MACROINVERTEBRATE AND FRESHWATER MUSSEL SURVEY

WEST CANADA CREEK HYDROELECTRIC PROJECT

FERC NO. 2701-NY

Prepared for:

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DEFINITIONS OF TERMS, ACRONYMS, AND ABBREVIATIONS

Brookfield	Brookfield Renewable
BAP	Biological Assessment Profile
Commission	Federal Energy Regulatory Commission
DIV	Species Diversity
DO	dissolved oxygen
EPT	Ephemeroptera, Plecoptera, Trichoptera Richness
Erie or Licensee	Erie Boulevard Hydropower, L.P.
FERC	Federal Energy Regulatory Commission
HBI	Hilsenhoff Biotic Index
ILP	Integrated Licensing Process
MW	Megawatts
NBI-P	Nutrient Biotic Index for Phosphorus
NGVD	National Geodetic Vertical Datum
NOI	Notice of Intent
NYSDEC	New York State Department of Environmental Conservation
PAD	Pre-Application Document
PMA	Percent Model Affinity
Project	FERC Project No. 2701, West Canada Creek Project
Project Area	The area within the FERC project boundary
Project Boundary	The boundary line defined in the Project license issued by FERC that surrounds the Project
Project Vicinity	The general geographic area in which the Project is located; the towns of Trenton and Prospect, New York
PSP	Proposed Study Plan
RTE	Rare, Threatened or Endangered
RSP	Revised Study Plan
SD	Scoping Document
SPD	Study Plan Determination
SPP	Species Richness
SWCA	SWCA Environmental Consultants
Tailrace	Channel through which water is discharged from the powerhouse turbines
USFWS	U.S. Fish and Wildlife Service
WCC	West Canada Creek

1.0 INTRODUCTION

Erie Boulevard Hydropower, L.P. (Erie or Licensee), a Brookfield Renewable company (Brookfield), is the Licensee, owner, and operator of the existing West Canada Creek Hydroelectric Project (FERC Project No. 2701) (Project). The West Canada Creek Project consists of two developments, Prospect and Trenton, and is located on West Canada Creek in Oneida and Herkimer counties, New York. A detailed description of the Project is provided in the Pre-Application Document (PAD) (Erie 2018).

The Federal Energy Regulatory Commission (FERC or Commission) issued the current license for the Project on March 18, 1983, which expires February 28, 2023. Erie is pursuing a new license under FERC's Integrated Licensing Process (ILP) and intends to file an application for a new license with FERC before February 28, 2021. On December 11, 2018, Erie filed a Revised Study Plan (RSP), and on March 7, 2019, FERC issued the Study Plan Determination (SPD) approving the RSP with modifications. On October 31, 2019, Erie requested a revision of the Process Plan and Schedule, and on December 5, 2019, FERC granted this revision to change the Initial Study Report (ISR) filing date to March 7, 2020, to align with one year following the issuance of FERC's SPD.

As part of the study implementation and in accordance with FERC's SPD, Erie initiated consultation with agencies regarding aspects of the Project's relicensing studies. FERC identified specific topics for consultation with the U.S. Fish and Wildlife Service (USFWS) and New York State Department of Environmental Consultation (NYSDEC) regarding the Aquatic Mesohabitat Assessment, Macroinvertebrate and Mussel Surveys, Fish Assemblage Assessment, and Fish Entrainment and Turbine Passage Survival Assessment studies. Accordingly, Erie conducted consultation calls with USFWS and NYSDEC on April 18, 2019, July 16, 2019, and August 9, 2019. Documentation of this consultation was provided in the Study Progress Reports filed with FERC and distributed to the stakeholders on July 29, 2019, and October 31, 2019.

This report describes the methods and results of the Macroinvertebrate and Freshwater Mussel Survey. Kleinschmidt Associates (Kleinschmidt) conducted the macroinvertebrate sampling. SWCA conducted the mussel survey and lab analysis of the macroinvertebrate samples. The purpose of the Macroinvertebrate and Freshwater Mussel Survey is to provide information on

existing macroinvertebrate and freshwater pearly mussel (Unionoidae) communities that could be affected by the Project operations.

Erie consulted with USFWS and NYSDEC (April 18, 2019, and August 9, 2019) regarding the sampling locations for the macroinvertebrate and freshwater mussel surveys (see the July 29, 2019, and October 31, 2019, Study Progress Reports). Erie did not propose any surveys within either the Trenton bypass reach, or Trenton impoundment given that the substrates were predominantly bedrock ledge that were unsuitable habitat for mussels and sampling would pose a significant safety risk for divers. NYSDEC and USFWS (August 9, 2019) agreed that sampling in Trenton impoundment or bypass was not necessary, stating that sampling would be conducted upstream at Prospect and also within the downstream reaches. This is a consistent with Erie's RSP which had proposed sampling in the Trenton impoundment and bypass reaches if suitable habitat was present (see Section 2.0 for further discussion of methodology).

2.0 METHODOLOGY

2.1 STUDY AREA

Erie proposed in the RSP that the Macroinvertebrate and Freshwater Mussel Survey study area include representative habitats in the littoral zone of the Project's, impoundments (mussel survey only), bypass reaches, and a 12.5-mile reach of West Canada Creek downstream of the Trenton tailrace to the confluence of the Newport Dam. FERC recommended in the SPD that Erie extend the study area to the confluence with the Mohawk River, shifting some of the proposed sample locations downstream of Newport dam, and that Erie consult with the USFWS and NYSDEC to identify sampling locations.

Erie consulted with USFWS and NYSDEC (April 18, 2019 and August 9, 2019) regarding the sampling locations for macroinvertebrate and mussel surveys.[1] As agreed to with the USFWS and NYSDEC, for the macroinvertebrate sampling, Kleinschmidt collected 2 kick net samples within the Prospect bypass reach (Figure 2-1), deployed macroinvertebrate sampling traps at 2 locations in the Trenton bypass reach (Figure 2-2), and conducted kick net sampling at 8 locations in the downstream reach at approximately 4-mile intervals (Figure 2-3).

In addition, as discussed with the USFWS and NYSDEC, SWCA conducted the mussel surveys within representative habitats of: the littoral zone within the existing Project boundary of the Prospect impoundment (Figure 2-4); the Prospect bypass reach within the existing Project boundary (Figure 2-5); and West Canada Creek downstream from the Trenton station tailrace to the confluence of the Mohawk River (Figure 2-6). The study area for mussel surveys did not include the Trenton bypass reach or impoundment given that the substrates were predominantly bedrock ledge that were unsuitable habitat for mussels and sampling would pose a significant safety risk for divers. The USFWS and NYSDEC indicated that sampling in Trenton impoundment and bypass was not necessary, given the limited suitable habitat and that sampling would be conducted upstream at Prospect impoundment and bypass reach, and also with the downstream reaches of West Canada Creek (consultation August 9, 2019, see Progress Report 2, filed October 31, 2019). This is consistent with Erie's RSP which proposed sampling in the Trenton impoundment and bypass reaches only if suitable habitat was present.

[1] See consultation record in the Study Progress Reports filed with FERC on July 29, 2019, and October 31, 2019.

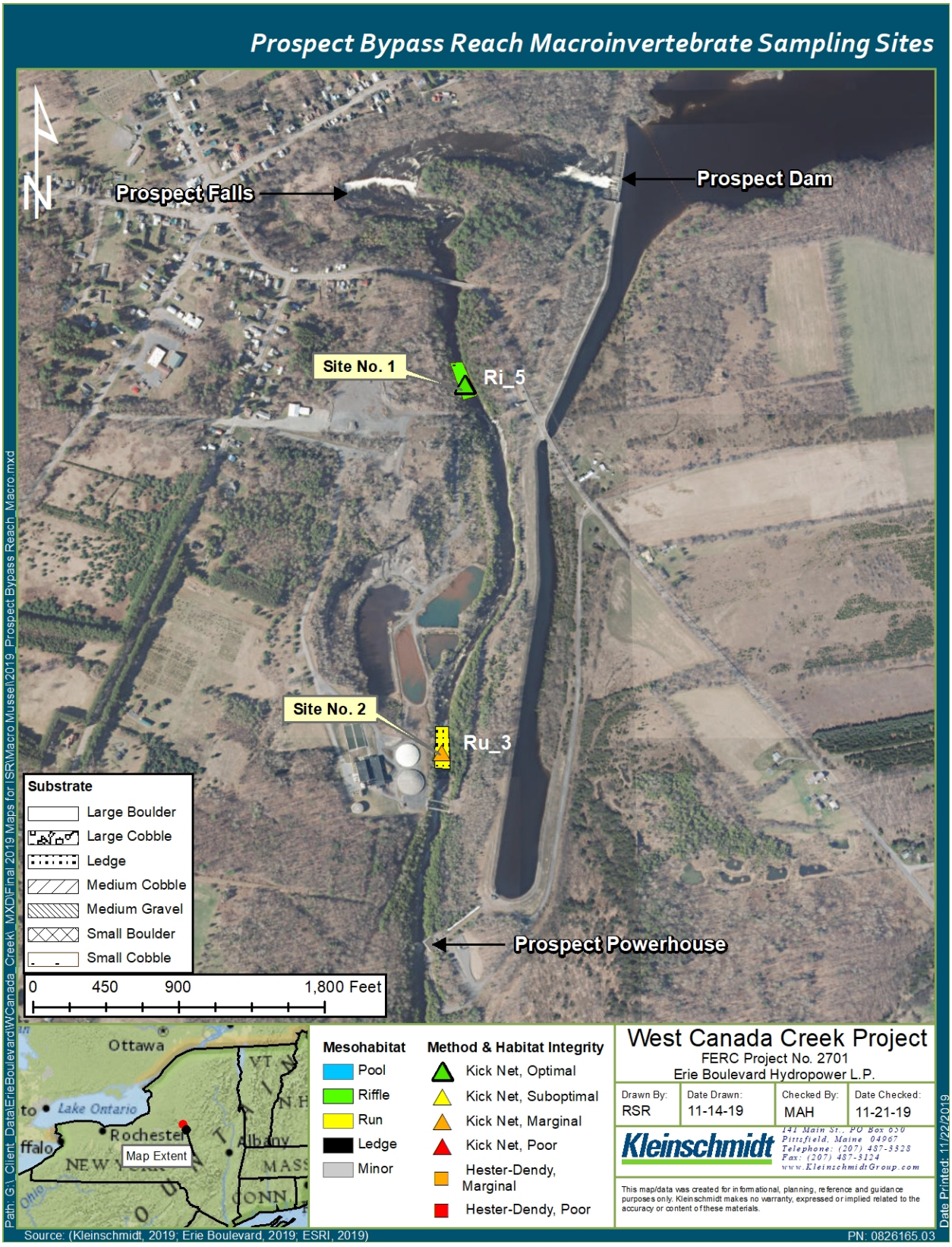

FIGURE 2-1 MACROINVERTEBRATE KICK SAMPLE SITES WITHIN THE PROSPECT BYPASS REACH.

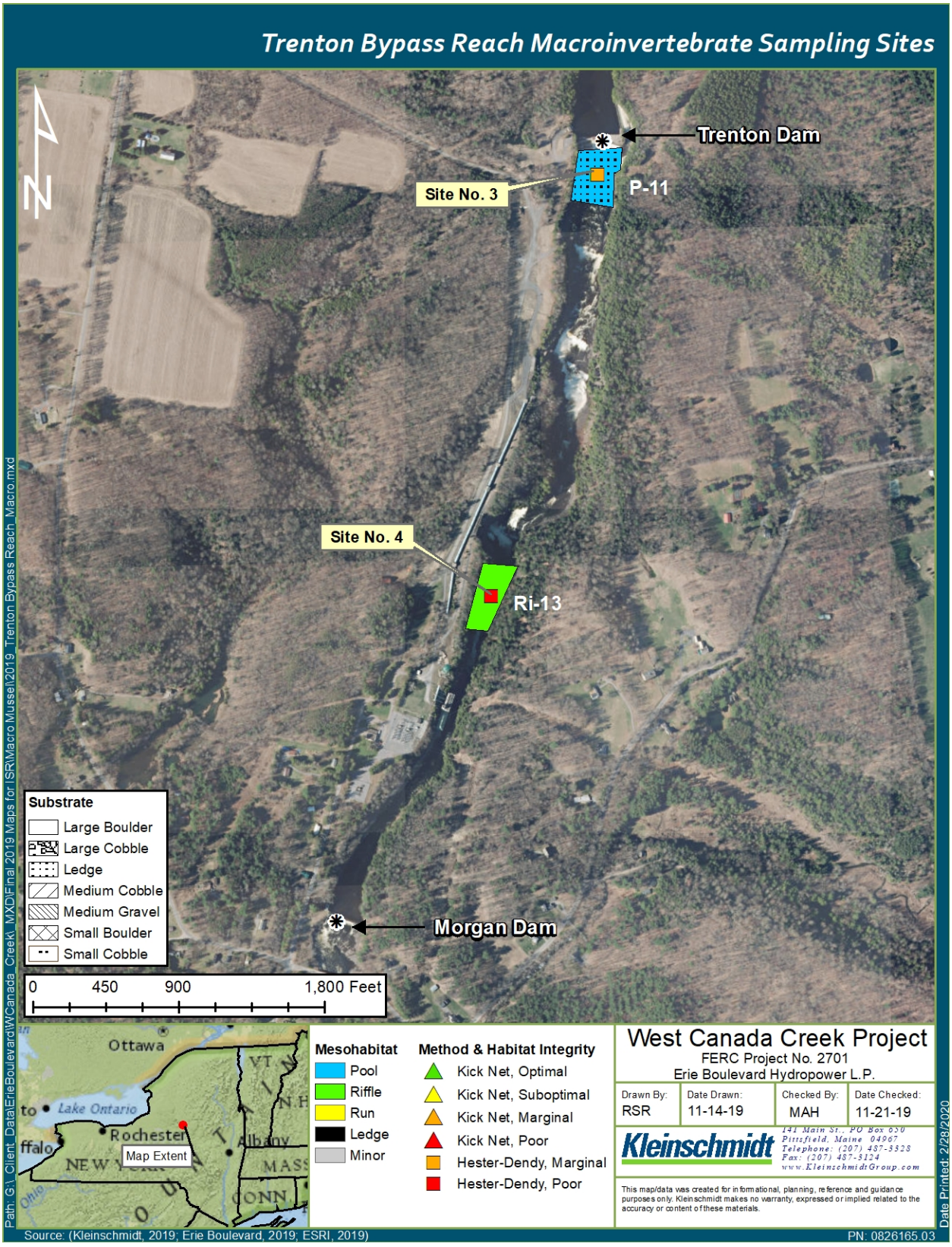

FIGURE 2-2 DEPLOYMENT SITES OF HESTER-DENDY MACROINVERTEBRATE SAMPLERS WITHIN THE TRENTON BYPASS REACH.

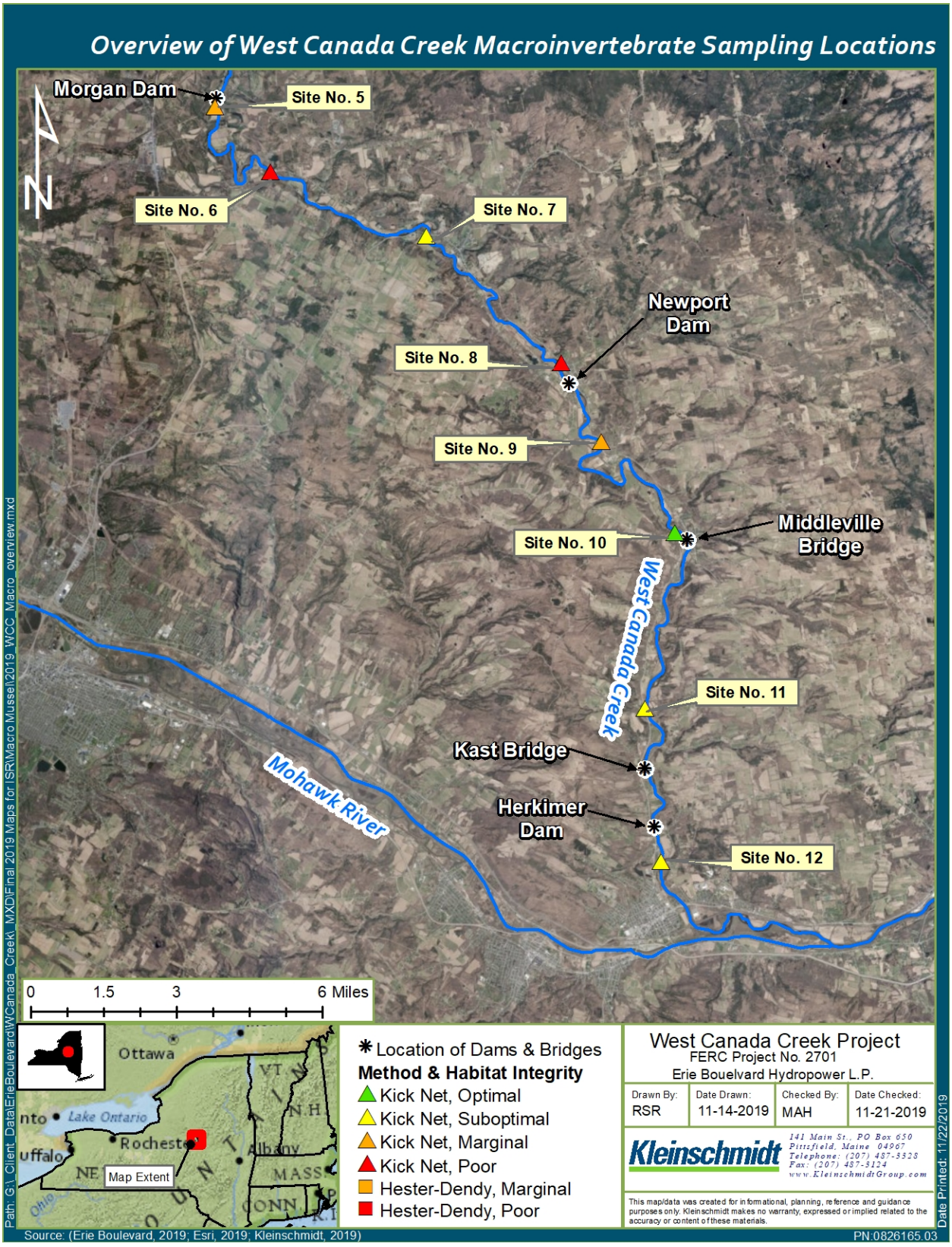

FIGURE 2-3 MACROINVERTEBRATE KICK NET SAMPLE SITES WITHIN WEST CANADA CREEK FROM MORGAN DAM TO THE MOHAWK RIVER CONFLUENCE.

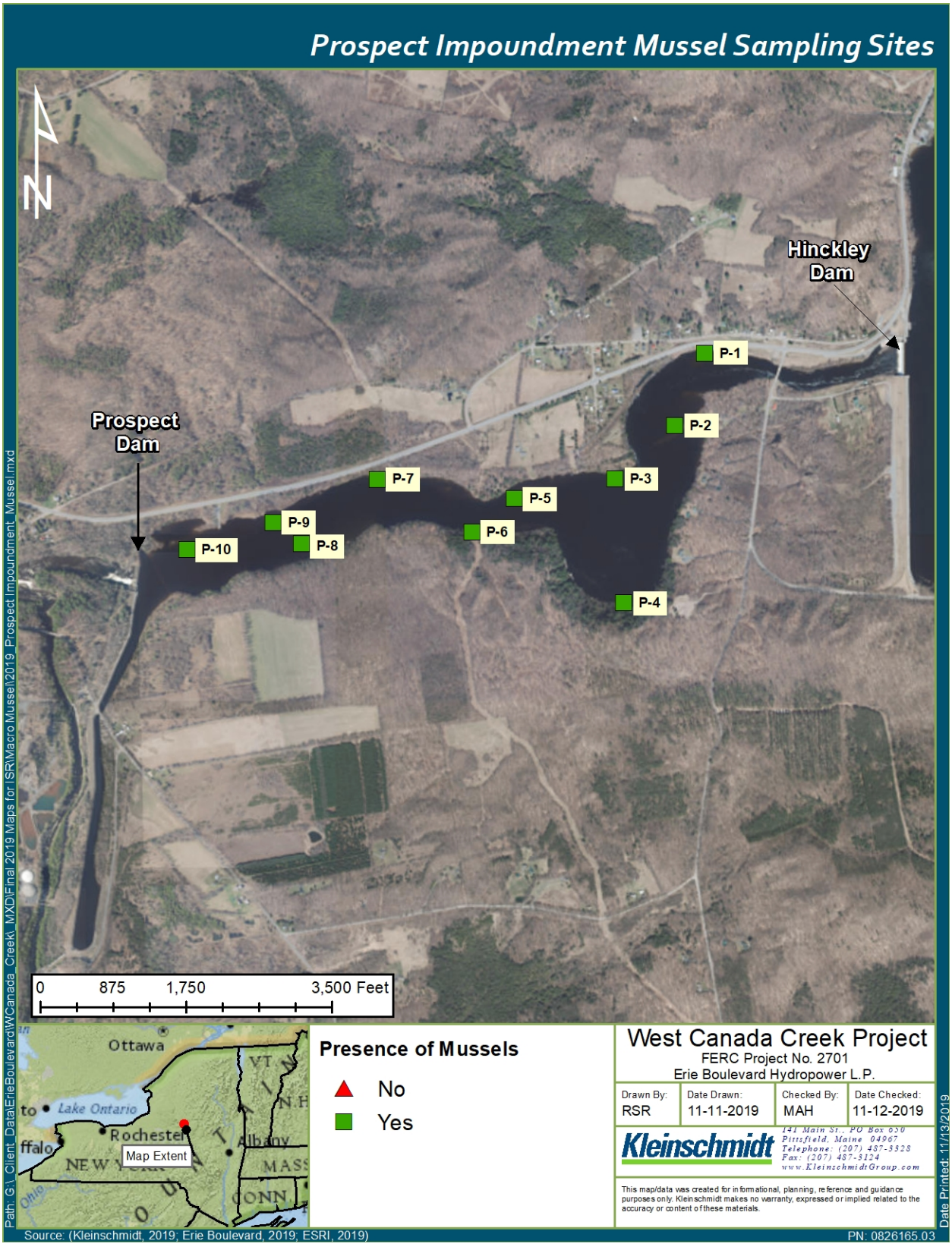

FIGURE 2-4 MUSSEL SAMPLING SITES WITHIN THE LITTORAL ZONE OF PROSPECT IMPOUNDMENT.

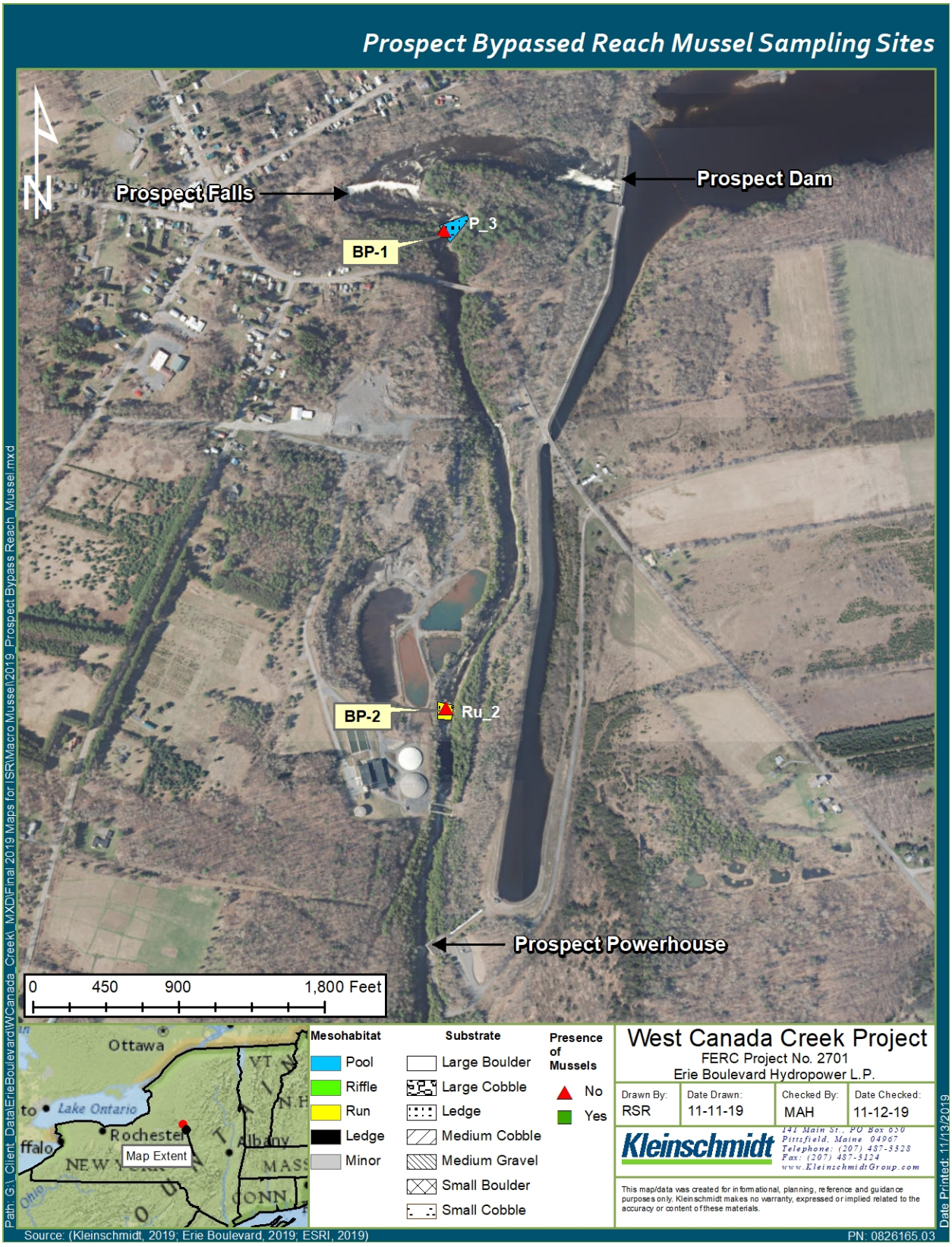

FIGURE 2-5 MUSSEL SAMPLING SITES WITHIN THE PROSPECT BYPASS REACH.

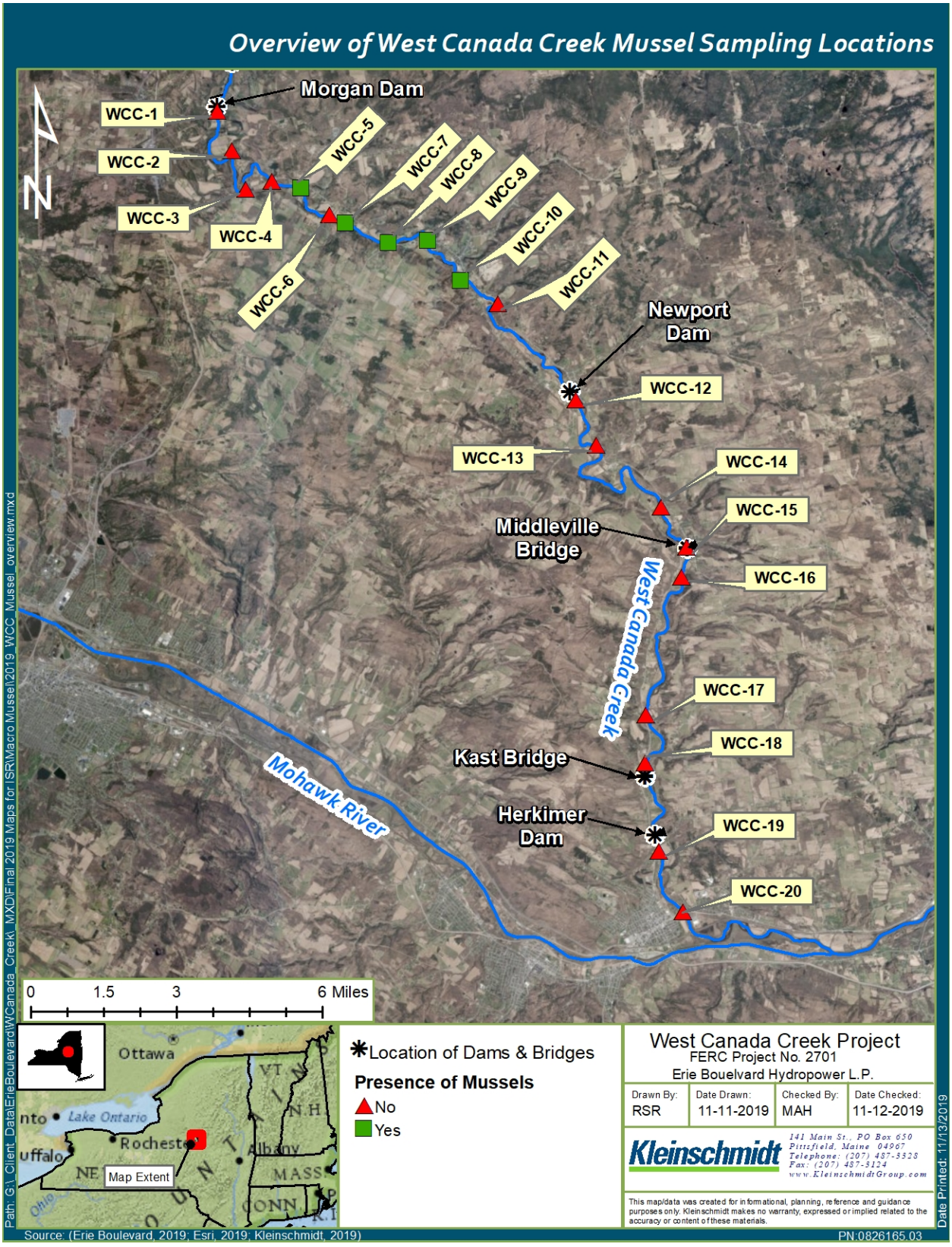

FIGURE 2-6 MUSSEL SAMPLING LOCATIONS WITHIN WEST CANADA CREEK FROM MORGAN DAM TO THE CONFLUENCE OF THE MOHAWK RIVER.

2.2 DATA COLLECTION

2.2.1 BENTHIC MACROINVERTEBRATE SAMPLING

Benthic macroinvertebrate kick net samples were collected in representative habitats with flowing waters in the littoral zone of the Prospect bypass reach and downstream of the Trenton tailrace to the Mohawk River confluence. Kick net sampling was conducted in late summer, on September 4 and 5, 2019, as recommended by NYSDEC. Spring sampling was avoided due to high numbers of naidid worms frequently occurring in spring samples (NYSDEC 2018b). In addition, Kleinschmidt deployed macroinvertebrate substrate traps (Hester-Dendy) in the Trenton bypass reach for approximately 6 weeks from August 21, 2019, to October 3, 2019 (Figure 2-2).

Kick net sampling is a standard method of sampling benthic organisms by disturbing bottom substrates and catching the disturbed organisms downstream with an aquatic net. The sampling approach followed the NYSDEC Division of Water, Standard Operating Procedure (NYSDEC 2018b). Sampling was conducted on hard bottom substrate composed of boulder, cobble, gravel, and sand. Depth at sample locations was less than one meter, and current speed was generally ≥ 40 centimeters/second. An aquatic net (size 9 inches X 18 inches, mesh opening size 0.8 millimeter X 0.9 millimeter) was positioned in the water about 0.5 meter downstream of the sampled substrate and the stream bottom was disturbed by foot, so that the displaced organisms would float into the net. Sampling continued for 5 minutes for 5 meters at each sample location.

The downstream reach, between Trenton tailrace and the Mohawk River confluence, was sampled at approximately 4 mile intervals for a total of 8 samples (Figure 2-3). Samples were collected at representative mesohabitats that met the proper depth and water velocity criteria (e.g., riffles, runs). Two kick samples were collected in the Prospect bypass reach, for a total of 10 samples (Figure 2-1). Additionally, two (2) WaterMark ® Hester-Dendy round multi-plate samplers were deployed in both the upper and lower Trenton bypass, for a total of 4 samples (Figure 2-2). Hester-Dendy samplers were used in the Trenton bypass because the substrate, predominately ledge and large boulders, was not conducive to kick net sampling.

The contents of the kick net samples were sorted, large debris removed, and the remaining sample was sieved with a U.S. no. 25 standard sieve and transferred to a quart jar and preserved

by adding 95 percent ethyl alcohol (NYSDEC 2018b). After a 6-week soak period, substrate plates from the Hester-Dendy samplers were placed in a quart jar and preserved with 95 percent ethyl alcohol. In the lab, samples were drained through a U.S. no. 60 sieve to remove the alcohol in preparation for processing. The samples were examined under a dissecting microscope and all invertebrates larger than 1.5 millimeters were removed and identified to the lowest practical taxon.

2.2.2 FRESHWATER MUSSEL SURVEY

SWCA conducted freshwater mussel surveys on September 16 through 20, 2019, and September 23, 2019 through September 25, 2019. Sampling locations included 10 cells in the Prospect impoundment (Figure 2-4), 2 cells in the Prospect bypass reach (Figure 2-5) and 20 cells in the downstream reach between Morgan Dam and the Mohawk River confluence (Figure 2-6). Prior to this study there were no known records of freshwater mussel species in the West Canada Creek drainage basin (NYPA 2017), thus a presence/absence survey of unionid mussels was conducted in the Prospect impoundments, Prospect bypass reach and in West Canada Creek from the Trenton tailrace to Herkimer, NY.

Information collected during the Aquatic Mesohabitat Assessment Study (Kleinschmidt 2020a) and the Impoundment Shoreline Characterization Study (Kleinschmidt 2020c) was used to refine sampling locations based on habitat parameters suitable for mussel colonies. Areas identified for sampling included a variety of lower energy mesohabitats containing smaller substrates, such as small cobble, gravel and sand where mussels could anchor in the substrate and not be displaced. Sample sites were selected based on these parameters, mapped and shared with the NYSDEC and the USFWS during study consultation on August 9, 2019.[2] The location of the survey sites was further refined in the field based on the conditions encountered at the time of the survey. Surveys were consistent with the sampling protocols from West Virginia Department of Natural Resources 2016, as requested by the NYSDEC (NYSDEC PSP comments submitted November 13, 2018).

Mussel surveys employed a stratified approach in which shallow (<6 feet) littoral areas containing suitable substrates (e.g., cobble sized or smaller) were surveyed in the Prospect

[2] See consultation record in the Study Progress Reports filed with FERC on October 31, 2019.

bypass reach, and the downstream reach of West Canada Creek. The surveyed zone in the Prospect impoundment extended from a minimum depth of approximately 6 feet below the lower operational pond elevation (1,156.5 feet NGVD29[3]) to depths as great as 20 feet. Erie monitors water surface elevation in the Prospect impoundment, and the minimum depth criterion was estimated in the field from the water surface elevation at the time of the survey. Suitable areas were divided into non-overlapping polygons or cells 100 meter^2 in size, typically 10 meters X 10 meters squares. A subset of 32 cells, described above, were selected for surveys (see Figure 2-4 to Figure 2-6).

The mussel survey was conducted by mussel experts from SWCA Environmental Consultants with over 15 years conducting mussel surveys in the Northeast, Maryland and Texas. The survey consisted of timed searches within the 32 selected cells. Cells were surveyed at a rate of 0.2 minutes per meter^2 (20-minute total). If mussels were observed, surveying continued for an additional 0.3 minutes per meter^2, for a final rate of up to 0.5 per meter^2 or 50 minutes per cell. Two biologists, using snorkel and SCUBA equipment surveyed each cell. SCUBA was used for portions of cells with depths greater than three feet. Within each survey cell, the two biologists conducted both visual and tactile surveys for mussels. Tactile surveys consisted of each diver raking their fingers through soft substrates to a depth of approximately 4 inches.

Survey cells within the Prospect impoundment were located at a minimum depth of 6 feet below the minimum pond depth. Survey depths for cells within the Prospect impoundment ranged from 6 to 20 feet, dependent on the water surface elevation at the time of each survey. Survey cells within the Prospect impoundment were accessed via a small motorboat. The remaining 22 survey cells were located within the Prospect bypass reach and West Canada Creek in areas with a maximum depth of six feet. All creek and bypass survey sites were accessed via wading or kayak.

The following data were recorded for each survey cell:

- Site ID and latitude/longitude coordinates;
- Date and start/end times of survey;
- Water visibility at time of survey (measured by secchi disk);

[3] All elevations refer to USGS mean sea level datum (National Geodetic Vertical Datum or NGVD).

- Predominate substrates (the two most dominate substrates present);
- River discharge (cfs)
- WSEL
- Photos of survey location and observed mussels (by species, if applicable);
- List of mussel species observed; and
- Number of observed mussels.

2.3 DATA ANALYSIS

In the lab, macroinvertebrate kick net samples were separated from the alcohol solution and examined under a dissecting microscope. Invertebrates were removed from the sample, enumerated and identified to taxonomic family. These data were used to calculate a number of metrics that illustrated the severity of negative impacts on quality of the water in West Canada Creek and the health of the biotic community. The benthic macroinvertebrate community metrics analyzed for this assessment were consistent with those identified in the RSP and the FERC SPD and include: 1) Species Richness (SPP), 2) Ephemeroptera, Plecoptera, and Trichoptera (EPT) Richness, 3) Hilsenhoff's Biotic Index (HBI), 4) NYSDEC's Biological Assessment Profile (BAP), and 5) Percent Model Affinity (PMA).

Species Richness is the number of species or taxa found in the sample. Although subjective, greater numbers of species found in a sample is mostly associated with clean-water conditions (NYSDEC 2018b). EPT Richness represents the total number of species of mayflies (Ephemeroptera), stoneflies (Plecoptera), and caddisflies (Trichoptera) found in a sample. These are mostly clean-water organisms inhabiting flowing waters, and their presence generally is correlated with good water quality (NYSDEC 2018b). HBI is calculated by multiplying the number of individuals of each species by its assigned tolerance value, summing these products, and dividing by the total number of individuals. On a 0-10 scale, tolerance values range from intolerant (0) to tolerant (10). Low HBI values indicate low level of pollution, and optimal water quality and habitat integrity (NYSDEC 2018b).

BAP is a combination of metrics converted to common 0-10 scale, with 1 being poor water quality and 10 being optimal water quality. Once metrics are converted to a common scale, they are averaged to assign the overall BAP value to represent the severity of water quality impact.

The metrics used to calculate BAP differ depending on the habitat and method of sampling, and include the metrics mentioned above, in addition to Species Diversity (DIV) and Nutrient Biotic Index – Phosphorus (NBI-P). Table 2-1 lists and describes the metrics used to calculate BAP score for the two collection methods employed in this study. Specific conversion and calculation methods for BAP can be found in the NYSDEC Division of Water Standard Operating Procedure for Biological Monitoring of Surface Waters in New York State (2018). The NYSDEC water quality impact categories and representative BAP scores include: non-impact -range of 10-7.5, slight impact -7.5-5, moderate impact -5-2.5, and severe impact -2.5-0 (NYSDEC 2018b). Table 2-2 summarizes the levels of water quality impact (i.e. non-impact, slight, moderate, and severe), habitat integrity (i.e. poor, marginal, suboptimal, and optimal), and the corresponding range of metric scores.

TABLE 2-1 METRICS USED TO CALCULATE BAP FOR KICK NET SAMPLES AND MULTI-PLATE SAMPLERS.

Kick net samples	
SPP	Number of taxa found in the sample
HBI	calculated by multiplying the number of individuals of each species by its assigned tolerance value, summing these products, and dividing by the total number of individuals. On a 0-10 scale, tolerance values range from intolerant (0) to tolerant (10).
EPT	total number of species of mayflies (Ephemeroptera), stoneflies (Plecoptera), and caddisflies (Trichoptera) found in a sample
PMA	Measure of similarity to a model non-impacted community based on percent abundance of 7 major groups. The model for statewide kick samples was used for this study.
Nutrient Biotic Index – Phosphorus (NBI-P)	A similar calculation to HBI with different tolerance values for select families
Multiple-plate samples.	
SPP	See above
HBI	See above
EPT	See above
Species diversity (DIV)	Combines SPP and community balance (evenness)

Note: Details for calculating each metric can be found in the NYSDEC Division of Water, Standard Operating Procedure for Biological Monitoring of Surface Waters in New York State (2018)

TABLE 2-2 HABITAT INTEGRITY AND WATER QUALITY IMPACT CATEGORIES AND THEIR CORRESPONDING RANGE OF METRIC SCORES

HABITAT INTEGRITY		**POOR**	**MARGINAL**	**SUBOPTIMAL**	**OPTIMAL**
WATER QUALITY IMPACT		**SEVERE IMPACT**	**MODERATE IMPACT**	**SLIGHT IMPACT**	**NON-IMPACT**
Metric	**SPP**	0-11	11-19	19-26	>26
	HBI	10-8.5	8.5-6.5	6.5-4.5	4.5-0
	EPT	0-2	2-6	6-10	>10
	PMA	20-35	35-49	49-64	64-90
	NBI-P	>7	7-6	6-5	5-0
	DIV	1-2	2-3	3-4	4-5
	BAP	**0-2.5**	**2.5-5**	**5-7.5**	**7.5-10**

2.4 VARIANCES FROM APPROVED STUDY PLAN

The Macroinvertebrate and Freshwater Mussel Survey was conducted in accordance Erie's proposed RSP and the FERC SPD. In addition, observations of mussels encountered outside of the designated areas of the sample polygons were also noted during this study.

3.0 STUDY RESULTS

3.1 BENTHIC MACROINVERTEBRATE SAMPLING

Kick net samples were collected in the Prospect bypass reach on September 4, 2019, and in the lower reach of West Canada Creek, downstream of Morgan Dam, on September 5, 2019. The 10 kick net samples were collected in riffle and run habitats with cobble and gravel substrates and suitable depth (Table 3-1). Discharge from Trenton powerhouse ranged from 1,266 to 1,348 cubic feet per second (cfs) on September 5, when samples were collected (2:30 pm - 7:30 pm) in the lower section of West Canada Creek. River flow at Kast Bridge gage (USGS 01346000) ranged from 725 to 747 cfs during this time (Figure 3-1). Four Hester-Dendy multi-plate samplers were paired and deployed in the upper and lower areas of the Trenton bypass reach where bedrock did not allow for effective kick net sampling. These samplers were deployed from August 21, 2019 to October 3, 2019 (Table 3-1). Six (6) spill events occurred at the Trenton Dam during this time, with maximum flows of 347 cfs on September 24, 2019 (Figure 3-2).

Table 3-2 lists the total number of specimens identified in each sample and the resulting metrics. A total of 46 families were identified throughout the study area, with *Ephemeroptera Siphlonuridae* (n=311) being the most common taxa. The greatest species richness was observed in the upper Prospect bypass and upstream of the Middleville bridge, with 21 and 22 families collected, respectively. Overall 23 EPT families were identified and HBI was 4.5. PMA ranged from 0 to 83, with an overall PMA of 81. The average BAP for the 10 kick net sample sites was 6.0, ranging from 2.8, at the Route 28 crossing, to 8.2, just upstream of the Middleville bridge (Figure 2-3). Specimens were only recovered from the Hester-Dendy samplers deployed in the upper Trenton bypass reach, resulting in a BAP of 2.9. No organisms occurred on the Hester-Dendy sampler in the lower Trenton bypass reach and thus resulted in a BAP score of 0.

Figures 2-1 and 2-2 and Appendix A provide detailed maps of the location of each macroinvertebrate sampling site. Habitat and substrate for the section of river sampled is depicted in these maps, as well as a color coded habitat integrity, as determined by BAP score, with red representing poor water quality and habitat integrity (BAP = 0 to 2.5), orange indicating marginal (BAP = 2.5 to 5.0), yellow indicating good/suboptimal (BAP = 5.0 to 7.5), and green indicting optimal water quality and habitat integrity (BAP = 7.5 to 10.0) (NYSDEC 2018b). Appendix B provides a list of macroinvertebrates identified in each sample.

TABLE 3-1 MACROINVERTEBRATE SAMPLE SITES AND HABITAT DESCRIPTION

SITE NO.	LOCATION	RIVER MILE	SAMPLE METHOD	DATE	HABITAT	SUBSTRATE	DEPTH (FT)
1	Upper Prospect Bypass	34.5	Kick Net	9/4/2019	riffle	large gravel	1.0
2	Lower Prospect Bypass	34.1	Kick Net	9/4/2019	run	small cobble	1.5
3	Upper Trenton Bypass	33.3	Hester-Dendy	8/21/2019 – 10/3/2019	pool	bedrock	2.0
4	Lower Trenton Bypass	33.0	Hester-Dendy	8/21/2019 – 10/3/2019	run	bedrock	1.5
5	Downstream Morgan Dam	32.1	Kick Net	9/5/2019	riffle	small cobble	2.5
6	Upstream Route 28 crossing	28.5	Kick Net	9/5/2019	run	medium gravel	2.5
7	Downstream Poland Water Quality Site 6	24.3	Kick Net	9/5/2019	run	large gravel	2.5
8	Newport Market	19.8	Kick Net	9/5/2019	run	medium gravel	0.5
9	Route 29 pull-off Water Quality Sampling Site 8	17.7	Kick Net	9/5/2019	riffle	small cobble	2.0
10	Upstream Middleville Bridge	13.3	Kick Net	9/5/2019	riffle	small cobble	1.5
11	1.5 miles Upstream of Kast Bridge	8.9	Kick Net	9/5/2019	run	small cobble, fines	3.0
12	Mohawk River Confluence	5.0	Kick Net	9/5/2019	riffle	large cobble	1.0

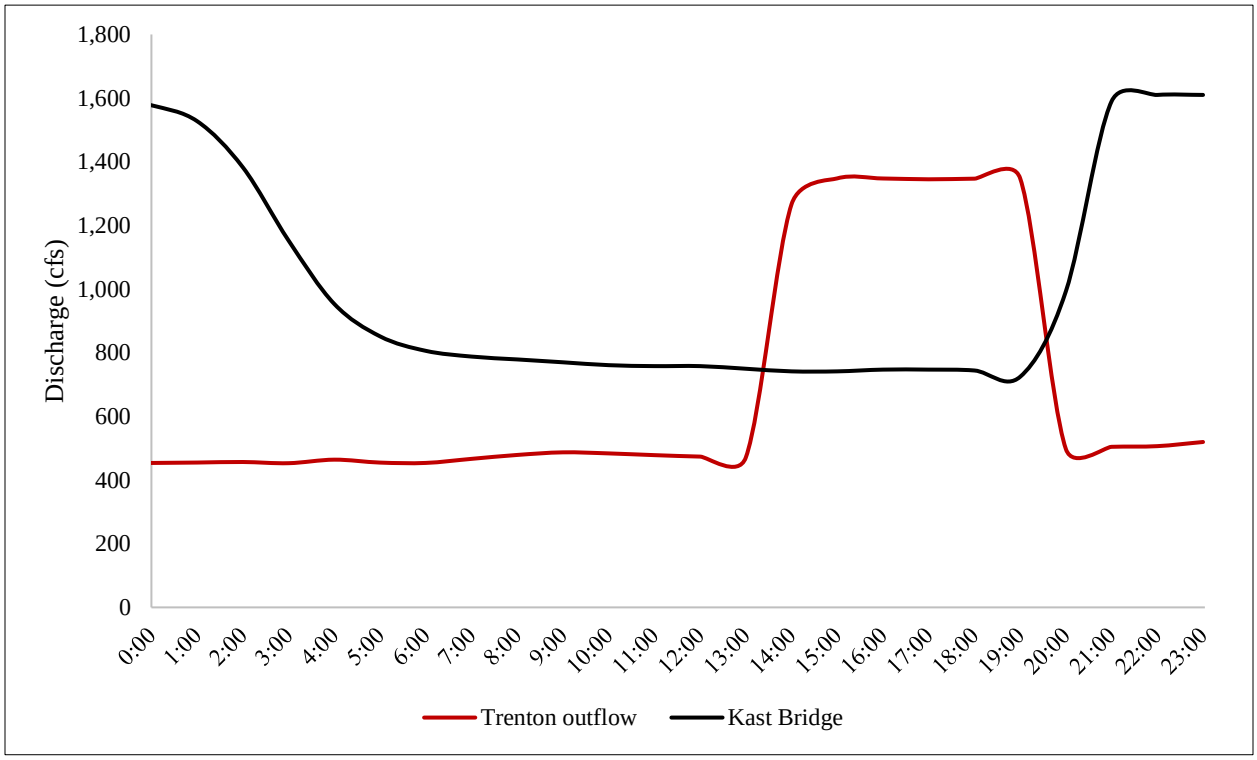

FIGURE 3-1 DISCHARGE AT TRENTON TAILRACE AND KAST BRIDGE DURING MACROINVERTEBRATE SAMPLE COLLECTION IN LOWER WEST CANADA CREEK ON SEPTEMBER 5, 2019

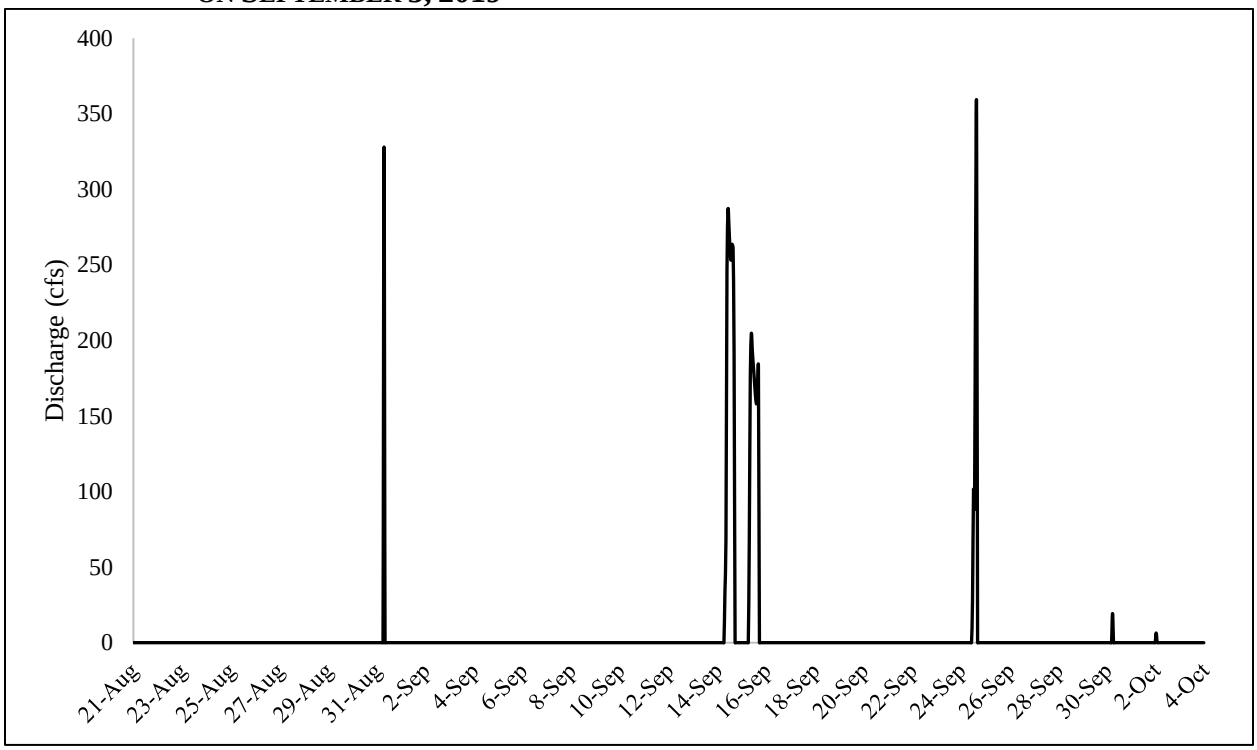

FIGURE 3-2 SPILL FROM TRENTON DAM DURING HESTER-DENDY DEPLOYMENT AUGUST 21 THROUGH OCTOBER 3, 2019

TABLE 3-2 BIOLOGICAL METRICS FOR EACH SITE SAMPLED FOR MACROINVERTEBRATES

SITE NO.	LOCATION	TOTAL SPECIMENS	SPP	EPT	HBI	PMA	NBI-P	DIV	BAP
1	Upper Prospect Bypass	582	21	10	4.1	67	3.6	-	**7.56**
2	Lower Prospect Bypass	12	8	4	6.5	50	4.0	-	**4.87**
3	Upper Trenton Bypass	8	1	1	3.0	40	-	0	**2.88**
4	Lower Trenton Bypass	0	0	0	0	0	-	0	**0**
5	Downstream Morgan Dam	52	15	5	5.2	72	4.9	-	**6.24**
6	Upstream Route 28 Crossing	10	5	0	6.3	25	5.0	-	**2.8**
7	Downstream Poland Water Quality Site 6	105	15	7	4.5	80	4.4	-	**6.93**
8	Newport Market	13	4	2	6.5	53	*	-	**3.4**
9	Route 28 pull off-water quality Site 8	53	13	4	5.6	73	4.8	-	**5.97**
10	Upstream Middleville Bridge	367	22	14	4.2	81	3.9	-	**8.18**
11	1.5 mile Upstream of Kast Bridge	61	14	9	5.3	83	4.7	-	**6.83**
12	Downstream Herkimer Dam	457	15	9	4.9	77	4.0	-	**7.01**

*No families observed in the sample from Site 8 were assigned NBI-P tolerance values.

Values of (-) indicate that the metric was not used to calculate BAP score.

3.1.1 PROSPECT BYPASS REACH

The Prospect bypass exhibited large variability in BAP scores when comparing the upper to the lower reach. The BAP value for the upper Prospect bypass reach (7.6) suggests optimal habitat integrity. This sample contained the greatest number of specimens (n=582) with one of the highest species richness (21 families) (Table 3-2). The most common taxon at this site was *Ephemeroptera Siphlonuridae* (179) (Appendix B). Conversely, the sample collected in the lower Prospect bypass contained only 12 specimens, representing 8 families. The BAP value for this site was 4.9 suggesting marginal habitat integrity that has been moderately impacted (Table 3-2).

3.1.2 TRENTON BYPASS REACH

The Trenton bypass reach reflected low BAP scores with a BAP of 2.9 in the upper bypass reach, and 0 in the lower bypass reach (Figure 2-2Table 3-2). No specimens were found in the Hester-Dendy sampler deployed in the lower Trenton bypass reach. Eight specimens, all from the *Ephemeroptera Heptageniidae* family, were found in the samplers deployed in the upper Trenton bypass (Appendix B).

3.1.3 LOWER WEST CANADA CREEK

West Canada Creek, downstream of Morgan Dam to the confluence of the Mohawk River, had a wide range of BAP scores (range of 2.8 to 8.2), but had predominately good/suboptimal water quality (median BAP 6.5) (Table 3-2). Within this study reach, the sample from Site 10 at the Middleville dam contained the most specimens (367), representing 22 macroinvertebrate families, predominantly *Ephemeroptera Heptageniidae* (70) (Appendix B). Conversely, Site 6, where Route 28 crosses the West Canada Creek near Gravesville, exhibited the lowest BAP score (2.8) and contained only 10 specimens, representing 5 families (Table 3-2).

3.2 FRESHWATER MUSSEL SURVEY

Freshwater mussel surveys were conducted over 8 days from September 16, 2019 to September 20, 2019, and September 23, 2019 to September 25, 2019. The 32 cells sampled were located within the Prospect impoundment and bypass reach and within the lower West Canada Creek from the Morgan dam area to the confluence of the Mohawk River (Figure 2-4 through Figure 2-6). Three species of mussel were found within the study area; lake floater (*Pyganodon lacustris*), eastern elliptio (*Elliptio complanata*) and eastern pearlshell (*Margaritifera margaritifera*). Appendix C provides detailed maps of the location of each mussel survey sampling site. Appendix D contains a table with the species and number of mussels found at each sample site as well habitat descriptions. Appendix E provides photos of sampling efforts and representative habitats.

3.2.1 PROSPECT IMPOUNDMENT

Live mussels were observed in all ten survey cells within the Prospect impoundment. In total, 598 lake floater (*Pyganodon lacustris*) were observed. The number of observed individual mussels per cell ranged from 6 to 116. The average mussel density within the impoundment was

0.6 mussels per meters^2, or one mussel for each 1.7 meters^2. No other freshwater mussel species were observed within the impoundment. All mussels observed appeared to be healthy, and a number of juvenile mussels were found over the course of the surveys, indicating successful reproduction within the population.

The dominant substrate type observed within the impoundment survey cells was soft organic muck, ranging in depth from three inches to over two feet and occurring in all ten cells. In seven of the ten cells, sand, gravel, clay, and/or tree roots were observed as well, but were always far less prevalent than organic muck. Secchi disk readings within the Prospect impoundment ranged from seven to eight feet.

3.2.2 PROSPECT BYPASS REACH

No live mussels or shells were found within the Prospect bypass reach. Substrates within the bypass were primarily ledge, boulder, and cobble; however, survey cell locations were chosen to include areas with some smaller substrates such as gravel, sand, and silt. Water clarity was very high within the bypass reach. Survey Cell BP-1 was located within a deep pool where a secchi disk reading of over 20 feet was recorded (see Figure 2-5). Water depths were insufficient to take a secchi disk reading at the second site, as the bottom was clearly visible at all depth encountered at this site.

3.2.3 LOWER WEST CANADA CREEK

Two species of mussel, eastern elliptio (*Elliptio complanata*) and eastern pearlshell (*Margaritifera margaritifera*), were observed in or near five of the 20 survey cells located within lower West Canada Creek. All five sites with live mussels were located within a 4.6-mile section of the creek, beginning 0.6 miles below the Route 28 Bridge in Gravesville, and ending approximately 1.7 miles above the Route 200 Bridge in Poland, NY (Figure 2-6, Appendix C). Substrate observed within all cells of this section of creek consisted of a mix of sand, gravel, and cobble. Water depths where mussels were observed ranged from 0.5 feet to 2.5 feet. Depths were insufficient at each survey area to take a secchi disk reading, but visibility was estimated by the divers to be between three and seven feet. No live mussels were observed within other portions of West Canada Creek. Although survey cell locations were selected based on suitable substrates

for mussels, survey cells without live mussels typically contained higher percentages of larger substrates (e.g., more cobble, boulder, and/or ledge).

In total, seven live pearlshell were observed in or near survey cells, and two live elliptio were observed near, but outside survey cells. Shells from both species were observed at all five sites with live mussels. Shells were not observed at any of the remaining survey cells. A total of six survey cells (WCC-5 through WCC-10) were sampled within the section of creek where live mussels were observed, approximately 30 percent of the survey effort was dedicated to the lower West Canada Creek reach (see Appendix D).

The estimated average density of mussels within this section of creek is 0.008 mussels per meter^2, or one mussel in 125 meters^2. Of the seven pearlshell observed, six were full-sized adults ranging from 108 to 134 millimeters in length. The remaining live pearlshell was 65 millimeters in length. Shell wear was minimal for all observed pearlshell, suggesting that all mussels were in good health. The two observed live elliptio were 79 millimeters and 97 millimeters in length. Both individuals exhibited severe shell wear.

4.0 DISCUSSION

4.1 BENTHIC MACROINVERTEBRATE SAMPLING

The upper Prospect bypass reach, Site 1, exhibited one of the highest BAP values of all sampled sites. The coarse cobble substrate within a riffle habitat produced the highest yielding sample with the highest diversity of macroinvertebrate families represented. These are characteristic of optimal water quality within this area of the Prospect bypass. Approximately half a mile downstream at sample Site 2, water quality macroinvertebrate metrics declined. The numbers of specimens and families captured at Site 2 were less when compared to Site 1, resulting in a BAP score of 4.87. Water velocities at Site 2 were lower than at Site 1. The slower waters may have affected catch rate at this site; however, water velocity was estimated to be within the guideline, exceeding 40 centimeters/second. Site 2 was also located approximately 750 feet downstream of discharge from Mohawk Valley Water Authority stilling ponds. These ponds may affect the water quality and benthic communities at Site 2.

Benthic communities within the Trenton bypass were difficult to evaluate due to the low number of specimens collected with the Hester-Dendy samplers. The shallow bedrock habitat within the Trenton bypass is not optimal for benthic communities and is likely the reason behind the low density (Gomez and Sullivan 2000).

The lower reach of West Canada Creek, between Morgan Dam and the Mohawk River confluence, reflected good water quality metrics as suggested by a median BAP of 6.5. The highest BAP score occurred at Site 10 (river mile 13.0), near Middleville, NY. This sample site was located in a riffle downstream of deep pool which was formed at a bend in the river. Site 6 and Site 8 had the lowest BAP scores of the 8 sample sites in the lower West Canada Creek, with BAP values of 2.8 and 3.4, respectively. The sample at Site 8 was collected at a gravel bar downstream of a small tributary. The habitat was a slow-moving run that was most likely influenced by the tributary and backwatering from the Newport impoundment located directly downstream of the sample site. Site 6 was also located at a slower-moving run with small gravel substrate and is subjected runoff from the nearby Route. 28 and Partridge Hill Road.

Overall the macroinvertebrate indices throughout the study area suggested good water quality. The median HBI for the 10 kick net samples was 5.3, ranging from 4.1 to 6.5. Median BAP

values for all 12 sample sites was 6.1 (ranging from 0 to 8.1), indicating good water quality with a healthy macroinvertebrate community (NYSDEC 2018b).

4.2 FRESHWATER MUSSEL SURVEY

Three species of mussel were found within the study site; lake floater (*Pyganodon lacustris*), eastern elliptio (*Elliptio complanata*) and eastern pearlshell (*Margaritifera margaritifera*). Lake Floater (*Pyganodon lacustris*) was the only species observed in the Prospect impoundment but was widely distributed having been found at all ten sample sites. The health and abundance of these mussels, as well as the presence of juvenile Lake Floaters, suggest that the mussel population in the Prospect impoundment is successfully reproducing. Although not formally targeted for surveyed in this study, lake floater was observed as shallow as 3 foot in depth, within the currently licenses fluctuation zone of the Project. Their presence in such shallow waters suggests that the current operating mode does not prevent mussels from inhabiting the shallow littoral habitat of the Prospect impoundment.

No mussels were observed in the Prospect bypass reach. This is in spite of favoring areas with finer substrate, such as gravel and sand. Based on the substrate composition and sparsely observed aquatic life, it appears that the bypass experiences high velocity flows on a periodic basis, such high flows can displace mussels making the area unsuitable for persistent colonization.

Two species of native mussel, eastern elliptio (*Elliptio complanata*) and eastern pearlshell (*Margaritifera margaritifera*), were observed in or near survey cells located between Route 28 bridge in Gravesville and the Route 200 bridge in Poland, NY. SWCA altered the method slightly to include observations around the original 10 meters X 10 meters sample cell. This additional survey technic resulted in findings of two live elliptio observed near, but outside survey cells.

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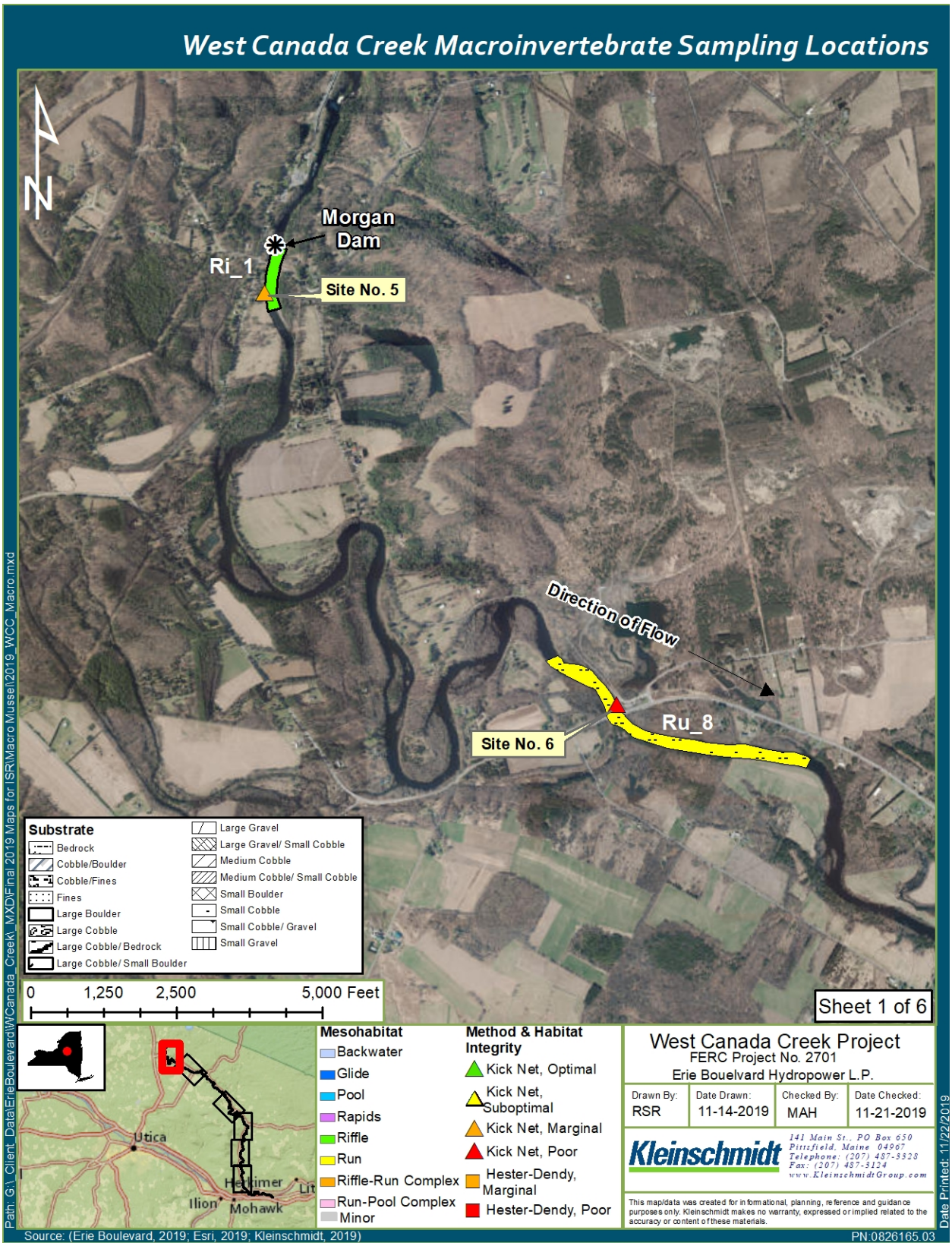
APPENDIX A

MACROINVERTEBRATE SAMPLING SITES LOCATIONS


West Canada Creek Macroinvertebrate Sampling Locations
N
Morgan Dam
Ri_1
Site No. 5
Direction of Flow
Ru_8
Site No. 6
Substrate
Bedrock
Cobble/Boulder
Cobble/Fines
Fines
Large Boulder
Large Cobble
Large Cobble/ Bedrock
Large Cobble/ Small Boulder
Large Gravel
Large Gravel/ Small Cobble
Medium Cobble
Medium Cobble/ Small Cobble
Small Boulder
Small Cobble
Small Cobble/ Gravel
Small Gravel
0 1,250 2,500 5,000 Feet
Sheet 1 of 6
Utica
Herkimer
Ilion
Mohawk
Mesohabitat
Backwater
Glide
Pool
Rapids
Riffle
Run
Riffle-Run Complex
Run-Pool Complex
Minor
Method & Habitat Integrity
Kick Net, Optimal
Kick Net, Suboptimal
Kick Net, Marginal
Kick Net, Poor
Hester-Dendy, Marginal
Hester-Dendy, Poor
West Canada Creek Project
FERC Project No. 2701
Erie Bouelvard Hydropower L.P.
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Date Drawn: 11-14-2019
Checked By: MAH
Date Checked: 11-21-2019
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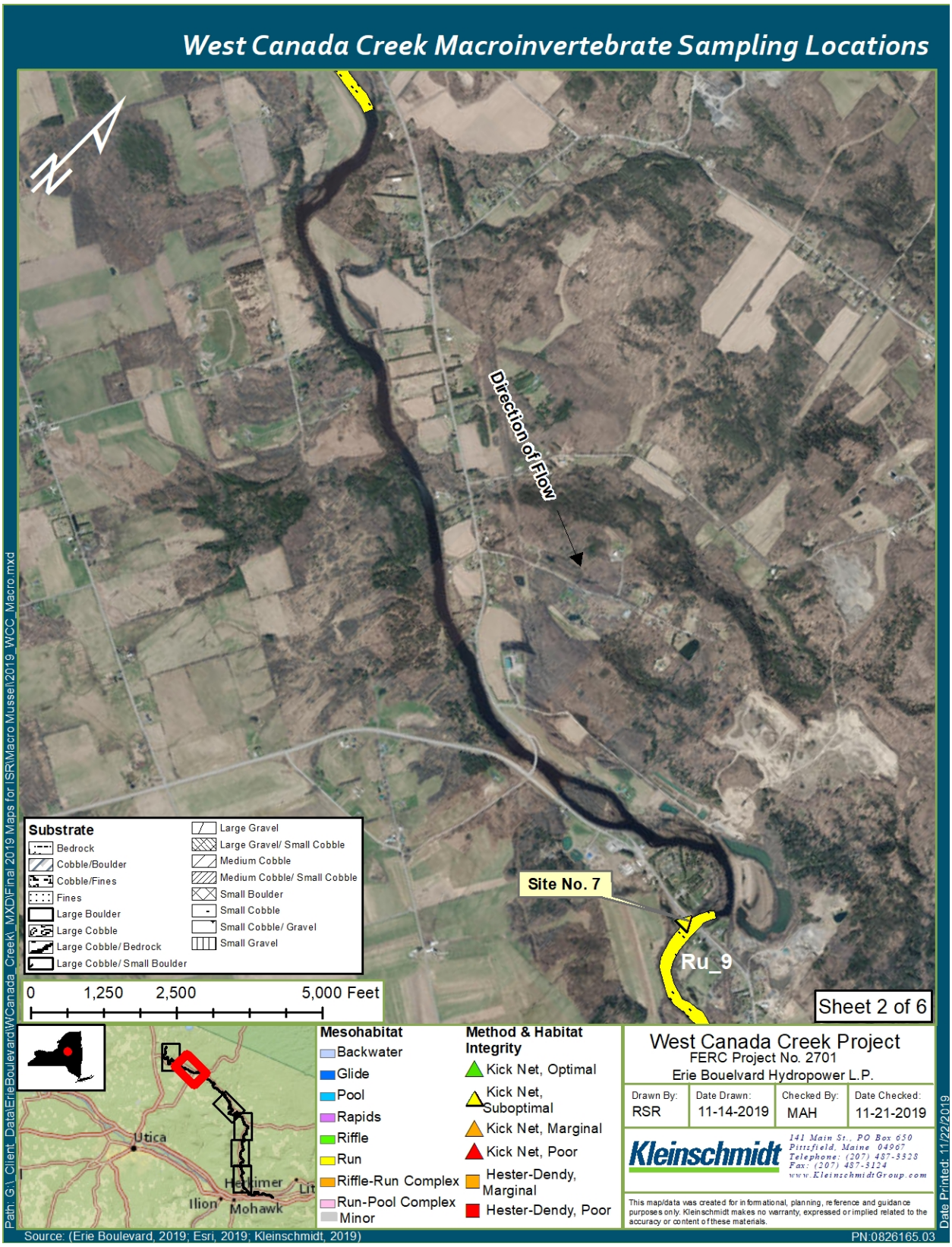
West Canada Creek Macroinvertebrate Sampling Locations
Direction of Flow
Site No. 7
Ru_9
Sheet 2 of 6
Substrate
Bedrock
Cobble/Boulder
Cobble/Fines
Fines
Large Boulder
Large Cobble
Large Cobble/ Bedrock
Large Cobble/ Small Boulder
Large Gravel
Large Gravel/ Small Cobble
Medium Cobble
Medium Cobble/ Small Cobble
Small Boulder
Small Cobble
Small Cobble/ Gravel
Small Gravel
0 1,250 2,500 5,000 Feet
Utica
Ilion
Mohawk
Mesohabitat
Backwater
Glide
Pool
Rapids
Riffle
Run
Riffle-Run Complex
Run-Pool Complex
Minor
Method & Habitat Integrity
Kick Net, Optimal
Kick Net, Suboptimal
Kick Net, Marginal
Kick Net, Poor
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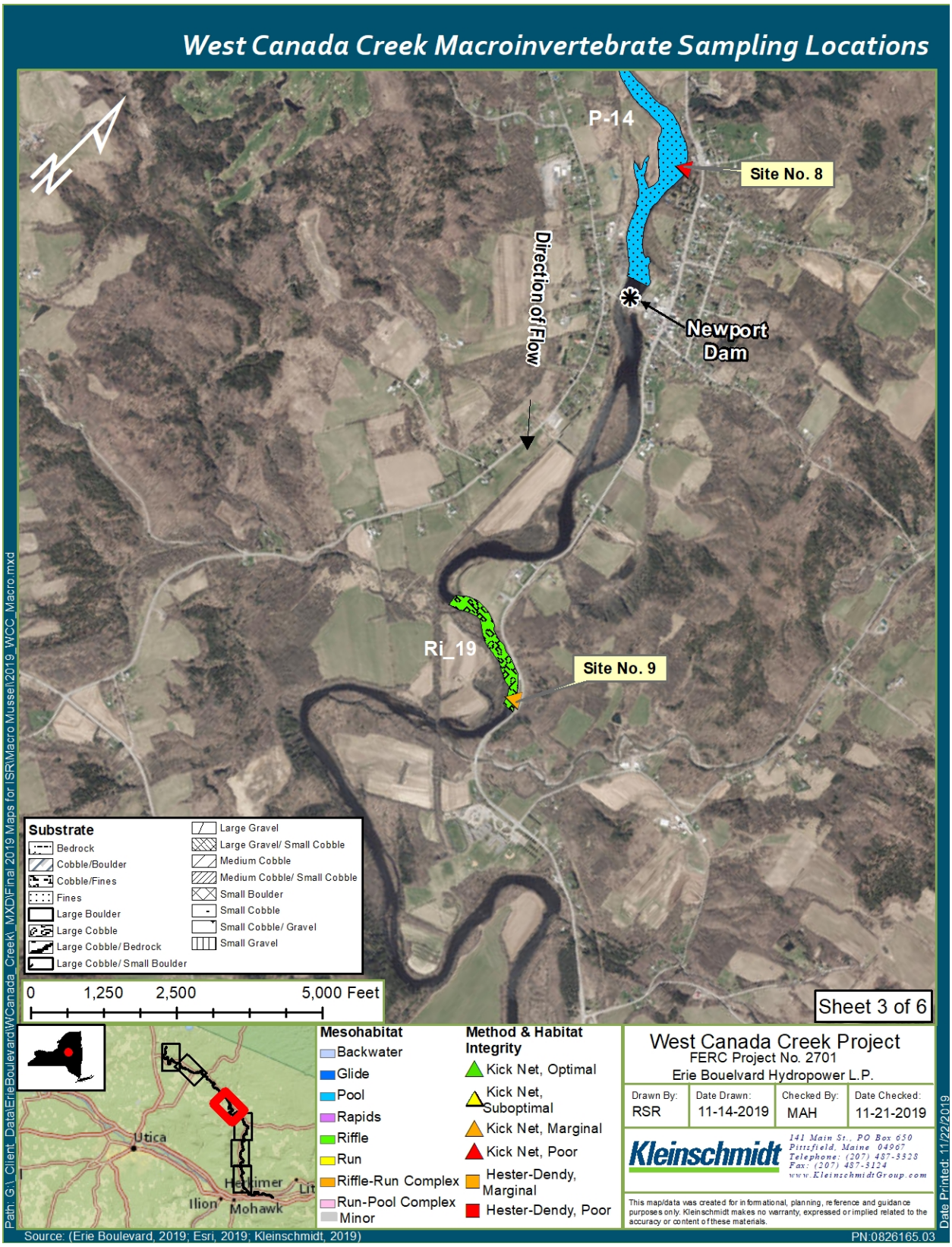
West Canada Creek Macroinvertebrate Sampling Locations
P-14
Site No. 8
Direction of Flow
Newport Dam
Ri_19
Site No. 9
Substrate
Bedrock
Cobble/Boulder
Cobble/Fines
Fines
Large Boulder
Large Cobble
Large Cobble/ Bedrock
Large Cobble/ Small Boulder
Large Gravel
Large Gravel/ Small Cobble
Medium Cobble
Medium Cobble/ Small Cobble
Small Boulder
Small Cobble
Small Cobble/ Gravel
Small Gravel
0 1,250 2,500 5,000 Feet
Sheet 3 of 6
Utica
Herkimer
Ilion
Mohawk
Mesohabitat
Backwater
Glide
Pool
Rapids
Riffle
Run
Riffle-Run Complex
Run-Pool Complex
Minor
Method & Habitat Integrity
Kick Net, Optimal
Kick Net, Suboptimal
Kick Net, Marginal
Kick Net, Poor
Hester-Dendy, Marginal
Hester-Dendy, Poor
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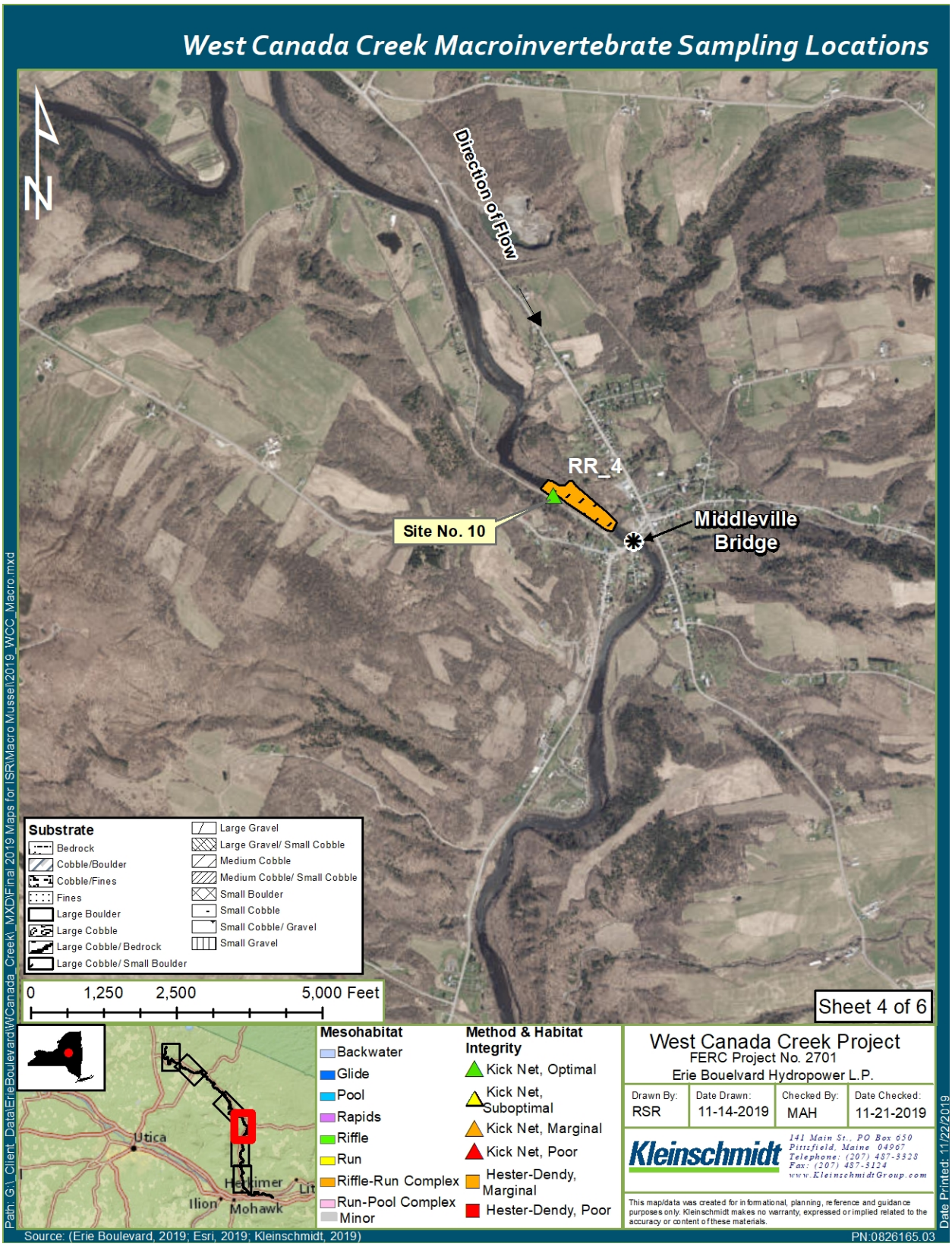
West Canada Creek Macroinvertebrate Sampling Locations
N
Direction of Flow
RR_4
Site No. 10
Middleville Bridge
Substrate
Bedrock
Cobble/Boulder
Cobble/Fines
Fines
Large Boulder
Large Cobble
Large Cobble/ Bedrock
Large Cobble/ Small Boulder
Large Gravel
Large Gravel/ Small Cobble
Medium Cobble
Medium Cobble/ Small Cobble
Small Boulder
Small Cobble
Small Cobble/ Gravel
Small Gravel
0 1,250 2,500 5,000 Feet
Sheet 4 of 6
Utica
Herkimer
Ilion
Mohawk
Mesohabitat
Backwater
Glide
Pool
Rapids
Riffle
Run
Riffle-Run Complex
Run-Pool Complex
Minor
Method & Habitat Integrity
Kick Net, Optimal
Kick Net, Suboptimal
Kick Net, Marginal
Kick Net, Poor
Hester-Dendy, Marginal
Hester-Dendy, Poor
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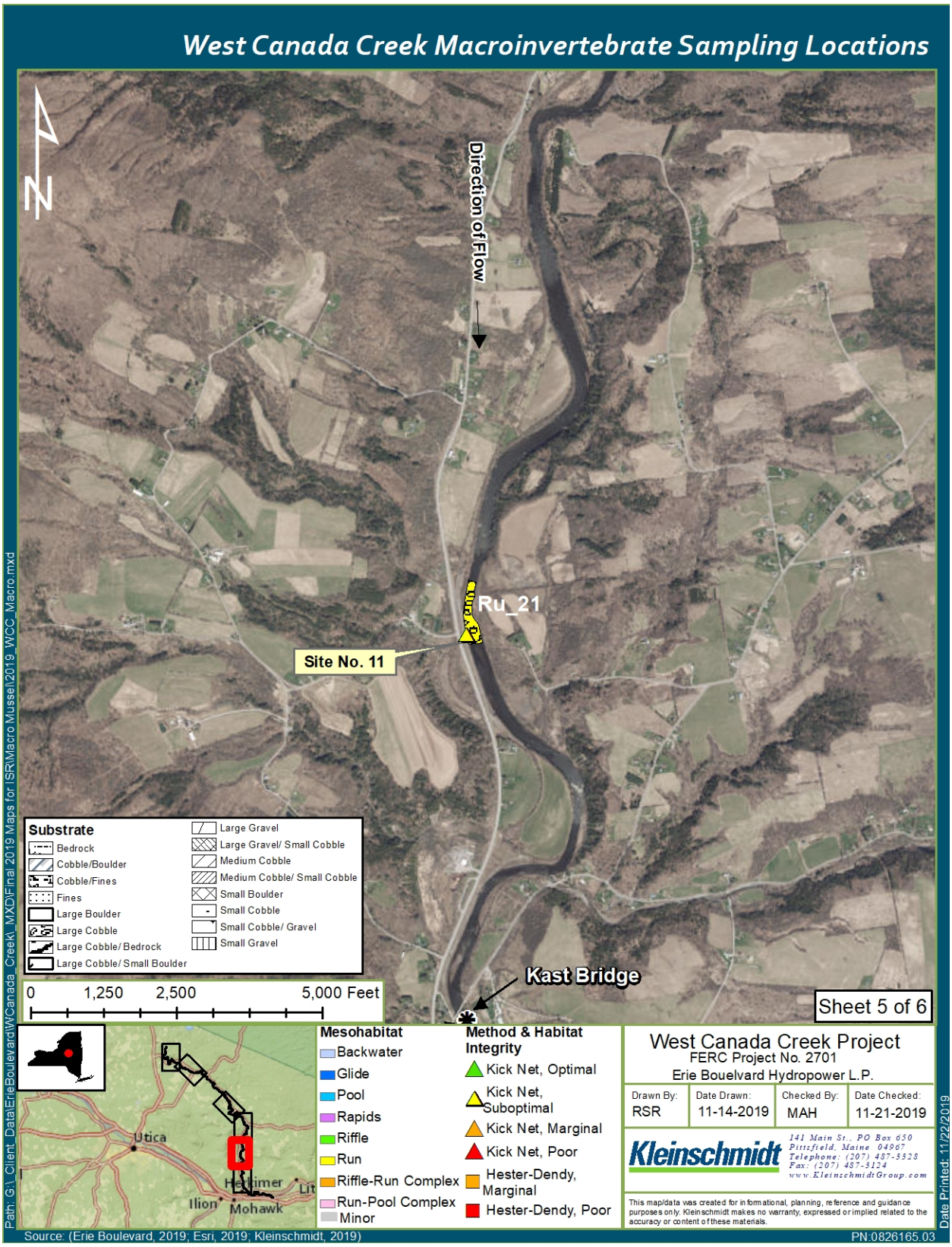
West Canada Creek Macroinvertebrate Sampling Locations
N
Direction of Flow
Ru_21
Site No. 11
Kast Bridge
Sheet 5 of 6
Substrate
Bedrock
Cobble/Boulder
Cobble/Fines
Fines
Large Boulder
Large Cobble
Large Cobble/ Bedrock
Large Cobble/ Small Boulder
Large Gravel
Large Gravel/ Small Cobble
Medium Cobble
Medium Cobble/ Small Cobble
Small Boulder
Small Cobble
Small Cobble/ Gravel
Small Gravel
0 1,250 2,500 5,000 Feet
Utica
Herkimer
Ilion
Mohawk
Mesohabitat
Backwater
Glide
Pool
Rapids
Riffle
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Riffle-Run Complex
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Method & Habitat Integrity
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Kick Net, Marginal
Kick Net, Poor
Hester-Dendy, Marginal
Hester-Dendy, Poor
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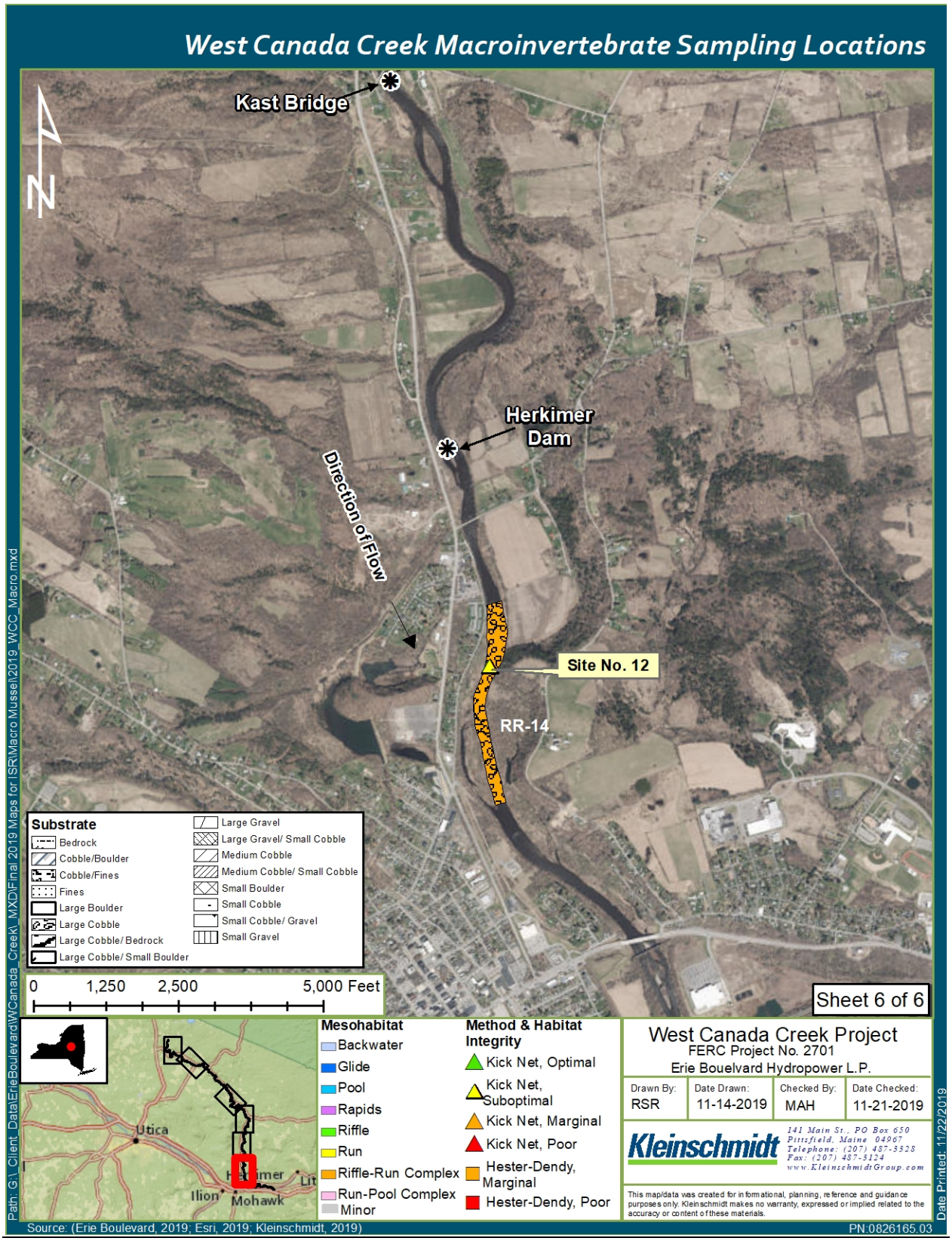
West Canada Creek Macroinvertebrate Sampling Locations
Kast Bridge
Herkimer Dam
Direction of Flow
Site No. 12
RR-14
N
Substrate
Bedrock
Cobble/Boulder
Cobble/Fines
Fines
Large Boulder
Large Cobble
Large Cobble/ Bedrock
Large Cobble/ Small Boulder
Large Gravel
Large Gravel/ Small Cobble
Medium Cobble
Medium Cobble/ Small Cobble
Small Boulder
Small Cobble
Small Cobble/ Gravel
Small Gravel
0 1,250 2,500 5,000 Feet
Sheet 6 of 6
Utica
Ilion
Mohawk
Mesohabitat
Backwater
Glide
Pool
Rapids
Riffle
Run
Riffle-Run Complex
Run-Pool Complex
Minor
Method & Habitat Integrity
Kick Net, Optimal
Kick Net, Suboptimal
Kick Net, Marginal
Kick Net, Poor
Hester-Dendy, Marginal
Hester-Dendy, Poor
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APPENDIX B

IDENTIFIED MACROINVERTEBRATE FAMILIES AT SAMPLING SITES

TABLE 1. LIST OF IDENTIFIED MACROINVERTEBRATE FAMILIES AT SAMPLE SITE 1, THE UPPER PROSPECT BYPASS.

Insects	Count
Ephemeroptera	
Oligoneuriidae	68
Baetidae	16
Ephemerellidae	8
Heptageniidae	34
Siphlonuridae	179
Plecoptera	
Perlidae	5
Trichoptera	
Hydropsychidae	142
Hydroptilidae	2
Philopotamidae (Chimarra sp.)	32
Rhyacophilidae (Rhyacophila sp.)	1
Coleoptera	
Elmidae	5
Psephenidae (Psephenus sp.)	18
Hemiptera	
Veliidae	1
Megaloptera	
Corydalidae	1
Diptera	
Chironomidae	53
Simuliidae	7
Tabanidae	2
Tipulidae	5
Non-Insects	
Crustacea	
Asellidae	1
Cambaridae	1
Gastropoda	
Ancylidae	1
Total	**582**

TABLE 2. LIST OF IDENTIFIED MACROINVERTEBRATE FAMILIES AT SAMPLE SITE 2, THE LOWER PROSPECT BYPASS

Insects	Count
Ephemeroptera	
Caenidae	1
Heptageniidae	1
Trichoptera	
Leptoceridae	1
Polycentropodidae	2
Coleoptera	
Elmidae	1
Non-Insects	
Crustacea	
Asellidae	1
Annelida	
Nemertea (Prostoma graecense)	2
Oligochaeta	3
Total	**12**

TABLE 3. LIST OF IDENTIFIED MACROINVERTEBRATE FAMILIES AT SAMPLE SITE 3, THE UPPER TRENTON BYPASS (1)

Insects	Count
Ephemeroptera	
Heptageniidae	8
Total	**8**

TABLE 4. LIST OF IDENTIFIED MACROINVERTEBRATE FAMILIES AT SAMPLE SITE 5.

Insects	Count
Ephemeroptera	
Caenidae	1
Heptageniidae	17
Leptohyphidae	1
Trichoptera	
Hydropsychidae	1
Polycentropodidae	6
Coleoptera	
Dytiscidae	1
Elmidae	1

Insects	Count
Psephenidae (Psephenus sp.)	3
Diptera	
Chironomidae	2
Non-Insects	
Crustacea	
Cambaridae	2
Annelida	
Nemertea (Prostoma graecense)	3
Nematomorpha	2
Oligochaeta	1
Bivalvia	
Sphaeriidae	2
Gastropoda	
Ancylidae	9
Total	**52**

TABLE 5. LIST OF IDENTIFIED MACROINVERTEBRATE FAMILIES AT SAMPLE SITE 6.

Insects	Count
Coleoptera	
Elmidae	4
Psephenidae (Psephenus sp.)	1
Non-Insects	
Crustacea	
Asellidae	1
Annelida	
Oligochaeta	3
Gastropoda	
Ancylidae	1
Total	**10**

TABLE 6. LIST OF IDENTIFIED MACROINVERTEBRATE FAMILIES AT SAMPLE SITE 7.

Insects	Count
Ephemeroptera	
Oligoneuriidae	12
Baetidae	1
Ephemerellidae	9
Heptageniidae	34

Insects	Count
Plecoptera	
Perlidae	1
Trichoptera	
Hydropsychidae	2
Leptoceridae	1
Coleoptera	
Elmidae	15
Psephenidae (Psephenus sp.)	2
Diptera	
Chironomidae	17
Empididae	1
Tipulidae	2
Non-Insects	
Annelida	
Nemertea (Prostoma graecense)	3
Oligochaeta	1
Gastropoda	
Ancylidae	4
Total	**105**

TABLE 7. LIST OF IDENTIFIED MACROINVERTEBRATE FAMILIES AT SAMPLE SITE 8.

Insects	Count
Ephemeroptera	
Baetidae	2
Polymitarcyidae	4
Diptera	
Chironomidae	1
Non-Insects	
Annelida	
Oligochaeta	6
Total	**13**

TABLE 8. LIST OF IDENTIFIED MACROINVERTEBRATE FAMILIES AT SAMPLE SITE 9.

Insects	Count
Ephemeroptera	
Oligoneuriidae	3
Baetidae	3
Heptageniidae	9
Trichoptera	
Hydropsychidae	3
Coleoptera	
Elmidae	6
Hydrophilidae	1
Psephenidae (Psephenus sp.)	5
Megaloptera	
Sialidae (Sialis sp.)	1
Diptera	
Chironomidae	18
Non-Insects	
Bivalvia	
Sphaeriidae	1
Gastropoda	
Ancylidae	1
Hydrobiidae	1
Planorbidae	1
Total	**53**

TABLE 9. LIST OF IDENTIFIED MACROINVERTEBRATE FAMILIES AT SAMPLE SITE 10.

Insects	Count
Ephemeroptera	
Oligoneuriidae	26
Baetidae	5
Ephemerellidae	26
Heptageniidae	70
Polymitarcyidae	4
Siphlonuridae	37
Plecoptera	
Perlodidae	1
Trichoptera	
Beraeidae	4
Helicopsychidae	37

Insects	Count
Leptoceridae	1
Limnephilidae	1
Philopotamidae (Chimarra sp.)	16
Psychomiidae	2
Rhyacophilidae (Rhyacophila sp.)	3
Coleoptera	
Elmidae	38
Psephenidae (Psephenus sp.)	19
Megaloptera	
Corydalidae	1
Diptera	
Chironomidae	52
Empididae	1
Non-Insects	
Annelida	
Oligochaeta	5
Gastropoda	
Ancylidae	17
Miscellaneous	
Hydrachnidae	1
Total	**367**

TABLE 10. LIST OF IDENTIFIED MACROINVERTEBRATE FAMILIES AT SAMPLE SITE 11.

Insects	Count
Ephemeroptera	
Oligoneuriidae	2
Baetidae	2
Ephemerellidae	2
Ephemeridae	1
Heptageniidae	21
Plecoptera	
Leuctridae	1
Perlidae	1
Trichoptera	
Hydropsychidae	5
Odontoceridae	1
Coleoptera	
Elmidae	1

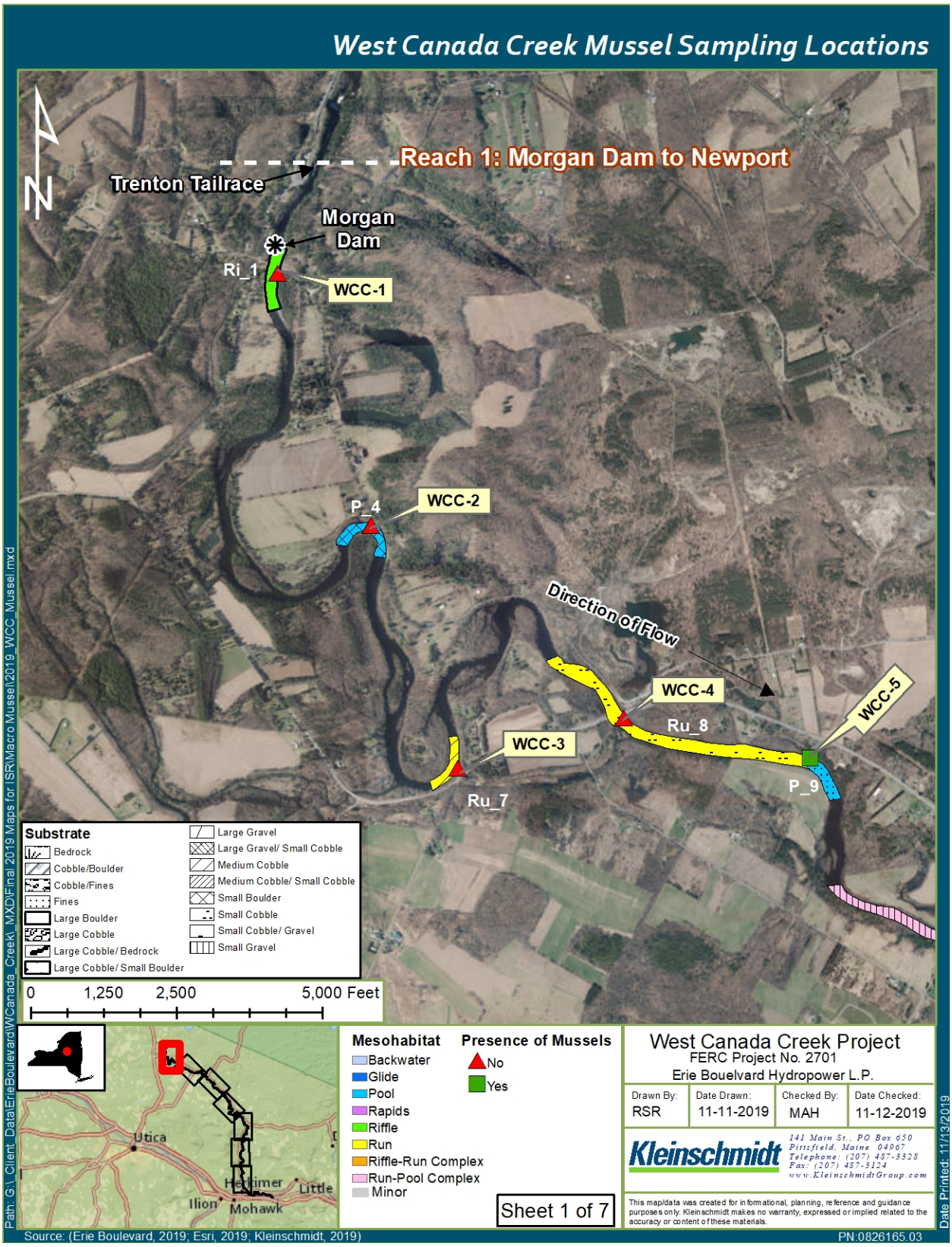
Insects	Count
Psephenidae (Psephenus sp.)	2
Diptera	
Chironomidae	19
Non-Insects	
Annelida	
Oligochaeta	2
Gastropoda	
Ancylidae	1
Total	**61**

TABLE 11. LIST OF IDENTIFIED MACROINVERTEBRATE FAMILIES AT SAMPLE SITE 12.

Insects	Count
Ephemeroptera	
Oligoneuriidae	21
Baetidae	46
Ephemerellidae	13
Heptageniidae	65
Siphlonuridae	95
Plecoptera	
Perlidae	2
Trichoptera	
Hydropsychidae	40
Lepidostomatidae	6
Philopotamidae (Chimarra sp.)	25
Coleoptera	
Elmidae	21
Psephenidae (Psephenus sp.)	3
Diptera	
Chironomidae	114
Non-Insects	
Annelida	
Oligochaeta	2
Miscellaneous	
Lepidoptera	3
Hydrachnidae	1
Total	**457**

APPENDIX C

MUSSEL SURVEY SAMPLING SITES LOCATIONS


West Canada Creek Mussel Sampling Locations
Reach 1: Morgan Dam to Newport
Trenton Tailrace
Morgan Dam
Ri_1
WCC-1
P_4
WCC-2
Direction of Flow
WCC-4
Ru_8
WCC-5
WCC-3
Ru_7
P_9
Substrate
Bedrock
Cobble/Boulder
Cobble/Fines
Fines
Large Boulder
Large Cobble
Large Cobble/ Bedrock
Large Cobble/ Small Boulder
Large Gravel
Large Gravel/ Small Cobble
Medium Cobble
Medium Cobble/ Small Cobble
Small Boulder
Small Cobble
Small Cobble/ Gravel
Small Gravel
0 1,250 2,500 5,000 Feet
Utica
Herkimer
Little
Ilion
Mohawk
Mesohabitat
Backwater
Glide
Pool
Rapids
Riffle
Run
Riffle-Run Complex
Run-Pool Complex
Minor
Presence of Mussels
No
Yes
Sheet 1 of 7
West Canada Creek Project
FERC Project No. 2701
Erie Bouelvard Hydropower L.P.
Drawn By: RSR
Date Drawn: 11-11-2019
Checked By: MAH
Date Checked: 11-12-2019
Kleinschmidt
141 Main St., PO Box 650
Pittsfield, Maine 04967
Telephone: (207) 487-3328
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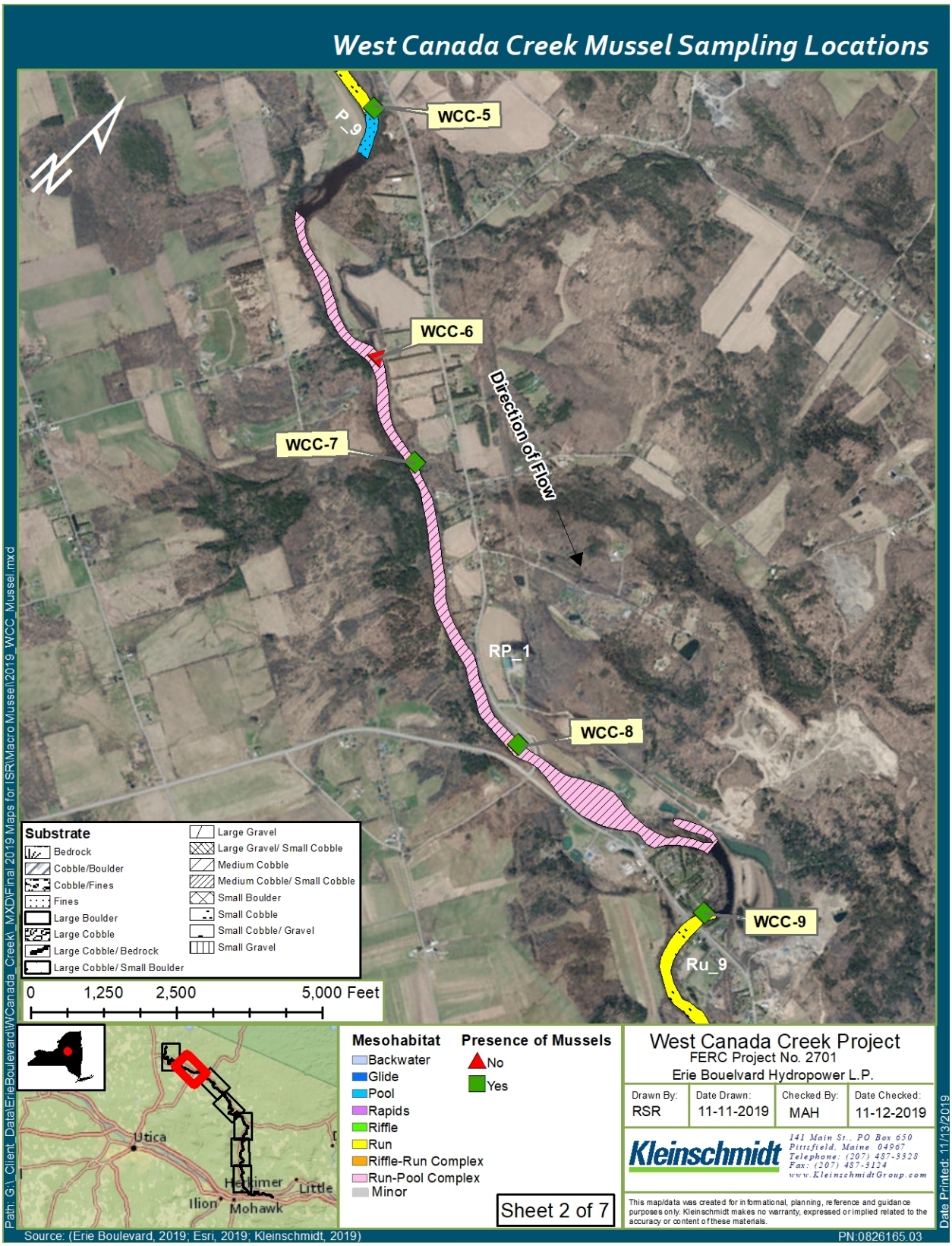
Date Printed: 11/13/2019
Source: (Erie Boulevard, 2019; Esri, 2019; Kleinschmidt, 2019)
PN:0826165.03


West Canada Creek Mussel Sampling Locations
WCC-5
P_9
WCC-6
WCC-7
Direction of Flow
RP_1
WCC-8
WCC-9
Ru_9
Substrate
Bedrock
Cobble/Boulder
Cobble/Fines
Fines
Large Boulder
Large Cobble
Large Cobble/ Bedrock
Large Cobble/ Small Boulder
Large Gravel
Large Gravel/ Small Cobble
Medium Cobble
Medium Cobble/ Small Cobble
Small Boulder
Small Cobble
Small Cobble/ Gravel
Small Gravel
0 1,250 2,500 5,000 Feet
Utica
Herkimer
Little
Ilion
Mohawk
Mesohabitat
Backwater
Glide
Pool
Rapids
Riffle
Run
Riffle-Run Complex
Run-Pool Complex
Minor
Presence of Mussels
No
Yes
Sheet 2 of 7
West Canada Creek Project
FERC Project No. 2701
Erie Bouelvard Hydropower L.P.
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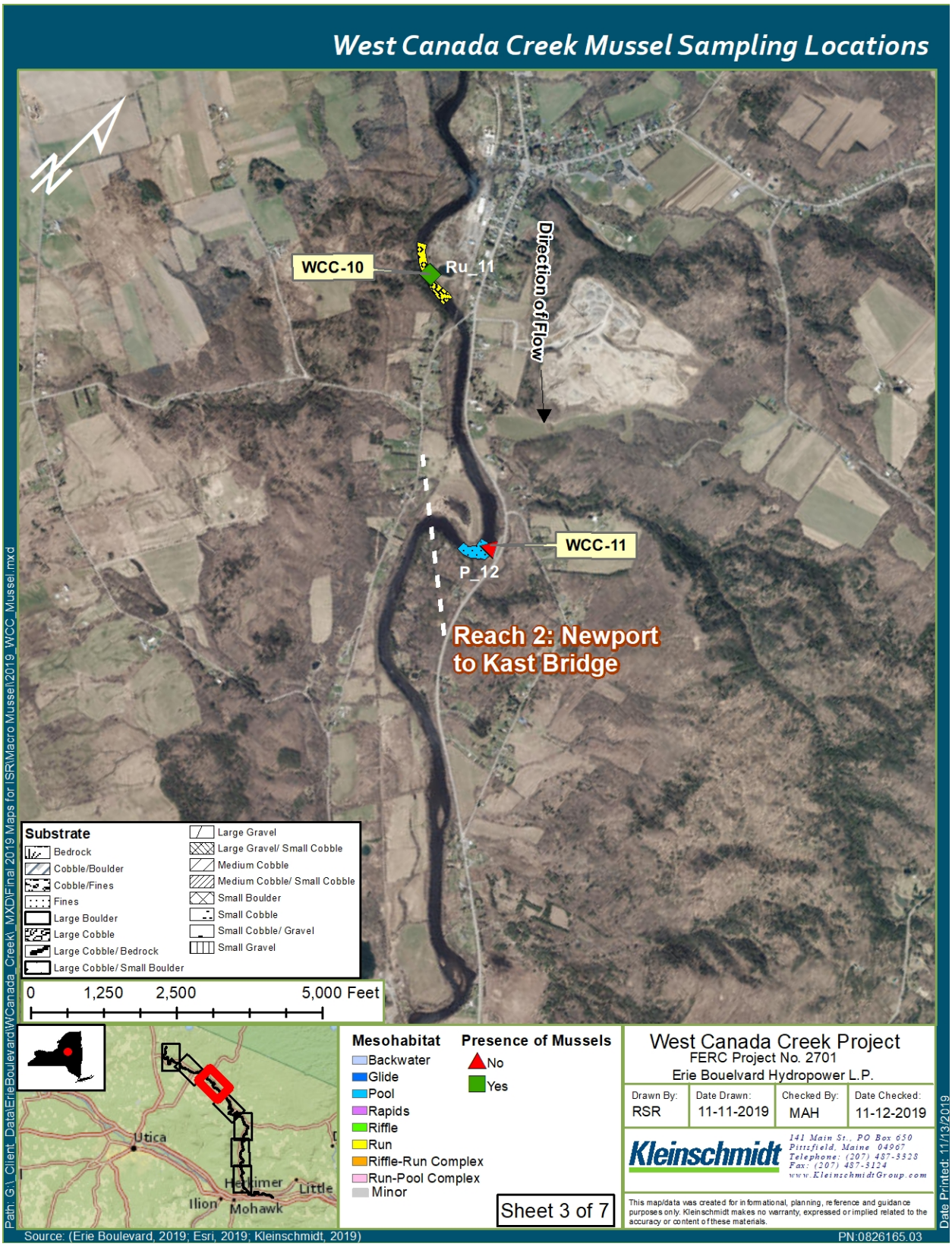
West Canada Creek Mussel Sampling Locations
WCC-10
Ru_11
Direction of Flow
WCC-11
P_12
Reach 2: Newport to Kast Bridge
Substrate
Bedrock
Cobble/Boulder
Cobble/Fines
Fines
Large Boulder
Large Cobble
Large Cobble/ Bedrock
Large Cobble/ Small Boulder
Large Gravel
Large Gravel/ Small Cobble
Medium Cobble
Medium Cobble/ Small Cobble
Small Boulder
Small Cobble
Small Cobble/ Gravel
Small Gravel
0 1,250 2,500 5,000 Feet
Utica
Herkimer
Little
Ilion
Mohawk
Mesohabitat
Backwater
Glide
Pool
Rapids
Riffle
Run
Riffle-Run Complex
Run-Pool Complex
Minor
Presence of Mussels
No
Yes
Sheet 3 of 7
West Canada Creek Project
FERC Project No. 2701
Erie Bouelvard Hydropower L.P.
Drawn By: RSR
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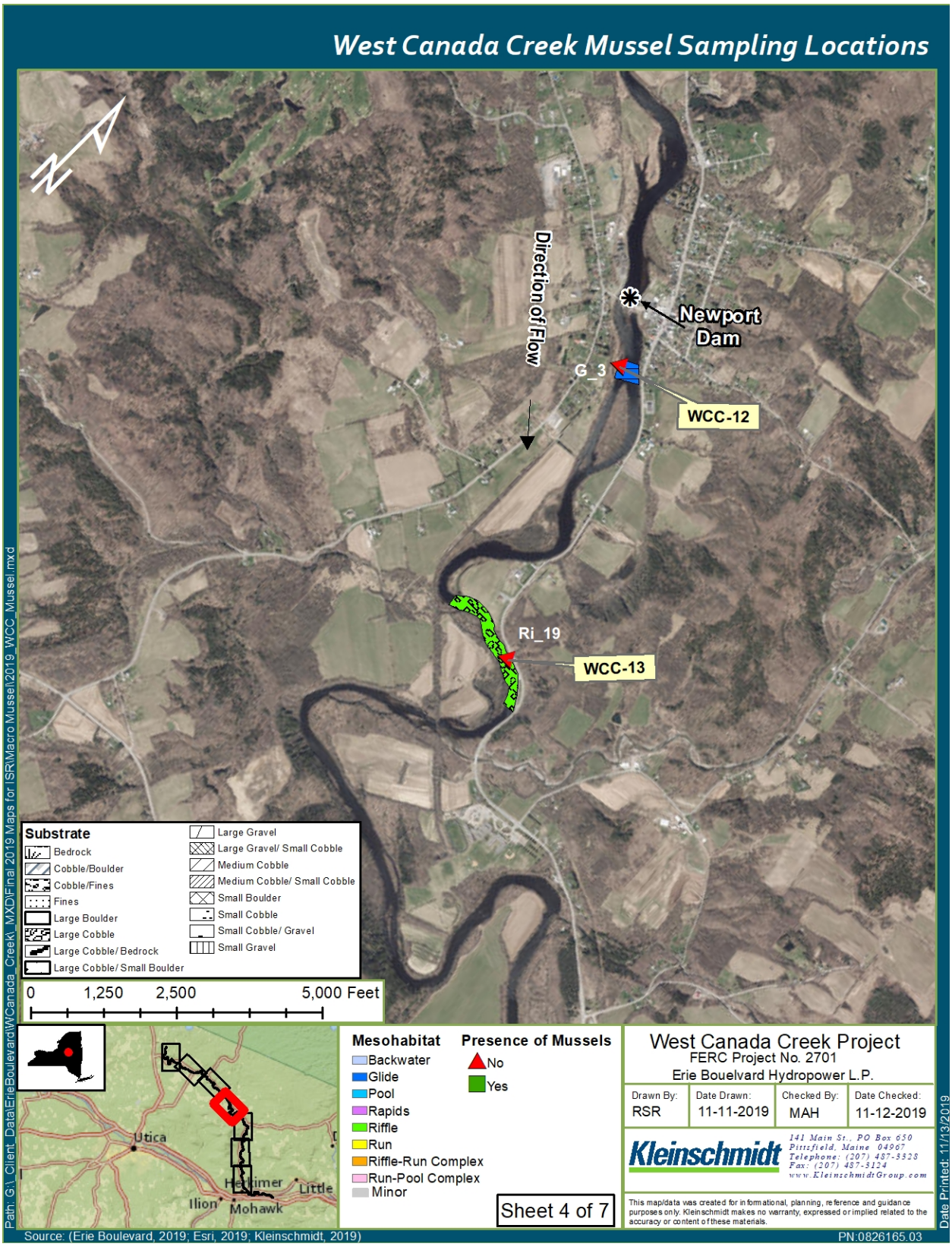
West Canada Creek Mussel Sampling Locations
Direction of Flow
Newport Dam
G_3
WCC-12
Ri_19
WCC-13
Substrate
Bedrock
Cobble/Boulder
Cobble/Fines
Fines
Large Boulder
Large Cobble
Large Cobble/ Bedrock
Large Cobble/ Small Boulder
Large Gravel
Large Gravel/ Small Cobble
Medium Cobble
Medium Cobble/ Small Cobble
Small Boulder
Small Cobble
Small Cobble/ Gravel
Small Gravel
0 1,250 2,500 5,000 Feet
Utica
Herkimer
Little
Ilion
Mohawk
Mesohabitat
Backwater
Glide
Pool
Rapids
Riffle
Run
Riffle-Run Complex
Run-Pool Complex
Minor
Presence of Mussels
No
Yes
Sheet 4 of 7
West Canada Creek Project
FERC Project No. 2701
Erie Bouelvard Hydropower L.P.
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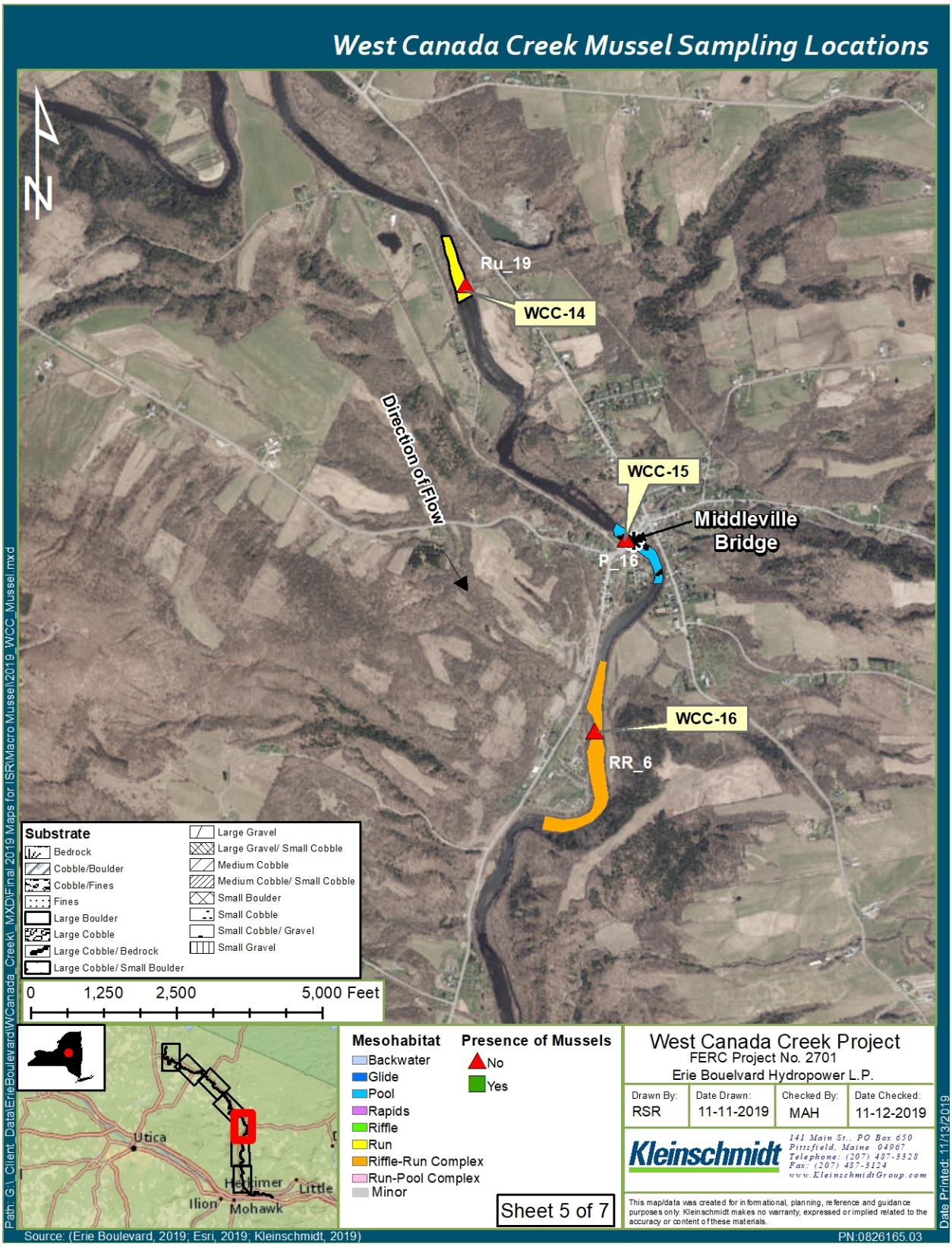
West Canada Creek Mussel Sampling Locations
N
Ru_19
WCC-14
Direction of Flow
WCC-15
Middleville Bridge
P_16
WCC-16
RR_6
Substrate
Bedrock
Cobble/Boulder
Cobble/Fines
Fines
Large Boulder
Large Cobble
Large Cobble/ Bedrock
Large Cobble/ Small Boulder
Large Gravel
Large Gravel/ Small Cobble
Medium Cobble
Medium Cobble/ Small Cobble
Small Boulder
Small Cobble
Small Cobble/ Gravel
Small Gravel
0 1,250 2,500 5,000 Feet
Utica
Herkimer
Little
Ilion
Mohawk
Mesohabitat
Backwater
Glide
Pool
Rapids
Riffle
Run
Riffle-Run Complex
Run-Pool Complex
Minor
Presence of Mussels
No
Yes
Sheet 5 of 7
West Canada Creek Project
FERC Project No. 2701
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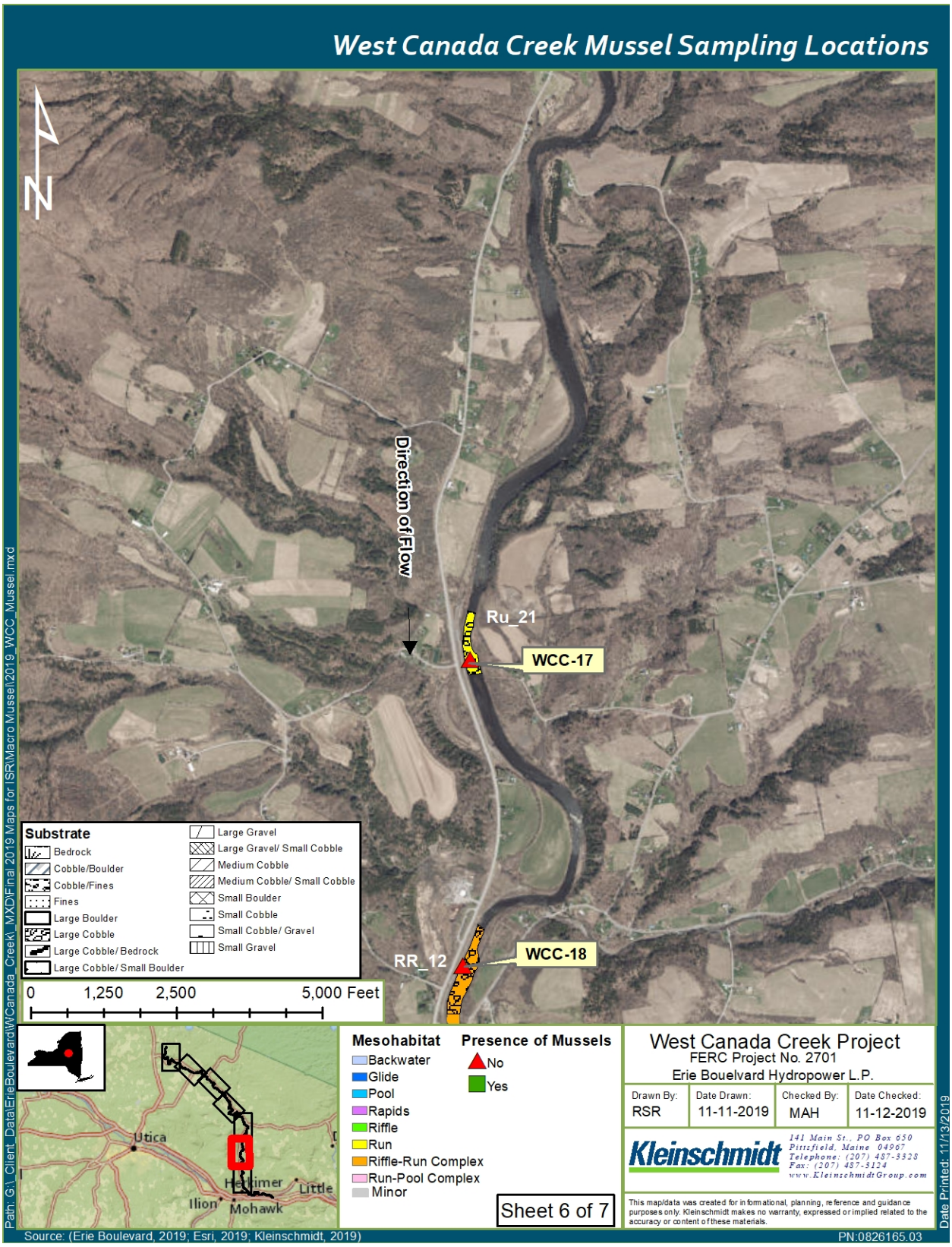
West Canada Creek Mussel Sampling Locations
N
Direction of Flow
Ru_21
WCC-17
RR_12
WCC-18
Substrate
Bedrock
Cobble/Boulder
Cobble/Fines
Fines
Large Boulder
Large Cobble
Large Cobble/ Bedrock
Large Cobble/ Small Boulder
Large Gravel
Large Gravel/ Small Cobble
Medium Cobble
Medium Cobble/ Small Cobble
Small Boulder
Small Cobble
Small Cobble/ Gravel
Small Gravel
0 1,250 2,500 5,000 Feet
Utica
Herkimer
Little
Ilion
Mohawk
Mesohabitat
Backwater
Glide
Pool
Rapids
Riffle
Run
Riffle-Run Complex
Run-Pool Complex
Minor
Presence of Mussels
No
Yes
Sheet 6 of 7
West Canada Creek Project
FERC Project No. 2701
Erie Bouelvard Hydropower L.P.
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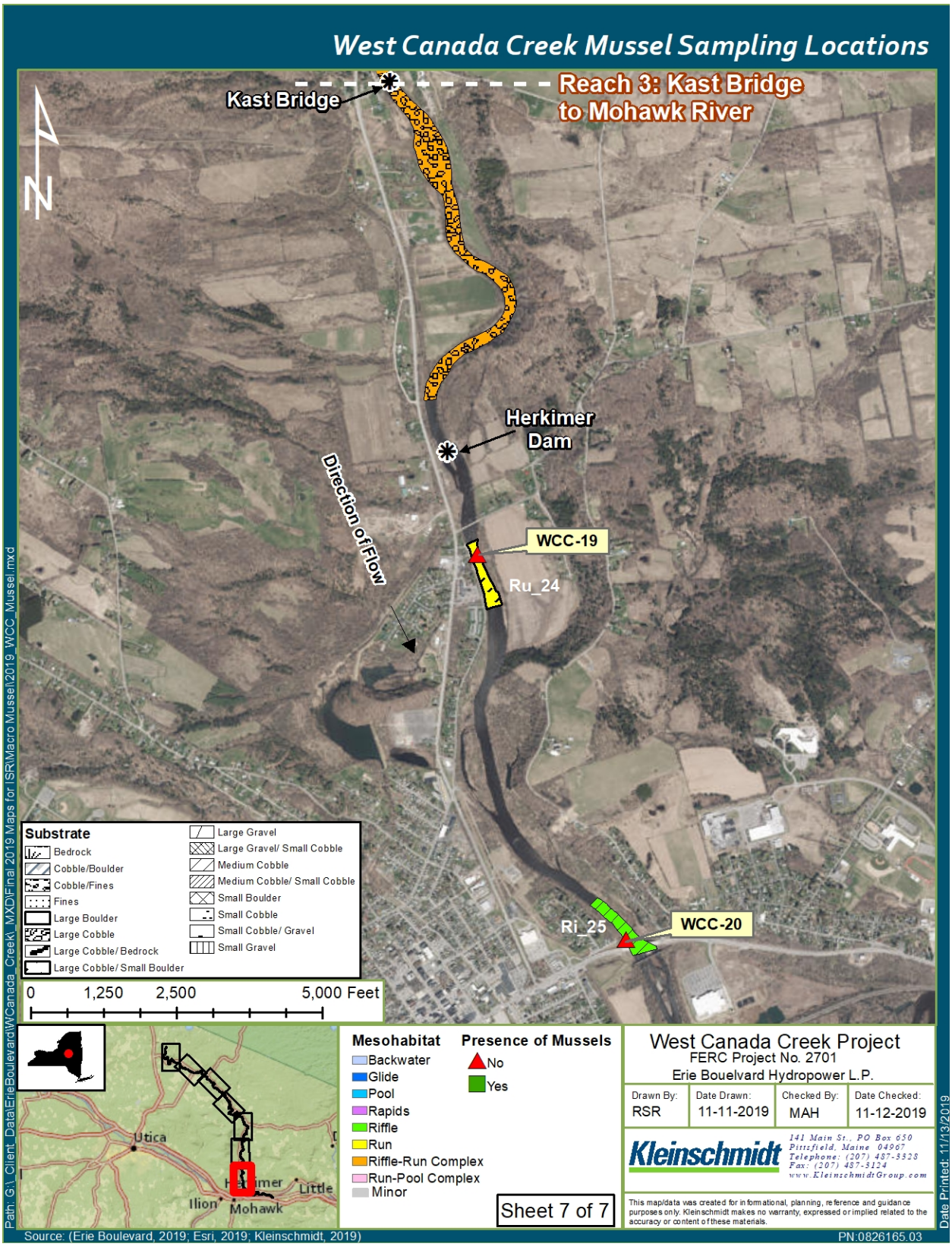
West Canada Creek Mussel Sampling Locations
Reach 3: Kast Bridge to Mohawk River
Kast Bridge
Herkimer Dam
Direction of Flow
WCC-19
Ru_24
Ri_25
WCC-20
N
Substrate
Bedrock
Cobble/Boulder
Cobble/Fines
Fines
Large Boulder
Large Cobble
Large Cobble/ Bedrock
Large Cobble/ Small Boulder
Large Gravel
Large Gravel/ Small Cobble
Medium Cobble
Medium Cobble/ Small Cobble
Small Boulder
Small Cobble
Small Cobble/ Gravel
Small Gravel
0 1,250 2,500 5,000 Feet
Utica
Little
Ilion
Mohawk
Mesohabitat
Backwater
Glide
Pool
Rapids
Riffle
Run
Riffle-Run Complex
Run-Pool Complex
Minor
Presence of Mussels
No
Yes
Sheet 7 of 7
West Canada Creek Project
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APPENDIX D

MUSSEL SURVEY SAMPLING DATA

Survey Cell	Date	Mussels Present	Species	Count	Substrate	Depth (ft)	Secci (ft)	Start	End	Duration	Notes
P-1	9/18/2019	Y	*Pyganodon lacustris*	6	muck/fine sand	7	7	9:50	10:40	0:50	Impoundment
P-2	9/17/2019	Y	*Pyganodon lacustris*	116	muck	7.0-8.0	8	16:30	17:20	0:50	Impoundment
P-3	9/17/2019	Y	*Pyganodon lacustris*	80	muck	7.0-9.0	8	14:20	15:10	0:50	Impoundment
P-4	9/17/2019	Y	*Pyganodon lacustris*	50	muck/gravel/sand	8.0-20.0	8	15:25	16:15	0:50	Impoundment
P-5	9/17/2019	Y	*Pyganodon lacustris*	23	muck/clay/sand	8.0-13.0	8	13:15	14:05	0:50	Impoundment
P-6	9/17/2019	Y	*Pyganodon lacustris*	25	rip-rap/muck	7.0-16.0	8	11:10	12:00	0:50	Impoundment
P-7	9/17/2019	Y	*Pyganodon lacustris*	109	muck/sand	8.0-20.0	7.5	10:10	11:00	0:50	Impoundment
P-8	9/16/2019	Y	*Pyganodon lacustris*	48	muck and tree roots	7.5-8.5	8	16:00	16:50	0:50	Impoundment
P-9	9/17/2019	Y	*Pyganodon lacustris*	85	muck/cobble/sand/gravel	6.0-13.0	7	8:50	9:40	0:50	Impoundment
P-10	9/16/2019	Y	*Pyganodon lacustris*	56	muck on gravel	8.5-9.5	8	14:20	15:10	0:50	Impoundment
BP-1	9/18/2019	N			cobble/gravel	0.5-7.0	20	11:40	12:00	0:20	run/pool
BP-2	9/18/2019	N			ledge/cobble/gravel	0.5-4.0	20	12:35	12:55	0:20	run/pool
WCC-1	9/19/2019	N			cobble/boulder/gravel	0.0-3.5	NA	13:45	14:05	0:20	side pool/run
WCC-2	9/19/2019	N			cobble/gravel	0.0-3.5	NA	9:50	10:17	0:27	run/pool
WCC-3	9/19/2019	N			cobble/gravel/sand	0.5-4.5	NA	11:56	12:16	0:20	run/back eddy
WCC-4	9/19/2019	N			gravel/cobble	0.0-3.0	NA	10:55	11:15	0:20	run/pool
WCC-5	9/25/2019	Y	*Elliptio complanata* -outside cell		sand/gravel/cobble	1.0-2.5	NA	10:30	10:55	0:25	run/pool, mussel was outside cell
WCC-6	9/20/2019	N			cobble/gravel/silt	1.5-2.5	NA	9:15	9:35	0:20	run/pool, excellent mussel habitat
WCC-7	9/25/2019	Y	*Margaratifera margaratifera*	2	gravel/sand/cobble	1.0-2.5	NA	11:25	12:15	0:50	run/pool, 1 Elliptio outside cell
WCC-8	9/18/2019	Y	*Margaratifera margaratifera*	1	cobble/gravel/sand	0.0-2.0	NA	15:00	15:50	0:50	run/pool, Elliptio shell present
WCC-9	9/18/2019	Y	*Margaratifera margaratifera*	1	sand/gravel/cobble	1.0-2.5	NA	16:35	17:25	0:50	Run, 2 other *margaratifera* outside cell
WCC-10	9/23/2019	Y	*Margaratifera margaratifera*	1	gravel/sand/cobble	1.0-2.5	NA	13:50	14:40	0:50	run/pool, Elliptio shell present
WCC-11	9/23/2019	N			sand/gravel	1.5-3.5	NA	15:22	15:45	0:23	run/back eddy
WCC-12	9/24/2019	N			sand/gravel	1.5-2.5	NA	10:04	10:25	0:21	run/pool
WCC-13	9/23/2019	N			gravel/sand/cobble	1.5-2.5	NA	16:34	16:55	0:21	run/back eddy
WCC-14	9/20/2019	N			cobble/gravel	1.5-3.5	NA	12:00	12:20	0:20	run/pool
WCC-15	9/20/2019	N			cobble/fine sand/gravel	0.0-3.5	NA	11:20	11:40	0:20	run/back eddy
WCC-16	9/24/2019	N			sand/cobble/boulder/gravel	0.5-3.0	NA	11:33	11:55	0:22	run/back eddy

Survey Cell	Date	Mussels Present	Species	Count	Substrate	Depth (ft)	Secci (ft)	Start	End	Duration	Notes
WCC-17	9/19/2019	N			sand/gravel/cobble	2.0-3.5	NA	15:35	16:05	0:30	run
WCC-18	9/24/2019	N			cobble/sand/silt	1.0-2.0	NA	13:39	14:01	0:22	run/pool
WCC-19	9/25/2019	N			sand/silt/cobble	0.5-3.5	NA	13:10	13:30	0:20	run/pool
WCC-20	9/24/2019	N			cobble/sand/silt	1.0-3.0	NA	15:20	15:42	0:22	run/pool

APPENDIX E

REPRESENTATIVE PHOTOS OF SAMPLING LOCATIONS AND METHODOLOGY

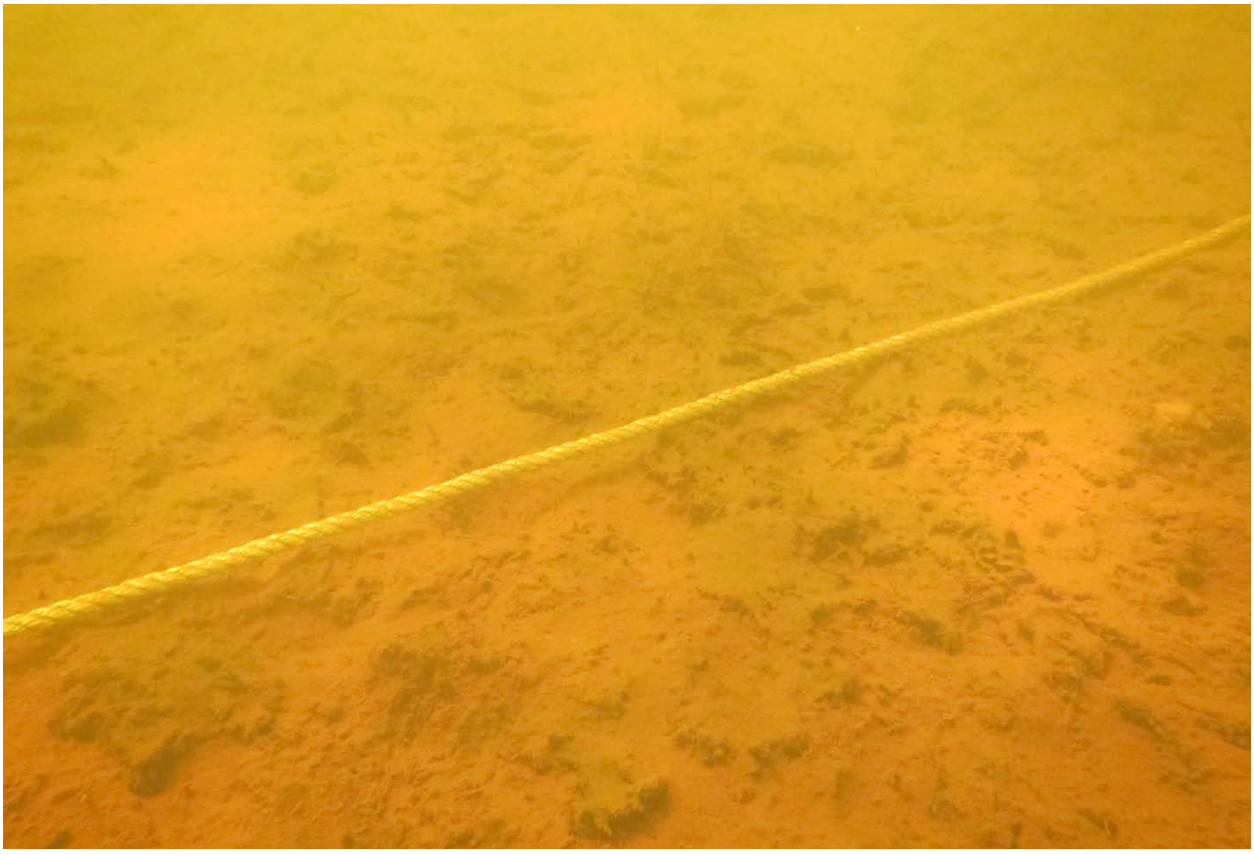
Prospect Impoundment

Survey Cell P-1. Cell P-1 in foreground, P-2 in background.

Survey Cell P-1. Lake Floater (*Pyganodon lacustris*) observed in Cell P-1.

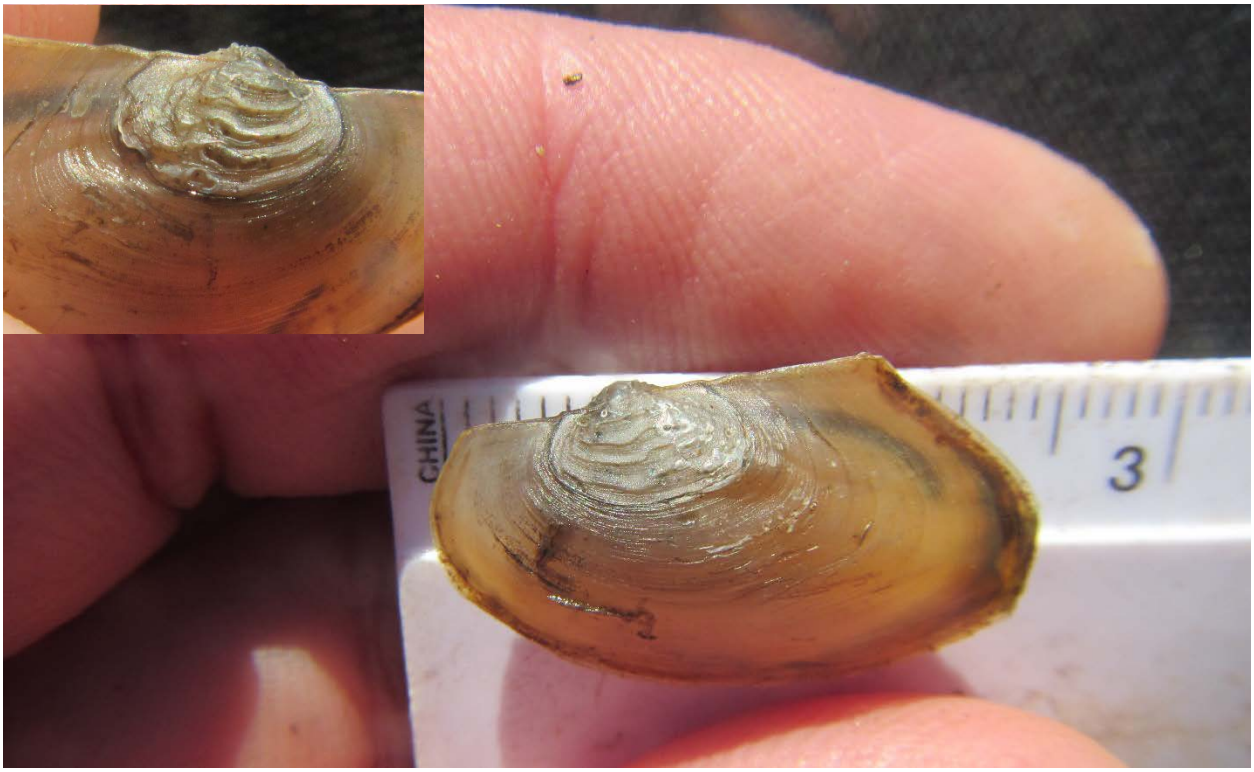
Survey Cell P-2. Lake floater observed in Cell P-2. Cell was located in the east end of Prospect Impoundment.

Survey Cell P-2. Juvenile lake floater observed in Cell P-2 with characteristic double-looped bars of beak sculpture.



Survey Cell P-3. Muck substrate observed at most sites within Prospect Impoundment.

Survey Cell P-3. Lake floater observed filtering within Cell P-3.



Survey Cell P-3. Juvenile lake floater with characteristic double-looped bars of beak sculpture.

Survey Cell P-4. No photo available

Survey Cell P-5. Lake floater observed in Cell P-5.

Survey Cell P-6. Cell P-6 was located along the southern shore of Prospect Impoundment.

Survey Cell P-6. Lake floater observed in Cell P-6.

Survey Cell P-7. Cell P-7 was located off the northern shore of Prospect Impoundment.

Survey Cell P-7. Lake floater observed at Cell P-7.

Survey Cell P-8. Cell P-8 was located along northern shore of Prospect Impoundment.

Survey Cell P-8. Lake floater found in Cell P-8, September 16, 2019.

Survey Cell P-9. Cell P-9 was located near the northern shore of Prospect Impoundment.

Survey Cell P-9. A portion of the lake floater observed at Cell P-9.

Survey Cell P-9. A close up of juvenile lake floater showing double-looped bars of beak sculpture.

Survey Cell P-10. Located at downstream end of Prospect Impoundment

Survey Cell P-10. Lake floater observed at site P-10

Survey Cell P-10. Close up of Juvenile and adult lake floater.

Prospect Bypass Reach

Survey Cell BP-1. Cell BP-1 was located in the upper bypass reach. No mussels were observed here.

Survey Cell BP-2. Cell BP-2 was located in the bypass reach. No mussels were observed here.

West Canada Creek

Survey Cell WCC-1. Course cobble/gravel substrate of WCC-1. No mussels were found in this cell.

Survey Cell WCC-1. Juvenile white sucker observed in WCC-1. No mussels were found in this cell.

Survey Cell WCC-2. Course cobble/gravel substrate was observed throughout the cell. No mussels were observed.

Survey Cell WCC-3. Back eddy and side pool of WCC-3. No mussels were found in this cell.

Survey Cell WCC-4. Cell WCC-4 was located just downstream of Rote 28 bridge.

Survey Cell WCC-4. Crayfish on gravel/cobble substrate of WCC-4. No mussels were found in this cell.

Survey Cell WCC-5. Substrate comprised primarily of sand and gravel, with some cobble.

Survey Cell WCC-5. Heavily worn eastern elliptio found approximately 10 feet upstream of WCC-5.

Survey Cell WCC-6. Substrate consisted primarily of fine sand, gravel and cobble; no mussels observed.

Survey Cell WCC-6. Example of area dominated by gravel substrate.

Survey Cell WCC-6. Example of area dominated by fine sand substrate.

Survey Cell WCC-7. Substrate comprised of gravel, sand, and cobble.

Survey Cell WCC-7. One of two live eastern pearlshells observed in WCC-7.

Survey Cell WCC-7. Second eastern pearlshell observed within Cell WCC-7.

Survey Cell WCC-7. Filtering eastern elliptio observed outside WCC-7.

Survey Cell WCC-7. Fantail darter observed in WCC-7.

Survey Cell WCC-8. Sand/gravel/cobble substrate observed throughout Cell WCC-8.

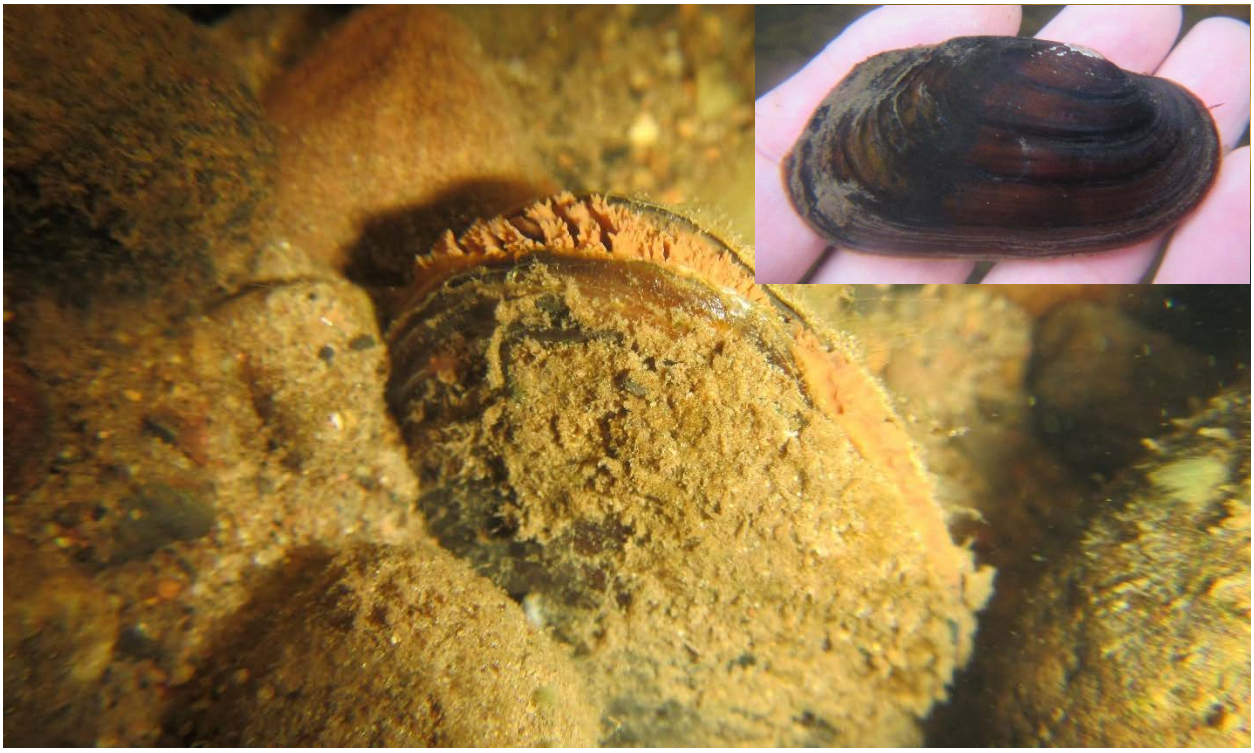
Survey Cell WCC-8. Single eastern pearlshell (*Margaritifera margaritifera*) observed in Cell WCC-8.

Survey Cell WCC-8. Shell of eastern elliptio (*Elliptio complanata*) found in WCC-8.

Survey Cell WCC-9. Cobble/sand/gravel/silt substrate of WCC-9.

Survey Cell WCC-9. Eastern pearlshell observed filtering in and around Cell WCC-9. One live mussel was found within the cell, while two individuals were found just downstream of the cell.

Survey Cell WCC-10. Substrate consisted primarily of gravel and sand, with some cobble.



Survey Cell WCC-10. Eastern pearlshell observed in Cell WCC-10 9/23/2019.

Survey Cell WCC-11. Substrate comprised primarily of sand, with some gravel. No mussels observed.

Survey Cell WCC-12. Substrate primarily sand and gravel. No mussels observed 9/24/2019.

Survey Cell WCC-12. Snail observed in sand substrate of WCC-12.

Survey Cell WCC-13. Substrate primarily gravel with some sand/cobble. No mussels observed.

Survey Cell WCC-13. Typical substrates observed in Cell WCC-13. No mussels were observed here.

Survey Cell WCC-14. Substrate consisted primarily of cobble and gravel; no mussels observed.

Survey Cell WCC-14. Substrate consisted primarily of cobble and gravel; no mussels observed.

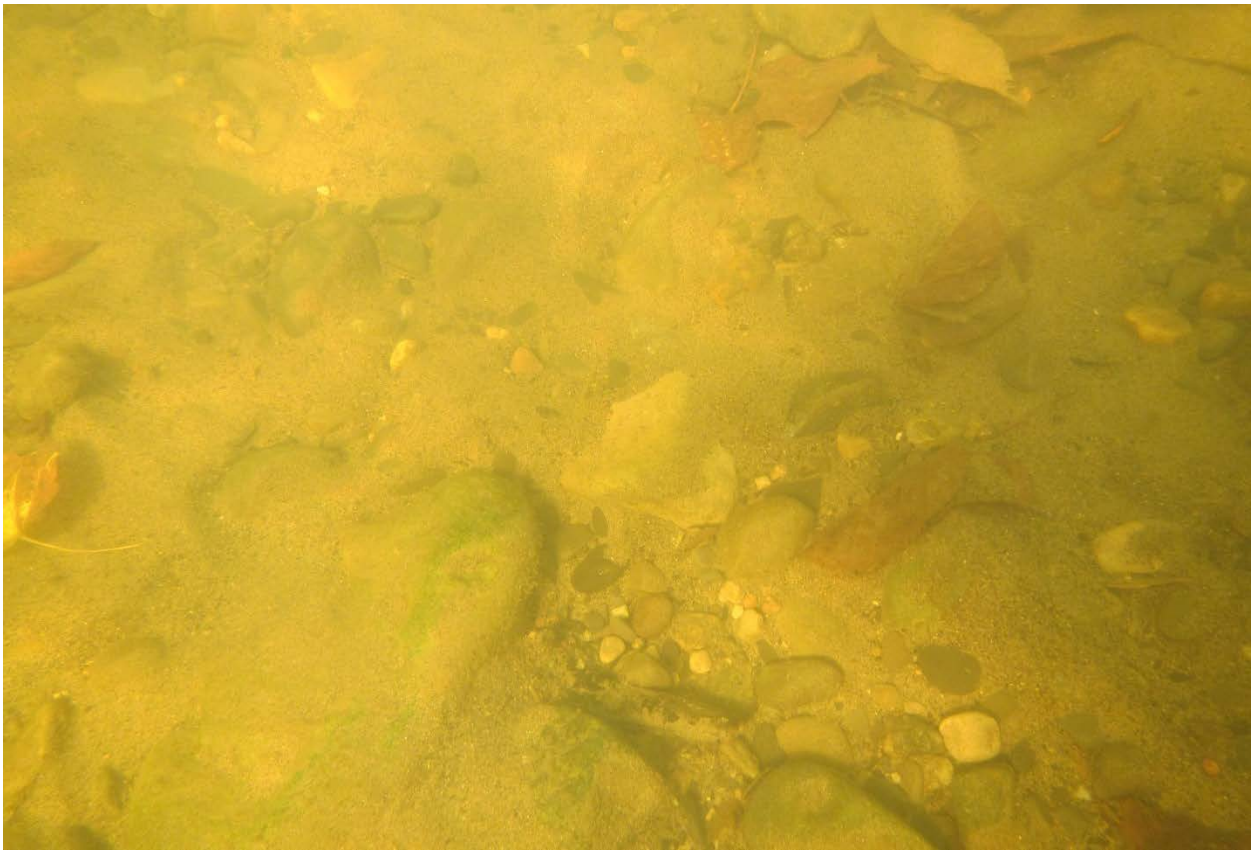
Survey Cell WCC-15. Substrate consisted primarily of cobble with fine sand and gravel; no mussels observed.

Survey Cell WCC-15. Substrate consisted primarily of cobble with fine sand and gravel; no mussels observed.

Survey Cell WCC-16. Substrate consisted primarily of unconsolidated sand, with some cobble, boulder, and gravel; no mussels observed.

Survey Cell WCC-16. Unconsolidated sand observed throughout much of WCC-16.

Survey Cell WCC-17. Substrate consisted of unconsolidated sand with gravel/cobble, no mussels observed.



Survey Cell WCC-17. Substrate consisted of unconsolidated sand with gravel/cobble, no mussels observed.

Survey Cell WCC-18. consisted primarily of cobble/gravel, some silt; no mussels observed.

Survey Cell WCC-18. Tessellated darter observed in WCC-18.

Survey Cell WCC-19. Substrate consisted primarily of sand and silt with some cobble; no mussels observed.

Survey Cell WCC-19. Sand/silt substrate of WCC-19.

Survey Cell WCC-20. Located approximately 140 feet upstream of Route 5 Bridge. No mussels observed.

Survey Cell WCC-20. Substrate consisted primarily of cobble and gravel; no mussels were observed.

Macroinvertebrate Survey – Representative Photos

Photo 1. Macroinvertebrate sample Site 1 in the upper Prospect bypass reach. Photo oriented upstream.

Photo 2. **Macroinvertebrate sample Site 2 in the lower Prospect bypass reach. Photo oriented downstream. Sampling targeted gravely and cobble areas occurring within the predominately bedrock reach.**

Photo 3. **Macroinvertebrate sample Site 2 in the lower Prospect bypass reach. Sample collected in an area of flowing water with cobble and gravel substrate.**

Photo 4. Hester-Dendy macroinvertebrate sample Site 3 downstream of Trenton Dam.

Photo 5. Hester-Dendy macroinvertebrate sample Site 4 in the lower Trenton bypass reach.

Photo 6. **Macroinvertebrate sample Site 5, downstream of Morgan Dam. Photo oriented upstream.**

Photo 7. **Macroinvertebrate sample Site 8, upstream of Newport impoundment. Sample taken at gravel/cobble bar in run habitat. Photo oriented upstream.**

Photo 8. Macroinvertebrate sample Site 10 upstream of Middleville Bridge.

Photo 9. Kaccent sample from Site 1, including a crayfish