Handout 9a

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June 4, 2015

Dear Mr. Scot Williamson,

Please find enclosed, the Nature Conservancy of Canada (NCC) application to the North Atlantic Landscape Conservation Cooperative (NA LCC) Priority Science Program for the project "Developing a GIS-based freshwater classification for the Canadian portion of the North Atlantic Landscape Conservation Cooperative (NA LCC)." It is anticipated that this project will be 18 months in duration, beginning in September 2015.

We respectfully request that NA LCC contribute $110,000 for the development of this aquatic ecosystem classification for the Canadian portion of the NA LCC, (which includes New Brunswick, Nova Scotia, Prince Edward Island and Eastern Quebec). This classification will be the first step in completing a seamless classification system for the entire NA LCC region (U.S. and Canadian portions).

The overall goal of this project is to increase the knowledge and data available to more effectively protect and manage freshwater aquatic resources in the Canadian and cross-border portions of the NA LCC. Specifically, the classification will: 1) fill a large data gap by developing and mapping an aquatic ecosystem classification in the Canadian portion of the NA LCC; 2) provide the ecological basis to identify "representative" aquatic ecosystems for management, restoration, research and most importantly as an aid to programs and organizations aimed at conserving biological diversity of freshwater resources; 3) provide common definitions and mapping of aquatic habitat types across provincial and bordering state lines allowing each province/state to identify aquatic habitats consistently across jurisdictional borders; 4) build a greater understanding of the state of the aquatic ecosystems by providing a standardised approach for assessing the current state and changes of riverine ecosystems.

To ensure the relevance of this work for key organizations that may benefit from the development of an aquatic classification, we will ask representatives from local and regional conservation organizations to serve on a steering committee. NCC will review the classification variables and data used in the aquatic classification developed by TNC's Eastern Conservation Science office and will work collaboratively with TNC staff to ensure the end products are compatible and result in seamless aquatic classification for the entire NA LCC. The classification variables will consider: size of rivers/streams, gradient, buffering capacity, temperature and tidal classes.

Please do not hesitate to contact me if you have any further questions.

Thank you for your consideration.

Sincerely,

Margo Morrison
Manager, Conservation Science
Nature Conservancy of Canada - Atlantic Region

Section 2: Project Summary

Geographic Scope: Nature Conservancy of Canada **(**NCC) and partners will produce a GIS-based aquatic classification for the Canadian portion of the North Atlantic Landscape Conservation Cooperative (NA LCC), which includes New Brunswick, Nova Scotia, Prince Edward Island and the Eastern portion of Quebec.

Start Date and Projected End Date: September 1, 2015 to March 1, 2017

Goals and Relevance: Worldwide, species extinction in freshwater environments is estimated to be higher than in terrestrial ecosystems (Linke et al. 2011). Conversely, conservation action largely occurs in terrestrial environments. Demands on aquatic resources is increasing, therefore, coordinated and effective conservation action is needed.

Conserving the NA LCC's freshwater resources will require a consistent classification of stream and lake features into recognizable categories. The freshwater classification developed for the U.S. portion of the NA LCC has allowed individual states to understand their freshwater resources in light of the full distribution of stream types in the U.S (Olivero and Anderson 2008). A group of over 40 Canadian and U.S. partners met last year and agreed that there is a need for a consistent aquatic classification across this ecoregion. Further, this work will allow us to plan for aquatic resources shared between the U.S. and Canada.

Until recently, ecological data and frameworks required to effectively manage and protect aquatic resources were largely not available in Canada across broad areas- such as the NA LCC. Even five years ago, the base data required for such a classification tool was not available in Canada. However, recent efforts by various partners has made much of the needed information available, or easily created, which is why there is so much interest in this project. Aquatic conservation planning efforts on the U.S. side of the NA LCC have increased significantly, but comprehensive aquatic datasets generally stop at the Canadian border. We have resolved the border issue for terrestrial systems through the release of the NA LCC-funded Northeast Terrestrial Habitat map that now includes Maritime Canada. This will inform the management of terrestrial-based resources, and facilitate large-scale conservation planning. A comprehensive aquatic classification will do the same for freshwater ecosystems which, to date, has largely occurred incidentally by conserving or managing terrestrial resources.

The overall goal of this project is to increase the knowledge and data available to more effectively protect and manage freshwater aquatic resources in the Canadian and cross-border portions of the NA LCC. Specifically, the classification will: 1) fill a large data gap by developing and mapping an aquatic ecosystem classification in the Canadian portion of the NA LCC; 2) provide the ecological basis to identify "representative" aquatic ecosystems for management, restoration, research and most importantly as an aid to programs and organizations aimed at conserving biological diversity of freshwater resources; 3) provide common definitions and mapping of aquatic habitat types across provincial and bordering state lines allowing each province/state to identify aquatic habitats consistently across jurisdictional borders; 4)build a greater understanding of the state of the aquatic ecosystems by providing a standardised approach for assessing the current state of riverine ecosystems and identifying potential changes to riverine ecosystems resulting from the alteration of physical and biological processes.

METHODS:

1. Identify and engage all partner organizations and key staff within these organizations, to serve as advisors to the development of the aquatic classification (September to October 2015).
To ensure the relevance of this work for key organizations that may benefit from the development of an aquatic classification, we will ask for representatives from local conservation organizations to serve on a steering committee which will meet, in person, a minimum of three times throughout the project. Additional meetings may be held by WebEx or phone, if deemed necessary. Attendees of an aquatic workshop that NCC hosted last April, to determine the need for an aquatics classification system, will be contacted first. Local representation will be sought from organizations such as: the provincial governments of each province, Atlantic Canada Conservation Data Centre (ACCDC), Department of

Fisheries and Oceans (CWS), Atlantic Salmon Federation (ASF), Ducks Unlimited Canada (DUC), universities, local land trusts and aboriginal groups. Twelve of these organizations have already written and signed letters of support for this project. It is important to note that NCC will be working closely with The Nature Conservancy (TNC) to ensure that we are basing our classification on the model that was already created for the U.S. portion of the NA LCC. Finally, during this time we will hire and train the GIS analyst who will be the point person for data compilation.

2. Compile foundational datasets for aquatic classification in the Canadian portion of the NA LCC (October 2015 – January 2016).

During the aquatic workshop NCC held in April 2014, attendees discussed data availability in each province that could contribute towards an aquatic classification and other aquatic conservation planning projects. Many of the necessary input datasets are now available and partners have agreed to contribute this data in order to support the development of an aquatic classification across the entire ecoregion. NCC will begin by assembling region-wide and provincial spatial datasets that will drive the aquatic ecological classification in the Canadian portion of the NA LCC. Datasets will include: surficial and bedrock geology, a high resolution digital elevation model (DEM), freshwater element occurrence records from the Atlantic Canada Conservation Data Centre (ACCDC), temperature data for the region from Institut National de la Recherche Scientifique (INRS) (e.g. minimum and maximum temperatures during summer months, length of high temperature periods etc), a networked hydrography layer from World Wildlife Fund (WWF), and levels of tidal influence for coastal areas.

3. Review variables to classify stream network based on TNC aquatic classification in the U.S. portion of the NA LCC (September 2015 to December 2015).

One of the objectives of this project is to ensure the aquatic classification developed for the Canadian portion of the NA LCC is compatible with the aquatic classification which already exists for the U.S. NCC will review the classification variables and data used in the aquatic classification developed by TNC's Eastern Conservation Science office. We will work collaboratively with TNC staff to ensure the end products are compatible and result in seamless aquatic classification for the entire NA LCC.

The classification variables will consider: size of rivers/streams, gradient, buffering capacity, temperature and tidal classes. Each of these variables has been shown to greatly influence the ecosystems and species found in each combination of the classes. These variables affect the stream bed morphology, alkalinity, stream temperature, flow rates, channel size, pool characteristics, sinuosity and more. The interaction of all these variables, in addition to climatic and historic factors, helps to predict the distribution of freshwater biota.

Partners will be consulted to ensure that the variables used in the TNC analysis for the aquatic classification in the U.S. portion, are relevant/scientifically accurate for Canadian partners. Variables and definitions of classes will be reviewed by the steering committee.

4. Delineate watershed and drainage basins (January 2016 to March 2016).

The International Joint Commission (IJC) has cross walked watersheds that straddle the international border but watersheds located solely within Canada are not available at a fine enough scale for this analysis. NCC staff will work with Arlene Olivero-Sheldon of TNC to replicate, in Canada, the process used to delineate drainage basins on the U.S. side of the border. Using a high resolution DEM, watershed drainage areas will be delineated for each reach in the Canadian National Hydro Network (NHN). These detailed watersheds will allow sampling and accumulation of upstream land characteristics for each reach. These watershed attributes are critical to assigning the size, buffering capacity, and temperature class of each reach. Final iterations of the watersheds drainage basins will be reviewed by steering committee members to ensure accuracy.

5. Process the remaining aquatic classification variables and determine classes within each one (March 2016 to September 2016).

Once all input datasets have been acquired, NCC will work with TNC staff and the aquatic classification steering committee to determine appropriate classes within each aquatic classification variable. To do this we will 1) run analyses to test natural breaks in the data (where data naturally falls into classes); 2) examine relationships between classes and known occurrences of various aquatic species (ACCDC database); 3) examine proposed classes and compare to other similar classification systems (including

TNC's) . A cluster analysis will be run to examine the relationship of rare stream biota to each class. Once classes within each variable have been determined, we will review with the steering committee and reach out to additional experts and solicit their opinion.

This analysis will be conducted for stream size, gradient, geologic setting/buffering capacity, stream temperature and tidal class. In some cases, such as stream temperature, additional processing will be required to model the relationship between the variable and species occurrences.

6. Combine classification variables and individual classes and determine resultant stream types (September – December 2016)

Once all classes have been finalized, we will then merge all variables together to determine the total number of combinations. Likely, this will result in too many stream types and will need to be simplified to make the classification more useful. Based on methods from TNC's aquatic classification for the U.S portion of the NA LCC, NCC will reduce the number of aquatic habitat types by 1) variable prioritization rules that prioritize across variables (e.g. size is more important than geology) 2) collapsing rules that prioritize the thresholds within variables (e.g. size 1 and 4 are more different than size 1a, 1b and 1C) and 3) removing biologically insignificant combinations. The resulting simplified classification will be mapped and presented to the steering committee for review.

7. Map view, final report and produce communication materials (January 2016- March 2017).

The results of the Canadian aquatic classification system and corresponding GIS products will be presented to all steering committee members (i.e. conservation partners) and other interested parties (i.e. other conservation organizations, NA LCC partners). This will be done early enough in the project implementation process to provide an opportunity for all partners to comment and submit critical feedback. Steering committee members will be solicited for feedback throughout the development of the aquatic classification.

To facilitate easy access to partners, NCC will upload the data to Two Countries, One Forest's Nature Atlas, which uses DataBasin to display the map of the classification, provides the users with a brief description and will link the user to the final report. Users can also view the data on DataBasin or download the GIS files if they have GIS capabilities. NCC and TNC will also provide links to the data and final report on their respective websites.

NCC will issue a news release and conduct interviews with media outlets located within the Canadian portion of the NAP Ecoregion to inform the public that an aquatic classification for the region is being developed and that information will be shared with all interested groups and organizations. In the media release, we will communicate the importance and results of this project while recognizing funding partners for their contributions. Information will also be conveyed to present the broader context and importance of this classification within the larger landscape (entire NA LCC). A joint media event could also be arranged with partners to celebrate the completion of a seamless U.S./Canadian aquatic classification.

Measurable Products and Outcomes:

Final products will include 1) A consistent mapped aquatic classification for the Canadian portion of the NA LCC which will be seamless with previous NA LCC supported classification currently available for Maine to Virginia 2) A GIS dataset of hydrography coded with key attributes used in the U.S. classification such as stream size, gradient, geology, stream temperature and tidal class. 3) A report describing the methods used to develop the classification and full metadata for any GIS-layers derived through this project. NCC will be reporting back to the NA LCC community through WebEx presentation to report progress.

Budget: September 2015 – March 2017

Fiscal Contact; Christina Appleby; 1-877-231-4400

Total project cost; $ 174,116

Total NA LCC funding request; $110,000

Agency Partner Leverage Amount: We have pledges of support from partners (totalling $5,800 in-kind services), as well as the Salamander Foundation ($25,000). We are awaiting confirmation of other private sources of funding.

Category	Requested from NA LCC	Leveraged Funds	In – kind Services	Total Budget
Personnel Service (i.e. salaries)	$80,000	$43,536	$0	$123,536
Fringe Benefits and Indirect Overhead (15% of salaries)	$12,000	$8,780	$0	$20,780
Contracts	$15,000	$0	$0	$15,000
Supplies and Materials	$0	$4,500	$5,800	$10,300
Travel	$3,000	$0	$0	$3,000
Other	$0	$1,500	$0	$1,500
Total	$110,000	$58,316	$5,800	$174,116

Description of Project Costs:
Personnel time is estimated at 360 days (18 months). Includes Manager of Conservation Science (NCC Atlantic), Manager of Conservation Science (Quebec), a hired Aquatics Ecologist/GIS technician Fringe benefits are included in the Personnel line at 15% which includes costs such as vacation pay, medical benefits and federal/provincial income tax
Supplies and materials include a work station, the costs associated with hosting meetings and the value of GIS datasets. Travel is anticipated a minimum of 3 trips for the duration of the project. In-kind materials include GIS datasets donated for use in this project.
We will be contracting technical assistance from TNC's Eastern Conservation Science office out of Boston, MA.
Travel costs include car rental, gas, overnight lodging and per diem.

Principal Organizations leading the project

Nature Conservancy of Canada (NCC) is Canada's leading conservation organization; protecting over 2.7 million acres across the country; over 62,000 acres in Atlantic Canada. NCC protects important habitat, plants and animals through the science-driven acquisition and stewardship of ecologically significant land. Our mission is to protect areas of biodiversity for their intrinsic value and for our children and grandchildren. We are non-advocacy, non-confrontational and take a very business-like approach to our work; building our success through partnership and mobilizing resources in a collaborative way with individuals, corporations, community groups, foundations and government agencies.

NCC has an excellent track record that has been built over more than fifty years, including being ranked in *MoneySense Magazine's* "Charity 100 Rankings[1]" as the top Environmental Charity in Canada [with an A grade] for the fifth consecutive year based on our ability to keep costs low and put more than 84 cents of every dollar directly into conservation. We have also received top ratings from The Financial Post and Charity Intelligence. NCC aspires to build on this success and the solid program we have established in Atlantic Canada.

The Nature Conservancy (TNC) is one of the world's leading conservation organizations, with more than a million members who support our work to protect ecologically important lands and waters for nature and people. We owe our success to a collaborative, science-based approach that offers pragmatic solutions to conservation challenges. TNC has a 60+-year record of protecting ecologically important lands and waters for nature and people. Since 1951, we have protected more than 119 million acres of land and 5,000 miles of rivers worldwide, and we operate more than 100 marine conservation projects globally. In addition, we have leveraged billions of dollars for conservation in the U.S. through legislative and ballot initiatives at the federal, state, and local levels. The Conservancy develops and uses the best available science to guide our conservation actions.

Project Director: Margo Morrison, Manager of Conservation Science, Nature Conservancy of Canada - Atlantic Region: Margo has 11 years of experience in conservation planning in Atlantic Canada. She holds a Bachelor of Science in Forestry from the University of New Brunswick, a minor in Geographic Information Systems and is a Registered Professional Forester in New Brunswick. Currently, Margo sits on the board of directors of Two Countries One Forest (2C1F) and the steering committee of Staying Connected Initiative (SCI).

Principle Investigator: Arlene Olivero – Sheldon, Aquatic Ecologist and GIS analyst, The Nature Conservancy, Eastern U.S. Division. : Arlene has 16 years of experience in conservation planning GIS. Arlene has a Masters of Science in Biology from the University of Massachusetts Boston and a Bachelor of Science in Natural Resources from the University of Michigan. Arlene's areas of expertise include freshwater ecosystem classification and condition assessment, raster and vector GIS analysis with a focus on hydrologic modeling, and conservation area planning and prioritization.

Principle Investigator: GIS Analyst (New hire) - NCC will be seeking an individual with advanced GIS skills and knowledge of hydrology and classification work

Project Advisor: Mark Anderson, Director of Conservation Science, The Nature Conservancy, Eastern U.S. Division, TNC

Literature Cited

Linke, S., E. Turak and J. Nel. 2011. Freshwater conservation planning: the case for systematic approaches. *Freshwater Biology* 56: 6-20.

Olivero A., M.G. Anderson. 2008. Northeast Aquatic Habitat Classification System. The Nature Conservancy, Eastern Conservation Science. 90pp. http://www.rcngrants.org/spatialData

[1] To view the full MoneySense Article, please visit http://www.moneysense.ca/planning/2015-charity-100-grades/