Friends of the Winooski River
PO Box 777
Montpelier VT 05601

info@winooskiriver.org • 802-882-8276

February 1, 2016

Final Report for ERP-2015-1-06

Background

The Park-Winter Meadow-Tremont neighborhood sits in the steeply pitched northeast corner of Barre City. Even during relatively modest rain events, runoff quickly gathers speed and not only washes surface sediment into the storm sewer system but actively erodes driveways and streets (some are dirt), lawns and along the edges of paved streets. The neighborhood is fairly complex. The majority of the neighborhood has a slope of at least 15% and in some spots exceeds 25%. While there is some open space near the top of the neighborhood, most parcels are relatively small and densely built. Another challenging condition for management of runoff is high groundwater and springs that several residents noted to us. High groundwater does not afford good opportunity for infiltration of surface runoff and therefore runoff volumes are amplified. Stormwater management BMPs must be designed to function in this steep, high groundwater environment, and if possible help to mitigate some of these groundwater impacts on neighboring properties. This project identified possible locations for mitigation practice that could control the stormwater in the neighborhood. The master plan has resulted in designs for three practices.

Project Summary

A summary of the three major steps is listed below. More details on each step including the field data, alternatives analysis and 30% designs can be found in the project folder shared via Drop Box.

1. The first step was to gather and review existing data regarding the condition in the neighborhood. This included compiling GIS data such as subwatersheds, stormwater infrastructure, soils and topography and any water quality data as well as meeting with City personnel and residents to discuss historic flooding, perpetual erosion issues, as well as areas sensitive to stormwater runoff. This resulted in a GIS project that identified problem areas and retrofit locations considering transportation, utility, space, soil infiltration capacity (based mapped soil groups) and land ownership issues.

2. In the next step, field surveys were conducted to verify the location and extent of the identified problem sites, as well as the feasibility of a stormwater management retrofits. Relevant drainage infrastructure and subwatersheds were field verified and mapped. Soil cores using a hand auger were completed at one site and a wetland was delineated at another.

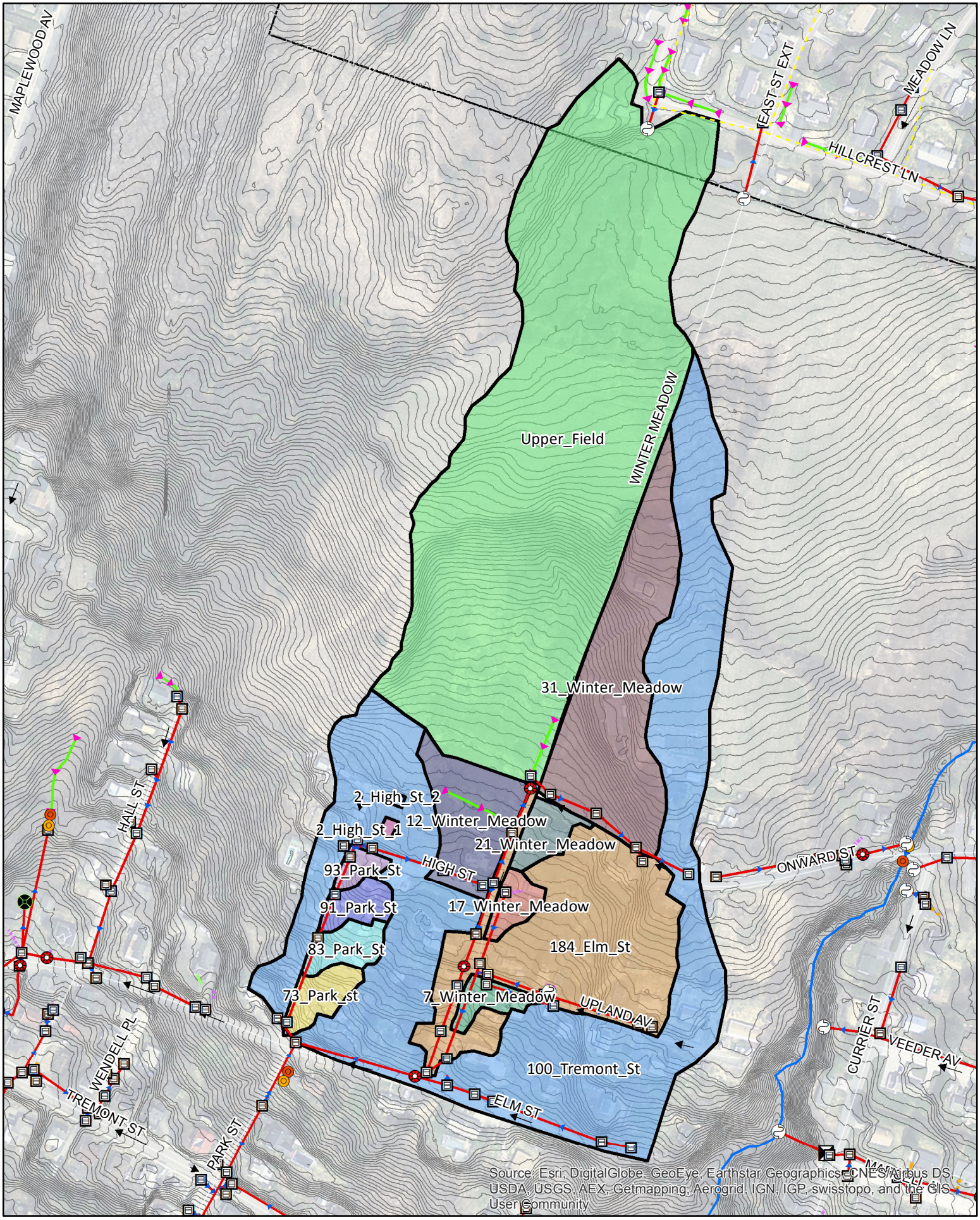
3. Modeling tools were used to calculate overall stormwater volume as well as loading of sediment and phosphorus. This information was combined with previous field survey information to prioritize the areas of interest in order of high benefit and cost effectiveness. The top 10 priority retrofit projects were summarized with a map of potential BMP footprint, a narrative description and photo documentation. Three sites were chosen for 30% designs. Selection was

based on landowner and City interest, position of the property in the drainage area and water quality impacts.

The initial scope of work included revegetating the open hillside above the neighborhood. This task was not completed and the funds associated with this task (#5) were not requested. It was determine that this location should include some shallow drainage swales and that replanting the area should occur after that work is complete.

Next Steps

A meeting with the City of Barre took place on January 14, 2016 to discuss the City's willingness to pursue all three of the designs. The City's support and commitment is critical to construction and maintenance. Two of the three practices interface with City infrastructure and therefore could not be completed without their consent. Also, the City will need to maintain the practices, even the portions on private property. The City does seem interested but details need to be worked out regarding landowner consent and the need for possible easements for maintenance. The Friends will continue to work with the City on this issue. If these details can be worked out, the intent would be to apply for additional funding for construction during the 2017 field season.



N

0 62.5 125 250 Feet

Park Street - Stormwater Retrofit Study
Drainage Area Delineations
Barre City, VT

VERMONT WATERSHED CONSULTING ASSOCIATES, LLC
430 Shelburne Road | PO Box 4413
Burlington, VT 04506
802.497.2367
watershedca.com

Project: Park Street Stormwater Retrofit Study, Barre City, VT

Assessed by:AT

Site ID Code: Upper Meadow

Site Rating:

Name:

E911 Address:	NA
Date/Time Assessed:	1/8/2015

Practice Concept:

Vegetated swales could capture and disperse runoff from the upland meadow area, encourage infiltration and sheetflow to reduce potential gullying and lowering peak flows to the downhill neighborhood. Increase plantings and tree canopy to intercept precipitation, encourage evapotranspiraton, and increase infiltration.

Ownership:	Private
Site Contact:	Ann Smith

Contour swales in the upper meadow area would disperse flows from the hill above the residential area.

LID Practice Details

Practice 1:	Contour swale system
Practice 2:	Vegetation enhancement
Practice 3:	
New/Retrofit?:	New

Maintenance Burden:

High	Medium	Low

Site Information

Site Landuse 1:	Old pasture
Site Landuse 2:	Open
SW Practice On-Site?:	No
Pollutant Hotspot?:	No
Pollutant of Concern 1:	N/A
Pollutant of Concern 2:	N/A

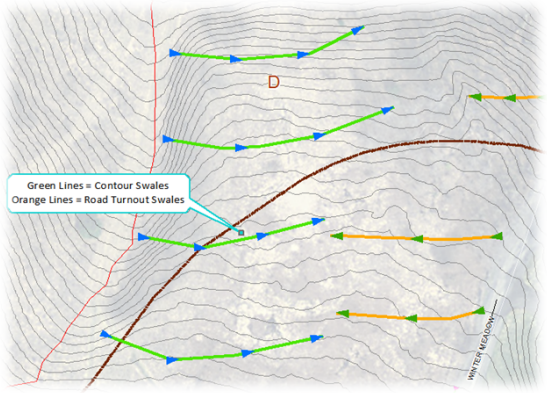
Design Considerations:

Drainage Area (ac):	UNK
Impervious %:	None
DA Usage:	Open
Practice Area (sq. ft.):	UNK
Soils (mapped):	HSG D

Feasibility/Design Notes:

HSG D soils may not have high infiltration capacity. Swales may only spread flow for vegetative uptake and evapotranspiration unless swale soils are amended with stone or other porous material. Planting of trees is highly encouraged at this site.

Location:



Benefits		Constraints	
Velocity Reduction?:	Yes	Soils?:	No
Storage?:	Yes	Contamination?:	UNK
Water Quality?:	No	Utilities?:	Not likely
Recharge?:	Maybe	Access?:	OK
Collateral Benefits:?	Yes	Bedrock/Water Table?:	No
Community Engagment?:	No	Wetland?:	Possible
Other?:		Other?:	

Project: Park Street Stormwater Retrofit Study, Barre City, VT

Assessed by:AT

Site ID Code: 93 Park Street

Site Rating:

Name:

E911 Address:	93 Park Street
Date/Time Assessed:	1/8/2015

Practice Concept:

Bioretention could be built into existing municipal ROW - would require terracing. The practice would be designed primarily for street runoff.

Ownership:	Public
Site Contact:	Ann Smith

Bioretention practice at this location could manage street runoff.

LID Practice Details

Practice 1:	Bioretention
Practice 2:	Vegetated Swale (terraced)
Practice 3:	
New/Retrofit?:	New

Maintenance Burden:

High	Medium	Low

Site Information

Site Landuse 1:	Road ROW
Site Landuse 2:	
SW Practice On-Site?:	No
Pollutant Hotspot?:	No
Pollutant of Concern 1:	N/A
Pollutant of Concern 2:	N/A

Design Considerations:

Drainage Area (ac):	UNK
Impervious %:	UNK
DA Usage:	Residential
Practice Area (sq. ft.):	~500
Soils (mapped):	HSG C

Feasibility/Design Notes:

HSG C soils on site may not have sufficiently high infiltration capacity. Practice would likely require soil amendment to achieve desired infiltration rate. Practice could be built in road ROW but may require additional consideration for utilities.

Location:

Benefits		Constraints	
Velocity Reduction?:	Yes	Soils?:	Possible
Storage?:	Yes	Contamination?:	UNK
Water Quality?:	Possible	Utilities?:	Possible
Recharge?:	Posible	Access?:	Public
Collateral Benefits:?	Traffic Calming, Aesthetics	Bedrock/Water Table?:	No
Community Engagment?:	Yes	Wetland?:	No
Other?:		Other?:	

Project: Park Street Stormwater Retrofit Study, Barre City, VT

Assessed by:AT

Site ID Code: 91 Park Street

Site Rating:

Name:

E911 Address:	91 Park Street
Date/Time Assessed:	1/8/2015

Practice Concept:

Bioretention could be built into existing municipal ROW - would require terracing. The practice would be designed primarily for runoff from residence at 91 Park St and some additional street runoff.

Ownership:	Private
Site Contact:	Ann Smith

Bioretention practice at this location could manage runoff from residential roof and drive.

LID Practice Details

Practice 1:	Bioretention
Practice 2:	Vegetated Swale (terraced)
Practice 3:	
New/Retrofit?:	New

Maintenance Burden:

High	Medium	Low

Site Information

Site Landuse 1:	Road ROW
Site Landuse 2:	Private Property
SW Practice On-Site?:	No
Pollutant Hotspot?:	No
Pollutant of Concern 1:	N/A
Pollutant of Concern 2:	N/A

Design Considerations:

Drainage Area (ac):	UNK
Impervious %:	UNK
DA Usage:	Residential
Practice Area (sq. ft.):	~500 - 700
Soils (mapped):	HSG C

Feasibility/Design Notes:

HSG C soils on site may not have sufficiently high infiltration capacity. Practice would likely require soil amendment to achieve desired infiltration rate. Practice could be built in road ROW but may require additional consideration for utilities.

Location:

Benefits		Constraints	
Velocity Reduction?:	Yes	Soils?:	Possible
Storage?:	Yes	Contamination?:	UNK
Water Quality?:	Possible	Utilities?:	Possible
Recharge?:	Posible	Access?:	Public
Collateral Benefits:?	Traffic Calming, Aesthetics	Bedrock/Water Table?:	No
Community Engagment?:	Yes	Wetland?:	No
Other?:		Other?:	

Project: Park Street Stormwater Retrofit Study, Barre City, VT

Assessed by:AT

Site ID Code: 73 Park Street

Site Rating:

Name:

E911 Address:	73 Park Street
Date/Time Assessed:	1/8/2015

Practice Concept:

Green Gutter' concept where runoff from street and possibly residences would funnel to vegetated, leveled swale and infiltrate or filter.

Ownership:	Public
Site Contact:	Ann Smith

A 'green gutter' or terraced swale could provide infiltration at this site.

LID Practice Details

Practice 1:	Green Gutter (bioretention)
Practice 2:	Vegetated Swale (terraced)
Practice 3:	
New/Retrofit?:	New

Maintenance Burden:

High	Medium	Low

Site Information

Site Landuse 1:	Road ROW
Site Landuse 2:	Private Property
SW Practice On-Site?:	No
Pollutant Hotspot?:	No
Pollutant of Concern 1:	N/A
Pollutant of Concern 2:	N/A

Design Considerations:

Drainage Area (ac):	UNK
Impervious %:	UNK
DA Usage:	Residential
Practice Area (sq. ft.):	~800
Soils (mapped):	HSG C

Feasibility/Design Notes:

HSG C soils on site may not have sufficiently high infiltration capacity. Practice would likely require soil amendment to achieve desired infiltration rate. Practice could be built in road ROW but may require additional consideration for utilities.

Location:

Benefits		Constraints	
Velocity Reduction?:	Yes	Soils?:	Possible
Storage?:	Yes	Contamination?:	UNK
Water Quality?:	Possible	Utilities?:	Possible
Recharge?:	Posible	Access?:	Public
Collateral Benefits:?	Traffic Calming, Aesthetics	Bedrock/Water Table?:	No
Community Engagment?:	Yes	Wetland?:	No
Other?:		Other?:	

Project: Park Street Stormwater Retrofit Study, Barre City, VT

Assessed by:AT

Site ID Code: 83 Park Street

Site Rating:

Name:

E911 Address:	83 Park Street
Date/Time Assessed:	1/8/2015

Practice Concept:

Green Gutter' concept where runoff from street and possibly residences would funnel to vegetated, leveled swale and infiltrate or filter.

Ownership:	Public
Site Contact:	Ann Smith

A 'green gutter' or terraced swale could provide infiltration at this site.

LID Practice Details

Practice 1:	Green Gutter (bioretention)
Practice 2:	Vegetated Swale (terraced)
Practice 3:	
New/Retrofit?:	New

Maintenance Burden:

High	Medium	Low

Site Information

Site Landuse 1:	Road ROW
Site Landuse 2:	Private Property
SW Practice On-Site?:	No
Pollutant Hotspot?:	No
Pollutant of Concern 1:	N/A
Pollutant of Concern 2:	N/A

Design Considerations:

Drainage Area (ac):	UNK
Impervious %:	UNK
DA Usage:	Residential
Practice Area (sq. ft.):	~800
Soils (mapped):	HSG C

Feasibility/Design Notes:

HSG C soils on site may not have sufficiently high infiltration capacity. Practice would likely require soil amendment to achieve desired infiltration rate. Practice could be built in road ROW but may require additional consideration for utilities. Terracing is likely needed for this practice to be most effective.

Location:

Benefits		Constraints	
Velocity Reduction?:	Yes	Soils?:	Possible
Storage?:	Yes	Contamination?:	UNK
Water Quality?:	Possible	Utilities?:	Possible
Recharge?:	Posible	Access?:	Public
Collateral Benefits:?	Traffic Calming, Aesthetics	Bedrock/Water Table?:	No
Community Engagment?:	Yes	Wetland?:	No
Other?:		Other?:	

Project: Park Street Stormwater Retrofit Study, Barre City, VT

Assessed by:AT

Site ID Code: 31 Winter Meadow

Site Rating:

Name:

E911 Address:	31 Winter Meadow
Date/Time Assessed:	1/8/2015

Practice Concept:

Natural low depression could receive runoff from Onward and upper Winter Meadow streets (and residences along those streets as well) for infiltration. Site currently has large open lawn space. Practice could overflow to existing stormwater catch basin system.

Ownership:	Private
Site Contact:	Ann Smith

Natural depression could serve as bioretention for road and residential runoff.

LID Practice Details

Practice 1:	Bioretention
Practice 2:	Shallow Basin
Practice 3:	
New/Retrofit?:	New

Maintenance Burden:

High	Medium	Low

Site Information

Site Landuse 1:	Private Open Space
Site Landuse 2:	Road ROW
SW Practice On-Site?:	No
Pollutant Hotspot?:	No
Pollutant of Concern 1:	N/A
Pollutant of Concern 2:	N/A

Design Considerations:

Drainage Area (ac):	UNK
Impervious %:	UNK
DA Usage:	Residential
Practice Area (sq. ft.):	~1000-1,500
Soils (mapped):	HSG C

Feasibility/Design Notes:

HSG C soils on site may not have sufficiently high infiltration capacity. Practice would likely require soil amendment to achieve desired infiltration rate. Practice could be built in road ROW but may require additional private land to adequately manage all runoff.

Location:

Benefits		Constraints	
Velocity Reduction?:	Yes	Soils?:	Possible
Storage?:	Yes	Contamination?:	UNK
Water Quality?:	Possible	Utilities?:	Possible
Recharge?:	Posible	Access?:	OK
Collateral Benefits:?	Traffic Calming, Aesthetics	Bedrock/Water Table?:	No
Community Engagment?:	Yes	Wetland?:	No
Other?:		Other?:	

Project: Park Street Stormwater Retrofit Study, Barre City, VT

Assessed by:AT

Site ID Code: 21 Winter Meadow

Site Rating:

Name:

E911 Address:	21 Winter Meadow
Date/Time Assessed:	1/8/2015

Practice Concept:

Practice could take runoff from 21 Winter Meadow residence and associated street segment.

Ownership:	Public
Site Contact:	Ann Smith

Natural depression could serve as bioretention for road and residential runoff.

LID Practice Details

Practice 1:	Bioretention
Practice 2:	Green Gutter
Practice 3:	
New/Retrofit?:	New

Maintenance Burden:

High	Medium	Low

Site Information

Site Landuse 1:	Road ROW
Site Landuse 2:	Private Open Space
SW Practice On-Site?:	No
Pollutant Hotspot?:	No
Pollutant of Concern 1:	N/A
Pollutant of Concern 2:	N/A

Design Considerations:

Drainage Area (ac):	UNK
Impervious %:	UNK
DA Usage:	Residential
Practice Area (sq. ft.):	~600
Soils (mapped):	HSG C

Feasibility/Design Notes:

HSG C soils on site may not have sufficiently high infiltration capacity. Practice would likely require soil amendment to achieve desired infiltration rate. Practice could be built in road ROW but may require additional private land to adequately manage all runoff.

Location:

Benefits		Constraints	
Velocity Reduction?:	Yes	Soils?:	Possible
Storage?:	Yes	Contamination?:	UNK
Water Quality?:	Possible	Utilities?:	Possible
Recharge?:	Posible	Access?:	OK
Collateral Benefits:?	Traffic Calming, Aesthetics	Bedrock/Water Table?:	No
Community Engagment?:	Yes	Wetland?:	No
Other?:		Other?:	

Project: Park Street Stormwater Retrofit Study, Barre City, VT

Assessed by:AT

Site ID Code: 17 Winter Meadow

Site Rating:

Name:

E911 Address:	17 Winter Meadow
Date/Time Assessed:	1/8/2015

Practice Concept:

Practice could take runoff from 17 Winter Meadow and associated street segment.

Ownership:	Public
Site Contact:	Ann Smith

Natural depression could serve as bioretention for road and residential runoff.

LID Practice Details

Practice 1:	Bioretention
Practice 2:	Green Gutter
Practice 3:	
New/Retrofit?:	New

Maintenance Burden:

High	Medium	Low

Site Information

Site Landuse 1:	Road ROW
Site Landuse 2:	Private Open Space
SW Practice On-Site?:	No
Pollutant Hotspot?:	No
Pollutant of Concern 1:	N/A
Pollutant of Concern 2:	N/A

Design Considerations:

Drainage Area (ac):	UNK
Impervious %:	UNK
DA Usage:	Residential
Practice Area (sq. ft.):	~600
Soils (mapped):	HSG C

Feasibility/Design Notes:

HSG C soils on site may not have sufficiently high infiltration capacity. Practice would likely require soil amendment to achieve desired infiltration rate. Practice could be built in road ROW but may require additional private land to adequately manage all runoff.

Location:

Benefits		Constraints	
Velocity Reduction?:	Yes	Soils?:	Possible
Storage?:	Yes	Contamination?:	UNK
Water Quality?:	Possible	Utilities?:	Possible
Recharge?:	Posible	Access?:	OK
Collateral Benefits:?	Traffic Calming, Aesthetics	Bedrock/Water Table?:	No
Community Engagment?:	Yes	Wetland?:	No
Other?:		Other?:	

Project: Park Street Stormwater Retrofit Study, Barre City, VT

Assessed by:AT

Site ID Code: 7 Winter Meadow

Site Rating:

Name:

E911 Address:	7 Winter Meadow
Date/Time Assessed:	1/8/2015

Practice Concept:

Practice could take runoff from 7 Winter Meadow and associated street segment, as well as part of Upland Ave.

Ownership:	Public
Site Contact:	Ann Smith

Natural depression could serve as bioretention for road and residential runoff.

LID Practice Details

Practice 1:	Bioretention
Practice 2:	Green Gutter
Practice 3:	
New/Retrofit?:	New

Maintenance Burden:

High | Medium | Low

Site Information

Site Landuse 1:	Road ROW
Site Landuse 2:	Private Open Space
SW Practice On-Site?:	No
Pollutant Hotspot?:	No
Pollutant of Concern 1:	N/A
Pollutant of Concern 2:	N/A

Design Considerations:

Drainage Area (ac):	UNK
Impervious %:	UNK
DA Usage:	Residential
Practice Area (sq. ft.):	~1000
Soils (mapped):	HSG C

Feasibility/Design Notes:

HSG C soils on site may not have sufficiently high infiltration capacity. Practice would likely require soil amendment to achieve desired infiltration rate. Practice could be built in road ROW but may require additional private land to adequately manage all runoff.

Location:

Benefits		Constraints	
Velocity Reduction?:	Yes	Soils?:	Possible
Storage?:	Yes	Contamination?:	UNK
Water Quality?:	Possible	Utilities?:	Possible
Recharge?:	Posible	Access?:	OK
Collateral Benefits:?	Traffic Calming, Aesthetics	Bedrock/Water Table?:	No
Community Engagment?:	Yes	Wetland?:	No
Other?:		Other?:	

Project: Park Street Stormwater Retrofit Study, Barre City, VT

Assessed by:AT

Site ID Code: 2 High Street

Site Rating:

Name:

E911 Address:	2 High Street
Date/Time Assessed:	1/8/2015

Practice Concept:

Rain barrel or small cistern could be installed at residence at 2 High St - roofs are guttered and could be easily achievable.

Ownership:	Private
Site Contact:	Ann Smith

Guttered roof could be retrofit with residential rain barrels to capture runoff for reuse.

LID Practice Details

Practice 1:	Rain Barrel
Practice 2:	Small Cistern
Practice 3:	Possible Residential Rain Garden
New/Retrofit?:	New

Maintenance Burden:

High | Medium | Low

Site Information

Site Landuse 1:	Private
Site Landuse 2:	
SW Practice On-Site?:	No
Pollutant Hotspot?:	No
Pollutant of Concern 1:	N/A
Pollutant of Concern 2:	N/A

Design Considerations:

Drainage Area (ac):	UNK
Impervious %:	UNK
DA Usage:	Residential
Practice Area (sq. ft.):	N/A
Soils (mapped):	HSG C

Feasibility/Design Notes:

Rain barrels could be installed at the downspouts at 2 High Street.

Location:

Benefits

Velocity Reduction?:	Yes
Storage?:	Yes
Water Quality?:	Possible
Recharge?:	Posible
Collateral Benefits:?	Traffic Calming, Aesthetics
Community Engagment?:	Yes
Other?:	

Constraints

Soils?:	Possible
Contamination?:	UNK
Utilities?:	Possible
Access?:	OK
Bedrock/Water Table?:	No
Wetland?:	No
Other?:	

Project: Park Street Stormwater Retrofit Study, Barre City, VT

Assessed by:AT

Site ID Code: 12 Winter Meadow

Site Rating:

Name:

E911 Address:	12 Winter Meadow
Date/Time Assessed:	1/8/2015

Practice Concept:

Underground infiltration gallery or chambers could take significant runoff from upper Winter Meadow street, as well as runoff associated with upland meadow above 18 Winter Meadow. This practice would be underground and would not aesthetically change the current landscaping.

Ownership:	Private
Site Contact:	Ann Smith

An underground stone gallery or manufactured infiltration chambers could handle runoff.

LID Practice Details

Practice 1:	Underground Gallery
Practice 2:	Infiltration Chambers
Practice 3:	
New/Retrofit?:	New

Maintenance Burden: High | Medium | Low

Site Information

Site Landuse 1:	Private
Site Landuse 2:	Road ROW
SW Practice On-Site?:	No
Pollutant Hotspot?:	No
Pollutant of Concern 1:	N/A
Pollutant of Concern 2:	N/A

Design Considerations:

Drainage Area (ac):	UNK
Impervious %:	UNK
DA Usage:	Open / Residential
Practice Area (sq. ft.):	~3000
Soils (mapped):	HSG C

Feasibility/Design Notes:

Underground gallery or chambers could handle a relatively large runoff volume at this site. Chambers would provide a larger volume per footprint, but would potentially cost more. This practice could incorporate an underdrain with an overflow to the City's stormwate system.

Location:

Benefits		Constraints	
Velocity Reduction?:	Yes	Soils?:	Possible
Storage?:	Yes	Contamination?:	UNK
Water Quality?:	Possible	Utilities?:	Possible
Recharge?:	Posible	Access?:	Good
Collateral Benefits:?	Flooding Reduction	Bedrock/Water Table?:	No
Community Engagment?:	No	Wetland?:	No
Other?:		Other?:	

Project: Park Street Stormwater Retrofit Study, Barre City, VT

Assessed by:AT

Site ID Code: Upper Field

Site Rating:

Name:

E911 Address:	Upper Field
Date/Time Assessed:	1/8/2015

Practice Concept:

Infiltration gallery or basin could be constructed in open space in the upper field (above 18 Winter Meadow) to receive runoff from upland meadow area (no impervious runoff).

Ownership:	Private
Site Contact:	Ann Smith

Either an infiltration gallery or small detention basin would help prevent flooding at this spot.

LID Practice Details

Practice 1:	Underground Gallery
Practice 2:	Detention Basin
Practice 3:	
New/Retrofit?:	New

Maintenance Burden:

High	Medium	Low

Site Information

Site Landuse 1:	Open
Site Landuse 2:	
SW Practice On-Site?:	No
Pollutant Hotspot?:	No
Pollutant of Concern 1:	N/A
Pollutant of Concern 2:	N/A

Design Considerations:

Drainage Area (ac):	UNK
Impervious %:	UNK
DA Usage:	Open
Practice Area (sq. ft.):	~2000 - 5000
Soils (mapped):	HSG C

Feasibility/Design Notes:

Installing an infiltration gallery or small detention basin to collect runoff from the open field would alleviate some of the downstream concerns with flooding. The existing swale (downhill of the site shown) could also be retrofitted to provide more infiltration or detention capacity.

Location:

Benefits		Constraints	
Velocity Reduction?:	Yes	Soils?:	Possible
Storage?:	Yes	Contamination?:	UNK
Water Quality?:	Possible	Utilities?:	Possible
Recharge?:	Posible	Access?:	Good
Collateral Benefits:?	Flooding Reduction	Bedrock/Water Table?:	No
Community Engagment?:	No	Wetland?:	Possible
Other?:		Other?:	

Project: Park Street Stormwater Retrofit Study, Barre City, VT

Assessed by:AT

Site ID Code: 184 Elm Street

Site Rating:

Name:

E911 Address:	184 Elm Street
Date/Time Assessed:	1/8/2015

Practice Concept:

Underground infiltration gallery or chambers could take runoff from combined street/residential runoff from Winter Meadow. Could also be possible to route existing stormwater pipes underground to gallery/chambers.

Ownership:	Private
Site Contact:	Ann Smith

Infiltration gallery or chambers could be installed underground to take runoff from the stormwater system.

LID Practice Details

Practice 1:	Underground Gallery
Practice 2:	Infiltration Chambers
Practice 3:	
New/Retrofit?:	New

Maintenance Burden:

High	Medium	Low

Site Information

Site Landuse 1:	Open
Site Landuse 2:	
SW Practice On-Site?:	No
Pollutant Hotspot?:	No
Pollutant of Concern 1:	N/A
Pollutant of Concern 2:	N/A

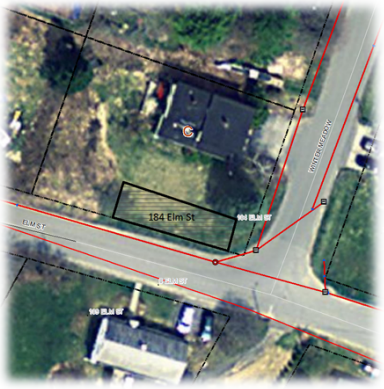
Design Considerations:

Drainage Area (ac):	UNK
Impervious %:	UNK
DA Usage:	Residential
Practice Area (sq. ft.):	~1500
Soils (mapped):	HSG C

Feasibility/Design Notes:

This practice could potentially receive both overland flow runoff as well as runoff collected via catch basins and pipes. This would need to be verified with field surveying to confirm pipe inverts, etc. The practice would be underground and should have no effected on the current landscaping.

Location:



Benefits

Velocity Reduction?:	Yes
Storage?:	Yes
Water Quality?:	Possible
Recharge?:	Posible
Collateral Benefits:?	
Community Engagment?:	No
Other?:	

Constraints

Soils?:	Possible
Contamination?:	UNK
Utilities?:	Possible
Access?:	Good
Bedrock/Water Table?:	No
Wetland?:	No
Other?:	

Project: Park Street Stormwater Retrofit Study, Barre City, VT

Assessed by:AT

Site ID Code: 100 Tremont Street

Site Rating:

Name:

E911 Address:	100 Tremont Street
Date/Time Assessed:	1/8/2015

Practice Concept:

Infiltration gallery (if feasible) or extended detention chamber could be placed underground at corner of Tremont and Elm St. Slopes are potentially a limitation in this location. This practice could take a significant amout of drainage.

Ownership:	Private
Site Contact:	Ann Smith

An underground detention chamber could reduce peak discharges to the stormwater sewer.

LID Practice Details

Practice 1:	Underground Detention Chamber
Practice 2:	Infiltration Chambers
Practice 3:	
New/Retrofit?:	New

Maintenance Burden:

High	Medium	Low

Site Information

Site Landuse 1:	Open
Site Landuse 2:	
SW Practice On-Site?:	No
Pollutant Hotspot?:	No
Pollutant of Concern 1:	N/A
Pollutant of Concern 2:	N/A

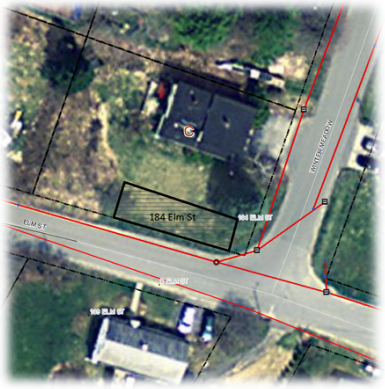
Design Considerations:

Drainage Area (ac):	UNK
Impervious %:	UNK
DA Usage:	Residential
Practice Area (sq. ft.):	~3000
Soils (mapped):	HSG C

Feasibility/Design Notes:

Slopes at this location are steep, which could present a challenge. Land would have to be acquired, or an easement negotiated, for installation. Infiltration may not be feasible here.

Location:



Benefits		Constraints	
Velocity Reduction?:	Yes	Soils?:	Possible
Storage?:	Yes	Contamination?:	UNK
Water Quality?:	Possible	Utilities?:	Possible
Recharge?:	Possible	Access?:	Good
Collateral Benefits:?	No	Bedrock/Water Table?:	No
Community Engagment?:	No	Wetland?:	No
Other?:		Other?:	

Project: Park Street Stormwater Retrofit Study, Barre City, VT

Assessed by:AT

Site ID Code: Upper Meadow

Site Rating:

Name:

E911 Address:	Upper Meadow
Date/Time Assessed:	1/8/2015

Practice Concept:

Vegetated swales with stone-lined entrances could take runoff from upper Winter Meadow street, associate driveways, and residences and turn it across existing contours to infiltrate and spread out flows.

Ownership:	Private
Site Contact:	Ann Smith

Turn-out swales could reduce runoff running down the ditch to the municipal catch basins.

LID Practice Details

Practice 1:	Vegetated Swales
Practice 2:	Level Spreaders
Practice 3:	
New/Retrofit?:	New

Maintenance Burden:

High	Medium	Low

Site Information

Site Landuse 1:	Open
Site Landuse 2:	
SW Practice On-Site?:	No
Pollutant Hotspot?:	No
Pollutant of Concern 1:	N/A
Pollutant of Concern 2:	N/A

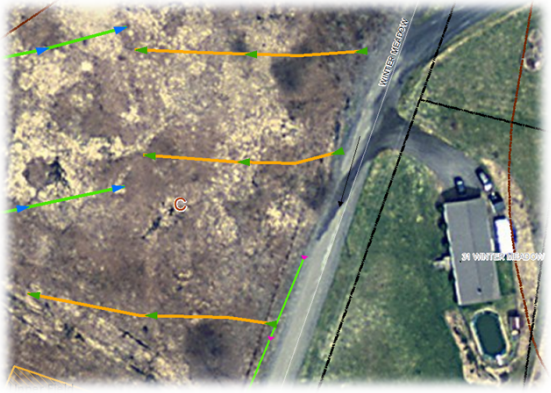
Design Considerations:

Drainage Area (ac):	UNK
Impervious %:	UNK
DA Usage:	Open / Residential
Practice Area (sq. ft.):	N/A
Soils (mapped):	HSG C

Feasibility/Design Notes:

Inlets to swales would have to be armored using stone rip-rap. Outlets could also use level spreaders to ensure erosion doesn't occure. Swales could be vegetated with trees and shrubs to encourage evapotranspiration.

Location:

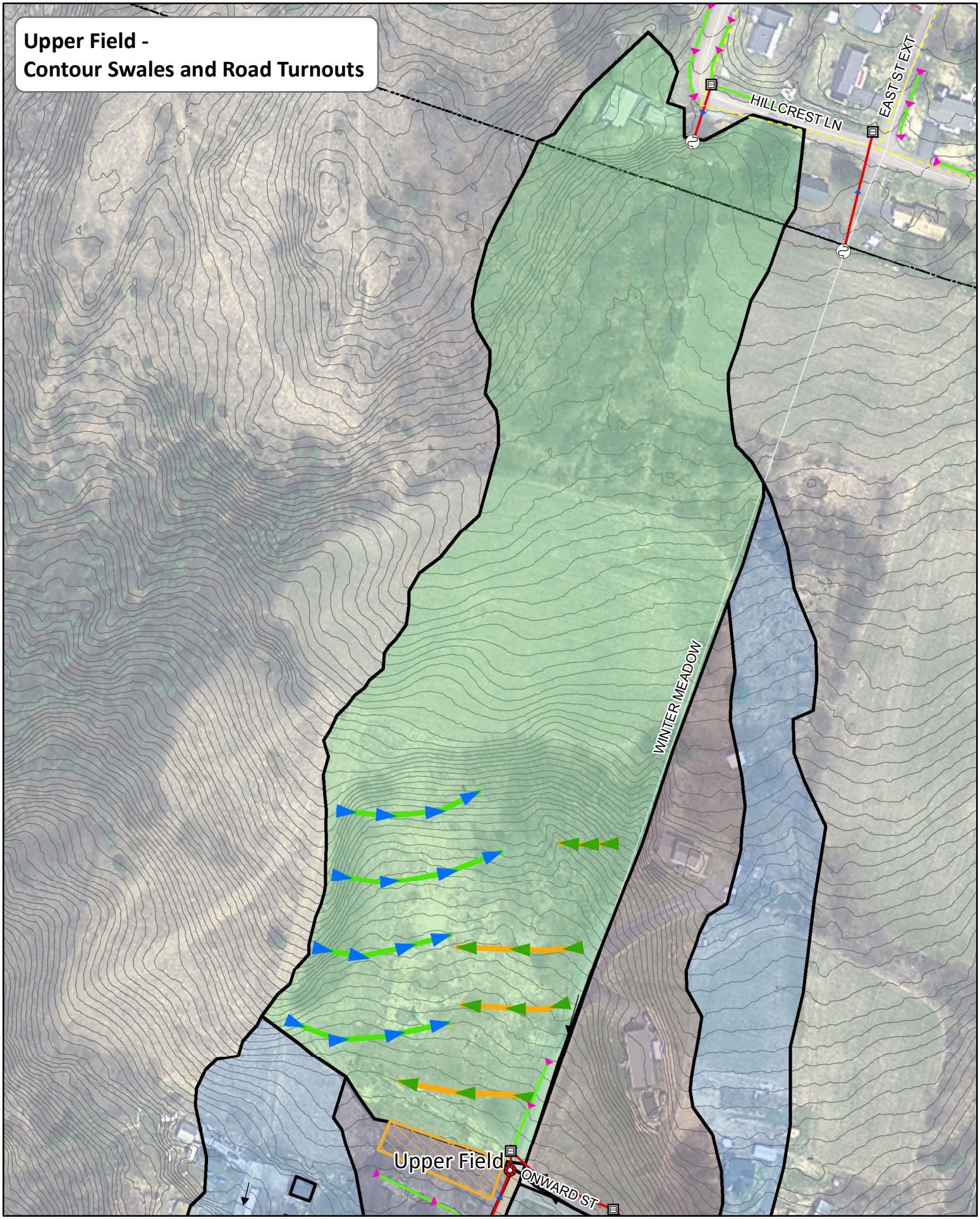


Benefits

Velocity Reduction?:	Yes
Storage?:	Yes
Water Quality?:	Possible
Recharge?:	Possible
Collateral Benefits:?	Aesthetic Benefits, Erosion Reduction
Community Engagment?:	No
Other?:	

Constraints

Soils?:	Possible
Contamination?:	UNK
Utilities?:	No
Access?:	Good
Bedrock/Water Table?:	No
Wetland?:	Possible
Other?:	

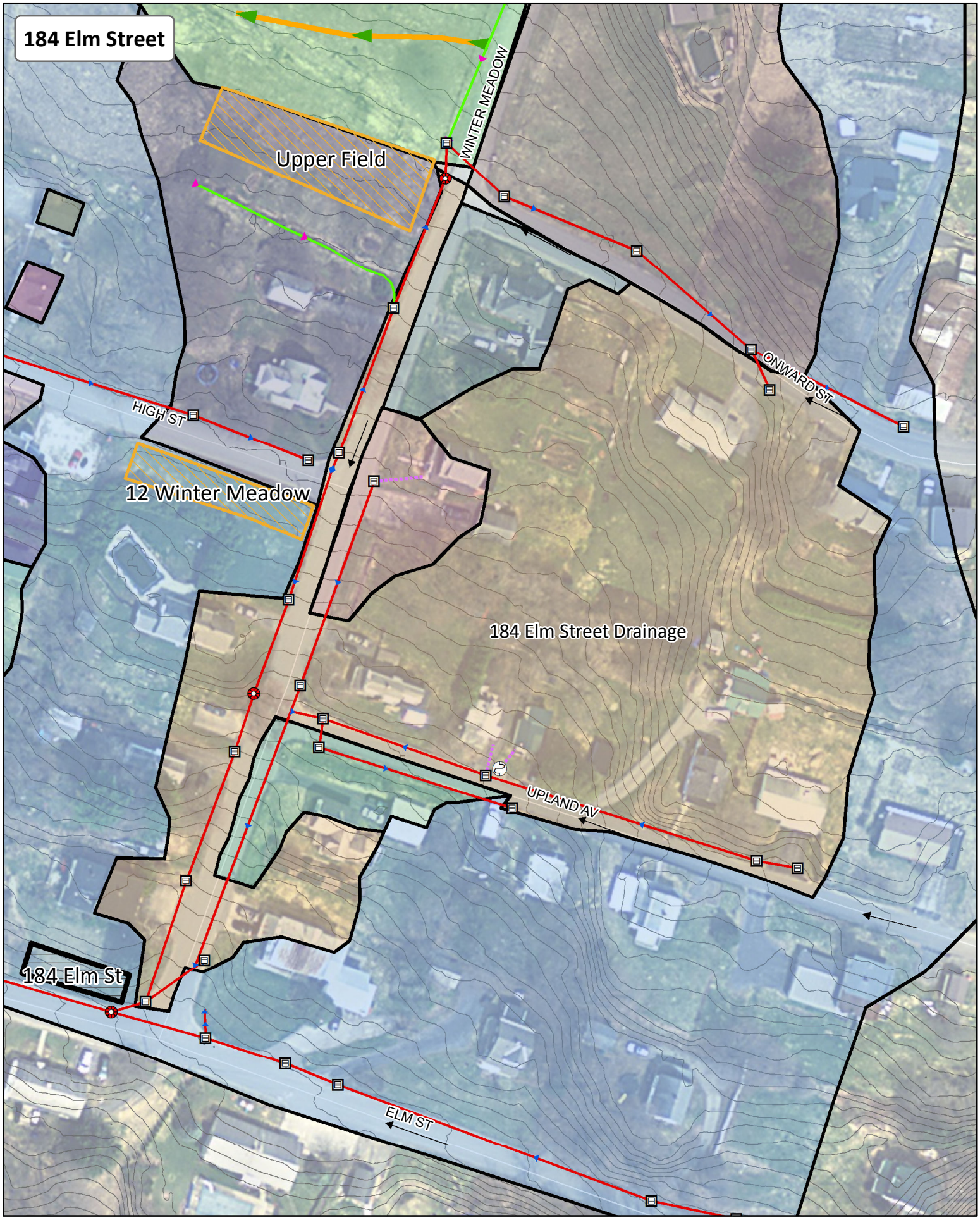


N

0 40 80 160 Feet

Park Street - Stormwater Retrofit Study
Barre City, VT

VERSHED CONSULTING ASSOCIATES, LLC
430 Shelburne Road | PO Box 4413
Burlington, VT 04506
802.497.2367
watershedca.com

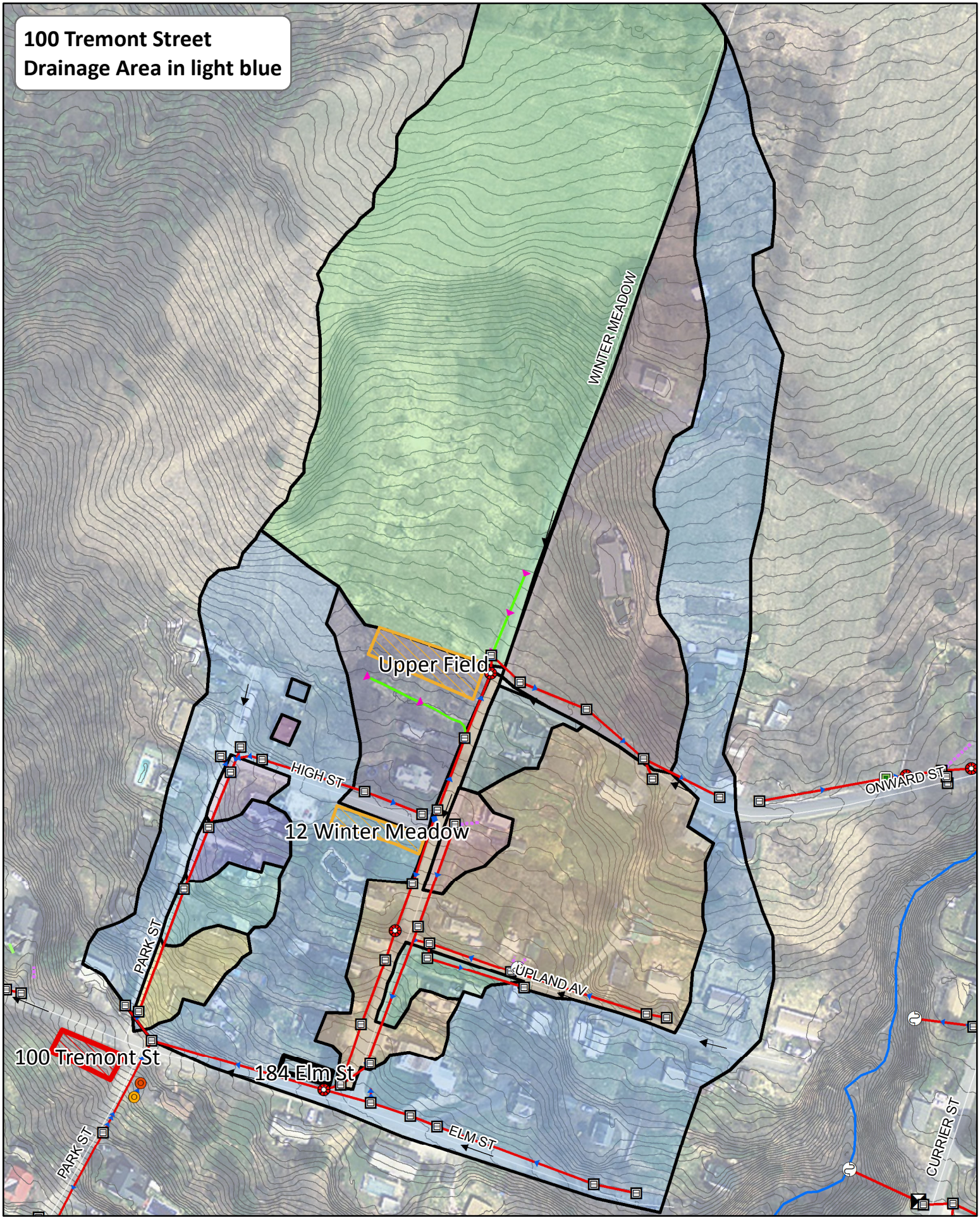


N

0 20 40 80 Feet

Park Street - Stormwater Retrofit Study
Barre City, VT

VERSHED CONSULTING ASSOCIATES, LLC
430 Shelburne Road | PO Box 4413
Burlington, VT 04506
802.497.2367
watershedca.com

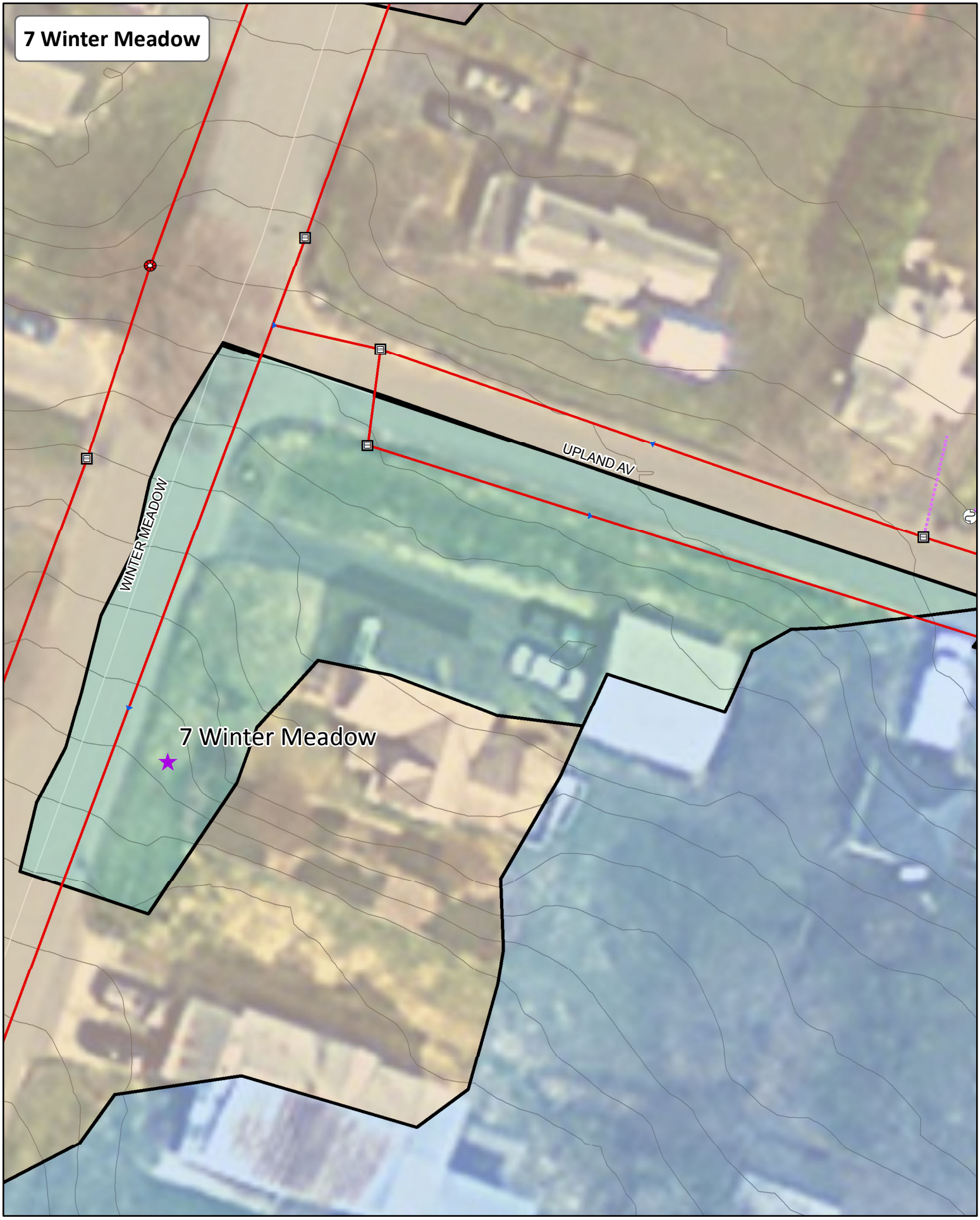


N

0 40 80 160 Feet

Park Street - Stormwater Retrofit Study
Barre City, VT

VERSHED CONSULTING ASSOCIATES, LLC
430 Shelburne Road | PO Box 4413
Burlington, VT 04506
802.497.2367
watershedca.com



N

0 5 10 20 Feet

Park Street - Stormwater Retrofit Study
Barre City, VT

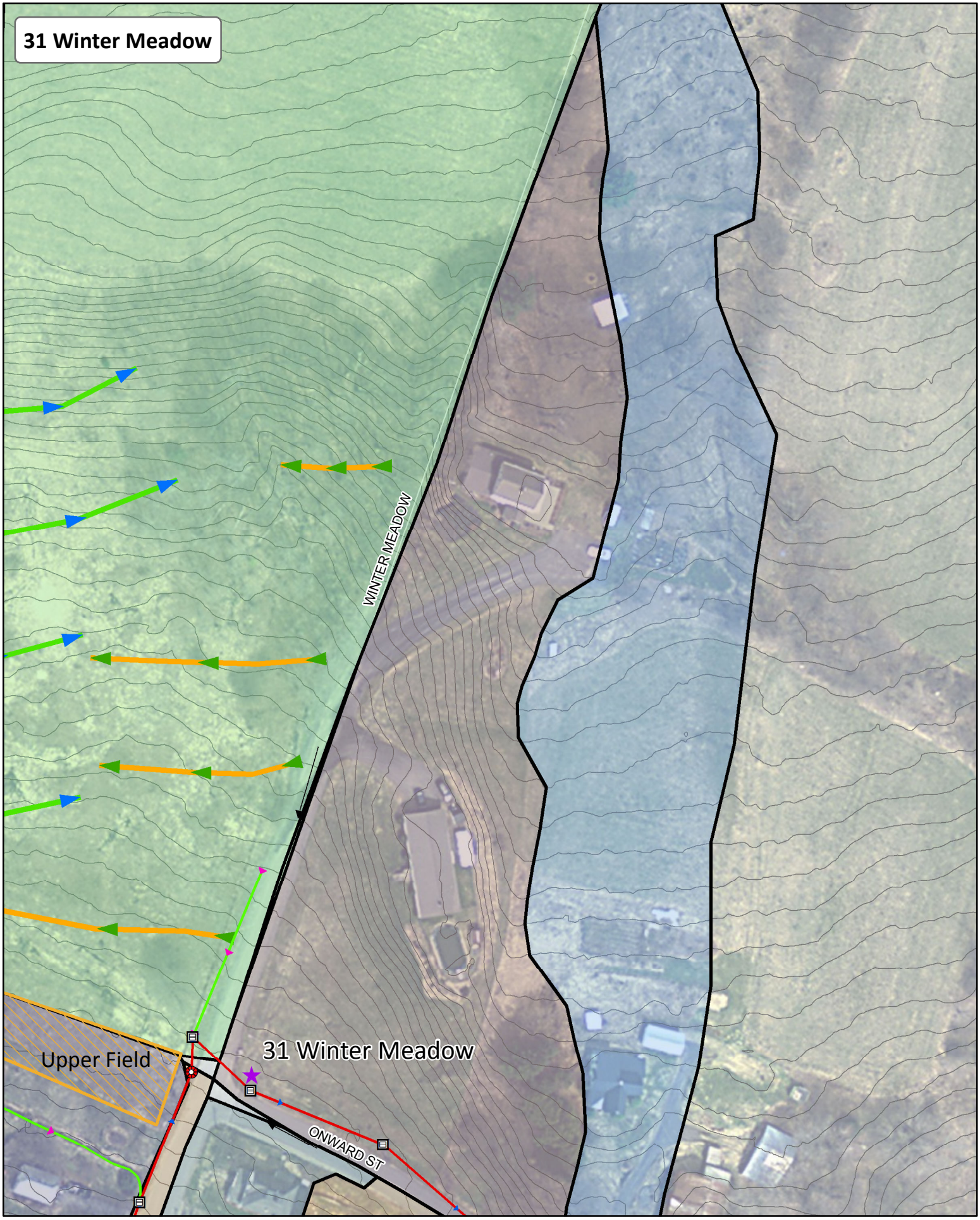
VERSHED CONSULTING ASSOCIATES, LLC
430 Shelburne Road | PO Box 4413
Burlington, VT 04506
802.497.2367
watershedca.com

N

0 4.5 9 18 Feet

Park Street - Stormwater Retrofit Study
Barre City, VT

WATERSHED CONSULTING ASSOCIATES, LLC
430 Shelburne Road | PO Box 4413
Burlington, VT 04506
802.497.2367
watershedca.com



N

0 20 40 80 Feet

Park Street - Stormwater Retrofit Study
Barre City, VT

VERSHED CONSULTING ASSOCIATES, LLC
430 Shelburne Road | PO Box 4413
Burlington, VT 04506
802.497.2367
watershedca.com

N

0 5 10 20 Feet

Park Street - Stormwater Retrofit Study
Barre City, VT

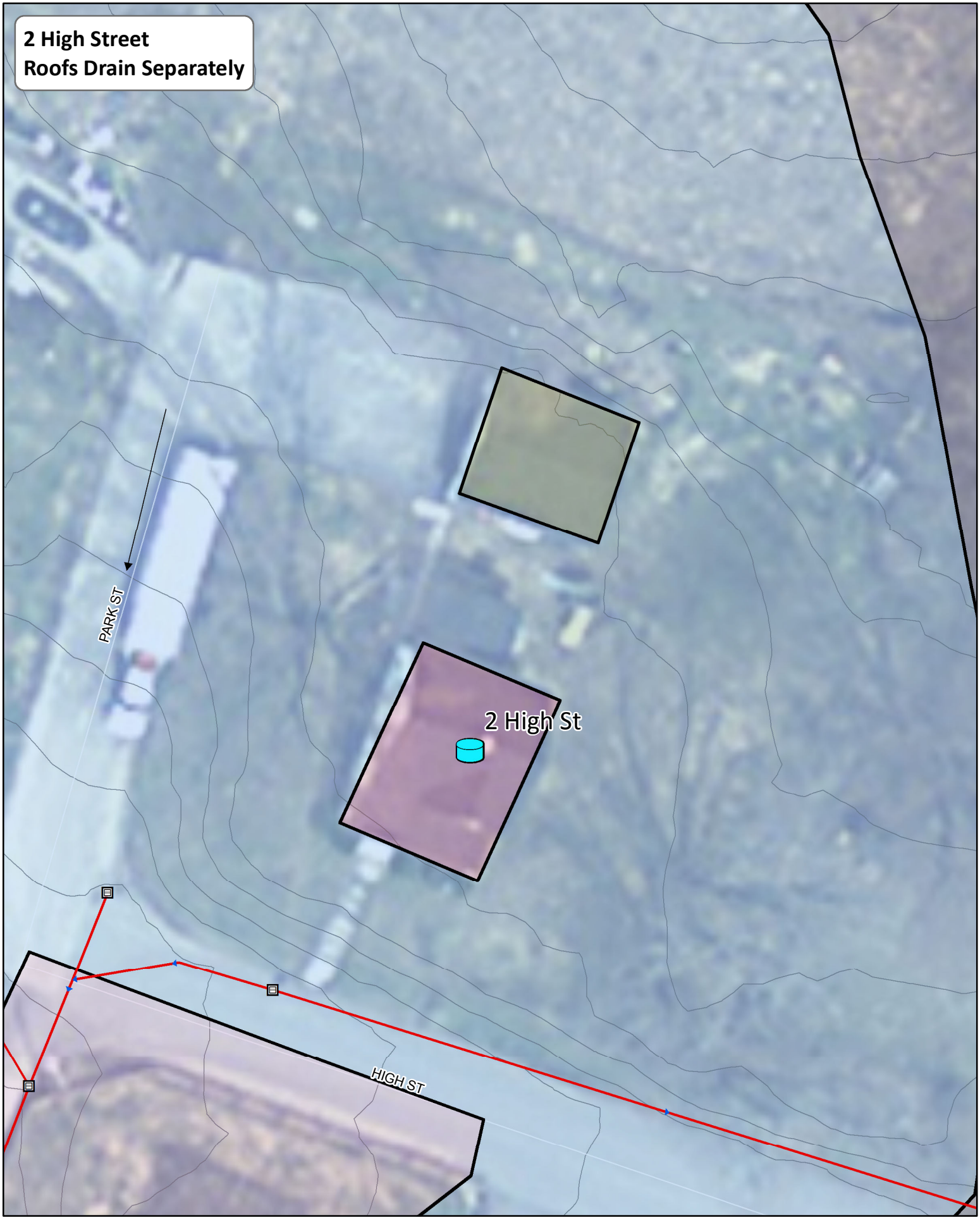
VERSHED CONSULTING ASSOCIATES, LLC
430 Shelburne Road | PO Box 4413
Burlington, VT 04506
802.497.2367
watershedca.com

N

0 5 10 20 Feet

Park Street - Stormwater Retrofit Study
Barre City, VT

VERSHED CONSULTING ASSOCIATES, LLC
430 Shelburne Road | PO Box 4413
Burlington, VT 04506
802.497.2367
watershedca.com



N

0 5 10 20 Feet

Park Street - Stormwater Retrofit Study
Barre City, VT

VERSHED CONSULTING ASSOCIATES, LLC
430 Shelburne Road | PO Box 4413
Burlington, VT 04506
802.497.2367
watershedca.com

N

0 10 20 40 Feet

Park Street - Stormwater Retrofit Study
Barre City, VT

VERMONT WATERSHED CONSULTING ASSOCIATES, LLC
430 Shelburne Road | PO Box 4413
Burlington, VT 04506
802.497.2367
watershedca.com

N

0 5 10 20 Feet

Park Street - Stormwater Retrofit Study
Barre City, VT

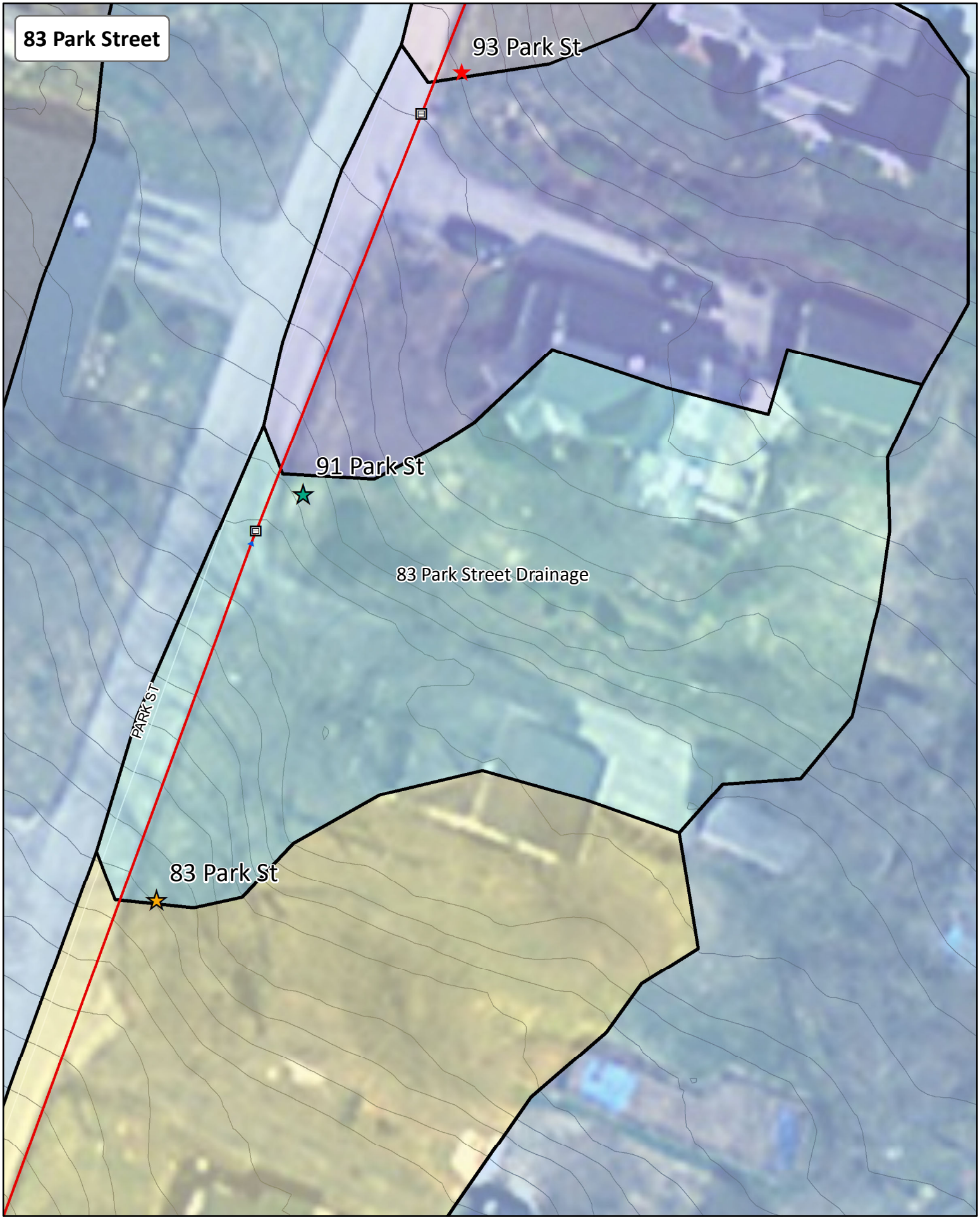
VERSHED CONSULTING ASSOCIATES, LLC
430 Shelburne Road | PO Box 4413
Burlington, VT 04506
802.497.2367
watershedca.com

N

0 5 10 20 Feet

Park Street - Stormwater Retrofit Study
Barre City, VT

Watershed Consulting Associates, LLC
430 Shelburne Road | PO Box 4413
Burlington, VT 04506
802.497.2367
watershedca.com



N

0 5 10 20 Feet

Park Street - Stormwater Retrofit Study
Barre City, VT

VERMONT WATERSHED CONSULTING ASSOCIATES, LLC
430 Shelburne Road | PO Box 4413
Burlington, VT 04506
802.497.2367
watershedca.com

GSI Practice

- Bioretention for Residential / Street Runoff
- Bioretention for Residential Runoff
- Bioretention for Street Runoff
- Infiltration Swale or Terraced Infiltration Bed
- Residential Rain Barrels
- Contour Swales
- Runoff Turn-outs
- Infiltration Gallery
- Infiltration Gallery or Basin
- Infiltration Gallery or Detention Chamber
- Parcels
- Soils

Upper Field

31 Winter Meadow

2 High St

93 Park St

12 Winter Meadow

21 Winter Meadow

17 Winter Meadow

91 Park St

83 Park St

7 Winter Meadow

73 Park St

100 Tremont St

184 Elm St

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

N

0 37.5 75 150 Feet

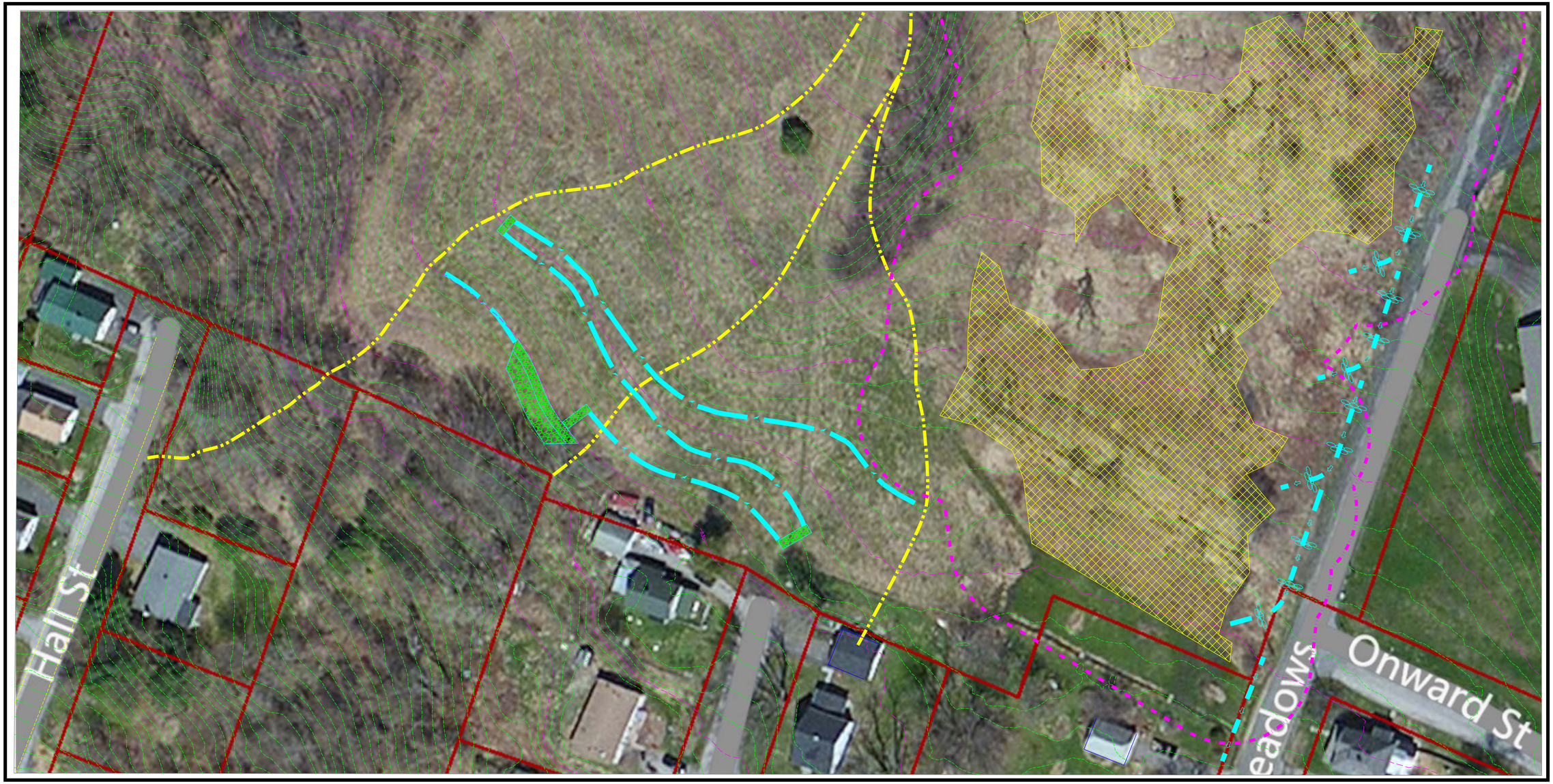
Park Street - Stormwater Retrofit Study
Barre City, VT

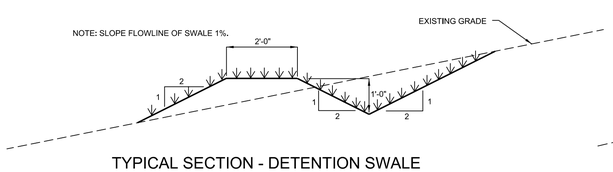
WATERSHED CONSULTING ASSOCIATES, LLC
430 Shelburne Road | PO Box 4413
Burlington, VT 04506
802.497.2367
watershedca.com

N

LEGEND:

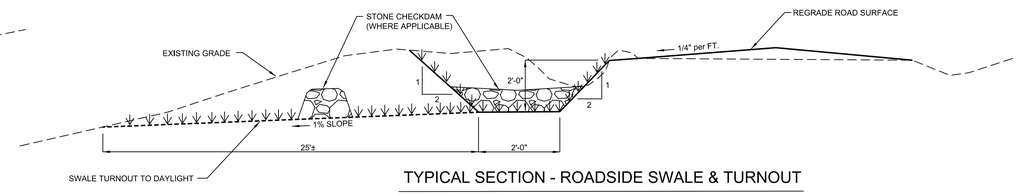
- 2-FOOT INTERVAL CONTOUR
- 10-FOOT INTERVAL CONTOUR
- DRAINAGE AREA BOUNDARY
- CLASS II WETLAND
- 50' WETLAND BUFFER
- PROPOSED DETENTION SWALE
- PROPOSED REHABILITATED ROADSIDE SWALE AND TURNOUT
- PROPOSED STONE CHECK DAM
- STONE PROTECTION





TYPICAL SECTION - DETENTION SWALE

NOT TO SCALE



TYPICAL SECTION - ROADSIDE SWALE & TURNOUT

NOT TO SCALE

GRAPHIC SCALE

30 0 30 60 120

1" = 30'

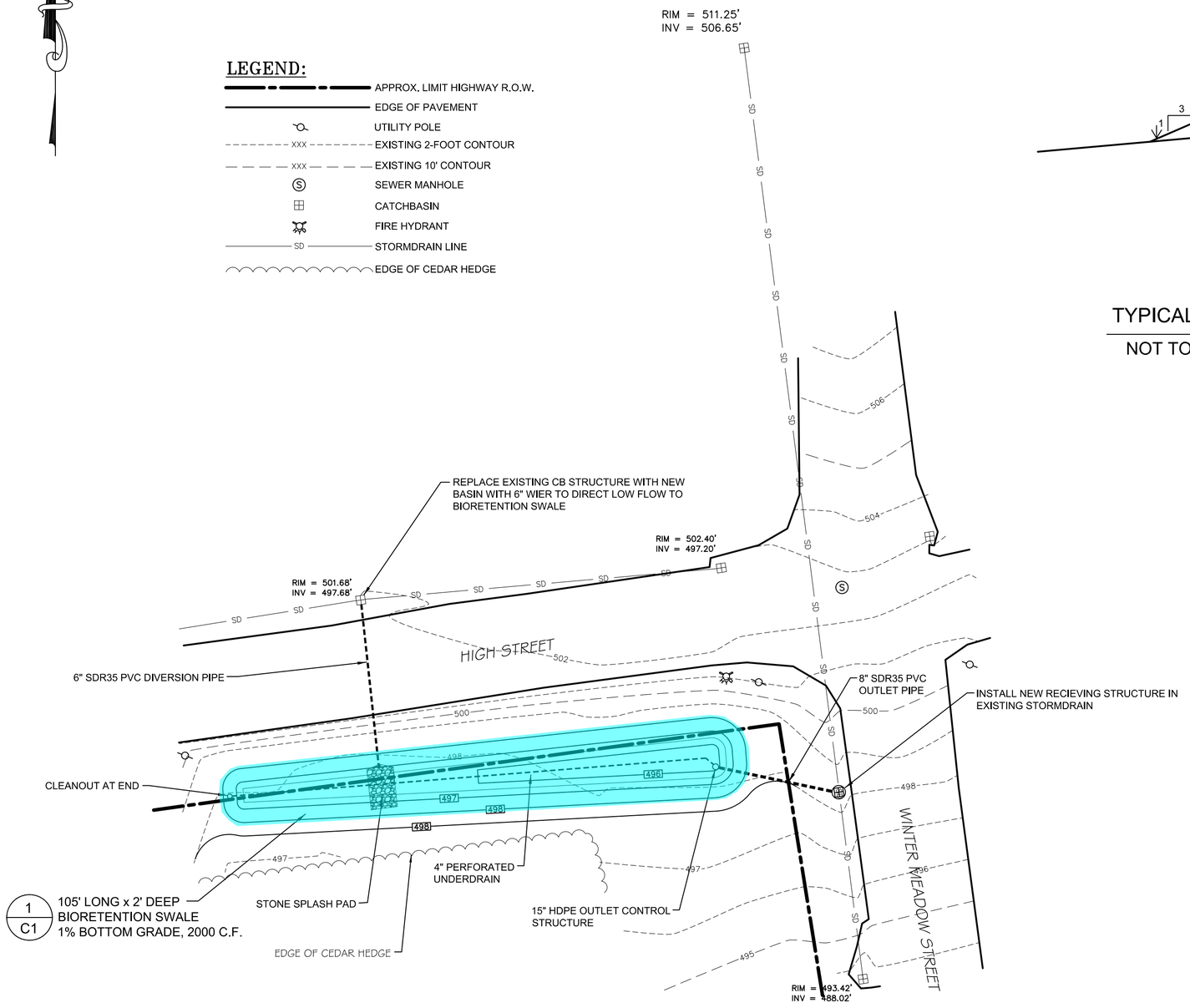
PROPOSED DRAINAGE IMPROVEMENTS
CITY OF BARRE
PERRIN PROPERTY
PARK ST. & WINTER MEADOW ST.

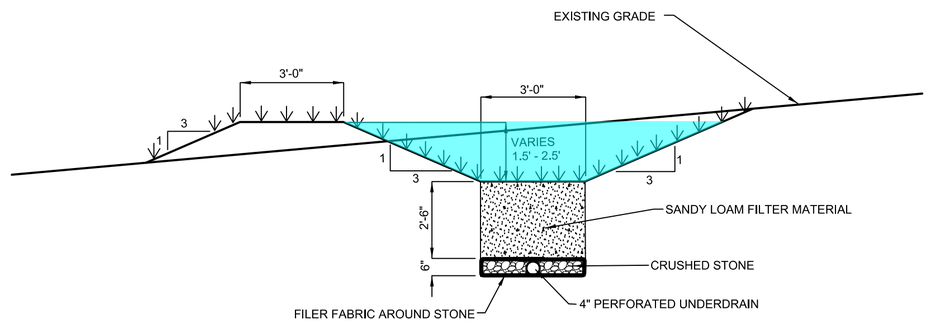
SCALE: 1" = 30'	DATE: 9/24/15	PROJ.# 2015-063	DWG.#063D
DRAWN BY: KKJ	CHECKED BY: AT	FB/PG. EFB	SHEET C3

WATERSHED
CONSULTING ASSOCIATES, LLC
PO BOX 4413, BURLINGTON, VT (802)497-2367

LEGEND:

- APPROX. LIMIT HIGHWAY R.O.W.
- EDGE OF PAVEMENT
- UTILITY POLE
- EXISTING 2-FOOT CONTOUR
- EXISTING 10' CONTOUR
- SEWER MANHOLE
- CATCHBASIN
- FIRE HYDRANT
- STORMDRAIN LINE
- EDGE OF CEDAR HEDGE





TYPICAL SECTION - BIORETENTION SWALE

NOT TO SCALE

1
C1

GRAPHIC SCALE

20 0 20 40 80

1" = 20'

BIORETENTION SWALE

CITY OF BARRE

HIGH & WINTER MEADOW STREETS

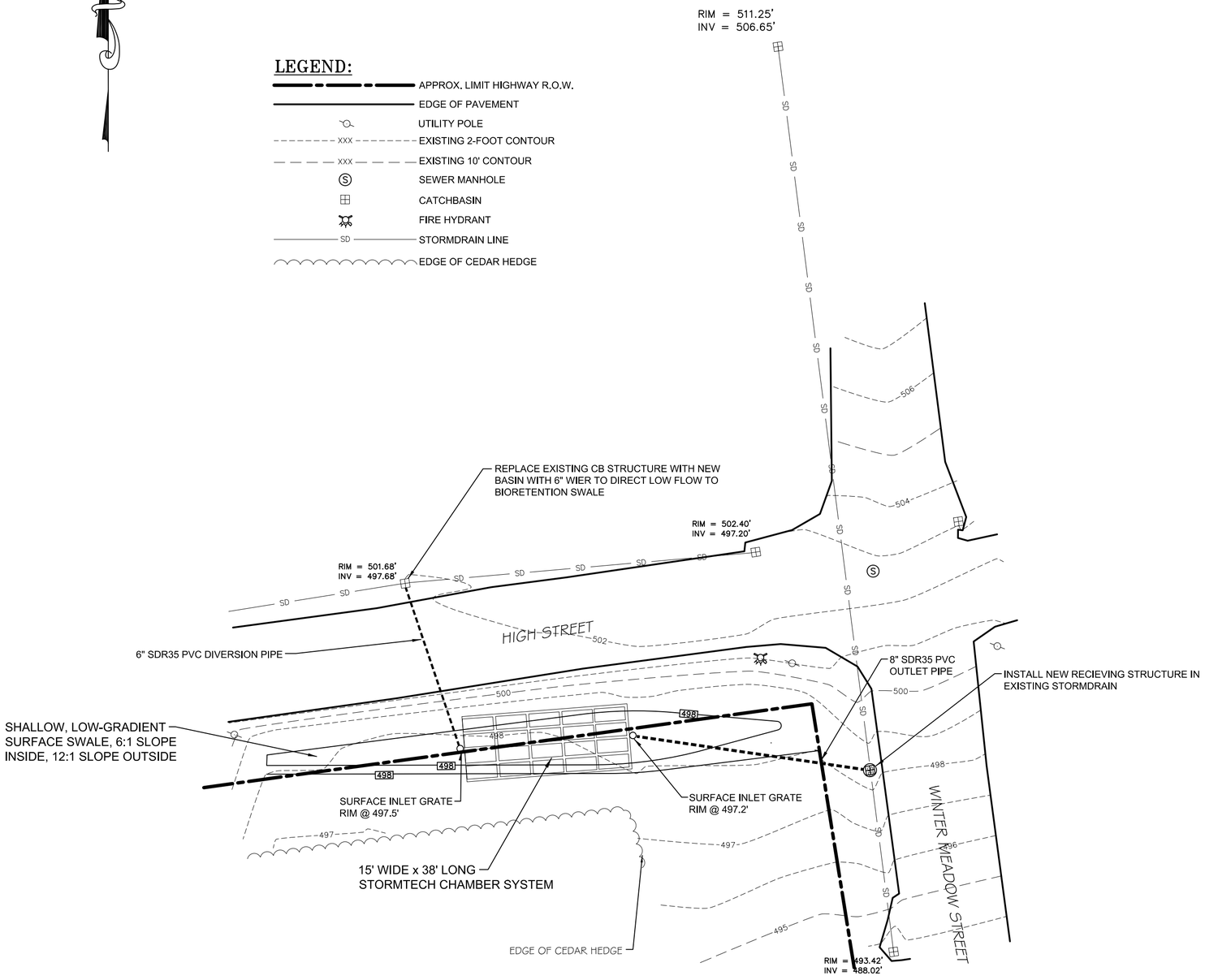
BARRE CITY, VERMONT

SCALE: 1" = 20'	DATE: 8/27/15	PROJ.# 2015-063	DWG.#063B
DRAWN BY: KKJ	CHECKED BY: AT	FB/PG. EFB	SHEET C1

WATERSHED
CONSULTING ASSOCIATES, LLC
PO BOX 4413, BURLINGTON, VT (802)497-2367

LEGEND:

- APPROX. LIMIT HIGHWAY R.O.W.
- EDGE OF PAVEMENT
- UTILITY POLE
- EXISTING 2-FOOT CONTOUR
- EXISTING 10' CONTOUR
- SEWER MANHOLE
- CATCHBASIN
- FIRE HYDRANT
- STORMDRAIN LINE
- EDGE OF CEDAR HEDGE



GRAPHIC SCALE

20 0 20 40 80

1" = 20'

POTENTIAL STORMTECH SYSTEM

CITY OF BARRE

HIGH & WINTER MEADOW STREETS

BARRE CITY, VERMONT

SCALE: 1" = 20'	DATE: 10/27/15	PROJ.# 2015-063	DWG.#063B
DRAWN BY: KKJ	CHECKED BY: AT	FB/PG. EFB	SHEET C1

WATERSHED
CONSULTING ASSOCIATES, LLC
PO BOX 4413, BURLINGTON, VT (802)497-2367