City of Barre

Stormwater Infrastructure Mapping Project

April 2013

VTDEC – CLEAN WATER INITIATIVE PROGRAM, WATERSHED MANAGEMENT DIVISION

https://dec.vermont.gov/water-investment/cwi/solutions/developed-lands/idde

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Overview

This stormwater infrastructure mapping project was completed for the municipality by the Agency of Natural Resources Ecosystems Restoration program to supplement the existing drainage data collected by the town and with the intention of providing a tool for planning, maintenance, and inspection of the stormwater infrastructure.

The GIS maps and geodatabase are meant to provide an overall picture and understanding of the connectivity or connectedness of the storm system on both public and private properties in order to raise the awareness of the need for regular maintenance. The generation and transport of nonpoint source pollution increases with increasing connectivity of a drainage system. Having an understanding of the connectedness of the system is also a valuable tool for hazardous material spill planning and prevention. Knowledge of the extent of the system is also essential for the detection and elimination of illicit discharges. Outfall locations and system connectedness data are used as a base for locating illicit or illegal discharges of non-stormwater to the municipal storm system and tracing them up to the source. Knowledge of which areas of the sewer service area have combined stormwater and sewer systems can better assist the municipality in planning and implementing combined sewer separation projects. Knowledge of the layout and extent of the stormwater system can inform options for cleaning up existing polluted stormwater discharges. This project provides information and guidance for potential retrofit treatment locations and opportunities. Knowledge of where storm drains are located can also assist municipalities and residents with emergency preparedness for large rainfall events (i.e. Tropical Storm or Hurricanes) or spring snowmelt runoff events. By keeping storm drains clean, clear and open a good deal of localized flooding could be prevented. Finally, by providing a more thorough understanding of the system it is the hope that this project could be the basis for a local stormwater ordinance or be used to help enhance an existing stormwater management program.

Project Summary

The principal goal of this project was to develop up to date municipal drainage maps. These drainage maps were created showing the paths that stormwater runoff travels from where it falls on impervious surfaces such as parking lots, roads, and rooftops, to the outfall points in various receiving waters. These maps show the stormwater infrastructure including features like pipes, manholes, catchbasins, and swales within a municipality. Data sources included data collected from field work, a mapping grade Trimble GPS unit, available state permit plans, record drawings, town plans, WWMD plans, existing GIS data from contractors, and the input and guidance of knowledgeable members from the municipalities.

A second goal of this project was to establish potential locations for Best Management Practice (BMP) stormwater retrofit sites. These are sites where stormwater treatment structures could be added and where they would be most cost effective and efficient for sediment and phosphorus or nitrogen removal. In order to develop a retrofit site list, drainage area subwatersheds were delineated around the drainage networks. Determining how the stormwater infrastructure was connected was necessary in determining the subwatershed drainage areas within the town.

Delineating the drainage areas was done using the stormwater infrastructure maps, along with satellite imagery, a Digital Elevation Model (DEM), and USGS topographic maps. These data sources were used to approximate where the land area within each municipality was draining to; as well as where the high points were that divided the sub-drainage areas. The

completed maps show the drainage coverage for essentially the entire municipality, but with a focus on areas with greater concentrations of impervious cover.

Impervious cover layers were created by either hand digitization or by using a method of raster pixel calculation (with ArcGIS spatial analyst extension) to create a vegetation index from the National Agricultural Imagery Program (NAIP) 08 orthophotos. The area which contrasted with the vegetation represents impervious surfaces and was then modified with buffered water and roads layers to make it more accurate. A more detailed explanation of this process is available in a separate document. The impervious layer was used to calculate the percent of each delineated drainage area that would generate stormwater runoff. The percentage of impervious surface number for each subwatershed was then adjusted with a connectivity rating. A rating was assigned to each drainage area polygon describing how directly connected the impervious surfaces within that subwatershed are to the receiving water. By adjusting the percent impervious area numbers with this connectivity rating the effective impervious area (EIA) was established for each subwatershed (*Sutherland, 1995*). This effective impervious number is a more accurate description of the amount of runoff produced by each of the subwatersheds because it helps to take factors such as infiltration into account.

After the effective impervious numbers were calculated for the subwatersheds the Simple Method was used to estimate the annual sediment (TSS) and phosphorus (TP) or Nitrogen (TN) loads generated by each subwatershed. The Simple method uses information which includes the adjusted impervious value, average annual rainfall for the location, total subwatershed area, and a given pollutant concentration value to calculate an annual load for various pollutants (*Schueler,1987*). Pollutant loads estimated by the Simple Method in this project are planning level estimates and are meant to give a general idea of the amounts of sediment or nutrient wash-off produced by each subwatershed for prioritization purposes. Subwatersheds were then prioritized, using the loading calculations as well as other criteria, and given Action List numbers ranging from 1 to 3 (one being the highest priority). The Action List number depends both upon loading values and feasibility of potential retrofit treatment options. Potential retrofit options listed in the TARGET maps are based on field observations and not on actual availability of land or willingness of landowner.

Water Quality Volume (WQv – the amount of storage needed to treat stormwater from a 0.9 inch storm) and Channel Protection Volume (CPv – the volume of storage that is needed to hold and slowly release stormwater for a 2.1inch rain event) were also calculated for delineated subwatershed areas. CPv calculations are only applicable if the receiving water is not a large body of water and is therefore susceptible to channel erosion. These numbers were used in the retrofit recommendation process because the volume of water to be treated was a key factor in determining the type of retrofit.

Project References

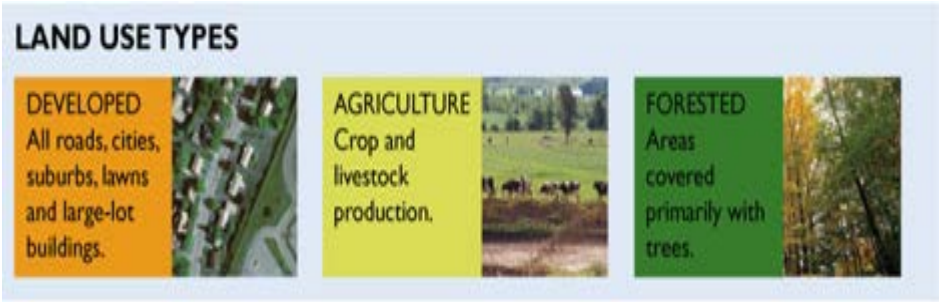
Schueler, T. 1987. Technical Documentation of a Simple Method for Estimating Urban Storm Pollutant Export. Controlling Urban Runoff: A Practical Manual for Planning and Designing Urban BMPs. Appendix A.

Schueler, T. et.al., 2007. Urban Stormwater Retrofit Practices, Version 1.0. Manual 3, Center for Watershed Protection, August 2007.

Sutherland, R. 1995. Methodology for Estimating the Effective Impervious Area of Urban Watersheds. Technical Note 58 – Pervious Area Management. Watershed Protection Techniques. Vol. 2, No. 1

***All data was created in an ArcGIS 10 Geodatabase format and is available from VTDEC.**

Main Lake and Winooski River Nonpoint Phosphorus Overview



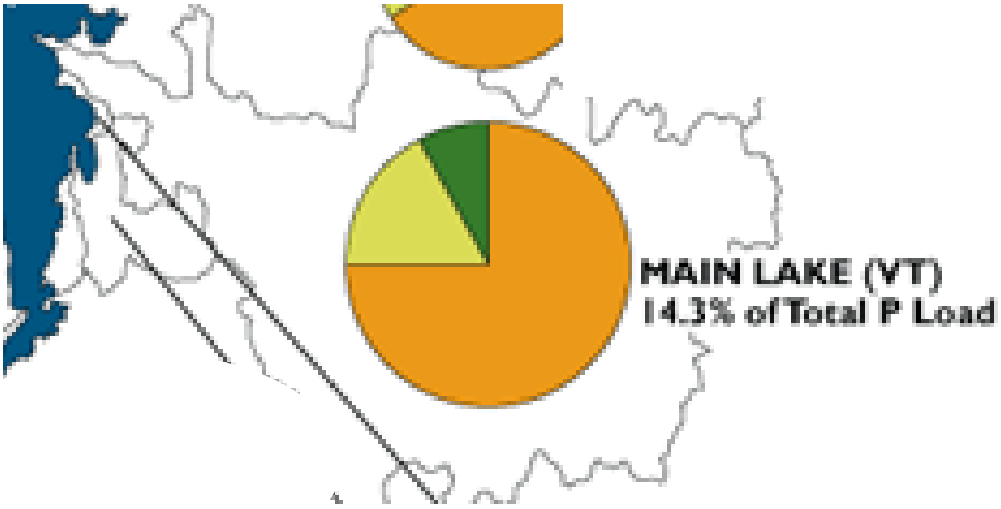
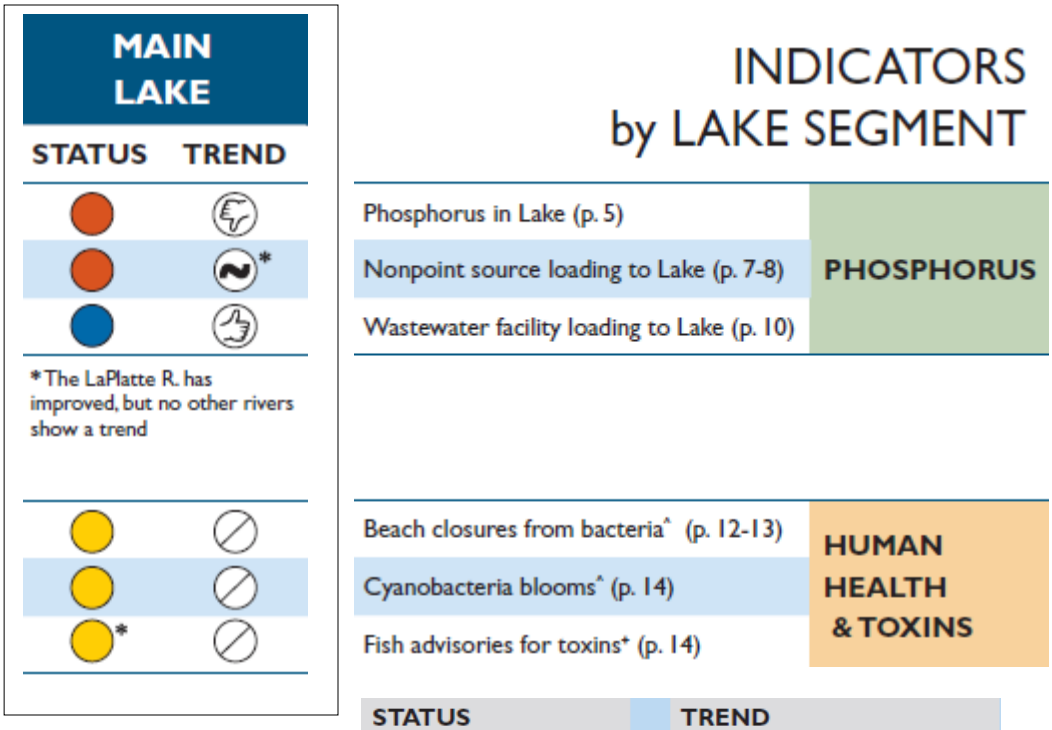


Figure shows the breakdown of contributions from developed, agricultural and forested land sources in the Main Lake-Winooski River Watershed to Total Phosphorus loading of the Main Lake, VT side.



* Figures taken from Lake Champlain Basin Program – *State of the Lake and Ecosystem Indicators Report (2012).* http://sol.lcbp.org/

Subwatershed Data

Tables showing calculations and Priority drainage area retrofit possibilities

This is a key showing the abbreviations of the different stormwater treatment structures or practices listed in the calculation sheets.

Abbreviation Key	
Code	**Structure Type**
BB	Baffle Box
BFCB	Baffled Catchbasin
BR	Bioretention Area (aka Bioretention Filter)
BS	Buffer Strip (25' Min.)
CB	Catch Basin
CBI	Catch Basin Insert
CD	Check Dam
DG	Detention Gallery
DI	Drop Inlet
DP	Dry Pond
DS	Dry Swale
DW	Drywell
EDPMP	Extended Detention Pond with Micropool (aka Micropool Extended Detention Basin)
GS	Grass Swale (aka Open Channel)
IB	Infiltration Basin
IG	Infiltration Gallery
IP	Infiltration Pipe
OF	Overland Flow
OGF	Organic Filter
POP	Pocket Pond
PP	Perforated Pipe
RDD	Roof Drain Disconnect
RR	Rock Riprap
RS	Riprap Swale
SB	Sediment Basin
SF	Sand Filter (aka Surface Sand Filter)
SS-SF	Swirl Separator – Sand Filter
ST	Septic Tank
SWPPP	Stormwater Pollution Prevention Plan
TT	Treatment Tank
WL	Wetland (Constructed)
WP	Wet Pond (Retention)
WS	Wet Swale

Barre City - Subwatershed Prioritization and Recommendations

Watershed Number	Action List #	Proposed Action	Proposed or Existing Stormwater Treatment Practice	Permit Number	Watershed Area (Acres)	Percent Mapped Impervious Area (MIA)	Sediment Load with Current Reductions (lbs)	Sediment Load with Priority Action (lbs)	Phosphorus Load with Current Reductions (lbs)	Phosphorus Load with Priority Action (lbs)	Water Quality Volume (Acre-Feet)	Channel Protection (Acre-Feet)
1 Barre City			CB/OF		13.1	17	1,944	1,944	5.4	5.4	0.11	FALSE
2 Barre City			CB/OF		44.7	3	3,220	3,220	8.9	8.9	0.18	FALSE
3 Barre City			CB		2.1	17	442	442	1.2	1.2	0.02	FALSE
4 Barre City	1	Bioretention in right of way between road and railroad, combine with 5	BRA/CB/OF		12.1	8	1,119	224	3.1	1.9	0.06	FALSE
5 Barre City	1	Bioretention in right of way between road and railroad, combine with 4	BRA/OF		1.3	21	332	66	0.9	0.6	0.02	FALSE
6 Barre City			CB/OF		7.3	23	1,429	1,429	4.0	4.0	0.08	0.18
7 Barre City	1	Riprap and sedimentation basin next to laundry	SB/RR/CB		9.0	14	1,159	695	3.2	2.6	0.07	0.14
8 Barre City			CB/GS		14.7	22	3,787	3,787	10.5	10.5	0.21	FALSE
9 Barre City			OF		9.7	0	640	640	1.8	1.8	0.04	FALSE
10 Barre City			CB/GS		8.5	10	886	886	2.5	2.5	0.05	FALSE
11 Barre City			CB/GS		20.2	2	1,394	1,394	3.9	3.9	0.08	FALSE
12 Barre City			CB/GS		26.4	1	1,806	1,806	5.0	5.0	0.10	FALSE
13 Barre City			IB/OF/BS	5594-9010	8.2	29	1,709	1,709	4.7	4.7	0.10	FALSE
14 Barre City			CB/GS		38.0	8	3,506	3,506	9.7	9.7	0.20	FALSE
15 Barre City			CB/SWPPP	6447-9003	4.4	61	2,818	2,818	7.8	7.8	0.16	FALSE
16 Barre City			CB/OF	6447-9003	3.8	84	3,945	3,945	11.0	11.0	0.22	FALSE
17 Barre City			OF/GS	5594-9010	4.7	41	1,564	1,564	4.3	4.3	0.09	FALSE
18 Barre City			CB/GS		40.5	3	2,967	2,967	8.2	8.2	0.17	FALSE
19 Barre City	3	Sedimentation basin in storage area west of Treatment Plant Rd	SB/OF/SWPPP	6447-9003	7.0	58	4,128	2,064	11.5	9.2	0.23	FALSE
20 Barre City			CB		4.6	73	4,076	4,076	11.3	11.3	0.23	FALSE
21 Barre City			CB/OF		5.2	39	2,364	2,364	6.6	6.6	0.13	FALSE
22 Barre City			GS/CB/OF/WP/ SWPPP	4413-9003	11.6	67	9,307	9,307	25.9	25.9	0.53	FALSE
23 Barre City			GS/OF	3252-9010	24.5	17	3,120	3,120	8.7	8.7	0.18	0.47
24 Barre City			CB/OF		3.0	27	717	717	2.0	2.0	0.04	FALSE
25 Barre City			CB/GS/OF	3506-9010	20.1	41	6,644	6,644	18.5	18.5	0.38	FALSE
26 Barre City			CB/GS/OF		9.0	15	1,199	1,199	3.3	3.3	0.07	FALSE
27 Barre City			CB/GS/OF		18.4	8	1,702	1,702	4.7	4.7	0.10	FALSE
28 Barre City			CB/GS/OF/ST	5510-9015/ 5969-9010	12.6	37	3,626	3,626	10.1	10.1	0.21	FALSE
29 Barre City			CB/GS/SWPPP	5071-9003	71.5	9	6,920	6,920	19.2	19.2	0.39	0.68
30 Barre City			GS/CB/OF		21.7	4	1,639	1,639	4.6	4.6	0.09	0.09
31 Barre City			CB/OF		65.4	19	10,905	10,905	30.3	30.3	0.62	FALSE
32 Barre City			OF/GS/CB		46.9	4	3,527	3,527	9.8	9.8	0.20	FALSE
33 Barre City			OF/GS/CB		134.8	2	9,402	9,402	26.1	26.1	0.53	FALSE
34 Barre City			CB/OF		38.1	3	2,786	2,786	7.7	7.7	0.16	FALSE
35 Barre City			CB/OF/SWPPP	5835-9003	4.7	22	870	870	2.4	2.4	0.05	FALSE
36 Barre City			OF		53.9	5	4,280	4,280	11.9	11.9	0.24	FALSE

Barre City - Subwatershed Prioritization and Recommendations

Watershed Number	Action List #	Proposed or Existing Stormwater Treatment Practice	Estimated Basin Construction Cost	Estimated Other BMP Construction Cost	Cost of Sediment Removal Per Pound (based on annual sediment load)	Cost of Phosphorus Removal Per Pound (based on annual phosphorus load)	Assistance Program	Number of LID - Roof Raingardens to treat CPv (Residential)	Raingarden Cost
1 Barre City	0	CB/OF						0	$0
2 Barre City	0	CB/OF						0	$0
3 Barre City	0	CB						0	$0
4 Barre City	1	BRA/CB/OF	29,646.17		$26	$18,386	ERP, Section 319, LCBP	0	$0
5 Barre City	1	BRA/OF	Combine with 4				ERP, Section 319, LCBP	0	$0
6 Barre City	0	CB/OF						91	$42,030
7 Barre City	1	SB/RR/CB		10,000.00	$22	$15,532	ERP, Section 319, LCBP	69	$31,902
8 Barre City	0	CB/GS						0	$0
9 Barre City	0	OF						0	$0
10 Barre City	0	CB/GS						0	$0
11 Barre City	0	CB/GS						0	$0
12 Barre City	0	CB/GS						0	$0
13 Barre City	0	IB/OF/BS						0	$0
14 Barre City	0	CB/GS						0	$0
15 Barre City	0	CB/SWPPP						0	$0
16 Barre City	0	CB/OF						0	$0
17 Barre City	0	OF/GS						0	$0
18 Barre City	0	CB/GS						0	$0
19 Barre City	3	SB/OF/SWPPP		30,000.00	$15	$13,082	ERP, Section 319, LCBP	0	$0
20 Barre City	0	CB						0	$0
21 Barre City	0	CB/OF						0	$0
22 Barre City	0	GS/CB/OF/WP/ SWPPP						0	$0
23 Barre City	0	GS/OF						234	$107,579
24 Barre City	0	CB/OF						0	$0
25 Barre City	0	CB/GS/OF						0	$0
26 Barre City	0	CB/GS/OF						0	$0
27 Barre City	0	CB/GS/OF						0	$0
28 Barre City	0	CB/GS/OF/ST						0	$0
29 Barre City	0	CB/GS/SWPPP						341	$156,923
30 Barre City	0	GS/CB/OF						47	$21,662
31 Barre City	0	CB/OF						0	$0
32 Barre City	0	OF/GS/CB						0	$0
33 Barre City	0	OF/GS/CB						0	$0
34 Barre City	0	CB/OF						0	$0
35 Barre City	0	CB/OF/SWPPP						0	$0
36 Barre City	0	OF						0	$0

Barre City - Subwatershed Prioritization and Recommendations (pg2)

Watershed Number	Action List #	Proposed Action	Proposed or Existing Stormwater Treatment Practice	Permit Number	Watershed Area (Acres)	Percent Mapped Impervious Area (MIA)	Sediment Load with Current Reductions (lbs)	Sediment Load with Priority Action (lbs)	Phosphorus Load with Current Reductions (lbs)	Phosphorus Load with Priority Action (lbs)	Water Quality Volume (Acre-Feet)	Channel Protection (Acre-Feet)
37 Barre City	3	Swirl Separator at outfall	VS/CB/GS/EDP		50.4	27	16,045	3,209	44.6	40.1	0.91	FALSE
38 Barre City			CB/OF		2.8	39	995	995	2.8	2.8	0.06	0.12
39 Barre City			OF		19.3	5	1,575	1,575	4.4	4.4	0.09	0.12
40 Barre City			CB/OF		5.1	21	930	930	2.6	2.6	0.05	0.12
41 Barre City			CB		34.5	46	18,465	18,465	51.3	51.3	1.04	FALSE
42 Barre City			OF/CB		47.3	4	3,630	3,630	10.1	10.1	0.21	0.22
43 Barre City			OF/CB		15.9	5	1,269	1,269	3.5	3.5	0.07	0.09
44 Barre City			CB		6.1	33	1,767	1,767	4.9	4.9	0.10	0.22
45 Barre City			OF/CB		1.8	13	212	212	0.6	0.6	0.01	0.02
47 Barre City			OF/CB		69.5	9	6,847	6,847	19.0	19.0	0.39	0.69
48 Barre City			OF/CB		45.9	12	5,442	5,442	15.1	15.1	0.31	0.63
49 Barre City			OF		0.3	44	136	136	0.4	0.4	0.01	0.02
50 Barre City	1	Riprap erosion at outfall	RR/GS/CB		33.0	26	7,548	4,529	21.0	16.8	0.43	0.96
51 Barre City			CB/GS		4.3	40	1,619	1,619	4.5	4.5	0.09	FALSE
52 Barre City			CB/GS/BRA		13.0	51	6,563	6,563	18.2	18.2	0.37	FALSE
53 Barre City			OF		0.8	24	172	172	0.5	0.5	0.01	FALSE
54 Barre City	1	Riprap erosion at outfall	RR/CB		9.5	60	5,821	4,657	16.2	14.6	0.33	FALSE
55 Barre City			CB		0.4	98	519	519	1.4	1.4	0.03	FALSE
56 Barre City			GS/CB		3.7	39	1,317	1,317	3.7	3.7	0.07	FALSE
57 Barre City			OF/GS/CB		9.3	59	5,662	5,662	15.7	15.7	0.32	FALSE
58 Barre City			OF/CB/SWPPP	4526-9003	11.6	68	8,538	8,538	23.7	23.7	0.48	FALSE
59 Barre City			CB		1.0	79	988	988	2.7	2.7	0.06	FALSE
60 Barre City			CB		1.3	84	1,366	1,366	3.8	3.8	0.08	FALSE
61 Barre City			OF		5.2	73	4,179	4,179	11.6	11.6	0.24	FALSE
62 Barre City			CB		0.2	20	31	31	0.1	0.1	0.00	FALSE
63 Barre City			OF	3379-9010	8.0	9	773	773	2.1	2.1	0.04	FALSE
64 Barre City			CB/OF		1.2	31	318	318	0.9	0.9	0.02	FALSE
65 Barre City			CB/OF		0.6	34	190	190	0.5	0.5	0.01	FALSE
66 Barre City			CB		0.9	25	197	197	0.5	0.5	0.01	FALSE
67 Barre City			CB		2.1	45	1,131	1,131	3.1	3.1	0.06	FALSE
68 Barre City			OF/CB		1.4	7	125	125	0.3	0.3	0.01	FALSE
69 Barre City	1	Raingarden at south end of rear parking lot	BRA/CB/GS		13.4	53	7,037	4,222	19.5	15.6	0.40	FALSE
70 Barre City	1	Raingarden in traffic island	BRA/CB		1.5	68	1,123	674	3.1	2.5	0.06	FALSE
71 Barre City			CB		2.1	12	247	247	0.7	0.7	0.01	FALSE
72 Barre City			CB		14.7	11	1,600	1,600	4.4	4.4	0.09	FALSE
73 Barre City			OF		14.5	1	989	989	2.7	2.7	0.06	FALSE
74 Barre City			CB		4.5	91	5,064	5,064	14.1	14.1	0.29	FALSE
75 Barre City			OF		1.0	78	870	870	2.4	2.4	0.05	FALSE
76 Barre City			OF		4.0	18	634	634	1.8	1.8	0.04	FALSE
77 Barre City			OF		6.4	31	1,762	1,762	4.9	4.9	0.10	FALSE
78 Barre City			CB/OF		8.7	20	1,542	1,542	4.3	4.3	0.09	0.20
80 Barre City			CB/OF		2.3	31	625	625	1.7	1.7	0.04	0.08
81 Barre City			CB/OF		2.5	26	554	554	1.5	1.5	0.03	0.07
82 Barre City			CB/OF		6.9	36	2,266	2,266	6.3	6.3	0.13	0.28
83 Barre City	1	Extended Detention Basin at 70 Camp Street, Combine with 84-87	EDP/CB/OF		8.3	30	2,183	655	6.1	3.9	0.12	0.27

Barre City - Subwatershed Prioritization and Recommendations (pg2)

Watershed Number	Action List #	Proposed or Existing Stormwater Treatment Practice	Estimated Basin Construction Cost	Estimated Other BMP Construction Cost	Cost of Sediment Removal Per Pound (based on annual sediment load)	Cost of Phosphorus Removal Per Pound (based on annual phosphorus load)	Assistance Program	Number of LID - Roof Raingardens to treat CPv (Residential)	Raingarden Cost
37 Barre City	3	VS/CB/GS/EDP		50,000.00	$4	$11,218	ERP, Section 319, LCBP	0	$0
38 Barre City	0	CB/OF						60	$27,457
39 Barre City	0	OF						58	$26,782
40 Barre City	0	CB/OF						59	$27,289
41 Barre City	0	CB						0	$0
42 Barre City	0	OF/CB						111	$50,920
43 Barre City	0	OF/CB						44	$20,199
44 Barre City	0	CB						110	$50,470
45 Barre City	0	OF/CB						12	$5,683
47 Barre City	0	OF/CB						344	$158,300
48 Barre City	0	OF/CB						314	$144,320
49 Barre City	0	OF						8	$3,657
50 Barre City	1	RR/GS/CB		5,000.00	$2	$1,192	ERP, Section 319, LCBP	480	$220,953
51 Barre City	0	CB/GS						0	$0
52 Barre City	0	CB/GS/BRA						0	$0
53 Barre City	0	OF						0	$0
54 Barre City	1	RR/CB		5,000.00	$4	$3,092	ERP, Section 319, LCBP	0	$0
55 Barre City	0	CB						0	$0
56 Barre City	0	GS/CB						0	$0
57 Barre City	0	OF/GS/CB						0	$0
58 Barre City	0	OF/CB/SWPPP						0	$0
59 Barre City	0	CB						0	$0
60 Barre City	0	CB						0	$0
61 Barre City	0	OF						0	$0
62 Barre City	0	CB						0	$0
63 Barre City	0	OF						0	$0
64 Barre City	0	CB/OF						0	$0
65 Barre City	0	CB/OF						0	$0
66 Barre City	0	CB						0	$0
67 Barre City	0	CB						0	$0
68 Barre City	0	OF/CB						0	$0
69 Barre City	1	BRA/CB/GS	91,566.70		$33	$23,423	ERP, Section 319, LCBP	0	$0
70 Barre City	1	BRA/CB	14,618.25		$33	$23,423	ERP, Section 319, LCBP	0	$0
71 Barre City	0	CB						0	$0
72 Barre City	0	CB						0	$0
73 Barre City	0	OF						0	$0
74 Barre City	0	CB						0	$0
75 Barre City	0	OF						0	$0
76 Barre City	0	OF						0	$0
77 Barre City	0	OF						0	$0
78 Barre City	0	CB/OF						98	$45,181
80 Barre City	0	CB/OF						39	$18,005
81 Barre City	0	CB/OF						35	$16,261
82 Barre City	0	CB/OF						138	$63,523
83 Barre City	1	EDP/CB/OF	112,626.28		$25	$17,745	ERP, Section 319, LCBP	137	$63,186

Barre City - Subwatershed Prioritization and Recommendations (pg3)

Watershed Number	Action List #	Proposed Action	Proposed or Existing Stormwater Treatment Practice	Permit Number	Watershed Area (Acres)	Percent Mapped Impervious Area (MIA)	Sediment Load with Current Reductions (lbs)	Sediment Load with Priority Action (lbs)	Phosphorus Load with Current Reductions (lbs)	Phosphorus Load with Priority Action (lbs)	Water Quality Volume (Acre-Feet)	Channel Protection (Acre-Feet)
84 Barre City	1	Combine with 83-87	EDP/CB/OF		9.9	17	1,482	445	4.1	2.7	0.08	0.18
85 Barre City	1	Combine with 83-87	EDP/CB/OF		2.8	44	1,185	355	3.3	2.1	0.07	0.14
86 Barre City	1	Combine with 83-87	EDP/CB/OF		3.7	26	835	251	2.3	1.5	0.05	0.11
87 Barre City	1	Combine with 83-87	EDP/CB/OF		3.9	25	843	253	2.3	1.5	0.05	0.11
88 Barre City			CB		50.9	47	28,163	28,163	78.2	78.2	1.59	FALSE
89 Barre City			CB		3.1	46	1,364	1,364	3.8	3.8	0.08	FALSE
90 Barre City			CB		0.6	43	259	259	0.7	0.7	0.01	FALSE
91 Barre City			CB		38.9	40	18,239	18,239	50.7	50.7	1.03	FALSE
92 Barre City			CB		0.0	66	32	32	0.1	0.1	0.00	FALSE
93 Barre City			OF		18.7	10	1,904	1,904	5.3	5.3	0.11	FALSE
94 Barre City			OF		2.0	46	1,096	1,096	3.0	3.0	0.06	FALSE
95 Barre City			OF		2.2	17	332	332	0.9	0.9	0.02	FALSE
96 Barre City			OF		6.5	30	1,677	1,677	4.7	4.7	0.09	FALSE
97 Barre City			OF		4.4	16	609	609	1.7	1.7	0.03	FALSE
98 Barre City			OF		1.1	72	988	988	2.7	2.7	0.06	FALSE
99 Barre City			CB		1.6	61	1,176	1,176	3.3	3.3	0.07	FALSE
100 Barre City			CB		0.7	55	365	365	1.0	1.0	0.02	FALSE
101 Barre City			CB		16.2	51	9,663	9,663	26.8	26.8	0.55	FALSE
102 Barre City			OF		9.0	11	984	984	2.7	2.7	0.06	0.11
103 Barre City			CB		1.3	57	755	755	2.1	2.1	0.04	FALSE
104 Barre City			CB		12.9	72	11,936	11,936	33.2	33.2	0.68	FALSE
105 Barre City			CB		0.5	74	491	491	1.4	1.4	0.03	FALSE
106 Barre City			CB		0.1	68	70	70	0.2	0.2	0.00	FALSE
109 Barre City			CB/OF		15.6	46	6,823	6,823	19.0	19.0	0.39	0.79
110 Barre City			CB/OF		1.5	48	695	695	1.9	1.9	0.04	0.08
111 Barre City			CB/OF		2.1	42	820	820	2.3	2.3	0.05	0.10
112 Barre City			CB/OF		2.8	20	485	485	1.3	1.3	0.03	0.06
113 Barre City			CB/OF		13.2	19	2,236	2,236	6.2	6.2	0.13	0.28
114 Barre City			OF		5.2	7	451	451	1.3	1.3	0.03	0.04
115 Barre City			OF		4.6	4	346	346	1.0	1.0	0.02	0.02
116 Barre City			CB/OF		7.9	26	1,764	1,764	4.9	4.9	0.10	0.22
117 Barre City			CB/OF		0.8	25	173	173	0.5	0.5	0.01	0.02
118 Barre City			CB/OF		27.0	27	6,229	6,229	17.3	17.3	0.35	0.79
119 Barre City			CB/OF		1.3	22	239	239	0.7	0.7	0.01	0.03
120 Barre City			CB/OF		6.8	29	1,741	1,741	4.8	4.8	0.10	0.22
121 Barre City			CB/OF/CS		5.5	35	1,712	1,712	4.8	4.8	0.10	0.21
122 Barre City			CB/OF		6.9	31	1,867	1,867	5.2	5.2	0.11	0.23
123 Barre City			CB/OF		6.8	34	2,077	2,077	5.8	5.8	0.12	0.26
124 Barre City			CB/OF		4.9	28	1,202	1,202	3.3	3.3	0.07	0.15
125 Barre City			CB/OF		5.0	26	1,101	1,101	3.1	3.1	0.06	0.14
126 Barre City			CB/OF		5.0	26	1,103	1,103	3.1	3.1	0.06	0.14
127 Barre City			GS/CB/OF		6.4	9	646	646	1.8	1.8	0.04	0.07
128 Barre City			OF		2.1	8	187	187	0.5	0.5	0.01	0.02
129 Barre City			OF		3.1	15	431	431	1.2	1.2	0.02	0.05
130 Barre City			OF		9.7	7	843	843	2.3	2.3	0.05	0.07
131 Barre City			CB		1.0	43	412	412	1.1	1.1	0.02	0.05
132 Barre City			OF		2.7	14	353	353	1.0	1.0	0.02	0.04
134 Barre City			CB/OF		6.1	23	1,227	1,227	3.4	3.4	0.07	0.16
135 Barre City			OF		1.8	20	316	316	0.9	0.9	0.02	0.04
136 Barre City			CB/OF		5.8	35	1,810	1,810	5.0	5.0	0.10	0.22
137 Barre City			OF		0.8	37	268	268	0.7	0.7	0.02	0.03

Barre City - Subwatershed Prioritization and Recommendations (pg3)

Watershed Number	Action List #	Proposed or Existing Stormwater Treatment Practice	Estimated Basin Construction Cost	Estimated Other BMP Construction Cost	Cost of Sediment Removal Per Pound (based on annual sediment load)	Cost of Phosphorus Removal Per Pound (based on annual phosphorus load)	Assistance Program	Number of LID - Roof Raingardens to treat CPv (Residential)	Raingarden Cost
84 Barre City	1	EDP/CB/OF	Combine with 83-87					92	$42,536
85 Barre City	1	EDP/CB/OF	Combine with 83-87					69	$31,733
86 Barre City	1	EDP/CB/OF	Combine with 83-87					53	$24,475
87 Barre City	1	EDP/CB/OF	Combine with 83-87					54	$24,757
88 Barre City	0	CB						0	$0
89 Barre City	0	CB						0	$0
90 Barre City	0	CB						0	$0
91 Barre City	0	CB						0	$0
92 Barre City	0	CB						0	$0
93 Barre City	0	OF						0	$0
94 Barre City	0	OF						0	$0
95 Barre City	0	OF						0	$0
96 Barre City	0	OF						0	$0
97 Barre City	0	OF						0	$0
98 Barre City	0	OF						0	$0
99 Barre City	0	CB						0	$0
100 Barre City	0	CB						0	$0
101 Barre City	0	CB						0	$0
102 Barre City	0	OF						54	$24,813
103 Barre City	0	CB						0	$0
104 Barre City	0	CB						0	$0
105 Barre City	0	CB						0	$0
106 Barre City	0	CB						0	$0
109 Barre City	0	CB/OF						394	$181,061
110 Barre City	0	CB/OF						40	$18,230
111 Barre City	0	CB/OF						48	$22,281
112 Barre City	0	CB/OF						31	$14,179
113 Barre City	0	CB/OF						142	$65,268
114 Barre City	0	OF						19	$8,777
115 Barre City	0	OF						10	$4,445
116 Barre City	0	CB/OF						112	$51,708
117 Barre City	0	CB/OF						11	$5,064
118 Barre City	0	CB/OF						396	$182,243
119 Barre City	0	CB/OF						15	$7,033
120 Barre City	0	CB/OF						110	$50,526
121 Barre City	0	CB/OF/CS						105	$48,388
122 Barre City	0	CB/OF						117	$53,846
123 Barre City	0	CB/OF						128	$58,910
124 Barre City	0	CB/OF						76	$34,997
125 Barre City	0	CB/OF						70	$32,296
126 Barre City	0	CB/OF						70	$32,352
127 Barre City	0	GS/CB/OF						33	$15,248
128 Barre City	0	OF						9	$3,939
129 Barre City	0	OF						26	$12,097
130 Barre City	0	OF						36	$16,373
131 Barre City	0	CB						24	$11,140
132 Barre City	0	OF						21	$9,790
134 Barre City	0	CB/OF						78	$36,066
135 Barre City	0	OF						20	$9,227
136 Barre City	0	CB/OF						111	$51,201
137 Barre City	0	OF						16	$7,483

Barre City - Subwatershed Prioritization and Recommendations

(pg4)

Watershed Number	Action List #	Proposed Action	Proposed or Existing Stormwater Treatment Practice	Permit Number	Watershed Area (Acres)	Percent Mapped Impervious Area (MIA)	Sediment Load with Current Reductions (lbs)	Sediment Load with Priority Action (lbs)	Phosphorus Load with Current Reductions (lbs)	Phosphorus Load with Priority Action (lbs)	Water Quality Volume (Acre-Feet)	Channel Protection (Acre-Feet)
138 Barre City			CB/GS/OF		34.0	17	5,042	5,042	14.0	14.0	0.29	0.63
139 Barre City			OF		4.1	10	426	426	1.2	1.2	0.02	0.04
140 Barre City			CB/GS/OF		29.5	17	4,383	4,383	12.2	12.2	0.25	0.55
141 Barre City			OF		2.6	40	960	960	2.7	2.7	0.05	0.11
142 Barre City			CB/OF		69.7	46	37,841	37,841	105.1	105.1	2.14	FALSE
143 Barre City			OF		80.0	1	5,354	5,354	14.9	14.9	0.30	0.06
144 Barre City			CB/OF		12.8	20	2,234	2,234	6.2	6.2	0.13	0.28
145 Barre City			CB/OF		2.3	47	1,028	1,028	2.9	2.9	0.06	0.12
146 Barre City			CB/OF		9.7	15	1,339	1,339	3.7	3.7	0.08	0.16
147 Barre City			OF		13.0	2	915	915	2.5	2.5	0.05	0.03
148 Barre City			CB/OF		5.7	27	1,315	1,315	3.7	3.7	0.07	0.17
149 Barre City			CB		23.2	51	13,934	13,934	38.7	38.7	0.79	1.30
150 Barre City			CB/OF		5.2	24	1,086	1,086	3.0	3.0	0.06	0.14
152 Barre City			CB/POP	5858-INDS	23.0	80	14,063	14,063	52.1	52.1	1.33	FALSE
155 Barre City			CB		9.2	14	1,184	1,184	3.3	3.3	0.07	0.14
156 Barre City			CB/OF		2.9	57	1,660	1,660	4.6	4.6	0.09	0.18
157 Barre City			OF		10.1	2	711	711	2.0	2.0	0.04	0.03
158 Barre City			CB/GS		7.4	25	1,576	1,576	4.4	4.4	0.09	0.20
159 Barre City			OF/CB		12.4	15	1,646	1,646	4.6	4.6	0.09	FALSE
160 Barre City			OF/CB		25.3	26	5,764	5,764	16.0	16.0	0.33	FALSE
161 Barre City			OF/GS/CB		12.2	15	1,667	1,667	4.6	4.6	0.09	FALSE
162 Barre City			CB		1.9	50	937	937	2.6	2.6	0.05	FALSE
163 Barre City			CB		2.1	31	571	571	1.6	1.6	0.03	FALSE
164 Barre City			CB		3.2	67	2,639	2,639	7.3	7.3	0.15	FALSE
165 Barre City			CB		2.0	83	2,042	2,042	5.7	5.7	0.12	FALSE
166 Barre City	3	Extended Detention Basin at corner of Granite St and Madison St, combine with 168 and 187	EDP/CB/GS/OF		35.9	23	7,213	4,328	20.0	16.0	0.41	FALSE
167 Barre City	2	Bioretention area at corner of Cleveland St and Lincoln St	BRA/OF/CB		2.6	26	600	360	1.7	1.3	0.03	0.08
168 Barre City	3	Extended Detention Basin at corner of Granite St and Madison St, combine with 166 and 187	EDP/CB/GS/OF		22.7	5	1,768	1,061	4.9	3.9	0.10	FALSE
169 Barre City			CB		0.3	30	68	68	0.2	0.2	0.00	FALSE
170 Barre City			CB		0.6	30	157	157	0.4	0.4	0.01	FALSE
171 Barre City			OF/CB		3.9	24	802	802	2.2	2.2	0.05	FALSE
172 Barre City			GS/CB		5.7	21	1,041	1,041	2.9	2.9	0.06	FALSE
173 Barre City			CB		3.7	85	3,905	3,905	10.8	10.8	0.22	FALSE
174 Barre City	3	Raingarden adjacent to RR Tracks next to 1 Williams Lane	BRA/CB/SWPPP	4966-9003	6.6	87	7,147	5,718	19.9	17.9	0.40	FALSE
175 Barre City			CB		3.3	82	3,325	3,325	9.2	9.2	0.19	FALSE
176 Barre City			CB		16.4	51	9,738	9,738	27.0	27.0	0.55	0.91
178 Barre City			CB		3.0	47	1,390	1,390	3.9	3.9	0.08	FALSE

Barre City - Subwatershed Prioritization and Recommendations (pg4)

Watershed Number	Action List #	Proposed or Existing Stormwater Treatment Practice	Estimated Basin Construction Cost	Estimated Other BMP Construction Cost	Cost of Sediment Removal Per Pound (based on annual sediment load)	Cost of Phosphorus Removal Per Pound (based on annual phosphorus load)	Assistance Program	Number of LID - Roof Raingardens to treat CPv (Residential)	Raingarden Cost
138 Barre City	0	CB/GS/OF						314	$144,376
139 Barre City	0	OF						22	$10,240
140 Barre City	0	CB/GS/OF						273	$125,584
141 Barre City	0	OF						57	$26,445
142 Barre City	0	CB/OF						0	$0
143 Barre City	0	OF						29	$13,279
144 Barre City	0	CB/OF						142	$65,380
145 Barre City	0	CB/OF						59	$27,064
146 Barre City	0	CB/OF						82	$37,641
147 Barre City	0	OF						16	$7,483
148 Barre City	0	CB/OF						84	$38,485
149 Barre City	0	CB						651	$299,345
150 Barre City	0	CB/OF						69	$31,902
152 Barre City	0	CB/POP						0	$0
155 Barre City	0	CB						71	$32,578
156 Barre City	0	CB/OF						90	$41,355
157 Barre City	0	OF						13	$6,020
158 Barre City	0	CB/GS						101	$46,306
159 Barre City	0	OF/CB						0	$0
160 Barre City	0	OF/CB						0	$0
161 Barre City	0	OF/GS/CB						0	$0
162 Barre City	0	CB						0	$0
163 Barre City	0	CB						0	$0
164 Barre City	0	CB						0	$0
165 Barre City	0	CB						0	$0
166 Barre City	3	EDP/CB/GS/OF	184,480.19		$43	$155,742	ERP, Section 319, LCBP	0	$0
167 Barre City	2	BRA/OF/CB	7,802.12		$33	$23,423	ERP, Section 319, LCBP	38	$17,555
168 Barre City	3	EDP/CB/GS/OF	Combine with 166,187					0	$0
169 Barre City	0	CB						0	$0
170 Barre City	0	CB						0	$0
171 Barre City	0	OF/CB						0	$0
172 Barre City	0	GS/CB						0	$0
173 Barre City	0	CB						0	$0
174 Barre City	3	BRA/CB/SWPPP	93,004.53		$65	$46,846	ERP, Section 319, LCBP	0	$0
175 Barre City	0	CB						0	$0
176 Barre City	0	CB						455	$209,337
178 Barre City	0	CB						0	$0

Barre City - Subwatershed Prioritization and Recommendations (pg2)

Watershed Number	Action List #	Proposed Action	Proposed or Existing Stormwater Treatment Practice	Permit Number	Watershed Area (Acres)	Percent Mapped Impervious Area (MIA)	Sediment Load with Current Reductions (lbs)	Sediment Load with Priority Action (lbs)	Phosphorus Load with Current Reductions (lbs)	Phosphorus Load with Priority Action (lbs)	Water Quality Volume (Acre-Feet)	Channel Protection (Acre-Feet)
179 Barre City			GS/CB		29.5	30	7,735	7,735	21.5	21.5	0.44	FALSE
180 Barre City			GS		0.8	41	322	322	0.9	0.9	0.02	FALSE
181 Barre City			CB/GS		10.4	15	1,384	1,384	3.8	3.8	0.08	0.17
182 Barre City			CB/GS	3197-9010	5.9	34	1,495	1,495	4.2	4.2	0.08	0.22
183 Barre City			CB/GS	3197-9010	0.3	44	101	101	0.3	0.3	0.01	0.01
184 Barre City			CB/GS	3197-9010	1.5	66	994	994	2.8	2.8	0.06	0.11
185 Barre City			CB/GS	3531-9010	24.5	27	4,848	4,848	13.5	13.5	0.27	0.73
186 Barre City			CB/GS	4829-9010	19.8	24	3,349	3,349	9.3	9.3	0.19	0.51
187 Barre City	3	Extended Detention Basin at corner of Granite St and Madison St, combine with 166 and 168	EDP/CB/GS/OF		8.1	25	1,712	1,027	4.8	3.8	0.10	FALSE
188 Barre City			GS/CB		24.1	6	2,067	2,067	5.7	5.7	0.12	FALSE
189 Barre City			CB		3.7	54	2,032	2,032	5.6	5.6	0.11	FALSE
190 Barre City			CB		2.2	81	2,196	2,196	6.1	6.1	0.12	FALSE
191 Barre City			GS/CB		9.0	72	7,917	7,917	22.0	22.0	0.45	FALSE
192 Barre City			CB		3.1	68	2,279	2,279	6.3	6.3	0.13	FALSE
193 Barre City			CB		21.3	39	9,633	9,633	26.8	26.8	0.55	FALSE
194 Barre City	3	Extended Detention Basin behind 2 John St	EDP/OF/CB		11.7	17	1,787	357	5.0	3.0	0.10	FALSE
195 Barre City			OF/CB/GS		16.1	11	1,795	1,795	5.0	5.0	0.10	0.20
196 Barre City			CB		7.4	11	820	820	2.3	2.3	0.05	0.09
197 Barre City			GS/CB		21.9	13	2,656	2,656	7.4	7.4	0.15	0.31
198 Barre City			GS/CB		30.7	13	3,710	3,710	10.3	10.3	0.21	0.43
199 Barre City			GS/CB	4818-9010	7.1	34	1,819	1,819	5.1	5.1	0.10	0.26
200 Barre City	1	Extended Detention Basin in open space on west side of entrance road	EDP/GS/CB/OF		23.6	32	8,696	1,739	24.2	14.5	0.49	0.82
201 Barre City	3	Bioretention to west of 21 Lawrence Ave, combine with 202	BRA/OF/CB		6.4	8	609	122	1.7	1.0	0.03	FALSE
202 Barre City	3	Bioretention to west of 21 Lawrence Ave, combine with 201	BRA/GS/OF		28.1	2	1,977	395	5.5	3.3	0.11	0.07
203 Barre City			CB		1.2	41	459	459	1.3	1.3	0.03	0.05
204 Barre City			CB/GS	3828-9010	99.1	2	6,999	6,999	19.4	19.4	0.40	0.26
205 Barre City			CB/OF		33.9	13	4,150	4,150	11.5	11.5	0.23	0.49
206 Barre City			OF		12.7	39	4,486	4,486	12.5	12.5	0.25	FALSE
207 Barre City			CB		0.2	98	292	292	0.8	0.8	0.02	FALSE
208 Barre City			OF		4.2	56	2,823	2,823	7.8	7.8	0.16	FALSE
209 Barre City			OF		5.2	54	2,787	2,787	7.7	7.7	0.16	FALSE
210 Barre City			CB		0.6	18	89	89	0.2	0.2	0.01	FALSE
211 Barre City			CB		0.6	24	132	132	0.4	0.4	0.01	FALSE
213 Barre City			CB		1.1	25	234	234	0.6	0.6	0.01	FALSE
214 Barre City			OF/CB		4.6	28	1,101	1,101	3.1	3.1	0.06	0.14
215 Barre City			OF/CB		3.9	17	598	598	1.7	1.7	0.03	0.07
216 Barre City			OF		3.2	5	251	251	0.7	0.7	0.01	0.02

Barre City - Subwatershed Prioritization and Recommendations (pg2)

Watershed Number	Action List #	Proposed or Existing Stormwater Treatment Practice	Estimated Basin Construction Cost	Estimated Other BMP Construction Cost	Cost of Sediment Removal Per Pound (based on annual sediment load)	Cost of Phosphorus Removal Per Pound (based on annual phosphorus load)	Assistance Program	Number of LID - Roof Raingardens to treat CPv (Residential)	Raingarden Cost
179 Barre City	0	GS/CB						0	$0
180 Barre City	0	GS						0	$0
181 Barre City	0	CB/GS						84	$38,542
182 Barre City	0	CB/GS						109	$50,076
183 Barre City	0	CB/GS						7	$3,095
184 Barre City	0	CB/GS						55	$25,319
185 Barre City	0	CB/GS						367	$168,964
186 Barre City	0	CB/GS						257	$118,157
187 Barre City	3	EDP/CB/GS/OF	Combine with 166,168					0	$0
188 Barre City	0	GS/CB						0	$0
189 Barre City	0	CB						0	$0
190 Barre City	0	CB						0	$0
191 Barre City	0	GS/CB						0	$0
192 Barre City	0	CB						0	$0
193 Barre City	0	CB						0	$0
194 Barre City	3	EDP/OF/CB	30,832.97		$22	$15,527	ERP, Section 319, LCBP	0	$0
195 Barre City	0	OF/CB/GS						100	$45,969
196 Barre City	0	CB						46	$20,987
197 Barre City	0	GS/CB						155	$71,232
198 Barre City	0	GS/CB						216	$99,420
199 Barre City	0	GS/CB						132	$60,766
200 Barre City	1	EDP/GS/CB/OF	150,030.02		$22	$15,527	ERP, Section 319, LCBP	412	$189,388
201 Barre City	3	BRA/OF/CB	33,651.68		$16	$11,712	ERP, Section 319, LCBP	0	$0
202 Barre City	3	BRA/GS/OF	Combine with 201					35	$15,923
203 Barre City	0	CB						27	$12,547
204 Barre City	0	CB/GS						129	$59,135
205 Barre City	0	CB/OF						243	$111,743
206 Barre City	0	OF						0	$0
207 Barre City	0	CB						0	$0
208 Barre City	0	OF						0	$0
209 Barre City	0	OF						0	$0
210 Barre City	0	CB						0	$0
211 Barre City	0	CB						0	$0
213 Barre City	0	CB						0	$0
214 Barre City	0	OF/CB						70	$32,127
215 Barre City	0	OF/CB						37	$17,217
216 Barre City	0	OF						8	$3,770

Barre City - Subwatershed Prioritization and Recommendations (pg2)

Watershed Number	Action List #	Proposed Action	Proposed or Existing Stormwater Treatment Practice	Permit Number	Watershed Area (Acres)	Percent Mapped Impervious Area (MIA)	Sediment Load with Current Reductions (lbs)	Sediment Load with Priority Action (lbs)	Phosphorus Load with Current Reductions (lbs)	Phosphorus Load with Priority Action (lbs)	Water Quality Volume (Acre-Feet)	Channel Protection (Acre-Feet)
217 Barre City			OF/CB		5.4	68	4,448	4,448	12.4	12.4	0.25	FALSE
218 Barre City			OF		1.3	36	425	425	1.2	1.2	0.02	FALSE
219 Barre City			OF/SWPPP	4966-9003	2.0	31	540	540	1.5	1.5	0.03	FALSE
220 Barre City			OF		2.3	44	964	964	2.7	2.7	0.05	FALSE
221 Barre City			OF		0.9	74	828	828	2.3	2.3	0.05	FALSE
222 Barre City			OF/CB		4.2	56	2,387	2,387	6.6	6.6	0.14	FALSE
223 Barre City			CB		5.3	21	968	968	2.7	2.7	0.05	0.12
224 Barre City			OF/CB		5.0	29	1,262	1,262	3.5	3.5	0.07	0.16
225 Barre City			OF/CB		3.7	22	708	708	2.0	2.0	0.04	0.09
226 Barre City			OF/CB		3.8	28	935	935	2.6	2.6	0.05	0.12
227 Barre City			CB		0.4	65	348	348	1.0	1.0	0.02	0.03
228 Barre City			OF/CB		1.0	38	350	350	1.0	1.0	0.02	0.04
229 Barre City			CB		2.4	56	1,550	1,550	4.3	4.3	0.09	0.14
230 Barre City			CB		1.4	72	1,236	1,236	3.4	3.4	0.07	0.11
231 Barre City			CB		1.1	82	1,135	1,135	3.2	3.2	0.06	0.10
232 Barre City			OF		1.0	19	164	164	0.5	0.5	0.01	0.02
233 Barre City			OF		1.2	61	741	741	2.1	2.1	0.04	0.08
234 Barre City			CB		1.5	34	471	471	1.3	1.3	0.03	0.06
235 Barre City			OF		1.2	43	497	497	1.4	1.4	0.03	0.06
236 Barre City			CB		0.7	67	491	491	1.4	1.4	0.03	0.05
237 Barre City			OF		0.2	62	163	163	0.5	0.5	0.01	0.02
238 Barre City			OF		2.2	37	728	728	2.0	2.0	0.04	0.09
239 Barre City			OF		1.1	36	347	347	1.0	1.0	0.02	0.04
240 Barre City			OF		1.2	29	307	307	0.9	0.9	0.02	0.04
241 Barre City			OF		1.5	64	1,031	1,031	2.9	2.9	0.06	0.11
242 Barre City			OF		0.8	41	319	319	0.9	0.9	0.02	0.04
243 Barre City			CB		2.1	80	2,066	2,066	5.7	5.7	0.12	0.18
244 Barre City			CB/OF		1.3	35	420	420	1.2	1.2	0.02	FALSE
245 Barre City			OF		1.0	32	266	266	0.7	0.7	0.02	FALSE
246 Barre City			CB/GS		1.5	50	721	721	2.0	2.0	0.04	FALSE
247 Barre City			OF		4.5	13	560	560	1.6	1.6	0.03	FALSE
248 Barre City			OF/CB		3.4	15	460	460	1.3	1.3	0.03	FALSE
249 Barre City			OF		4.5	54	2,427	2,427	6.7	6.7	0.14	FALSE
250 Barre City			CB		2.4	76	2,211	2,211	6.1	6.1	0.13	FALSE
251 Barre City			CB		1.3	97	1,583	1,583	4.4	4.4	0.09	FALSE
252 Barre City			OF		1.2	43	597	597	1.7	1.7	0.03	FALSE
253 Barre City			CB		0.8	87	818	818	2.3	2.3	0.05	FALSE
254 Barre City			CB		1.3	98	1,554	1,554	4.3	4.3	0.09	FALSE
255 Barre City			CB		0.3	99	405	405	1.1	1.1	0.02	FALSE
256 Barre City			OF		2.0	57	1,354	1,354	3.8	3.8	0.08	FALSE
257 Barre City			OF		1.0	44	530	530	1.5	1.5	0.03	FALSE
258 Barre City			OF/CB		3.8	54	2,402	2,402	6.7	6.7	0.14	FALSE
260 Barre City			OF		3.3	54	1,806	1,806	5.0	5.0	0.10	FALSE
261 Barre City			OF/CB		4.8	44	1,945	1,945	5.4	5.4	0.11	FALSE
262 Barre City			OF/CB		2.6	73	2,263	2,263	6.3	6.3	0.13	FALSE
263 Barre City			OF/GS/SWPPP	5109-9003	3.6	64	2,494	2,494	6.9	6.9	0.14	FALSE
264 Barre City			CB		1.5	32	415	415	1.2	1.2	0.02	FALSE
265 Barre City			GS/CB		9.9	28	2,417	2,417	6.7	6.7	0.14	FALSE
266 Barre City			OF		0.9	12	100	100	0.3	0.3	0.01	FALSE
267 Barre City			OF/CB		136.2	2	9,503	9,503	26.4	26.4	0.54	FALSE
270 Barre City			OF/CB/SWPPP	6447-9003	0.5	95	619	619	1.7	1.7	0.04	FALSE

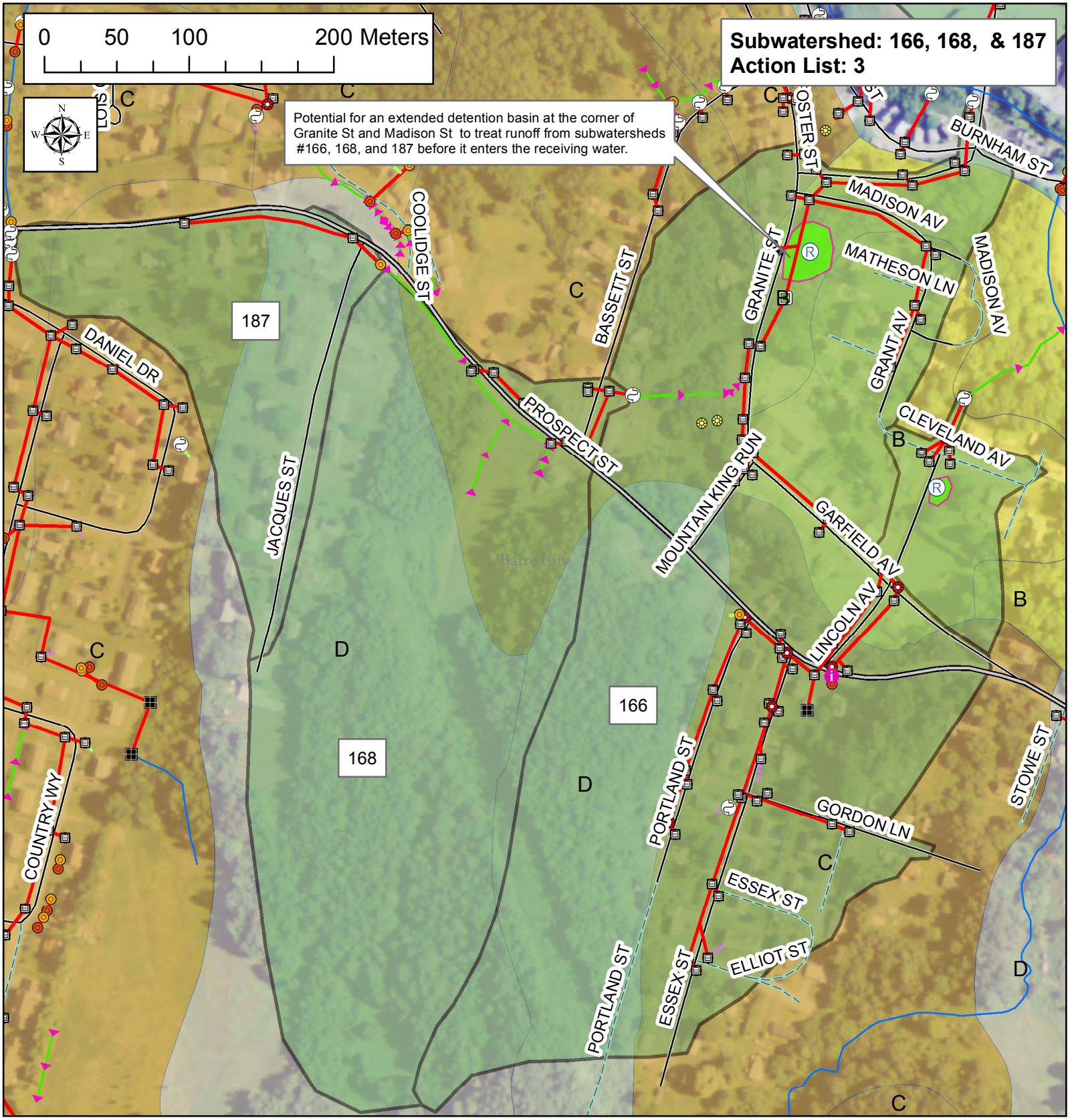
Barre City - Subwatershed Prioritization and Recommendations (pg2)

Watershed Number	Action List #	Proposed or Existing Stormwater Treatment Practice	Estimated Basin Construction Cost	Estimated Other BMP Construction Cost	Cost of Sediment Removal Per Pound (based on annual sediment load)	Cost of Phosphorus Removal Per Pound (based on annual phosphorus load)	Assistance Program	Number of LID - Roof Raingardens to treat CPv (Residential)	Raingarden Cost
217 Barre City	0	OF/CB						0	$0
218 Barre City	0	OF						0	$0
219 Barre City	0	OF/SWPPP						0	$0
220 Barre City	0	OF						0	$0
221 Barre City	0	OF						0	$0
222 Barre City	0	OF/CB						0	$0
223 Barre City	0	CB						62	$28,414
224 Barre City	0	OF/CB						80	$36,629
225 Barre City	0	OF/CB						45	$20,818
226 Barre City	0	OF/CB						59	$27,232
227 Barre City	0	CB						16	$7,314
228 Barre City	0	OF/CB						21	$9,734
229 Barre City	0	CB						72	$33,084
230 Barre City	0	CB						56	$25,769
231 Barre City	0	CB						51	$23,294
232 Barre City	0	OF						10	$4,783
233 Barre City	0	OF						39	$18,061
234 Barre City	0	CB						29	$13,335
235 Barre City	0	OF						29	$13,391
236 Barre City	0	CB						25	$11,591
237 Barre City	0	OF						9	$3,939
238 Barre City	0	OF						44	$20,368
239 Barre City	0	OF						21	$9,734
240 Barre City	0	OF						19	$8,890
241 Barre City	0	OF						54	$24,700
242 Barre City	0	OF						19	$8,721
243 Barre City	0	CB						92	$42,536
244 Barre City	0	CB/OF						0	$0
245 Barre City	0	OF						0	$0
246 Barre City	0	CB/GS						0	$0
247 Barre City	0	OF						0	$0
248 Barre City	0	OF/CB						0	$0
249 Barre City	0	OF						0	$0
250 Barre City	0	CB						0	$0
251 Barre City	0	CB						0	$0
252 Barre City	0	OF						0	$0
253 Barre City	0	CB						0	$0
254 Barre City	0	CB						0	$0
255 Barre City	0	CB						0	$0
256 Barre City	0	OF						0	$0
257 Barre City	0	OF						0	$0
258 Barre City	0	OF/CB						0	$0
260 Barre City	0	OF						0	$0
261 Barre City	0	OF/CB						0	$0
262 Barre City	0	OF/CB						0	$0
263 Barre City	0	OF/GS/SWPPP						0	$0
264 Barre City	0	CB						0	$0
265 Barre City	0	GS/CB						0	$0
266 Barre City	0	OF						0	$0
267 Barre City	0	OF/CB						0	$0
270 Barre City	0	OF/CB/SWPPP						0	$0

Target Maps

Showing Priority Action List Drainage Areas

And Potential Retrofit Locations



Barre City, VT

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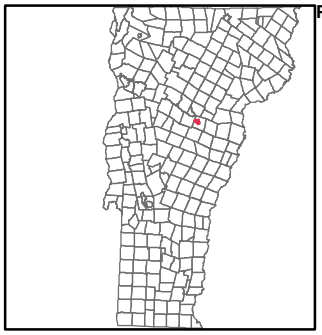

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DEC - WSMD - Ecosystem Restoration Section
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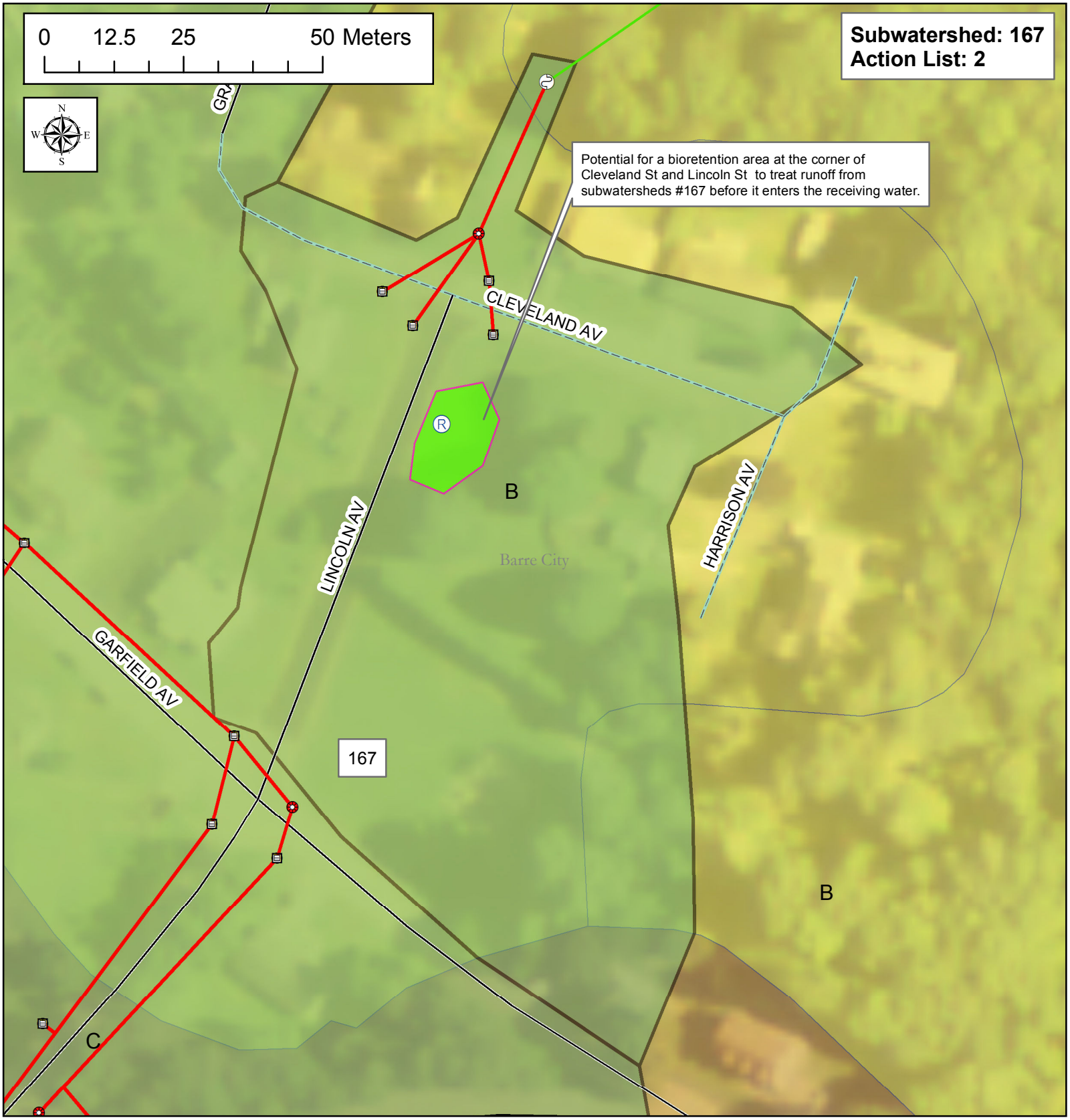

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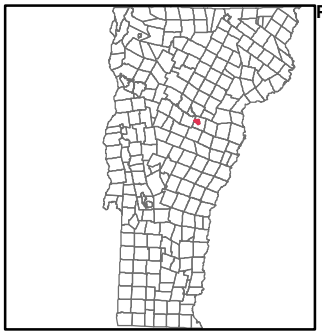

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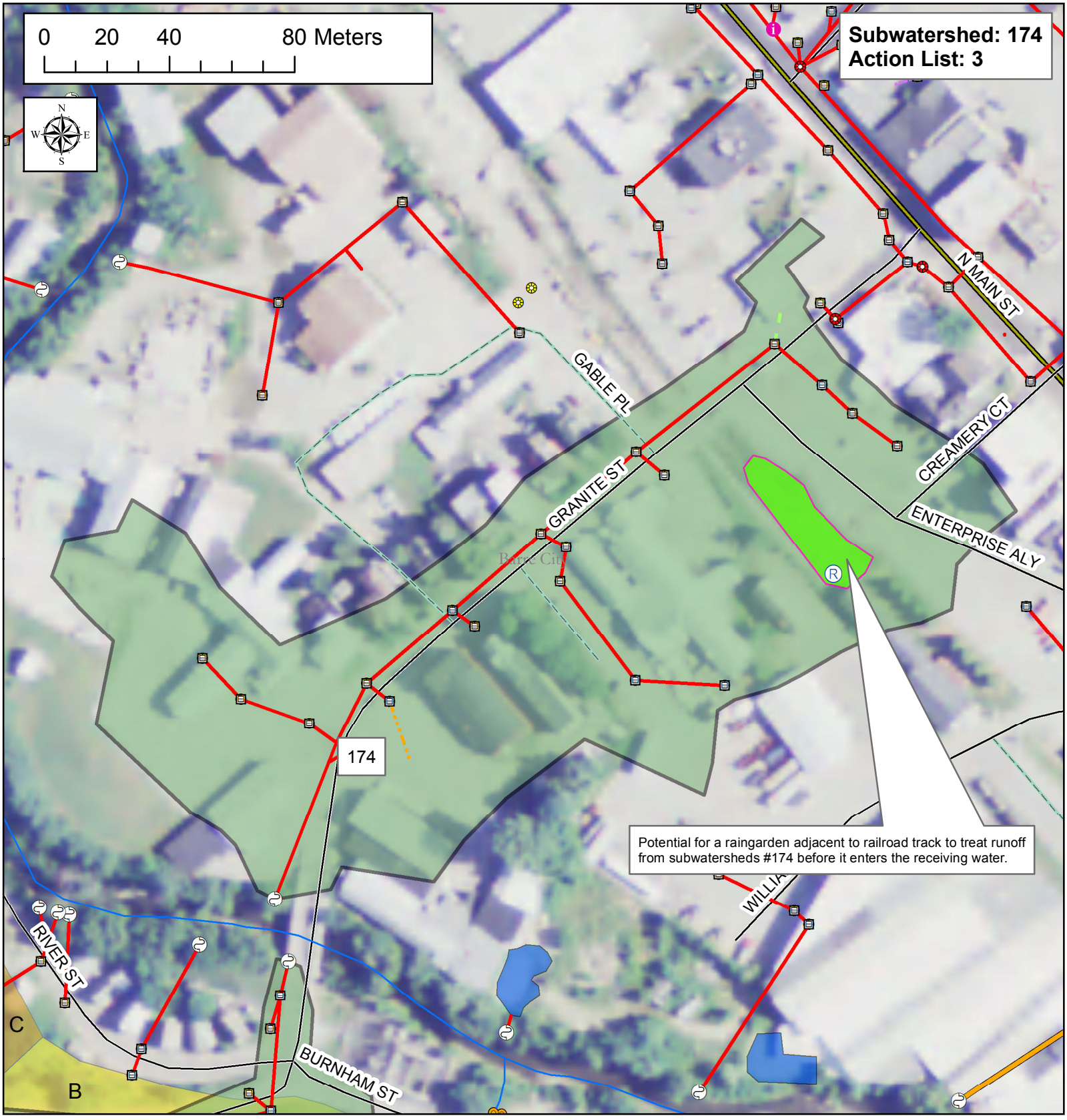

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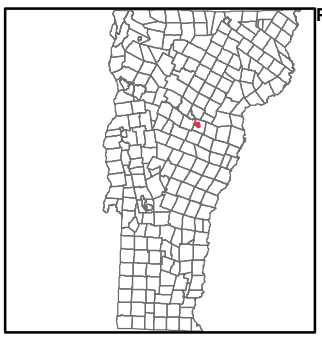

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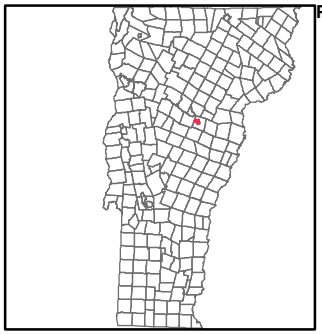

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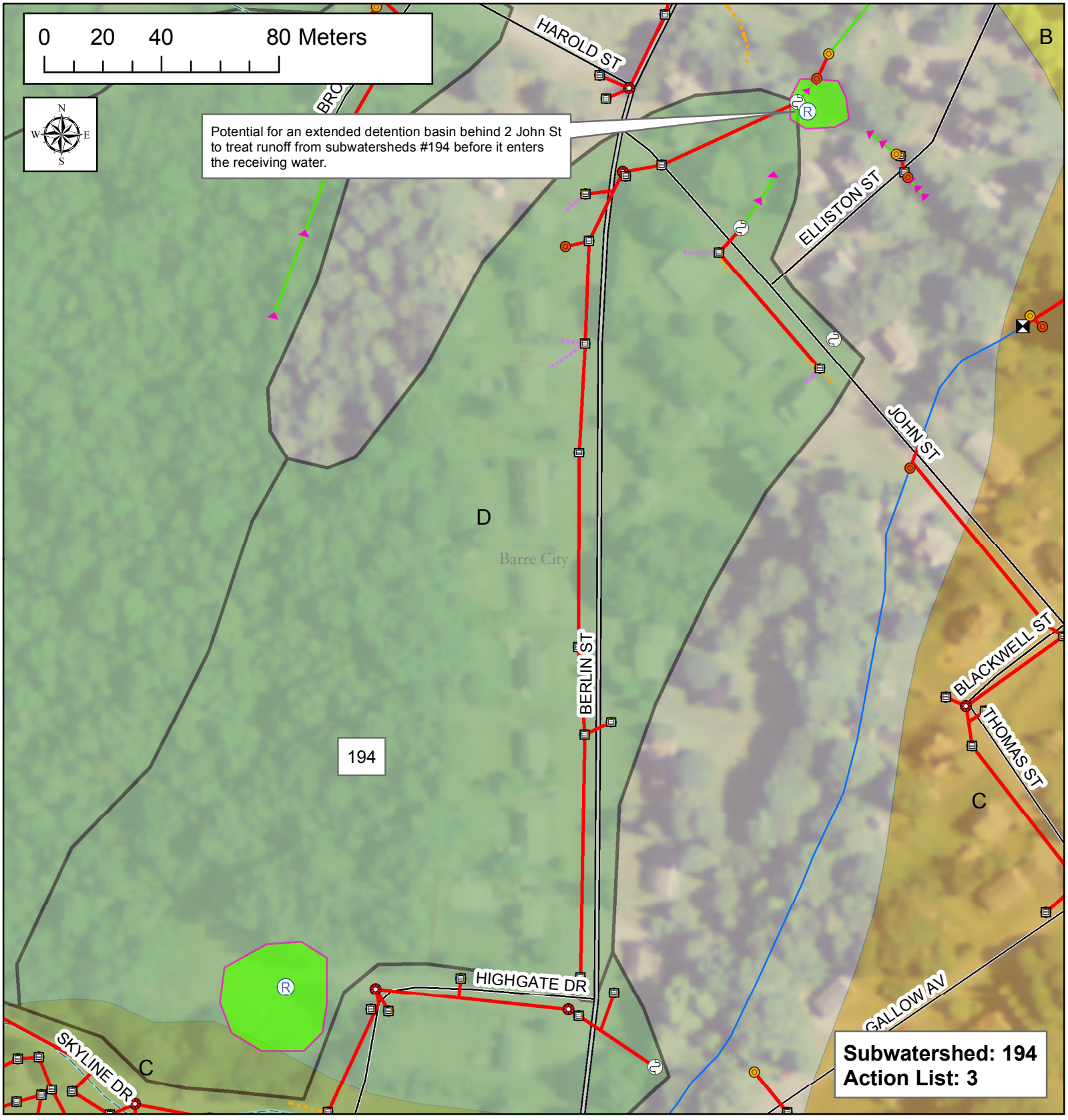

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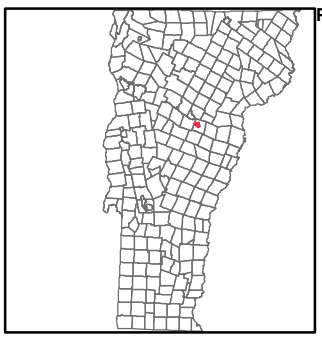

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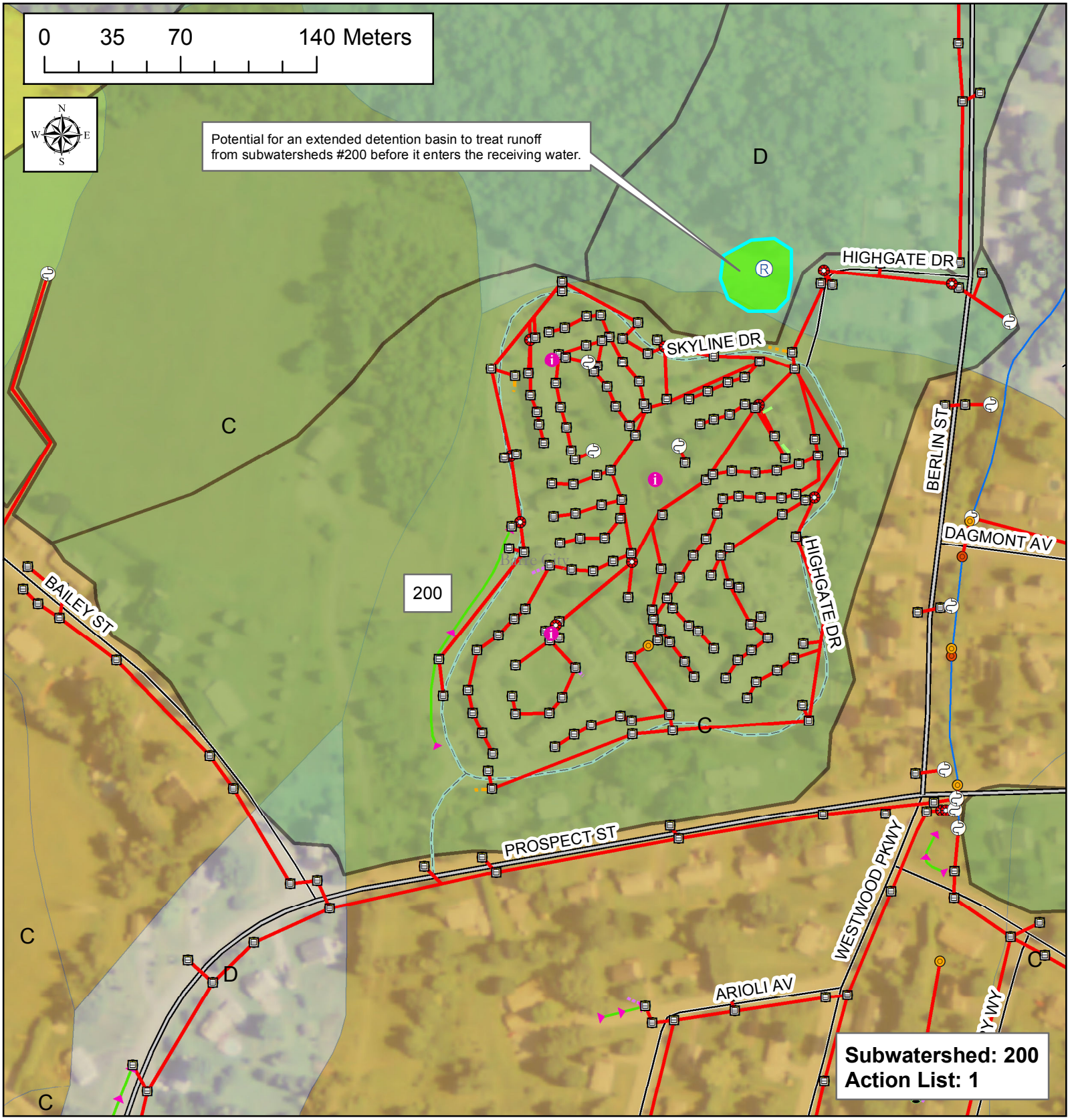

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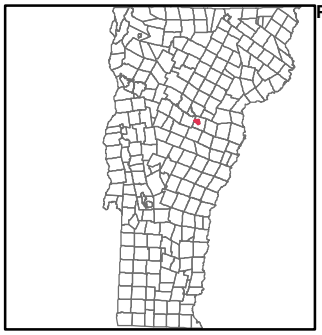

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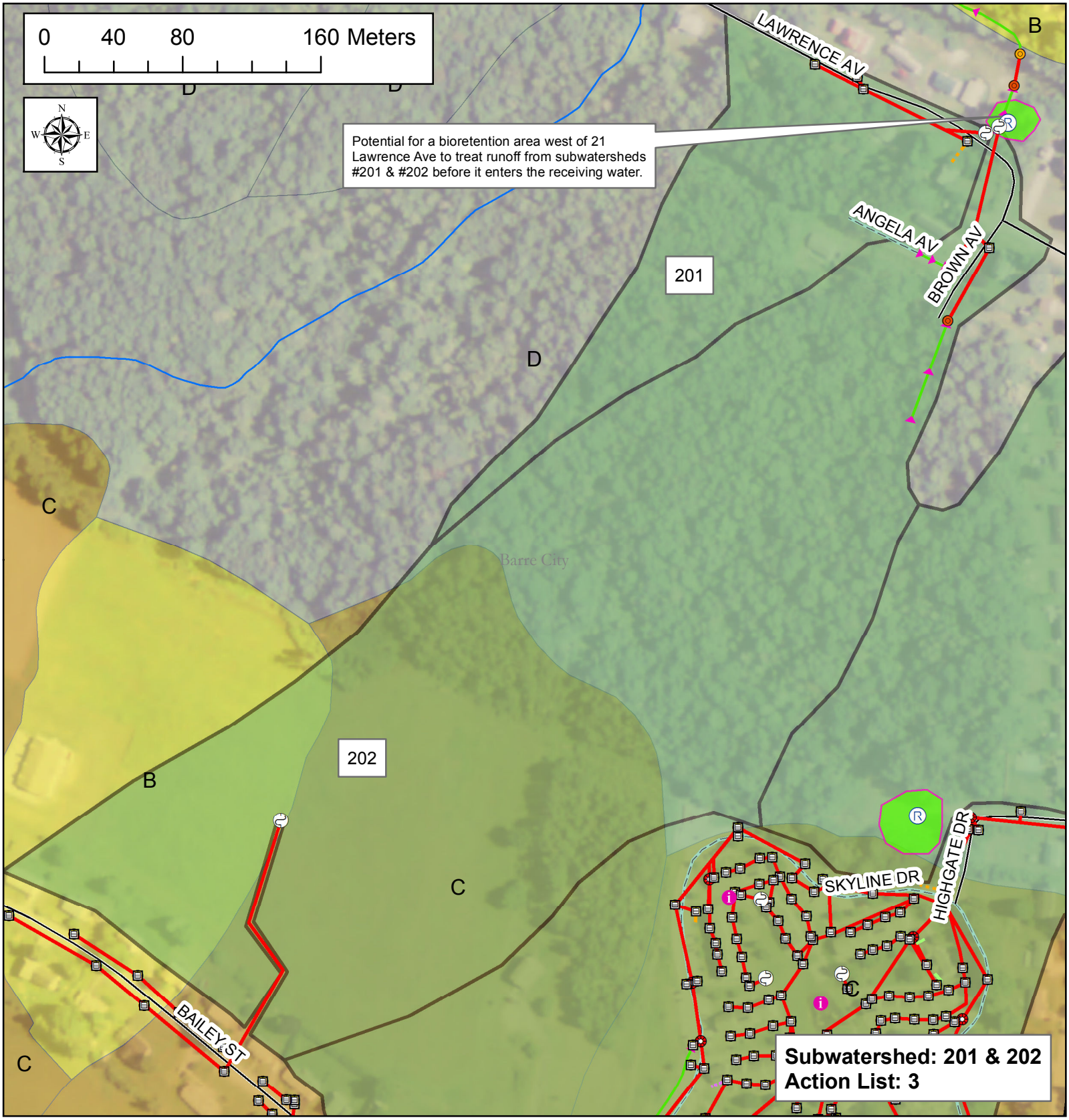

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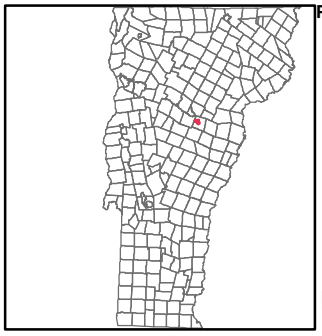

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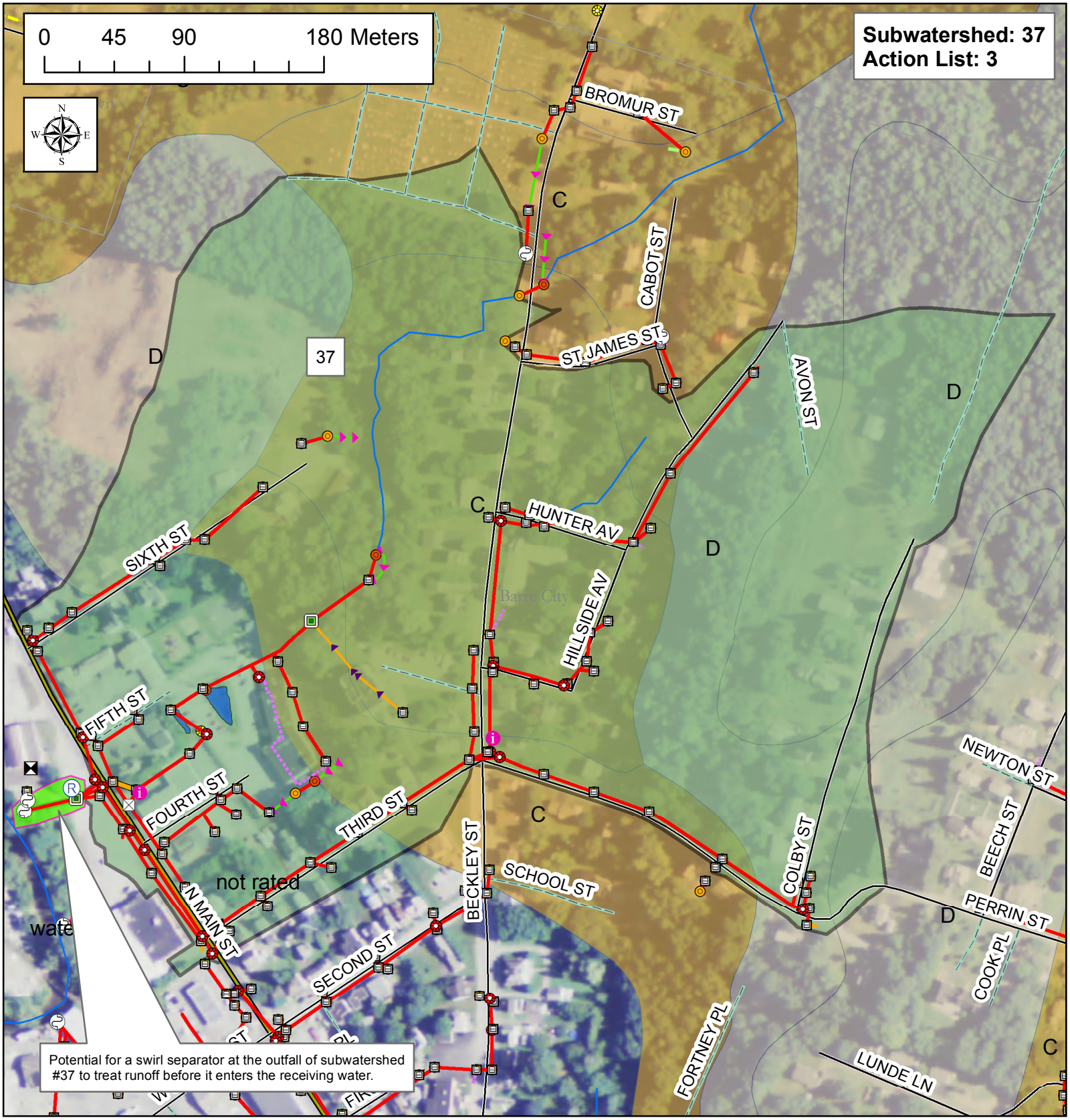

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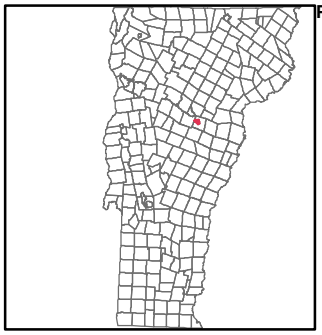

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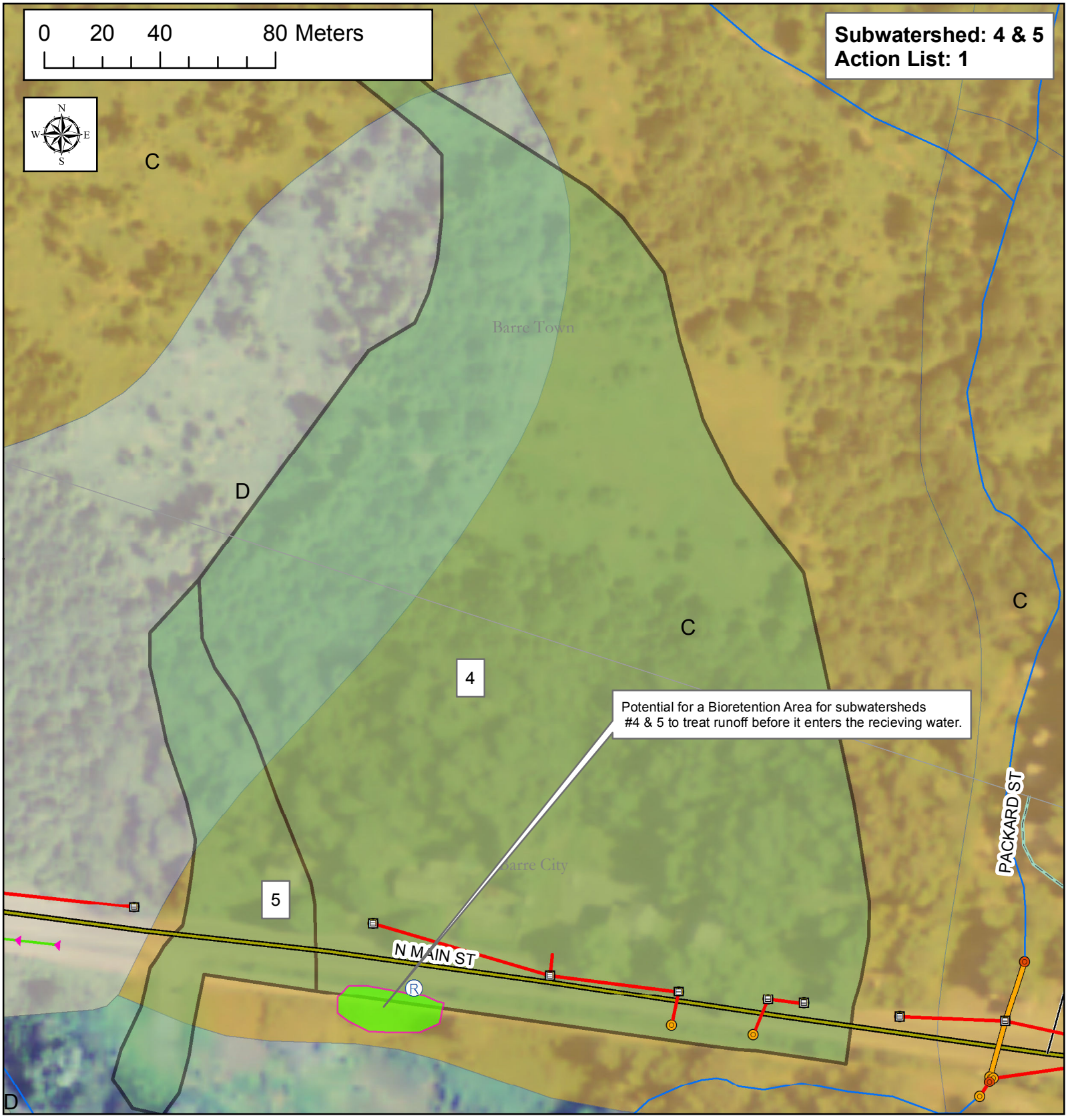

Barre City, VT

DEC Stormwater Infrastructure Mapping Project

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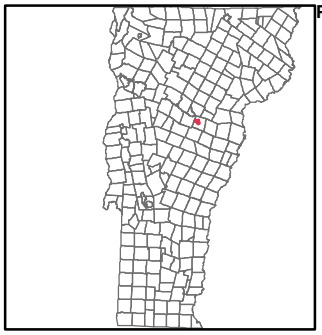

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Creator: Jim Pease, David Ainley
DEC - WSMD - Ecosystem Restoration Section
Plotted Date: 4/16/2013
Data Sources: VTRANS Roads data, VT Hydrography data set, DEC Stormwater database
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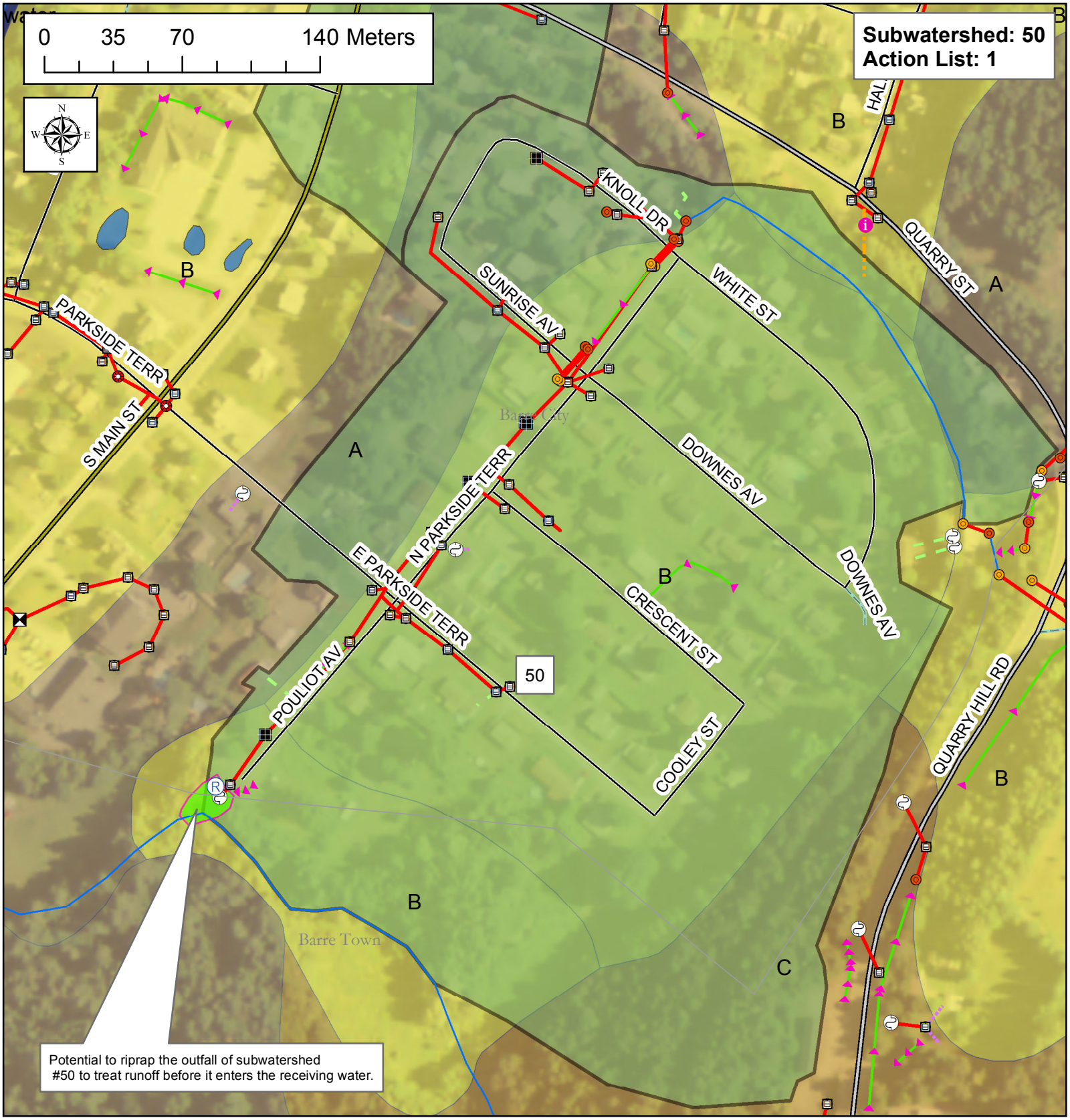

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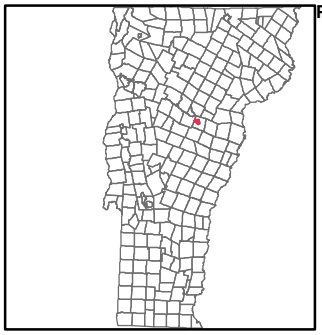

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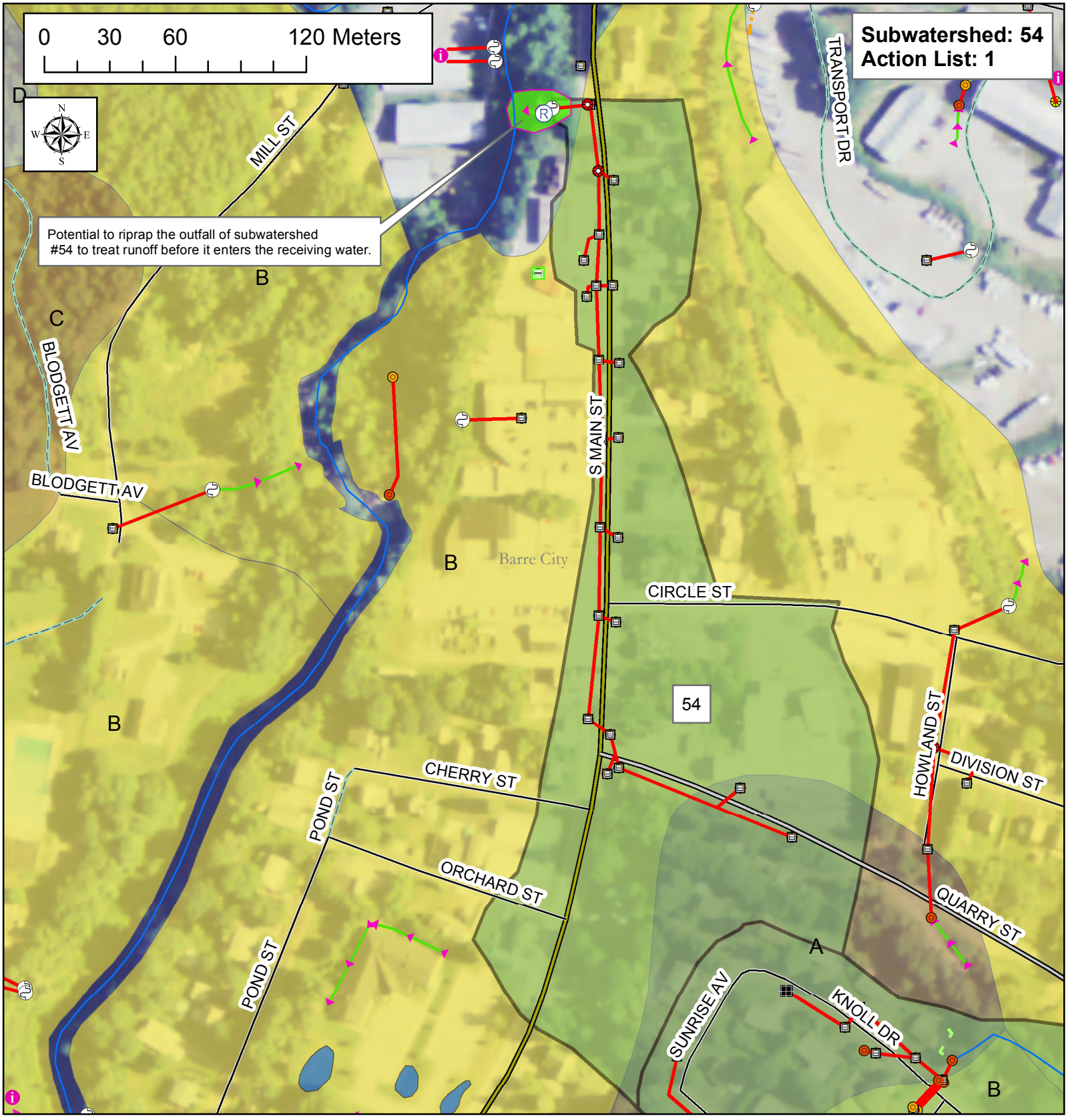

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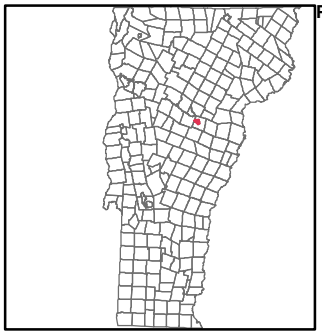

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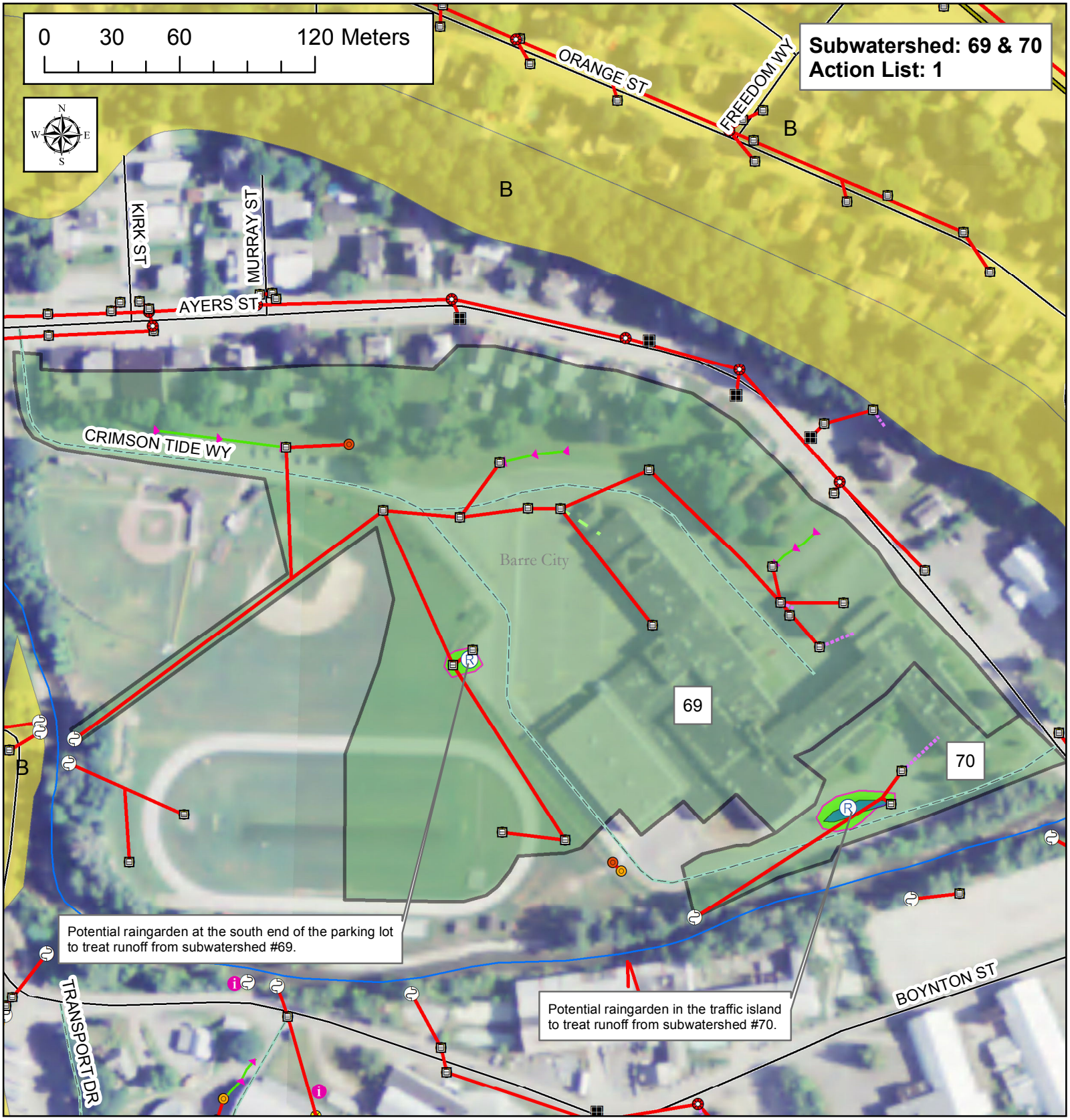

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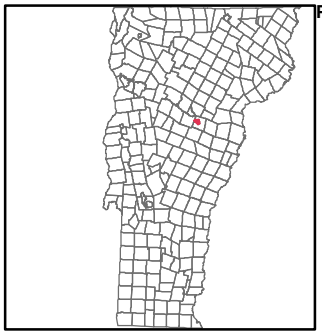

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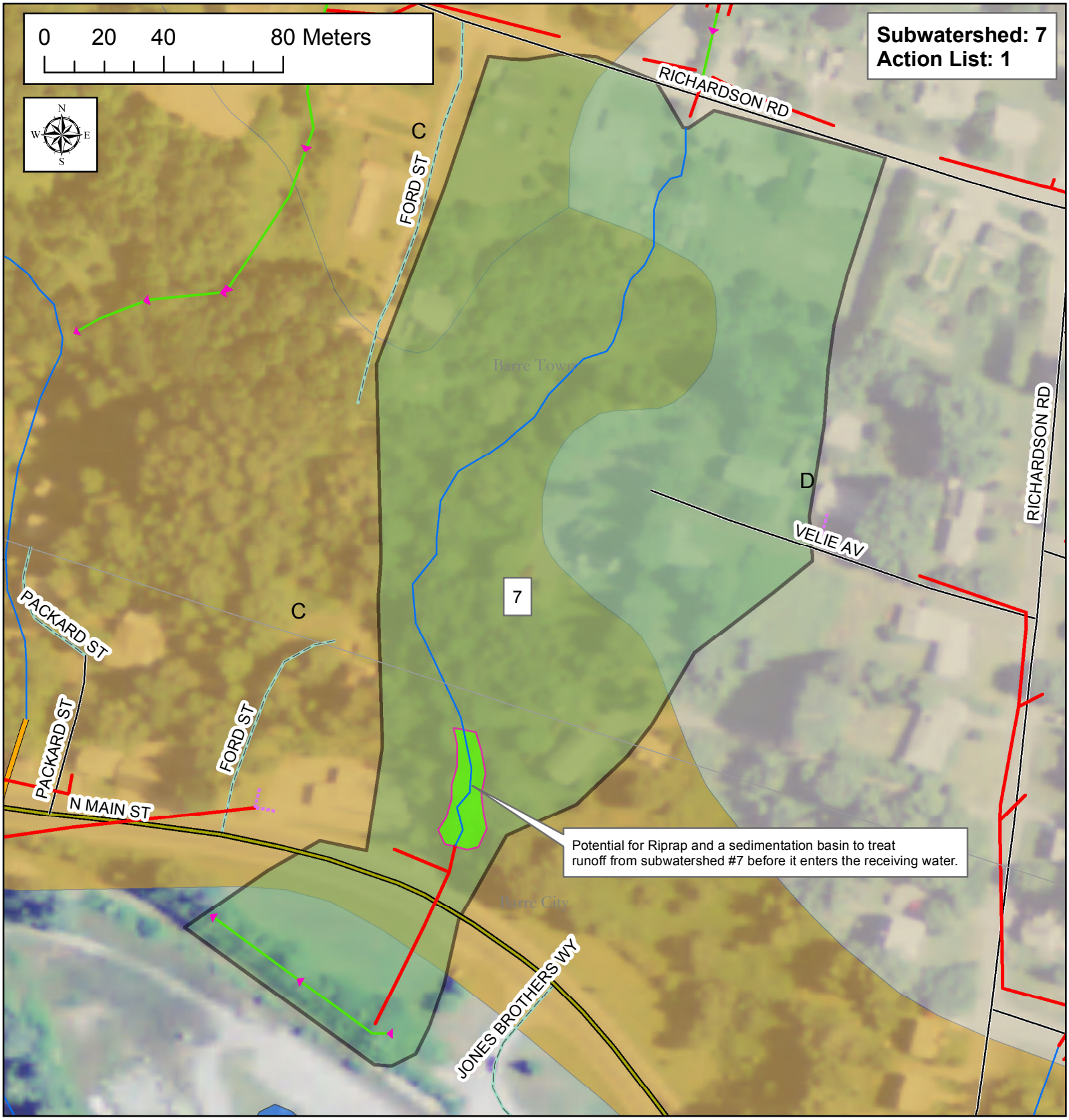

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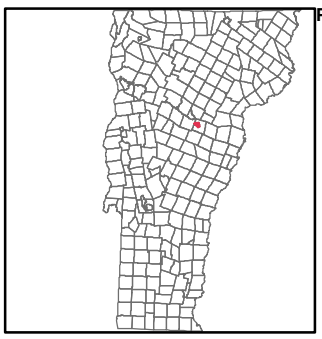

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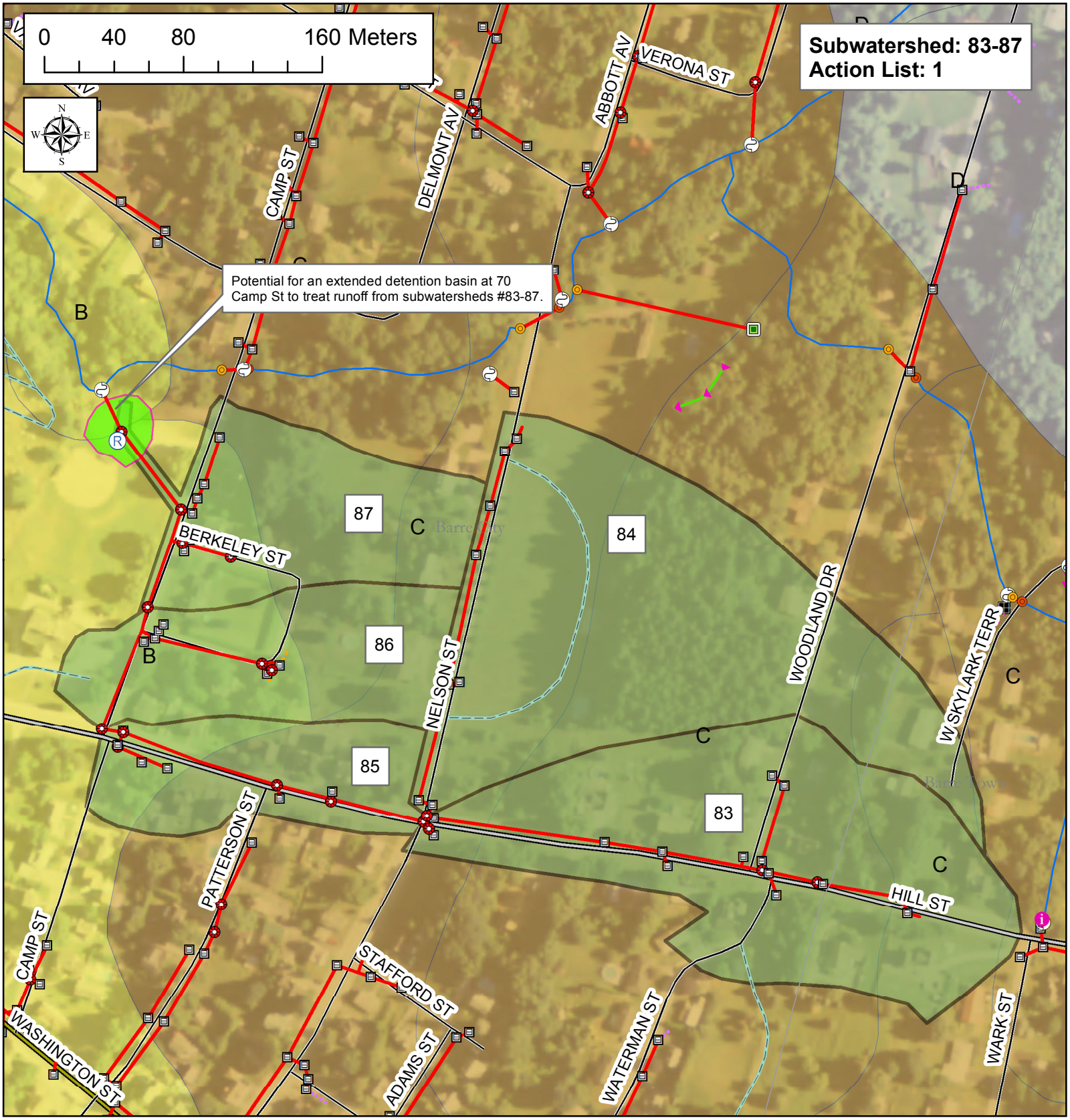

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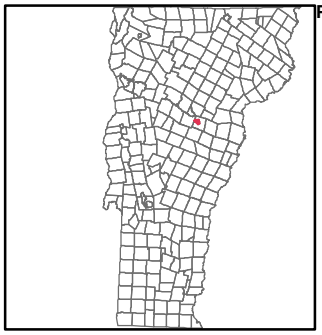

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Spill Control

and

Vermont Hazardous Waste Management Regulations

Have a spill control plan for accidental spills at municipal facilities and on municipal streets

These stormwater infrastructure maps show the connectivity of the stormwater system for the municipality as accurately as it could be determined with the collected and existing data. In the event of a spill this can be a valuable tool for controlling spills and in spill response.

Towns should be equipped with suitable equipment to contain and clean up spills of hazardous materials. Accidental spills of materials can be sources of runoff pollution if not addressed appropriately. If possible Towns should be prepared to address spills on municipal streets while at the same time contacting the state Waste Management Division. DPW managers should be aware of all applicable requirements and should contact regulatory authorities if requirements are not known.

All spills should be cleaned up immediately after they occur. For municipal facilities the creation of a site specific spill control and response plan in combination with spill response training for designated on-site personnel can be effective in dealing with accidental spills and preventing the contamination of soil, water, and runoff. Preparation of a spill containment, control, and countermeasures (SPCC) plan might be required to meet regulatory requirements (e.g., requirements regarding storage of specified chemicals above certain volume thresholds).

Even if a formal plan is not required, preparing one is a good idea. In general, an SPCC plan should include guidance to site personnel on the following:

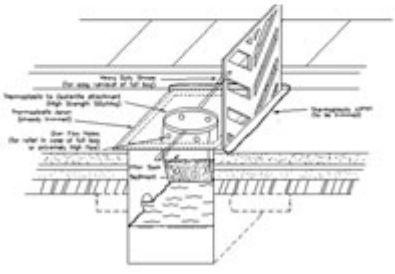
— Proper notification when a spill occurs;
— Site responsibility with respect to addressing the cleanup of a spill;
— Stopping the source of a spill;
— Cleaning up a spill;
— Proper disposal of materials contaminated by the spill;
— Location of spill response equipment programs; and
— Training for designated on-site personnel.

A periodic spill “fire drill” should be conducted to help prepare Town personnel in the event of a spill.

Spill Prevention and Response Measures

Catch Basin Inserts

Catch Basin Inserts (Drain Guards / Sediment Traps) protect our rivers and streams by capturing sediment, debris, oil and grease at storm water catch basins. Catch Basin Inserts are an economical and effective method to protect you from costly clean-up work.



The standard filter material is a non-woven geotextile with built-in overflow ports for cases of abnormally high water flow or over-filled filter bags. Catch Basin Inserts are available with a replaceable 5” x 15” oil absorbent boom that floats to absorb any oil, gas or diesel entering a storm water catch basin.

Urethane Drain Protector

Urethane Drain Protectors are positive sealing drain covers that ensure spills do not enter drains. Drain Protectors are environmentally safe and resistant to chemicals, solvents and hydrocarbons. After use, the Drain Protector can be washed and stored in its tube storage container.

Absorbent Socks

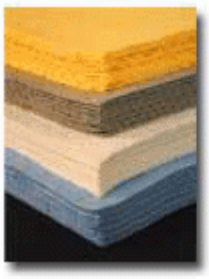
Absorbent socks are flexible tubes used to contain and clean-up spilled fluids. Socks are widely used in industrial applications and are ideal for Spill Kits. Fast spreading spills are quickly stopped with a sock.

Drums & Intermediate Bulk Containers (IBC's)

New and reconditioned steel drums are ideal for storing solid and liquid waste. Poly drums available for durable outdoor storage or for building your own spill kits. Steel and poly drums are available in both tight-head (TH) and full open-head styles (FOH).

Pads & Rolls

Absorbent pads and rolls made from polypropylene fibers are the most popular form of absorbents on the market. Various types of absorbent pads and rolls can be used for different liquids and site applications.



The most widely used absorbent pads and rolls are oil-only (white) and universal (grey). Pads and rolls are great for spills on land, easily absorbing 20 to 25 times their own weight in recovered liquid. Rolls can easily be cut to the exact size required.

water or

Booms

Linkable Absorbent Booms

Absorbent booms are ideal for containing and cleaning up spills on water. Booms repel water and float even when completely saturated. Absorbent booms are constructed with a strong mesh outer skin encasing non-linting and highly absorbent polypropylene filler. Linkable booms come complete with end rings and clips attached to nylon rope running the length of the boom.

Collection basins
Collection basins are permanent structures in which large spills or contaminated storm water is contained and stored before cleanup or treatment. Collection basins are designed to receive spills, leaks, etc., and to prevent pollutants from being released into the environment. Unlike containment dikes, collection basins can receive and contain materials from many locations across a facility.

Containment diking
Containment dikes are temporary or permanent earth or concrete berms or retaining walls that are designed to hold spills. Diking can be used at any industrial facility, but is most common for controlling large spills or releases from liquid storage and transfer areas. Diking can provide one of the best protective measures against the contamination of storm water because it surrounds the area of concern and keeps spilled materials separated from the storm water outside of the diked area.

Curbing
Similar to containment diking, a curb is a barrier that surrounds an area of concern. Unlike diking, curbing is unable to contain large spills and is usually implemented on a small-scale basis. However, curbing is common at many facilities and in small areas where liquids are handled and transferred.

Granular Absorbents
A variety of granular and powdered absorbents are available for the effective clean-up of spills on streets, construction sites and in repair shops. These products absorb spilled liquids of various kinds to greatly lower the viscosity, aiding in the clean-up of the spill.

Sorbents, Gels, and Foams
Sorbents are compounds that immobilize materials by surface absorption or adsorption in the sorbent bulk. Gelling agents interact with the spilled chemical(s) by concentrating and congealing to form a rigid or viscous material more conducive to a mechanical cleanup. Foams are mixtures of air and aqueous solutions of proteins and surfactant-based foaming agents. The primary purpose of foams is to reduce the vapor concentration above the spill surface, thereby controlling the rate of evaporation.

§ **7-105** EMERGENCY AND CORRECTIVE ACTIONS
(a) Emergency actions
(1) In the event of a discharge of hazardous waste or a release of a hazardous material, the person in control of such waste or material shall:
(A) Take all appropriate immediate actions to protect human health and the environment including, but not limited to, emergency containment measures and notification as described below; and
(B) Take any further clean up actions as may be required and approved by federal, state, or local officials, or corrective actions as specified under **subsection (b)** of this section so that the discharged waste or released material and related contaminated materials no longer present a hazard to human health or the environment.
(2) Reporting
(A) All discharges and/or releases that meet any of the following criteria shall be immediately reported to the Secretary by the person or persons exercising control over such waste by calling the Waste Management Division at **(802) 241-3888**, Monday

through Friday, 7:45 a.m. to 4:30 p.m. or the Department of Public Safety, Emergency Management Division at **(800) 641-5005**, 24 hours/day:

(i) A discharge of hazardous waste, or release of hazardous material that exceeds 2 gallons;

(ii) A discharge of hazardous waste, or release of hazardous material that is less than or equal to 2 gallons and poses a potential or actual threat to human health or the environment; or

(iii) A discharge of hazardous waste, or release of hazardous material that equals or exceeds its corresponding reportable quantity under CERCLA as specified under **40 CFR § 302.4.**

Note: Under the Federal Water Pollution Control Act, certain spills of "oil" and/or "hazardous substances" are prohibited and must be reported pursuant to the requirements of **40 CFR Part 110** / Discharge of Oil. Certain spills of hazardous substances must also be reported pursuant to CERCLA. In both cases, the National Response Center must be notified at **(800) 424-8802**. Finally, in addition to federal and state spill reporting, EPCRA requires that spills are also reported to local authorities.

(B) A written report shall be submitted to the Secretary within ten (10) days following any discharge or release subject to **subsection (a)(1)** of this section. The report should be sent to: The Vermont Department of Environmental Conservation, Waste Management Division, 103 South Main Street, Waterbury, VT 05671-0404. The person responsible for submitting the written report may request that it not be submitted for small discharges and/or releases that were reported pursuant to subsection (a)(2)(A) of this section, and that have been entirely remediated within the ten (10) day period immediately following the discharge and/or release

(3) If the discharge or release occurred during transportation, the transporter shall, in addition to notifying the Secretary:

(A) Notify the National Response Center at (800) 424-8802 or (202) 426-2675, if required by **49 CFR § 171.15**; and

(B) Report in writing to the Director, Office of Hazardous Materials Regulations, Materials Transportation Bureau, Department of Transportation, Washington, D.C. 20590, if required by **49 CFR § 171.16**; and

(C) A water (bulk shipment) transporter who has discharged hazardous wastes must give the same notice as required by **33 CFR § 153.203** for oil and hazardous substances.

(4) If a discharge or release occurs and the Secretary determines that immediate removal of the waste is necessary to protect human health or the environment, the Secretary may authorize its removal by unpermitted transporters without the preparation of a manifest. Such hazardous waste may be transported to a site authorized by the Secretary under the provisions of **§ 7-503** to temporarily accept hazardous waste generated during an emergency cleanup of a discharge or release.

(5) In the case of an explosives or munitions emergency response, if a Federal, State, Tribal or local official acting within the scope of his or her official responsibilities, or an explosives or munitions emergency response specialist, determines that immediate removal of the material or waste is necessary to protect human health or the environment, that official or specialist may authorize the removal of the material or waste by transporters who do not have EPA identification numbers or hold Vermont hazardous waste transportation permits and without the preparation of a manifest. In the case of emergencies involving military munitions, the responding military emergency response specialist's organizational unit must retain records for three years identifying the dates of the response,

the responsible persons responding, the type and description of material addressed, and its disposition.

(6) All clean up debris and residues that are hazardous waste must be transported ultimately to either:

(A) A designated facility;

(B) A person authorized by the Secretary to use such waste if the waste has been delisted pursuant to **§ 7-218**;

(C) Some other location specified and authorized by the Secretary to receive clean up debris and residues if the waste has been delisted pursuant to **§ 7-218**; or

(D) For hazardous waste not defined as hazardous in 40 CFR Part 261 (i.e., waste regulated as hazardous by Vermont), to a facility, that is not a designated facility, located in a state other than Vermont provided the facility can receive such waste under applicable state and local laws, regulations and ordinances.

(b) Corrective actions

(1) If a discharge of hazardous waste, or a release of hazardous material has not been adequately addressed under **subsection (a)(1)(A)** of this section the Secretary may require that the person or persons responsible pursuant to **10 V.S.A. § 6615** complete the following:

(A) Engage the services of an environmental consultant experienced in the investigation and remediation of hazardous waste-contaminated sites; and

(B) Within thirty (30) days from either the date of the discharge/release or the date that the release was discovered if the date of discharge/release is not known, or within a period of time established by an alternative schedule approved by the Secretary, submit for approval by the Secretary a work plan for an investigation of the contaminated site (i.e., site investigation) prepared by the environmental consultant. The site investigation shall define the nature, degree and extent of the contamination; and shall assess potential impacts to human health and the environment (refer to the document titled: "Site Investigation Procedure" which is available from the Secretary upon request); and

(C) Perform the site investigation within either ninety (90) days of receiving written approval of the work plan by the Secretary, or a period of time established by an alternative schedule approved by the Secretary. A report detailing the findings of the site investigation shall be sent to the Secretary for review; and

(D) Within either thirty (30) days from the date of final acceptance of the site investigation report by the Secretary, or a period of time established by an alternative schedule approved by the Secretary, submit a corrective action plan prepared by the environmental consultant (refer to the document titled: "Corrective Action Guidance" which is available from the Secretary upon request); and

(E) Implement the corrective action plan within either ninety (90) days of receiving written approval of the plan by the Secretary, or a period of time established by an alternative schedule approved by the Secretary. The corrective action activity shall continue until the contamination is remediated to levels approved by the Secretary; and

(F) Submit to the Secretary all investigative, corrective action and monitoring reports, and all analytical results related to subsections (b)(1)(C) through (E) of this section, as they become available.

(2) A used or fired military munition is a waste and is potentially subject to corrective action authorities pursuant to 10 V.S.A. § 6615, and the process described by subsection (b)(1) of this section if the munition lands off-range and is not promptly rendered safe or retrieved. Any imminent and substantial threats associated with any remaining material must be addressed. If remedial action is infeasible, the operator of the range must maintain a record of the event for as long as any threat remains. The record must include the type of munition and its location (to the extent the location is known).

§ 7-106 LAND DISPOSAL RESTRICTIONS

(a) Certain hazardous wastes shall not be disposed of in or on the land. **40 CFR Part 268**, which is hereby incorporated by reference, except for 40 CFR §§ 268.5, 268.6, and 268.42(b), identifies those wastes which shall not be land disposed and describes the limited circumstances under which an otherwise prohibited waste may continue to be land disposed. The authority for implementing the CFR sections not incorporated by reference remains with the EPA.

Note: A copy of 40 CFR Part 268 (the Land Disposal Restrictions rule), as incorporated by these regulations, is available from the Secretary upon request.

(b) In addition to the prohibitions of **40 CFR Part 268**, the Secretary may restrict the land disposal of any hazardous waste in the State of Vermont:

(1) Which may present an undue risk to human health or the environment, immediately or over a period of time; or

(2) Which would be incompatible with the **groundwater protection rule and strategy** of chapter 12 of the environmental protection rules.

(c) Dilution of hazardous waste subject to the land disposal restrictions of **40 CFR Part 268** is prohibited pursuant to **40 CFR § 268.3.**

§ 7-107 ENFORCEMENT

(a) Information that the generation, transportation, treatment, storage or disposal of hazardous waste may present an actual or potential threat to human health or the environment, or is a violation of the 10 V.S.A. chapter 159, or these regulations, or any term or condition of certification, order, or assurance, may serve as grounds for an enforcement action by the Secretary, including, but not limited to:

(1) After notice and opportunity for hearing, issuing an order directing any person to take such steps as are necessary to:

(A) Immediately cease and desist any operation or practice;

(B) Correct or prevent environmental damage likely to result from any deficiency in operation or practice;

(C) Suspend or revoke any certification and require temporary or permanent cessation of the operation of such facility;

(2) A request that the Attorney General or appropriate State's Attorney commence an action for injunctive relief, the imposition of penalties and fines provided in **10 V.S.A. § 6612** and other relief as may be appropriate.

(3) An order for reimbursement to any agency of federal, state, or local government from any person whose act caused governmental expenditures under **10 V.S.A § 1283**.

(4) All other powers of enforcement available to the Secretary through **10 V.S.A., chapter 201**.

(b) The hearing by the Secretary identified under **subsection (a)(1)** of this section shall be conducted as a contested case. Pursuant to **10 V.S.A. § 6610(b)**, the Secretary may issue an emergency order without a prior hearing when an ongoing violation presents an immediate threat of substantial harm to the environment or an immediate threat to public health. An emergency order shall be effective upon actual notice to the person against whom the order is issued. Any person to whom an emergency order is issued shall be given the opportunity for a hearing within five (5) business days of the date the order is issued.

(c) Inspections, investigations, and property access **(10 V.S.A. § 8005)**

(1) Inspections and investigations

(A) An investigator may perform routine inspections to determine compliance.

(B) An investigator may investigate upon receipt or discovery of information that an activity is being or has been conducted that may constitute or cause a violation.

(C) An investigator, upon presentation of credentials, may seek permission to inspect or investigate any portion of the property, fixtures, or other appurtenances belonging to or used by a person whose activity is required to be in compliance. The investigator shall state the purpose of the inspection or investigation. An inspection or investigation may include monitoring, sampling, testing, and copying of any records, reports, or other documents relating to the purposes to be served by compliance.

(D) If permission for an inspection or investigation is refused, the investigator may seek an access order from the district or superior court in whose jurisdiction the property is located enabling the investigator to perform the inspection or investigation.

(2) Access orders

(A) If access has been refused, an access order may be sought pursuant to either **10 V.S.A. § 80**05 or **10 V.S.A. § 6609**.

(B) Issuance of an access order shall not negate the Secretary's authority to initiate criminal proceedings in the same matter by referring the matter to the office of the attorney general or a state's attorney.

(d) In an action to enforce these regulations, anyone raising a claim that a certain material is not a hazardous waste, or is exempt from regulation as hazardous waste, must demonstrate that there is a known market or disposition for the material, and that they meet the terms of the exclusion or exemption. Appropriate documentation (such as contracts showing that a second person uses the material as an ingredient in a production process) to demonstrate that the material is not a waste, or is exempt from regulation, must be provided. Owners and operators of facilities claiming that they are actually recycling materials must show that they have the necessary equipment to do so.