Niblett Environmental Associates Inc.
Biological Consultants

Memo

October 03, 2011

Lisa Keable
Renewable Energy Biologist
Ministry of Natural Resources
Sault Ste. Marie District
64 Church Street, ON
P6A 3H3

Re: Draft Aquatic Biomonitoring Protocol, Lizard Creek long term monitoring

Dear Lisa,

Niblett Environmental Associates Inc. (NEA) has prepared the draft *Aquatic Biomonitoring Protocol,* for the purpose of monitoring water quality and habitat changes over time in the Lizard Creek proposed hydroelectric generating facility site. The protocol will be implemented this fall (October 2011).

Please note the complete long-term monitoring program is still being developed for the Lizard Creek proposed hydroelectric generating facility. This program will be inclusive of all biological long term monitoring protocols.

If you have any questions regarding this memo or project please feel free to contact me.

Sincerely,

Amanda Smith

Amanda Smith
Fisheries Biologist
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AQUATIC BIOMONITORING PROTOCOL

Background:

The Ontario Benthos Biomonitoring Protocol (OBBN) was used to develop the Aquatic Biomonitoring Protocol for the purpose of monitoring water quality and habitat changes over time in the Lizard Creek proposed hydroelectric generating facility site.

Purpose: To assess the aquatic ecosystem over time using benthos as indicators of water and habitat quality.

Hypothesis: If the natural aquatic habitat in the Zone of Influence is impacted by the operation of the Lizard Creel hydroelectric generation facility, then the benthos community composition will change over time.

Sampling Benthos and Characterizing Habitat Method:

Design Type: Before and After Control Study- using set reference sites to sample before and after the stressor discharge (hydroelectric generating station).

Collection Gear: Fixed Area Collection using one or all of the following;

- Stationary kick net method with a $1m^2$ 500um mesh size;
- Grab method using Ekman dredge.

Fixed area collection permit strong control of sampling effort and yields per-area densities. Stationary kick net method will be the primary collection method used. Grabs may be used from a boat where site are non-wadeable.

Grabs samples are not anticipated to be used in pre construction assessment since all sites are expected to be wadeable. However, the post-construction aquatic environment may differ (water depth and flow) and the appropriate sampling gear will used to maintained high sampling effort and yields.

Replicates: Three (3) samples (2 riffles and 1 pool) will be collected for each site. Specifically, OBBN lake and river environment sampling methods will be implemented.

Assessment Frequency: The Aquatic Biomonitoring Protocol will be implemented once per year during an assessment year. All sites will be sampled in fall (October). Samples will not be collected during the spring (May) due to the known high flows of Lizard Creek limiting accessibility to sites and increased health and safety concerns for staff.

During the fall (October), benthos communities have high richness and environmental conditions allow safe sampling. The invertebrate composition may reflect summer impacts and have high frequencies of juvenile benthos.

Assessment Duration: Pre Construction - The Aquatic Biomonitoring Protocol will be conducted once before construction of the Lizard Creek Hydroelectric generating facility in the fall (Oct) 2011.

Post Construction - The Aquatic Biomonitoring Protocol will be conducted post construction for multiple years. The duration and frequency of sampling is yet to be determined.

Picking: Specimens will be preserved in 70% methyl alcohol and identified in the lab to the family taxonomic level. Unknown or hard to identify families will be outsourced for precise identification. Family-level identification is generally recommended for bio-assessment projects (OBBN 2007).

Effort: A minimum of 100 animals will be collected per replicate or sub-sample, even in sparse habitats. At a given location sampling effort (e.g., time spent sampling, distance covered, number of pooled grabs) will be adjusted accordingly based on benthos abundance. If estimated catch per sub-sample is less than 100 animals, an additional sub-sample will be collected; including site and effort metrics to ensure a minimum catch of 100 animals per sub-sample.

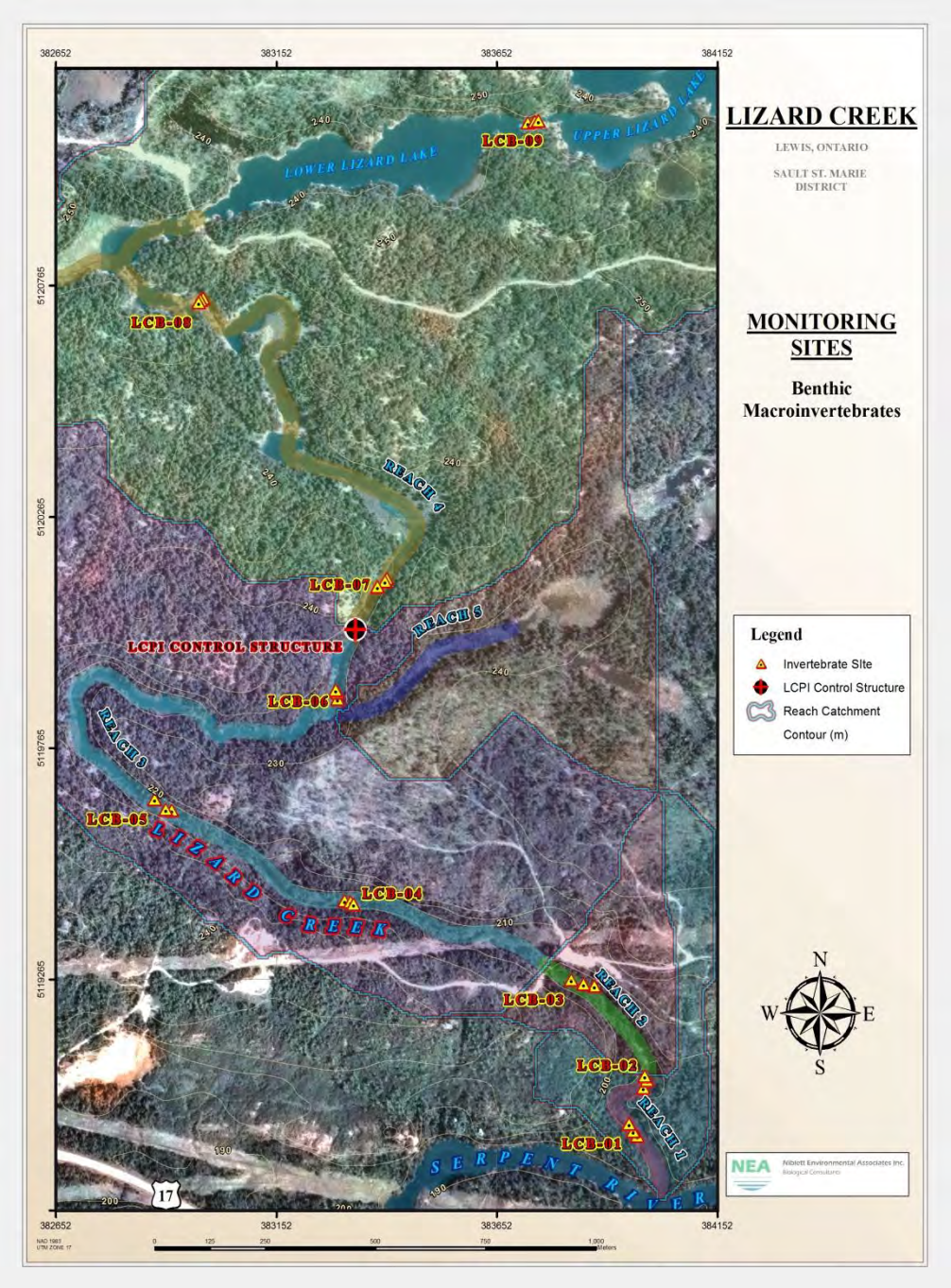

Figure 1.

Site Location: Sites were selected to correspond with existing biological data collection areas (i.e. historic benthos and water quality monitoring sites) and/or fill existing data gaps. All site locations are mapped on **Figure 1**. The number of biomonitoring sites per reach are summarized in **Table 1**.

Table 1. Number of biomonitoring sites located in Lizard Creek by reach.

Reach	Number of Sites	Number of Samples
1	2	6
2	1	3
3	3	9
4	2	6
Upper Lizard Lake	1	3
Total	**9**	**27**

Stream Sampling Methods: Where applicable a site will be defined as a 1 meander wavelength or three cross-overs. The morphological definition of pools and riffles is difficult to apply in rivers where channel features are shaped more by rocky features, such as Lizard Creek. In such sites where pools and riffles do not occur in regular patterns, a site will encompass functionally defined pools and riffles (i.e., slow/deep and fast/shallow areas, respectively), regardless of where they occur in the meander sequence.

Where pools and riffles cannot be distinguished, a site will be defined as 14-20 times the bank-full width, which corresponds to the normal meander wavelength of similar sized streams with natural channels.

Habitat: Habitat information can help to identify the cause of biological responses. OBBN habitat variables will be recorded at each site.

Analysis: To determine if the benthic community has changed over time, from pre to post construction, multiple metrics will be analysed. OBBN, 2007 acknowledges that in most cases we won't know *a priori* of what the best set of summary metrics are for a given test site and therefore recommend using a large set of metrics in order to contribute as much information as possible to assessments.

Since minimal historic benthos information exists for Lizard Creek. The natural community and family seasonal/annual variability is not understood. We propose a comprehensive analysis using a large set a matrices to monitor potential community shift and temporal trends.

The following community metrics will be calculated for each benthos site:

- Taxonomic richness (family level);
- Percent of dominant taxa;
- Percent of Oligochaeta;
- Percent of Chironomidae - higher proportions of midge larvae are expected at more impacted sites
- Percent of EPT- members of the orders Ephemeroptera, Plecoptera and Tricoptera are generally considered to be sensitive to pollution, preferring oxygen rich habitat. Higher proportions of these organisms are expected at less impacted sites;
- Ratio of EPT to Chironomidae – an indication of community balance, this ratio is lower under conditions of environmental stress.
- Percent of ETO- similar to EPT, but included Odonata instead of Plecoptera, which are also considered to be sensitive. Higher proportions of these organisms are expected at less impacted sites;
- Percent of clinger taxa- organism that hold their position on the bottom substrate in flowing waters. Their numbers are lower in the presence of excess algal growth or sedimentation;
- Percent of pollution-intolerant taxa- ‘pollution’ refers to primary to nutrient or organic enrichment. Organism assigned values based on Hilsenhoff Index;
- Percent of filtering collectors – these organism will be found in greater proportions at sites with more fine particulate organic matter in the water column;
- Percent of burrowers- these organisms will be found in greater numbers where the riverbed is covered with sediment;
- Percent of Insecta;

Temporal Analysis of Community Metrics

- Analysis of variance (ANOVA) for changes in mean metric values for each site (temporal differences) over years for each site.
- Multivariate analysis to investigate community structure over years (temporal differences). May be coupled with additional environmental data (i.e. temperature, water quality and habitat).

Interpretation of Results: The describe metrics will be calculated after each assessment season/year. Comparing metric for temporal trends will be conducted after three (3) assessment years (3 applications of the completed aquatic biomonitoring protocol). At that time, a comprehensive report will be submitted to the OMNR detailing the analysis including; raw data, detailed statistical methods, results, discussion and recommendations.

All trends will be analysed, discussed and reported to the OMNR. If the results indicate potential negative impacts from the hydroelectric generation facility operation, NEA will work with the client and OMNR to negate further negative impacts to the aquatic environment and update and/or develop best management practices.