46th Meeting of the

US - Canada

Hydrographic Commission









National Report by Canada

Executive Summary

This report to USCHC46 provides a summary of Canadian activities and points of interest since the previous USCHC meeting which was held in June 2022.

1. Hydrographic Office

- **1.1** Annie Biron has been appointed as Regional Director of CHS Quebec Region.
- 1.2 In the summer of 2022, the Canadian Government announced a renewal of the Ocean Protection Plan (OPP).

Under the renewed program, the CHS will receive an investment of \$84 million over a period of 9 years to deliver on two key initiatives:

- Advancing Arctic surveying and charting: continue to survey and chart to increase coverage and fill gaps; leverage innovation including: increased use of automated data processing, spacebased remote sensing applications, uncrewed and autonomous surface and subsurface systems;
- Community Based Hydrographic Data Collection and Use: empower indigenous and coastal communities to collect and use hydrographic data, building and expanding on recent pilots and initiatives. (This is one element of crowd source bathymetry the CHS is pursuing).
- 1.3 The CHS, along with all other departments in the Canadian government, has recently announced its plans to transition to a hybrid work model, combining remote work and in-office work. This approach aims to boost employee flexibility and productivity while prioritizing the safety and well-being of the workforce during the ongoing COVID-19 pandemic. The CHS will work closely with its employees to facilitate a seamless transition to the new hybrid work model, which will become fully effective by the spring of 2023.
- 1.4 As part of CHSTransformation (Chapter 1- Workplace and workforce), CHS recently conducted an organizational-wide culture review, covering all aspects of its functions, programs, and areas. The Culture Review was carried out internally and included engaging the services of Organizational Effectiveness consultants in 2022. The aim was to reaffirm CHS's commitment to promoting a highly skilled, knowledgeable workforce that reflects the diversity of Canadians, while ensuring a healthy and rewarding work environment. The culture review had three key objectives:

- To evaluate employees' workplace experiences, including relationships and interactions with managers, colleagues, co-workers, and clients/customers;
- To assess any perceived barriers to inclusion in the workplace; and
- To provide recommendations to enhance work, workplace, and employee satisfaction.

Results have been shared with staff and recommendations are being addressed. Plans are to administer a yearly follow-up short survey to monitor progress.

- **1.5** The monthly meetings between the office of Coast Survey and CHS Central have been ongoing, with discussions covering various topics such as data sharing, transboundary evaluation of product coverage, data acquisition locations, and IGLD. The Pacific and Atlantic regional offices have also conducted meetings with their Coast Survey counterparts to explore transboundary coverage between Canada and the United States, providing an opportunity for CHS and OCS staff to establish connections in those regions. For more information, please refer to the HGPSC's report to USCHC46. These meetings have been beneficial in fostering collaboration and information exchange.
- **1.6** The CHS has continued in its Paper Chart 2.0 efforts. Paper Chart 2.0 represents the next iteration and successor to traditional paper charts, and as such, its appearance will differ from the familiar look and feel of its predecessor. This innovative upgrade will enable CHS to optimize the production of paper charts from ENCs, freeing up valuable resources to concentrate on electronic chart updates and other pressing national priorities. The CHS plans to automatically generate paper charts by utilizing its existing portfolio of Electronic Navigational Charts. Recognizing the importance of adhering to I HO S4 standards for official paper charts, CHS is currently assessing via a contractor whether the output of Paper Chart 2.0 conforms to S4 and where it falls short. The analysis will include recommendations for strategies to ensure comprehensive alignment between Paper Chart 2.0 and IHO S4. CHS plans to share these results with the IHO community.

2. Survey

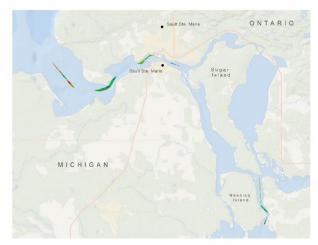
The Canadian Hydrographic Service (CHS) performs surveys to collect and provide hydrographic information and products to support safe, efficient, and sustainable marine navigation in Canadian waters. Its critical annual surveys included in 2022:

- Bathymetric survey operations conducted throughout the interconnecting waterways of Detroit,
 St. Clair and St. Mary's Rivers in support of Canadian Coast Guard waterways
 maintenance/dredging operations and incident response;
- CHS surveys for Canadian Coast Guard waterway management (between Quebec City and Montréal).

The CHS also performed surveys in a number of areas including:

In the Pacific Region, the British Columbia coast, from Southern Vancouver Island to the North Coast, Plumper Sound, the vicinity of the Sombrio fault line, and various areas in Barkley Sound, Gulf Island Anchorages, Kootenay Lake, Winchelsea Islands, Little River, Whaletown, and Hardy Bay/Bear Cove for

BC Ferries and Kitimat; in the Atlantic Region, Eastern Shore Islands, Port Joli, Ports of Halifax and Charlottetown; in Ontario and Prairie, Nipigon Strait, Lake Superior; and in Quebec Region, North Shore & Gaspésie Peninsula, Cacouna-Bic. Arctic Survey work will be reported at ARHC13 in September 2023.





New Surveys Sault Ste. Marie Area

New Survey Detroit River

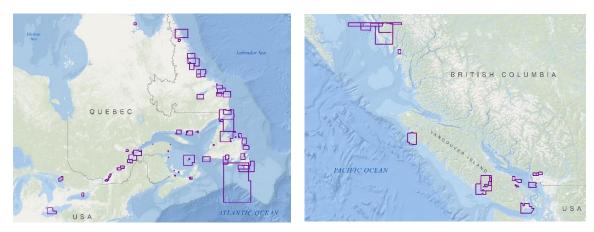
3. New Charts and updates

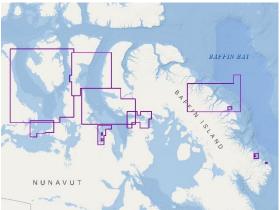
3.1 Between May 1st, 2022 and Jan 15th, 2023, the CHS released 15 new ENC's, and 119 new edition ENC's, 6 new paper charts, 28 new edition paper charts.





New ENC's released since May 1, 2022.





New Edition ENC's released since May 1, 2022.



New Chart's released since May 1, 2022.



New Edition Charts released since May 1, 2022.

- **3.2** In preparation for moving to S101 CHS is modernizing its portfolio, and will be retiring charts available in old formats in order to offer the most up to date formats. The CHS has initiated the cancellation of BSB raster charts in areas where sufficient ENC coverage existed. In March 2022, 139 of the 810 BSB's were cancelled following months of consultation. Currently, an additional 160 BSB's have been identified for cancellation. Moving forward, the CHS will link BSB cancellation to ENC generation on the grid. This approach ensures data being moved to the grid has been looked at, vetted and validated. Once those ENC's on the grid are known to maintain the same coverage as their BSB counterpart, the CHS will safely cancel the BSB.
- **3.3** CHS uses CARIS HPD, which is now compliant with S-100 standards. With the recent acquisition of the S-100 module, the CHS is moving to start creating and testing the S-101 edition 1.0 ENC's.
- **3.4** The CHS's move to a gridded schema is well-aligned with the new coverage categories introduced in S-101, which include Port, Transit, and Overview. While grids are not mandatory for S-101, the CHS recognizes the benefits of rationalizing our coverage to a maximum of 3 scales at a single site. This approach is well-suited for cataloguing purposes and will enhance our ability to provide effective and efficient charting services.
- **3.5** The CHS has established grids that are located south of the 68th parallel. At present, Hudson Bay and James Bay are not included in these grids as they are being considered for inclusion in the Arctic Grid, which is currently under review by the Arctic Hydrographic Commission.

4. New publications & updates:

- **4.1** The Canadian Hydrographic Service recently released/collaborated on a number of articles posted in the International Hydrographic Review. These include:
 - The Hydrographer of the Future Reflections on an International Virtual Workshop (Nov 2022)
 - CHS Priority Planning Tool (Nov 2022)
 - Development of the S-121 for Maritime Limits and Boundaries (Nov 2022)
 - Empowering Women in Hydrography SAFETY FIRST! (May 2022)

5. Maritime Safety Information (MSI)

- **5.1** Information on marine communications and traffic services (MCTS) in Canada is available at: https://www.ccg-gcc.gc.ca/mcts-sctm/index-eng.html
- **5.2** Canadian Coast Guard (CCG) continues to operate the Navigational Warnings (NAVWARNs) web site and subscription service which replaced the domestic Notice to Shipping (NOTSHIP) services. For further information visit:

http://nis.ccg-gcc.gc.ca/

- **5.3** In April 2022, Canada was subject to a scheduled IMO audit. With respect to the provision of hydrographic services (MSC 81/24/4 Annex; SOLAS regulations V/4 and V/9), there were no findings of non-compliance or corrective actions required. The position of the CHS was greatly strengthened by the organization's own internal quality management system and preparation was aided by the IMO audit checklist developed by the IHO.
- **5.4** Canadian Coast Guard is the lead for e-navigation or E-nav in Canada and has been hosting regular meetings with stakeholders to discuss standardization of AIS data feeds to upcoming single window reporting, optimization and automation of navigation operations..

CHS has been testing new S-100 services in support of E-nav.

6. C-55

6.1 Canada is in the process of updating its C-55 information, including MSI.

7. Capacity Building

7.1 The recent approval of the OPP 2.0 Community Hydrography project aims to I empower coastal and indigenous communities to conduct self-directed hydrographic projects, thereby enhancing their capacity to collect and use data. In 2023, CHS will publish the first ever report on the State of Play of Community Hydrography in Canada.

8. Oceanographic Activities

8.1 CHS Bathymetric Gap Analysis update since USCHC45

In order to align with the US methodology to provide a regional status, the CHS developed a bathymetric gap analysis using a series of spatial analytical tools performed on all of the Canadian bathymetric data holdings to derive data classifications to present an understanding of the extent of bathymetric coverage in Canadian waters. With the methodology recently updated, the following results have been obtained (based on April 2022 data):

- Methodology has been updated to apply a 100m x 100m grid which is consistent with the Seabed 2030 assessment method
- Result of updated analysis show 86.4% of the 100m grid cells in Canadian waters are void of soundings.
- For the Great Lakes (Excluding St. Lawrence River), 75.46% of the grid are void of soundings. This considers Canadian waters only. *Note* this metric is reflective of the legacy data not yet loaded into the database

Results of Phase 1 version 2 – Data Driven method

	Canada		
Classification Name	Number of cells	Square kilometre	Percentage
GAP - Void of Soundings	508,028,872.00	5,080,288.72	86.41%
Minimal Coverage	7,870,459.00	78,704.59	1.34%
Moderate Coverage	1,437,563.00	14,375.63	0.24%
Full Bottom Coverage	70,587,963.00	705,879.63	12.01%

- **8.2** The bi-national International Great Lakes Datum (IGLD) Update project is currently underway. It is being managed by the Co-ordinating Committee on Great Lakes Basic Hydraulic and Hydrologic Data and its various sub-committees. While several components of the IGLD Update are ongoing, some key items are worth noting. They are as follows:
 - The 2022 GNSS campaign was successfully completed, collecting data at over 300 locations; the processing of that data continues. (https://www.greatlakescc.org/wp-content/uploads/2022/09/GNSS_one_pager.pdf)
 - An IGLD Fact Sheet been published (available here: https://www.greatlakescc.org/wp-content/uploads/2022/11/UPDATED_IGLD_factsheet.pd)f and a Low Water Datum Fact Sheet is being finalized
 - Work continues on the low water datum analysis, to determine which time series and record length to use, this information will inform decisions needed for low water datum
 - The low water datum decisions will have an impact on charting products.
- **8.3** CHS, working with oceanographer colleagues and with Environment and Climate Change Canada (ECCC), have developed a multi-scale IHO standard S-100 file production approach for S111 and S104 delivery at the following scales:
 - In-transit (open ocean),
 - approach (shelf and coastal) and

• nearshore and Port and waterway (high resolution)

Lower resolution in-transit and approach scale S-100 products are developed from existing NEMO ocean models already running within ECCC's operational environmental prediction systems. Medium and high resolutions S100 products are developed from six new NEMO based, multi-downscale (down to 20-30 m grid spacing) Port Prediction Systems (POPS) driven by existing ECCC larger scale NEMO solutions. These were developed specifically for dynamic electronic navigation (dE-nav) and enhanced oil spill response and cover six key high-traffic, high-risk Canadian Ports and Waterways:

- Port of Metro Vancouver BC
- Fraser River BC
- The Kitimat Estuary BC
- The St. Lawrence River Estuary Que
- Port of Canso NS, and
- Port of Saint John NB

Standards, or 'fit for purpose' evaluation criteria for model source data to feed dE-nav systems are not presently well described. Initially, and in the immediate future, many developing S-100 systems are likely to rely on pre-existing operational model solutions created for other or multiple purposes. Canada's new high-res POPs were developed with specific consideration, based on present understanding, of both dynamic electronic navigational and oil spill response needs.

Of note, these models were developed though a multi-departmental cooperation called the Canadian Operational Network of Coupled Environmental Prediction Systems (CONCEPTS). CONCEPTS is a collaboration between DFO, ECCC, the Department of National Defence (DND), the Canadian Space Agency (CSA) and the National Research Council (NRC), https://science.gc.ca/site/science/en/concepts. The pre-existence, and logical extension, of this cooperative predictive system development approach to include consideration of dE-nav needs has been key to enabling the parallel development of multiple new POPs solutions propagating capability to small area, high resolution scales where required.

Concepts procedures include both internal (CPOP and ACOM) and external expert-invited Canadian Science Advisory Secretariat (CSAS) model review and evaluation processes. These evaluations consider aspects of both qualitative and quantitative model performance, run-time stability and efficiency, and 'fit for purpose'.

A CSAS evaluation for the new high-resolution model solutions, including the first 'fit for purpose' Canadian evaluation for dE-nav services, is planned for Spring 2023. This evaluation is expected to generate recommendations for the development of additional, future 'fit for purpose' dE-nav criteria.

9. Spatial data infrastructures:

- **9.1** The Canadian Hydrographic Service's Marine Spatial Data Infrastructure is currently in its fourth year and is in the process of planning for the next five years.
- **9.2** In 2022, the Canadian MSDI has facilitated a number of applications including:

- Canada Marine Spatial Planning Atlas Integrates data into a common platform, uses applications to perform geospatial analysis and develops map products to support the development of publicly available interactive maps and marine spatial plans
- Canadian Aquaculture Public Reporting Interface (CAPRI): Allows the general public to examine drug and pesticide data for reporting aquaculture sites
- Canadian Extreme Water Level Adaptation Tool (CAN-EWLAT): A science-based planning tool for climate change adaptation of coastal infrastructure related to future water-level extremes and changes in wave climate
- Whale Insight: An interactive map displaying visual and/or acoustic detections of North Atlantic right whale detections in eastern Canadian waters.
- **9.3** All data published through the MSDI adheres to the Government of Canada's Harmonized North American Profile (HNAP) ISO 19115. Since its inception, the MSDI has contributed over 500 datasets to the Canadian Open Data Initiative. The MSDI has developed an infrastructure that relies on stakeholder expertise and adheres to set standards and security practices. The MSDI focuses on interoperability and data sharing.
- **9.4** The CHS NON-Navigational or NONNA-10 (2020) and NONNA-100 (2018) Bathymetric Data products continue to be available, since being released:
 - ~1.7 million CHS NONNA Product Downloads
 - Over 9,200 unique users
 - 4.3/5 user rating
 - ~1.25 million downloads are coming from the new Packages Layer
 - ~1 million CARIS Map Tile activity occurring per month
 - Our users are global.

10. Innovation

- **10.1** The Canadian Hydrographic Service is continuing to make progress on digital transformation, and has operationalized four out of eight chapters so far. Some results for each chapter are as follows:
 - **Chapter 2** is entitled: *CHS Business Model Modernization: Streamlining and strengthening our business practices.* The CHS has updated its agreements with key partners and modernized our internal revenue collection and reporting practices. Free and licensable data for use by the non-navigation community has been expanded.
 - Chapter 3 is entitled: Data Acquisition Transformation: Modernizing our data acquisition methods. Various software and connectivity for remote processing have been trialed/tested, including automation of manual processing procedures. Autonomous Surface Vehicles have been trialed/utilized for production surveys. Testing of low earth orbit communication systems for large data volume transfers have been performed. Currently, the CHS continues to contract for some data acquisition by autonomous platforms, remote data processing is pushing forward, and the last of the DFO-CG icebreaking fleet (CCGS Henry Larsen) is being fitted with an EM302 MBES. New (University of New Hampshire) QC tools are also being trialed towards streamlining

- data analysis and cleaning. The CHS has also operationalized remote sensing to support survey planning and charting. This includes the use of in-house expertise and contracting.
- **Chapter 4** is entitled: *Database Transformation: Transforming our databases*. Project leads have ensured that databases have been cleaned up to ensure data is accurate, digital and current. Principles of comparative validation have been applied which have prioritized legacy integration and the merging of data within regional production plans.

10.2 In conjunction with the IHO-Singapore Lab, the Nautical Information Provision Working Group (NIPWG) is directing a project to further develop and operationalize S-131. Canada is leading the project team and also is providing two years of funding.

11. Other Activities

- **11.1** The Canada/US Division of the United Nations Group of Experts on Geographical Names (UNGEGN) has recently been reactivated, and the CHS is an active participant in its meetings. One of the current priorities is to discuss how both countries are addressing derogatory names and to share best practices. In Canada at the national level, the CHS is a member of the Geographical Names Board of Canada (GNBC) Derogatory Names Working Group, which is working to establish a standardized method for addressing hurtful names assigned to land and underwater features.
- **11.3** Part of the Ocean Decade project's aim is to detect and study the more than 40 types of undersea features, each with its unique characteristics, to gain insight into new underwater ecosystems. As Seabed 2030 continues to update GEBCO's global bathymetry grid, we anticipate that detecting submarine features using GIS, geomatics, and deep learning will become increasingly feasible. To facilitate this, all undersea features in the GEBCO database are publicly available to build a digital inventory of training bathymetric data that can be used to detect additional undersea features with deep learning analysis. Other methods of analysis, such as remote sensing and geological data, can complement these results. Since 2017, this project has been primarily developed by university and college students working for the CHS. Key outputs include a methodology for detecting undersea features that can be used and reused by other hydrographic offices and the larger science community, criteria for the application of deep learning, and the development of an S-100 specification for undersea features. Additionally, we will produce a database of unnamed undersea features.
- **11.2** The CHS held an international workshop on the Hydrographer of the Future in April 2022, and the results were published to the IHR. Some of the key messages from that workshop include:
 - Focus on utilizing technology to fill in the gaps and automate processes
 - Increase skillset of the hydrographer (coding, links to other disciplines)
 - Able to validate and assign accuracy on the data even when not involved in its collection
 - The hydrographer will be a technical project manager, able to manage the data collection and perform the QA/QC on the data.
- **11.3** On 19 December 2022, Canada submitted an addendum to its partial Submission to the Commission on the Limits of the Continental Shelf regarding its continental shelf in the Arctic Ocean. In

accordance with the Rules of Procedure of the Commission (CLCS/40/Rev.1), a communication was circulated to all Member States of the United Nations, as well as States Parties to the Convention, in order to make public the executive summary of the addendum to the partial Submission, including all illustrative maps and coordinates contained therein.

Annex

The following represents coverage of new surveys obtained in 2022. This is only a selection of coverage, as the CHS continues work on processing data.



Figure 1: New Surveys Arctic Region



Figure 2: New Surveys Arctic Region

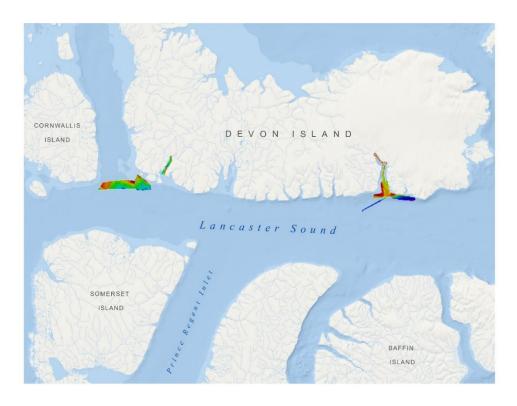


Figure 3: New Survey Arctic Region

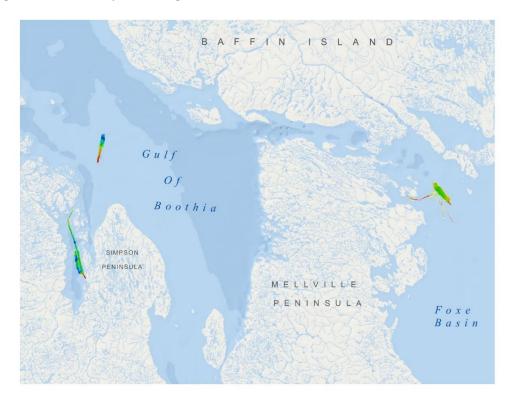


Figure 4: New Surveys Arctic Region



Figure 5: New Survey Nipigon Bay

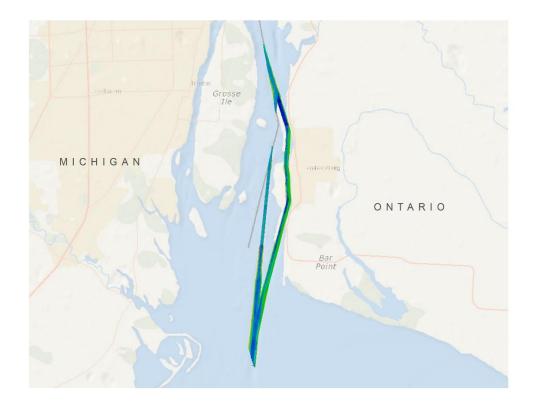


Figure 6: New Survey Detroit River #2



Figure 7: New Survey St. Clair River



Figure 8: New Survey St. Clair River #2

The following represent a selection of planned surveys for the upcoming 2023 season. (This does not include Arctic surveys).

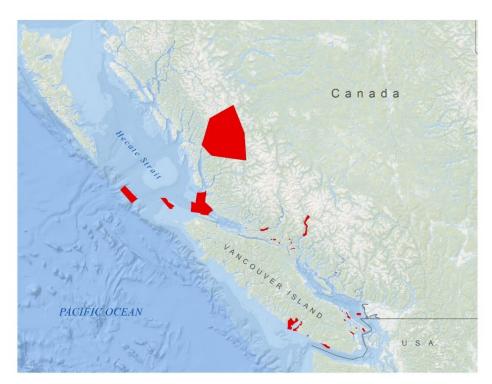


Figure 9: Planned Survey's Pacific Region

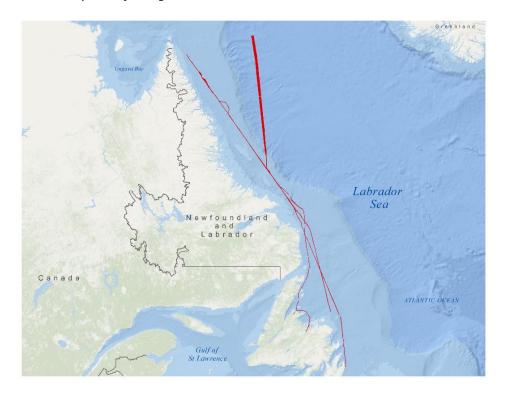


Figure 10: Planned Survey's Atlantic Region

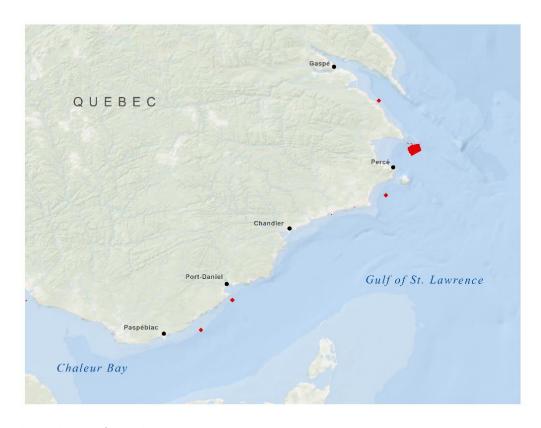


Figure 11: Planned Survey's Quebec Region

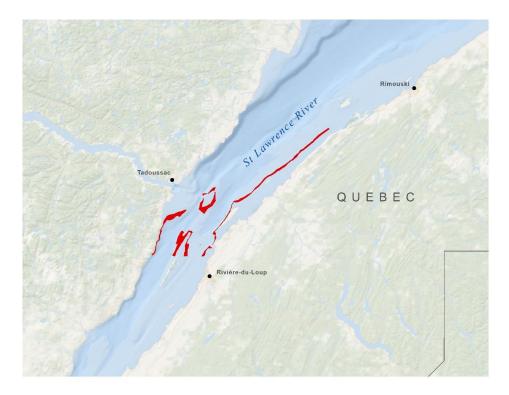


Figure 12: Planned Survey's Quebec Region