

FINAL



November 2020

St. Lawrence River Watershed Subwatershed Assessment



EcoLogic

Prepared for Franklin County Soil & Water Conservation District

*This plan was prepared with funding provided by the New York State
Department of State under Title 11 of the Environmental Protection Fund.*



**Department
of State**

FINAL

November 2020

St. Lawrence River Watershed Subwatershed Assessment

Prepared for

Franklin County Soil & Water Conservation District
151 Finney Blvd.
Malone NY 12953

Prepared by

EcoLogic, LLC
9 Albany St. Suite 3J
Cazenovia, NY 13035

TABLE OF CONTENTS

1	Objective	1
1.1	Purpose of the Assessment	1
1.2	Assessment Criteria and Procedure	1
1.2.1	Selection of Watershed Indicators for Assessment.....	2
1.2.2	Calculation and Scoring of Watershed Indicator Values.....	3
2	Subwatershed Assessment Results.....	7
2.1	Documented Impairments.....	7
2.2	Environmental Setting.....	10
2.3	Human Impacts.....	14
2.4	Local Capacity for Restoration/Protection.....	18
2.5	Overall Score.....	21

TABLES

Table 1	Assessment Indices, Indicators and Data Sources.....	2
Table 2	Indicator Scoring.....	4
Table 3	Composite Score Ranges.....	6
Table 4	Summary of Documented Impairment Scores at the HUC10 Level	8
Table 5	Summary of Environmental Setting Scores at the HUC10 Level.....	12
Table 6	Summary of Human Impact Scores at the HUC10 Level.....	16
Table 7	Summary of Local Capacity for Restoration/Protection Scores at the HUC10 Level .	19
Table 8	Summary of Final Weighted Scores and Priority Watersheds.....	21

MAPS

Map 1	Indicator Score for Locally Impaired Waters
Map 2	Indicator Score for Regionally Impaired Waters
Map 3	Indicator Score for Natural Land Cover
Map 4	Indicator Score for Soil Erodibility
Map 5	Indicator Score for Flood Risk
Map 6	Indicator Score for Water Resource Value
Map 7	Indicator Score for NPDES Permit Count
Map 8	Indicator Score for Road Density

Map 9	Indicator Score for Percentage of Agricultural Lands
Map 10	Indicator Score for Livestock Density
Map 11	Indicator Score for Percent of Impervious Surfaces
Map 12	Indicator Score for Protected Lands
Map 13	Indicator Score for Unassessed Waters
Map 14	Final Weighted Indicator Scores in St. Lawrence River Watershed

ABBREVIATIONS

ECHO	Environmental Compliance History Online
HUC	Hydrologic Unit Code
NLCD	National Land Cover Dataset
NRCS	Natural Resources Conservation Service
NYSDEC	New York State Department of Environmental Conservation
SPDES	State Pollution Discharge Elimination System
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
WI/PWL	Waterbody Inventory / Priority Waterbodies List

1 Objective

1.1 Purpose of the Assessment

The watershed analysis and prioritization are intended to categorize the subwatersheds of the St. Lawrence River watershed in order to better understand and identify areas requiring additional measures to improve and protect water quality.

A watershed based approach is necessary for effective management of an area as vast and diverse as the St. Lawrence River watershed. A watershed consists of smaller streams successively joining larger ones, with upstream conditions and practices influencing downstream conditions. In this way, we recognize that restoration and protection efforts at smaller units will progressively and cumulatively improve the health of the entire watershed. This assessment serves to set priorities for addressing degraded areas of the watershed at its source, protecting areas that are not degraded but may be threatened without effective management, and areas of public interest. However, “priority” is not meant to limit the potential for projects to receive funding in any given area of the watershed. Recommendations for addressing the restoration and protections issues uncovered in this assessment are discussed in the **St. Lawrence River Watershed Recommendations & Implementation Strategy** document.

1.2 Assessment Criteria and Procedure

This subwatershed assessment was designed to incorporate the stakeholder defined vision and goals for the St. Lawrence River watershed described below.

Vision: The St. Lawrence River watershed is a sustainable source of clean water, recreation, renewable energy, transportation, and timber and food production.

Watershed Goals:

- Protect and enhance habitats of native plants and animals
- Adapt to a changing climate
- Ensure that communities retain their essential character while providing economic opportunity
- Resolve issues of legacy contamination and atmospheric deposition
- Increase awareness of how human actions affect the ecosystem
- Prepare for emerging issues and threats

The public survey results and comments provided input on the communities’ greatest concerns within the watershed.

1.2.1 Selection of Watershed Indicators for Assessment

To identify existing and potential water quality issues within the St. Lawrence River watershed, a methodology for scoring and prioritizing the subwatersheds was developed to assist in identifying problem areas and ultimately, recommendations for mitigating and improving water quality. The prioritization model includes fourteen indicators (**Table 1**) that have a direct influence on natural resources. These factors have been grouped into four indices.

- Documented Impairments
- Environmental Setting
- Human Impacts
- Local Capacity for Restoration/Protection

Each index was assigned a score that incorporated various quantitative indicators (metrics) of watershed health, and each indicator was weighted for overall significance. A cumulative score encompassing all indicators and their weighted-significance, can be used to help define priority areas (subwatersheds with the lowest overall scores), while preserving important information regarding the underlying causes for concern. Quantitative indicators and resulting scores for each index of watershed health are described in this section.

Table 1
Assessment Indices, Indicators and Data Sources

	Indicator	Description	Data Source
Documented Impairments	% of Locally Impacted Waters ¹	The sum of locally impacted surface waters that are impaired, have minor impacts, threatened, or needing verification as a percentage of assessed surface waters.	WI/PWL
	% of Waters Impacted by Atmospheric Deposition/Industrial Pollution ¹	The sum of atmospheric deposition and industrial pollution impacted surface waters as a percentage of assessed surface waters.	WI/PWL
Environmental Setting	% Natural Land Cover	Percent of subwatershed that is in the riparian zone and classified as natural land cover (forest, wetlands, shrubland, and grassland)	National Land Cover Database ² , 2016
	Soil Erodibility	Average soil erodibility (K) factor in the subwatershed.	NRCS Soil Survey Geographic (STATSGO2) database, USGS 2013
	Flood Risk	Areas at risk of flooding with significant impacts	History, NHDPlus2 Flow Accumulation grids (downloaded October 2012)

	Indicator	Description	Data Source
	Water Resource Value	Metric is meant to target areas that have a water resource-dependent local economy, assessed by waterbody area of the HUC10.	NHDPlus WBD Snapshot, EnviroAtlas Version (February 2015 version).
Human Impacts	SPDES Count	Count of SPDES locations divided by HUC12 acreage	USEPA Environmental Compliance History Online (ECHO)
	Road Density	Density of total road miles in the HUC10 (km/sq. km)	US Census Bureau TIGER Roads National Geodatabase (2015 version).
	% Agricultural Lands	Percent of the subwatershed classified as agriculture cover. Includes cropland and pasture/hay.	National Land Cover Database ² , 2016
	Livestock Density	Farm animal populations for an area of interest are estimated from county-level data by first calculating an average “animals per farmland acres” for each animal type for each county.	USDA County Level Agricultural Assessments
	% Impervious Surfaces	Sum of impervious surfaces in a subwatershed as a percentage of the HUC10 area.	National Land Cover Database ² , 2016, Percent Imperviousness dataset (April 2019 version).
Local Capacity for Protection/Restoration	% Unassessed Waters	Percent of total surface waters assessed as part of NYSDEC’s Waterbody Inventory	WI/PWL
	% Protected Lands	Percent of the subwatershed designated as having Status 1 or Status 2 protection by the USGS Gap Analysis Program. These lands are defined as having permanent protection from conversion of natural land cover and a mandated management plan. This includes lands held by national, state, or local governments or non-profit organizations, as well as voluntarily protected private lands.	Protected Areas Database of the United States Version 1.2 from the USGS Gap Analysis Program; EPA EnviroAtlas “Protected Lands for the Conterminous United States” dataset, 2015 version.

Notes:

1. “Impaired” waters have frequent and persistent water quality conditions which prevent, limit, or discourage the use of the waterbody. Waterbodies with “minor impacts” are considered stressed and have documented water quality impacts less severe than impaired waters. “Threatened” waters have no existing water quality problems but are included in the Priority Waterbodies List due to land use changes in the watershed that are known or strongly suspected to threaten water quality.
2. The National Land Cover Database (NLCD) uses Landsat imagery to differentiate between types of land cover and estimate impervious surfaces. Therefore, it is important to note that sometimes land cover types can be misrepresented. For example, \ Fort Drum maintains an area of grassland to practice field operations which is classified as “agricultural hay/pasture” by the NLCD, resulting in the Otter Creek – Indian River (0415030303) subwatershed having a relatively high percentage of agricultural lands.

1.2.2 Calculation and Scoring of Watershed Indicator Values

Directionality of indicators was first configured to ensure that all indicators demonstrate values that signify ‘higher is more stressed’. Watershed indicator values were calculated for each HUC10 watershed on a five point scale by allotting scores that fell within respective ranges for each

indicator, with ranges determined by analyzing the range and distribution of the indicator.

Additionally, as certain indicators have a greater influence on water quality than others, weighting factors were assigned to each indicator based on the category to which they were assigned. A higher weight indicates factors with a greater influence on water quality. See **Table 2** for indicators and their respective weighting factor.

Table 2
Indicator Scoring

	Indicator	Scoring Scales		Weighting Factor
Documented Impairments	Impacted Waters ¹ (% of assessed)	< 20	1	2
		20-40	2	
		40-60	3	
		60-80	4	
		> 80	5	
	Waters Impacted by Atmospheric Deposition/Industrial Pollution (% of assessed)	< 20	1	1
		20-40	2	
		40-60	3	
		60-80	4	
		> 80	5	
Environmental Setting	Natural Land Cover (%)	> 80	1	2
		70-80	2	
		60-70	3	
		50-60	4	
		< 50	5	
	Soil Erodibility (k-factor, unitless)	< 0.26	1	1
		0.26-0.29	2	
		0.29-0.32	3	
		0.32-0.35	4	
		> 0.35	5	
	Flood Risk (upstream grid pixels)	< 1500	1	1.5
		1500-3000	2	
		3000-4500	3	
		4500-6000	4	
		> 6000	5	
	Water Resource Value (acres)	< 500	1	2
		500-1000	2	
		1000-1500	3	
		1500-2000	4	

	Indicator	Scoring Scales		Weighting Factor
	SPDES Count	> 2000	5	1
		< 3	1	
		3-6	2	
		6-9	3	
		9-12	4	
		> 12	5	
	Road Density (km/sq km)	< 0.75	1	1.5
		0.75-1.5	2	
		1.5-2.25	3	
		2.25-3	4	
		> 3	5	
	Agricultural Lands (%)	< 10	1	2
		10-20	2	
		20-30	3	
		30-40	4	
		> 40	5	
	Livestock Density (lb./acre)	0-0.03	1	1
		0.03-0.06	2	
		0.06-0.09	3	
		0.09-0.12	4	
		> 0.12	5	
	Impervious Surfaces (%)	< 0.5	1	1
		0.5-0.75	2	
		0.75-1	3	
		1-1.25	4	
		> 1.25	5	
Local Capacity for Protection/Restoration	Unassessed Waters	First, HUC10s were given a score based on total stream miles and lake acres present (streams: <100 miles, 1; 100-200, 2; 200-300, 3; 300-400, 4; > 400, 5; lakes: <500, 1; 500-1000, 2; 1000-1500, 3; 1500-2000, 4; > 2000, 5). The scores were then multiplied by the percentage of unassessed streams or lake acres, respectively. The product of this calculation was averaged and used for the Unassessed Waters indicator score.		2

	Indicator	Scoring Scales		Weighting Factor
		< 75	1	
		75-150	2	
		150-225	3	
		225-300	4	
		> 300	5	
	Protected Lands (%)	> 50	1	1
		40-50	2	
		30-40	3	
		20-30	4	
		<20	5	

Calculating Index Scores. Indices include documented impairments, environmental setting, human impacts, and local capacity for protection/restoration. A watershed's index score was calculated by summing indicator scores after they had been multiplied by their weighting factor.

Calculating Composite Scores. The composite score represents the overall priority ranking of subwatersheds and provides a summary of watershed health and a preliminary assessment of restoration and protection potential. Higher scores indicate areas of higher overall watershed health and are potential candidates for conservation. Lower scores indicate areas with greater overall stress and are possible targets for restoration. Scores in the mid-range indicate areas with less extreme challenges in terms of overcoming sources of high stress, but where restoration work may have a large impact. Potential values range from 18-89.

Table 3
Composite Score Ranges

Priority	Score Range
Lower	0 - 35
Medium	36 - 55
High	56 - 85

2 Subwatershed Assessment Results

2.1 Documented Impairments

The documented impairments index is used to highlight locations that are impacted by human activity and where riparian protection or restoration activities could improve water quality. Higher scores indicate areas where water quality is under less stress and efforts should focus on protection. Low scores indicate areas of high stress for water quality, generally areas with more human use for agriculture or development. The data source for this assessment is the 2019 NYSDEC Waterbody Index/Priority Waterbodies List (WI/PWL). The scores calculated for these metrics are presented in **Table 4**. The total 'documented impairments' score ranges from 3-15. 'Locally impacted waters' is weighted higher to give greater emphasis on waters that respond to local and voluntary mitigation efforts. This is in contrast to 'regionally impacted waters' as efforts to remediate or minimize sources is subject to

Locally Impacted Waters (Weighting Factor = 2)

Locally impacted waters are displayed in **Map 1**. There is a strong correlation between heavy human use area and water quality impairment. Highly scored areas are concentrated in the Indian River and lower waters of the Oswegatchie River watersheds. This happens to also be where agriculture is a dominant land use. The headwaters of the Oswegatchie, Raquette, St. Regis and Chateaugay-English generally scored low likely because headwaters typically are more pristine due to the fact that headwaters are the beginning of flow for a watershed and due to the fact that they are positioned within the Adirondack Park which receives some protection and is generally forested with natural land cover intact. As subwatersheds and waters highlighted under this metric are most likely impaired to local land use practices, subwatersheds should focus on incorporating best management practices relevant to their respective water impairment sources.

Regionally Impacted Waters (Weighting Factor = 1)

Regionally impacted waters refer to waters that have been impacted by atmospheric deposition or industrial pollution; **Map 2** highlights these areas. The headwaters of the Raquette River and Oswegatchie River watersheds scored high due to acid impairment of high-elevation lakes. Robinson Creek – Upper St. Lawrence (0415030103) includes the St. Lawrence River Area of Concern at Massena/Akwesasne, polluted from several sources including historical industrial discharges resulting in high levels of PCBs, PAHs, and pesticides. Acid rain affected waters should continue to be monitored for aquatic distress. Subwatersheds affected by industrial contamination should strive to continue remediating those areas in a timely fashion and restore them to alternative uses.

Table 4
Summary of Documented Impairment Scores at the HUC10 Level

Subwatershed	% Regionally Impacted of Assessed Waters	Regionally Impacted Score	% Locally Impacted of Assessed Waters	Locally Impacted Score	Documented Impairments Weighted Score
0415030101	46	3	46	3	9
0415030102	14	1	19	1	3
0415030103	100	5	94	5	15
0415030201	98	5	0	1	7
0415030202	52	3	50	3	9
0415030203	50	3	0	1	5
0415030204	100	5	0	1	7
0415030205	9	1	0	1	3
0415030206	0	1	32	2	5
0415030207	0	1	100	5	11
0415030208	0	1	100	5	11
0415030209	0	1	100	5	11
0415030210	0	1	100	5	11
0415030301	23	2	77	4	10
0415030302	0	1	100	5	11
0415030303	0	1	100	5	11
0415030304	34	2	0	1	4
0415030305	0	1	100	5	11
0415030401	2	1	0	1	3
0415030402	0	1	50	3	7
0415030403	0	1	42	3	7
0415030404	0	1	32	2	5
0415030405	24	2	76	4	10
0415030501	87	5	0	1	7
0415030502	25	2	0	1	4

Subwatershed	% Regionally Impacted of Assessed Waters	Regionally Impacted Score	% Locally Impacted of Assessed Waters	Locally Impacted Score	Documented Impairments Weighted Score
0415030503	85	5	9	1	7
0415030504	34	2	1	1	4
0415030505	36	2	2	1	4
0415030506	0	1	42	3	7
0415030507	0	1	37	2	5
0415030601	58	3	0	1	5
0415030602	27	2	23	2	6
0415030603	6	1	40	3	7
0415030604	2	1	40	3	7
0415030701	18	1	42	3	7
0415030702	0	1	0	1	3
0415030703	0	1	100	5	11
0415030801	83	5	15	1	7
0415030802	0	1	52	3	7
0415030803	0	1	0	1	3
0415030804	0	1	0	1	3
0415030805	--	3	--	3	9

Note: Subwatersheds with two dashes "--" indicate subwatersheds where all waters are unassessed.

2.2 Environmental Setting

The scores calculated for these metrics are presented in **Table 5**. The environmental setting index is meant to capture the intrinsic character of the watershed including its geography, hydrography, land cover, and its natural vulnerability.

Percent Natural Land Cover (Weighting Factor = 2)

Natural land cover provides excellent protection for waterbodies by providing vegetative cover. **Map 3** shows how each subwatershed was scored with respect to its percent natural land cover. The Adirondack area remains largely forested due to the Adirondack Park and its protections on development. Otter Creek – Indian River (0415030303), home to Fort Drum, Lisbon Creek – Oswegatchie River (0415030210), and Chippewa Creek – Upper St. Lawrence River (0415030101) have under 50% natural land cover, scoring as the highest priority subwatersheds with respect to percent natural land cover. High scoring subwatersheds should focus on incorporating natural land cover along waterways to improve habitat and water quality.

Soil Erodibility (Weighting Factor = 1)

Soil erodibility is a measure of the intrinsic susceptibility of a soil to erosion by runoff and raindrop impact. Soils high in clay typically have low erosion potential because they are resistant to detachment. Soil erodibility score distribution throughout the watershed is displayed in **Map 4**. Otter Creek – Indian River (0415030303) and Cold River – Raquette River (0415030502) are most susceptible to erosion and score the highest. The soils of the high-elevation areas in the Raquette River as well as Chippewa Creek – Upper St. Lawrence River, and Little River – Grasse River (0415030403) are moderately susceptible to erosion. High priority subwatersheds should examine soil conditions and find best suited practices to stabilize streambanks and work to restore natural hydrology to minimize risk of erosion.

Flood Risk (Weighting Factor = 1.5)

Due to recent issues concerning flooding along the St. Lawrence River and some inland areas, a flood risk metric was incorporated to capture a watershed's natural vulnerability to flooding. **Map 5** shows the results of the flood risk assessment. All three HUC10s within the Upper St. Lawrence River watershed, lower waters of the Oswegatchie River and Raquette River watersheds scored the highest indicating high risk and priority. These subwatersheds should focus on incorporating stormwater management, restoring natural hydrology, and restoring streambanks in order to reduce sediment and associated nutrient transport during high flow events.

Water Resource Value (Weighting Factor = 2)

The St. Lawrence River watershed is dense with water resources. Waters of the St. Lawrence provide a variety of services for its community including wildlife habitat, recreation, beautiful scenery, drinking

water, navigation, and energy. **Map 6** shows how each HUC10 was ranked concerning water resource value. A significant portion of the St. Lawrence River watershed scores high with respect to its water resource value, highlighting popular recreation areas like Tupper Lake and Blue Mountain Lake within the Raquette River, the Upper St. Lawrence River subwatersheds, and much of the St. Regis River watershed.

Table 5
Summary of Environmental Setting Scores at the HUC10 Level

Subwatershed	% Natural Land Cover	Natural Land Cover Score	Soil Erodibility (k-factor)	Soil Erodibility Score	Water Resource Value (acres)	Water Resource Value Score	Flow Accumulation (Upstream grid pixels)	Flood Risk Score	Environmental Setting Weighted Score
0415030101	49	5	0.32	4	1363	5	216	5	31.5
0415030102	57	4	0.29	2	265	5	321	5	27.5
0415030103	65	3	0.31	3	109	5	1215	5	26.5
0415030201	92	1	0.29	2	8350	5	805	1	15.5
0415030202	94	1	0.28	2	1733	4	598	1	13.5
0415030203	97	1	0.29	2	1483	3	868	1	11.5
0415030204	97	1	0.30	3	565	2	722	1	10.5
0415030205	94	1	0.26	2	889	2	2370	2	11
0415030206	91	1	0.30	3	1896	4	4036	3	17.5
0415030207	75	2	0.29	2	279	1	471	1	9.5
0415030208	63	3	0.29	2	1781	4	9265	5	23.5
0415030209	65	3	0.28	2	627	2	6805	5	19.5
0415030210	43	5	0.30	3	131	1	12579	5	22.5
0415030301	91	1	0.28	2	2141	5	570	1	15.5
0415030302	87	1	0.28	2	987	2	1422	1	9.5
0415030303	42	5	0.35	5	55	1	2095	2	20
0415030304	72	2	0.29	2	1474	3	5721	4	18
0415030305	61	3	0.28	2	11856	5	1627	2	21
0415030401	95	1	0.25	1	1417	3	399	1	10.5
0415030402	97	1	0.28	2	1026	3	1406	1	11.5
0415030403	77	2	0.32	4	121	1	713	1	11.5
0415030404	68	3	0.30	3	975	2	3514	3	17.5
0415030405	57	4	0.29	2	60	1	16440	5	19.5
0415030501	90	1	0.30	3	12128	5	692	1	16.5

Subwatershed	% Natural Land Cover	Natural Land Cover Score	Soil Erodibility (k-factor)	Soil Erodibility Score	Water Resource Value (acres)	Water Resource Value Score	Flow Accumulation (Upstream grid pixels)	Flood Risk Score	Environmental Setting Weighted Score
0415030502	98	1	0.38	5	734	2	505	1	12.5
0415030503	91	1	0.33	4	7083	5	1446	1	17.5
0415030504	91	1	0.30	3	20049	5	2703	2	18
0415030505	93	1	0.27	2	6963	5	5347	4	20
0415030506	89	1	0.26	2	2141	5	6536	5	21.5
0415030507	74	2	0.28	2	173	1	8384	5	15.5
0415030601	95	1	0.26	2	2481	5	755	1	15.5
0415030602	92	1	0.28	2	2285	5	1913	2	17
0415030603	85	1	0.27	2	655	2	1218	1	9.5
0415030604	88	1	0.28	2	3790	5	4119	3	18.5
0415030701	93	1	0.28	2	1705	4	874	1	13.5
0415030702	72	2	0.29	2	353	1	1093	1	9.5
0415030703	62	3	0.28	2	504	2	2784	2	15
0415030801	88	1	0.30	3	3361	5	823	1	16.5
0415030802	59	4	0.27	2	27	1	1129	1	13.5
0415030803	74	2	0.26	2	40	1	1367	1	9.5
0415030804	87	1	0.32	3	50	1	675	1	8.5
0415030805	81	1	0.29	3	19	1	553	1	8.5

2.3 Human Impacts

The human impacts scores are presented in **Table 6**. This category targets the built environment and land use within the watershed. Higher scoring subwatersheds typically comprise the developed and agricultural areas. Lower scoring subwatersheds are found in the Adirondack region where there is little to no development or intensive agriculture.

SPDES Count (Weighting Factor = 1)

The State Pollutant Discharge Elimination System (SPDES) count distribution across the watershed is displayed in **Map 7**. Subwatersheds with lower densities pose a lower risk to water quality and are considered a lower priority. The SPDES permit program regulates activities for facilities or construction that discharges wastewater into surface waters or ground waters of the state. Therefore, municipal wastewater treatment facilities, combined sewer overflows, municipal separate storm sewer systems, industrial facilities, and concentrated animal feeding operations are required to obtain a permit. Although the SPDES programs provides a means to regulate discharge, the discharges themselves present the opportunity to affect water quality and ecology. The developed, more populous subwatersheds score high here largely due to the existing wastewater infrastructure and presence of agriculture. Facilities and respective municipalities should develop sufficient monitoring protocols to ensure compliance with the SPDES program.

Road Density (Weighting Factor = 1.5)

Road density scores are found in **Map 8**. Subwatersheds with higher concentrations of impervious cover with close proximity to waters allow for a greater potential of pollutant transport such as road salt, sediment, and nutrients as well as increased stormwater runoff. The greatest road density is found along the Upper St. Lawrence River watersheds as well as the more metropolitan areas of Fort Drum, Gouverneur, Potsdam, and Malone.

Percent Agriculture (Weighting Factor = 2)

Map 9 displays the scores for each HUC10 based on percentage of agricultural land. The extent of agriculture within a watershed can negatively impact water quality, with areas comprising larger amounts of agriculture often exhibiting higher sediment, bacteria, and nutrient loads. The highest scored watersheds are Lisbon Creek – Oswegatchie River (0415030210), Otter Creek – Indian River (0415030303), and Chippewa Creek – Upper St. Lawrence River (0415030101) with additional high priority areas for watersheds along the St. Lawrence River. Efforts to incorporate agricultural best management practices are a high priority for these high-scoring subwatersheds.

Livestock Density (Weighting Factor = 1)

HUC10 livestock density scores are shown in **Map 10**. While not all livestock use in a given watershed is detrimental to water quality, livestock use can impact water quality by increasing coliform bacteria, sediment, and water temperatures, as well as decrease dissolved oxygen

concentrations. Thus, watersheds with increased concentrations of livestock are considered to be of higher priority. Livestock densities are highest in the Upper Chateaugay River (0415030802) and Lisbon Creek – Oswegatchie River (0415030210) subwatersheds. Barnyard, pasture, and manure management are particularly important for these subwatersheds to reduce erosion and nutrient contribution to both surface and ground waters.

Impervious Surfaces (Weighting Factor = 1)

Impervious surfaces include surfaces that do not allow water to penetrate and cause it to runoff rather than infiltrate into the soil. This includes roadways, parking lots, sidewalks, driveways, and roofs. Indicator scores for impervious surfaces within the watershed are pictured in **Map 11**.

Increased impervious surfaces in a watershed leads to more stormwater runoff during high rainfall events and hydromodification. Therefore, watersheds with urban centers contribute to increased impervious surfaces, highlighting the Upper St. Lawrence River watershed which includes the City of Ogdensburg and Towns of Clayton, Waddington, and Massena, and also highlights the Fort Drum subwatershed, Otter Creek – Indian River (0415030303). It is important for these watersheds to incorporate stormwater best management practices to slow surface water runoff, encourage water infiltration, and reduce pollutant transport to waterways.

Table 6
Summary of Human Impact Scores at the HUC10 Level

Subwatershed	SPDES County	SPDES Score	Road Density (km/sq km)	Road Density Score	% Agriculture	Agriculture Score	Livestock Density (lb/acre)	Livestock Density Score	% Impervious Surfaces	Impervious Surfaces Score	Human Impact Weighted Score
0415030101	18	5	2.3	5	43	5	0.119	4	1.80	5	31.5
0415030102	28	5	1.8	4	35	4	0.099	4	1.33	5	28
0415030103	2	1	4.1	5	16	2	0.055	2	6.04	5	19.5
0415030201	1	1	0.3	1	0	1	0.000	1	0.01	1	6.5
0415030202	0	1	1.0	2	0	1	0.002	1	0.10	1	8
0415030203	0	1	0.5	2	0	1	0.001	1	0.02	1	8
0415030204	0	1	0.8	2	0	1	0.002	1	0.03	1	8
0415030205	1	1	1.1	3	2	1	0.008	1	0.15	1	9.5
0415030206	2	1	1.0	2	3	1	0.016	1	0.15	1	8
0415030207	1	1	1.3	3	22	3	0.079	3	0.34	1	15.5
0415030208	12	4	1.6	4	29	3	0.110	4	0.88	3	23
0415030209	11	4	1.3	3	30	4	0.109	4	0.34	1	21.5
0415030210	11	4	1.7	4	50	5	0.140	5	1.28	5	30
0415030301	4	2	1.1	3	2	1	0.015	1	0.13	1	10.5
0415030302	2	1	1.8	4	8	1	0.047	2	0.50	2	13
0415030303	11	4	2.6	5	45	5	0.117	4	5.33	5	30.5
0415030304	1	1	1.4	3	21	3	0.063	3	0.52	2	16.5
0415030305	7	3	1.3	3	27	3	0.087	3	0.48	1	17.5
0415030401	0	1	1.2	3	0	1	0.002	1	0.06	1	9.5
0415030402	0	1	0.7	2	0	1	0.003	1	0.03	1	8
0415030403	2	1	1.6	4	18	2	0.062	3	0.50	1	15
0415030404	21	5	1.4	3	26	3	0.082	3	0.56	2	20.5
0415030405	9	3	2.4	5	28	3	0.081	3	2.83	5	24.5
0415030501	3	1	0.5	1	0	1	0.000	1	0.04	1	6.5
0415030502	0	1	0.2	1	0	1	0.000	1	0.00	1	6.5

Subwatershed	SPDES County	SPDES Score	Road Density (km/sq km)	Road Density Score	% Agriculture	Agriculture Score	Livestock Density (lb/acre)	Livestock Density Score	% Impervious Surfaces	Impervious Surfaces Score	Human Impact Weighted Score
0415030503	1	1	0.8	2	0	1	0.000	1	0.09	1	8
0415030504	2	1	0.9	2	0	1	0.001	1	0.19	1	8
0415030505	0	1	1.0	2	0	1	0.001	1	0.06	1	8
0415030506	8	3	1.4	3	4	1	0.015	1	0.16	1	11.5
0415030507	15	5	1.7	4	18	2	0.067	3	1.07	4	22
0415030601	0	1	0.6	2	0	1	0.002	1	0.08	1	8
0415030602	0	1	1.0	3	4	1	0.017	1	0.10	1	9.5
0415030603	9	3	1.2	3	11	2	0.046	2	0.19	1	14.5
0415030604	9	3	1.2	3	6	1	0.022	1	0.27	1	11.5
0415030701	0	1	1.1	3	3	1	0.015	1	0.25	1	9.5
0415030702	3	1	1.3	3	23	3	0.105	4	0.35	1	16.5
0415030703	17	5	1.6	4	32	4	0.113	4	1.09	4	27
0415030801	5	2	1.1	3	5	1	0.022	1	0.30	1	10.5
0415030802	14	5	1.4	3	38	4	0.158	5	0.29	1	23.5
0415030803	4	2	1.2	3	22	3	0.082	3	0.31	1	16.5
0415030804	3	1	0.9	2	10	2	0.055	2	0.12	1	11
0415030805	1	1	0.8	2	16	2	0.097	4	0.11	1	13

2.4 Local Capacity for Restoration/Protection

This index is intended to give some indication of watershed stakeholders ability to affect how the land is managed. **Table 7** shows the indicator scores for each HUC10 corresponding to its local capacity for restoration/protection.

Protected Lands (Weighting Factor = 1)

Indicator scores for protected lands are displayed in **Map 12**. As development is unlikely to occur on these lands, subwatersheds comprising large proportions of these areas pose a lower risk to water quality than do subwatersheds comprising smaller amounts. As the Adirondack Park exhibits various levels of protection within its boundaries, therefore the headwaters and watersheds wholly or partially within the park are scored lower, meaning protections extend to larger proportions of the watershed. Alternatively, the valley watersheds outside of the Park boundary have small proportions of protected lands, typically below 20% with some exceptions at the lower waters of the St. Regis watershed.

Unassessed Waters (Weighting Factor = 2)

Due to the vast, expansive, water-dense, and largely wild and forested area of the St. Lawrence River watershed, there is a large proportion of unassessed waters. This could mean that waters have not been assessed or have not been assessed recently enough to provide a current assessment. **Map 13** shows the indicator score for unassessed waters in the watershed. Unassessed waters are waterbodies where adequate water quality information is not available to evaluate the support of a respective waterbody's designated uses. Unassessed waters cannot be defined as healthy or stressed and were therefore given a score of 3 when scoring 'Documented Impairments' in **Section 2.1**. This metric measures the extent to which a subwatershed's waters are unassessed. The lack of available knowledge threatens the ability of a community or municipality to address any issues and measure effectiveness of restoration efforts. West Branch Saint Regis River (0415030602), Upper Grasse River (0415030402), Tupper Lake – Raquette River (0415030504), and Boland Creek – Oswegatchie River (0415030208) have the highest percentage of unassessed waters when normalized to surface water area.

Table 7
Summary of Local Capacity for Restoration/Protection Scores at the HUC10 Level

Subwatershed	Unassessed Waters (Unitless, see Table 2)	Unassessed Waters Score	% Protected Lands	Protected Lands Score	Local Capacity Weighted Score
0415030101	213	3	7	5	11
0415030102	0	1	9	5	7
0415030103	2	1	38	3	5
0415030201	220	3	90	1	7
0415030202	171	3	59	1	7
0415030203	110	2	62	1	5
0415030204	63	1	61	1	3
0415030205	223	3	21	4	10
0415030206	135	2	11	5	9
0415030207	96	2	37	3	7
0415030208	302	5	5	5	15
0415030209	257	4	13	5	13
0415030210	137	2	2	5	9
0415030301	158	3	34	3	9
0415030302	275	4	73	1	9
0415030303	54	1	28	4	6
0415030304	117	2	8	5	9
0415030305	151	3	9	5	11
0415030401	0	1	64	1	3
0415030402	344	5	79	1	11
0415030403	118	2	5	5	9
0415030404	191	3	7	5	11
0415030405	39	1	1	5	7
0415030501	279	4	69	1	9

Subwatershed	Unassessed Waters (Unitless, see Table 2)	Unassessed Waters Score	% Protected Lands	Protected Lands Score	Local Capacity Weighted Score
0415030502	162	3	100	1	7
0415030503	185	3	62	1	7
0415030504	336	5	57	1	11
0415030505	213	3	48	2	8
0415030506	256	4	22	4	12
0415030507	78	2	8	5	9
0415030601	31	1	82	1	3
0415030602	415	5	49	2	12
0415030603	83	2	33	3	7
0415030604	224	3	46	2	8
0415030701	172	3	61	1	7
0415030702	110	2	5	5	9
0415030703	70	1	7	5	7
0415030801	109	2	40	3	7
0415030802	85	2	0	5	9
0415030803	156	3	12	5	11
0415030804	76	2	6	5	9
0415030805	100	2	0	5	9

2.5 Overall Score

The total relative assessment scores (incorporating documented impairments, environmental setting, human impacts, and local capacity for restoration/protection) for each of the HUC10 subwatersheds are shown in **Table 8** and **Map 14**.

Table 8
Summary of Final Weighted Scores and Priority Watersheds

HUC10 Name	HUC10	Score	High	Medium	Low
Chippewa Creek-Frontal Saint Lawrence River	0415030101	83	X		
Sucker Brook-Frontal Saint Lawrence River	0415030102	65.5	X		
Robinson Creek-Frontal Saint Lawrence River	0415030103	66	X		
Headwaters Oswegatchie River	0415030201	36		X	
Little River	0415030202	37.5		X	
Middle Branch-Oswegatchie River	0415030203	29.5			X
Upper West Branch-Oswegatchie River	0415030204	28.5			X
Lower West Branch - Oswegatchie River	0415030205	33.5			X
Stammer Creek - Oswegatchie River	0415030206	39.5		X	
Matoon Creek	0415030207	43		X	
Boland Creek - Oswegatchie River	0415030208	72.5	X		
Beaver Creek - Oswegatchie River	0415030209	65	X		
Lisbon Creek - Oswegatchie River	0415030210	72.5	X		
Headwaters Indian River	0415030301	45		X	
Black Creek-Indian River	0415030302	42.5		X	
Otter Creek-Indian River	0415030303	67.5	X		
Red Lake - Indian River	0415030304	47.5		X	
Black Lake - Indian River	0415030305	60.5	X		
Headwaters Grasse River	0415030401	26			X
Upper Grasse River	0415030402	37.5		X	
Little River	0415030403	42.5		X	
Middle Grasse River	0415030404	54		X	
Lower Grasse River	0415030405	61	X		
Raquette Lake - Raquette River	0415030501	39		X	
Cold River	0415030502	30			X
Big Brook - Raquette River	0415030503	39.5		X	
Tupper Lake - Raquette River	0415030504	41		X	
Jordan River - Raquette River	0415030505	40		X	
Parkhurst Brook - Raquette River	0415030506	52		X	
Raquette River	0415030507	51.5		X	
East Branch Saint Regis River	0415030601	31.5			X
West Branch Saint Regis River	0415030602	44.5		X	
Deer River	0415030603	38		X	

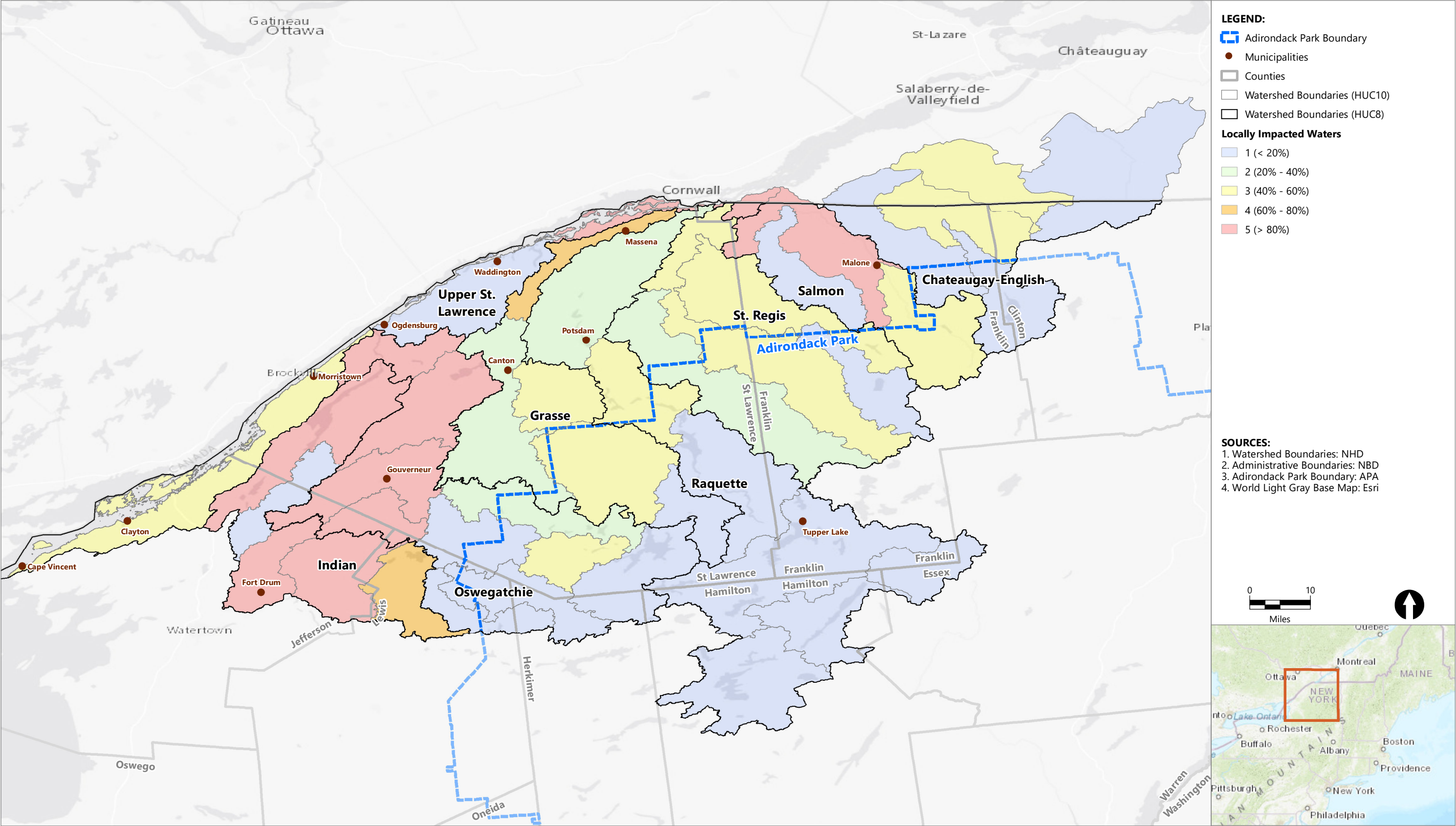
HUC10 Name	HUC10	Score	High	Medium	Low
Saint Regis River	0415030604	45		X	
Headwaters Salmon River	0415030701	37		X	
Little Salmon River	0415030702	38		X	
Salmon River	0415030703	60	X		
Headwaters Chateaugay River	0415030801	41		X	
Upper Chateaugay River	0415030802	53		X	
Trout River	0415030803	40		X	
English River (mostly in Canada)	0415030804	31.5			X
Middle Chateaugay River (mostly in Canada)	0415030805	39.5		X	

Recall that higher scores indicate greater impairment, resource value, and vulnerability and suggest the need for restoration. In contrast, lower scores indicate healthy conditions that warrant protection. Referring to the assessment composite scores, there are three scoring categories, Low, Medium, and High, with the following ranges:

High	Scores of 56-85. Subwatersheds in this range are considered unhealthy and in need of restoration.
Medium	Scores of 36-55. Subwatersheds in this range have a mix of unhealthy and healthy conditions and need more restoration and protection.
Low	Scores of 0-35. Subwatersheds in this range are considered healthy and in need of protection.

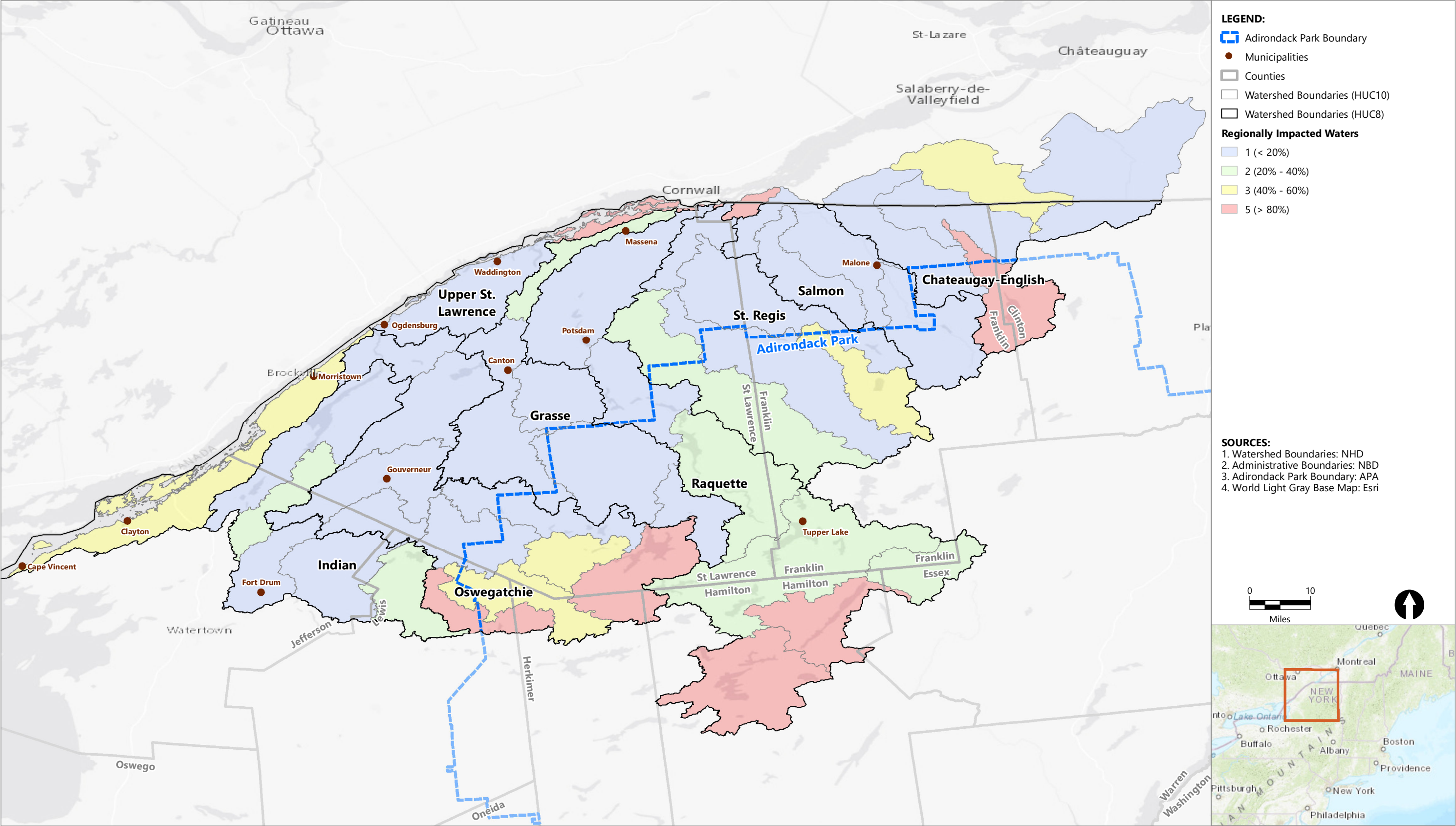
The high-elevation headwater subwatersheds are typically the lowest priority subwatersheds, with priority increasing (darker colors) as water flows north through the valley to the St. Lawrence River. The darker-shaded subwatersheds exhibit the high and medium range of scores; these subwatersheds are focused along the northern skirt of the St. Lawrence River valley. These areas are associated with the higher percentages of residential, commercial, and agricultural land uses (**Map 14**). This includes the entire Upper St. Lawrence River watershed, and the lower waters of the Indian, Oswegatchie, and Salmon River watersheds. High priority subwatersheds would benefit from efforts to incorporate best management practices that minimize pollutant transport, restore natural hydrology, and improve habitat. The lighter shaded (lower priority) subwatersheds are typically located in the pristine, undeveloped areas. Low scoring subwatersheds tend to concentrate within the high elevation areas of the Adirondack region where natural land cover has been maintained and there is limited human development (**Map 14**). This area is valued for its high abundance of water resources, pristine habitat, and scenic vistas making it a popular destination for recreationists. These subwatersheds would benefit from continued natural resource protection, planning that maintains the community character, and improves habitat.

Prioritization Indicator Score Maps

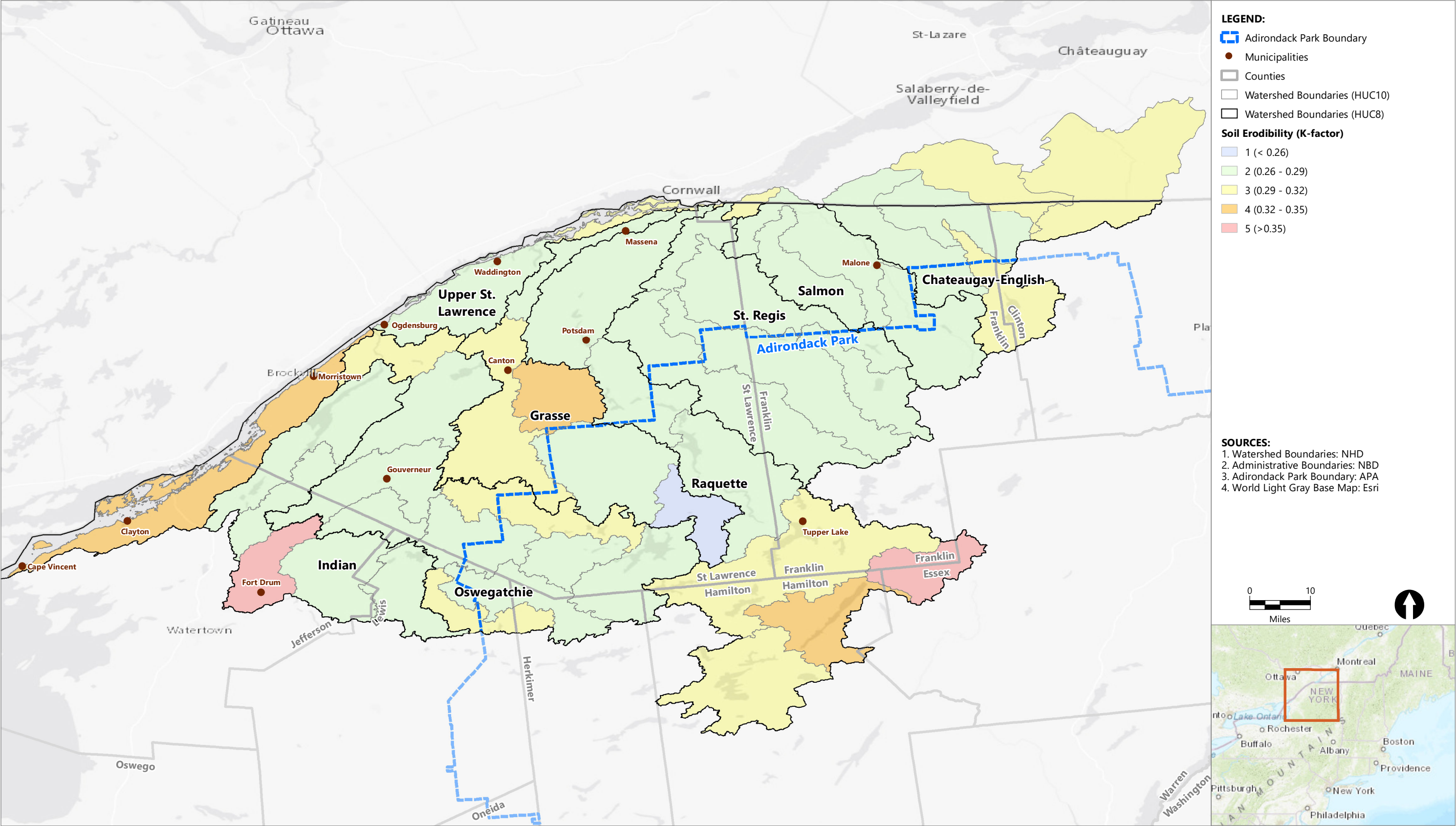


Publish Date: 2020/06/29, 4:18 PM | User: alesueur
Filepath: \\orcass\gis\Jobs\Franklin_County_SWCD\PrioritizationScoring\Maps\AQ_FigX_SLRwatershed_PrioritizationScoring.mxd





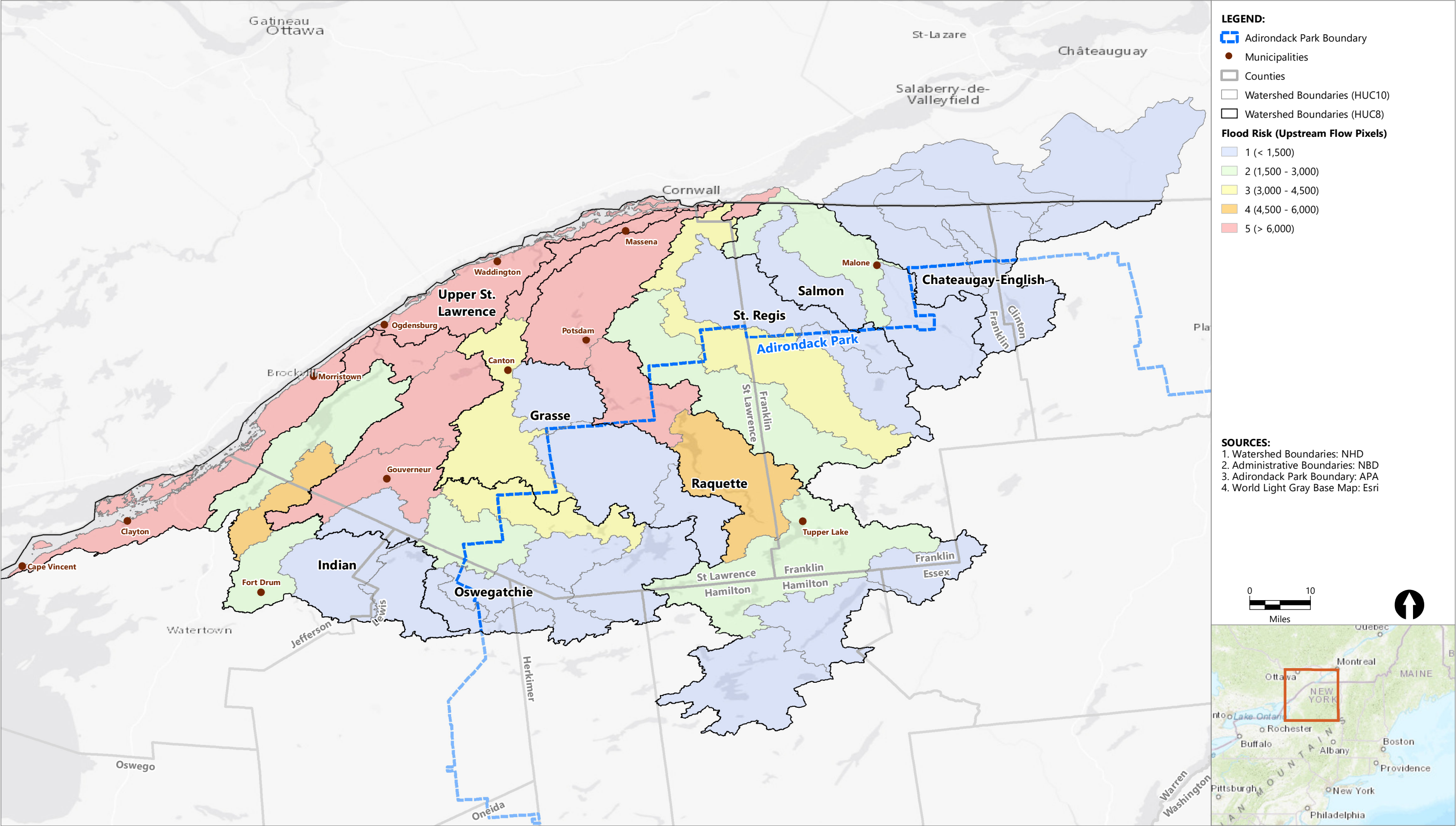
Publish Date: 2020/06/29, 4:19 PM | User: alesueur
Filepath: \\orcas\gis\Jobs\Franklin_County_SWCD\PrioritizationScoring\Maps\AQ_FigX_SLRwatershed_PrioritizationScoring.mxd



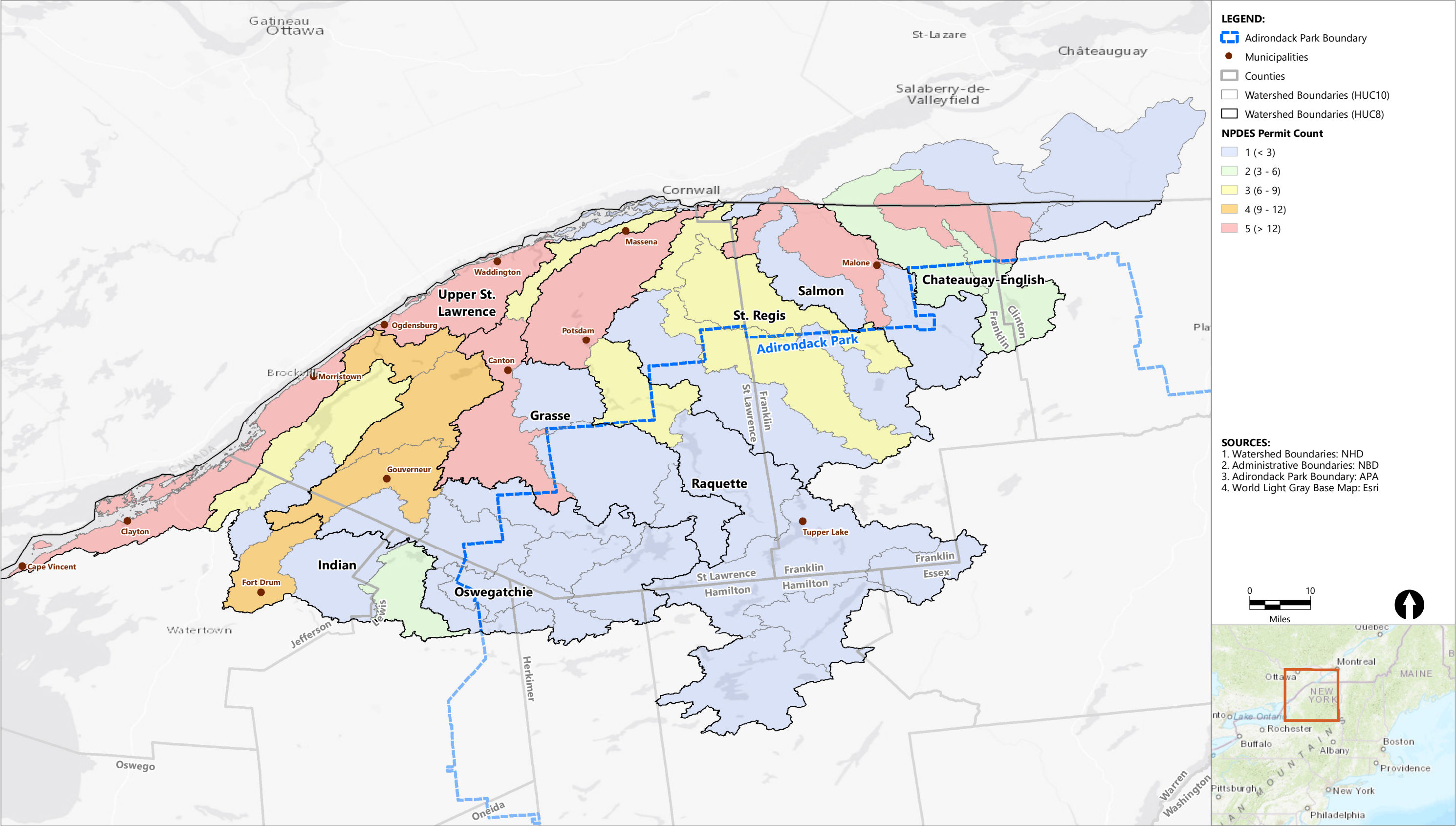
Publish Date: 2020/06/29, 4:19 PM | User: alesueur
Filepath: \\orcas\gis\Jobs\Franklin_County_SWCD\PrioritizationScoring\Maps\AQ_FigX_SLRwatershed_PrioritizationScoring.mxd



Department
of State

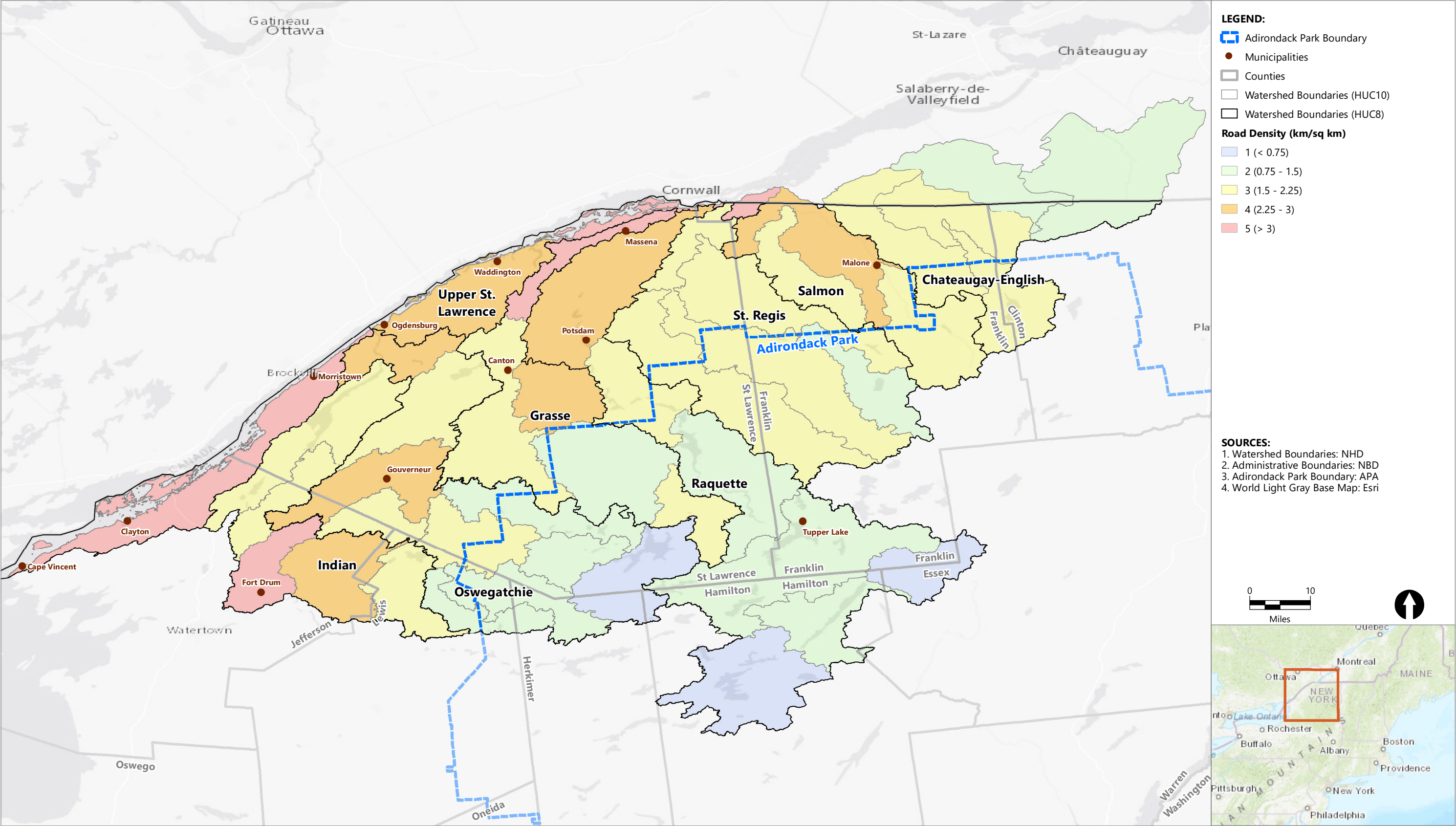


Publish Date: 2020/06/29, 4:20 PM | User: alesueur
Filepath: \\orcass\gis\Jobs\Franklin_County_SWCD\PrioritizationScoring\Maps\AQ_FigX_SLRwatershed_PrioritizationScoring.mxd

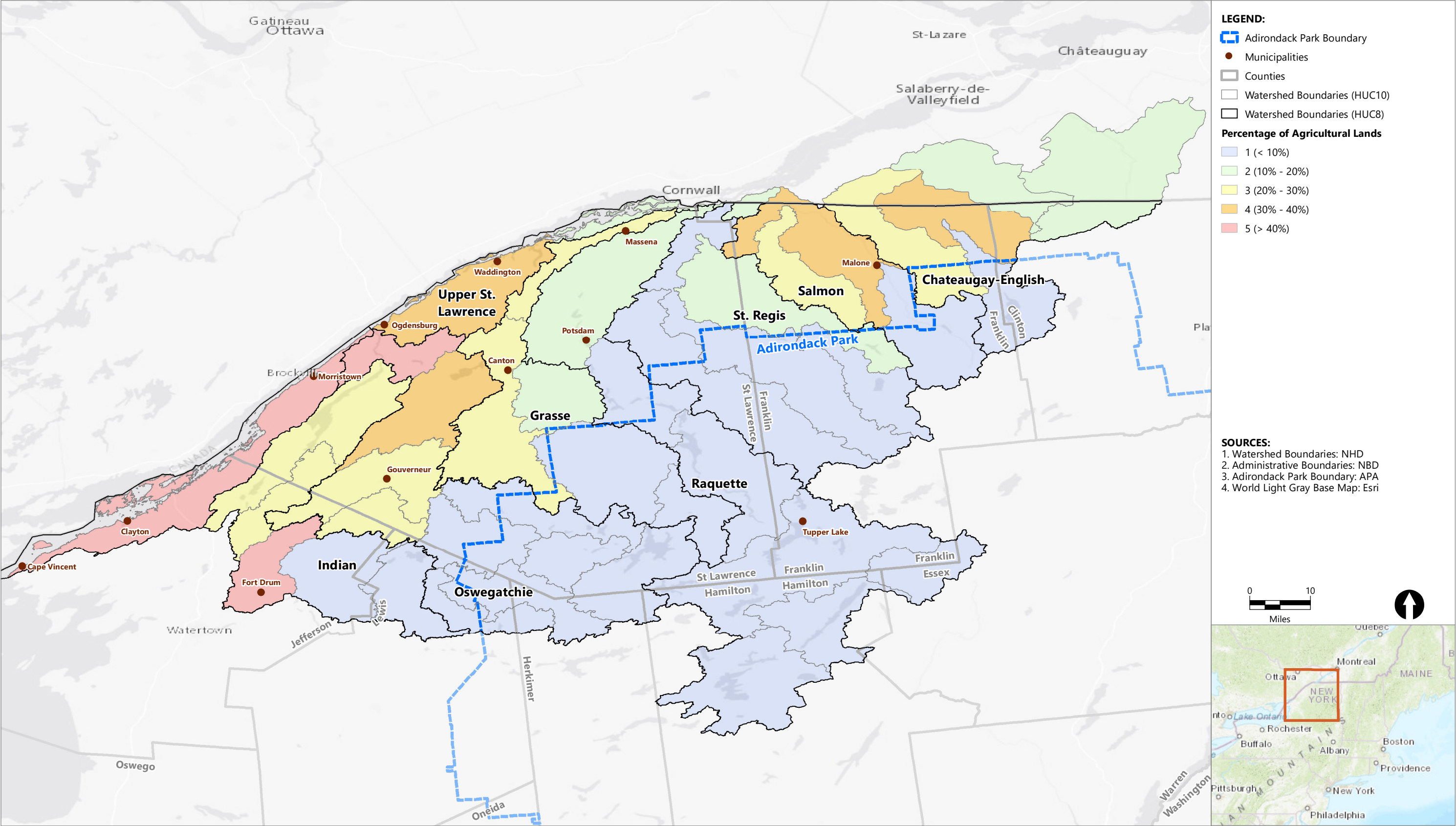


Publish Date: 2020/06/29, 4:21 PM | User: alesueur
Filepath: \\orcas\gis\Jobs\Franklin_County_SWCD\PrioritizationScoring\Maps\AQ_FigX_SLRwatershed_PrioritizationScoring.mxd

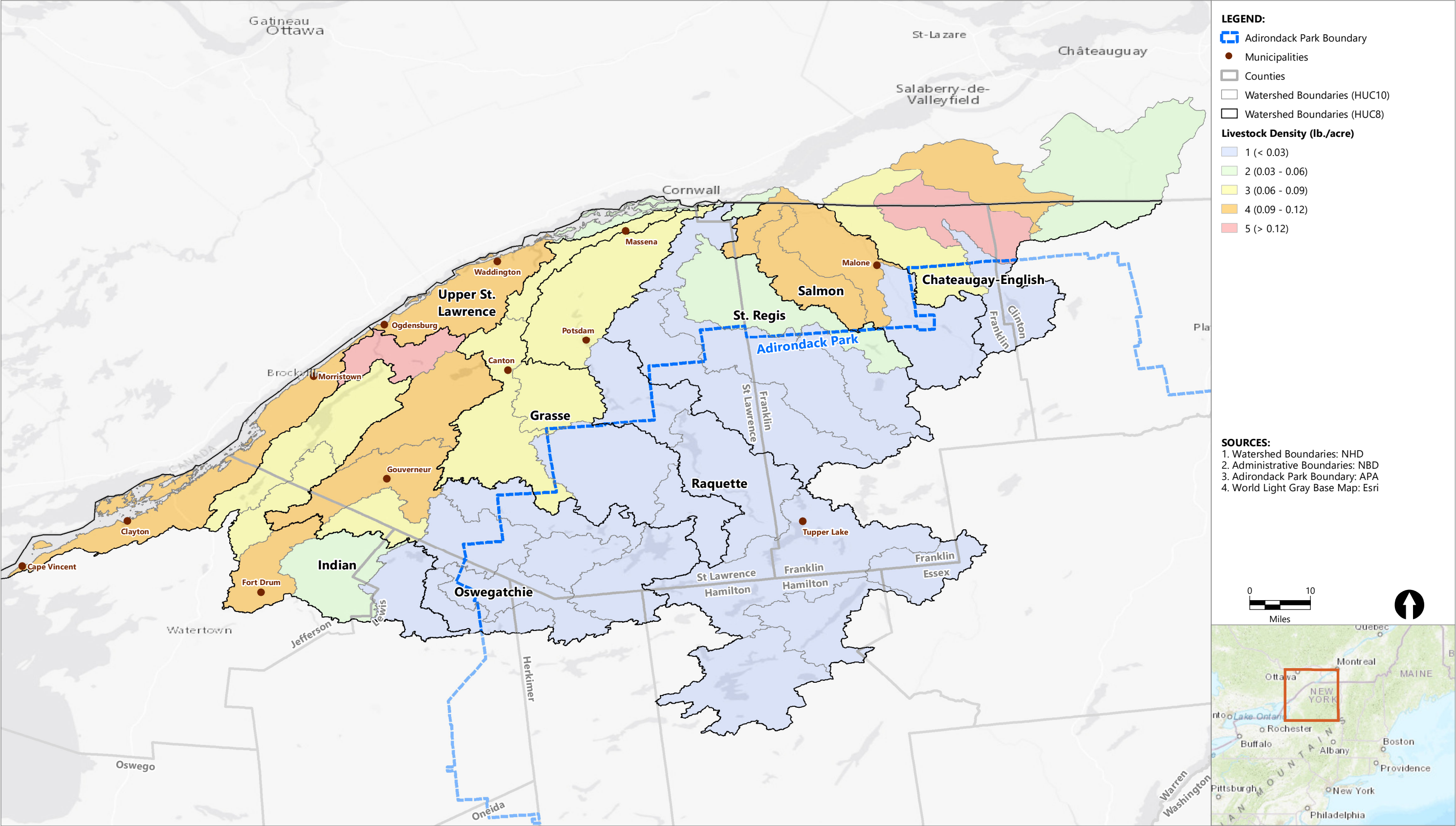




Publish Date: 2020/06/29, 4:21 PM | User: alesueur
Filepath: \\orcas\gis\Jobs\Franklin_County_SWCD\PrioritizationScoring\Maps\AQ_FigX_SLRwatershed_PrioritizationScoring.mxd

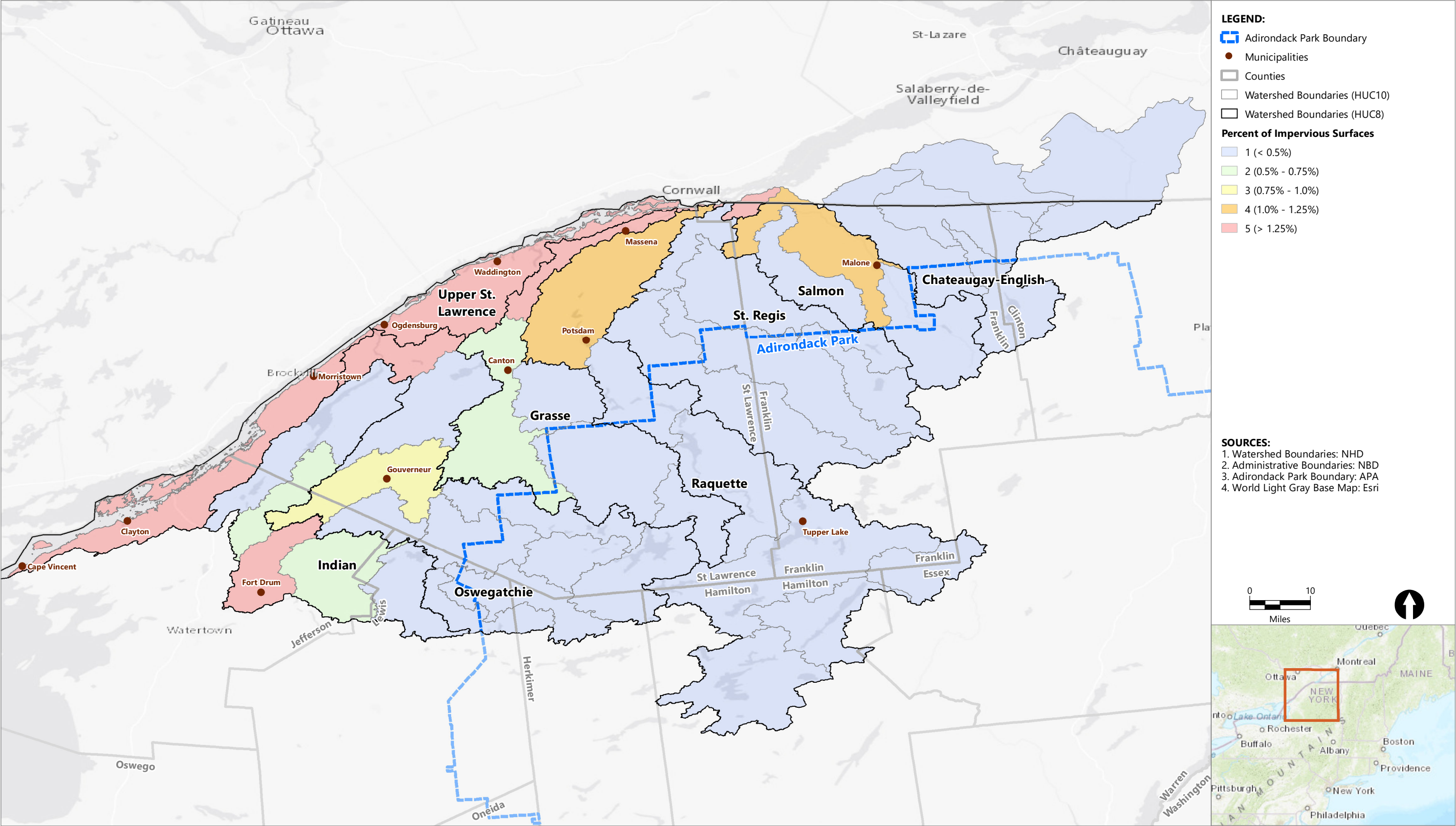


Publish Date: 2020/06/29, 4:21 PM | User: alesueur
Filepath: \\orcas\gis\Jobs\Franklin_County_SWCD\PrioritizationScoring\Maps\AQ_FigX_SLRwatershed_PrioritizationScoring.mxd

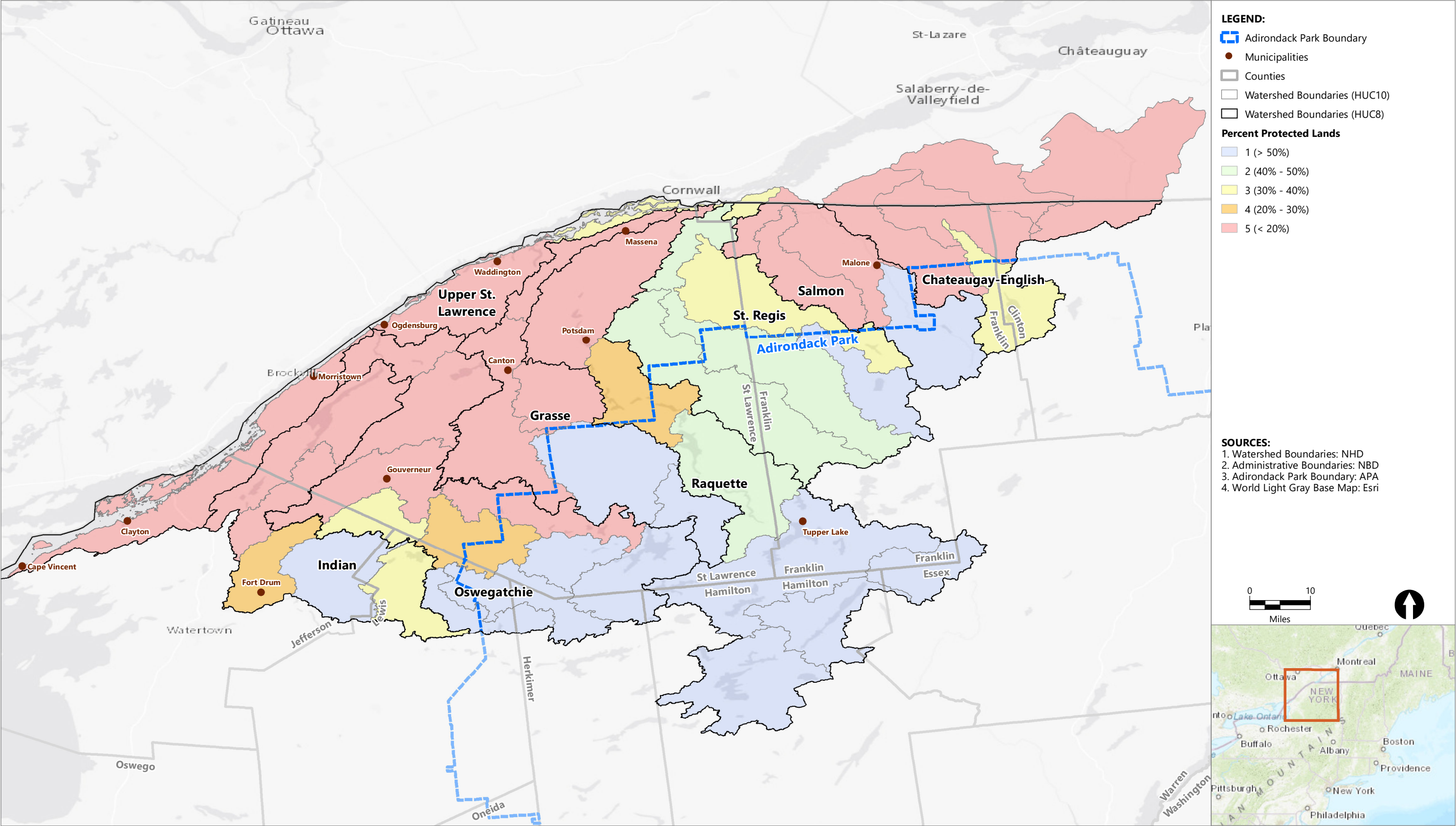


Publish Date: 2020/06/29, 4:22 PM | User: alesueur
Filepath: \\orcas\gis\Jobs\Franklin_County_SWCD\PrioritizationScoring\Maps\AQ_FigX_SLRwatershed_PrioritizationScoring.mxd



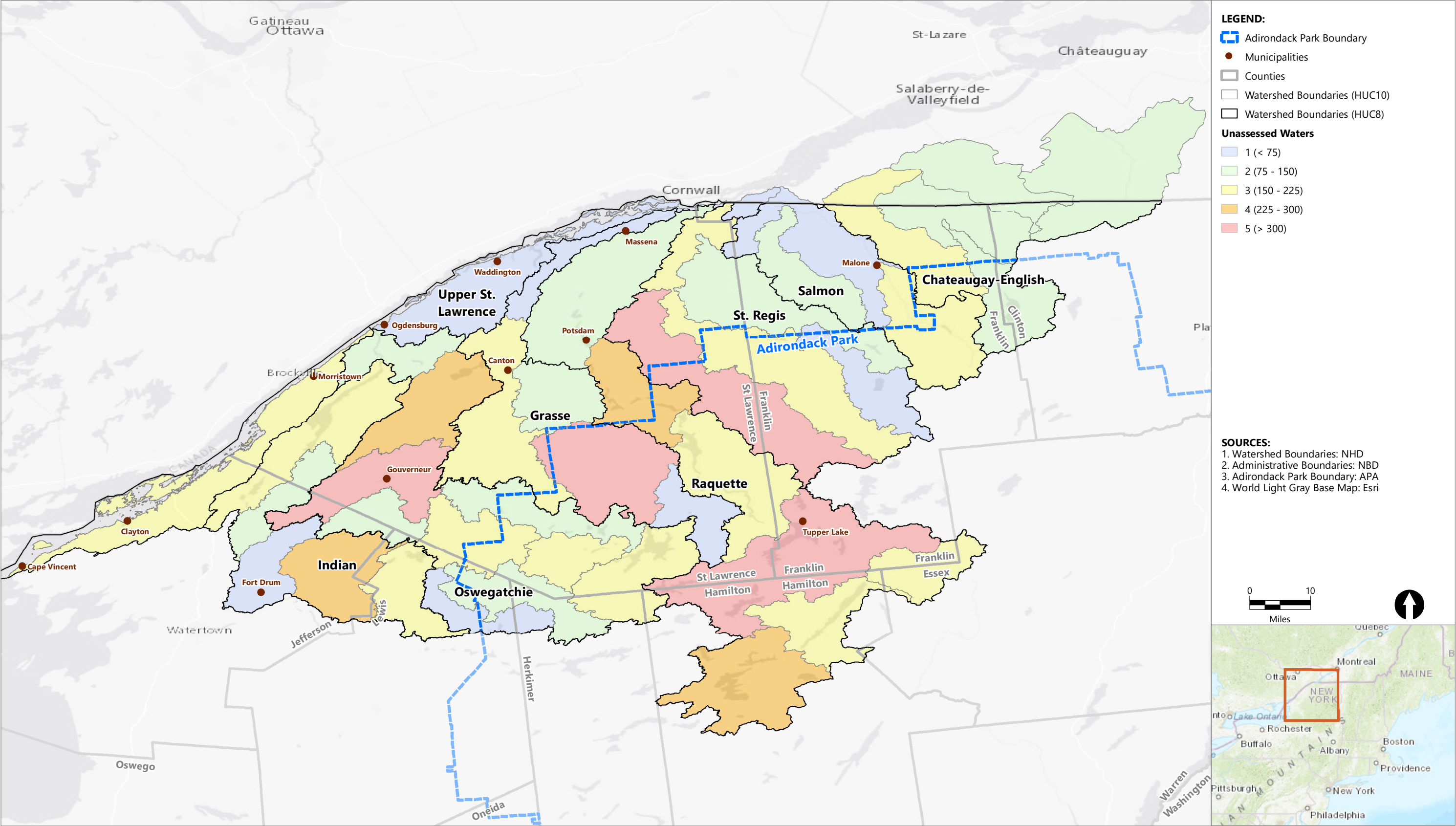


Publish Date: 2020/06/29, 4:22 PM | User: alesueur
Filepath: \\orcass\gis\Jobs\Franklin_County_SWCD\PrioritizationScoring\Maps\AQ_FigX_SLRwatershed_PrioritizationScoring.mxd



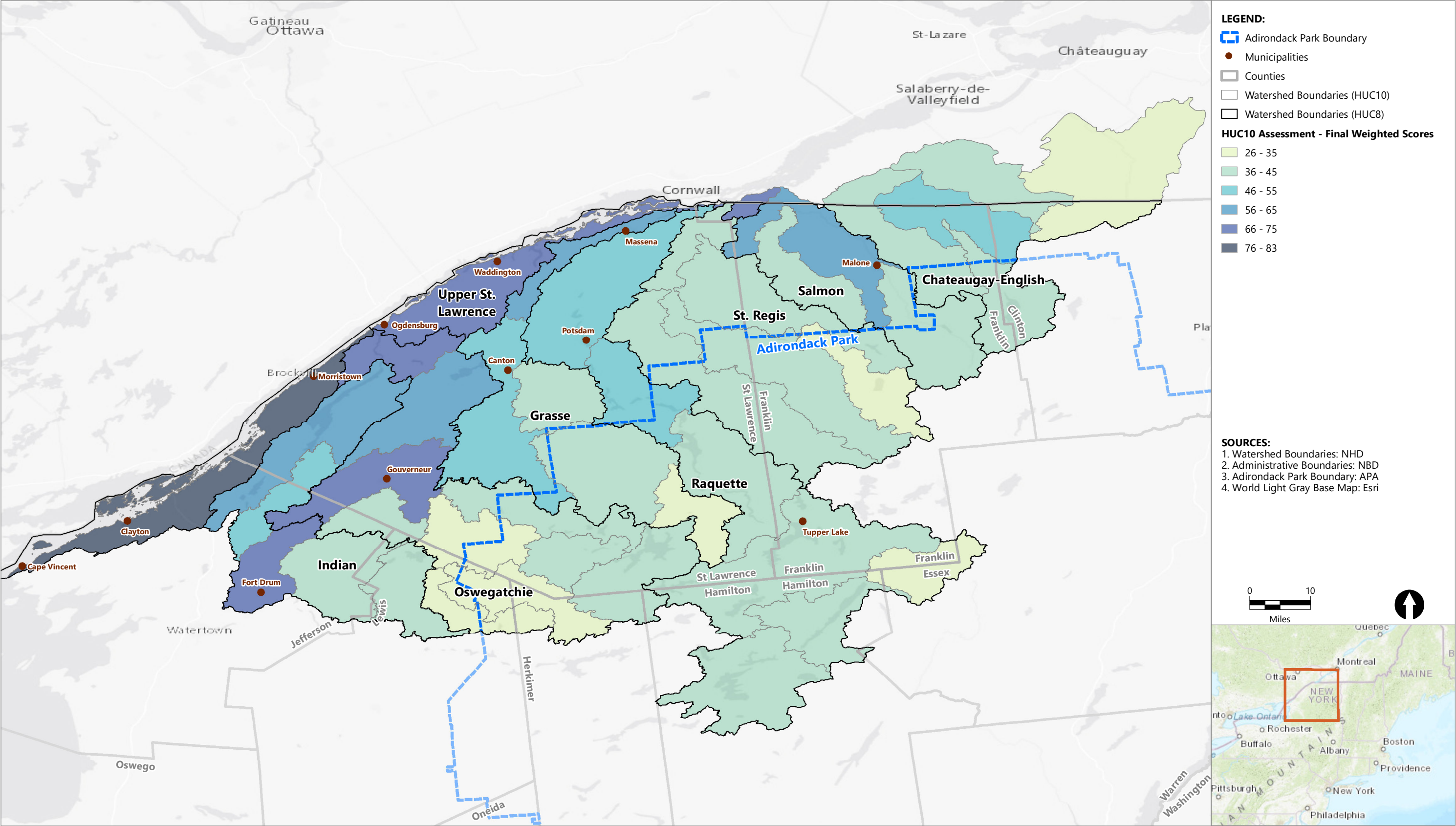
Publish Date: 2020/06/29, 4:23 PM | User: alesueur
Filepath: \\orcass\gis\Jobs\Franklin_County_SWCD\PrioritizationScoring\Maps\AQ_FigX_SLRwatershed_PrioritizationScoring.mxd





Publish Date: 2020/06/29, 4:23 PM | User: alesueur
Filepath: \\orcass\gis\Jobs\Franklin_County_SWCD\PrioritizationScoring\Maps\AQ_FigX_SLRwatershed_PrioritizationScoring.mxd





Publish Date: 2020/06/29, 4:23 PM | User: alesueur
Filepath: \\orcas\gis\Jobs\Franklin_County_SWCD\PrioritizationScoring\Maps\AQ_FigX_SLRwatershed_PrioritizationScoring.mxd

