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# Surveyor General Branch Biennial Report

2016 – 2018

Canada

Natural Resources Canada  
Surveyor General Branch  
588 Booth Street  
Ottawa, Ontario K1A 0Y7

Tel.: 343 – 292 – 6642

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# 1. Message from the Surveyor General

This Review describes the highlights for fiscal years 2016 through 2018 (April 1, 2016 to March 31, 2018), including publications and other metrics, for the Surveyor General Branch (SGB) of the Lands and Minerals Sector (LMS)<sup>1</sup> at Natural Resources Canada (NRCan). It is the eighth in a suite of reviews intended to report on the Branch's annual accomplishments.

The Surveyor General Branch embraces a process of continual improvement that includes a medium term Strategic Outlook aligned with the priorities of the Government of Canada designed to grow the economy and incite innovation. The current Strategic Outlook is ongoing until 2022. Change is managed through 2-year Integrated Business Plans<sup>2</sup>, supported by a rigorous project management approach to delivery.

I am pleased to report that the Branch has made significant movement towards the strategic priorities highlighted in the SGB 2017-2022 Strategic Outlook<sup>3</sup>:

- Priority 1: Indigenous Peoples' control of their lands,
- Priority 2: Spatially enabling Canada for the digital economy,
- Priority 3: Northern property Rights, and
- Priority 4: Protection of Canada's oceans.

The success of the organization depends on the enthusiasm and energy of the dedicated staff of the SGB and input from the ultimate users of the knowledge, information and services that the Branch provides. I would like to thank the many participants who have contributed to our efforts over the last two years and have provided input to the priorities we have advanced.

I would particularly like to thank Peter Sullivan CLS, ALS, MBA who completed his service as Surveyor General of Canada Lands in 2017 and wish him all the best in his retirement.

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

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<sup>1</sup> The Surveyor General Branch became part of the Lands and Minerals Sector in January 2017 as a result of reorganization within NRCan. Previously it had been part of the former Earth Sciences Sector.

<sup>2</sup> [https://intranet.nrcan.gc.ca/sites/intranet.nrcan.gc.ca/files/sgb/pdf/SGB\\_2016-2018\\_IBP\\_EN.pdf](https://intranet.nrcan.gc.ca/sites/intranet.nrcan.gc.ca/files/sgb/pdf/SGB_2016-2018_IBP_EN.pdf)

<sup>3</sup> [https://intranet.nrcan.gc.ca/sites/intranet.nrcan.gc.ca/files/sgb/Strategic%20Outlook/SGB\\_Strategic\\_Outlook\\_2017-2022\\_EN.pdf](https://intranet.nrcan.gc.ca/sites/intranet.nrcan.gc.ca/files/sgb/Strategic%20Outlook/SGB_Strategic_Outlook_2017-2022_EN.pdf)

## 2. SGB's Role within NRCan's strategic outcomes

Under the Program Alignment Architecture that the Government of Canada uses to link programs to strategic outcomes, SGB contributes to NRCan's Strategic Outcome 3:

"Canadians have information to manage their lands and natural resources and are protected from related risks"

### ***Sub-Program 3.2.1: Essential Geographic Information (Geodesy/Mapping/Earth Observation)***

This sub-program ensures public access to accurate, authoritative and assured satellite imagery, survey and mapping data, as well as applications and other thematic products or specialty tools to government and non-government users. This sub-program also maintains geodetic networks to monitor Earth dynamics and provide access to Canada's fundamental reference system for the measurement of latitude, longitude and elevation. A geodetic reference system consistent with international standards is essential to exploit the full capability of Earth Observation and precise satellite positioning (e.g., GPS).

### ***Sub-Program 3.2.2: Canada's Legal Boundaries (Property and jurisdictional boundaries)***

Through this sub-program, NRCan ensures boundary certainty by proper maintenance of the Canada-US international boundary for law enforcement, land administration, customs and immigration, and transboundary resource management; effective boundary surveys of Indigenous settlement lands to meet Canada's obligations under land claim settlement legislation and treaties; and statutory registration of legal surveys on Canada Lands (the North, Canada's offshore area, Indigenous Lands and National Parks), essential to the creation of legal property boundaries. The boundary certainty provided by NRCan through this Sub-program enables effective management of Canada lands and collaboration across jurisdictions, which advance the interests of Canada's natural resource sectors, both domestically and internationally.

### **3. SGB Business lines that deliver Essential Geographic Information and define Canada's Legal Boundaries**

#### **Canada's Spatial Reference System – the base for measurement**

The Canadian Geodetic Survey (CGS) within SGB establishes and provides the fundamental reference values used as standards for measuring latitude, longitude, elevation and gravity within Canada; and monitors the motions of the continental land mass to support numerous scientific and engineering activities that require precise measurements of the Earth. CGS operates a network of precise geodetic sensors that enable technologies such as those used in land surveying for oil and gas exploration or engineering for road construction, while also making essential contributions to global organizations that provide the measurement base for systems such as GPS.

#### **Canada's Survey Registry – the framework for legal surveys**

The cadastral surveys operations within the SGB regulate legal surveys by providing instructions, setting standards, ensuring quality control and registering official plans and related documents such as field notes and reports. This regulatory function provides a legal framework for the definition of property and jurisdictional boundaries that are administered on Canada Lands and on private (fee simple) lands in the Yukon, Northwest Territories and Nunavut. The Canada Lands Survey Registry is a public repository required by the Canada Lands Surveys Act that contains a vast array of land records dating to the early 1800s. The Registry has recently been digitized and is now available online. Historical hard copy records are collected under Library and Archives Canada.

#### **Canada's Survey Program – the management of legal surveys**

The ten regional offices of the SGB manage boundary and property surveys for numerous departments across the Government of Canada. The work related to defining Indigenous Settlement Lands to meet Canada's obligations in land claim legislation and agreements has constituted the largest land surveying program in Canada since the opening of the west following confederation. Efforts continue to support land claim and treaty commitments as well as emerging self-government programs such as First Nations Land Management.

Examples of work for other departments during 2016 to 2018 includes managing the surveys for the Rouge National Park in the Toronto area and various military sites in Canada's north for the Department of National Defence.

#### **Canada – United States International Boundary Commission**

The Canadian Section of the International Boundary Commission (IBC) is embedded within the SGB, and the Surveyor General is appointed as Canadian Commissioner under the International Boundary Commission Act. The Canadian Section of the International Boundary Commission, in cooperation with its United States counterpart, maintains the boundary between Canada and the United States and regulates the construction of works within three metres of the boundary.

## **Alberta – British Columbia Boundary Commission**

The Surveyor General is appointed to the Alberta-British Columbia Boundary Commission by statute along with representatives from both provinces. The Commission meets twice per year to set policy for boundary maintenance, to issue contracts for re-surveying and inspect monuments and to repair damaged monuments. Annual reports are maintained by Alberta and British Columbia as well as in the Canada Lands Survey Registry.



### **Did you know?**

**The Alberta-British Columbia Boundary is the longest interprovincial boundary in Canada, at 1842 km long.**

“Surveying from a station near the top of one of the passes 1913 - 1917”

Source: “Surveying the Great Divide” by Jay Sherwood, 2017

## 4. Highlights of 2016 - 2018

### Priority 1: Indigenous Peoples control of their lands

#### The Surveyor General Branch is supporting numerous Government of Canada Indigenous Reconciliation initiatives

The SGB provides contributions towards Modern Treaty implementation programs, additions to Reserves and Specific Claims that require historical research and analysis, and the clear definition of boundaries. A lot of support is also provided to self-government programs such as First Nations Land Management.

Since 1999, professional land surveyors in SGB have worked with Indigenous and Northern Affairs Canada (INAC) to conduct research on boundary and land related issues, and provide legal land descriptions to support the First Nations Land Management program. The Surveyor General is required by the First Nations Land Management Act to “*prepare or approve a description of land which will be subject to a First Nation’s land code prepared under the Act.*” (Section 6(1) (a))

Of the 634 First Nations in Canada, there are over 110 First Nation Communities active in First Nations Land Management program. Budget 2018 provides funding for an additional 50 First Nations to manage their lands. It typically takes 2 to 3 years for a First Nation to develop their Land Code and associated laws before presenting the governance package to their membership for a vote. During this developmental stage, the SGB supports the program by providing comprehensive research, professional advice related to boundaries and tenure, and a land description for the lands the First Nation will manage under the Act. The legal description provides each party to the agreement certainty of the status and extent of these lands.



*The SGB’s role is to **provide certainty as to the extent of the lands** that a First Nation will be managing.*

*This role will be expanded to support **capacity building** in communities over the next five years.*

*SGB provides communities with modern land administration tools such as this digital property map with a high definition image backdrop.*

As part of the expansion of the First Nations Land Management funding announced in the federal 2018 budget, SGB received approval to deliver two innovative activities to help remove barriers to effective land management. SGB will deliver a Land Surveying Capacity Building project targeting 24 First Nation communities over the next five years. Second, SGB will research and test alternative



approaches to resolving boundary disputes on Indigenous lands, incorporating Indigenous perspectives of land management.

### **A comprehensive forecast of land survey activity on Indigenous Lands until 2021**

In collaboration with the Association of Canada Lands Surveyors and the Department of Indigenous Affairs, a geographic information system analysis was conducted to evaluate industry capacity to respond to the forecasted demand for surveys of Indigenous Lands.

Results illustrate that although industry has the required capacity, it is not always in the optimum location, therefore negatively impacting the travel costs for legal surveys. Actions have been developed with industry to address the cost drivers to ensure that the surveys that communities require to move towards self-government are financially feasible (see part 11, page 18).

### **A Joint Industry and SGB Action Plan has the following objectives:**

- Develop a Foreign Professionals Recognition Program to increase the number of available professionals;
- Facilitate internal Canadian professional labour mobility through modernized on-line exams to expedite licensing in the Canada Lands jurisdiction;
- Build capacity in Indigenous communities (SGB – First Nation Land Management pilot projects)

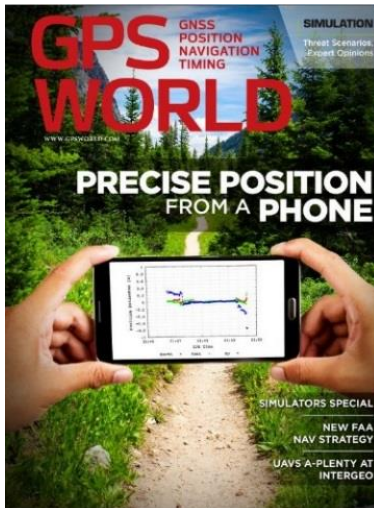
In order to achieve success in promoting First Nations control of their land, collaboration with Indigenous communities, Government of Canada partner organizations, the National Aboriginal Lands Managers Association, the FNLM Resource Centre, and the Association of Canada Lands Surveyors is essential. We are proud to work closely with our partners to foster Indigenous reconciliation through our shared relationship with the land.

## **Priority 2: Spatially enabling Canada for the digital economy**

Positioning, Navigation and Timing (PNT) provides precise location to support a broad array of activities from land surveying to navigation and will be a driver for innovation and competitiveness in the emerging digital economy. Further, 75% of Canada's critical infrastructure depends on precise timing.

In 2017, The Surveyor General Branch partnered with Innovation, Science and Economic Development Canada (ISED) to establish Canada's PNT Board. The Canadian Space Agency and the Departments of Public Safety, Fisheries and Oceans, Transport, Defence Research and Development are also sponsoring the Board.

The Board has the responsibility to direct related activities in the Government of Canada with a focus on system security and resiliency, investments in infrastructure and mobilizing innovation. The SGB through the Canadian Geodetic Survey is now providing leadership to develop a PNT infrastructure strategy for Canada.



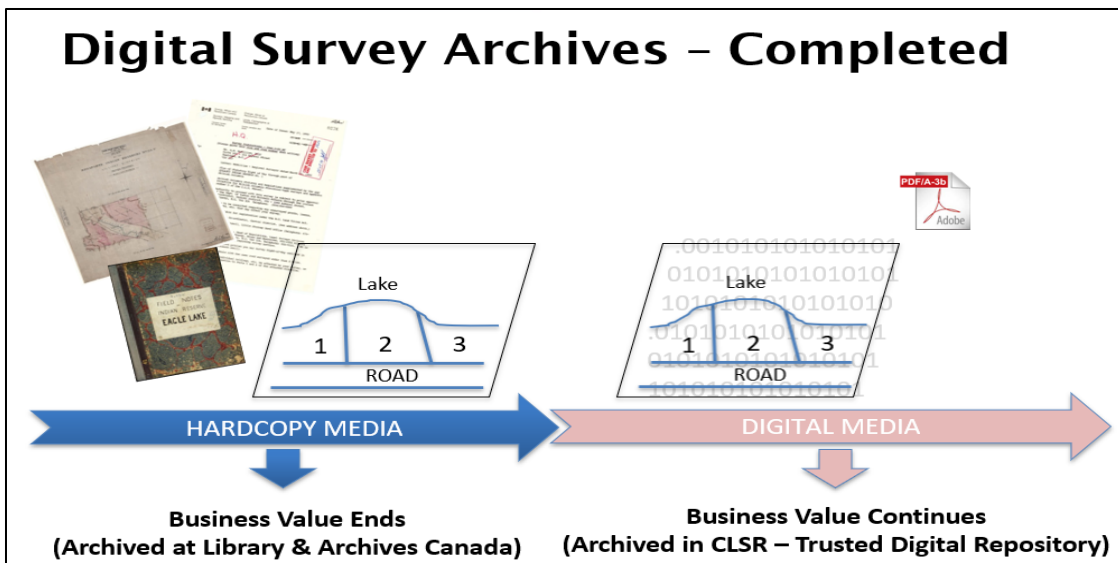
**Did you know?**

The global positioning market is now worth over \$400 Billion!

Source: Geobuiz

SGB digitized the Canada Lands Surveys Registry to support land administration in the digital economy.

Processing of approvals and archiving of records can now be completed on-line, reducing the time needed for land transactions. Digital maps of the property boundaries can also be downloaded and used for many land administration functions. The historical collection of hard copy records dating to pre-confederation has been transferred to Library and Archives Canada for perpetual storage and maintenance.



## A new Canada – United States International Boundary Commission website

In July 2016 a new website and related applications were launched to form the backbone for the organization’s information management and provide citizens in both countries with access to boundary data.



### ***Did you know?***

**The Canada – United States international boundary was formed by over 20 treaties and agreements, dating back as far as 1783.**

[www.internationalboundarycommission.org](http://www.internationalboundarycommission.org)

## **Priority 3: Northern property Rights**

In 2012, Yukon Territory’s Department of Justice launched the Yukon Land Titles Modernization initiative to facilitate more timely and efficient land transactions, while providing Yukoners and others with better access to information. Early in the project, SGB was recognized as an essential partner to ensure success, resulting in a Letter of Intent from Yukon to Natural Resources Canada. This laid the foundation to achieve an integrated and collaborative work entity, through shared objectives.

This project included modernization of Land Titles Legislation, updating business processes and procedures, and implementing a new secure electronic land titles registry. The new Land Titles Act formally recognizes SGB as their Survey Authority. Over the 2016 to 2018 review period, implementation of the new system has been completed resulting in a more efficient system of land registration in Yukon. The Land Titles Office (Yukon Territory) and the SGB (NRCAN) have operated as one efficient and effective entity since 2016, despite operating at two different levels of government in different locations.

Between 2016 and 2018 the SGB continued to support land administration to territorial governments with the completion of the NWT/Nunavut Administrative Boundary and several legal surveys of National Defence Sites in Canada’s high Arctic.



*The NWT/Nunavut administrative boundary provides certainty for investments in land and resource development – critical for effective administration post-devolution*

*Numerous federal lands such as National Defence sites have to be defined by legal survey in the devolution process*

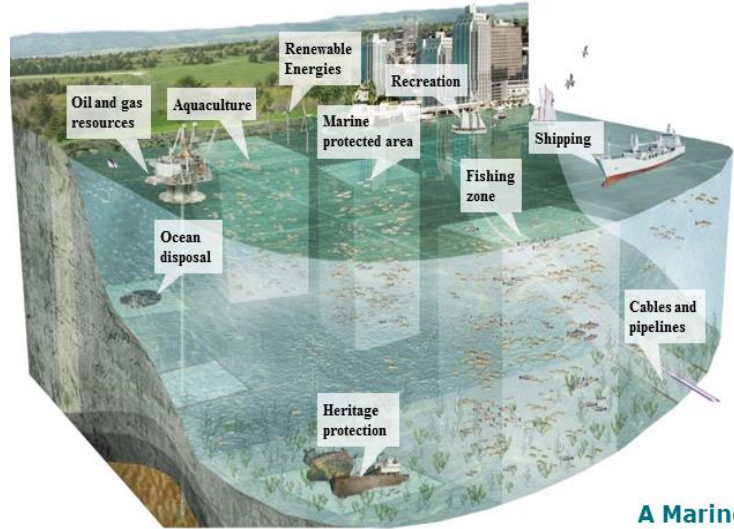


**Priority 4: Protection of Canada’s oceans**

The SGB is collaborating with the Canadian Hydrographic Service, Department of Fisheries and Oceans (DFO), towards the development of a Marine Spatial Data Infrastructure (MSDI) & Marine Cadastre Application. An MSDI is considered a key component necessary for efficient and effective governance of Canada’s oceans and a Marine Cadastre provides the foundation for the management of related rights, restrictions and responsibilities.

In collaboration with CHS, work began on the development of a Marine Spatial Data Infrastructure (MSDI) portal. This work advanced a data structure to store marine rights in a common format and provides SGB with the starting point for developing a collaborative marine rights tool. It also supports DFO as they consolidate data for use in an MSDI.

*A marine cadastre is an integrated system of registries that is fundamental to enable the systematic public recording of all recognized legal rights, restrictions, and responsibilities related to ocean space (Joint Task Team, March 2010).*



**A Marine Cadastre**

### Current Status ?

#### Prototype Development

- Define 3 pilot areas
- Gather, harmonize data/metadata
- Create test applications
- Create single point of entry
- Enhance the prototype infrastructure
- Refine application to meet client vision and needs



#### Collaboration

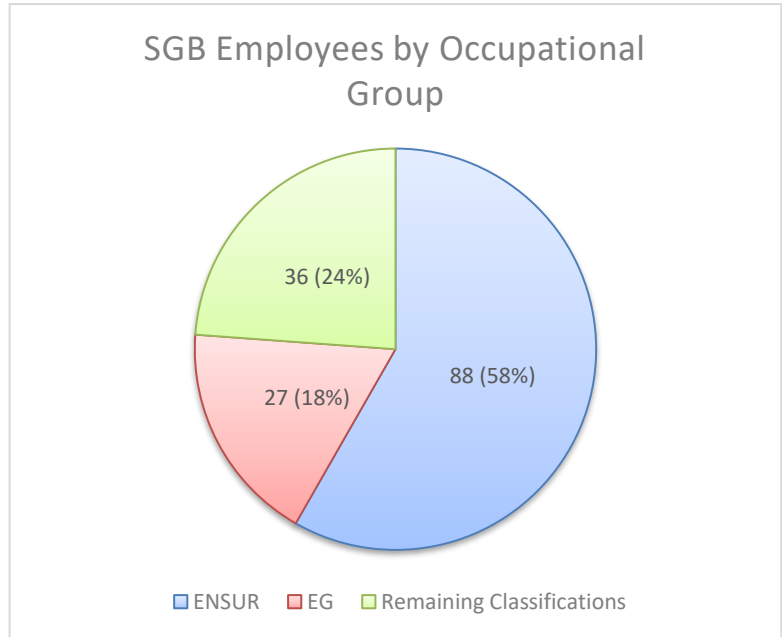
- DFO-Science
- CHS
- Fisheries Management
- Ecosystems Oceans Sciences
- Aquaculture
- **Natural Resources Canada**
  - **Surveyor General Branch (SGB)**
- Transport Canada
- Environment Canada
- Department of National Defense

Next steps include a project to implement a standard data format, based on internationally recognized models and to develop a web service solution that will allow users to search and identify extent and ownership of rights.

## 5. Building capacity for the future:

SGB staff are spread across Canada, operating out of 10 regional offices and a main office in Ottawa. By operating close to clients and stakeholders, we are able to strengthen collaboration and stay attuned with regional practices and priorities.

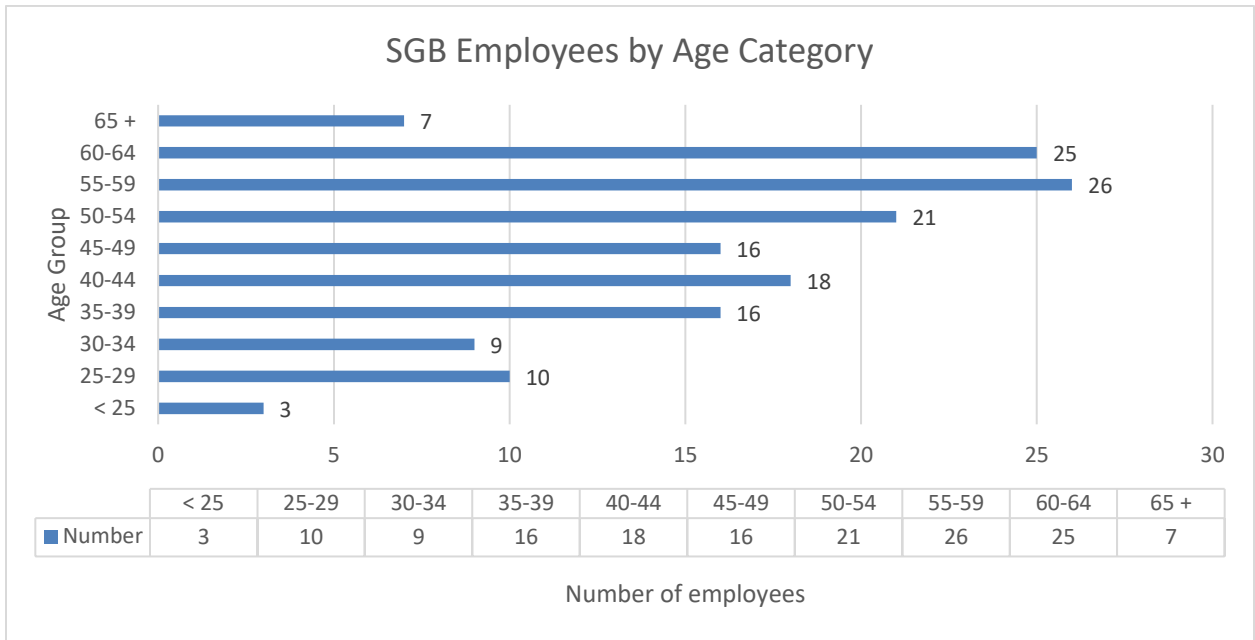
SGB work requires a high level of professional and technical expertise. Charts below demonstrate the distribution of employees across occupational groups. Over half of SGB employees are ENSURs and close to 18% have an EG (Technical/Scientific Support) classification. For the cadastral line of business, a large portion of positions also require a Canada Lands Surveyor (CLS) license.



GROUP	Count
Administrative Services (AS)	6
Clerical and Regulatory (CR)	4
Computer Systems(CS)	4
Engineering and Scientific Support (EG)	27
Electronics (EL)	2
Engineering and Land Survey (EN-SUR)	88
Executive (EX)	3
General Labour and Trades (GL)	6
Physical Sciences (PC)	3
Programme Administration (PM)	2
Scientific Research (SERES)	4
Other	2
<b>Total</b>	<b>151</b>

SGB, like the survey profession at large, has a high representation of “baby boomers”. The nature of the industry and our work means that many staff join mid-career. Accordingly, approximately 55% of our staff

are over 50 years of age. Many retirements are anticipated in the near future. In 2016-2018, twelve staff retired, representing approximately 8% of the workforce. This places significant pressure on the Branch.



In 2017, the Land Surveyor Development Program was implemented to ensure SGB’s sustainability and capacity to deliver and stabilize current capacity and increase mobility within the ENSUR group by:

- Investing in our people – Establishing a strategy for current employees to obtain a licence to practise as a land surveyor; and
- Investing in Canada’s youth – Recruiting new graduates and providing the necessary training and experience to become professionally licensed land surveyors.

## **6. Conclusion and moving forward from 2018 to 2020**

The 2016 to 2018 business cycle for SGB represented an extremely busy period filled with enormous change. Devolution of land administration responsibilities continued in the Northwest Territories and Nunavut; The First Nations Land Management program expanded; activity increased in Canada's offshore regions and the Government of Canada established a Position, Navigation and Timing Board.

All of these activities required a great deal of leadership and change management. Traditional institutional structures and program delivery mechanisms were continually challenged to meet evolving demands for new services. The project management framework used by SGB ensured that programs and services continually improved over 2016 to 2018 and that change was implemented effectively and with minimal disruption.

Priorities for the 2018 to 2020 business cycle will continue to be guided by the Branch Strategic Outlook to 2022. An updated Integrated Business Plan to 2020 will be published early 2019 that will lay out the strategic objectives and change projects for the next two years. As always stakeholders will be consulted throughout the process.



## 7. External publications from SGB – CLSS – IBC

**Ballantyne, B.**, 2016. A modest proposal: A boundary tribunal for Aboriginal lands; *Geomatica*, v. 70, no. 1, p. 60-63. doi:10.5623/cig2016-107

**Ballantyne, B.**, 2016. A puddle is not public: Wetlands, former Indian Reserves and land development in suburban Edmonton; *ALS News*, September 2016, p. 34-36.

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**Egesborg, P.**, 2016. ISO 19152:2012 – Land Administration Domain Model (LADM); International Hydrographic Organization, Minutes of the first Project Team Meeting on S-121 – Maritime Limits and Boundaries, New-York, USA.

**Egesborg, P.**, 2017. ISO 19152 – LADM in Canada, Surveyor General Branch Perspective; The 6th Land Administration Domain Model Workshop, Delft, Netherlands.

International Boundary Commission, 2016. United States and Canada 2015 Joint Annual Report.

**Rogers, S., Ballantyne, B. and Heibein, E.**, 2016. Assessing the Mapping Accuracy of Aboriginal Lands: Enhancing tenure security and land governance; World Bank Conference on Land and Poverty, Washington, DC.

**Rogers, S., Ballantyne, B. and Ballantyne, C.**, 2017. Rigorous Impact Evaluation of Land Surveying Costs: Empirical Evidence from Indigenous Lands in Canada; World Bank Conference on Land and Poverty, Washington, DC.

**Sullivan, P.**, 2017, A View to the Future, a Surveyor General's Perspective, with input from SGB staff and members of the ACLS, circulated to the ACLS membership in 2017 and posted on the NRCan website - <http://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/pdf/Aviewtothefuture.pdf> Geoscan ID: 300271

**Sullivan, P.**, 2017 as editor – Canadian Generally Accepted Land Surveying Principles, with contributions from the Canadian Council on Geomatics Cadastral Forum, the land surveying profession as well as SGB staff.  
<http://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/earthsciences/pdf/CanadianGenerallyAcceptedLandSurveyingPrinciples.pdf>

## 8. External publications from SGB – CGS

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doi:10.1002/2015WR018211

**Donahue, B., Ghoddousi-Fard, R., Mireault, Y., Lahaye, F.**, 2016. NRCAN Analysis Center technical report 2015; International GNSS Service Technical Report 2015, p. 45-50.

**Ghoddousi-Fard, R.**, Prikryl, P, Stanley Jacobsen, K; **Lahaye, F.**, 2016. GPS and GLONASS 1 Hz phase rate observations to study high latitudes ionospheric irregularities; AGU Fall Meeting, San Francisco.

**Jobin, D.M., Véronneau, M.**, Miles, W., 2017. First vertical derivative of gravity anomalies map, Canada / Carte des anomalies de la dérivée première verticale du champ de gravité, Canada; Geological Survey of Canada, Open File 8080, 1 sheet, scale 1:750 000 000. doi:10.4095/299560

**Jobin, D.M., Véronneau, M.**, Miles, W., 2017. Gravity anomaly map, Canada / Carte des anomalies gravimétriques, Canada; Geological Survey of Canada, Open File 8081, 1 sheet, scale 1:750 000 000. doi:10.4095/299561

**Jobin, D.M., Véronneau, M.**, Miles, W., 2017. Gravity Station Location Map / Carte de localisation des stations gravimétriques, Canada; Geological Survey of Canada, Open File 8077, 1 sheet, scale 1:750 000 000. doi:10.4095/299557

**Jobin, D.M., Véronneau, M.**, Miles, W., 2017. Horizontal gradient of gravity anomalies map, Canada / Carte des anomalies du gradient horizontal du champ de gravité, Canada; Geological Survey of Canada, Open File 8079, 1 sheet, scale 1:750 000 000. doi:10.4095/299559

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Li, X., **Crowley, J.W.**, Holmes, S.A., Wang, Y., 2016. The Contribution of the GRAV-D Airborne Gravity to Geoid Determination in the Great Lakes Region; *Geophysical Research Letters*. May.  
doi:10.1002/2016GL068374

**Klatt, C.**, 2016. Geodetic Technologies Enabling Innovation – Part 1: Federal Government; *Geomatica* v. 70, no 3, p. 187-193. doi:10.5623/cig2016-304

**Klatt, C.**, 2016. Precise timing from global navigation satellite systems & implications for critical infrastructure; *IR3 Infrastructure Resilience Risk Reporter*, v. 1, no. 5, p. 3-9.

Nudds, S., **Robin, C.**, MacAulay, P., 2016. Continuous Vertical Datum Separations for Canadian Waters: Creating Canada's First Hydrographic Vertical Separation Surfaces; *Sea Technology*, v. 57, no. 9, p. 38-42.

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Simon, K.M., James, T.S., **Henton, J.A.**, Dyke, A.S., 2016. A new glacial isostatic adjustment model for the Central and Northern Laurentide Ice Sheet based on relative sea-level and GPS measurements; *Geophysical Journal International*, no.205, p. 1618-1636. doi:10.1093/gji/ggw103

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van Diggelen, F., **Banville, S.**, 2017. Vers un positionnement GNSS de précision avec les téléphones intelligents Android; *Géomatique* v. 43, no. 4, p. 28-32.

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Ziegeweid, J R., **Silliker, R J.**, Densmore, B K., 2016. Revising Water-Surface Elevation Data for Gages in Rainy Lake Namakan Reservoir, and Selected Rivers in Minnesota, United States and Ontario, Canada; *Report to the International Joint Commission (Agreement No. – 1042-400750)*.

## 9. Metrics from SGB – CLSS

Output	2015 – 2016	2016 – 2017	2017 – 2018
Parcels created in cadastral datasets	4,445	3,983	5,930
Documents registered	1,885	1,386	1,418
Instructions issued	970	808	662
Plans deposited/registered	1,242	914	881
<b>Saskatchewan treaty land entitlement</b>			
Area of parcels described	6,222 ha	8,200 ha	9367 ha
Progress <sup>4</sup>	59%	60%	61.1%
<b>Manitoba treaty land entitlement</b>			
Area surveyed	2192.57 ha	1604.583 ha	1748.6 ha
Progress <sup>5</sup>	48%	49 %	50%
<b>FNLMA</b>			
Land descriptions	45	54	99
Research reports	132	33	135
<b>Interdepartmental letters of agreement</b>			
Number	40	32	30
Value	\$4.9 million	\$3.7 million <sup>6</sup>	\$3.9 million
<b>Survey contracts to the private sector</b>			
Number	170	162	77 <sup>7</sup>
Value		\$2.7 million	\$2.3 million <sup>8</sup>

<sup>4</sup> Progress refers to the proportion of the total shortfall of 859,000 ha that has been described by SGB.

<sup>5</sup> Progress refers to the proportion of the total obligation of 577,000 ha that has been described by SGB.

<sup>6</sup> The significant reduction in the value of Interdepartmental letters of agreement (ILA) in 2016-2017 is attributable to receiving direct funding for FNLMA rather than indirect funding through the ILA process.

<sup>7</sup> In 2017/18 fewer contracts were issued, however the average cost per contract increased.

<sup>8</sup> Grants and Contributions and other contracts are now being issued by FN organizations, which contributed to a decrease in contract dollars in 2017/2018 .

## 10. Metrics from SGB – CGS

Responsibility		Measured output		
Provide accessible, authoritative, reliable and accurate geodetic information				
	Target accuracy	2015 - 2016	2016 - 2017	2017 - 2018
Quality and extent of coverage				
Final GNSS orbits/clocks accuracy with respect to international standards				
Orbits	<4 cm	~1.1 cm	~1.1 cm	~1.5 cm
Clocks	<100 picoseconds	~15 ps	~15 ps	~16.7 ps
Canadian GNSS stations for which data were distributed	Positive trend	103 stations	112 stations	112 stations
Canadian GNSS stations for reference frame and velocity computations	Positive trend	177 CACS stations	181 CACS stations	186 CACS stations
		148 CBN stations <sup>9</sup>	146 CBN stations <sup>10</sup>	146 CBN stations
Maintenance of the Canadian gravity standardization network (CGSN)	<10 microGals	3 microGals	3 microGals	3 microGals
Timelines				
Posting of Canadian Active Control System GNSS observation files				
Hourly files <sup>11</sup>	CACS posted within 15 min. hourly, 90% of the time	99.25%	98.7%	95.6%
Daily files <sup>12</sup>	CACS posted within 30 min. daily, 95% of the time	99.6%	99.2%	92.5% (Note: Process has since been modified and target is now being met)
Geodetic survey product usage				
On-line sessions/data requests	Positive trend	19,966 requests/month	26,330 requests/	37,235 requests / month

<sup>9</sup> The decline is because some CBN points were converted to CACS stations.

<sup>10</sup> The decline is because some CBN points were converted to CACS stations.

			month	
GNSS data files retrieved	5% yearly increase	34,327 files/month	104,586 files/month <sup>11</sup>	44,609 files/month
Precise Point Positioning (PPP)				
Active PPP Users	Positive trend	4,969 users	5,497 users	6,224 users
PPP files processed	Positive trend	27,891 files/month	43,123 files/month	48,296 files/month

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<sup>11</sup> Although 1,255,032 GNSS files were retrieved in 2016-2017 (an average of 104,586 files per month), 820,829 of those files were retrieved by a single user over a three month period. Excluding this single user, an average of 33,408 GNSS files were retrieved per month.

# 11. Geographic location of professional land surveyors and indigenous communities

A visual graphic representation of the geographic location of professional land surveyors and indigenous communities. Source: SGB

