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Modernizing SDI: Enabling Data Interoperability for Regional Assessments and Cumulative Effects Concept Development Study

Request for Information (RFI)

RFI Response Due Date: Friday, May 29, 2020

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Abstract

The Open Geospatial Consortium (OGC) and Natural Resources Canada (NRCan) are requesting information to support a concept development study (CDS) entitled "*Modernizing SDI: Enabling Data Interoperability for Regional Assessments and Cumulative Effects*" (Modernizing SDI CDS). Information is being sought from a wide variety of organizations and individuals, particularly those who must use spatial data sourced from multiple suppliers and/or time periods, to perform regional assessments and cumulative effects analysis. This study seeks to define modernized parameters for local, regional and national spatial data infrastructures, including the integration of new tools, standards, and techniques (such as machine learning), that will promote increased data interoperability.

The motivation for issuing this RFI is to gather information to better support governments, agencies, non-governmental organizations and citizens to unlock the full societal and economic potential of spatial data and observations at national, regional, community or local levels by increasing its overall interoperability in a spatial data infrastructure. OGC and NRCan aim to enable federal, provincial, territorial and First Nations/Indigenous partners concerned with cumulative effects and regional assessments to establish a consensus and implement common, open, standards-based approaches that leverage emerging technological capabilities, leading to new levels of digital data interoperability.

OGC and NRCan wish to hear from a wide range of respondents, including those from:

- Federal/National governments
- Provinces/Territories/States (or equivalent sub-national entities)
- Indigenous communities and First Nations
- Municipalities
- Academic and Research Institutions
- Private sector geospatial solution providers and consultants
- Scientists and policy analysts concerned with regional environmental assessments and cumulative effects analysis

RFI results will also provide information on the current state of spatial data infrastructures with regards to how well they support regional assessments and cumulative effects analysis. It will gather and analyze information necessary to inform and guide the modernization of spatial data infrastructures in how they enable data interoperability and exchange between governments, regions, organizations and communities.

Outputs of this study will include a report that articulates practical ways to shift towards more intelligent, inferential, machine-driven solutions that allow data to be interoperable at need. Results will be communicated to the geospatial community through two public webinars. Results will also serve to inform future OGC Innovation Program and standards development activities, and lay the groundwork for a potential OGC Interoperability Pilot.

Responses to this RFI are requested by ***May 29, 2020***. Instructions on how organizations can respond to and submit questions about the RFI are found in this document.

1. Introduction

This Request for Information (RFI) is part of an OGC Innovation Program Project “Modernizing SDI: Enabling Data Interoperability for Regional Assessments and Cumulative Effects Concept Development Study (Modernizing SDI CDS)”. The initiative is sponsored by Natural Resources Canada (NRCan).

1.1. RFI Objective and Scope

This Concept Development Study seeks to answer the primary question “How can an ocean of environmental, foundational/framework, biological, socio economic and other data, from multiple different sources, collected over time, and with varying levels of standardization, be readily consumed and integrated by scientists and citizens alike?”

The overall objective of this study is to inform federal, provincial, territorial and First Nations/Indigenous stakeholders, concerned with cumulative effects and regional assessments, how best to establish consensus and implement common, open standards-based, approaches that leverage emerging technological capabilities, leading to new levels of digital geospatial data interoperability.

The scope of the CDS includes:

- Characterizing the current state of spatial data infrastructures and their use of current or emerging standards and advanced technology to enable data interoperability, and understanding current gaps and challenges;
- Assessing the availability and interoperability of geospatial data across various regions or jurisdictions, specifically those needed for regional environment assessments or cumulative effects analysis, as well as the technologies and services currently leveraged;
- Exploring and articulating practical means to achieve modernized, intelligent, inferential, machine-driven solutions that support and enable improved, efficient geospatial data interoperability. Results (including analysis of responses to this RFI) will be compiled in an engineering report for public release and will also be presented in two public webinars (English and French) in September 2020. Preliminary results may be presented in person at the OGC Technical Committee meeting in Montreal in June, 2020. CDS results will serve to inform future OGC Innovation Program and standards development activities including a possible Interoperability Pilot.

2. Background

This Request for Information (RFI) is a component of an OGC Concept Development Study (CDS) and subsequent Interoperability Pilot with the goal of assembling ideas, technologies, and practices that may enable federal, provincial, territorial and First Nations/Indigenous partners concerned with cumulative effects and regional assessments to establish inter-jurisdictional consensus and implement common, open standards-based approaches that leverage emerging technological capabilities, leading to new levels of digital data interoperability.

To fully understand the scope and components of interest of this study, and its Canadian context, some background and definitions are provided in the following sections.

2.1. The Canadian Geospatial Data Infrastructure (CGDI)

Canada's spatial data infrastructure (SDI), referred to as the Canadian Geospatial Data Infrastructure (CGDI) is the relevant base collection of standards, policies, applications, and governance that facilitate the access, use, integration, and preservation of spatial data.

GeoConnections is a national program with the mandate and responsibility to lead the Canadian Geospatial Data Infrastructure (CGDI) through a baseline of consensus-based, internationally accepted standards-based technologies and operational policies for data sharing and integration.

2.2. The Federal Geospatial Platform

The Federal Geospatial Platform (FGP) is an initiative of the Government of Canada's Federal Committee on Geomatics and Earth Observations (FCGEO), a committee of senior executives from 21 federal departments and agencies that are producers, consumers or stakeholders in activities, requirements and infrastructure related to geomatics. In 2017, the FCGEO community acted on an opportunity for federal departments and agencies to manage geospatial information assets in a more efficient and coordinated way by using a common "platform" of technical infrastructure, policies, standards and governance. The FGP fully leverages the standards, standards-based technologies and operational policies endorsed by the CGDI.

The FGP's primary mission is to "Geo-enable the Canadian Federal Government". The FGP intranet site (https://gcgeo.gc.ca) provides a collaborative online environment where federal government employees can easily share, find, view and analyze the Government of Canada's authoritative geospatial data holdings to support informed and insightful decisions and policy-making, and ultimately provide better service for Canadians. Overall, the Federal Geospatial Platform provides an enabling infrastructure to the public service and to Canadians, for access, visualization and analysis of trusted geospatial data, services and applications.

Under the basic premise, "build it once, use it many times," the FGP leverages coordination efforts and utilizes best practices, new technologies, and open standards to provide more accessible data and services while realizing efficiencies through shared, cloud-enabled infrastructure and economies of scale. This approach allows FGP to supply its data and services to other government initiatives. The FGP makes all federal open geospatial metadata and web services available to

Canada's Open Government Portal - Open Maps. The FGP will also underpin the Open Science and Data Platform for Cumulative Effects.

2.3. The Open Science and Data Platform for Cumulative Effects

Natural Resources Canada and Environment and Climate Change Canada are currently co-developing the Open Science and Data Platform for Cumulative Effects (OSDP), with the first release planned for spring 2020. The FGP is a primary delivery partner for the current OSDP initiative, with responsibility for making geospatial technologies, federal, provincial and territorial geospatial data and web services needed for cumulative effects analysis available to the OSDP.

The OSDP initiative aims to give to all Canadians a single point of access to data and scientific information to improve their understanding of cumulative effects and support impact impacts and cumulative effects assessments. The scope of data and information planned for release through the OSDP highlights a critical need to collaborate with all partners towards greater data interoperability.

How the OSDP integrates into the Canadian Geospatial Data Infrastructure is shown in Figure 1.

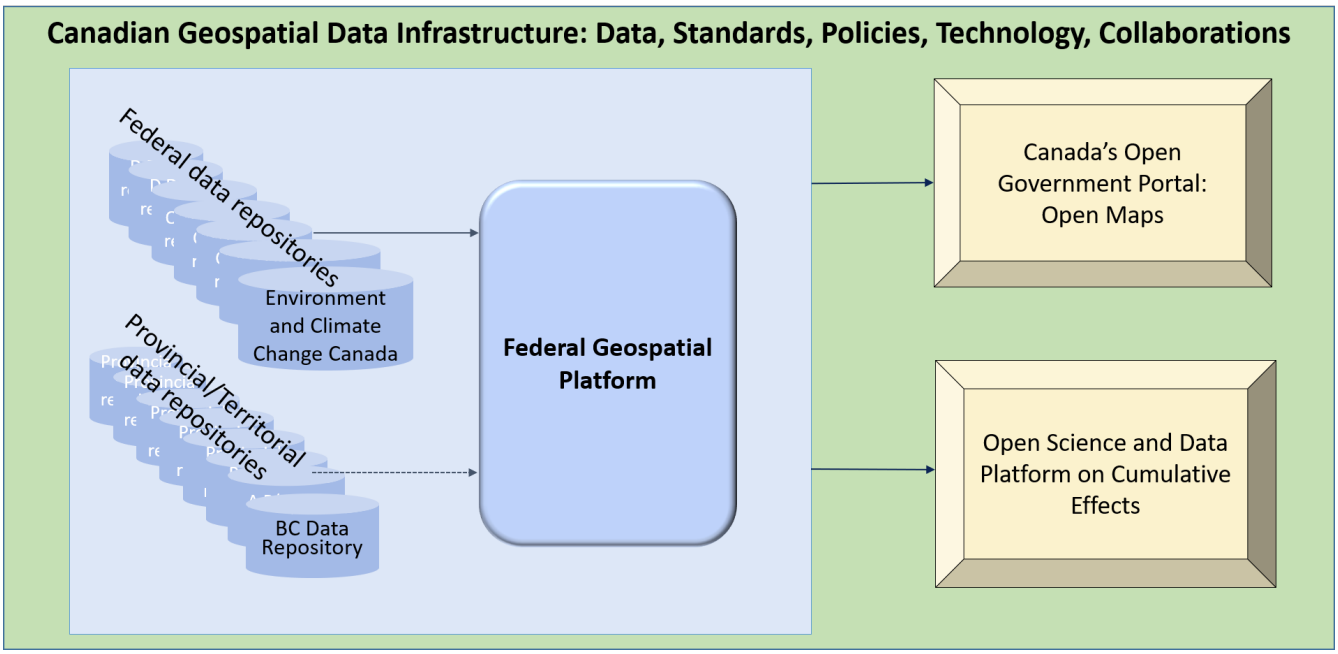

Figure 1. Canadian Geospatial Data Infrastructure (Source: Natural Resources Canada)

2.4. Data Interoperability

Data interoperability is generally defined as the ability for data held in one system to be compatible with other data products or systems and thus able to be integrated with other datasets across a number of different systems or analytical products. Data interoperability can be achieved by optimizing both the usability and reusability of data through the use of open standards.

2.5. Focus on Environmental Data

This CDS will focus research and discussion on the use case of geospatial data typically required for environmental regional assessments and / or cumulative effects analyses (RA/CE).

NRCan's current commitment to providing essential geospatial data via the Federal Geospatial Platform, to support initiatives such as the Open Science and Data Platform for Cumulative Effects, is driving this context.

Additionally, the broad scope of geospatial data requirements for RA/CE, as well as climate change studies and science, make this use case particularly and widely applicable to many stakeholders.

The scope of data needed for regional assessments or cumulative effects analysis confirms a critical need to collaborate with all partners towards greater data interoperability. An example of the wide variety and quantity of data required for a Regional Assessments and Cumulative Effects analysis is demonstrated by the recently completed "Regional Assessment of Offshore Oil and Gas Exploratory Drilling East of Newfoundland and Labrador". This assessment included the following data categories:

- Boundaries and Basemaps - National/International boundaries, offshore areas, leases, etc.
- Physical Environment - Bathymetry, Atmospheric Light
- Biological Environment - Fish and Fish Habitat, Marine Birds, Marine Mammals and Sea Turtles, Special Areas
- Socioeconomic Environment - Marine Fisheries including Domestic and International Commercial Fish Landings and Locations, Aquaculture Facilities, Indigenous Communities and Lands, Petroleum-related Activity, Shipwrecks and Legacy Sites, Other Marine Infrastructure (cables, etc.) Other geospatial data commonly used in Regional Assessments and Cumulative Effects processes can include:
- Data related to development activities, i.e.:
- Data on valued environmental components (VEC's), i.e.:
- Data that describe environmental management frameworks, i.e.:
- Data drawn from Indigenous or traditional knowledge

A more comprehensive list is shown in Figure 2.

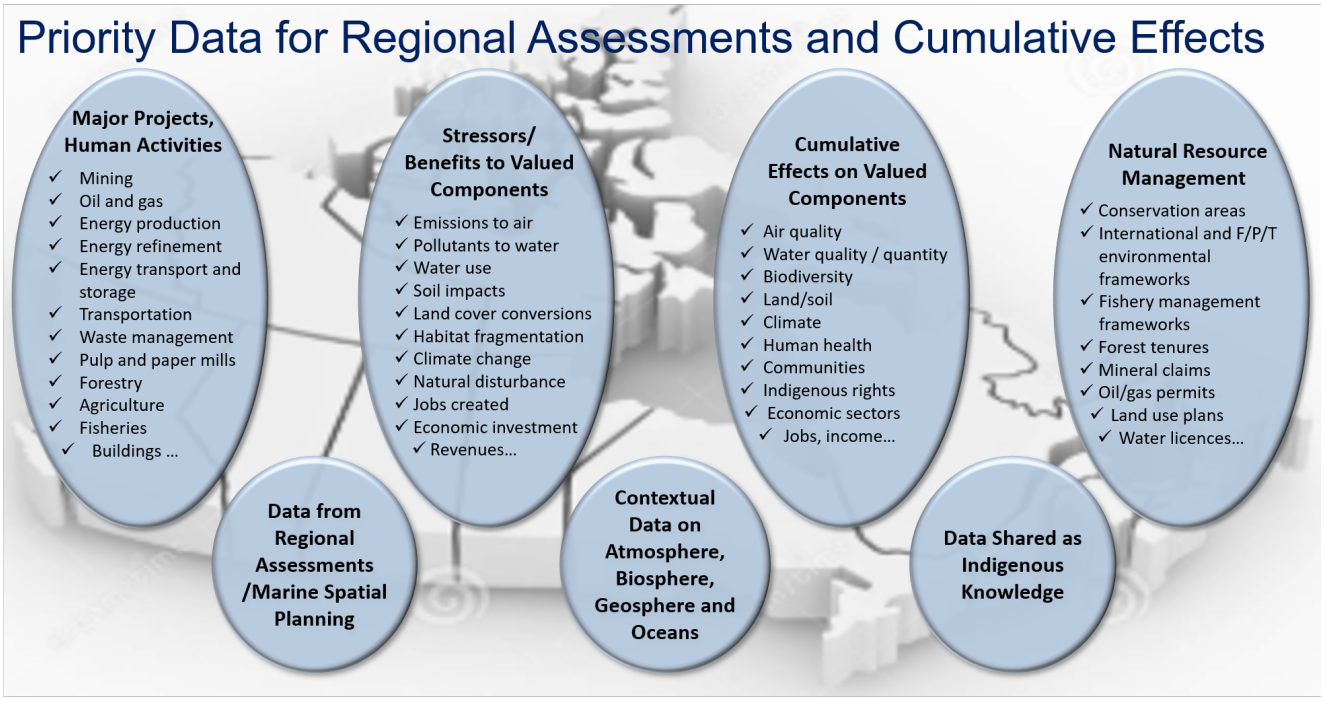

Figure 2. Priority Data for Regional Assessments and Cumulative Effects (Source: Natural Resources Canada)

3. Modernizing SDI: Enabling Data Interoperability for Regional Assessments and Cumulative Effects

Data interoperability is the next challenge in spatial data infrastructure. Data normalization, where it exists, tends to occur in domain-specific silos that, while valuable in that domain, lend little aid when integrating data more broadly. In the cumulative effects analysis use case, data can be sourced from a range of jurisdictions, sectors, domains, time periods, and social or community contexts. Meantime, next generation standards, massive processing power and machine learning are all rapidly advancing capabilities. How do geospatial data producers and consumers, prepare to leverage these new standards and tools to facilitate data harmonization and real data interoperability?

This CDS seeks to specifically identify standards-based solutions that enable data interoperability of key environmental data, from multiple jurisdictions, using emerging Internet-based technology like machine-learning/reasoning, data fabrics, data lakes, cloud services, OpenAPIs, and other evolving standards, technologies and tools.

The overall Modernizing SDI: Enabling Data Interoperability for Regional Assessments and Cumulative Effects project will be performed over two phases.

3.1. Phase One: OGC Concept Development Study (CDS)

The CDS phase will:

- Gather lessons learned in data interoperability from other spatial data infrastructures - INSPIRE, Arctic SDI, etc.
- Identify current and emerging open international standards and standards-based technological capabilities that can advance geospatial data interoperability, within the context of data typically utilized for cumulative effects analysis, including, but not limited to:
    - *Geosemantics* to enhance data reusability
    - *OpenAPI* to increase Web-based data accessibility
    - *GeoPackage* with embedded metadata for online-offline data exchange
    - *Self-describing data* for greater data portability and analysis readiness
    - *Blockchain* for distributed validation of data and metadata authenticity
    - *Cloud data storage / data lakes* to provide critical points of interoperability
    - *Machine learning and __inference* to help create cohesive data fabrics from disparate data sources
- Evaluate other standards and technologies emergent in the OGC community that support data interoperability, beyond the topics noted here, as appropriate to cumulative effects assessment
- Articulate, in an engineering report, architectural and technological requirements to enable increased data interoperability

- Develop a detailed project plan and schedule for a follow-on multi-jurisdictional data interoperability pilot for the purposes of testing possible solutions proposed in the Concept Development Study
- Deliver two webinars (one in English, one in French) based on the results of the Concept Development Study that inform geospatial data producers and stakeholders on:
    - Potential solutions for data interoperability based on these current and emerging standards and technologies
    - The relevance of each aspect of a next-generation approach to data interoperability, as noted above, as unique and critical building blocks towards data interoperability
- Propose a way forward for geospatial data producers to adopt and integrate new and emerging standards and technologies into their data architectures, data lifecycles and data dissemination processes.

3.2. Phase Two: Interoperability Pilot

Pending successful completion of the CDS, the Interoperability Pilot phase will follow the project plan developed as part of the CDS as a collaborative Canada-based OGC Innovation Program initiative with active participation by multiple OGC member organizations. The goal of the Phase 2 Interoperability Pilot will be to test concepts and solutions resulting from the Concept Development Study in a real-world scenario where data from multiple jurisdictions in Canada are sourced and used as input into regional assessments that range over one or more jurisdictional boundaries.

Areas of cumulative effects analysis or regional assessments often include more than one administrative area (i.e. a watershed that crosses one or more borders) and involve data inputs from multiple jurisdictions with varying data policies and standards. Examining and increasing levels of standards-based interoperability across jurisdictions should result in efficiencies for not only accessing but also utilizing data from different governments. The Pilot will source data from multiple Canadian jurisdictions for use in a cumulative effects regional assessment that itself ranges over one or more jurisdictional boundaries.

Other Pilot goals include:

- Testing of capabilities for data interoperability identified in the Concept Development Study within an inter-jurisdictional scenario of regional assessment for cumulative effects,
- Use of a broad range of framework, thematic, tabular, imagery, and sensor-based geospatial and socio-economic data,
- Involvement of multiple (two or more) Canadian inter-jurisdictional partners (federal departments or agencies, provincial and/or territorial governments, municipalities, or First Nations or Indigenous communities)

The Pilot will result in publication of an engineering report detailing the results of the project, as well as webinars (to be presented in both Official Languages) that present and promote the results and recommendations.

The region to be explored by the pilot will be determined in the planning stage, in consultation with stakeholders and proposed pilot participants.

4. RFI Response Outline

This RFI solicits responses from a wide audience to specific questions in eight subject categories below. Respondents to this RFI should respond to questions in one or more of these categories, as applicable to your role or experience. You may also submit any documents you feel are applicable to this RFI.

RFI responses will form a key input to this Concept Development Study including the final engineering report to be released publicly through the OGC Technical Committee.

4.1. Stakeholders

1. What is your name, position and contact information?
2. What is the name of the primary organization with which you're affiliated?
3. Which of the following categories best describes your organization?
    - Federal/National government
    - Province/Territory/State (or equivalent sub-national entities)
    - Indigenous community or Inuit, Métis or First Nation
    - Private sector geospatial solution providers and consultants
    - Municipality or equivalent
    - Academic or research institutions
    - Non-governmental organization or advocacy group
    - Other (please state)?
4. Where does your organization operate (country, province, territory, state, region)?
5. Is your primary professional role within your organization a:
    - Scientist concerned with regional environmental assessments and cumulative effects analysis
    - Policy analyst concerned with environmental, climate or economic development policy
    - Geospatial data provider or owner (e.g. data, tools, applications, services)
    - Geospatial data user
    - Technical solutions provider (e.g. software, hardware, standards setting, tools, applications, innovations, consulting)
    - Other (please state)?
6. Who are the key geospatial data and data standards stakeholders you interact with from local to international levels?
7. Who are the other organizations you routinely engage or collaborate with to access, share and or integrate data?

4.2. SDIs and Data Architectures

1. How aware are you/your organizations of Federal/National/Provincial/Territorial/State or other spatial data infrastructures available online today?
2. How significantly do you/your organization rely on spatial data infrastructures for data dissemination or data access?
3. How well does the Federal/National Spatial Data Infrastructure for your location meet your needs?
4. Does your organization currently contribute data and/or services to a Federal/National spatial data infrastructure? If so, please provide a brief description of how this is accomplished, and the scope of data provided.
5. Do spatial data infrastructure currently support your need to make available or access data related to environmental regional assessments and/or cumulative effects analysis?
6. Does your organization have a geospatial data management system? If so, please briefly describe the system's capability.
7. Are you/your organization familiar with OGC standards?
8. Do you currently use open geospatial standards to access data and services? If so, what are the key geospatial standards you use?

4.3. Data for Regional Assessments/Cumulative Effects Analysis

1. What data do you/your organization provide that could be included within a national spatial data infrastructure architecture to support regional assessments/cumulative effects analysis?
2. In what formats or by what means do you/your organization share or be most able to share this data?
3. Within the context of data typically utilized for cumulative effects analysis (both temporal and spatial), what current and/or emerging open international standards does you or your organization currently employ:
    - OGC Web Services
    - Geosemantics
    - OpenAPI
    - GeoPackage
    - Self-describing data
    - Other?
4. Do you/your organization release geospatial data that complies with a data standard, classification system or common schema? Please identify the standard, classification system or common schema.
5. What data sets do you use to support data-intensive analyses such as regional assessments or cumulative effects analysis? Are these data freely available through a spatial data infrastructure

or other online platform?

6. More generally, are there any global, regional, national or local datasets that you rely on? If so, please list these datasets.
7. Is the data you require:
    - “analysis ready” or “fit for use”?
    - available in the formats you require?
    - updated in the time interval that meets your needs?
8. Are you/your organization able to locate and access all the necessary data required for a fulsome environmental regional assessment or for cumulative effects analyses?
9. What data sets should be more broadly or openly made available (as part of a spatial data infrastructure or other Internet platform) to support environment regional assessments or cumulative effects analysis?
10. Do you/your organization experience challenges when integrating geospatial data from two or more sources? If yes, please describe them.
11. Are data you have access to or need access to protected or otherwise not widely distributed? This could include limited or proprietary data vs. Open Data.

4.4. Technology and Applications

1. What current standards, technologies or tools are you/your organization using or considering using to integrate and analyze disparate geospatial data?
2. What emerging technologies and tools are you currently using or investigating. (e.g.: machine-learning/reasoning, data fabrics, data lakes, Blockchain, cloud services, or other evolving standards, technologies and tools).
3. How have these emerging technologies and tools aided you/your organization in improving data architecture, data access and data interoperability?
4. What do you/your organization perceive as the most serious challenge to data interoperability? How might this challenge be overcome?
5. What other types of applications, tools, and services do you believe should be developed or built upon?

4.5. Requirements

1. What requirements, (including constraints) do you experience that should be considered for future design and development of an (inter)national spatial data infrastructure architecture?
2. Are there sufficient tools available to help you meet your requirements? Please describe any performance issues you may experience. If so, what are the issues?
3. What privacy and/or confidentiality requirements or concerns are associated with the datasets you employ and/or the analytical results you generate?
4. Are there any Indigenous or First Nations Ownership, Control, Access and Possession (OCAP®) requirements associated with the datasets you employ and/or the analytical results you

generate?

5. Are there any data licensing / rights requirements associated with the datasets you employ and/or the analytical results you generate?

4.6. Usage Scenarios

1. What scenarios and use cases would you like to recommend as part of future Cumulative Effects Pilot activities?

4.7. Operation and Organization

1. What policy, organizational, and administrative challenges do you have that must be addressed to improve a spatial data infrastructure architecture?
2. Are there unique needs that need to be considered at various levels of operations (local, state, regional, tribal, national, international levels, and by various players (government, commercial, NGO, academia/research)?

4.8. Other Factors

1. What other success factors or considerations do you see as needed for a successful National spatial data infrastructure architecture?

5. Organizations Issuing this RFI

Natural Resources Canada (NRCan), sponsor of this initiative, seeks to enhance the responsible development and use of Canada's natural resources and the competitiveness of Canada's natural resources six products. We are an established leader in science and technology in the fields of energy, forests, and minerals and metals and use our expertise in earth sciences to build and maintain an up-to-date knowledge base of our landmass. NRCan houses the Canada Centre for Mapping and Earth Observation and is a key contributor to national and international standards setting in the geospatial domain. NRCan develops policies and programs that enhance the contribution of the natural resources sector to the economy and improve the quality of life for all Canadians.

The Open Geospatial Consortium (OGC), host of this initiative, is an international consortium of more than 500 companies, government agencies, research organizations, and universities driven to make geospatial (location) information and services FAIR - Findable, Accessible, Interoperable, and Reusable. OGC's member-driven consensus process creates royalty free, publicly available geospatial standards. Existing at the cutting edge, OGC actively analyzes and anticipates emerging tech trends, and runs an agile, collaborative Research and Development (R&D) lab that builds and tests innovative prototype solutions to members' use cases. OGC members together form a global forum of experts and communities that use location to connect people with technology and improve decision-making at all levels. OGC is committed to creating a sustainable future for us, our children, and future generations. Recommendations from these initiatives become new or revised open standards and best practices which help to improve decision making, reduce the time and cost in mobilizing new capabilities, and to save lives and minimize the impact to property and the environment.

6. How to Respond to this RFI

6.1. General terms and conditions

Responses to this RFI are due by May 29, 2020 as listed in the Master Schedule (see Section 8). Responses will be distributed to members of the organizations listed in section 5. Submissions will remain in the control of this group and will be used for the purposes identified in this RFI. A summary of the RFI Responses may be made public. If you wish to submit proprietary information, contact (techdesk@opengeospatial.org) in advance of sending the response.

6.2. How to transmit a response

Send your response in electronic version to the OGC Technology Desk (techdesk@opengeospatial.org) by the submission deadline. Microsoft® Word format is preferred, however, Rich Text Format, or Adobe Portable Document Format® (PDF) are acceptable.

6.3. RFI response outline

A response to this RFI shall respond to as many applicable aspects defined in section 4 as possible. No particular format is required, but any response should be structured in a way that allows understanding of the respondents' position on key aspects as listed in Section 6: stakeholders, architecture, data, scenarios & use cases, requirements & constraints, operation & organization, and applications & technologies. Respondents are free to add any additional topic as they think appropriate. Please limit the total response to 15 pages.

6.4. Questions and clarifications

Questions and requests for clarification should be sent to techdesk@opengeospatial.org.

Questions received as well as clarifications from the RFI developers will be posted publicly at the Modernizing SDI CDS web site:

https://www.opengeospatial.org/projects/initiatives/modernizingsdi

6.5. Reimbursements

The organizations issuing this RFI will not reimburse submitters for any costs incurred in connection with preparing responses to this RFI. Cost share opportunities should arise from the Request for Quotation described in the abstract of this document, during the follow-on Pilot activity.

7. Master CDS Schedule

Activity / Milestone	Date
RFI Issued	March 31, 2020
RFI Responses Due	May 29, 2020
Presentation at Montreal TC Meeting	June 15-18, 2020
Final CDS Report and Pilot Plan	July 24, 2020
Public Webinar (English)	September 2020
Public Webinar (French)	September 2020
Pilot CFP Release	September 2020

8. Glossary

Term	Definition
CDS: Concept Development Study	Engages stakeholders, OGC membership, and the broader community of geospatial experts to identify opportunities and issues for advancing new interoperability solutions.
CGDI: Canadian Geospatial Data Infrastructure	Relevant base collection of standards, policies, applications, and governance that facilitate the access, use, integration, and preservation of spatial data
Cumulative Effects	Cumulative environmental effects and cumulative impacts, can be defined as changes to the environment caused by the combined impact of past, present and future human activities and natural processes (Wikipedia)
FGP: Federal Geospatial Platform	An enabling infrastructure to the public service and to Canadians, for access, visualization and analysis of trusted geospatial data, services and applications.
OCAP ® : Indigenous Ownership,	https://fnigc.ca/ocap
OSDP: Open Science and Data Platform for Cumulative Effects	A single point of contact for all Canadians to access data and scientific information relevant to project impacts, and regional, cumulative effects assessment.
Regional Assessments	Regional assessments are studies conducted in areas of existing projects or anticipated development to inform planning and management of cumulative effects and inform project impact assessments. (Canada.ca)
RFI: Request for Information	A CDS stage of widely gathering information from knowledgeable stakeholders on geospatial interoperability and data sharing challenges in a new domain.
SDI: Spatial Data Infrastructure	The technology, policies, standards, human resources, and related activities necessary to acquire, process, distribute, use, maintain, and preserve spatial data (Circular No. A-16 Revised)