Blue Grass	7 Exotic
75	<i>Poa pratensis</i>	Kentucky Blue Grass	4 Secure
76	<i>Pogonia ophioglossoides</i>	Rose Pogonia	4 Secure
77	<i>Pontederia cordata</i>	Pickerelweed	4 Secure
78	<i>Potamogeton confervoides</i>	Alga Pondweed	4 Secure

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	Latin Name	Common Name	Nova Scotia General Status Rank
79	Potentilla sp.	a cinquefoil	4 Secure
80	Prenanthes trifoliolata	Three-leaved Rattlesnakeroot	4 Secure
81	Prunella vulgaris	Heal-all	7 Exotic
82	Pteridium aquilinum	Bracken Fern	4 Secure
83	Quercus rubra	Red Oak	4 Secure
84	Rhododendron canadense	Rhodora	4 Secure
85	Rhynchospora alba	White Beakrush	4 Secure
86	Rubus hispida	Bristley Dewberry	4 secure
87	Sarracenia purpurea	Pitcher Plant	4 Secure
88	Scirpus atrocinctus	Black-girdled Wooldsedge	4 Secure
89	Scirpus cyperinus	Common Wooldsedge	4 Secure
90	Solidago juncea	Early Goldenrod	4 Secure
91	Solidago puberula	Downy Goldenrod	4 Secure
92	Solidago rugosa	Rough Goldenrod	4 Secure
93	Sparganium americanum	American Burreed	4 Secure
94	Spiraea alba var. latifolia	Meadowsweet	4 Secure
95	Spiraea tomentosa	Steeplebush	4 Secure
96	Spiranthes sp. (in bud; possibly <i>S. ochroleuca</i> )	a ladies-tresses	4 Secure
97	Triadenum fraseri	Fraser's Marsh St. John's-wort	4 Secure
98	Trifolium arvensis	Rabbit's-foot Clover	7 Exotic
99	Tsuga canadensis	Hemlock	4 Secure
100	Vaccinium macrocarpon	Large Cranberry	4 Secure
101	Veronica officinalis	Common Speedwell	7 Exotic
102	Viburnum cassinoides	Witherod	4 Secure
103	Viola lanceolata	Lance-leaved Violet	4 Secure

## WILDCAT SHALE PIT REMEDIATION PROJECT, PETITE RIVIÈRE WATERSHED, LUNENBURG COUNTY, NS

## Appendix 3. Financial Breakdown

## Project Expenses as Proposed

Project Costs	Forecasted Amounts	Actual Amounts
Project Coordinator	\$21,500	\$23,987.60
Project Management	\$5,000	\$5,000.00
Consultant	\$28,850	\$31,533.00
Material Trucking / Excavating	\$24,000	\$26,151.00
Additional Trucking	\$15,000	\$10,522.50
Restoration Equipment / Material	\$15,000	\$24,976.18
Security Gate	\$3,500	\$3,501.75
Travel	\$1,000	\$2,464.14
Signage	\$500	\$80.50
Insurance	\$1,200	\$1,099.57
<b>Total</b>	<b>\$115,550</b>	<b>\$129,316.24</b>

## Project Partners

Partner	Amount
Bluenose Coastal Action Foundation	\$316.24
Resource Recovery Fund Board	\$10,000
Recreational Fisheries Conservation Partnership Program	\$20,000
NSLC Adopt-A-Stream Program	\$15,000
National Wetlands Conservation Fund	\$40,000
NS Dept. of Transportation and Infrastructure Renewal	\$35,000
Bridgewater Public Service Commission	\$5,000
TD Friends of the Environment Foundation	\$4,000
<b>Total</b>	<b>\$129,316.24</b>