GREENLAND® GROUP of Companies "Value-Added Engineering and Technology Services"

Internet Decision Support System Platforms

- **THREATS** TM (Cumulative Effects Watershed Monitoring)
- <u>CAN</u>adian <u>Watershed Evaluation Tool (CANWET M</u>)
- **ISWMS**TM International Flood Forecasting Joint Venture



Updated: April 2017

GREENLAND® Group - Mission Statement

The **<u>GREENLAND</u>**[®] **Group** provides civil and environmental engineering services, as well as urban design planning expertise.

We also strive to offer excellence in 'niche' disciplines by <u>developing</u> <u>environmental software systems and water technology products</u>, while maintaining our unique corporate brand with the Public, Indigenous Peoples, Business Community, our Clients and Employees.

Since 1994, the GREENLAND® Group has also been committed to developing innovative solutions with a conservationist ethic that respects the environment from the outset and incorporates best available science, open data, and defendable technologies to address climate change concerns (and opportunities).



For more information visit, www.grnland.com

Technologies Enterprise

Internet Decision Support System Platforms (with International Partners)

Since 2013 'Intelligence Information' Age





Mobile Devices and Sharing



COMMUNITECH







1980-90's 'Tandy, IBM-XT & AST Computers and Dot Matrix Age'

DOS>



Windows M

ISWMS



Since 2000

[•]Information Technology' Age

Five (5) Components of Cumulative Effects Management for Canadian Watersheds





- What exists on the land? How close are we to limits? Will this project application put us over?
- Can we fast-track a development and illustrate no harm?
- Are there areas where the subject development can be accelerated "IF" the environmental risk is low and the environment is stable?
- What are the environmental changes that have occurred? Are regulations protective?
- Given the resource distribution, probability and economics of the subject development, and existing state of the environment, what is the predicted environmental response to the development?
- Is there an alternate scenario?
- Will the predicted state result in exceedances of a thresholds and will <u>climate change</u> be a factor?

Five (5) Components of Cumulative Effects Assessments for Canadian Watersheds (cont'd)





1st SESSION, 41st LEGISLATURE, ONTARIO 64 ELIZABETH II, 2015

Bill 66

(Chapter 24 Statutes of Ontario, 2015)

An Act to protect and restore the Great Lakes-St. Lawrence River Basin 1^{re} SESSION, 41^e LÉGISLATURE, ONTARIO 64 ELIZABETH II, 2015

Projet de loi 66

(Chapitre 24 Lois de l'Ontario de 2015)

Loi visant la protection et le rétablissement du bassin des Grands Lacs et du fleuve Saint-Laurent

The Hon. G. Murray Minister of the Environment and Climate Change L'honorable G. Murray Ministre de l'Environnement et de l'Action en matière de changement climatique

1st Reading	February 18, 2015
2nd Reading	June 4, 2015
3rd Reading	October 7, 2015
Royal Assent	November 3, 2015

1 ^{re} lecture	18 février 2015
2 ^e lecture	4 juin 2015
3° lecture	7 octobre 2015
Sanction royale	3 novembre 2015

Printed by the Legislative Assembly of Ontario Imprimé par l'Assemblée législative de l'Ontario



Strengthening Great Lakes Protection



The Great Lakes and St. Lawrence River Basin legislation (Bill 66) enacted November 2015 by the Government of Ontario will:

- Ensure monitoring / reporting programs are established/maintained;
- Commit to establishing sub-watershed targets to reduce algae levels;
- Establish targets to prevent the loss of wetlands;
- Have regard for traditional First Nations ecological knowledge;
- Require comprehensive progress reports every three (3) years;
- Require that Great Lakes Strategy be reviewed every six (6) years;
- Create opportunities for Ontarian citizens to become involved in the protection / restoration of the ecological health of the Great Lakes;
 Improve the capacity of the Great Lakes Basin to be resilient to the impacts of climate change; and,
- Have regard for individual and <u>cumulative impacts</u> and stresses and also support data sharing collaborations.



Five (5) Components of Cumulative Effects Assessments for Canadian Watersheds (cont'd)



<u>The Healthy River Ecosystem</u> AssessmenT System (aka THREATS™)





ASSESSING CUMULATIVE EFFECTS OF CANADIAN WATERS

DR. MONIQUE DUBÉ; CANADIAN RIVERS INSTITUTE, UNIVERSITY OF NEW BRUNSWICK

1st SESSION, 41st LEGISLATURE, ONTARIO 64 ELIZABETH II, 2015

Bill 66

(Chapter 24 Statutes of Ontario, 2015)

An Act to protect and restore the Great Lakes-St. Lawrence River Basin 1^{re} SESSION, 41º LÉGISLATURE, ONTARIO 64 ELIZABETH II, 2015

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Imprimé par l'Assemblée législative

de l'Ontario

CANADIAN WATER NETWORK

Printed by the Legislative Assembly of Ontario



Key Outcomes of Monitoring





Real-time Monitoring + Science-based Modeling = Cumulative Effects Decision Support







THREATS[™] v.2 (On-going) – 3D pipeline (oil & gas) metric for Alberta with temporal spill query and regard for sensitive land features (e.g. wetlands, wildlife, fisheries, etc.) and First Nation Lands





THREATS[™] v.2 (On-going) – Ontario watershed delineation and flow tracing tools to assess impacts from "pipeline incidents" (or other chemical spills) upon drinking water intakes (incl. PPTW locations & river/lake intakes)





THREATS[™] v.2 (On-going) – Canada-wide analysis of real-time Hydrometric Stations (climate/river flow) <u>and</u> Provincial water quality/benthic data

Five (5) Components of Cumulative Effects Assessments for Canadian Watersheds (cont'd)



CANadian Watershed Evaluation Tool (aka CANWET™)







CANWET[™] is an open source GIS and integrated water budget, nutrient and contaminant transport plus climate change impact decision support system. Since 2003, it has been used for urban & rural Assimilative Capacity Studies; Master Drainage Plans; TMDL and Other



Nutrient Management Studies; Source Water Protection Studies; and, Municipal Infrastructure Planning, Design and Environmental Assessment Projects.

Since 2006, the "Best Available Practices (BMP)" analytical tool built into **CANWETTM** (originally called PRedICT and part-of CANWET's U.S. "cousin" called 'MapShed') has been updated and used in Canada to estimate the reduction in nutrient, pathogen and sediment loadings associated with a variety of basin practices and climate change factors. CANWET™ has been used to develop subwatershed target and phosphorus offsetting (trading) programs with Ontario's water regulatory agencies and municipalities.

Version '5' (Internet Prototype) completed March/17 for Government of Canada.

Lake Simcoe Protection Plan







905+895+1281

905+853+5881

1.800.465.0437

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Fax:

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Box 282 Newmarket, Ontario

L3Y 4X1

February 26, 2010

R. Mark Palmer, P.Eng. President Greenland Consulting Engineers 120 Hume Street Collingwood, ON L9Y 1V5

Dear Mr. Palmer:

Re: CANWET[™] Model and Application



Please accept this letter as the Lake Simcoe Region Conservation Authority's endorsement of the CANWET^m (v.3) model. The Conservation Authority is extremely satisfied with the model's performance and accuracy and supports the continued use of this product in our watershed and others.

CANWET[™] was initially developed and tested to deal with nutrient loading issues within the Lake Simcoe basin. Since this time the model has become an invaluable tool in the development of growth plans, as was demonstrated in the Lake Simcoe and Nottawassaga River Assimilative Capacity studies to support the Inter Governmental Action Plan (IGAP) process within Simcoe County. The model has also been extensively used and tested as part of the Lake Simcoe Basin's Source Water Protection program to develop Tier 1 water budgets and, most recently, the development and implementation of the provincial Lake Simcoe Protection Plan (LSPP). The tool has allowed the Authority to develop water quality and quantity targets at a sub-catchment level and is being evaluated for use under a Phosphorus Trading program being considered by the Ministry of the Environment.

Please do not hesitate to contact me should you require any further information or assistance.

A

Sincerely,

Watershed

Michael Walters, CMM III General Manager, Watershed Management

MW/Imc

For

Life



County of Simcoe Water and Wastewater Visioning Strategy













January 19, 2012

SCHEDULE 8 Simcoe Sub-area





Simcoe County Water & Wastewater Visioning Strategy



The Study Simcoe County identified as a key



Wastewater Visioning Strategy.

area for planned employment and

Greenland retained to complete an infrastructure planning and water-ASSESS shed impact assessment study including GIS-based modeling of all County watersheds using CANWETTM (v.4).

Assess all existing water & wastewater system capacities with respect to servicing existing and proposed population growth in the County of Simcoe.

Sample Problem

Township of Essa (Angus Wastewater Treatment Plant) has residential wastewater capacity. Neighbouring municipalities,

(Clearview and have a negative servicing gap.	Adjala-Tosoro deficit waste	ntio) water
	SERVICING GAP ANALYSIS - TOWNSHIP ESSA	
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Project A and Concurrent International and Co

Study Objectives

CANNET

LINCI

SAN-9 Essa

Identify opportunities for all municipalities that are found to have a servicing gap.

* C4Nadian Watershed Evaluation COMPILE Compile genera review of existing environmental (natural, socio-economic) conditions for the County of Simcoe, including wastewater servicing opportunities and constraints using CANWET™- 4.









By connecting and treating 2031 wastewater flows from neighbouring municipalities (Clearview and Adjala-Tosorontio) at the Angus and C.F.B. Borden Wastewater Treatment Plants, there is a negligible increase in downstream phosphorus concentrations in the Nottawasaga River.

Submitted By:

- Greenland Consulting Engineers
- . Jim Hartman, P. Eng.
- . Trevor Boston, M.Sc., P. Eng.
- . Neil Marsden, B. Sc.
- . R. Mark Palmer, P. Eng.
- County of Simcoe
- Rick Newlove, P. Eng.—General Manager of Engineering, Planning & Environment
- . Grant Hudolin-Geographical Information Systems Manager
- . Matt Murray—Geographical Information Systems

Acknowledgments:

- Mark Aitken, CAO County of Simcoe
- Staff from the County of Simcoe
- Staffs from the Study Municipalities, First Nations & C.F.B. Borden
 - Elected Officials from the County of Simcoe & Study Area Municipalities
- District Municipality of Muskoka
- Regional Municipality of York
- Regional Municipality of Durham
- Nottawasaga Valley Conservation Authority
- Severn Sound Association

GREENLAND

Lake Simcoe Region Conservation Authority



Figure CPPS Township of Cloarview of 2 Opportun





Evaluation of Policy Options to Achieve Nutrient Reductions from Canadian Sources to Lake Erie

Prepared for: Environment Canada

Submitted By:



Greenland International Consulting Ltd.

In Association With:



University of Guelph

Wilkinson Insights Incorporated

Development of Policy Options & Lake Erie Demonstration Use of the CANWETTM Decision Support System (On-going)





NOTE: Current Lake Erie Basin Conditions and Without Climate Impact Analysis

Environment and *

Environnement et Climate Change Canada Changement climatique Canada Proposed IJC, OFA, UGuelph, UWaterloo, Penn State and IBM Collaboration to Use CANWET[™] for a 'Multi-Tier' Cumulative Effects Internet DSS on the Great Lakes Basin (On-going)





International Joint Commission Canada and United States



Commission mixte internationale Canada et États-Unis

February 24, 2015

Hussein Abdullah, Ph.D., P.Eng. Director, School of Engineering University of Guelph 50 Stone Road East Guelph, ON NIG 2W1

Dear Dr. Abdullah,

Thank you for your letter of January 26, 2015, regarding the University of Guelph's partnership with Greenland Consulting Engineers and how your emerging watershed evaluation tool (CANWETTM) may help address the issue of harmful algal blooms in Lake Erie.

We would be pleased to arrange a meeting with you and your colleagues to learn about your project ideas.

I have been made aware of Greenland Consulting Engineers and CANWETTM through briefings given to me by IJC scientists following conference presentations and informal webinar presentations. The IJC wishes to bring the best modelling technologies available from both Canada and the United States to the table as it seeks to advise the federal governments on how best to reduce loadings of nutrients to Lake Erie and improve water quality. You may be interested to know that the IJC is leading a binational effort to apply the USGS-developed SPARROW water quality model to the entire Great Lakes Basin.

Dr. Glenn Benoy, Senior Water Quality and Ecosystem Adviser, will represent the Canadian Section of the IJC in this discussion with the University of Guelph and Greenland Consulting Engineers. As necessary, he will involve science advisers from the IJC's United States Section in Washington, DC, and it's Great Lakes Region Office, in Windsor, Ontario. Dr. Benoy can be reached by telephone at 613-995-0433 or by email at <u>benoyg@ottawa.ijc.org</u>. As an aside, Glenn received his Ph.D. from the University of Guelph.

Gordan plalle

Gordon Walker, Q.C. Chair, Canadian Section

cc: Camille Mageau, Canadian Section, Secretary Glenn Benoy, Canadian Section, Senior Water Quality and Ecosystem Adviser

234 Laurier Avenue W., 22rd Floor Ottawa, ON K1P 6K6 Phone: (613) 995-2984 Fax: (613) 993-5583 commission@ottawa.ijc.org www.ijc.org 100 Ouellette Avenue, 8th Floor Windsor, ON N9A 6T3 Phone: (519) 257-6700 Fax: (519) 257-6740 commission@windsor.ijc.org

2000 L St. NW, Suite 615 Washington, DC 20036 Phone: (202) 736-9000 Fax: (202)632-2006 commission@washington.ijc.org



Real-time Monitoring + Science-based Modeling = Cumulative Effects Decision Support





Labelling Letter

Mrs Jing Li Lund University Paradisgatan 2 SE-221 00 Lund Sweden

24th February 2016 Brussels,

Dear Mrs Jing Li,

We are pleased to confirm the labelling of the project FLOODVIEW under our Open Call 7. This label is awarded subject to the satisfaction of national funding authority's requirements and obtaining funding.

ACQUEAU is the first EUREKA Cluster dedicated to environmental and water related technologies. It aims to promote innovation and market driven solutions to develop new technologies in the water sector. The ultimate aim of a EUREKA Cluster is to facilitate the generation of market-driven, pan-European collaborative water research and technological development R&D projects for the benefit of the European industry.

The ACQUEAU label is awarded to project proposals with the potential of developing breakthrough innovations. It allows successful consortium companies to apply for national funding in support of the labeled project; the label is an assessment of quality, economic interest and viability of the projects.

In order to receive the label, please, proceed to make the payment for the administration fee (see invoice attached). This is set at the 0.15% of the proposal budget which covers the cost of administering the call process.

Our warmest congratulations - we look forward to working with Project Assignments, and your partner on this innovative project and keep at your disposal for any additional information or request you might have.

Yours sincerely,

Daniel VILLESSOT Chairman of the Board

ACQUEAU – Eureka cluster for water Rue Neerveld 107/ 1200, Brussels – Beigium Tel: +32, 2,777,0986 / www.acqueau.eu



ISWMS[™] Internet Platform International Joint Venture (On-going)

NEWS LOCAL

Local firms going to Paris for global conference



By JT McVeigh, The Enterprise-Bulletin Monday, September 14, 2015 10:45:59 EDT AM



Eric Palmer, left, along with his parents Jane and Mark and brother Andrew are all of Greenland Consulting Engineers. The firm, long-recognized for their innovation will be heading to Paris, France, one of two Collingwood firms representing the National Research Council.

Integrated <mark>Science and Watershed Management</mark> System (ISWMS™)



The Integrated Science and Watershed Management System (ISWMS[™]) was originally developed by the GREENLAND® Group as a windows-based Decision Support System (DSS) for stormwater management; hydrological modelling; floodplain mapping and flood forecasting. Version '1' was completed in 2003.

At the time, the long-term DSS 'vision' (but depending upon the availability of certified open data and timely evolution of cost-effective operational platforms) included other science-based tools + integrated GIS / Internet tool sets.

The ISWMS[™] goal <u>'now with international partners & referred to as 'FLOODVIEW'</u> includes multi-functional stormwater management; hydrologic; water quality; nutrient trading; hydraulic and contaminant transport; flood forecasting; climate change impact; instream (biological) health assessment; and, Best Management Practice capabilities for watershed management programs. Our other Internet-based platform tools will also be used for concurrent water infrastructure & flood control planning / design initiatives.



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Mrs Jing Li Lund University Paradisgatan 2 SE-221 00 Lund Sweden

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Yours sincerely,

Daniel VILLESSOT Chairman of the Board



ACQUEAU – Eureka cluster for water Rue Neerveld 107/ 1200, Brussels – Belgium Tel: +32 2 777 0986 / www.acqueau.eu











SGBLS Source Water Region (1 of 3 Pilot Sites)





County of Simcoe Office of the Chief Administrative Officer 1110 Highway 26, Midhurst, Ontario LOL 1X0 Main Line (705) 726-9300 Toll Free 1-866-893-9300 Fax (705) 725-1285 simcoe.ca



October 19, 2015

Mr. R. Mark Palmer, President / CEO Greenland International Consulting Ltd. 120 Hume Street Collingwood, ON L9Y 1V5

Dear Mr. Palmer:

Re: Canada-Europe Partnership to Develop a Cloud-based Flood Reduction & Forecasting Platform

The County of Simcoe is the upper tier government and planning authority for most of the South Georgian Bay – Lake Simcoe Source Water Protection Region. The County, in partnership with its member municipalities, other levels of government, floodplain management agencies and two (2) conservation authorities, also provides leadership through policy, and actively in the restoration and protection of the environmental health and quality of these watersheds. As you know, in order to comply with, and be environmentally proactive with respect to the Province of Ontario's "Places to Grow" legislation, the County of Simcoe utilized innovative decision support tools such as Greenland's CANWET™ model. In 2012, CANWET™ was also used by the County to prepare a "Water and Wastewater Infrastructure Visioning Strategy". To this day, the information in the Strategy's final report is used by local municipalities, development interests and other stakeholders as a background reference to help identify sustainable development solutions.

As part of Greenland's growing international opportunities and commercialization of other in-house tools and decision support systems, we believe the subject Canada – Europe partnership will enable Greenland and its Ontario-based partners to further develop the "Integrated Science and Watershed Management System (ISWMS™) not only for use across Canada but also overseas for the benefit of many. The ISWMS™ platform includes the CANWET™ system, other proven tools and new ones being developed for an integrated stormwater management; low impact development; climate adaptation; and floodplain management focus.

This letter confirms the County of Simcoe's commitment of support which includes initially facilitating the introduction of this landmark international collaboration with all 16 local municipalities, other governments (small and large) and other agencies that partner now with the County of Simcoe on land use planning; infrastructure renewal; and flooding risk/damage reduction initiatives. Further considerations could also be contemplated through County Council once the project is approved and underway in the spring 2016.

As always, I look forward to our continued working relationship with you and your colleagues and the significant benefits these efforts will have for our residents and environment. The County of Simcoe appreciates your efforts towards developing information based decision making tools and we are confident that this project will prove beneficial in our collaborative goal to improve watershed health for all County residents.

If you require any further information, please do not hesitate to contact me.

Sincerely,

Mark Aitken Chief Administrative Officer The Corporation of the County of Simcoe

CAO-003-C01

Town of Collingwood

SGBLS Source Water Protection Region

Internet ISWMSTM Platform - Pretty River Watershed (On-going)



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ISWMSTM – SGBLS Source Water Protection Region (*On-going*)

THANK-YOU!



"I want you to find a bold and innovative way to do everything exactly the same way it's been done for 25 years."

