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Annual Report 2021-2022

The Surveyor General Branch

Canada 

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MESSAGE FROM THE SURVEYOR GENERAL

I am pleased to present the Surveyor General Branch's (SGB) annual report for the 2021–2022 fiscal year, the twelfth in a series that details our achievements, projects and publications.

This year's annual report:

- Showcases the volume of work and achievements of the branch in 2021–2022
- Highlights our four strategic priorities:
 - Indigenous Peoples' control of their lands
 - spatially enabling Canada for the digital economy
 - northern property rights
 - protection of Canada's oceans
- Discusses how the SGB will respond to current and future challenges, including the impact of the COVID-19 pandemic and a move to a hybrid workplace

The SGB continued to grow its importance within Natural Resources Canada's (NRCan) Lands and Minerals sector (LMS) and to contribute to sector-wide project collaborations with other branches and with other federal departments. The SGB continued to ensure that Canadians had access to secure and reliable land survey systems, clearly defined boundaries, and accurate positioning information to meet Canada's economic, social and environmental needs.

The SGB enjoyed many accomplishments and successes throughout 2021–2022, despite the ongoing COVID-19 pandemic. The pandemic affected each of the SGB's three programs, however, each program adapted to continue their work and serve Canadians who rely on our data and products.

As always, I invite you to review and provide comments on the report, and I look forward to your continued engagement.

Jean Gagnon
Surveyor General of Canada Lands
Canadian Commissioner, International Boundary Commission
Director General, Surveyor General Branch

THE SURVEYOR GENERAL BRANCH: WHO WE ARE

Our mission has continuously been to ensure that Canadians have access to secure and reliable land survey systems, clearly defined boundaries, and accurate positioning information to meet Canada's economic, social, and environmental needs. The SGB also contributes to the science and infrastructure that Canada needs to succeed in the global economy.

In 2021–2022, we had:

- a budget of
\$22,745,813
- **10 regional offices (RO) across Canada**
and 1 office in the National Capital Region
- **A dynamic workforce**
comprised of full-time and part-time staff, students and seasonal staff
- **154 employees,**
including survey engineers, geodetic engineers, survey technicians and support staff

OUR PROGRAMS

The SGB's three programs align with several government priorities and commitments. Our work contributes to NRCan's core responsibilities related to natural resource science and risk mitigation by providing important information about Canada's lands and supporting vital land management tools and practices.

- The **Canada Lands Survey System (CLSS)** helps to define, demarcate, and describe property boundaries and the extent of property rights for Canada Lands – the North, First Nations reserve lands, national parks, and offshore. With boundary certainty and a well-maintained property rights system, stakeholders can focus on community well-being and economic growth. A strong land survey system is especially significant to support Indigenous self-governance.
- The **Canadian Geodetic Survey (CGS)** provides the foundational positioning infrastructure, a fundamental reference framework that facilitates the accurate measurement of latitude, longitude, elevation, and gravity in Canada. It also monitors motion of our continental land mass in support of geomatics and geoscience. Such measurements are important not only for boundaries, but for anything for which precise geolocation matters, enabling mapping, land surveying, water management, and monitoring of natural hazards and engineering activities in Canada.
- The **Canadian Section of the International Boundary Commission (IBC)**, in co-operation with its United States counterpart, preserves and maintains a clear and visible boundary between Canada and the United States. This work includes maintaining the boundary monuments and open vistas through forested areas, as well as regulating construction and work within 3 metres of the 8,891-kilometre boundary. Having a clearly visible Canada-United States boundary is essential to the safety of citizens who carry out activities near the border and to law enforcement agencies for protecting the security of Canadians and preserving our sovereignty.

PROGRAM EVALUATION

To ensure that we are delivering on our commitments effectively and providing high quality products and services to our clients, the SGB regularly reports on and assesses the performance of its programs. The SGB tracks the progress and results of key projects that support our strategic priorities, as well those that help to improve our daily operations. These projects are monitored through an evergreen dashboard that is updated every two months and shared with SGB management (see Annex 1). In 2021–2022, seven dashboard projects were completed.

In addition to internal reporting, the branch periodically undergoes audits at the departmental level (except in 2020 because of the COVID-19 pandemic). The last audit on the Canada Lands Survey (CLS) program was in 2019. We are still working to address the remaining recommendations of this audit, through tracking commitments to clients; reporting on performance and projects; and following up on client satisfaction surveys.

The SGB also developed a communications strategy to align with stakeholders' requests for more person-to-person contact. The plan of action lists activities to be implemented to improve the planning of our engagement with our Indigenous communities. The SGB will also formally track in-person communication efforts to better document efforts and to identify regional or user-group gaps.

In 2020, the SGB conducted the 2020 Client Satisfaction Survey (CSS) for stakeholder groups, including Canada Lands surveyors, other government land approvers, and Indigenous end users and organizations. The CSS measured the satisfaction of clients' experiences with the CLSS system. The findings from this survey can be used to improve the relationship with key stakeholders by providing a better understanding of how and why different client groups use these services, tools, and data. Overall satisfaction levels with the SGB's services and digital tools were high in every audience; however, some points of improvement were identified by respondents.

Following this survey, this past year the SGB has worked to address improvements and developed an SGB Working Group comprised of managers and assistant directors to facilitate this process.

These improvements include:

- a revised guide for installing and retrieving MyKey¹
- Association of Canada Lands Surveyors (ACLS) training
- User videos for CLEVER² and e-Approvals
- improving and simplifying document searches
- renewing the web map browser for a modern look and feel
- adding a new version of the standards manual to incorporate additional specimen plans

¹ A unique digital credential that is issued to federal government employees

² The Canada Lands e-Validation of Electronic Returns (CLEVER) is an SGB web application that validates digital spatial files provided by ACLS surveyors.



CANADA LANDS SURVEYORS ACT

In 2016, the ACLS submitted a request to the Minister of Natural Resources to amend the *Canada Lands Surveyors Act* to allow for a more transparent and robust complaints and discipline process and to better align with the Canadian Free Trade Agreement respecting labour mobility.

In 2021–2022, the SGB undertook the modernization of the *Canada Lands Surveyors Act* (the Act). The modernized act will reflect the evolving responsibilities of a self-governing profession. The update will also address the 2016 ACLS requests making the complaints and discipline process more transparent and robust and by reducing the regulatory burden on government and industry.

The Regulatory Modernization Bill was introduced in the Senate on March 31, 2022. The bill includes proposed changes to the Act. The bill must pass the third reading in the House of Commons and the Senate before it becomes law.

STRATEGIC PRIORITIES AND HIGHLIGHTS 2021–2022

PRIORITY 1:

Indigenous peoples' control of their lands

The SGB continues to support reconciliation initiatives within Indigenous communities. In 2021–2022, the Land Surveying Capacity Development program completed its fourth year of operations.

Land Survey Capacity Development program Three First Nations completed the program in 2021–2022.

The Waban-Aki First Nation (Quebec) and the Tzeachten First Nation (British Columbia) suspended the program because of the COVID-19 pandemic but completed their final sessions and held closing ceremonies in the fall of 2021.

Waban-Aki First Nation is expanding a large subdivision of 24 new lots, which was one of the projects completed during the field visits.

Tzeachten First Nation completed several projects over the course of the program, which included consolidating lots for a sports field and reviewing the national standards to better understand how to adapt local issues into survey plans.

Williams Lake First Nation (British Columbia) started and completed the program within the last fiscal year, through mostly virtual sessions. The sessions were suspended when the community discovered unmarked graves on their lands. The community resumed the program, with consistent attendance and a focus on field sessions.

The program goals remained the same:

- to increase a community's knowledge of land tenure systems and spatial data management to achieve aspirations of effective land management
- enhance surveying knowledge so that members can communicate their needs with the local surveying profession and enable members to participate in projects
- provide continuing education in science and technology – specifically geomatics

New this year, the training includes time for conversations with the communities about their perspectives and traditional land management practices.

The impacts of the COVID-19 pandemic continued to create obstacles for the capacity development program because some communities were closed to outside contractors. Consequently, the program needed to be creative about how to deliver the training. The result was virtual training sessions.

SGB staff assessed community training needs:

- developed training agreements with five First Nations³
- coordinated closing ceremonies with two First Nations⁴
- completed the full training program with one First Nation⁵
- continued to engage with six First Nations⁶

Because of the nature of virtual training, the number of participants was not recorded.

The LSCDP continued to engage with Indigenous communities, Indigenous organizations, academic institutions, and professional associations to ensure that the program structure, training material, and delivery are responsive to the needs of the Indigenous participants.

The SGB also supports Canada's efforts to reinforce Indigenous Peoples' authority over their lands through the First Nations Land Management Framework Agreement (FNLMA), which recognizes First Nations' right to self-govern their lands. The SGB continued to support Canada's recognition of Indigenous People's right of self-determination by supporting implementation of the FNLMA.

In 2021–2022, the SGB added 15 First Nations to the work plan, having a total of 61 reserves. The work plan supports the development phase of the community's consideration for adopting a land code under the First Nations Land Management (FNLMA) Framework Agreement.

The SGB conducted comprehensive historical research and analysis of the boundaries of reserve lands to provide a clear and unambiguous description of lands that will fall under a community's land code. The SGB works with the First Nation, the FNLMA Resource Centre, and Indigenous Services Canada to explain and resolve legacy issues involving land and boundaries, to provide this certainty.

This year, the SGB also completed:

- Comprehensive research reports on the survey history of 71 reserves
- 12 legal land descriptions for lands covered by a First Nation land code, with three of those descriptions approved and recorded in the Canada Lands Survey Registry (CLSR)

This work is important because it helps to provide certainty about the extent of the lands that a First Nation administers through the framework agreement.

The SGB ROs work closely and build relationships with First Nation communities within their region. Our ROs are the SGB's main line of communication with First Nations communities and work closely with other government departments such as Indigenous Services Canada, Crown-Indigenous Relations and Northern Affairs Canada (CIRNAC), and Parks Canada regarding land management and boundaries.

In **Vancouver, British Columbia**, the RO worked with Squamish First Nation on Kitsilano IR 6. The First Nation is planning to construct a mixed-use development on the urban reserve that will include 6,000 market rent units and 1,200 affordable units. The first plan of many pertaining to this development is an air space plan (111292 CLSR) to split up the project for volumetric leasing and phased construction.

³ Chippewas of Rama, Opaskwayak Cree Nation, Sumas, Williams Lake, and Metlakatla First Nations

⁴ Tzeachten and Waban-Aki First Nations

⁵ Williams Lake First Nation

⁶ Membertou, Nipissing, Shawanaga, Mistawasis, Muskoday, and Kitselas First Nations



High resolution imagery and LiDAR of Allison Bay 219 and custom reserve signage at Mikisew Cree First Nation, Alberta

The **Alberta RO** has been busy with various projects over the 2021–2022 period. In the spring of 2021, Mikisew Cree Nation identified the need for a residential subdivision for the community at Allison Bay. Houses, roads and other infrastructure were built, but the lots needed to be surveyed.

The RO staff recognized the need for a full topographic survey of the community because infrastructure already existed. Using high resolution imagery and LiDAR was an economical method of conducting the topographic survey because of the amount of information to integrate and the remote location of the community. The community lands department also hopes to use the imagery and LiDAR data to support the future subdivision survey and other development plans.

Additionally, the RO partnered with the First Nation to create custom reserve signage in English and Cree that was placed along the boundaries of Allison Bay 219 and Dog Head 218. The RO hopes to continue creating plaques in Indigenous languages for all future boundary markings.

- In Winnipeg, Manitoba, 44 hectares of the former Canadian Forces Base Winnipeg is being transferred to seven Treaty 1 First Nations for Addition to Reserve lands. These lands will be jointly held and managed through collaborative land code laws under the FNLMA. It is expected that the lands will become reserve lands in the fall of 2022.
- The Quebec RO was working in the Gulf of St. Lawrence on Ile du Corossol. This island is a federal migratory bird sanctuary. Work was completed on the island as part of a survey project in that region.

PRIORITY 2: **Spatially enabling Canada for the digital economy**

The CGS continued to provide the fundamental reference frame and standards for the measurement of latitude, longitude, elevation and gravity anywhere in Canada. They monitor movements of our continental land mass in support of geomatics and geoscience through the Canada Spatial Reference System (CSRS) and precise point positioning (PPP). The CSRS, which is the foundation of positioning in Canada, saw no major changes to the system. Version 7 of the CSRS was released in 2019 and was a significant advance for positioning information for Canadians. Clients are provided with essential positioning information through the CSRS-PPP service. This service has important applications across a wide range of fields, including professional surveying and engineering, construction, glaciology, geodynamics, and marine science. In late 2020, the CSRS-PPP service was modernized with a significant new release. In 2021, a new version of the vertical datum separation application GPS-h was released. The new version enables the private sector, scientists and government agencies to improve the vertical accuracy of coordinates, leading to increased efficiency and reduced costs. During the 2021–2022 fiscal year, the CGS had 9,600 active clients, and almost 1.2 million files were processed.



Survey work on Île du Corossol, Quebec

CGS and space news

The Canada Centre for Mapping and Earth Observation (CCMEO) recently passed the leadership of NRCan's working group on space to the CGS. This working group was created to facilitate sharing information at the working level with the hope that NRCan's interests and activities can be better considered at the decision-making level.

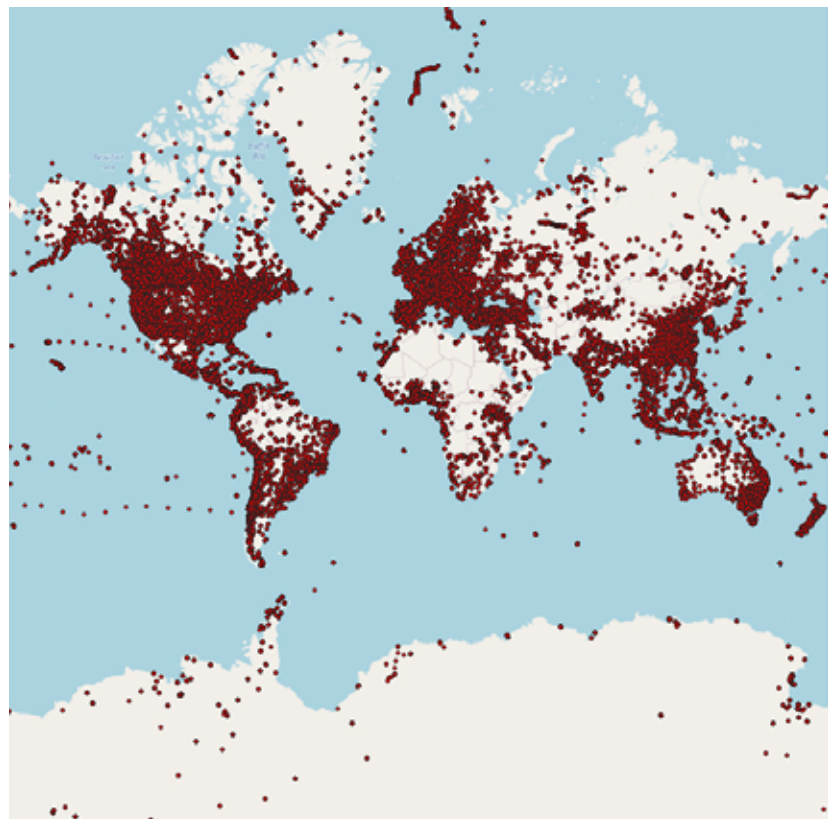
In 2022, a study was completed for Transport Canada to better understand position, navigation and timing (PNT) infrastructure requirements for next-generation transportation systems. Many recommendations had implications for the CGS that included the

- establishment of GNSS reference stations in specific areas to cover gaps in the North
- continuous refinement and modernization of Canada's reference datum to support highly accurate positioning services
- development of a real time ionosphere model for use by Canadian stakeholders to reduce convergence time
- establishment of a national operational model to ensure requirements are being met for PNT services provided by industry for on-road and marine transportation

The CGS is exploring options to support innovation in Canada on this front and address the needs identified in this report.

In October 2021, the CGS received funding over five years to expand Canada's global navigation satellite system (GNSS) infrastructure by adding at least 22 GNSS stations to increase the accuracy and availability of real-time PNT information across Canada.⁷ With these additions, Canada will have 58 highly reliable, real-time GNSS stations that the CGS will use to distribute precision and timing data free of charge to all Canadians. This data will also contribute to the definition of the International Terrestrial Reference Frame. Future enhancements will seek to further leverage ionospheric data from continuously operating GNSS stations and to provide multi-GNSS capabilities for several CGS product lines. We expect that the benefits will be substantial.

In 2021–2022, the CGS collaborated with numerous national and international academic and scientific partners on such topics as reference frames, space weather and PNT in Canada.



CSRS Global usage in 2021

⁷ The Space-Based Earth Observation (SBE0) project aims to install two GNSS stations by December 31, 2022, nine stations by December 31, 2023, nine stations by December 31, 2024, and 2 stations by December 31, 2025.



New SBE0 Station “CALV” at Calvert Island, British Columbia.

One major project is modernizing the CSRS to ensure compatibility with the new geometric and height reference system in the United States, which is expected to be adopted in 2025. This involves redefining the characteristics of the reference frame, which requires complex geoscience modeling and a clear understanding of client needs.

A modern unified reference system will improve accuracy and interoperability for all users and creators of geospatial data and will facilitate adopting modern technologies such as automated transport. This work is being coordinated with provinces and territories through the Canadian Geodetic Reference Systems Committee.

Work has begun with provincial government officials to develop detailed implementation plans for transitioning to the North American Terrestrial Reference Frame (NATRF2022). A road map for migrating to NATRF2022 was compiled and is evolving into an Implementation Plan as more details become concrete. The CGS is also working with the United States National Geodetic Survey (NGS) to develop a new North American gravity-based height system that involves extensive data exchange, knowledge transfer and regular communications. When complete, this new height model will form the basis of an update to the Canadian vertical reference system which is already compatible with the new American datum.

Additionally, the CGS is working on the much-needed updates for the specialized reference system used for the management of the Great Lakes waters, which serve 10 million people. The reference system is the International Great Lakes Datum and has historically been updated on a 25-year cycle. During 2021–2022, a working group was established between the CGS and the NGS to determine roles, responsibilities and logistics of an extensive 2022 fieldwork campaign. This campaign is being carried out to collect data regarding displacement of the Earth in this region and hence provide accurate geospatial reference required for hydrological modeling and land management.

The CGS continued to engage and collaborate with scientific and geoscience colleagues within Canada on advancing geodetic research and supporting federal coordination efforts related to PNT in Canada. The CGS chairs the Canadian Geodetic Science and

Applications Committee to share information and advance geodetic research in Canada. The CGS supported collaboration with geoscience colleagues within NRCan and with other agencies (Department of Fisheries and Oceans (DFO) and Environment and Climate Change Canada) on scientific and operational issues. The CGS also worked with Oceans Network Canada to integrate real-time GNSS position information with seismic data for future Tsunami Early Warning systems.

With respect to PNT, efforts involved bringing stakeholders together to share, collaborate and foster greater PNT knowledge, promote resilient uses and support Canada's economic growth. A key initiative today is to better address the needs of autonomous and assisted driving technology.

Internationally, the CGS continued to support the Canadian contribution to an international space weather consortium of Australia, Canada, France and Japan. Information about the electron content in the Earth's atmosphere is derived from geodetic instruments through dedicated data streams, scientific software systems, and product delivery following international standards.

The CGS provides this data as well as information about rapid changes in the electron content (scintillation). This geodetic data is an essential element of the consortium's work and supplements other types of information from the Canadian Hazard Information Service. The international consortium provides space weather information for civil aviation under the auspices of the United Nations International Civil Aviation Organization.

PRIORITY 3:

Northern property rights

Through the Canada Lands Survey program, the SGB provides the system of land surveys for the three territories. This system is the foundation and an essential component of property rights in the North and is mandated through both federal and territorial legislation.

The COVID-19 pandemic continued to negatively affect the SGB's work with territorial governments on surveying territorial parks and with Comprehensive Land Claim Agreements because of health measures and travel restrictions.

In 2021–2022, the Nunavut RO completed work on the Nunavut Mining Regulations SOR/2014-69. The regulations are now in place and the updated corresponding national standards have been published.

Additionally, the Nunavut RO continued work on the devolution process. This process involved transferring control over Nunavut's public (Crown) lands and resources to the Government of Nunavut. This transfer will grant the Government of Nunavut the authority to make decisions on how public lands and resources are used and developed. The SGB has been closely involved in this process to ensure that there are suitable surveys and descriptions to support certain lands being excluded from devolution. Because of COVID-19 restrictions, no fieldwork was completed this year. However, because most land development takes place within the communities, it is not anticipated that there will be many changes within the next few years.

Working with comprehensive land claim projects is tremendously important for the SGB because this facilitates building relationships with Indigenous groups, territorial governments, and other government departments such as CIRNAC.

The work on land claims is also essential for northern Canadians because it ensures boundary certainty for Indigenous groups and territorial governments and helps prevent future boundary-related conflict on federal lands.

In 2021–2022, in the Northwest Territories, the SGB contributed to the Gwich'in five-year land survey program. Funding was approved in support of the Gwich'in Comprehensive Land Claim Agreement, with the program running from 2021 to 2026. The SGB has maintained a positive, growing relationship with the Gwich'in Department of Lands and the Gwich'in Tribal Council (GTC).

Building on the strong relationship with the GTC, detailed work was undertaken to significantly improve the contracting process by updating the order of proposal evaluation to favour Indigenous participation. The COVID-19 pandemic brought significant challenges in executing contracts because this required bringing people from larger centres into smaller communities. Contract requirements required training and including local participants in the delivery of the work. As a result of open dialogue with GTC staff and contractors, protocols and procedures were developed to enable training and onsite work to occur.

Additionally in the Northwest Territories, it is expected that there will be two upcoming Comprehensive Land Claim agreements.

The first agreement will be the Athabasca Denesuline Agreement with the Athabasca Denesuline and Ghotelnene K'odtineh Dene. This agreement has the following land selections:

- title to about 2,400 square kilometres (km²) (926.65 square miles [sq. mi.]) of Denénj̄h Néné land vests in Nj̄h hoghedí Kóe
- title to about 291.90 km² (112.70 sq. mi.) of land vests in Nj̄h Ahtla bedta ghotd̄j̄h
- title to about 591.40 km² (228.34 sq. mi.) of land vests in Nj̄h hoghedí Kóe

The second agreement is with Nacho Nyak Dun for 300 km² (115.83 sq. mi.) of land (\$3.5 million).

These lands will be from the Northwest Territories land base; however, no selection has been completed yet.



PRIORITY 4:

Protection of Canada's oceans

The Protection of Canada's Oceans priority remains important because all levels of government seek clarity around jurisdiction and natural resource ownership in Canada's offshore regions. The SGB plays an important role in this context by providing foundational tools and services to support marine spatial governance.

This year, the momentum gained through the federal Blue Economy Strategy (BES), launched in February 2021 by Fisheries and Oceans Canada, continues. As mentioned in the strategy, growing a sustainable blue economy requires a strategy to create jobs in coastal communities while ensuring our oceans remain healthy. Through the BES, the SGB is looking ahead to the possibility of foundational regulation and coordination that will enable marine decision-making and administration. The SGB's goal is to enable access to an authoritative, accurate, and accessible picture of the spatial extent of all rights, responsibilities and restrictions affecting a region of ocean space.

One key recommendation from the 2019 Audit of the Canada Lands Survey Program - AU1905 is providing the impetus to support the BES. That support includes informally exploring the changes that would be required to the Canada Lands Surveyors Act to advance a marine cadastre for Canada's ocean space.

Consequently, the evaluation recommends that the Surveyor General

- develop and implement a comprehensive strategy to assess the impact of various modernization trends emerging within their environment, including collaborating with
 - territories, provinces and Indigenous communities
 - provincial and territorial governments
- assess whether key legislative instruments need to be updated

Numerous informal conversations with various government of Canada departments have signaled that increasing activity now requires a more comprehensive and inclusive approach to administer Canada's ocean space.

The SGB's vision is to build consensus for a Canadian model for integrated, offshore spatial governance. This model would lead to a current and complete view of the spatial extent of relationships in Canada's ocean space. The resulting regulatory clarity from such a system would reduce barriers to investment and economic development while protecting ocean ecosystems.

Exploratory work will continue in the coming year with the key objective of building consensus among stakeholders. This work would revolve around what is needed to conceive a made in Canada marine cadastre, the corresponding legislative requirements, and the possible roles for each federal agency participant.

Thus, the SGB continues to collaborate with various organizations on joint efforts in this area throughout 2021–2022, including the

- Canadian Hydrographic Service (CHS)
- Public Service and Procurement Canada
- DFO Domestic Ocean Policy
- DFO Marine Spatial Planning
- NRCan Offshore Renewable Energy, Carbon Capture and Storage



The CHS is currently developing a marine spatial data infrastructure (MSDI) to provide information on maritime routes. This requires the SGB to create synergies within the MSDI around a potential system listing the rights, responsibilities and restrictions in the marine field. The purpose of the proposed system is, among other things, to provide a level of boundary certainty and clarity for decision-making and de-risk investment and economic development in the offshore. The proposed regime, when combined with the MSDI, meets the overall strategic objective of enabling Canada to responsibly take advantage of the economic potential of its oceans.

Finally, the SGB is participating in the editorial committee for the development of ISO 19152-1 Land Administration Domain Model – Fundamentals and ISO 19152-3 Land Administration Domain Model – Marine space georegulation. These standards provide conceptual models and frameworks to represent and structure the concepts related to land administration (ISO 19152) and marine cadastres (ISO 19153-3). The standards also provide technical solutions needed to structure databases, integrate information systems and develop exchange formats.

The branch also continues its contribution to the United Nations Committee of Experts on Global Geospatial Information Management Marine Geospatial Information Working Group and their document IGIF-Hydro; FIG Working Group 4 Hydrography; and IHO MSDI Working Group.



RESPONDING TO FUTURE CHALLENGES

In addition to delivering on its commitments and providing access to reliable survey systems, positioning infrastructure, and framework, the SGB worked to identify current and future challenges. In 2021–2022, the SGB continued to adapt to the COVID-19 pandemic and the hybrid workforce; supply chain issues; changing technologies; and building our human resources capacity.

COVID-19 pandemic and a hybrid workforce

The COVID-19 pandemic continued to create issues with the delivery of our programs and has changed the work environment of employees. 2021–2022 saw the continuation of the pandemic, significant national and international travel restrictions, and many Indigenous communities restricting access in the interest of safety for community members.

These restrictions changed how SGB employees interact with the survey and geodesy communities – moving toward online interactions as opposed to in-person interactions.

The Land Survey Capacity Development program delivered many training sessions online; virtual meetings with Indigenous communities and partners became the norm, and conferences and presentations that typically would be held in person became virtual events. The COVID-19 pandemic has modified how we work, from working in the office to working from home.

We are in the process of implementing the return to the workplace plan. In the meantime, we continue to follow all federal and provincial health guidelines in the workplace and in the field when interacting with stakeholders and clients.

Supply chain issues

The COVID-19 pandemic caused operational challenges including supply chain issues with procurement, reducing our ability to acquire hardware required to maintain and improve our GNSS stations and replenish our capital assets. Highly specialized equipment was particularly impacted by this.

Within the CGS, fieldwork operations were suspended for the entire year, with a few exceptions, because of travel restrictions caused by the COVID-19 pandemic. Maintaining the specialized workforce required in the CGS to continue the current contributions as worldwide experts and to generate new GNSS products and services has been, and will continue to be, a challenge. One factor is that private companies have offered salaries and benefits to our employees that go beyond what we are able to offer in the public service.

For the CLSS program, fieldwork was also scaled down or suspended because many communities were closed to outside contractors. Fieldwork by the IBC to maintain the international boundary was only partially affected. The work was concentrated in areas where the boundary could be easily accessed from Canada and did not require going to the United States.

Changing technologies

2021–2022 saw challenges pertaining to rapidly evolving technology, requiring vigilant monitoring of our systems, processes and standards. The SGB prioritizes this in its everyday operations to stay aligned with the continuously evolving demands of industry and clients. We must remain up to date with new and innovative technology. The SGB must be agile in this complex technological era and operate on new servers.

This past year, the SGB worked on modernizing the CLSS and CGS applications to align with the Government of Canada Application Modernization and Cloud First Initiatives. The SGB also completed a review and cleanup of the survey record information system database.

The SGB-CLSS updated the Web Map Browser with the standard NRCAN web templates and refreshed all ICM applications for the Security Assessment and Authorization. The SGB will continue to adapt its practices and implement new technologies as needed.

There is an increasing need to support industry and science in expanded fields of applications that create new demands and pressures on GNSS infrastructure. Emerging needs require an infrastructure that provides higher accuracy, greater resilience to cyber attacks, improved uptime to support the needs of autonomous technologies, and greater scalability of services.

Because they have a long-standing partnership with the academic sector, the CGS is considering how to incorporate data from 350 new stations for ionosphere modeling and other applications over the next few years.

The need for scalability and modernization of the GNSS network generated a three-year project to migrate GNSS data processing to a cloud environment.

The following actions are key to supporting industry's reliance on accurate positioning services:

- regular and continuous upgrades of infrastructure and systems through scheduled, incremental investments to avoid dependence on legacy systems
- use of new constellations, such as Galileo

The SGB will continue to support the development of Canada's post-pandemic economic recovery plan and provide national leadership on PPP services.

Building human resources capacity

SGB's staff are spread out across Canada, operating out of 10 ROs and a main office in Ottawa. By working near our clients and stakeholders, we can strengthen collaboration and remain cognizant of regional needs and priorities. In 2021–2022, our employees were distributed across a variety of occupational groups, including ENSUR, EC, EG, IT, and AS (see Annex 5 for a full breakdown of occupational groups).

In 2021–2022, 8 employees retired from the SGB, and 11 indeterminate employees were hired, along with 3 term employees and 1 co-op student.

The CGS lost three senior employees to retirements and two more to the private sector. Replacing this very specialized staff has been challenging, and training and full integration into duties will take even longer.

Looking forward, the main challenge for geodetic capacity will be adapting to the retirement of several members of the management team. From a team of seven managers, two retired in the summer of 2021, and three more will leave in 2022 and 2023.

The CLSS saw some fluctuation of senior surveyors but was generally stable for critical positions.

As more people retire, we must ensure that the retirees' knowledge and experience are effectively passed to the next professional succession. The SGB also recognizes a need to bridge more students into permanent positions, especially in the regions. Employee scarcity is therefore at the forefront of the SGB's priorities.

In 2021, the Land Survey Capacity Development program (LSCDP) was approved by the NRCan Human Resources department. The aim is to recruit, develop and retain a diverse and inclusive workforce with the required land surveying competencies to address succession planning. The plan is to hire and train new graduates in land surveying for many years to come.

The LSCDP allows hiring managers the possibility of conducting interviews at qualifying institutions and offering conditional letters of offer to successful students, on the condition that they graduate before they start work.

Also, the SGB supports its employees in attaining a CLS licence. To that end, the LSCDP accepts SGB employees who do not have a CLS licence but are certified by the Canadian Board of Examiners for Professional Surveyors.

The LSCDP has had four candidates in the last fiscal year, all who now have their commission. These candidates work across the SGB, in various ROs and within the CGS. The program encourages collaboration between the various ROs and units of the Surveyor General Branch internal work terms to provide the necessary experience for candidates to acquire their CLS licence to practice.

Over the past few years, the International Boundary Commission has provided several months of field experience to candidates. The Alberta, Nunavut and Quebec ROs have provided opportunities on projects that had other government department funding. The Cadastral Survey Information unit has also provided training experiences for candidates to ensure that they learn how the branch operates.

ANNEX 1: SGB PROJECTS

The following table lists the 26 ongoing projects identified in and managed through the 2020–2023 Integrated Business Plan. Much progress has been made on these files, but some will require more time than initially planned. These delays are due to a number of circumstances, including the COVID-19 pandemic. In 2021–2022, seven projects were completed.

#	Project	Project description
1	Modernization of the <i>Canada Lands Surveyors Act</i>	<p>Finalize the amendments to the <i>Canada Lands Surveyors Act</i> (the Act) to respond to the request submitted by the ACLS and to modernize the legislative framework supporting the Canada Lands Surveyors profession. The Act has not been revised since it came into force in 1999.</p> <p>Completed. Needs to pass the third reading in both the Senate and House of Commons before receiving royal assent and becoming law. This project was completed in March 2022.</p>
2	Developing an MOU with the FNLM Resource Centre	<p>Negotiate an intergovernmental agreement with the First Nations Land Management Lands Advisory Board and Resource Centre related to the specifications for the description of lands for transactions recorded in the First Nations Lands Registry.</p> <p>75% complete</p>
3	Renew the Framework Accord with Indigenous Services Canada	<p>Renewal of an interdepartmental agreement with Indigenous Services Canada, related to cooperation on legal survey projects and the specifications for the descriptions of lands for transactions recorded in the Indian Lands Registry. This will also address a recommendation from the audit report of the CLSS program.</p> <p>25% complete</p>
4	Modernize the production of GNSS orbit and clock products	<p>Current precise orbit determination (POD) packages operated by the CGS are limited to GPS and/or GLONASS constellations and have reached their efficiency limits. The newly acquired software Gipsy-X will consolidate the production of all POD product lines and enable processing of emerging constellations, upholding the quality of NRCan’s international contributions and supporting CGS clients acquiring signals from multiple constellations.</p> <p>40% complete</p>

#	Project	Project description
5	Increase the accuracy and efficiency of the CSRS-PPP service	<p>The CSRS-PPP service allows GNSS users to collect data in the field, upload this data to NRCan, and within minutes receive an estimate of their positions, along with quality estimates and visual reports. The service is being modernized to include ambiguity resolution (PPP-AR), faster convergence using external ionospheric information, and the processing of new signals and constellations (Galileo and GPS L5).</p> <p>55% complete</p>
6	Co-develop the North American 4D Spatial Reference System	<p>Contribute to development of a North American 4D spatial reference system in collaboration with the NGS and the Mexican Instituto Nacional de Estadística y Geografía (INEGI). This work includes definition of the NATRF2022 and the North American-Pacific Geopotential Datum of 2022 (NAPGD2022).</p> <p>10% complete</p>
7	Collaborate with provinces and territories toward an improved unified reference frame	<p>Set the groundwork for the provincial, territorial and federal geodetic agencies to adopt NATRF2022 across Canada at the same time as the US and maintain a unified reference frame thereafter. This will ready Canada for ubiquitous instantaneous, sub-decimetre GNSS positioning.</p> <p>17% complete</p>
8	Update Canada's gravity standardization net to the International Gravity Reference System	<p>Integrate the Canadian Gravity Standardization Net within the new International Gravity Reference System recently adopted by the International Association of Geodesy. The new standard is based on absolute gravimetry. The Canadian network was last adjusted nationally in the 1970s under the IGSN71 standard.</p> <p>50% complete</p>
9	Improve real-time GNSS precise positioning services for public safety geosciences	<p>Public safety geosciences (e.g. tsunami and earthquake early warning systems) are increasingly reliant on high precision real-time GNSS-based positioning. Current CGS real-time products are GPS only. A robust contribution to these systems requires the integration of other GNSS constellations (GLONASS, Galileo) and new system products such as optimized combined coordinate streams and regional ionosphere data products.</p> <p>25% complete</p>

#	Project	Project description
10	Meet ICAO requirements for space weather monitoring and ionospheric products	<p>NRCan's Canadian Hazards Information Services (CHIS) is contributing space weather services for the International Civil Aviation Organization (ICAO). The GNSS ionospheric products needed to support ICAO and needed for the CHIS space weather webpage are provided by CGS. This project seeks to meet requirements and improve these ionospheric products by developing support for multi-GNSS constellations.</p> <p>52% complete</p>
11	Analyze gaps and identify options for Canada's geodetic observing infrastructure	<p>Develop options for national positioning services and infrastructure as part of the international geodetic infrastructure for reference systems and measuring our changing Earth. This would contribute to a larger PNT collaborative effort.</p> <p>Completed. Funding was completed for the Space Based Earth Observation (SBE0) project. This project was completed in December 2021.</p>
12	Expanded use of digital plans in the North	<p>The project consists of work with the Territorial Land Registry of Yukon to allow for the adoption of digital plans. Yukon SGB office is preparing digital plan guidelines for surveyors, which have been developed in conjunction with Yukon Land Title Office.</p> <p>50% complete</p>
13	Land knowledge capacity in CLCA areas	<p>Collaborate with beneficiary organizations, territorial governments and other federal government departments to build a framework for enhancing local capacity to work with geospatial land information. This project will identify stakeholders, categorize common objectives and facilitate the development of a framework that can be implemented.</p> <p>20% complete</p>
14	Support the modernization of Nunavut mining regulations	<p>For Nunavut, this project is the continuation of the project Support modernization of NU and NT mining regulations from the previous integrated business plan. The SGB will continue to support Nunavut as it moves toward a map selection process for its mining regulations.</p> <p>Completed. The amendments to the Nunavut Mining Regulations are in place. As a result, the SGB reviewed and modified its National Standards for the Survey of Canada Lands publication (Addendum 1.9) to reflect the changes to the mining regulations.</p>

#	Project	Project description
15	Support the northern land titles modernization and Integration	<p>Each territory is at various stages of modernizing its land titles systems and how they operate with the CLSS. This project will support and contribute in the modernization and integration of each territorial land titles systems, as well as enable stakeholder participation.</p> <p>50% complete</p>
16	Develop a Canadian marine cadastre governance framework to ensure communication and collaboration between federal agencies that have offshore responsibilities and rights	<p>The aim of this project is to organize a workshop with various partners with an interest in the marine area to develop a governance framework and stimulate a desire among partners to contribute, via their data, to a marine cadastre.</p> <p>80% complete</p>
17	Develop a plan of action to migrate ArcMap to the ArcGIS Pro environment	<p>The main objective of this project is to develop a plan of action to be ready for the software migration from ArcMap to the Arc GIS Pro. Our current GIS environment uses the ArcMap and ArcObjects, but these are no longer enhanced by ESRI and are only maintained for fixing problems.</p> <p>98% complete</p>
18	Facilitate the exchange of knowledge within the International Boundary Commission	<p>Improve access to the IBC data from our portal (internal and external), and to the methods used for field data capture and integration into IBC files.</p> <p>85% complete</p>
19	Client satisfaction questionnaire	<p>Working with the NRCan Communications and Portfolio Sector, the SGB will reinstitute biannual user feedback surveys to seek input on the effectiveness of our services and tools and unmet user needs from key stakeholders and end users, specifically land surveyors, other government departments, Indigenous organizations, Indigenous end users, and territorial governments.</p> <p>Completed. A response from the SGB Management Board to the survey was completed and approved and reported on the management action plan. This project was completed in December 2021.</p>

#	Project	Project description
20	Communication strategy with stakeholders	<p>The SGB will develop and implement a formal communications strategy to align with stakeholders' requests for greater person-to-person contact. The SGB supports and recognizes the benefits of in-person communications. Increased in-person liaison with stakeholders will require travel by SGB staff. This factor presents challenges that will be overcome through strategic engagement planning and participation in targeted events. The SGB will also formally track in-person communication efforts to better document efforts and to identify regional or user-group gaps.</p> <p>90% complete</p>
21	Develop an impact assessment of emerging modernization trends within the Canada Land Survey System environment	<p>This project will develop and implement a comprehensive strategy to assess the impact of various modernization trends emerging within the CLSS environment and to assess whether there is a need to update key legislative instruments. This project will be performed in collaboration with territories and provinces, and Indigenous communities.</p> <p>Completed. Working groups met to discuss four aspects: marine, technology, northern, and Indigenous. This project was completed in December 2021.</p>
22	Client satisfaction questionnaire	<p>This goal of this project is to make all the digital aerial photography collected by the SGB since 2007 available to the public. The Canada Centre for Mapping and Earth Observation (CCMEO) has developed the Earth Observation Data Management System (EODMS), which makes discoverable and downloadable digital aerial imagery including digital aerial photography. Working with CCMEO, the SGB is organizing, structuring and uploading its digital aerial photography into this management system.</p> <p>Completed. All data was uploaded to EODMS database, and a letter was prepared to inform First Nations of Quebec and the Atlantic region of the release of the aerial photography. This project was completed in May 2021.</p>

#	Project	Project description
23	Modernize the CLSS and CGS applications to align with the GC Application Modernization and Cloud First initiatives	<p>To comply with the government of Canada's Application Modernization Project and Cloud First Adoption Strategy, the SGB line-of-business applications need to be migrated to suitable approved end-state environments, either in the NRCan-managed commercial cloud or in the SSC enterprise data centres. This project entails assessing the technical suitability, security and on-going costs of running the applications in the proposed end-state environments. The project also assesses transforming or replacing legacy applications and migrating the applications and data to the selected end-states with minimum interruption to services.</p> <p>16% complete</p>
24	Implement a trusted digital repository	<p>The trusted digital repository (TDR) is being modified to focus on developing redundant digital preservation components to reduce risk on CLSR digital records. Once this component is in place, work will focus on longer term solutions. This focus on redundant digital preservation will eliminate dependency on microfilm. To date, development of a TDR based on GCDocs has been unsuccessful despite numerous attempts. Because the GCDocs environment is currently under evaluation to determine if it will be maintained with NRCan's move to Office365, the project will cease efforts to build a solution on this software and focus on alternative cloud-powered options.</p> <p>34% complete</p>
25	Road map and implementation of CLSS IT strategies	<p>The goal of this project is to finish the migration of the CLSS applications to the Windows 2016 server platform to comply with the Windows 2008 decommissioning project.</p> <p>Completed. The standard NRCan web template was applied to the Web Map Browser and all Security Assessment and Authorization was refreshed for all the ICM applications. This project was completed in July 2021.</p>
26	Land Survey Capacity Development Program	<p>The LSCDP will help with succession planning and recruiting by hiring and training new graduates in land surveying. This program also aims to help the new employees obtain the work experience needed to acquire their commission and licence to practise as a Canada Lands Surveyor.</p> <p>Completed. The program became operational in late 2021, with three participants registered with training plans. This project was completed in December 2021.</p>

ANNEX 2: PROGRAM METRICS

SGB metrics – Canada Lands Survey System

General metrics

To maintain the CLSS and the land registries across Canada, the SGB conducts various important daily operations represented by the metrics in the following table. This work provides the foundation for all of the projects and programs that support the SGB's four strategic priorities.

Measured output	2021–2022
New parcels created in cadastral datasets	4,531
Parcels maintained	322,123
Survey instructions issued	715
Documents registered in the CLSR	1,439

Saskatchewan Treaty Land Entitlement

Treaty Land Entitlement claims can be submitted by First Nations that did not receive all the land they were entitled to under treaties signed by the Crown. In Saskatchewan, much of this land has already been surveyed in the province's township system. The SGB is responsible for reviewing these parcels to identify and resolve any ambiguities or related issues.

Measured output	2021–2022
Area of parcels described	4,548 ha
Lands added to the reserve to date	358,014 ha

Manitoba Treaty Land Entitlement

In Manitoba, a significant proportion of the treaty land First Nations are entitled to has yet to be surveyed. The SGB is responsible for surveying this Crown land to define land selections and ensure that Canada adheres to its treaty obligations. The progress of this work is measured by the metrics in the following table.

Measured output	2021–2022
Area surveyed	32 ha
Lands added to the reserve to date	228,530 ha

ENLM Metrics

These metrics represent the work carried out to help provide certainty over the extent of lands a First Nation administers through the FNLMA.

Measured output	2021–2022
Land descriptions	12 completed 3 approved and recorded in the CLSR
Research reports completed	71

Interdepartmental letters of agreement and survey contracts to the private sector

To support the mandate and obligations of our partners in other government departments, certain SGB activities are carried out at cost recovery. The figures in the following table are indicators of the work accomplished in this context. The majority of survey contracts issued to the private industry are a result of these interdepartmental letters of agreement.

Measured output	2021–2022
Interdepartmental letters of agreement	
Letters of agreement	29
Value	\$3,575,545
Survey contracts to the private sector	
Contracts	175
Value	\$1,975,673

SGB metrics – Canadian Geodetic Survey

The following metrics are derived from the CGS Performance Indicator Profile and will serve as a key reference point for future evaluations. These indicators are used to monitor CGS' accomplishments and results from year to year. They are aligned with the division's expected immediate outcomes (providing accessible, accurate and timely geodetic information) and intermediate outcomes (georeferencing to a common Canadian reference system consistent with international standards).n's expected immediate outcomes (providing accessible, accurate and timely geodetic information) and intermediate outcomes (georeferencing to a common Canadian reference system consistent with international standards).

Measured output	Target	2021–2022
Accessible, accurate and timely geodetic information		
GNSS stations for which data is distributed	≥112	141
Accuracy of GNSS orbits with respect to international standards	<2 cm	1.23 cm
Horizontal accuracy of real-time GNSS products	<10 cm 95% of the time	N/A ⁸
GNSS stations used for reference frame and velocity computations	>330	336
Accuracy of the Canadian Gravity Standardization Network	<10 micro Gals	5 micro Gals ⁹
Availability of CACS daily data files (within 30 minutes after end of day)	>95%	98.10%
Availability of rapid orbit and clock products (within 12 hours after end of day)	≥95%	99.45%
Georeferencing to a common Canadian reference system consistent with international standards		
Direct users of CGS data products	≥7,000	10,844
Requests for CGS products and services	300,000	655,536
Commercial GNSS reference stations monitored by the CGS as part of the RTK compliance program	>500	701

⁸ This indicator cannot be calculated because the old servers were decommissioned (after the migration to virtual machines) and a 50% loss of HR capacity for this product.

⁹ This level of accuracy is assumed, but because of COVID-19 pandemic travel restrictions, the CGS has not compared gravimetric measures since 2020.

ANNEX 3: AWARDS

Awards received by SGB staff throughout 2021–2022

Instant awards

Mart Himma	Kent Campbell
Andrew Brebner	Philippe Lamothe
Bianca D'Aoust	Rémi Ferland
Elyes Hassen	Simon Banville
Gavin Lawrence	Sylvain Lelièvre
Justin Farinaccio	

Career milestones

30 years	25 years	20 years	15 years	10 years
Jean Gagnon	Khalil Hayek	Louis Carpentier	Andrzej Pienkowski	Reza
Joe Harrietha	Martin Gingras	Zoltan Bardossy	Goran Pavlic	Stuart Elson
Afzal Amlani	Al Bowler	Sylvain Lelièvre		Philippe Lamothe
Mike Craymer	Andrew Brebner	Steve Rogers		
		Craig Strang		

Retirements

Bruce Farquharson	18 years	Mark Caissy	33 years
Caroline Erickson	26 years	Rémi Ferland	34 years
Dave Strachan	24 years	Suzanne Lamontagne	31 years
Madeleine Bérubé	34 years	Andrzej Pienkowski	15 years

ANNEX 4: PUBLICATIONS

Banville S., Hasen E., Lamothe P., Farinaccio J., Donahue B., Mireault Y., Goudarzi M.A., Collins P., Ghoddousi-Fard R., Kamali O. Enabling Ambiguity Resolution in CSRS-PPP. Navigation: Journal of the Institute of Navigation. 2021(68), pp.433-451.
<https://doi.org/10.1002/navi.423>¹⁰

Banville S., Hassen E., Walker M., Bond J. Wide-Area Grid-Based Slant Ionospheric Delay Corrections for Precise Point Positioning. Remote Sensing. 2022; 14(5):1073.
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Craymer, M. NAD83(CSRS): From Static to Dynamic (2021). Continuing Professional Development of Canada's professional Land Surveyors.
<https://www.geoed.ca/product/nad83csrs-from-static-to-dynamic-product/>

Crowley, J. and Huang, J.: Simple regional analyses are still possible once correlated errors are removed, EGU General Assembly (2021). 19–30 Apr 2021, EGU21-5688
<https://doi.org/10.5194/egusphere-egu21-5688>

Heck, Craymer. Updating the International Great Lakes Datum: Enabling the integration of water and land management in the Great Lakes region. Proceedings FIG eWorking Week, June 20-25, 2021.
https://www.fig.net/resources/proceedings/fig_proceedings/fig2021/papers/ts05.1/TS05.1_heck_craymer_11046.pdf

Lamothe, P. NAD83(SCRS): de statique à dynamique (2021) Programme de développement professionnel continu des arpenteurs-géomètres du Canada.
<https://www.geoed.ca/fr/produit/nad83scrs-de-statique-a-dynamique-product/>

Li X., J. Huang, R. Klees, R. Forsberg, M. Willberg, C. Slobbe, C. Hwang, and R. Pail (2022) Characterization and stabilization of the downward continuation problem for airborne gravity data, Journal of Geodesy, 96, 4.

Liu Q., M. Hernández-Pajares, H. Yang, E. Monte-Moreno, D. Roma-Dollase, A. García-Rigo, Z. Li, N. Wang, D. Laurichesse, A. Blot, Q. Zhao, Q. Zhang, A. Hauschild, L. Agrotis, M. Schmitz, G. Wübbena, A. Stürze, A. Krankowski, S. Schaer, J. Feltens, A. Komjathy, and R. Ghoddousi-Fard (2021). The cooperative IGS RT-GIMs: a global and accurate estimation of the ionospheric electron content distribution in real-time. Earth Syst. Sci., doi: 10.5194/essd-2021-136

A. Ojo, Kao, Y. Jiang, Craymer, Henton. Strain accumulation and release rate in Canada: Implications for long-term crustal deformation and earthquake hazards. Journal of Geophysical Research, 2021.
<https://doi.org/10.1029/2020JB020529>

Sánchez L., Ågren J., Huang J., Wang Y.M., Mäkinen J., Pail R., Barzaghi R., Vergos G.S., Ahlgren K., Liu Q. (2021) Strategy for the realization of the International Height Reference System (IHRs). Journal of Geodesy, 95(3), 10.1007/s00190-021-01481-0

¹⁰ The journal of navigation informed NRCAN that *Enabling ambiguity resolution in CSRS-PPP* was among the top cited articles of 2021. This paper describes the latest correction method incorporated into the Canadian Spatial Reference System Precise Point Positioning (CSRS-PPP) service.

Sea-level projections (James et al., 2021) based on the Fifth Assessment Report of the IPCC and the Canadian Geodetic Survey crustal velocity model (Robin et al., 2020) are available for viewing and download at the Canadian Centre for Climate Services web site <http://climatedata.ca/variable/>

Wang Y.M., M. Véronneau, J. Huang, K. Ahlgren, J. Krcmaric, X. Li, D. Avalos (2022) On the accurate computation of the geoid-quasigeoid separation in a mountainous region – a case study in Colorado with a full extension to the experiential geoid region. *Journal of Geodetic Science*.

Yan Ming Wang, Laura Sánchez, Jonas Ågren, Jianliang Huang, René Forsberg, Hussein A. Abd-Elmotaal, Kevin Ahlgren, Riccardo Barzaghi, Tomislav Bašić, Daniela Carrion, Sten Claessens, Bihter Erol, Serdar Erol, Mick Filmer, Vassilios N. Grigoriadis, Mustafa Serkan Isik, Tao Jiang, Öykü Koç, Jordan Krcmaric, Xiaopeng Li, Qing Liu, Koji Matsuo, Dimitris A. Natsiopoulos, Pavel Novák, Roland Pail, Martin Pitoňák, Michael Schmidt, Matej Varga, Georgios S. Vergos, Marc Véronneau, Martin Willberg, Philipp Zingerle (2021) Colorado geoid computation experiment – Overview and summary, *Journal of Geodesy*, 95, 127. 10.1007/s00190-021-01567-



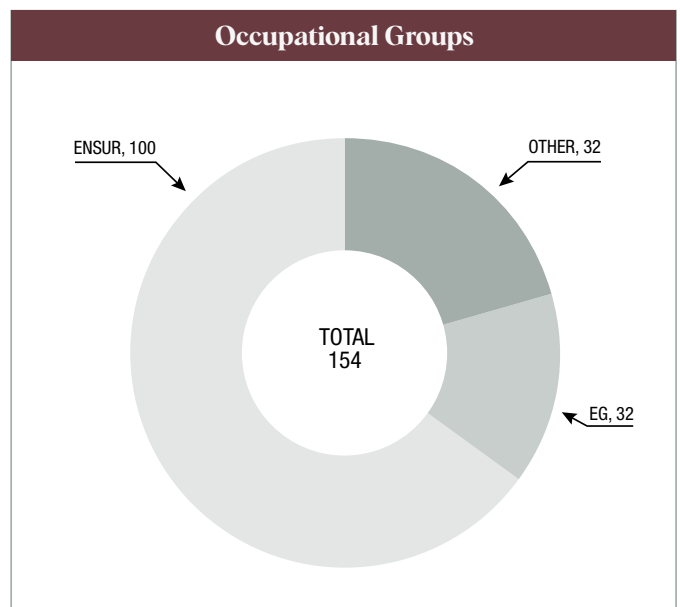
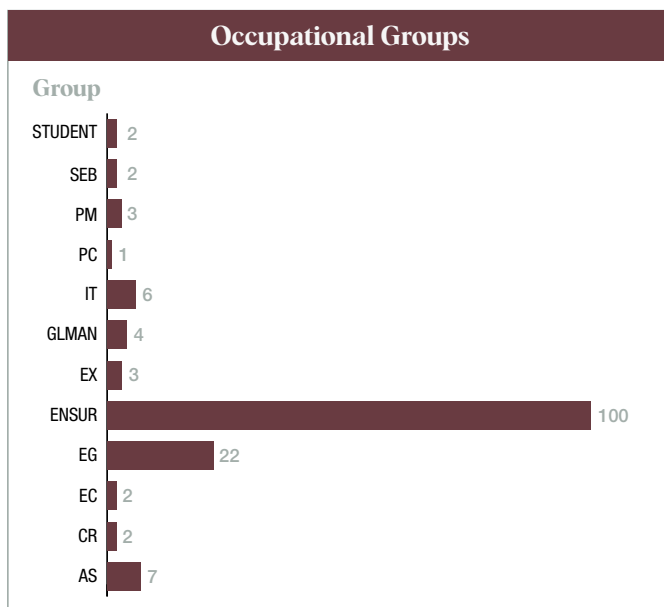
ANNEX 5: HUMAN RESOURCES DATA

The following table provides a breakdown of all the SGB occupational groups of employees in 2021–2022. Both the figures offer further analysis of occupational groups during the same period.

Occupational groups

Group	Count
AS	7
CR	2
EC	2
EG	22
ENSUR	100
EX	3
GLMAN	4
IT	6
PC	1
PM	3
SEB	2
Student	2
Total	154

Reference



ANNEX 6: ABBREVIATIONS

ACLS	Association of Canada Lands Surveyors
ACLS	Association of Canada Lands Surveyors
BES	Blue Economy Strategy
CGS	Canadian Geodetic Survey
CHS	Canadian Hydrographic Service
CIRNAC	Crown-Indigenous Relations and Northern Affairs Canada
CLEVER	Canada Lands e-Validation of Electronic Returns
CLS	Canada Lands Survey
CLSR	Canada Lands Survey Registry [?]
CLSS	Canada Lands Survey System
COVID-19	Coronavirus disease 2019
CSRS	Canadian Spatial Reference System
CSRS-PPP	Canadian Spatial Reference System-precise point positioning
DFO	Department of Fisheries and Oceans
FNLM	First Nations Land Management
FNLMFA	First Nations Land Management Framework Agreement
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
GTC	Gwich'in Tribal Council
IBC	International Boundary Commission
IHO	International Hydrographic Organization
ISO	International Organization for Standardization
LSCDP	Land Survey Capacity Development program
MSDI	marine spatial data infrastructure
NATRF2022	North American Terrestrial Reference Frame 2022
NGS	National Geodetic Survey
NRCan	Natural Resources Canada
POD	precise orbit determination
PNT	positioning, navigation and timing
PPP	precise point positioning
RO	regional office
SGB	Surveyor General Branch
US	United States

ANNEX 7: CONTACT US

Head offices

Surveyor General office

Natural Resources Canada
2nd Floor
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Northern Canada division

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International Boundary Commission – Canadian section

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Regional offices

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