Town of Randolph

Stormwater Infrastructure Mapping Project

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VTDEC – ECOSYSTEM RESTORATION SECTION
WATERSHED MANAGEMENT DIVISION

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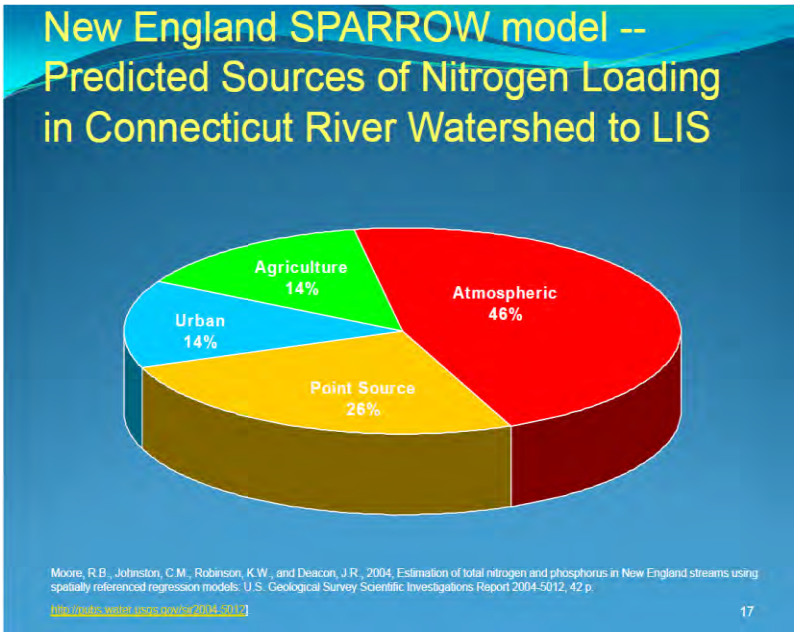
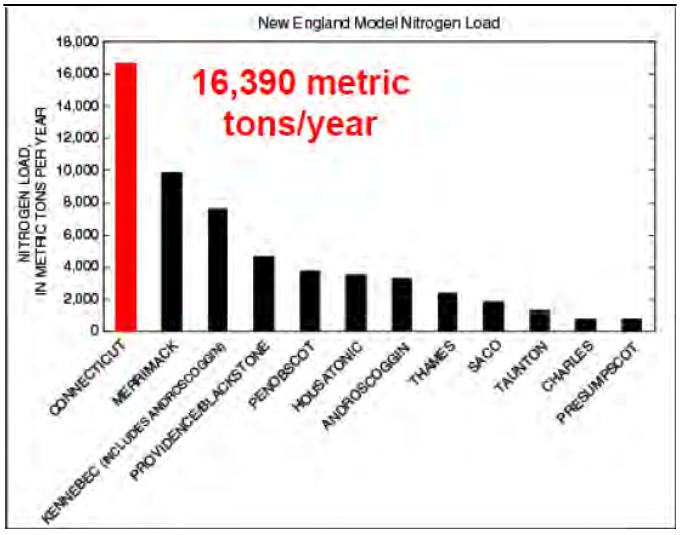
Long Island Sound – Connecticut River Watershed Nitrogen Overview

- This map shows an overview of the extent of the Connecticut River watershed including areas of Vermont, New Hampshire, Massachusetts, and Connecticut.



- This figure shows the modeled nitrogen loading contribution per year from the Connecticut River basin to the Long Island Sound.



- This graph shows the breakdown of the modeled nitrogen load from the Connecticut River watershed to the Long Island Sound from various sources.

- Above figure taken from USGS – *Assessment of Total Nitrogen in the Upper Connecticut River Basin in New Hampshire, Vermont, and Massachusetts, Dec 2002 – Sept 2005*. http://pubs.usgs.gov/sir/2006/5144/pdf/sir2006-5144.pdf

- Above figures taken from EPA/USGS – *Application of NHDPlus for SPARROW nutrient modeling of the Northeastern and Mid-Atlantic Region of the US* http://www.awra.org/orlando2010/presentations/Session22/NHDPlus_SPARROW_AWRA20100330-good.pdf

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.**

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
BRA	Bioretention Area (aka Bioretention Filter)
BS	Buffer Strip (25' Min.)
CB	Catch Basin
CBI	Catch Basin Insert
CD	Check Dam
DI	Drop Inlet
DP	Dry Pond
DS	Dry Swale
DW	Drywell
EDP	Extended Detention Pond with Micropool (aka Micropool Extended Detention Basin)
GR	Green Roof
GS	Grass Swale (aka Open Channel)
IB	Infiltration Basin
IG	Infiltration Gallery
IP	Infiltration Pipe
OF	Overland Flow
OGF	Organic Filter
PA/PC	Pervious Asphalt or Pervious Concrete
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/VS	Swirl Separator
ST	Septic Tank
SWPPP	Stormwater Pollution Prevention Plan
TT	Treatment Tank
WL	Wetland (Constructed)
WP	Wet Pond (Retention)
WS	Wet Swale

Randolph - 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)	Nitrogen Load with Current Reductions (lbs)	Nitrogen Load with Priority Action (lbs)
3 Randolph	1	Bioretention area on north side of library	BRA/CB/OF		1.9	30.4	493	99	4.1	1.6
28 Randolph	1	EDP/IB on side of Rte 66 southwest of Hebard Hill Rd	IB/CB/GS		92.8	8.9	9,090	1,818	75.8	45.5
59 Randolph	1	Bioretention or infiltration basin near municipal pool	IB/GS/OF/DW	3559-9010	167.9	21.1	25,473	5,095	212.3	84.9
60 Randolph	1	Repair erosion at outfall	RR/CB		20.7	37.9	7,116	4,270	59.3	47.4
65 Randolph	1	Repair erosion at outfall	RR/CB		2.5	39.0	908	545	7.6	6.1
77 Randolph	1	Infiltration basin or enhanced swale on south side of 463 VT Rte 12	IB/CB/GS		39.6	13.6	5,001	250	41.7	8.3
5 Randolph	2	Combine with 6,7,9 wet pond at outfall of 5	WP/CB		0.9	56.4	627	125	5.2	3.1
6 Randolph	2	Combine with 5,7,9 wet pond at outfall of 5	WP/CB/OF		6.5	51.2	3,922	784	32.7	19.6
7 Randolph	2	Combine with 5,6,9 wet pond at outfall of 5	WP/CB/OF		5.7	58.7	4,007	801	33.4	20.0
9 Randolph	2	Combine with 5,6,7 wet pond at outfall of 5	WP/CB/OF		2.5	68.1	1,828	366	15.2	9.1
45 Randolph	2	Bioretention basin or bioswale with check dams behind school	IB-IG/OF/CB/GS		61.2	16.3	8,889	1,778	74.1	44.4
46 Randolph	2	Bioretention basin behind school	IB/OF/CB/GS		24.5	37.8	8,421	1,684	70.2	42.1
53 Randolph	2	Infiltraton basin on north side of Prince St outside of floodplain. Bioretention area at Post Office. Combine with 55.	IB/BRA/CB/GS		15.1	69.3	12,621	631	105.2	21.0
55 Randolph	2	Combine with 53.	IB/CB/GS		2.0	35.0	641	32	5.3	1.1
56 Randolph	2	Bioretention or infiltration basin in Prince St ramp	BRA/CB		3.7	75.6	3,439	688	28.7	11.5
1 Randolph			WP/CB/GS	4374-9015.1	2.7	53.2	216	216	5.4	5.4
2 Randolph			CB/GS		5.2	52.5	2,692	2,692	22.4	22.4
4 Randolph			PP/BRA/CB	4374-9015	3.9	59.0	371	371	9.3	9.3
8 Randolph			EDP/CB		1.1	8.1	16	16	0.4	0.4
10 Randolph			DW/CB		0.9	58.9	415	415	3.9	3.9
11 Randolph			CB/GS		0.8	77.0	664	664	5.5	5.5
12 Randolph			CB/GS		0.5	85.9	478	478	4.0	4.0
13 Randolph			GS/OF		2.2	25.5	495	495	4.1	4.1
14 Randolph			CB/GS		3.1	20.2	549	549	4.6	4.6
15 Randolph			OF/GS	4374-9015.2	4.3	42.0	869	869	9.7	9.7
16 Randolph			OF/GS		19.5	9.0	1,917	1,917	16.0	16.0
17 Randolph			EDP/CB	5886-9015	4.0	10.6	64	64	1.6	1.6
18 Randolph			GS/OF		22.6	17.0	3,393	3,393	28.3	28.3
19 Randolph			CB/GS/DW		28.3	14.7	3,792	3,792	31.6	31.6
20 Randolph			OF		4.8	22.2	911	911	7.6	7.6
21 Randolph			GS/OF		79.5	3.0	5,758	5,758	48.0	48.0
22 Randolph			CB/GS/OF	3695-9010.1	7.5	36.4	1,269	1,269	14.1	14.1

Watershed Number	Water Quality Volume (Acre-Feet)	Channel Protection (Acre-Feet)	Estimated Basin Construction Cost	Estimated Other BMP Construction Cost	Cost of Sediment Removal Per Pound (based on annual sediment load)	Cost of Nitrogen Removal Per Pound (based on annual nitrogen load)	Assistance Program	# LID-Roof Raingardens to Treat Water Quality Volume	Raingarden Cost
3 Randolph	0.03	0.06	6,418		$16	$2,603	ERP,SRF	14	$6,418
28 Randolph	0.51	0.91	470,471		$65	$15,527	ERP,SRF	257	$118,290
59 Randolph	1.44	FALSE	1,318,371		$65	$10,351	ERP,SRF	721	$331,476
60 Randolph	0.40	FALSE		$5,000	$2	$422	ERP,SRF	201	$92,605
65 Randolph	0.05	0.11		$15,000	$41	$9,907	ERP,SRF	26	$11,822
77 Randolph	0.28	0.59	25,000		$5	$750	ERP,SRF	141	$65,071
5 Randolph	0.04	0.06	87,892		$10	$2,548	ERP,SRF	18	$8,164
6 Randolph	0.22	0.37					ERP,SRF	111	$51,042
7 Randolph	0.23	0.37					ERP,SRF	113	$52,138
9 Randolph	0.10	0.19					ERP,SRF	52	$23,790
45 Randolph	0.50	FALSE	115,670		$16	$3,904	ERP,SRF	251	$115,670
46 Randolph	0.48	FALSE	109,577		$16	$3,904	ERP,SRF	238	$109,577
53 Randolph	0.71	FALSE	686,343		$54	$7,738	ERP,SRF	357	$164,238
55 Randolph	0.04	FALSE					ERP,SRF	18	$8,336
56 Randolph	0.19	FALSE	44,753				ERP,SRF	97	$44,753
1 Randolph	0.06	0.16					ERP,SRF	30	$14,030
2 Randolph	0.15	0.30					ERP,SRF	76	$35,036
4 Randolph	0.11	0.25					ERP,SRF	53	$24,165
8 Randolph	0.00	0.01					ERP,SRF	2	$1,044
10 Randolph	0.03	0.06					ERP,SRF	15	$6,752
11 Randolph	0.04	0.06					ERP,SRF	19	$8,635
12 Randolph	0.03	0.04					ERP,SRF	14	$6,223
13 Randolph	0.03	0.06					ERP,SRF	14	$6,439
14 Randolph	0.03	0.07					ERP,SRF	16	$7,142
15 Randolph	0.08	0.20					ERP,SRF	41	$18,851
16 Randolph	0.11	0.19					ERP,SRF	54	$24,942
17 Randolph	0.02	0.05					ERP,SRF	9	$4,149
18 Randolph	0.19	0.42					ERP,SRF	96	$44,159
19 Randolph	0.21	0.46					ERP,SRF	107	$49,349
20 Randolph	0.05	0.12					ERP,SRF	26	$11,853
21 Randolph	0.33	0.26					ERP,SRF	163	$74,930
22 Randolph	0.12	0.30					ERP,SRF	60	$27,524

Randolph - 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)	Nitrogen Load with Current Reductions (lbs)	Nitrogen Load with Priority Action (lbs)
23 Randolph			GS/OF	3695-9010.1	14.8	15.2	1,022	1,022	11.4	11.4
24 Randolph			EDP/CB	3850-9015	14.2	16.8	428	428	8.3	8.3
25 Randolph			OF/GS		78.7	4.6	6,140	6,140	51.2	51.2
26 Randolph			SB/CB/GS		35.3	19.1	5,266	5,266	46.3	46.3
27 Randolph			CB		2.0	62.7	1,533	1,533	12.8	12.8
29 Randolph			IB/GS	4970-9015	4.8	30.4	171	171	4.3	4.3
30 Randolph			CB/OF		12.1	9.3	1,211	1,211	10.1	10.1
31 Randolph			OF/GS		41.0	4.5	3,184	3,184	26.5	26.5
32 Randolph			OF/GS/CB		39.2	7.4	3,543	3,543	29.5	29.5
33 Randolph			OF/GS/CB		77.2	4.2	5,904	5,904	49.2	49.2
34 Randolph			OF/GS/CB		23.2	5.5	1,896	1,896	15.8	15.8
35 Randolph			OF/GS/CB		6.6	30.6	1,757	1,757	14.6	14.6
36 Randolph			OF/GS/CB/ SWPPP	5129-9003	407.1	3.8	30,589	30,589	254.9	254.9
37 Randolph			OF		18.9	10.0	1,960	1,960	16.3	16.3
38 Randolph			CB/OF		12.2	20.6	2,169	2,169	18.1	18.1
39 Randolph			OF		1.8	22.7	352	352	2.9	2.9
40 Randolph			CB		2.9	30.0	769	769	6.4	6.4
41 Randolph			OF/DW		13.7	33.9	4,127	4,127	34.4	34.4
42 Randolph			OF/CB	7075-9015	0.7	86.2	128	128	3.2	3.2
43 Randolph			CB		10.5	27.6	3,370	3,370	28.1	28.1
44 Randolph			OF		56.1	7.9	5,216	5,216	43.5	43.5
47 Randolph			CB		5.3	18.2	848	848	7.1	7.1
48 Randolph			OF		32.9	22.3	6,298	6,298	52.5	52.5
49 Randolph			OF/GS/CB		7.4	29.9	1,923	1,923	16.0	16.0
50 Randolph			CB		6.7	41.5	3,252	3,252	27.1	27.1
51 Randolph			CB/OF		6.0	25.3	1,314	1,314	11.0	11.0
52 Randolph			CB		2.4	87.7	2,609	2,609	21.7	21.7
57 Randolph			GS/OF		3.4	38.1	1,173	1,173	9.8	9.8
58 Randolph			GS/OF		0.6	39.3	220	220	1.8	1.8
61 Randolph			CB/GS		10.8	28.9	2,720	2,720	22.7	22.7
62 Randolph			CB/GS		5.2	29.9	1,370	1,370	11.4	11.4
63 Randolph			CB/GS		10.2	36.7	3,374	3,374	28.1	28.1
64 Randolph			GS/OF		4.4	28.3	1,090	1,090	9.1	9.1
66 Randolph			CB/GS/EDP	4030-9015	59.6	14.6	1,092	1,092	27.3	27.3
67 Randolph			DW/CB		2.8	72.0	97	97	3.2	3.2
68 Randolph			CB		2.2	62.8	1,439	1,439	12.0	12.0
69 Randolph			GS/OF		24.5	10.1	2,568	2,568	21.4	21.4
70 Randolph			CB/WP	3652-9010	6.0	73.9	859	859	21.5	21.5
71 Randolph			CB		1.3	86.9	1,446	1,446	12.0	12.0
72 Randolph			CB/SWPPP/OF	7301-9003	41.7	25.5	7,340	7,340	68.8	68.8
73 Randolph			CB/DW/EDP/GS	6976-9015	89.6	9.2	4,678	4,678	52.0	52.0
74 Randolph			CB/GS		12.0	44.9	5,113	5,113	42.6	42.6
75 Randolph			OF		56.4	5.2	4,543	4,543	37.9	37.9
76 Randolph			OF/GS/CB		49.2	3.1	3,585	3,585	29.9	29.9
78 Randolph			OF/GS		15.0	17.8	2,334	2,334	19.5	19.5
79 Randolph			OF/GS		26.5	10.3	2,796	2,796	23.3	23.3
80 Randolph			CB		7.0	36.5	2,970	2,970	24.7	24.7
81 Randolph			GS/OF/SWPPP	4412-9003	8.1	34.5	1,709	1,709	16.0	16.0
82 Randolph			GS/SB/SWPPP	4412-9003	7.4	35.4	1,208	1,208	13.4	13.4
83 Randolph			OF		5.6	32.2	1,599	1,599	13.3	13.3
84 Randolph			CB		4.2	36.8	1,402	1,402	11.7	11.7
85 Randolph			OF/GS		55.8	5.4	4,531	4,531	37.8	37.8

Watershed Number	Water Quality Volume (Acre-Feet)	Channel Protection (Acre-Feet)	Estimated Basin Construction Cost	Estimated Other BMP Construction Cost	Cost of Sediment Removal Per Pound (based on annual sediment load)	Cost of Nitrogen Removal Per Pound (based on annual nitrogen load)	Assistance Program	# LID-Roof Raingardens to Treat Water Quality Volume	Raingarden Cost
23 Randolph	0.10	0.25					ERP,SRF	48	$22,168
24 Randolph	0.08	0.26					ERP,SRF	40	$18,560
25 Randolph	0.35	0.40					ERP,SRF	174	$79,904
26 Randolph	0.33	0.74					ERP,SRF	166	$76,144
27 Randolph	0.09	0.14					ERP,SRF	43	$19,943
29 Randolph	0.05	0.16					ERP,SRF	24	$11,117
30 Randolph	0.07	0.12					ERP,SRF	34	$15,761
31 Randolph	0.18	0.20					ERP,SRF	90	$41,432
32 Randolph	0.20	0.32					ERP,SRF	100	$46,103
33 Randolph	0.33	0.36					ERP,SRF	167	$76,829
34 Randolph	0.11	0.14					ERP,SRF	54	$24,677
35 Randolph	0.10	0.22					ERP,SRF	50	$22,866
36 Randolph	1.73	1.70					ERP,SRF	865	$398,056
37 Randolph	0.11	0.21					ERP,SRF	55	$25,508
38 Randolph	0.12	0.28					ERP,SRF	61	$28,224
39 Randolph	0.02	FALSE					ERP,SRF	10	$4,579
40 Randolph	0.04	FALSE					ERP,SRF	22	$10,011
41 Randolph	0.23	FALSE					ERP,SRF	117	$53,698
42 Randolph	0.04	FALSE					ERP,SRF	18	$8,355
43 Randolph	0.19	FALSE					ERP,SRF	95	$43,857
44 Randolph	0.30	FALSE					ERP,SRF	148	$67,873
47 Randolph	0.05	FALSE					ERP,SRF	24	$11,036
48 Randolph	0.36	FALSE					ERP,SRF	178	$81,954
49 Randolph	0.11	FALSE					ERP,SRF	54	$25,020
50 Randolph	0.18	FALSE					ERP,SRF	92	$42,315
51 Randolph	0.07	FALSE					ERP,SRF	37	$17,099
52 Randolph	0.15	FALSE					ERP,SRF	74	$33,952
57 Randolph	0.07	FALSE					ERP,SRF	33	$15,262
58 Randolph	0.01	FALSE					ERP,SRF	6	$2,858
61 Randolph	0.15	FALSE					ERP,SRF	77	$35,399
62 Randolph	0.08	FALSE					ERP,SRF	39	$17,821
63 Randolph	0.19	FALSE					ERP,SRF	95	$43,910
64 Randolph	0.06	FALSE					ERP,SRF	31	$14,180
66 Randolph	0.31	0.96					ERP,SRF	154	$71,038
67 Randolph	0.11	0.23					ERP,SRF	55	$25,351
68 Randolph	0.08	0.15					ERP,SRF	41	$18,731
69 Randolph	0.15	0.27					ERP,SRF	73	$33,416
70 Randolph	0.24	0.49					ERP,SRF	122	$55,893
71 Randolph	0.08	0.13					ERP,SRF	41	$18,810
72 Randolph	0.52	1.17					ERP,SRF	260	$119,396
73 Randolph	0.44	0.91					ERP,SRF	221	$101,461
74 Randolph	0.29	0.59					ERP,SRF	145	$66,529
75 Randolph	0.26	0.32					ERP,SRF	129	$59,120
76 Randolph	0.20	0.17					ERP,SRF	101	$46,648
78 Randolph	0.13	0.29					ERP,SRF	66	$30,378
79 Randolph	0.16	0.30					ERP,SRF	79	$36,379
80 Randolph	0.17	0.28					ERP,SRF	84	$38,647
81 Randolph	0.12	0.31					ERP,SRF	60	$27,795
82 Randolph	0.11	0.29					ERP,SRF	57	$26,200
83 Randolph	0.09	0.20					ERP,SRF	45	$20,806
84 Randolph	0.08	FALSE					ERP,SRF	40	$18,250
85 Randolph	0.26	0.33					ERP,SRF	128	$58,963

Randolph - 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)	Nitrogen Load with Current Reductions (lbs)	Nitrogen Load with Priority Action (lbs)
86 Randolph			OF		9.5	17.0	1,422	1,422	11.9	11.9
87 Randolph			OF/GS/WP		92.8	7.8	4,573	4,573	50.8	50.8
88 Randolph			OF/GS/CB		77.4	4.7	6,082	6,082	50.7	50.7
89 Randolph			OF/CB		23.1	15.1	3,138	3,138	26.2	26.2
90 Randolph			OF/GS		18.5	7.1	1,646	1,646	13.7	13.7
91 Randolph			OF		17.8	18.6	2,891	2,891	24.1	24.1
92 Randolph			OF/SWPPP	4652-9003	29.1	11.2	3,232	3,232	26.9	26.9
93 Randolph			OF/GS		38.5	14.2	5,009	5,009	41.7	41.7

Watershed Number	Water Quality Volume (Acre-Feet)	Channel Protection (Acre-Feet)	Estimated Basin Construction Cost	Estimated Other BMP Construction Cost	Cost of Sediment Removal Per Pound (based on annual sediment load)	Cost of Nitrogen Removal Per Pound (based on annual nitrogen load)	Assistance Program	# LID-Roof Raingardens to Treat Water Quality Volume	Raingarden Cost
86 Randolph	0.08	0.18					ERP,SRF	40	$18,507
87 Randolph	0.43	0.80					ERP,SRF	216	$99,174
88 Randolph	0.34	FALSE					ERP,SRF	172	$79,142
89 Randolph	0.18	FALSE					ERP,SRF	89	$40,840
90 Randolph	0.09	FALSE					ERP,SRF	47	$21,422
91 Randolph	0.16	FALSE					ERP,SRF	82	$37,615
92 Randolph	0.18	FALSE					ERP,SRF	91	$42,059
93 Randolph	0.28	FALSE					ERP,SRF	142	$65,181

Target Maps

Showing Priority Action List Drainage Areas

And Potential Retrofit Locations

Randolph, VT

DEC Stormwater Infrastructure Mapping Project

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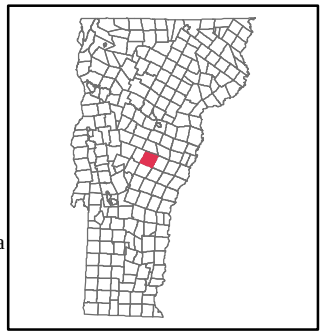

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Creator: Jim Pease, David Ainley
DEC - WSMD - Ecosystem Restoration Program
Plotted Date: 2/18/2015
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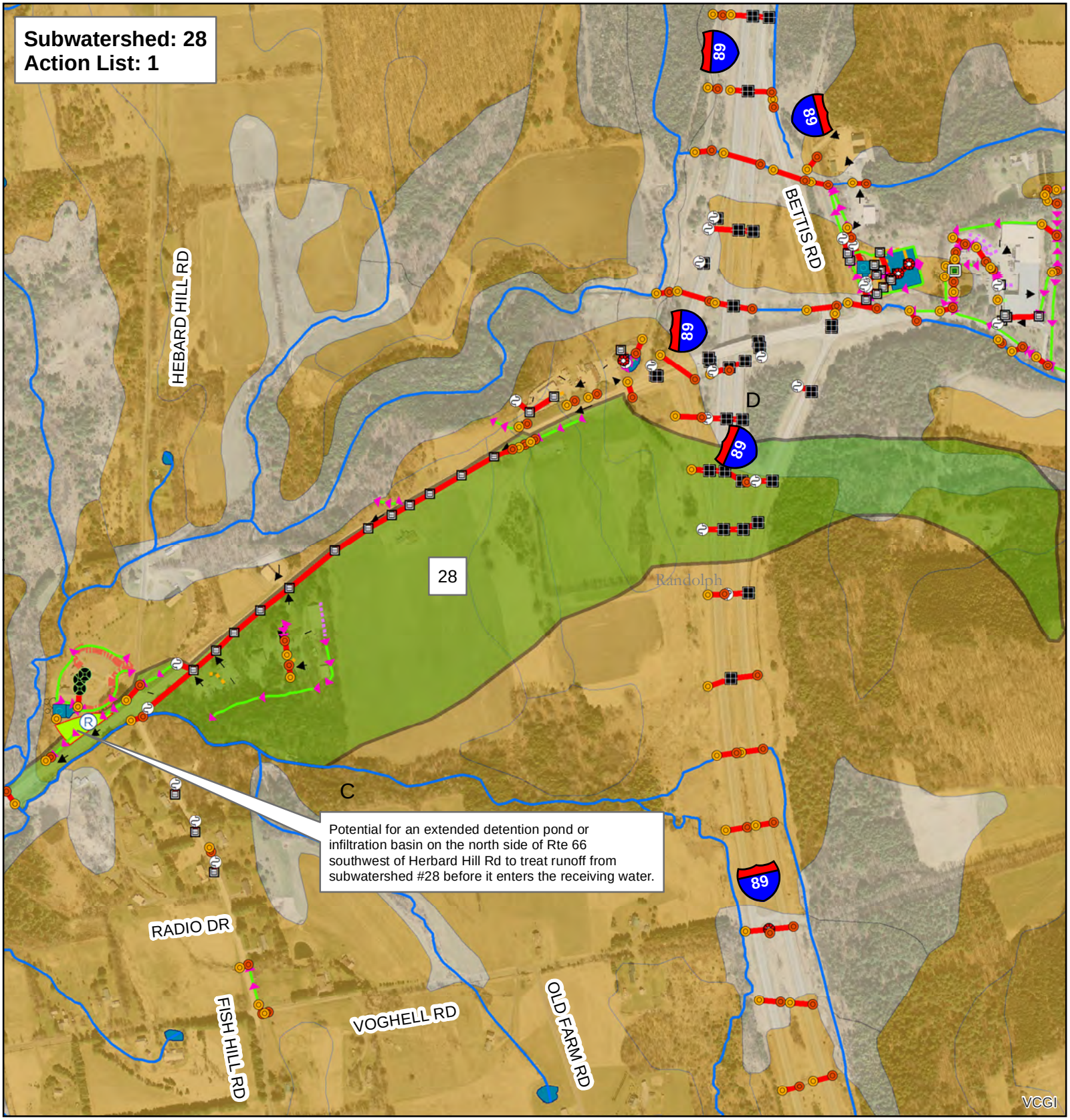

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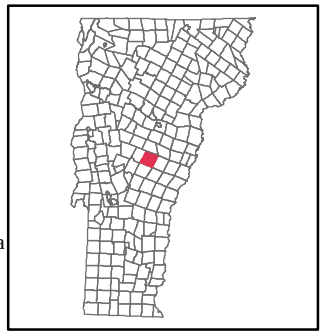

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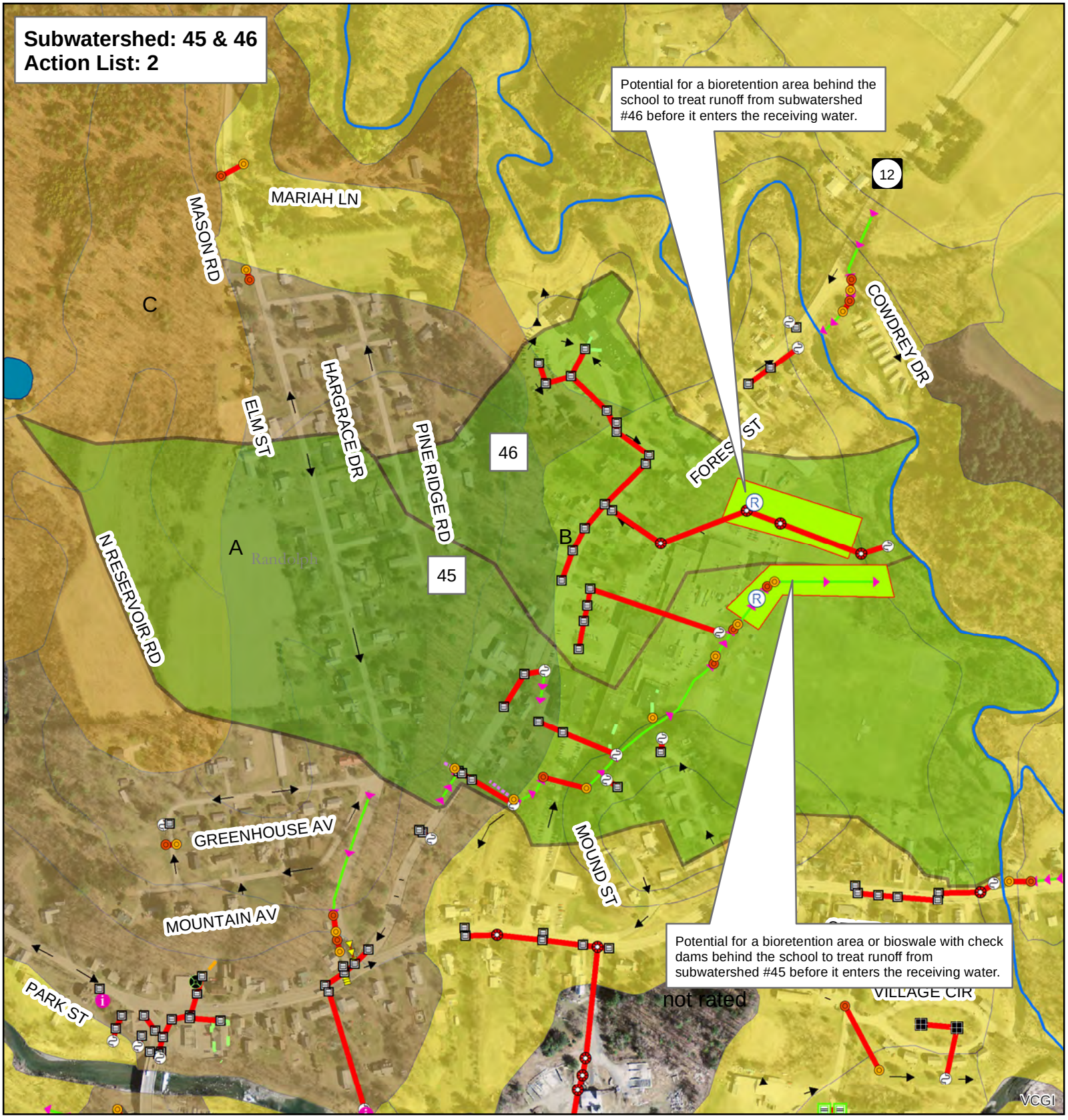

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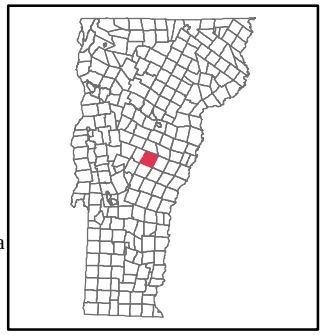

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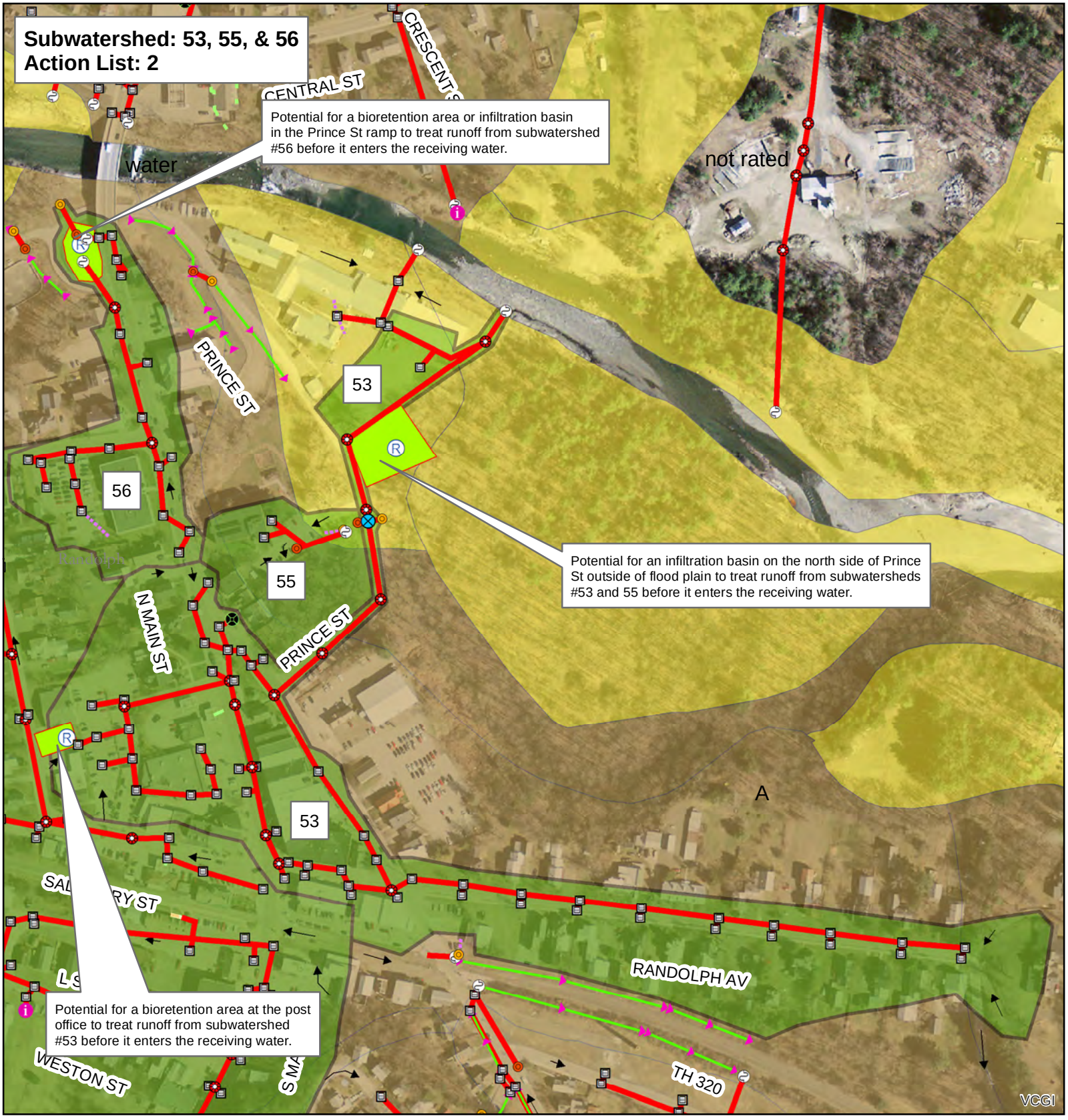

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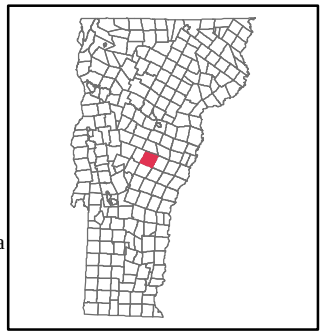

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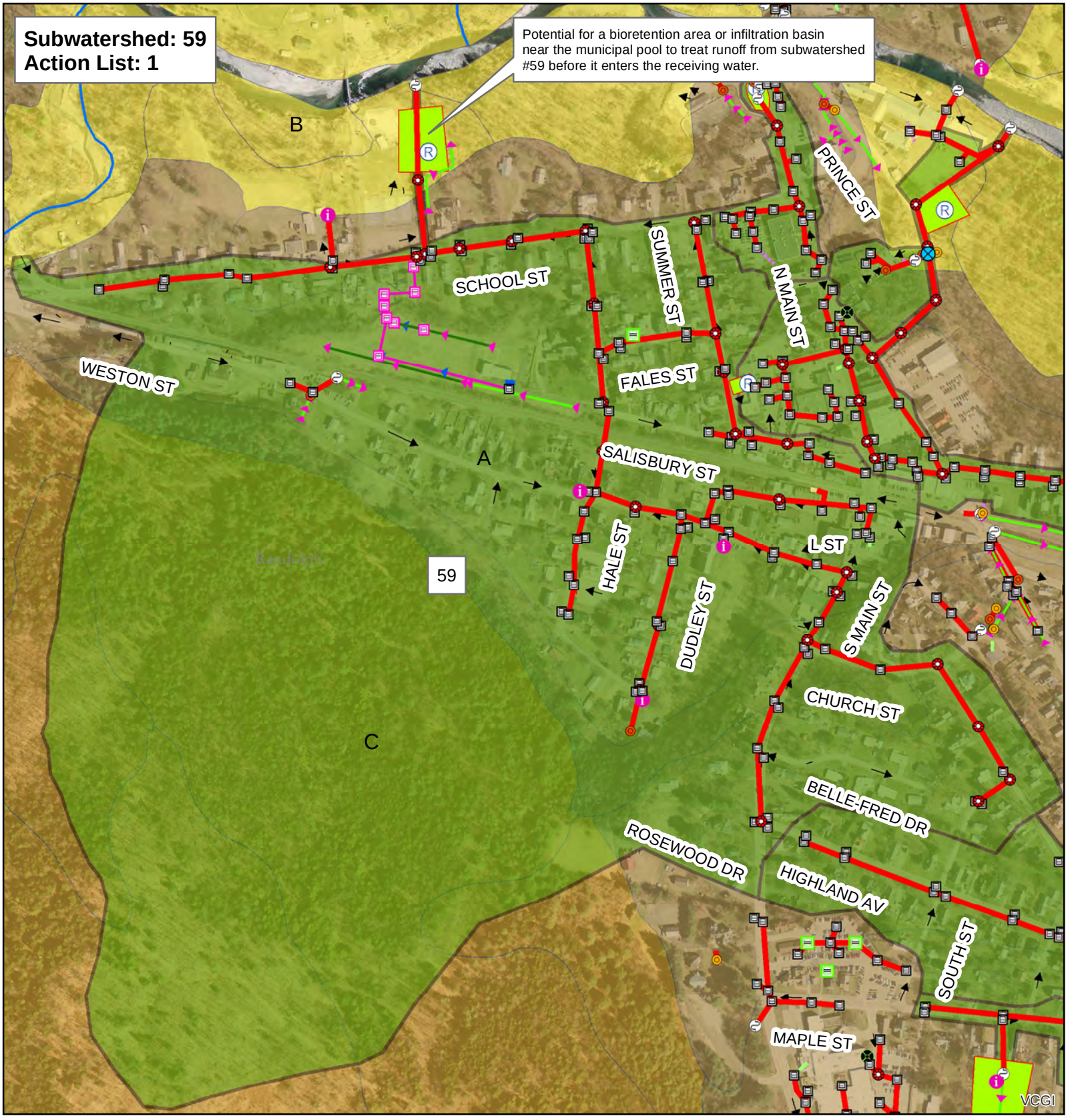

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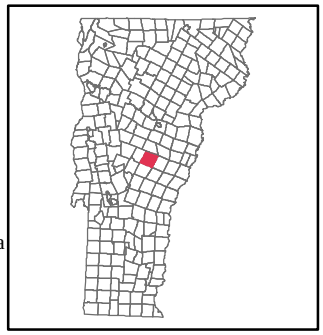

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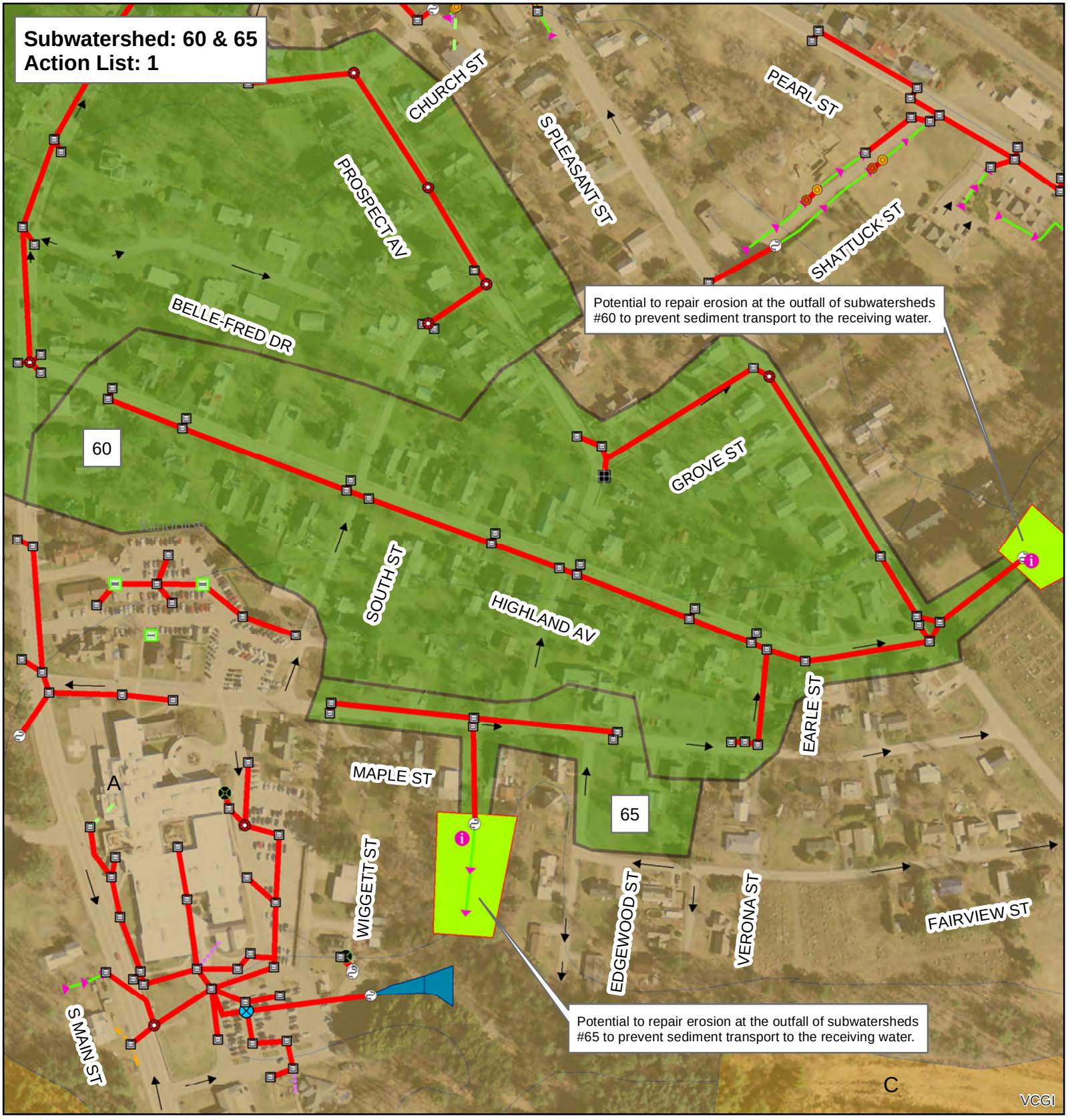

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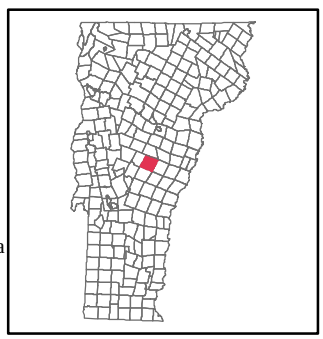

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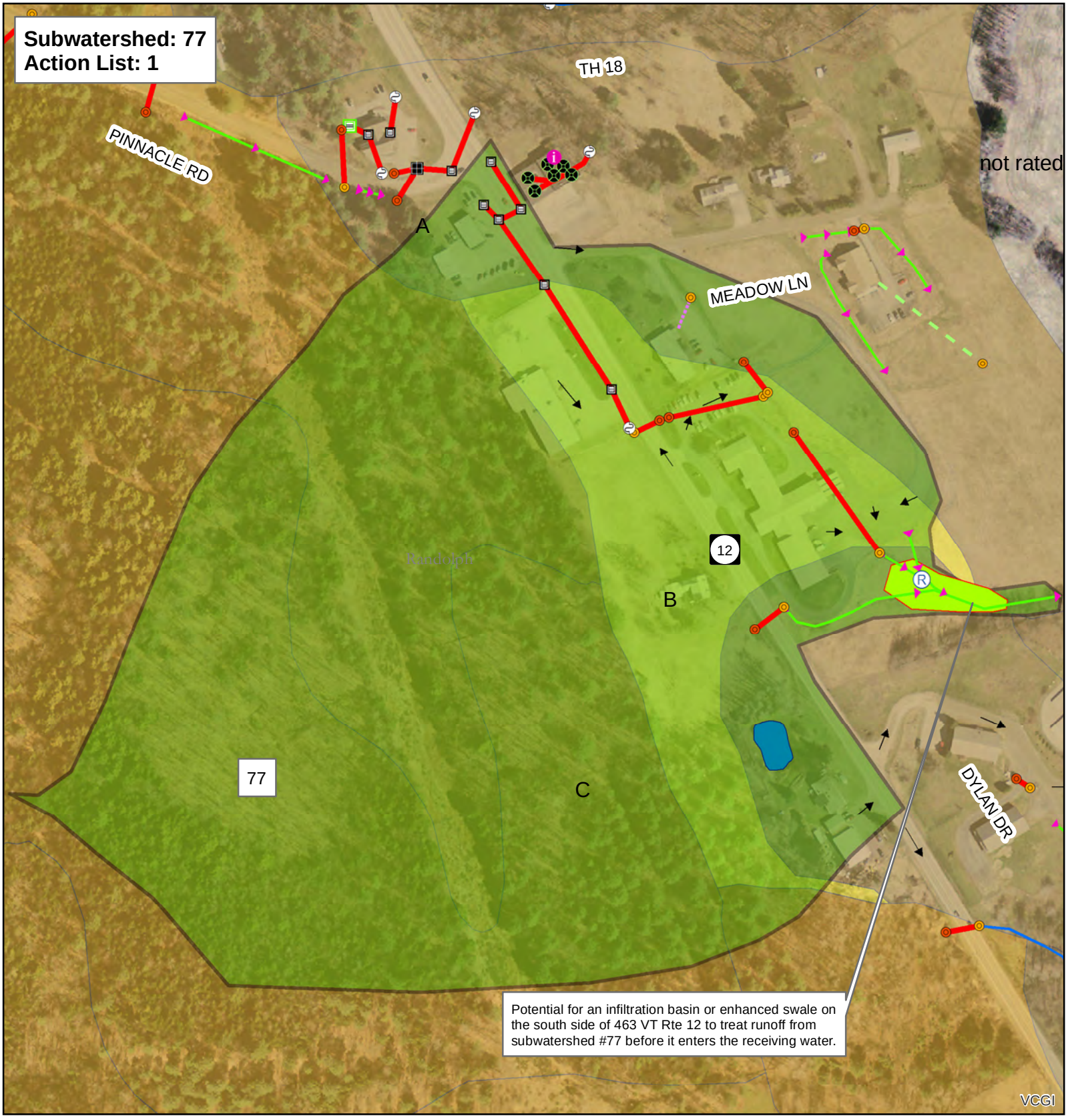

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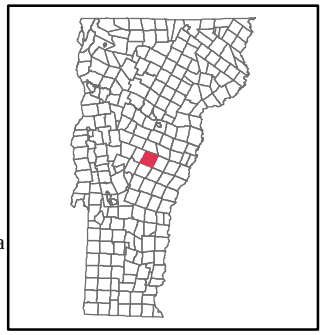

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Spill Control

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).

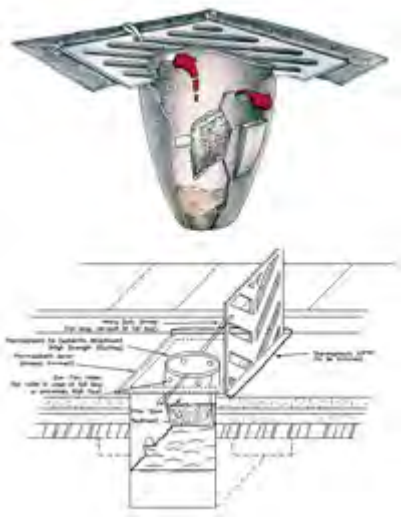
Even if a formal plan is not required, preparing one is a good idea. In general, an SPCC plan should include guidance to site personnel on the following:

— 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

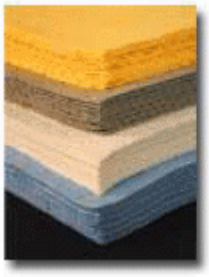
Absorbent socks are flexible tubes used to contain and clean-up spilled fluids. Socks are widely used in industrial applications and are ideal for Spill Kits. Fast spreading spills are quickly stopped with a sock.

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.