

Appendix B, Table B-1: Details for Completed Structural Stormwater Treatment Practices

ID	Site Name	Land Owner	MS4	Permit No.	Year Completed	BMP Status	Applicable FRP	LC TMDL Drainage Area	LC TMDL Lake Segment	BMP Type	Impervious area (acres)	Pervious area (acres)	Storage volume (ft ³)	P Base Load Before Treatment (kg/yr)	Practice Efficiency (%)	P Credit (kg/yr)	% of P Target Reduction
6653-9010	Village Walk POI 1	Village	Essex Junction MS4	6653-9010	2015	Complete	n/a	Winooski River	Main Lake	Infiltration Basin	3.32	6.22	26,586	5.15	99.2%	5.11	23%
6653-9010	Village Walk POI 2	Village	Essex Junction MS4	6653-9010	2015	Complete	n/a	Winooski River	Main Lake	Infiltration Basin	0.63	1.23	12,803	0.99	100.0%	0.99	4%
6653-9010	Village Walk POI 3	Village	Essex Junction MS4	6653-9010	2015	Complete	n/a	Winooski River	Main Lake	Infiltration Basin	0.32	0.96	6,849	0.58	100.0%	0.58	3%
TAP TA 18(2) Acc	Acorn Circle cul-de-sac retrofit - impervious removal	Village	Essex Junction MS4		2022	Complete	n/a	Winooski River	Main Lake	Impervious Removal	-0.06	0.06	0	1.36		0.03	0%
TAP TA 18(2) Acc	Acorn Circle cul-de-sac retrofit - media filter with specialized media	Village	Essex Junction MS4		2022	Complete	n/a	Winooski River	Main Lake	Sand Filter (w/ underdrain)	0.70	1.10	3,613	1.04	52.7%	0.94	4%
6006-9020.1	Taft Street S/N 001	Village	Essex Junction MS4	6006-9020.1	2016	Complete	Indian Brook	Malletts Bay	Malletts Bay	Wet pond/ Created Wetland	0.48	1.02	3,528	0.41	54.9%	0.22	2%
6006-9020.1	Taft Street S/N 002	Village	Essex Junction MS4	6006-9020.1	2016	Complete	Indian Brook	Malletts Bay	Malletts Bay	Wet pond/ Created Wetland	0.54	0.96	2,090	0.46	47.4%	0.22	2%
1-1074 SN 002	Fairview Drive/Main St Gravel Wetland	Village	Essex Junction MS4	1-1074 SN 002	2019	Complete	Indian Brook	Malletts Bay	Malletts Bay	Gravel Wetland	3.75	18.77	40,800	3.32	62.2%	2.06	23%
2-0317/2-0952	Mansfield Brickyard Gravel Wetland	Private	Essex Junction MS4	2-0317/2-0952	2020	Complete	Indian Brook	Malletts Bay	Malletts Bay	Gravel Wetland	11.39	6.28	70,153	9.47	65.3%	6.08	67%
4989-INDO	5 Corners North	Essex School D	Essex Junction MS4	4989-INDO		Complete	Indian Brook	Malletts Bay	Malletts Bay	Underground Detention	13.89	17.00	11,892	11.66	8.0%	0.72	8%
3081-9010.R	Perkins Bend 002	Town	Essex Town MS4	3081-9010.R	2010	Complete	n/a	Winooski River	Main Lake	Infiltration Chambers	6.00	7.30	1,520	8.39	22.4%	1.88	4%
7025.9014.ARA	Essex Police Station	Town	Essex Town MS4	7025.9014.ARA	2014	Complete	n/a	Winooski River	Main Lake	Bioretention (w/ underdrain)	1.14	2.50	3,554	1.85	44.4%	0.82	2%
7025.9014.ARA	Essex Police Station	Town	Essex Town MS4	7025.9014.ARA	2014	Complete	n/a	Winooski River	Main Lake	Grass Channel	1.14	2.50	978	1.85	5.2%	0.10	0.2%
5944-INDO.R	Kellogg Rd Detention Pond	Town	Essex Town MS4	5944-INDO.R	2011	Complete	Sunderland Brook	Winooski River	Main Lake	Wet pond/ Created Wetland	9.50	14.00	170,450	11.54	63.0%	7.27	17%
5263-9015	Tanglewood Drive infiltration (Birchwood Manor)	Town	Essex Town MS4	5263-9015	2012	Complete	n/a	Winooski River	Main Lake	Bioretention (infiltrating)	1.81	1.00	6,423	2.04	97.8%	2.00	5%
4181-9015.3	Thompson Drive infiltration	Town	Essex Town MS4	4181-9015.3	2014	Complete	n/a	Winooski River	Main Lake	Infiltration Trench	0.80	0.20	2,795	0.90	99.8%	0.90	2%
TAP TA 18(2) Oal	Oakwood Drive cul-de-sac retrofit - impervious removal	Town	Essex Town MS4		2022	Complete	n/a	Winooski River	Main Lake	Impervious Removal	-0.10	0.10	0	3.29		0.14	0%
TAP TA 18(2) Oal	Oakwood Drive cul-de-sac retrofit - media filter with specialized media	Town	Essex Town MS4		2022	Complete	n/a	Winooski River	Main Lake	Sand Filter (w/ underdrain)	2.13	0.00	11,500	3.43	54.5%	3.09	7%
TAP TA 18(2) Sag	Sage Circle cul-de-sac retrofit - impervious removal	Town	Essex Town MS4		2022	Complete	n/a	Winooski River	Main Lake	Impervious Removal	-0.07	0.65	0	0.85		0.06	0%
TAP TA 18(2) Sag	Sage Circle cul-de-sac retrofit - infiltration trenches	Town	Essex Town MS4		2022	Complete	n/a	Winooski River	Main Lake	Infiltration Trench	0.80	0.00	6,096	0.92	100.0%	0.92	2%
3585-9010.T	Saxon Hill ROW S/N 001	Town	Essex Town MS4	3585-9010.T	2005	Complete	n/a	Winooski River	Main Lake	Dry Swale (w/ underdrain)	1.14	0.85	12,460	1.47	63.0%	0.93	2%
1-1186	Sydney Drive - Woodlands II- Lang Farm Parcel	Town	Essex Town MS4	1-1186	2020	Complete	Indian Brook	Malletts Bay	Malletts Bay	Infiltration Chambers	4.04	28.76	38,812	3.68	92.2%	3.39	11%
4002-INDS.A	Essex Town Center- Essex Outlets	Private	Essex Town MS4	4002-INDS.A		Complete	Indian Brook	Malletts Bay	Malletts Bay	Wet pond/ Created Wetland	6.45	6.08	28,009	1.00	51.9%	0.39	1%
6262-9020	Essex Outlets Pond A	Private	Essex Town MS4	6262-9020		Complete	Indian Brook	Malletts Bay	Malletts Bay	Wet pond/ Created Wetland	5.65	9.07	74,139	4.77	62.4%	2.98	10%
6262-9020	Essex Outlets Pond B	Private	Essex Town MS4	6262-9020		Complete	Indian Brook	Malletts Bay	Malletts Bay	Wet pond/ Created Wetland	3.77	1.22	40,772	3.12	0.63	1.97	6%
6262-9020	Essex Outlets Pond C	Private	Essex Town MS4	6262-9020		Complete	Indian Brook	Malletts Bay	Malletts Bay	Wet pond/ Created Wetland	11.85	10.30	290,966	9.90	63.0%	6.24	20%

Note: n/a = not applicable

Appendix B, Table B-2: Details for Design-Phase Structural Stormwater Treatment Practices

ID	Site Name	Land Owner	MS4	Permit No.	Year Planned Construction	BMP Status	Applicable FRP	LC TMDL Drainage Area	LC TMDL Lake Segment	BMP Type	Impervious area (acres)	Pervious area (acres)	Storage volume (ft ³)	P Base Load Before Treatment (kg/yr)	Practice Efficiency (%)	P Credit (kg/yr)	% of P Target Reduction
EJ-WR-039	Hiawatha Infiltration Gallery Retrofit	Essex Westford School District	Essex Junction MS4			Preliminary Design (<100%)	n/a	Winooski River	Main Lake	Infiltration Chambers	11.71	20.88	14,244	13.50	87.7%	11.84	52%
2-0289	Countryside Cluster Homes A,B,C and Essex Parks East and West	Private	Essex Junction MS4	2-0289	2020	Final Design (100%)	Indian Brook	Malletts Bay Direct Drainage	Malletts Bay	Extended Dry Detention Pond	13.89	17.00	11,892	12.29	13.0%	0.72	8%
2-0155	Countryside Dr Intersection	ROW	Essex Junction MS4	2-0155		Preliminary Design (<100%)	Indian Brook	Malletts Bay Direct Drainage	Malletts Bay	Infiltration Chambers	1.95	3.30	4,792	1.65	68.0%	1.12	12%
2-0187	Grove St.	ROW	Essex Junction MS4 and VTrans	2-0187		Preliminary Design (<100%)	Indian Brook	Malletts Bay Direct Drainage	Malletts Bay	Infiltration Chambers	8.71	14.68	2,047	7.37	31.2%	2.30	25%
EX-WR-001	Meadows Edge/Steeplebush retrofit	Town	Essex Town MS4			Preliminary Design (<100%)	n/a	Winooski River	Main Lake	Gravel Wetland	8.73	16.87	33,149	13.65	52.9%	7.50	17%
EX-WR-041	ZOLET120 Logwood Circle stormline and catchbasin retrofits	Town	Essex Town MS4			Preliminary Design (<100%)	n/a	Winooski River	Main Lake	Infiltration Chambers	3.94	7.26	12,763	4.55	99.3%	4.50	10%
Outfall 126	Outfall 126: Fort Ethan Allen (Ryan St.)	Town	Essex Town MS4		2027?	Preliminary Design (<100%)	Sunderland Brook	Winooski River	Main Lake	Infiltration Chambers	9.84	10.58	12,239	4.33	99.8%	3.90	9%
1-0896, 1-0552, 1-1463	David Dr. Outfall	ROW	Essex Town MS4	1-0896, 1-0552, 1-1463	2032?	Preliminary Design (<100%)	Sunderland Brook	Winooski River	Main Lake	Infiltration Chambers	16.00	16.30	61,028	21.58	96.5%	20.80	48%
EX-LR-001	Autumn Knoll S/N 001 retrofit	Town	Essex Town MS4			Preliminary Design (<100%)	n/a	Lamoille River	Malletts Bay	Gravel Wetland	3.02	2.39	10,846	3.99	57.7%	2.50	8%
1-1319_p1_South	Church of Jesus Christ of Latter Day Saints, South Vault	Private	Essex Town MS4	1-1319	2024	Final Design (100%)	Indian Brook	Malletts Bay Direct Drainage	Malletts Bay	Sand filter (w/ underdrain)	1.83	0.67	13,286	1.52	60.0%	0.91	3%
1-1319_p2_North	Church of Jesus Christ of Latter Day Saints, North Vault	Private	Essex Town MS4	1-1319	2024	Final Design (100%)	Indian Brook	Malletts Bay Direct Drainage	Malletts Bay	Detention Chambers (negligible P treatment)	---	---	---	---	---	---	0%

Note: n/a = not applicable

Essex Junction

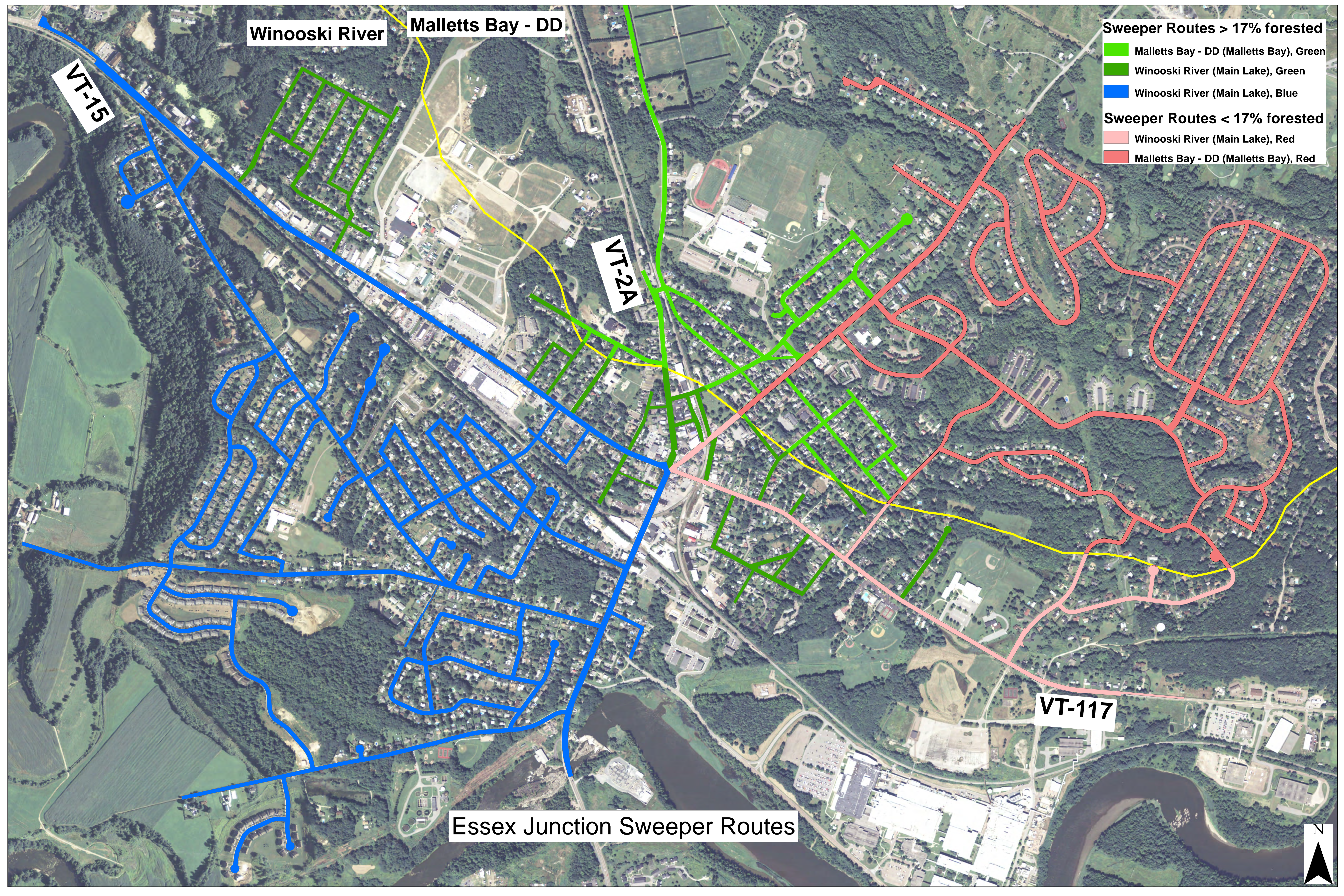
The Village of Essex Junction currently manages its municipal streets in the following way:

1. The Village has about 112 acres of impervious roadway surface that it manages both for catchbasin cleaning, street sweeping and leaf and litter control. Most of the Village streets are curbed or bermed on the roadway edge. The Village owns a 2013 vacuum sweeper and sweeps the streets 2x/year during the sweeping season. Main travel routes are swept 3-4x/yr. The Village also has a vactor and cleans catchbasins on average about 1 basin/2years. The Village does not have a municipal leaf collection program. Catchbasin cleanings, leaves and street sweeper materials are stockpiled separately at the WWTP at 69 Cascade St. The Village has not adopted an ordinance that prohibits residents from placement of leaves in the street
2. If the Village were to implement a higher frequency of street sweeping during October-November on the blue and green sweeping routes and adopt the Wisconsin DNR method of leaf management it could achieve a 12.9 kg/yr. net phosphorus reduction from Essex Junction Village Streets to the Winooski River and Malletts Bay. This would require an increase from 2-3 sweepings per year on these routes to 6-8 sweepings per year. The sweeping frequency would need to be adjusted to 2x/October and 2x/November. The Village's current sweeping practices have been in effect since about 2008 and therefore the credit has been prorated to the time frame of the TMDL monitoring period (2000-2009). The current sweeping practice removes about .65 kg/yr. of phosphorus from Essex Junction Streets to the Winooski River and Malletts Bay. Similarly, the Village's catchbasin cleaning practice has been in place since 2008. Therefore, the total creditable practices are 1.12 kg/yr.
3. There is a Lake Champlain TMDL phosphorus control plan requirement for the Village of Essex Junction and the current practices achieve about 5% (1.12 kg/yr.) of the target (23.08 kg/yr.). The target includes 2 different SWAT drainages as shown.
4. The attached table lists ineligible routes first (<17 percent tree cover) and then eligible routes by SWAT model drainage area ranked from highest to lowest in percentage of tree cover. The ranking places the highest phosphorus loading routes first based on the fact that there is a linear relationship between leaf area cover and dissolved phosphorus loading (Janke, 2018).
5. The Village of Essex Junction implemented their current catchbasin cleaning practice after 2008, and as stated above, it is therefore a creditable practice. If the Village were to adopt the most effective practice for catchbasin cleaning (2x/yr.) it could achieve a credit of 2.27 kg/yr.

MS4	SWAT Drainage Area	TMDL Target Municipal Roads Phosphorus Load Reduction (kg/yr)	CATCH BASIN CLEANING				STREET SWEEPING			Total Credits for Current Practices as % of Target
			Approximate Year Current CB Cleaning Practice Implemented	Current CB Cleaning Credit % of Target Prorated (-10%/yr) to TMDL Monitoring Period (2000-2009)	Current Catchbasin Cleaning Frequency	Max P Load Catchbasin Cleaning Credit (Assumes cleaning 2x/year) (kg/yr)	Approximate Year Current Sweeping Practice Implemented	Current Sweeping Credit % of Target Prorated (-10%/yr) to TMDL Monitoring Period (2000-2009)		
Essex Junction	Malletts Bay - DD	7.72	2008	1.95	1 every 2 years	0.75	2000/2013	3.42	5.4	
Essex Junction	Winooski River	15.36	2008	1.98	1 every 2 years	1.52	2000/2013	2.58	4.6	

Sweeper Route ID	SWAT Drainage Area	Sweeping Frequency	Loading Rate kg/ac/yr	Route Acres per SWAT Drainage	Impervious acreage per SWAT Drainage	Tree Cover Percentage Per SWAT Drainage	Phosphorus Load kg/yr	LEAF MANAGEMENT	
								Route Credit if Wisconsin Method Implemented kg/yr	Total Additional Credits as % of Target
Red	Malletts Bay - DD	2x/yr mainly	0.83	60.0	32.3	<17%			
Red	Winooski River	2-3x/yr mainly	1.12	13.8	9.2	<17%			
Green	Winooski River	2x/yr mainly	1.12	23.7	11.9	27.8	13.3	2.3	14.7
Green	Malletts Bay - DD	2x/yr mainly	0.83	21.3	10.6	22.5	8.8	1.5	19.3
Blue	Winooski River	2x/yr mainly	1.12	88.8	48.2	21.2	53.9	9.2	59.6

Malletts Bay - DD	8.78	1.49	19.34
Winooski River	53.87	9.16	59.63



Winooski River

Malletts Bay - DD

Sweeper Routes > 17% forested

Malletts Bay - DD (Malletts Bay), Green

Winooski River (Main Lake), Green

Winooski River (Main Lake), Blue

Sweeper Routes < 17% forested

Winooski River (Main Lake), Red

Malletts Bay - DD (Malletts Bay), Red

VT-15

VT-2A

VT-117

Essex Junction Sweeper Routes





MEMORANDUM

To: Annie Costandi, Town of Essex Stormwater Coordinator
Chelsea Mandigo, Village of Essex Junction Stormwater Coordinator

From: Lori Kennedy and Anne Kitchell, HW

Date: March 29, 2021

Re: Essex Stormwater Code Review

Cc: Amy Macrellis, Stone Environmental; Amanda Ludlow, Stantec

As part of the Phosphorus Control Plan (PCP) development for the Village of Essex Junction (Village) and Town of Essex (Town), the Horsley Witten Group Inc. (HW) reviewed the following Village and Town documents as they relate to stormwater management:

- Town and Village Stormwater Management Ordinance (Essex Town Ordinance 10.20 and Village Code Section 1901)
- Village of Essex Junction Land Development Code (LDC)
- Village Public Works Details
- Town of Essex Public Works Standard Specifications for Construction
- Town of Essex Subdivision Regulations
- Town of Essex Zoning Regulations

Building on a previous code review completed in 2019 by the Vermont League of Cities and Towns (VLCT), HW targeted this review to evaluate:

- Compliance with Vermont MS4 General Permit requirements,
- Consistency with State stormwater management standards,
- Effectiveness in promoting green infrastructure and environmentally sensitive site design, and
- Opportunities to earn phosphorus-reduction credit.

This memorandum summarizes HW's findings and recommendations, and incorporates feedback provided by Village and Town stormwater staff on the draft memorandum.

MS4 Permit Compliance

HW reviewed the Stormwater Ordinance to assess its compliance with the Vermont MS4 General Permit. Overall, the Stormwater Ordinance and the Village LDC meet MS4 General Permit requirements by:

- 1) Prohibiting illicit discharges,
- 2) Requiring construction-site stormwater management on projects disturbing less than 1 acre, and
- 3) Requiring post-construction stormwater management for projects disturbing more than 1 acre but creating or redeveloping less than 1 acre of impervious cover.

Table 1 summarizes how the Stormwater Ordinance and the Village LDC meet the requirements of the MS4 General Permit and provides recommendations for improving clarity and consistency.

Post-Construction Stormwater Management Consistency with VT General Permits and Guidelines

The MS4 General Permit requires that permittees review their existing policies, regulations, and ordinances to determine their consistency with the requirements of the Secretary's general permits, rules, and guidelines. As a first step toward meeting that requirement, HW completed a preliminary review of the Essex Stormwater Management Ordinance, the Town of Essex Public Works Standard Specifications for Construction, the Village LDC, and the Village Public Works Details to assess their consistency with the substantive requirements of the:

- Vermont General Permit 3-9050 (2020) for Operational Stormwater Discharges,
- Vermont Stormwater Management Manual Rule and Design Guidance (2017), and
- Road Stormwater Management Standards (Municipal Roads General Permit 3-9030, Part 6 and MS4 General Permit, Part 8.3.C).

This review was not meant to be comprehensive; rather, the focus was on illuminating opportunities to improve local post-construction stormwater management and enable the Village and Town to earn phosphorus-reduction credit toward their reduction target for the Lake Champlain TMDL (per MS4 General Permit Part 8.2). Table 2 summarizes the findings of this review.

Table 1. Village and Town Code Compliance with Vermont MS4 General Permit

MS4 Permit Section	Requirement	Stormwater Management Ordinance (Essex Town Ordinance 10.20 and Village Code Section 1901)		Village Land Development Code	
		Relevant Section/ Provision	Comments/ Recommendations	Relevant Section/ Provision	Comments/ Recommendations
6.2.3.a.(2) Illicit Discharge Detection and Elimination	<u>Applicability:</u> > 1 acre land disturbance <u>Requirements:</u> Effectively prohibit non-stormwater discharges into the regulated small MS4 and implement appropriate enforcement procedures and actions.	<u>§10.20.050 Illicit Discharge</u>	Meets MS4 Permit requirements	<u>§713.C Illicit Discharge Detection and Elimination</u>	Meets MS4 Permit requirements
6.2.4.a.(3) Construction-Site Stormwater Management	<u>Applicability:</u> < 1 acre land disturbance (state covers > 1 acre) <u>Requirements:</u> At a minimum, require implementation of the measures in the <i>Low Risk Site Handbook for Erosion Prevention and Sediment Control</i>	<u>§10.20.060 Erosion and Sediment Control</u> Requires erosion and sediment control for all projects and an Erosion Control Permit for projects disturbing < 1 acre and creating or redeveloping 0.5 to 1 acre of impervious area. Requires compliance with small-site erosion-control guidelines provided in Appendix A.	Add reference to the <i>Low Risk Site Handbook for Erosion Prevention and Sediment Control</i> Either compare and reconcile Appendix A to the Handbook or remove Appendix A	<u>§514: Approval of Activities Involving the Disturbance of Less than One (1) Acre</u> Requires applicant to submit an erosion and sediment control plan indicating compliance with the <i>Low Risk Site Handbook</i> . <u>§713.D. Construction Site Stormwater Runoff Control</u> Defines standards for inspection and maintenance of erosion and sediment controls	Meets MS4 Permit requirements

MS4 Permit Section	Requirement	Stormwater Management Ordinance (Essex Town Ordinance 10.20 and Village Code Section 1901)		Village Land Development Code	
		Relevant Section/ Provision	Comments/ Recommendations	Relevant Section/ Provision	Comments/ Recommendations
6.2.5.f.-g. Post-Construction Stormwater Management	<p><u>Applicability:</u> >1 acre land disturbance and <1 acre of impervious cover created or redeveloped.</p> <p><u>Requirements:</u> Develop and implement an ordinance that: (1) prevents or minimizes water quality impacts from runoff, (2) utilizes a combination of structural, non-structural, and LID/GSI practices; (3) ensures long-term O&M, and (4) includes procedures for inspecting projects for compliance.</p>	<p><u>§12.20.070 Development Storm Water Management</u> Applicable to projects that disturb >1 acre and "<i>create new or is an expansion of old impervious surfaces that are equal to or greater than one-half (1/2) acre</i>". Exempts additions/modifications to existing single-family homes. Requires stormwater management per VT standards; construction inspections; maintenance easements and as-built plans.</p> <p><u>§10.20.080 Stormwater Control, Operation and Maintenance</u> Requires maintenance per VT standards; maintenance agreement and covenant, right of entry, and record-keeping.</p>	<p>Meets MS4 Permit requirements</p> <p>Clarify Ordinance applicability language at §12.20.072</p> <p>Clarify or remove single-family home exemption (should not be exempt if disturbs over 1 acre)</p>	<p><u>§713.D.4: Stormwater Management Standards</u> Requires site design to minimize runoff; stormwater management per VSMM</p> <p><u>§713.F Operation and Maintenance of Stormwater Systems</u> Requires O&M plan with inspection and maintenance schedule and responsible party</p> <p><u>§713.D Procedures for Enforcement of Maintenance Requirements</u> Establishes procedures for enforcing maintenance requirements</p>	<p>Meets MS4 Permit requirements</p> <p>Consider adding a requirement to §713 for submission of as-built plans</p>

Table 2. Consistency with State General Permits and Stormwater Manual

State Permit/Manual	State Requirements	Applicable Local Ordinance/Regulation	Comments/Recommendations
Vermont General Permit for Operational Stormwater Discharges 3-9050 (2020)	Eligible projects include: <ul style="list-style-type: none"> Development or redevelopment of one or more acres of impervious surface (changing to ½ acre effective July 1, 2022) Expansion of existing impervious surface by more than 5,000 square feet, such that the total resulting impervious surface is equal to or greater than 1 acre 	<u>Ordinance §10.20.072</u> <ul style="list-style-type: none"> Sets threshold at ½ acre impervious area Allows acceptance of a VT Stormwater Permit as evidence of compliance <u>Village LDC §515</u> <ul style="list-style-type: none"> Sets thresholds of 1 acre land disturbance or creating a total resulting impervious surface of 1 acre or more Requires review in accordance with VT GP 3-9020 and GP 3-9015 or other applicable state permits Requires evidence of compliance with VT state requirements 	<u>Ordinance:</u> <ul style="list-style-type: none"> Clarify applicability language at §10.20.072 Review and update definitions (e.g., “land disturbance” and “redevelopment”) <u>Village LDC:</u> <ul style="list-style-type: none"> Update GP 3-9015 reference to GP 3-9050
Vermont Stormwater Management Manual Rule and Design Guidance (2017)	<ul style="list-style-type: none"> Provides instructions for site planning and stormwater treatment practice (STP) Establishes requirements to meet standards for groundwater recharge, water quality, channel protection, overbank flood protection, extreme flood control, and post-construction soil depth and quality Defines acceptable STPs and feasibility considerations 	<u>Ordinance §10.20.073 and LDC §713.D.4</u> References the Vermont Storm Water Management Manual (volumes I and II), latest version <u>Ordinance §10.20.074 and LDC §713.D.4</u> Sets requirements for peak rate control, groundwater recharge, water quality treatment (min. 80% TSS, 40% TP), channel protection, discharge to sensitive resources, hotspots.	Update references to VSMM Reconcile Ordinance Appendix D with VSMM Revise Ordinance §10.20.074 and Village LDC §713.D.4.: <ul style="list-style-type: none"> Add/strengthen requirements for low impact development site planning and design Update %TSS and %TP reduction and TMDL language Add requirements for flood control and soil quality

State Permit/Manual	State Requirements	Applicable Local Ordinance/Regulation	Comments/Recommendations
Road Stormwater Management Standards (Municipal Roads General Permit 3-9030, Part 6 and MS4 General Permit, Part 8.3.C.	Establishes standards for: <ul style="list-style-type: none"> • Revegetation of disturbed areas, • Roadway cross-slope, • Shoulder berms • Drainage ditches • Culverts • Catch-basin outlet stabilization 	<u>Town DPW Standard Specifications for Construction</u> <ul style="list-style-type: none"> • Chapter 5 provides technical specifications for streets and stormwater control facilities. • Of particular interest for revisions: <ul style="list-style-type: none"> ○ §502.1 Geometric standards for streets Table 1 ○ §511.2 Open Drainage ○ §511.5.4 Drainage Outlets ○ Appendix A – Details <u>Village Public Works Details</u> <ul style="list-style-type: none"> • Provides typical plan and detail for paved street with catch basins, underdrain 	Update Town DPW specifications to match MRGP standards for: <ul style="list-style-type: none"> • Minimum cross slopes • Drainage swale depth and turn-out • Drainage ditch headwalls • Stone aprons or plunge pools at culvert outlets • Check dam specifications Village Public Works Details: <ul style="list-style-type: none"> • Consider adding details for unpaved roads, open drainage, drainage outlets, and culverts meeting MRGP standards

Green Infrastructure and Environmentally Sensitive Site Design

HW reviewed the Town's Zoning Regulations, Subdivision Regulations, Stormwater Ordinance, and DPW construction specs and details and the Village LDC to identify gaps and potential barriers to implementing green infrastructure and more environmentally sensitive development projects. The intent of this review was to highlight regulatory areas the jurisdictions may want to revisit when updating the codes. Findings and recommendations are presented below in three general categories: site design, green infrastructure, and climate resilience.

Site Design

Development regulations have a direct impact on how development activities can improve or degrade the local environment. HW noted several areas for each jurisdiction to look at in more detail include:

1. The Town Subdivision/Zoning Regulations and Village LDC do not go far enough with provisions to improve existing stormwater management conditions during redevelopment or road improvements (widening or realignment). As most future development is likely to be redevelopment/infill, these projects present an opportunity to improve existing conditions in impaired watersheds. During the next round of code updates, consider clearly establishing water quality improvement objectives for redevelopment, set thresholds for triggering stormwater retrofits during road or parking lot improvements, or offer incentives for going above and beyond on water quality treatment or open space protection.
2. The Town lighting standards offer an opportunity to better address Dark Sky objectives. This is worth a more detailed dive into what the existing standards are, if they are compliant with Dark Sky, and how willing the Town is to tackle this issue. The Village lighting standards offer a great model to start from. LDC Section 704 has Dark Sky Complaint requirements for residential exterior lighting and is very detailed on commercial and business lighting. Consider extending to other uses such as recreational facilities.
3. The Village LDC includes a 15-foot minimum undisturbed riparian buffer (below the threshold considered protective) but does include some good language related to restoration. We recommend looking at the Town's requirements, which include some good provisions related to stream crossings at right angles, minimum culvert diameters, etc. Also, consider provisions for allowing third parties such as land trusts to manage buffers.
4. Lot geometry, streets, and parking standards can inadvertently restrict creative design, create excess impervious cover, and fail to protect the natural services of urban trees and open space. Based on the Center for Watershed Protection (CWP) Codes and Ordinance Worksheet (for post-construction stormwater), both the Town and Village score relatively high for environmental/water resources protection. Riparian buffer, open space, cluster/village/planned unit developments (PUD) design, and parking provisions are areas where both jurisdictions have done a good job. The Village LDC Section 273 PUD, for example, describes water resource protection goals. Table 3 summarizes several areas related to streets and lot geometry where the regulations differ from CWP recommendations.

Table 3. Current Standards Compared to Center for Watershed Protection (CWP) Standards

Category	CWP Standards	Town of Essex Current Standards	Village of Essex Junction Current Standards
Road width for low volume roads	<ul style="list-style-type: none"> 18-22 ft width 45 ft or less for ROW 	<ul style="list-style-type: none"> minimum of 24 ft ROW width of 60ft 	<ul style="list-style-type: none"> Local residential = 28 ft paved width with 50 ft ROW Private streets = 20 ft paved and 40 ft ROW widths Transit-oriented development (TOD) street requirements
Cul-de-sacs	<ul style="list-style-type: none"> 70-90 ft minimum diameter Allow alternative turnaround designs 	100 ft; alternative cul-de-sac designs allowed if recommended by Town Engineer (e.g., with island, hammerhead, loop de lanes), but there are no designs in the DPW materials	75 ft diameter, 100 ft ROW
Parking ratios	<ul style="list-style-type: none"> 3 spaces per 1,000 gross SF for professional offices (other use ratios also provided). Ratios should be based on actual needs Shared parking and mass transit provisions Set maximums 	<ul style="list-style-type: none"> 4 spaces per 1,000 gross SF In line with shopping center and SFR ratios Town did a great job with <ul style="list-style-type: none"> flexibility for modifying parking ratio shared parking provisions bike space requirements No required % for compact or electric vehicles 	<ul style="list-style-type: none"> 3.5 spaces per 1,000 gross SF for professional offices; in line with SFR (2 per dwelling) Ratio based on "net uses" for shopping centers TOD parking ratios all meet Waiver criteria allow for reductions based on shared parking, usage studies, and other
Minimum frontage and setback requirements for an equivalent 1/2 acre residential	Frontage: <80 ft Front Setback: ≤20 ft Rear: ≤25 ft Side: ≤8 ft	<ul style="list-style-type: none"> Low residential lot meets min rear yard, but exceeds front (25-40 ft), side (10-15 ft) and frontage (100 ft) PUD can meet rear (15-20 ft) and frontage (75-100 ft) This may not be critical if Town is not having problems with creative designs 	<ul style="list-style-type: none"> R-1 and R-2 both meet all recommended setbacks and frontage TOD has no min setbacks and sets a max front setback of 20 ft
Sidewalks	<ul style="list-style-type: none"> 4 ft min Encouraged alternative layouts Pitch to pervious 	<ul style="list-style-type: none"> 5 ft minimum Required on two-sides (except for dead end streets) Should allow for more flexibility to use alternative pedestrian paths that do not follow road layout 	<ul style="list-style-type: none"> 8 ft min in TOD, but within context of pedestrian friendly design
Driveways	<ul style="list-style-type: none"> 9 ft minimum width Shared driveways 	<ul style="list-style-type: none"> 10 ft min width Shared driveway provisions provided but there is a limitation to 2 dwellings 	<ul style="list-style-type: none"> 12 ft minimum, 20 ft max Up to 5 dwellings shared driveway

Green Stormwater Infrastructure

HW identified several areas that could present barriers to widespread implementation of green stormwater infrastructure within the Town and Village regulations and DPW materials. Table 4 summarizes these areas for a more detailed look:

Table 4. Opportunities to Advance Green Infrastructure in Codes

Category	Town of Essex	Village of Essex Junction
Definitions	<ul style="list-style-type: none"> • Ensure that there is consistency between definitions in regulations and stormwater ordinance • Revisit definitions of hard surface, impervious cover, stormwater retention, runoff, and streetscape to make sure they are not prohibitive to green infrastructure • Consider addition of terms “watershed”, “retrofit”, “buffer restoration”, “unpaved road” or other MS4 Permit-related terms 	
Documentation	<ul style="list-style-type: none"> • Application materials (i.e., site plan review applications) should include information on watershed, TMDL targets, and pollutant load calculations • Make a break from mylar? Consider requirements for hard copy plan sets and feasibility of including/or switching over to digital design plans, as-builts, etc. Would geospatial or spreadsheet-based submittal of drainage infrastructure data assist in development of tracking database for inspection and maintenance? Be consistent with Public Works specifications. 	
BMP preferences and specifications	<ul style="list-style-type: none"> • Multiple locations in the regulations and DPW specifications list specific BMP types (temporary or post-construction) as preferred practices. These do not include newer generation stormwater technologies or an emphasis on the volume reduction benefits of green infrastructure (recharge, reuse, evapotranspiration). • Silt fence and pond references, for example, should be replaced (or at least expanded upon) to include filter socks, bioretention, rainwater harvesting, etc. • The erosion and sediment control requirements in DPW materials could use an update, especially as relates to inspection procedures, preferred practices, and use of fertilizer for seeding (without soil test). • There are several references to plastic mesh erosion control matting that should be removed. 	<ul style="list-style-type: none"> • Similar to Town comments. • We recommend the Town and Village update and combine DPW specifications and standards. Review for consistency with Stormwater Ordinance Appendix D and consider consolidating Appendix D with DPW standards.

Category	Town of Essex	Village of Essex Junction
Permeable pavement (or any alternative to concrete or asphalt)	<ul style="list-style-type: none"> • Not currently mentioned • Allow flexibility for use of pervious materials in parking lots, driveways, streets, sidewalks, etc. • If the Town wants to promote permeable pavements or exert control on the material specifications and construction requirements, will need to update specs. 	<ul style="list-style-type: none"> • LCD Section 909 walkways and bike paths. Does concrete, bituminous paving, or gravel requirement prohibit permeable pavement alternatives?
Curbing	<ul style="list-style-type: none"> • Mentioned frequently as being required (although “partial curbing” appears once) • Could be interpreted as a barrier to alternative road designs or green streets depending on how the Town Engineer is applying the regulations. 	<ul style="list-style-type: none"> • Section 906 requires all streets to have curbing on each side but does offer a waiver option. Would be better if allowed alternatives for stormwater management.
Street trees	<ul style="list-style-type: none"> • No explicit prohibition of tree pits or other vegetated BMPs, but there is no mention of the benefits of trees for stormwater management or other co-benefits that would make it a more accepted practice. • Parking lot requirement for trees that requires raised curb and landscaping could be prohibitive for use of bioretention and other vegetative surface practices. • The Town already has areas in the code dedicated to trees and landscaping and it may be worth establishing urban and rural tree management goals in the context of stormwater, climate, and human health objectives. 	<ul style="list-style-type: none"> • Landscaping requirements in Chapter 2 General Regulations for Public Streets may want to explicitly address vegetation management for stormwater practices placed in the road ROW. • 710. Is there an issue with GI in the visibility triangle. If not, will want to specify low veg <30 inches. • 719. Landscaping. Great job outlining role of trees and landscaping in heat reduction, energy efficiency, stormwater management, air quality; Mature tree credit, salt tolerant, parking lot landscaping for stormwater are mentioned, performance bond etc. • Town should look at Village requirements when they merge
O&M	<p>Evaluate costs to the Village/Town for long-term O&M of accepted roads and associated drainage/stormwater facilities and operational permits. Consider revisions to fee schedules to ensure sufficient funding for ongoing street sweeping, catch basin cleaning, and stormwater facility maintenance and replacement.</p>	

Climate Resilience

HW also identified areas with the Town and Village regulations that present opportunities to promote climate mitigation and adaptation:

- 1) Do more to promote rainwater harvesting and reuse as a viable option for runoff reduction and water conservation.
- 2) Consider requiring a percentage of parking spaces at businesses and public properties to be dedicated for hybrid or electric vehicles to encourage reduced phosphorus loads from combustion engines. Consider offering incentives for installing electric vehicle charging stations.
- 3) For solar arrays, consider establishing specific zoning standards that outline siting preferences; tree, forest, viewshed protection objectives; and allowable/unallowable hydrologic alterations. Also consider adding design standards for parking lot solar awnings/covers.
- 4) For tree canopy cover in parking lots, consider adding language that references cooling, air quality, rainfall interception, and evapotranspiration benefits as objectives and establishing percent coverage targets.
- 5) Open space & Floodplain district regulations could include more emphasis on maintaining or restoring watershed function and improving the Town's resiliency rather than just ensuring recreational access. Similarly, the Village's LCD Section 6 Flood Plain could do a better job of linking floodplain function with climate resilience. Consider adding language related to invasives management, reforestation, and buffer enhancement to open space, buffer, or mitigation sections.
- 6) Add carbon calculation requirements as part of application packages as a way to help decision-makers evaluate the cost/benefit of site development proposals.
- 7) Add to landscaping language about using tree species that are more adaptive to changing climate patterns.
- 8) Add language requiring new public buildings to meet LEED standards, at a minimum, or achieve certification, at best.

Phosphorus-Reduction Crediting Opportunities

The MS4 General Permit allows permittees to take phosphorus-reduction credit for "implementation of municipal ordinances or other regulations to address sub-jurisdictional impervious surfaces." The following sections describe Stormwater Ordinance and Village LDC changes that the Village and Town might consider to enable phosphorus-reduction credit on non-municipal projects that are not otherwise subject to an operational stormwater permit.

Applicability Thresholds (Subjurisdictional Projects)

With the Ordinance's current applicability threshold for *Development Storm Water Management* (§10.20.072), the Village/Town can take phosphorus-reduction credit for stormwater treatment practices (STPs) on projects creating or redeveloping between 0.5 acre and 1 acre of new impervious cover. When the state lowers its applicability threshold for operation permits in July 2022, that credit will end unless the

Village/Town lowers the Ordinance applicability threshold. HW recommends that the Village and Town consider requiring smaller projects (e.g., creating or redeveloping >10,000 sf of impervious cover) to apply for a local stormwater permit.

Before selecting a lower threshold, HW recommends that the Town and Village evaluate the potential costs and benefits of different threshold levels. Considerations might include:

- How many projects would be expected at each threshold level (e.g., >10,000 sf, >5,000 sf),
- Typical phosphorus reduction credit for those projects,
- Staff hours required for permit application review, inspections, enforcement, and tracking.

Phosphorus-Reduction Documentation

The Town currently requires Stormwater Permit applicants, including those permitted under a state Operational Permit, to submit all stormwater plan documents and phosphorus reduction calculations. The Village does not currently require submission of stormwater plan documents and calculations for projects receiving state permits. HW recommends revisions to the Stormwater Ordinance §10.20.072 (State Permits paragraph), §10.20.076, and Appendix C, and the Village LDC §513, §514, and §713.D.4 to require stormwater management plan submissions (for local and state permits) to include all data needed to document phosphorus loading and reductions (pre- and post-development site land use and impervious cover; subwatershed; impervious and pervious drainage area; STP type, volume, and infiltration rate; phosphorus load, removal efficiency, and reduction). To improve tracking efficiency, HW recommends requiring standardized data submission via an online form (linked to ArcGIS online database) or using VT DEC's BMP Tracking Table spreadsheet.

Long-term Operation and Maintenance (O&M)

For MS4 permittees to take credit for phosphorus reduction on subjurisdictional projects, the MS4 General Permit requires that: *"the MS4 shall establish a maintenance agreement with the property owner(s) to ensure long-term maintenance of the BMP(s). The maintenance agreement can be conditions in a local permit, or part of a municipally-approved plan."* DEC issued informal guidance in 2019 that MS4 permittees would need to ensure maintenance of structural practices for subjurisdictional projects, beyond requiring long-term O&M as part of a local permit.

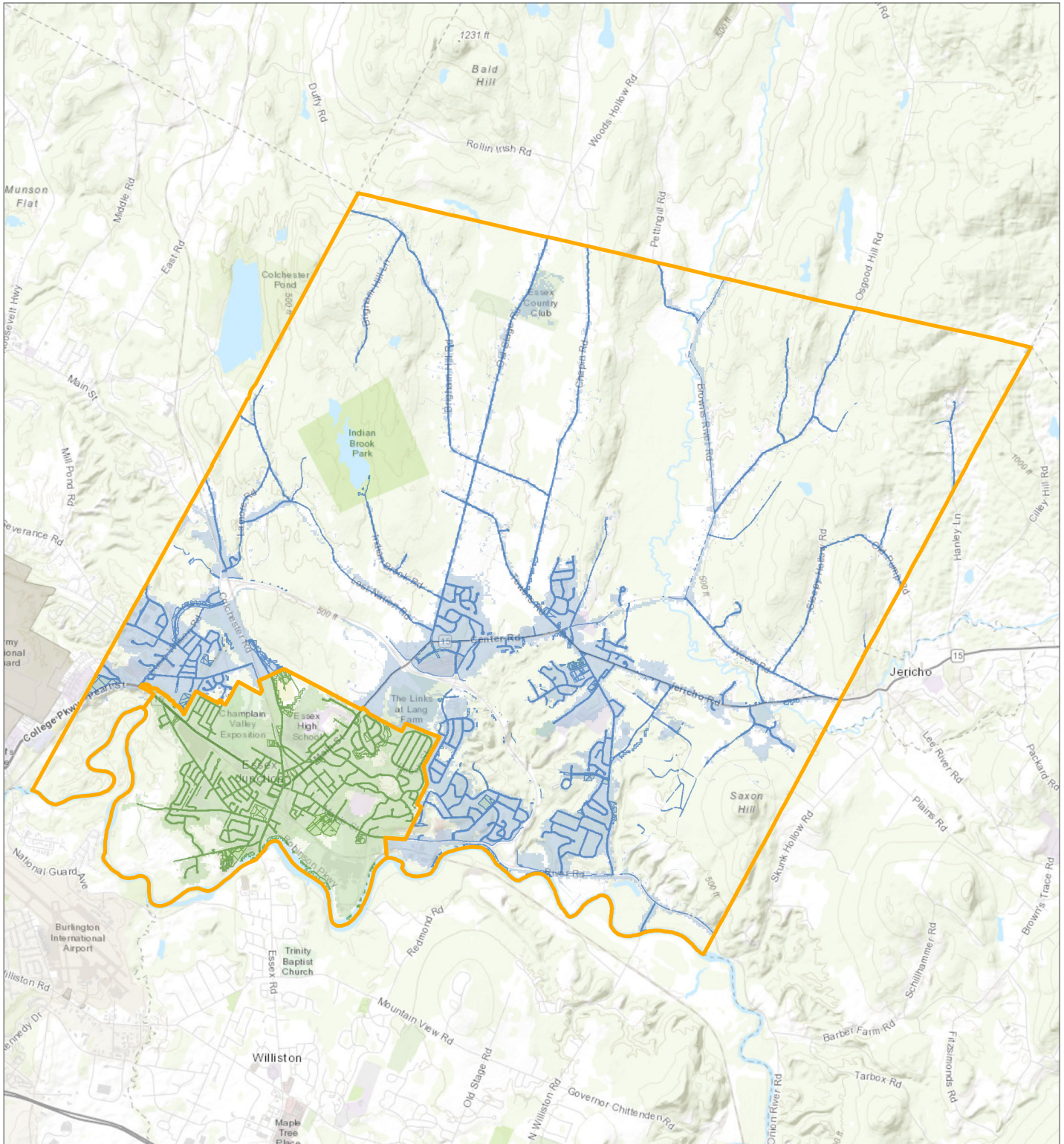
The Ordinance and Village LDC currently include requirements for routine maintenance, inspections, maintenance agreement and covenant, right-of-access for inspections, and record-keeping. HW recommends clarifying with DEC whether the Village/Town will need to report annually on inspections/maintenance of subjurisdictional STPs, and if so, what form that may take. The Village/Town could consider requiring an annual self-report from holders of local stormwater permits, certifying that they have inspected and maintained their STPs in accordance with their O&M plan. Self-reporting would be paired with an audit by Village/Town staff of a select number of permits and STPs annually. Alternatively, the Village/Town staff could annually inspect those STPs themselves.

Offsite Stormwater Mitigation






If the Village/Town decide to reduce the Ordinance applicability threshold below 0.5 acres, HW recommends exploring options to formalize a program for offsite stormwater mitigation. The Village LDC does not include provisions allowing for offsite mitigation. The Ordinance includes language at §10.20.100 allowing the Town to waive stormwater management requirements for projects that meet certain conditions, as long as acceptable mitigation measures are provided. Among the acceptable mitigation measures are: 1) the creation of a stormwater management facility or other drainage improvements on previously developed properties that lack adequate stormwater facilities, and 2) monetary contributions (fee-in-lieu) to fund stormwater management activities “such as research and studies”. The section also states that if a project is granted a waiver, the applicant must “pay a fee based on the impact of the impervious area created in an amount to be determined by the Town.”

The Village and Town could consider several regulatory revisions that would provide flexibility for optimizing stormwater management locations, maximizing phosphorus reduction, and easing phosphorus-reduction tracking and crediting. Options may include:

- 1) Eliminating the waiver allowance at Ordinance §10.20.100.
- 2) Requiring on-site stormwater management to the maximum extent practicable, as demonstrated with an engineering feasibility analysis.
- 3) Or, establishing other criteria by which applicants would demonstrate eligibility for offsite mitigation.
- 4) Allowing applicants to pay a stormwater impact fee in lieu of fully meeting stormwater standards on site. The Village and Town could allocate those funds toward retrofit projects identified in the Village/Town Phosphorus Control Plan.
- 5) Allowing applicants to directly implement STPs at an approved offsite location to provide equivalent stormwater mitigation.



LEGEND


-  Town and Village Boundaries
-  Essex Town Phosphorus Control Plan Area
-  Village of Essex Junction Phosphorus Control Plan Area
-  Essex Town Developed Areas (ANR)
-  Village of Essex Junction Developed Areas (ANR)

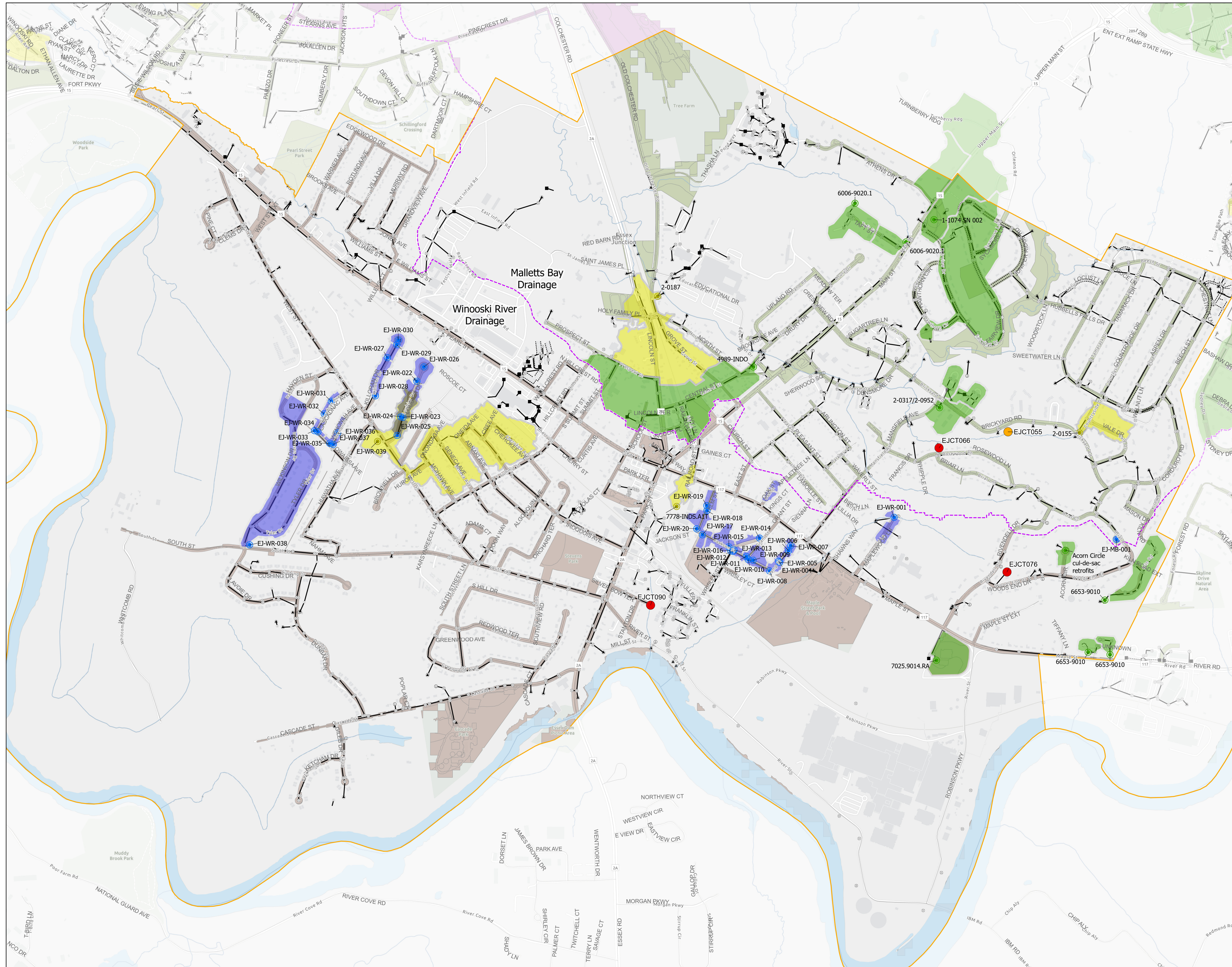


Map 1: Phosphorus Control Plan Areas

Essex Phosphorus Control Plan

Prepared for City of Essex Junction and Town of Essex, VT

 **STONE ENVIRONMENTAL**



0 500 1,000 Feet



LEGEND

Essex Junction PCP Area (Stone)

- Malletts Bay - DD
- Winooski River

Lake Champlain Drainage Areas

Essex Junction Outfalls

- Does Not Meet
- Partially Meets

Structural STP Drainage Areas

- Complete
- Design Phase
- Planned

Structural STP Locations

- Complete
- Design Phase
- Planned

Essex Storm Sewer Points

- Catch Basin
- STM
- Inlet
- Outlet
- Manhole

Essex Storm Sewer Lines

- Culvert
- Storm
- Underdrain
- MS4 Boundaries
- Road Centerlines (VCGI E911)
- Rivers (VCGI)
- Lakes (VCGI)

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**Map 2
 Essex Junction PCP Practices
 Structural STPs, Road Segments Not or
 Partially Meeting Standards, and Outlet
 Stabilization**

Essex Phosphorus Control Plan

Prepared for the City of Essex Junction
 and Town of Essex, VT

