Macroinvertebrate sampling and water chemistry in Ellen's Creek

Prepared for
Ellen's Creek Watershed Group
and
Watershed Ecology 462, University of Prince Edward Island

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Abstract:

This study provides baseline information on the water and habitat quality of Ellen's Creek, an urban stream that runs through the City of Charlottetown. Macroinvertebrate and surface water sampling was done at one site in the East Branch and one site in the West Branch of the stream. Macroinvertebrate sampling was carried out by taking one three-minute kick sample at each site. Invertebrates were identified to family level and the likelihood of organic pollution in the stream was assessed by calculating Hilsenhoff's family-level biotic index. The trophic relationships and habits of the invertebrates that were sampled were also considered in order to compare sampling sites. The sites were compared physically using the Pfankuck Habitat Quality index. Chemical characteristics were measured using a handheld YSI Model 556 Multiprobe System and by collecting surface water samples for analysis by the Province of P.E.I. analytical laboratory. Both sites showed similar site quality, based on Habitat Quality Index and Family Biotic Index scores which indicated that some organic pollution was likely and that the sampling sites were in "fair" health. The trophic relationships of the invertebrates reflected the difference in the upstream environments between the two sites, with the sample from the East Branch dominated by filter-feeding invertebrates commonly found downstream of ponds and the sample from the West Branch reflecting a more diverse rocky-stream community. However, the diversity of invertebrates at the two sites was found to be low when compared to healthy streams on P.E.I. Water chemistry analysis revealed that both sites were of fair quality except the eastern site had high conductivity as well as high concentrations of sodium and chloride, which was likely from road salt runoff from heavily used roads and parking lots upstream.

Introduction:

Ellen's Creek is an urban stream that runs through the City of Charlottetown. Urban streams face a number of challenges, such as increased precipitation runoff due to paved areas (Wang et al. 2001) and reduced vegetative cover (Moore and Palmer 2005). Prior to this study, no data had been collected on the water or habitat quality of Ellen's Creek. Collection of this data will allow comparison with future data and may promote further research, especially as urban development continues within the watershed.

One way that the health of a stream can be assessed is by looking at the organisms that live in the stream. This can be done by collecting benthic invertebrates, which are one of the most commonly selected groups of organisms for biomonitoring (Resh 2008). As some macroinvertebrates are more sensitive to pollution than others, a biotic index can be calculated

which provides a measure of the degree of stress a stream is under based on the tolerance of the invertebrates found. If a stream is dominated by organisms shown in previous studies to be tolerant to pollution, then pollution is likely (Hilsenhoff 1988). Benthic macroinvertebrates are affected both by the habitat quality of the stream as well as by the amount of organic pollution in the water (Carter et al. 2007). Therefore, habitat quality indices and data on the trophic relationships (functional feeding groups) and habits of invertebrates can also provide information on the state of a stream. Water chemistry analysis can provide information on the dissolved chemical constituents, offering further insight into the health of a stream. The objectives of this study were: (1) to provide baseline water quality and habitat assessment data for Ellen's Creek from macroinvertebrate and surface water sampling; and (2) to compare the East Branch and the West Branch based on the data collected.

Methods:

Study Sites

Ellen's Creek is an urban stream running through western Charlottetown, Prince Edward Island, flowing south into the North River (Figure 1). Two sites along Ellen's Creek were chosen for sampling, one along the East Branch (46°16'11.37"N, 63°09'04.08"W) and one along the West Branch (46°16'10.69"N, 63°09'41.79"W). Both sites consisted of a small rapids zone along an approximate 9 m reach in the stream.

The East Branch flows from its source above the PEI Humane Society through an industrial/retail area (Norman Dewar, Ellen's Creek Watershed Coordinator, Personal Communication). The sample site on this branch (Figure 2) was located downstream of a pond and several heavily used roads (University Ave. and Trans-Canada Hwy.). There was a large

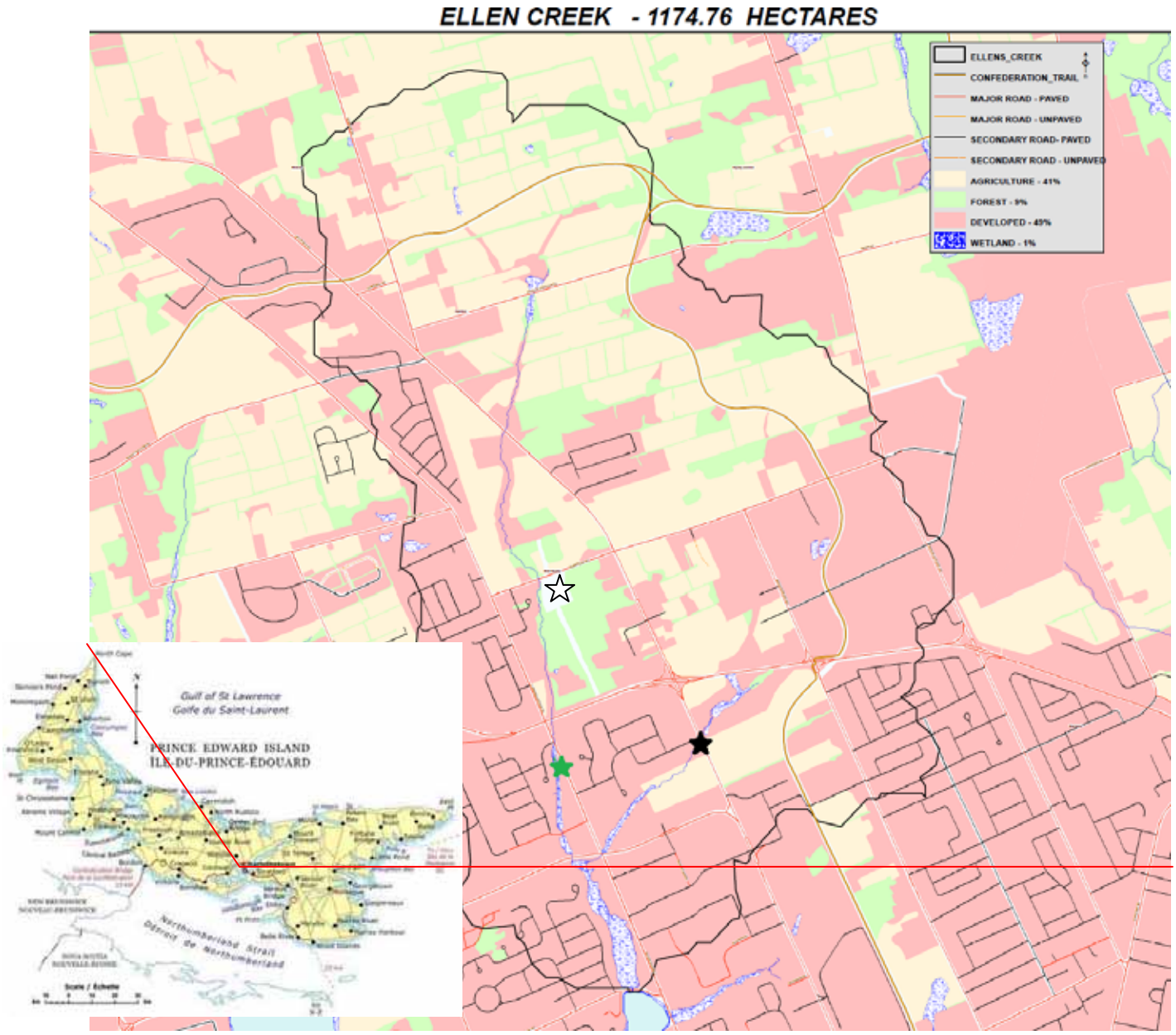


Figure 1. Ellen's Creek Watershed area with land-use, showing the eastern (black star; 46°16'11.37"N, 63°09'04.08"W) and western (white star; 46°16'10.69"N, 63°09'41.79"W) sample sites (map based on digital land use layer from Prince Edward Island Environment, Energy & Forestry 2009 and PEI map from Natural Resources Canada 2001).

Figure 2. Upstream view of the eastern sample site in Ellen's Creek.

culvert upstream (Figure 3) and another downstream of the sample site. Construction on a new mall had been occurring nearby at the time samples were taken and the Malpeque Road Water Pump station that is not currently in use was just adjacent to the sample site. The north bank of the site has a small row of trees that consists mainly of white spruce (*Picea glauca*) and short grass. Undercut portions on both the north and south banks were observed (Figure 4) and the streambed was moderately rocky.

The West Branch flows from its source in Winsloe through small areas of agricultural land and forest, but mostly through urban housing and retail development (Norman Dewar, Ellen's Creek Watershed Coordinator, Personal Communication). Urban construction had occurred fairly recently uphill of the western bank at this site. There was a road (Lower Malpeque Rd.) 10 meters east of the sample site. A culvert that regularly has had high water levels (Norman Dewar, personal communication) is directly upstream of the sample site, while downstream there was a man-made pool. The banks consisted of long grass (Figure 5) and there was undercutting occurring along the banks (Figure 6). The bottom of the stream held a lot of silt at the sampling date and there was evidence of silt beginning to pile up along the banks.

Figure 3. Downstream view of the eastern sample site in Ellen's Creek. There is grass along the southern bank and a row of trees along the northern bank.

Figure 4. Undercutting along the north bank of the eastern sample site in Ellen's Creek.

Figure 5. Upstream view at the western sample site in Ellen's Creek.

Figure 6. Sediment piling along the bank of the western sample site in Ellen's Creek.

Biological Sampling

Benthic invertebrates were sampled at the two sites on October 23, 2011. A three-minute traveling kick sample was collected at each site using a D-frame kick sampler with 400µm mesh. Sampling was carried out by zig-zagging along approximately 9 m of the stream. Specimens were live sorted from gravel and detritus in the lab, and then 20% of each sample was subsampled and completely sorted using a dissecting microscope. Complete-sorting of the subsample increased the invertebrate count by 15 in the East Branch sample and by 14 in the West Branch sample (about 5-7%), indicating that the live-sorting provided a representative sample for analysis. The specimens were preserved in 70% ethanol for storage and later identification. The invertebrates were separated and identified to family level using the keys by Merritt and Cummins (1996) and Clifford (1991). The Hilsenhoff's family-level biotic index (Hilsenhoff 1988) and the appendix of tolerance values for macroinvertebrates from Carter et al. (2007) were used to calculate a biotic index based on pollution tolerance scores. Trophic relationships and habits of invertebrate families sampled were also determined using Hilsenhoff (1988). The diversity of the two samples was compared using the Shannon-Wiener index. To assess the relative health of Ellen's Creek compared to healthy P.E.I. streams, the data were compared to data amassed by Purcell (2003) on 40 reference streams (minimally disturbed, well-treed small streams) in Prince Edward Island.

Chemical and Physical Characteristics

The water quality was assessed by measuring several chemical and physical characteristics. Dissolved oxygen, temperature and conductivity were measured at the two sites on November 15, 2011, using a handheld YSI Model 556 MPS (Multiprobe System) water

quality meter. Surface water samples were collected using water sample collection jars provided by Province of P.E.I. analytical laboratory, which subsequently carried out the water quality testing. Samples were collected and delivered for analysis on November 2, 2011. A subjective habitat quality index developed by Pfankuch (1975) was completed at the two sites on November 19, 2011. This index was used as a comparative tool to characterize the sites. Factors such as degree of vegetative bank protection, landform slope, and bank stability were scored and summed to obtain a habitat score.

Results:

The eastern and western sample sites received similar scores for both indices calculated. For the Hilsenhoff (1988) family-level biotic index, the eastern sample site attained a score of 4.482 (Table 1) and the western site obtained a score of 4.465 (Table 2). These scores placed both sites within the "good" range, indicating that some organic pollution is probable (Hilsenhoff 1988). In the habitat quality index developed by Pfankuch (1975), the eastern site (Figure 7) and the western site (Figure 8) were found to be in "fair" condition in a habitat scoring system that ranged from excellent, good, and fair, to poor.

The two sites had different proportions of invertebrate. The majority of invertebrates found in the eastern sample were net-spinning caddisflies in the family Hyrdopsychidae, which made up 85% of the macro-invertebrates in the sample (Figure 7a). The western sample site (Figure 7b) was more evenly distributed among taxa, with Baetidae (30% of sample) as the highest proportion. The percent of EPT (Ephemeroptera, Plecoptera, and Tricoptera) was calculated to be 85% in eastern sample and 52% in the western sample. The percent of Ephemeroptera as Baetidae was also calculated for the West Branch (95%).

The macro-invertebrates found at each site had very different proportions of specific trophic relationships (functional feeding groups) as well as habits. In the eastern site (Figure 8a), the majority (85%) of the invertebrates sampled were collector-filterers, while smaller numbers of collector-gatherers, predators, and scraper herbivores were present. In the western site (Figure 8b), collector-gatherer invertebrates were found to be of the highest proportion (63%), while predators were also fairly abundant and there was a small number of shredding invertebrates. The habits of invertebrates also varied at the two sites. Most of the invertebrates found in the eastern sample site (Figure 9a) were considered clingers (87%). The western sample site (Figure 9b) was approximately half burrowers, and also included crawlers, clingers, and case makers.

The diversity found within the two sites was quite low. The number of taxa was found to be 7 in the eastern sample and 10 in the western sample. The Shannon-Wiener index was calculated at the family-level and showed the western site to be more diverse (1.955) than the eastern site (0.338).

Various physical and chemical characteristics were recorded for the eastern and western sample sites (Table 3). Some dissolved solutes tended to be slightly elevated, especially in the East Branch. Most notably the eastern sample site had over twice the conductivity of the western sample site (616 mS/cm versus 288 mS/cm). Lab results showed that the eastern site also had much higher levels of chloride (191.9200 mg/L) and sodium (106 mg/L) compared to the western sample site.

Table 1. Water quality testing using the family biotic index for macroinvertebrates found in the Eastern Branch of Ellen's Creek on October 23, 2011.

Phylum	Class	Subclass or Order	Family	Total No.	Tolerance Score	Tot x Tol
Annelida	Oligochaeta			26	8	208
	Clitellata	Hirudinea	Glossiphoniidae	2	10	20
Mollusca	Gastropoda		Planorbidae	3	6	18
Arthropoda	Insecta	Coleoptera	Dytiscidae	1	6	6
		Diptera	Chironomidae	13	6	78
		Trichoptera	Hydropsychidae	257	4	1028
			Rhyacophilidae	1	0	0
			Total	303		1358
			FBI Score (1358/303)	4.482		

Table 2. Water quality testing using the family biotic index for macroinvertebrates found in the West Branch of Ellen's Creek on October 23, 2011.

Phylum	Class	Order	Family	Total No.	Tolerance Score	Tot x Tol
Nematoda				9	6	54
Annelida	Oligochaeta			36	8	288
Arthropoda	Insecta	Diptera	Chironomidae	26	6	156
			Tipulidae	25	3	75
		Ephemeroptera	Baetidae	61	4	244
			Ephemerellidae	3	1	3
		Plecoptera	Chloroperlidae	3	1	3
			Perlodidae	21	2	42
		Trichoptera	Limnephilidae	7	4	28
			Rhyacophilidae	9	0	0
			Total	200		893
			FBI Score (893/200)	4.465		

Table 3. Physical and chemical characteristics of the water in the East Branch and West Branch of Ellen's Creek, tested on November 2, 2011.

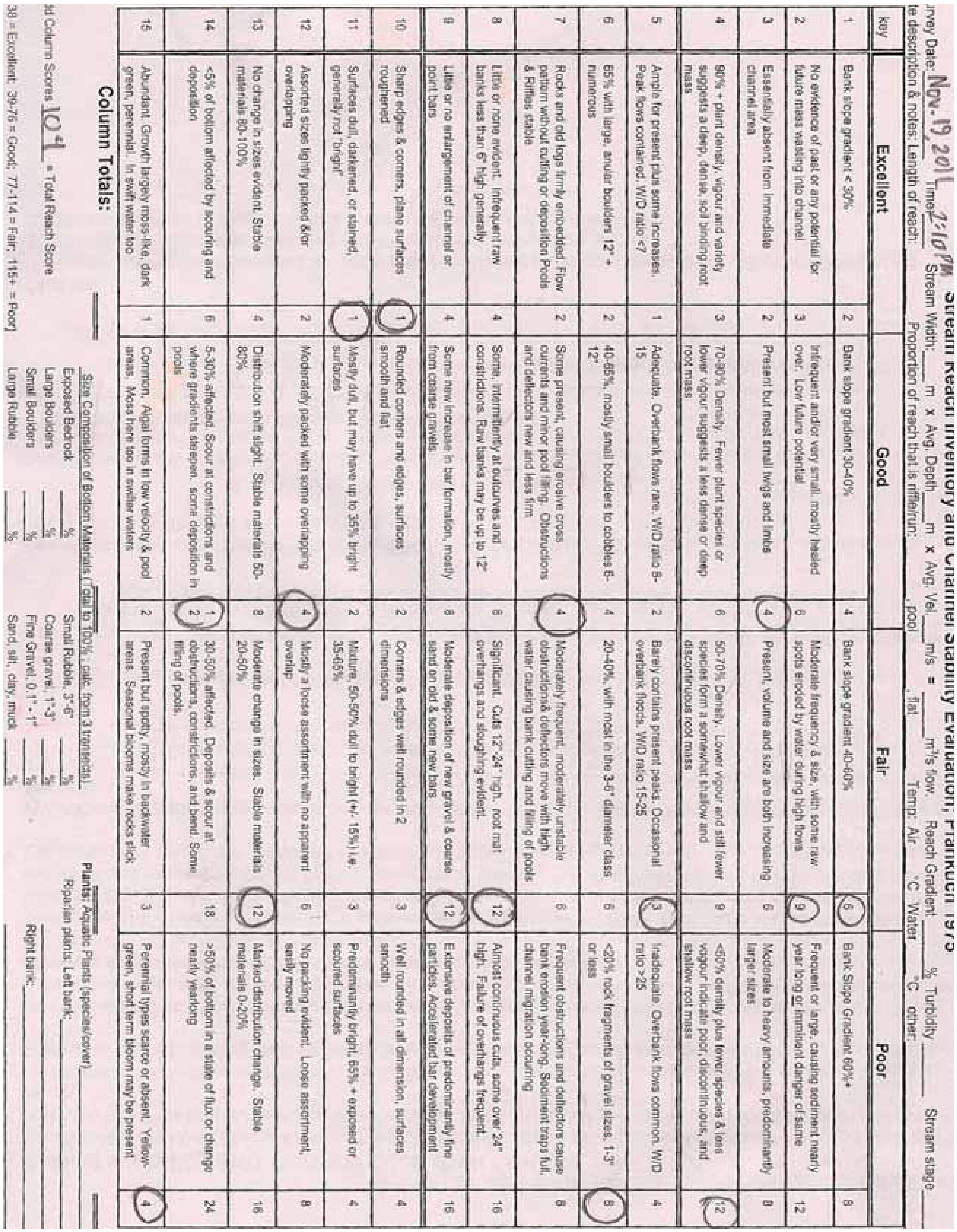
	East Branch	West Branch	Fresh water guideline[1]	Mean (+/- SD) for P.E.I. fresh surface water [2]
Dissolved Oxygen[3] (mg/L)	10.2	11.07	9.5	12.35
Conductivity[3] (µS/L)	616	288	n/a	200 +/- 121
Temperature[3] (°C)	9.61	9.18	n/a	n/a
pH	7.5	7.6	6.5 - 9.0	7.5
Barium, dissolved (mg/L)	0.16	0.23	n/a	0.10387 +/- 0.05702
Cadmium, dissolved (mg/L)	<0.005	<0.005	0.0008*	0.00002+/- 0.00002
Calcium, dissolved (mg/L)	41.3	30	n/a	21.9 +/- 10.7
Chloride (mg/L)	191.92	48.2623	120	12.1 +/- 6.2
Chromium, dissolved (mg/L)	<0.050	<0.050	0.02	0.00036 +/- 0.00020
Copper, dissolved (mg/L)	<0.020	<0.020	0.002*	0.00071 +/- 0.00044
Iron, dissolved (mg/L)	<0.10	<0.10	0.3	0.25710 +/- 0.25493
Lead, dissolved (mg/L)	<0.002	<0.002	0.002*	0.00014 +/- 0.00018
Magnesium, dissolved (mg/L)	20.3	18.5	n/a	6.9 +/- 4.3
Manganese, dissolved (mg/L)	0.23	0.04	n/a	0.02826 +/- 0.01764
Nickel, dissolved (mg/L)	<0.050	<0.020	0.065*	0.00011 +/-0.00014
Nitrate-N (mg/L)	1.5	3.1	2.935	1.7
Phosphorus, dissolved (mg/L)	<0.02	0.02	n/a	0.027
Total Phosphorus (mg/L)	60.7	43.5	n/a	49
Potassium, dissolved (mg/L)	4.17	1.99	n/a	1.3 +/- 0.5
Sodium, dissolved (mg/L)	106	22	n/a	6.2 +/-2.7
Sulfate, cal from S diss (mg/L)	<18.7	10.2	n/a	6.5 +/- 4.1
Zinc, dissolved (mg/L)	<0.02	<0.02	0.03	0.00194
Alkalinity (mg/L of CaCC)	132	117	n/a	67.9 +/-26.8
Hardness	187	151	n/a	n/a

[1]The Canadian Council of Ministers of the Environment (CCME) water quality guidelines for the protection of aquatic life.

[2]Calculated by Somers et al. (1999) for P.E.I Water Quality Interpretive Report.

[3]Measurements taken using a handheld YSI multiprobe system on November 15, 2011. All other measurements were completed by the Province of P.E.I. analytical laboratory.

*Calculated by Somers et al. (1999) as recommended by the CCME, using a value of hardness typical of PEI surface waters.



Stream Reach Inventory and Channel Stability Evaluation; Pfankuch 1975

Survey Date: Nov. 19, 2011 Time: 2:10 PM Stream Width: ___ m x Avg. Depth ___ m x Avg. Vel. ___ m/s = ___ m^3/s flow. Reach Gradient ___ % Turbidity ___ Stream stage ___

Site description & notes: Length of reach: ___ Proportion of reach that is riffle/run: ___ , pool ___ , flat ___ Temp: Air ___ °C Water ___ °C other: ___

key	Excellent		Good		Fair		Poor	
1	Bank slope gradient < 30%	2	Bank slope gradient 30-40%	4	Bank slope gradient 40-60%	(6)	Bank Slope Gradient 60%+	8
2	No evidence of past or any potential for future mass wasting into channel	3	Infrequent and/or very small, mostly healed over. Low future potential	6	Moderate frequency & size, with some raw spots eroded by water during high flows	(9)	Frequent or large, causing sediment nearly year long or imminent danger of same	12
3	Essentially absent from immediate channel area	2	Present but most small twigs and limbs	(4)	Present, volume and size are both increasing	6	Moderate to heavy amounts, predominantly larger sizes	8
4	90% + plant density, vigour and variety suggests a deep, dense, soil binding root mass	3	70-90% Density. Fewer plant species or lower vigour suggests a less dense or deep root mass	6	50-70% Density. Lower vigour and still fewer species form a somewhat shallow and discontinuous root mass	9	<50% density plus fewer species & less vogour indicate poor, discontinuous, and shallow root mass	(12)
5	Ample for present plus some increases. Peak flows contained. W/D ratio <7	1	Adequate. Overbank flows rare. W/D ratio 8-15	2	Barely contains present peaks. Occasional overbank floods. W/D ratio 15-25	(3)	Inadequate. Overbank flows common. W/D ratio >25	4
6	65% with large, anular boulders 12" + numerous	2	40-65%, mostly small boulders to cobbles 6-12"	4	20-40%, with most in the 3-6" diameter class	6	<20% rock fragments of gravel sizes, 1-3" or less	(8)
7	Rocks and old logs firmly embedded. Flow pattern without cutting or deposition Pools & Riffles stable	2	Some present, causing erosive cross currents and minor pool filling. Obstructions and deflectors new and less firm	(4)	Moderately frequent, moderately unstable obstructions& deflectors move with high water causing bank cutting and filling of pools	6	Frequent obstructions and deflectors cause bank erosion year-long. Sediment traps full, channel migration occurring	8
8	Little or none evident. Infrequent raw banks less than 6" high generally	4	Some, intermittently at outcurves and constrictions. Raw banks may be up to 12"	8	Significant. Cuts 12"-24" high. root mat overhangs and sloughing evident.	(12)	Almost continuous cuts, some over 24" high. Failure of overhangs frequent.	16
9	Little or no enlargement of channel or point bars	4	Some new increase in bar formation, mostly from coarse gravels	8	Moderate deposition of new gravel & coarse sand on old & some new bars	(12)	Extensive deposits of predominantly fine particles. Accelerated bar development	16
10	Sharp edges & corners, plane surfaces roughened	(1)	Rounded corners and edges, surfaces smooth and flat	2	Corners & edges well rounded in 2 dimensions	3	Well rounded in all dimension, surfaces smooth	4
11	Surfaces dull, darkened, or stained, generally not "bright"	(1)	Mostly dull, but may have up to 35% bright surfaces	2	Mixture, 50-50% dull to bright (+/- 15%) i.e. 35-65%	3	Predominantly bright, 65% + exposed or scoured surfaces	4
12	Assorted sizes tightly packed &/or overlapping	2	Moderately packed with some overlapping	(4)	Mostly a loose assortment with no apparent overlap	6	No packing evident. Loose assortment, easily moved	8
13	No change in sizes evident. Stable materials 80-100%	4	Distribution shift slight. Stable materials 50-80%	8	Moderate change in sizes. Stable materials 20-50%	(12)	Marked distribution change. Stable materials 0-20%	16
14	<5% of bottom affected by scouring and deposition	6	5-30% affected. Scour at constrictions and where gradients steepen. some deposition in pools	(12)	30-50% affected. Deposits & scour at obstructions, constrictions, and bend. Some filling of pools.	18	>50% of bottom in a state of flux or change nearly yearlong	24
15	Abundant. Growth largely moss-like, dark green, perennial. In swift water too	1	Common. Algal forms in low velocity & pool areas. Moss here too in swifter waters	2	Present but spotty, mostly in backwater areas. Seasonal blooms make rocks slick	3	Perennial types scarce or absent. Yellow-green, short term bloom may be present	(4)

Column Totals: ___ ___ ___ ___

Add Column Scores 104 = Total Reach Score

38 = Excellent; 39-76 = Good; 77-114 = Fair; 115+ = Poor]

Size Composition of Bottom Materials (Total to 100%; calc. from 3 transects)

Exposed Bedrock	___ %	Small Rubble, 3"-6"	___ %
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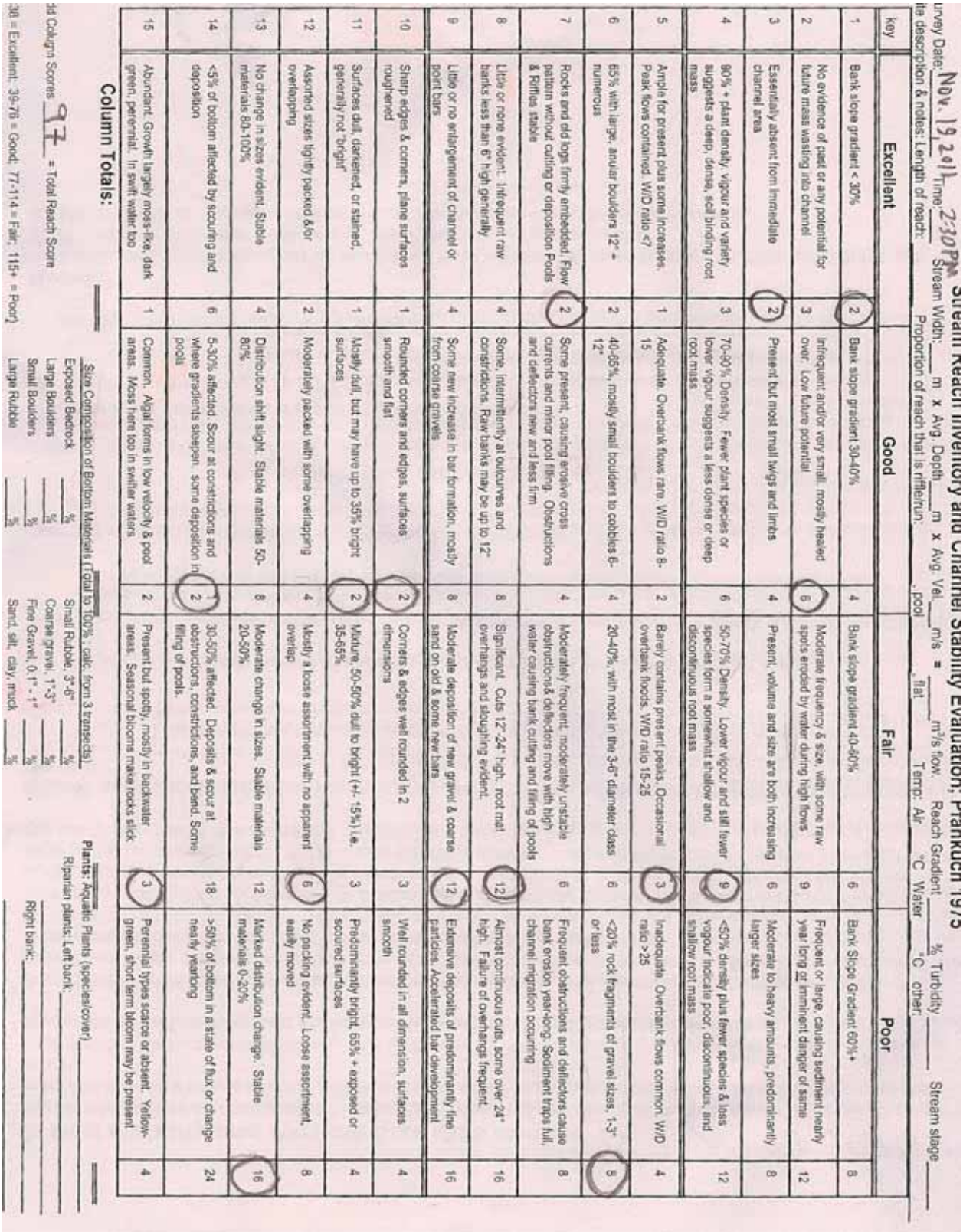
Small Boulders	___ %	Fine Gravel, 0.1" - 1"	___ %
Large Rubble	___ %	Sand, silt, clay, muck	___ %

Plants: Aquatic Plants (species/cover) ___

Riparian plants: Left bank: ___

Right bank: ___

Figure 7. Habitat quality index scoresheet for the sampling site of the East Branch of Ellen's Creek on November 19, 2011.



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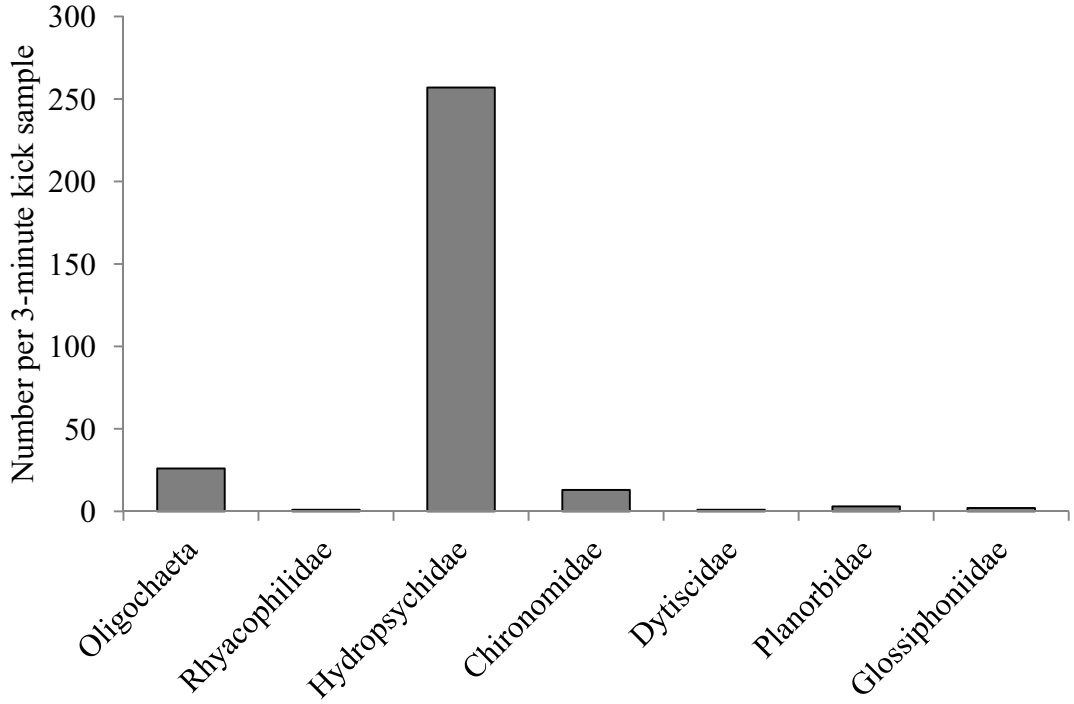


b) West Branch

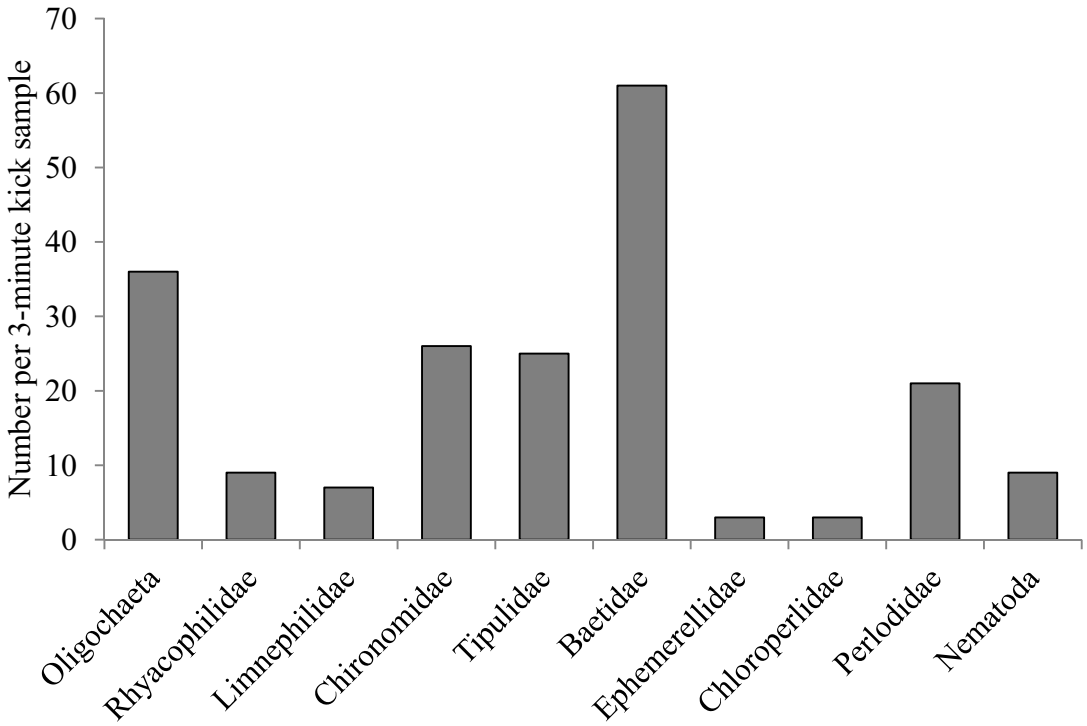
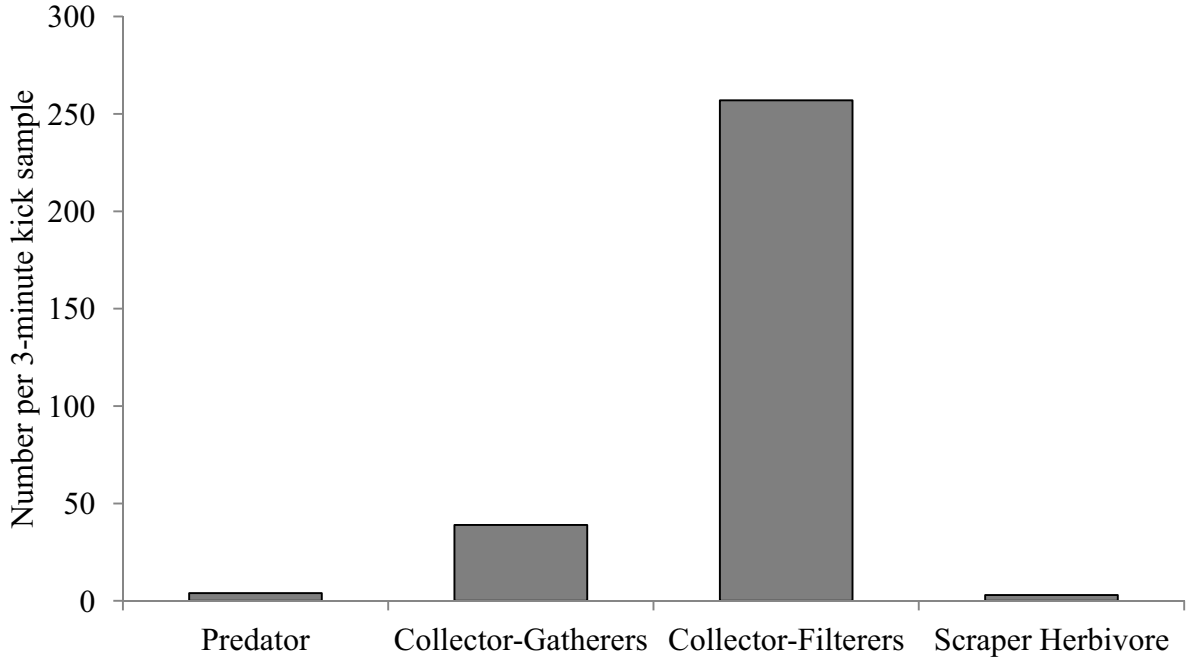


Figure 7. Proportions of macroinvertebrate taxa in the a) East Branch sample and b) West Branch sample of Ellen's Creek.

a) East Branch



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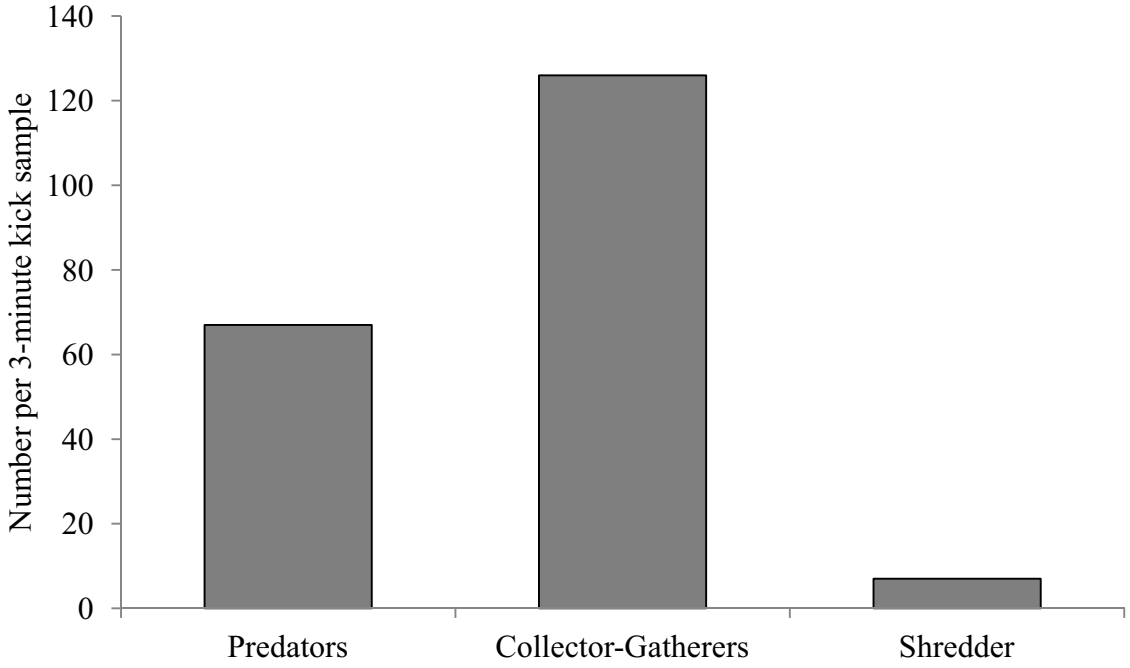

Figure 8. Trophic relationships of macro-invertebrates in the a) East Branch sample and b) West Branch sample of Ellen's Creek.

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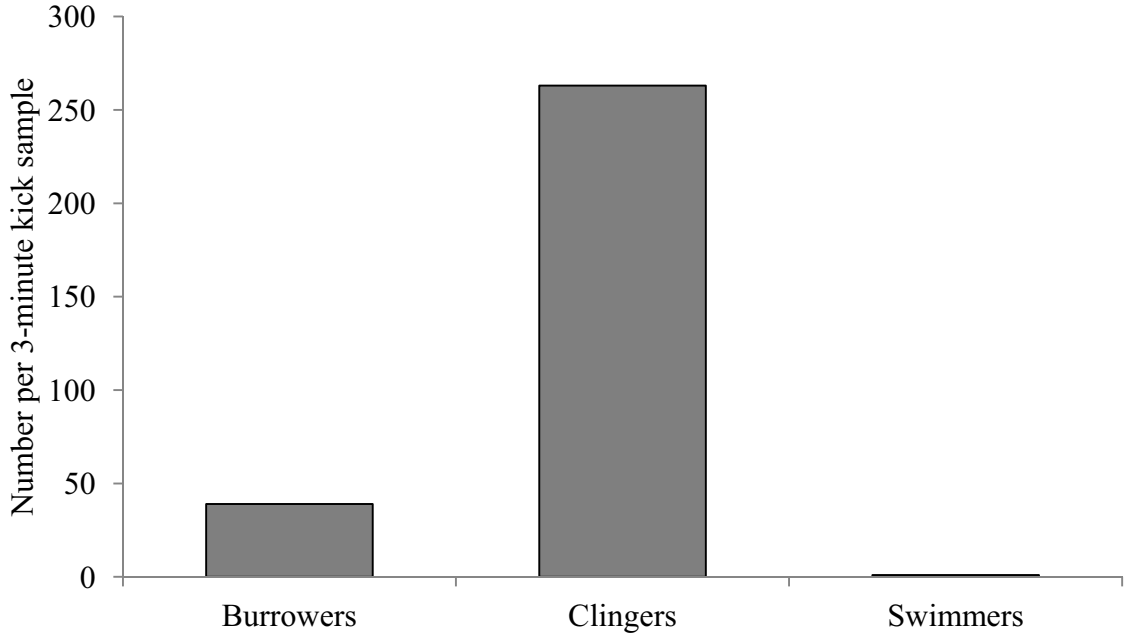

b) West Branch

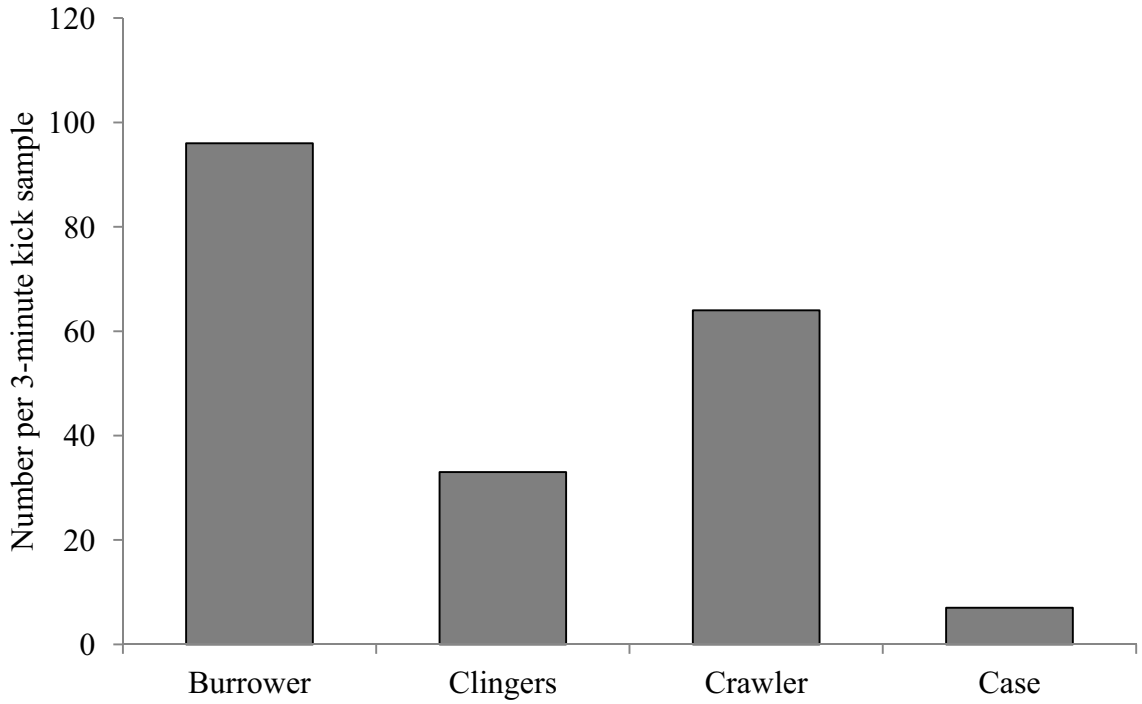

Figure 9. Habits of the invertebrates in the a) East Branch sample and b) West Branch sample of Ellen's Creek.

Discussion:

The eastern and western sites were found to be fairly similar in terms of health based on the biotic and habitat quality indices, though they had very different invertebrate communities. The scores for the family biotic index and the habitat quality index suggested that both sites were in a fair condition and likely have some organic pollution. To assess the relative health of Ellen's Creek compared to healthy P.E.I. streams, the data were compared to data amassed by Purcell (2003) on 40 reference streams (minimally disturbed, well-treed small streams) in Prince Edward Island. Oligochaeta (aquatic worms) and other burrowers are often tolerant of organic pollution and sedimentation that alters their habitat (Barbour et al. 1996). The Mayfly family Baetidae is generally more tolerant to pollution than the rest of the Order (Hilsenhoff 1988) and their presence could also be a sign of the presence of high sedimentation (Voshell 2002). The proportion of Oligochaeta in both branches of Ellen's Creek was found to be higher than the median value for PEI reference streams in both branches of Ellen's Creek. This was also found for the proportion of burrowers and proportion of Ephemeroptera as Baetidae (95%) in the West Branch. This indicates higher levels of pollution and sedimentation than in the reference streams. However, the proportion of EPT (Ephemeroptera, Plecoptera, and Trichoptera), which are generally reported to be sensitive to their environment and pollution (Riley et al. 2005), in the West Branch were similar to reference streams whereas those in the East Branch were of a higher proportion than the reference streams.

Aquatic organisms can also be classified functionally by how they eat (Cummins 1974), and looking at the trophic relationships of invertebrates can reveal some elements of the habitat they live in. The functional feeding groups and habits of the invertebrates varied between the eastern and western sites of Ellen's Creek. The eastern sample site consisted primarily of

collector-filterers. Hydropsychidae (the most abundant collector-filterer in the sample) obtain food through a net or web made of silk. They collect and feed on suspended particulate organic matter that drifts from upstream (Georgian and Wallace 1981). These collector-filterers also tend to be clingers, which can attach themselves to a stable surface (Voshell 2002). High density of these filter feeders usually occurs in lake-outlet reaches (Richardson 1984) and the eastern sample was taken just downstream of a pond. The western site was in a free flowing stream and collector-gatherers and predators were found in high proportions. Collector-gatherers feed on detritus material that has sunk to the stream bottom and some, such as Oligochaeta, will burrow into sediment to feed, while others feed on the detritus that has fallen on the top of the sediment. The habit for these organisms is described as burrowers and crawlers. Burrowers live in sediment that is loosely compacted and densities of burrowers will increase with the amount of deposited sediment (Rabeni et al. 2005). The high proportion of burrowers in the western site reinforces the component of the habitat quality index which found a high amount of sedimentation in the West Branch of Ellen's Creek.

The Shannon-Wiener index indicates a difference in diversity between the East Branch and the West Branch. This difference might be because the sampling sites were downstream from different types of environment (a flowing stream and a pond), with the Eastern sample being dominated by a high number of collector-filterers. However, both sites had extremely low diversity when compared to healthy P.E.I. streams from Purcell (2003). Low macroinvertebrate diversity is common in urban streams and has been found to be strongly related to land use. Specifically, positive relationships have been found between invertebrate diversity and riparian forest cover and negative relationships have been found between diversity and the amount of impervious surfaces (Moore and Palmer 2005).

The water chemistry results were, for the most part, similar to the surface fresh water means found for P.E.I (Somers et al. 1999) and were within CCME (Canadian Council of Ministers of the Environment) guidelines for the protection of aquatic life. The high levels of sodium and chloride are likely because of road salt runoff from the heavily used roads and parking lots by the East Branch. The runoff of deicing salt is common in urban streams and has been found to have profound effects on soil and stream water chemistry (Lofgren, 2011). Another explanation for the high salt concentration is salt water incursion from the estuary. A few other measurements were found to be elevated as well (calcium, potassium, and manganese) which all generally tend to be elevated in urban streams (Paul and Meyer 2001).

In conclusion, invertebrate sampling results suggest that in both the East Branch and the West Branch some organic pollution is probable. The habitat quality index found both sites to be of "fair" condition. Further evidence that some organic pollution and sedimentation is present in Ellen's Creek was the higher proportion of pollution and sediment tolerant organisms present compared to healthy reference streams. The trophic relationships (functional feeding groups) and the habits of invertebrates indicate that the sampling site environments differed, with the eastern site containing a composition of invertebrates characteristic of a lake-outlet and the western site reflecting a more diverse community. Water chemistry results for the most part were similar to means for P.E.I. and within CCME guidelines for the protection of aquatic life. The chloride and sodium concentrations found in the East Branch were elevated, likely due to runoff from road salt from nearby roads and parking lots. Overall, Ellen's Creek was found to be in fairly good health based on macroinvertebrate sampling and water surface testing, however some evidence of organic pollution, sedimentation, and high salt runoff was found.

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PEI Analytical Laboratories - Water Quality Test Report

440 University Avenue, Charlottetown, PE

Client Name: Ellens Creek Watershed Group
Sample Point: Ellens Creek Watershed Group
Date Sampled: November 02, 2011
Date Received: November 02, 2011

Sample Number: SW111102012
Sample Location: Ellen's Creek Below C'town
Sampler: Norman Dewar
Water Type: Surface Water - Fresh

Water Chemistry Results

(analysed at 440 University Av.)

Method ID		Parameter	Results	Units	Detection Limit
WCL_04M	*	pH for Water	7.5		0.00
WCL_07M	*	Cadmium, dissolved	<0.005	ppm	0.01
WCL_07M	*	Chromium, dissolved	<0.050	ppm	0.05
WCL_01M	*	Alkalinity	132	ppm of CaCC	8.00
WCL_01M	*	Nitrate-N	1.5	ppm	0.20
WCL_01M	*	Chloride	191.9200	ppm	1.00
WCL_07M	*	Copper, dissolved	<0.020	ppm	0.02
WCL_07M	*	Iron, dissolved	<0.10	ppm	0.10
WCL_07M	*	Nickel, dissolved	<0.050	ppm	0.05
WCL_07M	*	Barium, dissolved	0.16	ppm	0.01
WCL_07M	*	Calcium, dissolved	41.3	ppm	0.01
WCL_07M	*	Potassium, dissolved	4.17	ppm	0.05
WCL_07M	*	Magnesium, dissolved	20.3	ppm	0.01
WCL_07M	*	Manganese, dissolved	0.23	ppm	0.02
WCL_07M	*	Sodium, dissolved	106	ppm	0.10
WCL_07M	*	Phosphorus, dissolved	<0.02	ppm	0.02
WCL_07M	*	Lead, dissolved	<0.002	ppm	0.00
WCL_07M	*	Sulfate, calc from S diss	18.7	ppm	1.00
WCL_07M	*	Zinc, dissolved	<0.02	ppm	0.02
		Hardness	187		0.00
WCL_08M	*	Total Phosphorus	60.7000	ppb	6.00

Approved By: Lori Connolly-Brine Date: November 29, 2011

Date of Analysis available upon request.

Legend: MPN = Most Probable Number
cfu/100 mls = colony forming unit per 100 millilitres
* = method accredited by Standards Council of Canada;
mg/L = milligrams per litre
nd = not detected; na = not analysed

End of Report

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Portée d'accréditation 424

PEI Analytical Laboratories - Water Quality Test Report

440 University Avenue, Charlottetown, PE

Client Name: Ellens Creek Watershed Group
Sample Point: Ellens Creek Watershed Group
Date Sampled: November 02, 2011
Date Received: November 02, 2011

Sample Number: SW111102013
Sample Location: Ellen's Creek Near Culvert N
Sampler: Norman Dewar
Water Type: Surface Water - Fresh

Water Chemistry Results

(analysed at 440 University Av.)

Method ID		Parameter	Results	Units	Detection Limit
WCL_04M	*	pH for Water	7.6		0.00
WCL_07M	*	Cadmium, dissolved	<0.005	ppm	0.01
WCL_07M	*	Chromium, dissolved	<0.050	ppm	0.05
WCL_01M	*	Alkalinity	117	ppm of CaCC	8.00
WCL_01M	*	Nitrate-N	3.1	ppm	0.20
WCL_01M	*	Chloride	48.2623	ppm	1.00
WCL_07M	*	Copper, dissolved	<0.020	ppm	0.02
WCL_07M	*	Nickel, dissolved	<0.050	ppm	0.05
WCL_07M	*	Lead, dissolved	<0.002	ppm	0.00
WCL_07M	*	Barium, dissolved	0.23	ppm	0.01
WCL_07M	*	Calcium, dissolved	30.0	ppm	0.01
WCL_07M	*	Iron, dissolved	<0.10	ppm	0.10
WCL_07M	*	Potassium, dissolved	1.99	ppm	0.05
WCL_07M	*	Magnesium, dissolved	18.5	ppm	0.01
WCL_07M	*	Manganese, dissolved	0.04	ppm	0.02
WCL_07M	*	Sodium, dissolved	22.0	ppm	0.10
WCL_07M	*	Phosphorus, dissolved	0.02	ppm	0.02
WCL_07M	*	Sulfate, calc from S diss	10.2	ppm	1.00
WCL_07M	*	Zinc, dissolved	<0.02	ppm	0.02
		Hardness	151		0.00
WCL_08M	*	Total Phosphorus	43.5000	ppb	6.00

Approved By: Lori Connolly-Brine Date: November 29, 2011

Date of Analysis available upon request.

Legend: MPN = Most Probable Number
cfu/100 mls = colony forming unit per 100 millilitres
* = method accredited by Standards Council of Canada;
mg/L = milligrams per litre
nd = not detected; na = not analysed

End of Report