

Regional Snapshot Report Building Capacity to Build Trust: Key Challenges for Water Governance in Relation to Hydraulic Fracturing

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Prepared for:
Canadian Water Network

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**University
of Victoria**



Canadian
Water
Network

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EXECUTIVE SUMMARY

This report identifies the key water governance challenges specific to hydraulic fracturing across Canada (with a particular focus on British Columbia, New Brunswick, the Northwest Territories, and Nova Scotia) and the knowledge gaps that need to be addressed to resolve such challenges. We also seek to provide general research proposals that would close such gaps.

Part I of this report describes the three main methods used to develop the findings of this study: a literature review, a Delphi study, and a regional workshop. Part II provides the background and context needed to understand the key findings of this report. Specifically, Part II defines key terms, and provides an overview of the state of hydraulic fracturing and water allocation in different regions of Canada. Part III identifies the priority water governance challenges associated with hydraulic fracturing, as identified in the available literature and by participants in this study. We present the challenges in four major themes:

- Theme 1: Capacity, transparency, and accountability of regulators,
- Theme 2: Scientific uncertainty regarding risks and cumulative effects,
- Theme 3: Inclusion of Indigenous nations in water allocation decisions, and
- Theme 4: Community concern and sense of place.

The detailed findings within Theme 1 describe a widespread lack of public trust in decision-making processes, and industry notably faces the costs of this in the form of a lack of social licence. Primarily, the lack of trust was linked directly to governments' limited resources and capacity in some of the regions where shale gas development is occurring or is proposed. Concerns about capacity included: governments' low staffing levels in environmental and resource protection agencies, the often high turnover rates of staff in remote or rural regional offices, and the rapidly advancing technological developments in the industry in provinces where operations exist. Questions were raised about how governments could: (1) understand the complexity of ecosystem functions in the watersheds where developments are proposed or occurring; (2) develop trusting relationships with industry, community, and Indigenous nations; (3) fully understand the operational practices of the industry and how best to regulate those practices; and (4) from there, enforce any regulations that do exist, all while meeting goals of fairness and efficiency, particularly when hydraulic fracturing may be just one of many uses for water in the watershed.

Gaps in trust also stemmed from a perceived lack of accountability and limited transparency in the water allocation process and by industry in their operations. This should not negate the numerous efforts that governments and industry are indeed taking, which are described in more detail, region-by-region, in the report. Instead, it is worth noting that these perceptions exist even with the current efforts, and that in and of itself is the challenge for those responsible for governing. It is the additive effects of the regulators' lack of capacity, accountability, and transparency that is resulting in a lack of public trust.

In Theme 2, we conclude that trust issues also arise due to the uncertainty regarding contamination risks and threshold and volume-related risks – that is, how much water can be allocated to hydraulic fracturing before negative social and ecological impacts are experienced - along with a lack of baseline data and cumulative assessment and monitoring programs. But while many studies will claim that “we need more data” to address this concern, the challenges described in Themes 1 and 2 are also related to concerns about the governance of that data. Participants acknowledged the challenge in trusting data collected by other groups, and highlighted that any source of funding creates a bias. The result is a deep mistrust amongst the many groups that report on data analyses. Therefore, any attempts to build transparency and accountability within water governance will need to consider whether these mechanisms address these issues of mistrust. For example, simply creating chemical disclosure websites may technically improve transparency but may not resolve the challenge regarding trust, nor build capacity for informed decision-making due to the lack of contextual meaning that the provision of such technical data offers (particularly if amounts are not also disclosed).

Theme 3 findings echo previous studies that show that Indigenous communities often experience a disproportionate burden of resource extraction impacts. This theme focuses on issues related to the need for existing water allocation frameworks to fully recognize and respect Treaty rights and the spirit and intent of government-government relationships, and to ensure water allocation decisions are supported by consultation and accommodation requirements that are consistent with current legal frameworks regarding Aboriginal rights and title.

Theme 4 explains the need for those involved in water allocation processes to demonstrate that they have considered the high degree of public concern for water use for hydraulic fracturing and that they responded accordingly. Discussions in this theme highlight the urgency of improving community engagement processes, recognizing the value of “sense of place” in water allocation decisions,¹ and addressing the lack of knowledge transfer *among* the different decision-making bodies and affected parties, and lack of knowledge *about* those same bodies and parties.

In Part IV, we outline seven knowledge gaps that are understood to contribute to the above-mentioned governance challenges. These seven gaps describe that improved knowledge and understanding are needed about:

1. How to design processes in which “good governance” principles are embedded;
2. The relationship between transparency and trust in water governance;
3. Opportunities for developing and sharing rigorous data sets;
4. Methods for establishing publicly available information on the scope and availability of industry data;
5. The comparison of experiences of Indigenous peoples in North America with respect to water governance and hydraulic fracturing;

¹ As we describe below, a growing academic literature on “sense of place” explores the affective dimension of communities’ relationship to their local surroundings. This literature recognizes that the emotional bonds between people and places can strongly affect community responses to industrial projects (e.g. Devine-Wright and Howes 2010).

6. Collaborative watershed planning and governance approaches in rural and remote areas; and

7. The definition of “public interest” in water in the context of hydraulic fracturing.

For each knowledge gap, we propose a general research approach which could be used as a platform by water governance scholars to develop and test how to best address the priority governance challenges surrounding potential water allocations for hydraulic fracturing.

In Part V, we conclude the report by recognizing that the use of water in hydraulic fracturing activity in Canada has not caused, but has certainly illuminated, the fractured nature of existing water governance arrangements. We contend that there is an urgent requirement for generative actions – ones that build capacities for accountability, transparency, for engaging Indigenous and non-Indigenous communities, and for making informed decisions.

AUTHORS’ CAVEAT

Given the diversity of viewpoints that surround water governance in relation to hydraulic fracturing, it should come as no surprise that among our team, our partners, our academic advisors, and our workshop participants, the perspectives on this topic are not unified. In undertaking this work, the research team and our partners often faced questions, even accusations, by external observers that by engaging in a discussion about water governance in relation to hydraulic fracturing, we were inexorably helping to “pave the way” for hydraulic fracturing to occur – something that some of our partners and advisors have worked exhaustively to prevent. At the same time, other observers acknowledged that hydraulic fracturing was occurring in parts of Canada, and ignoring it would suggest passive complicity; thus there was a sense that dialogue that could improve the existing governing regime was worthwhile. Moreover, a few participants and reviewers claimed that the existing governance approaches for allocating and regulating water quantity and quality were already being made more stringent and that we were biased due to the lack of emphasis on the numerous ongoing efforts to regulate, consult, and improve operational practices. Capturing these diverse viewpoints in a single report with which everyone will agree to have their name associated would clearly be no small task. Thus, we have approached our report from a slightly different angle.

In many regions across the Canadian landscape, resource extraction activities often relied on water sources that, at least until now, have not had several competing demands. As a consequence, the governing of water for such use was deemed to not require much oversight. Thus, while the emerging debates and concerns about water use for hydraulic fracturing have highlighted weaknesses in the water governance frameworks that currently exist across Canadian jurisdictions, many of these weaknesses existed long before hydraulic fracturing was ever proposed, and previous resource-based industries have generated similar challenges for decision-makers. Consequently, we believe that innovations in water governance arrangements are needed and that the controversial nature of allocating water for hydraulic fracturing provides an opportunity to address broader systemic governance challenges.

The implementation of innovations that might improve governance (which can include, for example, the creation of watershed-based organizations or new regulations or engagement processes – see Moore et al. [2014]) could result in any number of decisions or outcomes. Some jurisdictions might opt to include hydraulic fracturing in their chosen water-energy future while others might not. Our focus in this report is on *processes* of good governance; as such, we do not analyze or assess the outcomes that such processes might produce. The discussion of the merits or risks of specific water-energy pathways is outside the scope of this report. Consequently, although this report will highlight several challenges specific to water governance in relation to hydraulic fracturing, one of the most significant governance challenges relates to the lack of a broader vision for the water-energy nexus (how water produces energy and how energy provides water services) within Canada.

Discussions about water governance, water use, and water-related risks associated with hydraulic fracturing activities have predominantly focused on determining who should be taking responsibility (government or industry) and on identifying the negative impact to the health of watersheds and the people living within them. Little effort has been invested in debating the question, “What does a sustainable water-energy future look like?” Some parties consider the development of shale gas to be part of the sustainable energy future. This view, however, remains problematic for two reasons: (1) this judgment has often been reached in the absence of adequate research and consideration of the water implications of the industry, and any sustainable future needs to include water; and (2) a meaningful public dialogue on how water use for hydraulic fracturing fits into a vision for Canada’s own sustainability path has not occurred. Without providing an opportunity to co-create this vision with government, rights-holders (i.e. Indigenous peoples), stakeholders (i.e. non-Indigenous communities, organizations, industry), and the public across Canada, water governance debates are inherently bound up with these concerns.²

During our research, broader questions about whether hydraulic fracturing activities contribute to an appropriate trajectory for our sustainable future often overshadowed questions of water governance. It was often difficult to keep the discussions focused on challenges specific to water governance. Therefore, the analysis that follows, and the participation of our partners in the discussion about water governance and hydraulic fracturing, must be understood in this complex context. That is, no broad-ranging agreement existed amongst our partners, or indeed amongst our research participants, that water use for hydraulic fracturing should or should not take place. We consider the absence of a public debate that is adequate to facilitate the development of some form of social consensus on this issue as a governance failure in itself – one that affects all water governance matters.

² The Government of British Columbia (n.d., 1) writes, “As indigenous people were the original occupants of the land, they have certain legal rights (Aboriginal or treaty) that other British Columbians do not have. This shapes the provincial government’s relationship with indigenous people – it is a government-to-government relationship where First Nations are rights-holders not stakeholders.” While this refers to the British Columbia context, it applies across the whole of the Canadian landscape.

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ACRONYMS AND ABBREVIATIONS

AER	Alberta Energy Regulator
ANSMC	Assembly of Nova Scotia Mi'kmaq Chiefs
BAPE	le bureau d'audiences publique sur l'environnement
CAPP	Canadian Association of Petroleum Producers
CBSM	Community-based social marketing
CCA	Council of Canadian Academies
CFCI	Canadian Forest Conservation Initiative
CMM	Confederacy of Mainland Mi'kmaq
CWN	Canadian Water Network
EIA	Environmental impact assessment
ESRF	Environmental Studies Research Fund
FITFIR	First in time, first in right
FNFN	Fort Nelson First Nation
GNWT	Government of the Northwest Territories
KMKNO	Kwilmu'kw Maw-klusuaqn Negotiation Office
LNG	Liquid natural gas
MNC	Multi-national corporation
MOE	Ministry of Environment
MVEIRB	Mackenzie Valley Environmental Impact Review Board
NAFTA	North American Free Trade Agreement
NGO	Non-governmental organization
OGC	Oil and Gas Commission

PACES	Program for groundwater knowledge acquisition (Quebec)
SEA	Strategic Environmental Assessment
SLWB	Sahtu Land and Water Board

INTRODUCTION

Hydraulic fracturing – as an extractive technique that involves injecting hydraulically pressurized liquid into shale rock in order to fracture it and release the natural gas inside – relies on significant throughputs of water and has several potential water-related effects. This technique has been the subject of growing, polarized public debate in many regions in Canada and around the world. With hydraulic fracturing activity increasing or proposed in several provinces, governance processes that seek to ensure decision-making about surface water and groundwater allocation are socially, economically, and ecologically responsible are urgently needed. In response to this need, the Canadian Water Network developed a research program to address four themes: (1) Wastewater handling, treatment, and disposal; (2) Groundwater and subsurface impact issues; (3) Landscape impact of operations on surface water/watersheds; (4) Watershed governance. Our project team focused on Theme 4, and we addressed this theme from a regional perspective, with a consideration of the following questions:

- What are the water governance challenges specific to hydraulic fracturing across Canadian regions, and particularly focusing on British Columbia, New Brunswick, the Northwest Territories (NWT), and Nova Scotia?
- From a regional perspective, what knowledge do Canadian researchers need to develop to address these challenges?
- What methods might be possible to generate this knowledge?

To address these questions, our team of researchers, partners, and trainees sought to assess the current state of knowledge regarding water governance for hydraulic fracturing. We analyzed the existing, albeit limited, literature, conducted a Delphi study, and carried out a workshop involving academics, non-academic partners, and government and industry participants from both the east and west coasts and the Northwest Territories. In this report, we present the results of this cross-Canada collaboration and offer several possible routes of knowledge development that could support water governance innovation using the case of hydraulic fracturing as a substantive anchor to our inquiry. We focused our research program specifically on processes of water allocation (i.e. who gets to use the water, in what quantities and for what activities) in the context of hydraulic fracturing.

Overall, we do not prescribe policy trajectories or even research agendas; rather, we focus on knowledge development to support effective governance *processes*, which will result in better outcomes (recognizing that even defining what “better” means would be an outcome of these processes).

PART I. Methods

To address our three-part research question, we developed a methodology with three main stages: a literature review, a Delphi study, and a workshop that drew together diverse perspectives from the primary regions in Canada where hydraulic fracturing is occurring or proposed. Findings from this research are drawn together in this synthesis report, within which the findings from each stage are discussed in relation to one another.

STAGE 1: Literature Review

Through an extensive literature review, we analyzed the current state of knowledge on hydraulic fracturing and water governance in Canada. We drew upon academic literatures, as well as a wide range of other sources, including reports by governments, expert panels, and international organizations. A full list of reviewed material can be found in the references section at the end of this report.

Academic Literatures

The body of literature that addresses both hydraulic fracturing and water governance specifically is new, and, although fast growing, remains fairly limited in its analysis of governance. Much of the emerging literature is focused on technical issues (see Government of New Brunswick 2014) or on providing scientific information that demonstrates whether and what types of impacts result from the use of water for hydraulic fracturing (e.g. CCA 2014). As a result, we drew from diverse areas of inquiry including political ecology, environmental justice, Indigenous governance (and collaborative governance models), governance of resource extraction, and general water governance literature. The vast literature on cumulative effects was also relevant. “Sense of place” literatures – focused on hydraulic fracturing (though usually not on water-related aspects of the technology) or other extractive or energy industries – helped us to consider how geography, identity, and place-based attachment also influence individual, community, and system-wide responses.

We conducted our search by using the database *Scopus* and referring to existing annotated bibliographies (e.g. Government of New Brunswick 2014). We did not set a timeframe but it is worth noting that the majority of the scholarship has only appeared in the last ten years; little was published before 2004.

Other Literatures

Beyond the peer-reviewed scholarship, we include data from two landmark 2014 studies: the Council of Canadian Academies’ *Environmental Impacts of Shale Gas in Canada* and the Report of the Nova Scotia Independent Review Panel on Hydraulic Fracturing. We also used provincial government reports and strategic documents for building an understanding of the regional differences in shale gas developments and existing water governance frameworks.

Where relevant, we also drew on resources that examine issues related to water governance risks and hydraulic fracturing in regions throughout the world, including the European Union, the United States, and Australia. As in Canada-focused literatures, many of the most comprehensive studies have been conducted by research organizations that have published the results in reports that are accessible to government, industry, Indigenous Nations, and non-governmental organizations (NGOs); results in peer-reviewed journals are less common. Examples of such reports include the World Resources Institute's (Reig et al. 2014) assessment of water availability for shale gas development in areas throughout the world, the Resources for the Future report that described pathways for dialogue (Krupnick et al. 2013), and the Rathenau Institute's analysis of the shale gas debate in media and government forums (van Waes et al. 2014).

STAGE 2: Delphi Study

What are the range of issues and options related to hydraulic fracturing and water governance in Canada? To begin to address this question and to help build the program of research, we developed a three-part Delphi study. A Delphi study is a research method used to structure an anonymous conversation involving a group of experts, centered on generating ideas and finding common ground between participants who may (or may not) have similar credentials or perspectives on a particular phenomenon. The purpose of engaging with these experts anonymously is to ensure equality and opportunity for panel members to express their independent opinions. This is particularly useful in a study such as this when “disagreements among individuals are so severe or politically unpalatable that the communication process must be refereed and/or anonymity assured” (Stitt-Ghodes and Crew, 2004, para 6). A Delphi study engages these experts anonymously and over multiple “rounds” of study (Linstone and Turoff 2002). In most cases, as with our study, Round 1 of the Delphi focuses on generating ideas that will later inform the subsequent two rounds. Delphi studies are known to be an effective way to draw on the “heterogeneity of the participants ... to assure validity of the results, i.e., avoidance of domination by quantity or by strength of personality” and when “the problem ... can benefit from subjective judgments on a collective basis” (Stitt-Ghodes and Crew 2004, para 6).

The purpose of our Delphi study was to create a “virtual panel” of experts that could define and then establish consensus on the top priority challenges in Canada with respect to water governance in relation to hydraulic fracturing. This study was conducted online between May and July 2014. Overall, the Delphi study sought to build consensus around three guiding questions:

1. What are the most significant priority decision challenges associated with water governance and hydraulic fracturing in Canada?
2. What are the key knowledge gaps associated with these challenges?
3. What are the best methods for filling these gaps?

The Expert “Virtual Panel”

Within a Delphi study, the number of individuals required can vary widely. While the number of participants often ranges from ten to thirty (Ludwig 1997), there are Delphi studies that have had as many as 121 participants (e.g. Khadka and Vacik 2011). The number of participants depends on participant availability and research goals; a higher number of participants may help ensure a broader range of response. To solicit diverse opinions, we contacted as many potential panelists as possible for this Delphi study. Our goal was to involve ten to fifteen participants within each of five categories: government, industry, Aboriginal organizations, non-governmental organizations, and academia. We hoped, overall, for a total of fifty to seventy-five participants sustained through all three stages of the study.

To begin the study, we sent a survey via email to 589 experts and, as a modest incentive to participate, indicated that all who provided responses across all three rounds would be entered into a draw for \$250. On the first round, we received a relatively high response rate of approximately 20 percent (112 people). Over the following two rounds, we had some withdrawal; in total, however, we achieved our goal of 50 to 75 participants, with 57 completing all three rounds (see Appendix 1 for an overview of participant affiliation and participation). In Round 1, NGOs represented the largest group of respondents at 28 percent of the total. Academics were the second largest group of respondents (18 percent). Participation among provincial government representatives (16 percent), industry representatives (12 percent), and from Aboriginal organizations (9 percent) was approximately even. Local government (4 percent) and federal government (3 percent) represented the smallest proportion of the total during Round 1. The number of participants from British Columbia was the highest; Alberta, Ontario, and Nova Scotia were also strongly represented (see Appendix 1).

Building Consensus: A Three-Part Process

As noted above, the Delphi approach is a structured, systematic method that uses an iterative process to generate knowledge and build consensus on a topic among a panel of experts (Lindstone and Turroff 2002). Researchers working on forecasting on public policy issues have increasingly applied this method (de Loë 1995; Taylor and Ryder 2003; Frewer et al. 2011). The technique works through a series of questionnaires that incorporate feedback (Wright 2002). We chose the Delphi approach in order to draw perspectives from a wide and diverse group of people with experience in the issue of water governance and/or hydraulic fracturing. The goal was to create, from these diverse perspectives, a consensus on the three key questions. In order to build this consensus, we conducted the study in three rounds, with the second and third rounds building upon and refocusing participant contributions.

ROUND ONE: Participants were invited via email to respond to the open-ended questions and submit their responses to the study moderator. The purpose of the first round was to generate content for a list of statements to be evaluated by the same participant group in the second and third rounds. The first round was highly productive, offering rich insight into what these experts saw as the key priority decision challenges, knowledge gaps, and methods for filling these gaps. At the end of the two-week period the moderator, using constant

comparative thematic analysis, amalgamated the responses to create concise statements, with each statement aligning to one of the three open-ended questions. As one example, in response to the question of key priority decision challenges, many participants identified a lack of trust as a key governance challenge, thus we generated the statement: “Building trust among all affected and involved parties, including industry, government, Aboriginal groups, and the general public.” In total, we developed nineteen statements (see Appendix 2).

ROUND TWO: In the second round, we asked participants to rank each statement based on desirability and feasibility using a scale of one (not desirable/feasible) to five (very desirable/feasible). Participants also had the option of “no judgment” in their ranking of a given statement. This ranking process was selected in order to facilitate the prioritization of statements by participants. At the end of each question, participants were provided with the opportunity to leave a comment or to suggest a new statement.

ROUND THREE: In the third round, participants had the opportunity to examine the group median responses (desirability and feasibility scores) for each statement, and to compare these with their own previous responses. Participants were asked whether they wanted to make any changes to their responses based on the median. At the end of the survey, we asked participants to explain how they were interpreting the term “feasibility,” and they offered several different responses:

- “Feasibility means the potential of carrying out the prescribed activity given current resources, scientific ability, and political will.”
- “Ease or practicality of implementation.”
- “I answered based on my experience in government and working with government.”
- “The term ‘feasibility’ was used in the overall economic sense – whether or not it would be affordable to approach the given statement.”

The “desirability/feasibility” evaluation is a key technique within Delphi studies that seek to address political and technical issues across a range of different items (or statements).

Overall, we selected the “desirability/feasibility” evaluation scale because the two-part scale can draw out tensions between the two types of ratings. Turoff (2002, 86) notes: “On the resolutions to a policy issue it is usually necessary to assess both desirability and feasibility. One will usually find a significant number of items [that] are rated desirable [but] unfeasible or undesirable [but] feasible. These types of items will usually induce a good deal of discussion among the respondents and may lead to the generation of new options.”

Interpreting Responses: Key Limitations

A number of limitations must be noted with respect to interpreting our data from the Delphi study. First, a key challenge during the content-generating round (Round 1) was that participants tended to address hydraulic fracturing more generally, rather than staying focused on the subject of water governance in relation to hydraulic fracturing. Second, the Delphi study technique allows us to reach individuals from many different backgrounds and for them to share our online survey invitation to others in their network of “experts”; based on some responses, we suspect that the Delphi technique was new to many, and many who may never have had the opportunity to participate in a survey of this kind, were using the study as an opportunity to share their perspectives with a national audience. For example, some

participants wrote, “ban hydraulic fracturing” for each question, without providing an additional rationale about the statement. Third, at our regional workshop, participants who had also been part of the Delphi study suggested that actors might have been strategic in their discussion of issues other than water (i.e. carbon outputs, landscape effects), noting that in these complex environmental discussions, one issue may often become a proxy for another.

We also came to realize that many participants had trouble expressing their views on water governance issues because of a lack of understanding regarding the specific processes that govern water use for hydraulic fracturing; during our analysis we discovered that participants were largely unable to separate out the different aspects of governance. Thus, an unanticipated but important finding of the Delphi study was that we identified the need for greater knowledge mobilization among industry, individuals, Aboriginal groups, and government about potential water allocation and use for hydraulic fracturing – a public education program that could support informed dialogue. This supported our findings of “top decision challenges,” as many participants also identified the need for knowledge mobilization and exchange as a key issue.

STAGE 3: Workshop

On October 16 and 17, 2014, in Victoria, BC, we ran a workshop called “Water Governance and Hydraulic Fracturing.” The workshop included a total of twenty-five people from sixteen organizations in five regions: British Columbia, Alberta, New Brunswick, the Northwest Territories, and Nova Scotia. The workshop was run according to Chatham House rules, which meant that no individual speaker would be named or identified in the research results or reporting but that participants would be free to use the information they received during the two-day event. Rather than to isolate individuals’ work or perspectives, the purpose of the workshop was – through discussion and debate – to build shared understanding on key challenges and knowledge needs related to water governance and hydraulic fracturing. We worked to identify priority decision challenges and key knowledge gaps, but also to map and understand regional differences. Here, after a brief overview of the workshop events, we describe the governance challenges (with attention to regional differences), ideal governance, knowledge gaps, and possible research methods, all as identified by participants.

Workshop Overview

PREPARATION OF REGIONAL BRIEFING NOTES: In advance of the workshop, members of the research team worked with research partners to create “Regional Briefing Notes” – a series of two–three page summaries of the key issues regarding water governance in relation to hydraulic fracturing in seven different regions (Alberta, British Columbia, New Brunswick, Nova Scotia, the Northwest Territories, Ontario, and Quebec) to provide a kind of “map” of regions where shale gas development are either occurring or are being considered. For the briefing notes, the research team conducted a literature review and interviews with research partners to develop a preliminary summary of the state of water governance and hydraulic fracturing in each place. The notes describe – in each of the seven regions – the state of the hydraulic fracturing industry, the water governance framework, water governance challenges, and any information gaps. The notes’ description of these issues was preliminary,

intended to support discussion at the workshop, rather than to be conclusive or all encompassing. They were emailed to participants a week in advance of the workshop, and the content of these has been used extensively in Part II of this report.

DAY 1: GOVERNANCE CHALLENGES, IDEAL GOVERNANCE, AND EXAMPLES OF INNOVATIVE GOVERNANCE

- After a brief welcome and introduction, we presented the result of the Delphi study and opened the floor for discussion.
- We then ran two linked sessions, the first on the identification of shared governance challenges, the second on identification of ideal characteristics of governance (i.e. what participants thought governance should be). In identifying challenges, participants worked within small groups, shared small-group perspectives with the workshop as a whole. We organized these challenges into themes, and then participants had the opportunity to vote on what they thought were the key challenges; they could select either a whole theme or a more specific issue within a theme.
- Next, to illustrate the idea of innovation and “new opportunity contexts,” two participants presented on case studies of innovative governance in their home regions. We heard analyses of the Wheeler Report, Nova Scotia’s independent assessment of hydraulic fracturing in the region, and of the Fort Nelson First Nation’s partnerships with a company for purposes of developing a monitoring initiative and program of regulatory oversight.

DAY 2: APPROACHES TO ADDRESSING CHALLENGES AND THE RESEARCH NEEDED

- To begin the second day, one of the facilitators offered a recap of the challenges identified by participants the day before. The participants then provided further feedback on these challenges, creating an iterative process through which the research team could further hone analysis and identify priorities.
- Next, we ran a structured brainstorming exercise on the topic of approaches to address governance challenges, and participants shared their regional experiences with different approaches.
- We then turned to the question of research, asking participants what research would be most help them. Through this line of questioning, we encourage participants to identify *specific* knowledge gaps – to name the grounded, situated information needs of their own work and in their region. We also asked participants how that research should be undertaken (i.e. who should be involved, what would the timeframe be, what methods should be employed).

Knowledge Synthesis

Taking these three stages of our research together, we synthesized the knowledge gathered and refined our analysis to ensure the research approaches suggested by participants of the Delphi study and the workshop would align and effectively address the increasingly nuanced understanding of the knowledge gaps.

PART II. Context: An Introduction to Water Governance and Hydraulic Fracturing in Canadian Regions

Section Highlights:

- Terms that will be used throughout the report are defined, including water governance, “good” water governance, and social licence
- An overview of the current status of hydraulic fracturing developments and water use issues are highlighted on a region-by-region basis across Canada
- The water allocation frameworks that determine whether and how much water may be used in hydraulic fracturing operations are then provided for those same regions

Water Governance: An Introduction

Over the course of our research, we have developed a three-part definition of water governance: (1) who decides who may use water and for what purposes; (2) what standards must be met during that use to protect ecological, economic, social, or cultural values; (3) how that decision process is undertaken. Thus, analysis of water governance must address key questions of authority, standards, and process. Throughout this research project, we have collected data from many actors on these three aspects of water governance in relation to hydraulic fracturing.

Box 1. VIEWS FROM THE WORKSHOP

What *Should* Water Governance in Relation to Hydraulic Fracturing Be?

Workshop participants worked together to describe how water governance in relation to hydraulic fracturing *should* be functioning. Participants articulated several ideas about a positive vision, suggesting that this governance should, for example:

- Be stewardship focused (e.g. “grounded in what’s best for human health and the land”)
- Be attentive to the distribution of costs and benefits
- Uphold the Treaty relationship between Indigenous peoples and the settler population
- Engage the general public meaningfully and in an ongoing way
- Be based on current and relevant research
- Have clear structures of accountability
- Be focused on above-minimum standards that foster innovation and best practices
- Consider cumulative effects and set appropriate thresholds

Participants synthesized these ideas into a working statement of what governance should be:

Water governance for hydraulic fracturing should be community driven with appropriate oversight and consideration of (physical and temporal) scales with accountability mechanisms that are adaptable and include baselines. It should work in recognition of the public interest and the treaty relationship.

Workshop participants agreed that any statement would be partial and overly general, and noted limitations of this group-generated ideal, such as: (a) the meaning of “community” was unclear and could be defined in various ways; (b) the scale of decision making was difficult to determine; and (c) no decision-maker had been identified.

Discussions about water governance often entail consideration of “good governance” – that is, what arrangement of authority, standards, and processes ensure water governance (or in this report’s analysis, water allocation) was “good”? Consensus has emerged in the academic literature that “good” governance – for water or in general – will include principles of participation, legitimacy, transparency, and accountability (van der Valk and Keenan 2011; Matthews and Schmidt 2014; Rogers and Hall 2003). Our research shows, too, that the capacity of regulators to ensure these principles is a key part of enabling “good governance” – a point we describe in detail in Part III. We agree, further, with the assessment of Walker and Salt (2006) that an outcome of “good or improved water governance would be that it provides a capacity to build social-ecological resilience; that is, the capacity of the watershed and the communities and businesses within them to withstand disturbances while maintaining their structure, function, identity, and ability to learn and/or transform as needed (Walker and Salt, 2006). Good governance, then, has basic principles of design and process, and works to build social-ecological resiliency.

Social Licence

Throughout this study, we also found that many scholars, survey respondents, and workshop participants referred to the concept of “social licence” in the context of operations associated with hydraulic fracturing. This concept refers to the notion that a social contract needs to exist among industry, government, Indigenous nations, and communities, and that the terms of that “contract”(which may be informal or embedded in tacit knowledge) indicate the preferred relationships and modes of operating.

It is important to note two key issues about social licence. Firstly, as Parsons and Moffatt (2014) have stated, social licence is not a binary concept, where an operation either has it or does not; rather it is a continuum along with a set of complex interactions may take place. Secondly, social licence is not equal to good governance. Improvements in participation, legitimacy, transparency, and accountability are needed for water governance, particularly with regards to water allocation for hydraulic fracturing; however, improving these aspects of water governance does not mean that industry automatically has “social licence” to operate. Communities may still oppose or challenge a project as a result of its basic characteristics. Thus, although “good” governance may increase the likelihood that a socially acceptable arrangement for using water for hydraulic fracturing could be established in some regions, good governance may also determine that use of this technology is *not* socially acceptable.

Hydraulic Fracturing Across Canada: Regional Overviews

Water use for shale gas development – especially hydraulic fracturing of unconventional sources – has become an increasing source of controversy across all scales of governance. Perceptions of the risks of hydraulic fracturing operations are polarized: supporters see the operations as a low-risk source of economic value, but opponents of the operations see these developments pose significant threats to surface and groundwater and associated social and ecological systems. While some regions have experience with extractive resource

development, many are new to an “oil and gas” culture (whether that means a culture of acceptance or not is different across regions); communities’ responses to new projects are shaped by their respective histories of extractive industries (or lack thereof) but also to cumulative and collective stories about impacts as well as media influence.

One fact that is not widely recognized in much of the debate is the variation in water use for hydraulic fracturing operations. While some operations do use large volumes, this changes across Canada depending on the operating strategy of a particular company and the characteristics of the play itself. In some cases, an operator could avoid the use of water as a carrier fluid by using non-water carrier fluid (e.g. hydrocarbon fluids such as diesel or oil, or high-vapor pressure fluids such as propane), or use low-water use carrier fluids (e.g. with certain concentrations of nitrogen or carbon dioxide, where lower water volumes are required). Moreover, “tight sands” may use less water than in other geological regions, such as the Cardium formation operations near Cochrane, AB which use <1000-3000 m³ per well, while others on the Duvernay formation near Fox Creek can require more than 40,000 m³ (Bevan, personal communication). These non-water use strategies raise other debates, not for water governance, which is the focus of our report, but with respect to land use planning, environmental degradation, and non-renewable energy extraction and consumption³.

Here we provide an overview of the status of the industry in seven regions, each with its own unique history and relationship to hydraulic fracturing.⁴ This overview shows that water governance for hydraulic fracturing varies dramatically across Canada, but key issues are shared among regions. In particular, in all regions, diverse actors are seeking greater authority in water governance and all jurisdictions are struggling with the challenges of knowledge gaps. (Appendix 3 provides an overview table that summarizes the status of the industry by region.)

Before reviewing the current status of the industry and the relevant water allocation frameworks, it must be emphasized that in some shale gas play areas, hydraulic fracturing may be only one of several resource-based industries extracting water. In these cases, the challenges of water governance must be recognized in this context.

Alberta: A Long History of Hydraulic Fracturing

The province of Alberta is the most significant oil and gas producer in Canada and has a long history of hydraulic fracturing, with more than 174,000 wells drilled since the 1950s (Alberta Environment and Sustainable Resource Development, 2014b). Because of the size and age of its industry, Alberta has developed regulatory frameworks to address energy-related water governance, but critics note that the industry’s agency with responsibility in this area – the Alberta Energy Regulator (AER) – fails to adequately balance water-related issues (and other socio-environmental concerns) with development. Alberta shale deposits include the

³ Addressing these issues is beyond the scope of our report

⁴ While the report focuses on just five regions, we provide information here on seven regions – i.e. the regions in Canada where hydraulic fracturing is underway or has been proposed – in order to explain the national context and create opportunities for comparisons between regions.

Duverney formation and the Colorado Group along the border with Saskatchewan, and others like the Montney and Muskwa-Otter Park.

In total, the number of horizontal oil and gas wells completed by multistage fracturing from 2008 until the end of 2014 is 10,000 (Bevan, AER staff, personal communication, March 3, 2015). Hydraulic fracturing is used to extract Alberta's unconventional shale gas, and shale or "tight" oil resources. Most hydraulic fracturing in Alberta has been for oil. However, while shale gas production in Alberta comprises only about 0.1 percent of the province's total gas production (Rivard et al. 2014, 75), analysts expect this proportion to increase with the growth of unconventional production in southern, central, and western Alberta. This increase will be encouraged by future development of greater pipeline capacity and west coast LNG processing facilities (CCA 2014, 25). The potential reserves are significant: a recent estimate for gas in place was greater than 3,000 trillion cubic feet (although typically only between 5–30 percent of in-place reserves are economically or technologically recoverable [CCA 2014, 125]).

Hydraulic fracturing is a key element of shale gas production; of the 190 shale gas wells drilled, 178 had been fractured (CCA 2014, 25; based on data to 2011). (Again, most of the hydraulic fracturing – i.e. the largest proportion of the 10,000 wells – has been undertaken for purposes of oil rather than gas extraction.)

Building on its longstanding history, it is widely acknowledged by the Alberta Energy Regulator, the Alberta Environment and Sustainable Resource Development agencies, and others, that Albertans can expect to "see hydraulic fracturing used even more in the years ahead" (AESRD, 2014b, para 4). In response, the AER and other government agencies are moving ahead with efforts to increase regulations, data collection (16 new observation wells in the Groundwater Monitoring network), and to test alternative approaches to energy developments. For instance, Alberta recently launched a pilot project to test a "play-based approach" to governing energy-water use, which requires full projects to be assessed, instead of the site-specific and well-by-well approaches that have traditionally been used (AER, 2015).

British Columbia: The Push for LNG Growth

British Columbia is home to massive shale gas plays and the provincial government is committed to their development as a key tenet of its economic strategy. Water governance is changing, particularly under the new *Water Sustainability Act* and through the development of new consultation agreements between First Nations and the provincial government; however, many actors continue to raise concerns over the impacts of fast-paced development, particularly in the province's northeast.

British Columbia holds four primary gas plays – the Montney Basin, the Horn River Basin, the Liard River Basin, and the Cordova Embayment – all of which are in the province's northeast. The production potential is massive; in the Montney and Horn River basins there are estimates that range from 580 trillion cubic feet to 1,200 trillion cubic feet, although only 20 percent of that amount is thought to be recoverable (CCA, 2014). Between 2005 and 2009,

producers aggressively pursued land tenures in the region (Adams 2012). In 2012, there were 1,100 active horizontal wells drilled post-2005 in the Montney (Oil and Gas Commission 2012), and in the Horn River Basin, 285 wells were drilled between 2008 and 2011 (Adams 2012). In the past few years, activity has due to market limitations. Some companies have sold their assets or remain inactive; the industry has developed a “wait and see” attitude. The provincial government is committed to the development export of natural gas and has sought through its “National Gas Strategy” to hasten the industry’s development (BC Ministry of Energy and Mines 2012).

New Brunswick: Early Development, Slow Development, and a Moratorium

New Brunswick’s oil and gas industry has a long history but remains relatively small, in spite of large shale gas deposits. New Brunswick’s first well, drilled in 1859, was one of the first in North America (St. Peter, 2000). The long, slow development of the industry has resulted in the use of varying technologies, from conventional vertical wells to newer horizontal slick-water fracturing methods (Office of the Chief Medical Officer for Health 2012). In spite of growth in oil and gas production starting in the 1990s, the industry remains small, especially when compared nationally

Initially, nine companies began work in the province, although currently, eight remain (Daigle, personal communication, April 2015). Corridor Resources and SWN Resources Canada are the two most active (Office of the Chief Medical Officer for Health 2012, and see <http://geonb.snb.ca/ong/> for map of current lease and licence holders). These companies are drawn to New Brunswick’s large estimated shale gas deposits and pre-existing infrastructure; the province holds an estimated 80 trillion cubic feet of deep shale gas reserves in a small and populated area (although the potential reserves in the SWN exploration area are still unknown) and the Maritime and Northeast Pipeline could be used to transport gas from new shale deposits to New England (Leonard, 2012).

Hydraulic fracturing, however, has been a source of great controversy in the province. In May 2013, the Elsipogtog First Nation initiated a widely publicized protest at a proposed shale gas site (Schwartz and Gollom 2013). Following an election in the fall of 2014, the Premier has moved ahead with imposing a moratorium on hydraulic fracturing, which received Royal Assent on March 27, 2015. The Premier also announced a Commission that would study the issue of hydraulic fracturing to determine if the conditions of the moratorium, which include having a social licence to operate, may be met (New Brunswick Energy and Mines, 2015).

Nova Scotia: Public Opposition, A Clear Position by Mi’kmaq Chiefs, and the Wheeler Review

Nova Scotia has a forty-year history of oil and gas exploration and development, and offshore production began in earnest in the 1990s (NSDE n.d.). The province’s shale gas resources are far less substantial compared to offshore petroleum. (The Horton Bluff Shale, which fronts the Bay of Fundy, is Nova Scotia’s most significant source of shale gas, holding an estimated 3.4 trillion cubic feet. [USDE 2013].) Nevertheless, in 2005, when offshore drilling results

began to disappoint, the province began to explore options for developing shale gas resources. In 2006, Triangle Resources began exploring some leases; however, public concern over Triangle's storage of wastewater led to broader concerns about the sustainability of the industry as a whole (Council of Canadians, n.d.).

With the 2007 Environmental Goals and Sustainable Prosperity Act (ESPGA), policymakers sought to integrate environmental health with economic prosperity. In seeking to diversify its energy sources, the province has suggested that shale gas could become part of a new energy plan (Nova Scotia Environment 2014a). However, when the New Democratic Party came into power in 2009, the provincial government announced that it would issue no licences for shale gas development until a regulatory regime was in place. During public consultation for this regime, there were 238 public submissions put forward, 92 percent of which were in support of a moratorium or ban on hydraulic fracturing (CBC 2014b).

The Liberal government, elected in October 2013, continued the policy review, expanding it to include a more extensive public inquiry. The panel was chaired by David Wheeler and became known as the "Wheeler Report." In the summer of 2014, the government released ten draft papers (Nova Scotia Environment 2014) and provided a two-month period for public comment. The report advocated a precautionary, "go slow" approach; report authors encouraged "Nova Scotia municipalities, Aboriginal governments, and communities to spend whatever time is necessary learning about these issues, keeping an open mind on future developments, and research and engaging with the possibilities as well as the risks of this activity" (Ibid, 5). In September 2014, by introducing amendments to the *Petroleum Resources Act*, Liberal energy minister Andrew Younger officially legislated a ban on hydraulic fracturing except for use in testing or research (Gorman 2014).

Although water is allocated by the provincial government, it must be acknowledged that the Mi'kmaq of Nova Scotia are signatories to the Peace and Friendship Treaty of 1725 to 1761 (KMKNO, 2008). The Assembly of Mi'kmaq Chiefs (the Assembly) is the highest level of decision making in the negotiation process in which all decisions are made by way of motion (KMKNO, 2008). The Assembly has clearly opposed any hydraulic fracturing and associated activities, such as allocating water, in their traditional territory. In 2013, the Assembly created a Hydraulic Fracturing Committee (KMKNO, 2014, September 03; KMKNO, 2014, August 12). This Committee was led by Chief Paul Prosper, the Assembly Lead Chief on the Energy Portfolio, and representatives from Kwilmu'kw Maw-klusuaqn Negotiation Office (KMKNO), the Confederacy of Mainland Mi'kmaq, Union of Nova Scotia Indians, and Unama'ki Institute of Natural Resources (KMKNO, 2014, September 03). This Committee researched and compiled Mi'kmaw concerns on the human health risks/ impacts, the lack of science, and the potential environmental impacts of hydraulic fracturing. The Committee made formal presentations of these concerns to Dr. Wheeler for the Wheeler Report (KMKNO, 2014, August 28; NSMi'kmaqRights, 2014, July 23). The Assembly supported the Nova Scotia Government decision to place a moratorium on hydraulic fracturing in the province (KMKNO, 2014, September 03). Moving forward, it will be essential for the Government of Nova Scotia continue to honour and respect Mi'kmaq Aboriginal and Treaty Rights as it pertains to any future decisions about hydraulic fracturing, or allocating water for the use of hydraulic fracturing, in Nova Scotia.

Northwest Territories: Future Development and Political Devolution

Companies have begun to explore in the Canol shale oil play, but development (and associated hydraulic fracturing activities) has been slow moving.⁵ Large restructurings of the balance of regional, territorial, and federal power under Bill C-15 will have significant – but as yet undetermined – effects on water governance in the context of oil and gas development.

Oil and gas companies are exploring the potential of the Canol shale play in the Sahtu Settlement Region in the Central Mackenzie Valley. Currently, while fourteen exploration licences have been granted encompassing 1.2 million hectares in the Norman Wells area (Aboriginal Affairs and Northern Development Canada 2013), no production licences have been issued. Lease-holding companies have organized into the Central Mackenzie Valley Producer's Group, which includes ConocoPhillips Canada, MGM (recently bought out by Paramount), Husky, Imperial Oil, and Shell Canada. Companies have taken small steps toward hydraulic fracturing:

- MGM (now Paramount) applied for permission to undertake hydraulic fracturing but withdrew the application when the Sahtu Land and Water Board (SLWB) decided the application demanded further review through the Mackenzie Valley Environmental Impact Review Board (MVEIRB).
- ConocoPhillips Canada, the most active company currently operating in the NWT, was approved for horizontal drilling and fracturing on two wells, which they carried out in over the 2013–14 winter, and plans more exploratory hydraulic fracturing on ten new wells over the next five years but has committed no funds toward the project for the 2014–15 winter (Wohlberg 2014a).

ConocoPhillips's decision to stall drilling is reflective of recent industry behaviour in the NWT, where companies appear to be putting development on hold. For example, in a recent “growth portfolio” created for their shareholders, Husky listed their NWT holdings as a long-term (2020 or later) project and recently withdrew an application to fracture four wells in the Sahtu. The profitability of NWT projects (perhaps in comparison to companies' other multinational holdings) is a likely factor behind companies' hesitations, perhaps because of high production costs and lack of existing transport and distribution infrastructure in the region (Shauna Morgan, personal communication, July 2014).

Ontario: Possible Future Development

Ontario holds a relatively small volume of oil and gas in shale plays; however, since 2010, geological researchers have begun to identify potentially productive reserves. A large proportion of these shale-based resources is located near densely populated regions in the province's south. Two successive premiers have opposed hydraulic fracturing in the region; opposition is also strong and widespread among First Nations. Ontario currently has no framework for the regulation of hydraulic fracturing.

⁵ The Canol play is an oil – rather than natural gas – play. However, we include reference to the NWT in this report because the institutional structures and governance innovations in the region provide important points of comparison and, in some cases, learning opportunities, particularly in relation to the recognition of the rights of Indigenous nations.

Energy researchers believe that the volume of potential shale gas and shale oil reserves in Ontario is less significant than that found in other regions. In 2010, however, a drilling program by the Ontario Geological Survey (OGS) discovered shale gas resources with “recoverable potential” (Béland Otis 2012). In 2011, a second drilling program at sites in the Lake Huron, Georgian Bay, and Manitoulin Island regions (Lui 2012). In 2012, two companies, Mooncor Oil and Gas and Dundee Energy, were acquiring exploration and oil and gas rights on Lake Huron in the Kettle Point play (Canadian Press 2012). At the time, however, then-premier Dalton McGuinty stated that Ontario was not prepared to allow hydraulic fracturing until the process and its implications for water were better understood (Canadian Press 2012).

Opposition coming from First Nations has been clear and widespread. In 2012, the Chiefs of Ontario (a political organization representing 133 First Nations in Ontario and which is committed to self-determination efforts), notified Premier Kathleen Wynne that they would fight hydraulic fracturing across Ontario (Manitoulin Expositor 2013). The Aamjiwnaang First Nation in the Sarnia area reported that when industry representatives visited to discuss hydraulic fracturing in the region, the First Nation said that it would stand up against any deployment of that technology (Graf 2014).

Quebec: A Precautionary Approach

Many publications list Quebec alongside British Columbia, Alberta, and New Brunswick as one of Canada’s high potential shale gas landscapes (CCA 2014; Rivard et al. 2014). In 2011, the Quebec provincial government established a moratorium on hydraulic fracturing and in late 2014, the Environmental Bureau (BAPE) released an assessment of the potential for developments, concluding that the financial benefits would not be sufficient to outweigh the costs (BAPE 2014; McCarthy 2014). The assessment noted that the government must work to restore public trust before any social acceptance of hydraulic fracturing might be possible (McCarthy 2014).

Since 2006, proponents have demonstrated considerable interest in the shale gas potential of the Utica Shale in the St. Lawrence lowlands. The area extends from Montreal to Quebec City and also encompasses Trois-Rivieres. The majority of the play lies beneath the south shore of the St. Lawrence River, but a narrower belt lies on the north shore as well. During a 2007–10 exploration period (see Rivard et al. 2014), twenty-nine wells were drilled, eighteen of which were hydraulically fractured; no wells, however, have so far reached production stages (CCA 2014). By 2008, the apex of the exploration rush in the Utica Shale (Rivard et al., 2014), the entire St. Lawrence sedimentary platform – an area of roughly 20,000 square kilometres – was licensed to oil and gas companies. While industry has yet to confirm the full potential of the play or the economic viability of production, early test wells showed fairly good returns and Quebec’s environmental assessment agency (a division within BAPE), published partial estimates of technologically recoverable gas between 22 to 47 trillion cubic feet (Quebec 2014: 31). The BAPE has estimated that full production of the Utica Shale could mean roughly 20,000 wells drilled (BAPE 2011; cited in CCA 2014: 119).

Still, at present, there is no production of shale gas in Quebec. Exploration in 2008–09 sparked significant community resistance; nearly one hundred anti-shale gas protest groups have formed (Rivard et al., 2014). In March 2011, the Quebec government placed a temporary moratorium on shale gas development in the St. Lawrence lowlands in order to conduct environmental studies, research hydraulic fracturing, and consult the public. One independent oil and gas exploration company, Lone Pine Resources Inc., has sued the Canadian federal government (under NAFTA’s Chapter 11) for \$250 million in investment damages caused by the moratorium. Nevertheless, the newly elected provincial Liberal government appears to plan to sustain the moratorium in the Utica Shale. The new government did, however, recently announce that it is committed to investing public funds in exploring the shale oil potential of Anticosti Island (potentially 30–50 billion barrels in place), a mostly unpopulated island northeast of the Gaspé Peninsula.

According to the 2014 Council of Canadian Academies report, Utica wells require between 12,000 and 20,000 cubic metres of water for hydraulic fracturing, an amount high relative other plays in Canada – second only to the Horn River Basin in BC (although water use in the Horn River is still significantly higher).

Water Allocation Frameworks by Region

In this context of polarized public discourse around hydraulic fracturing, many jurisdictions, facing the pressures of the fast-moving and powerful fossil fuel industry and – in many regions – lacking capacity and experience, have turned to one of two approaches: (1) opting in, allowing rapid development in a governance environment full of regulatory gaps, or (2) opting out, erecting bans or temporary moratoriums to delay production (see Stephenson and Shaw, 2013). In our research and workshop, the difference between the western cases of Alberta and British Columbia and the east coast cases of Nova Scotia and New Brunswick arose repeatedly. The regional differences shaped our research; we therefore provide, here, an overview of the seven different provinces we studied as necessary context within which to interpret our findings. (Appendix 3 provides an overview table that summarizes the overall framework for water governance, by region.)

While these contrasting approaches (supportive of development versus moratoriums; west versus east) might appear antithetical, the regional approaches to water governance in the context of hydraulic fracturing are more complex than a simple “yes” or “no.” In each jurisdiction, water-related decision-making and oil and gas-related decision-making come together in ways that are historically and regionally specific. Furthermore, water governance in general and water governance in relation to hydraulic fracturing is constantly changing; many regions are currently undergoing dramatic policy overhauls. For example, in the Northwest Territories, all resource-related decision-making is being restructured as a result of the devolution of power under Bill C-15. In British Columbia, the creation of a *Water Sustainability Act* will, over the next few years, change processes of water allocation, in ways as yet undetermined. We introduce here the basic policy frameworks for allocating water for use in hydraulic fracturing (if hydraulic fracturing activity is supported in the region) as an important context for the examples and analyses of regional differences that arise throughout

the report. Overall, in this report, we seek to build shared knowledge between and among jurisdictions, while also being realistic about the specificity of regional policy frameworks and their circumstances.

Alberta: The “Single-Window” Approach

The Alberta Energy Regulator (AER) is the agency responsible for all oil and gas development. Under Alberta’s *Water Act*, the AER regulates all aspects of energy-related water management (CCA 2014, 25) and is responsible for the allocation of water permits and licences for oil and gas activities like hydraulic fracturing. The AER regulations for hydraulic fracturing include requirements that (a) companies must notify the AER prior to any fracturing operation and (b) operators must have well integrity risk management plans plus offset energy well monitoring and well control plans (see AER Directive, 083). As stated previously, the AER is also currently testing a play-based approach. Critics, however, have noted that the AER – as a “single window” regulator created in 2013 to streamline regulation in order to attract energy investment – is focused on developing resources, and, as such, protections for public safety and the environment become minor caveats (see Vlavianos 2012).

The *Water Act* (2000) is the key legislation regarding water allocation in Alberta (Alberta Water Portal 2014). As of March 29, 2014, the AER (like the OGC in BC; see next section) will be responsible for water allocations under the *Water Act* for short- and long-term withdrawals for energy resource practices (AER 2014a). The *Water Act* specifies conditions for monitoring and reporting water use; public reporting is required under the Responsible Energy Development Act (2012) (AER 2014b). Further monitoring requirements are set out in the Environmental Protection and Enhancement Act (AER 2014a).

Alberta allocates water to oil and gas companies using a “first in time, first in right” (FITFIR) allocation system. Critics have challenged this system, within which the provincial collects no royalties when it allocates water rights (or when those water rights are later sold) (Christensen and Droitsch 2008, 15).

Since the early 2000s, Alberta has undertaken extensive efforts to develop and implement the *Water for Life* strategy, which led to the Alberta Water Council and Watershed Planning and Advisory Councils, and which has recently been updated. The strategy required each major water use sector to complete a Water Conservation, Efficiency, and Productivity Report (CEP). However, the report for Upstream Oil and Gas excluded shale gas water use from its report at the time it was completed (see CAPP and Oilsands Developer Group, 2011). As part of the growing interest about water use for hydraulic fracturing, the Alberta Environment and Sustainable Resource Development agency launched a water conversation about hydraulic fracturing, which largely focused on building an understanding about current regulations and current industry practices (see waterforlife.alberta.ca).

British Columbia: Another “Single Window” Regulator

British Columbia shares with Alberta a “single-window” regulator approach to oil and gas development. The BC Oil and Gas Commission (OGC) was created in the late 1990s to support the development of petroleum resources with a vision of regulatory excellence in the province (see OGC, 2015). Critics have noted that while the OGC was supposed to be an independent agency, the provincial government has – through several legislative changes – been given more influence over the commission’s operational activities (see Campbell and Horne 2011). Furthermore, other researchers and agencies have noted a potential conflict of interest: as a “single window” agency for energy governance, the OGC’s mandate includes potentially contradictory objectives, while its funding model and governance structure suggest limitations to its independence, raising concerns about its capacity to manage the impacts of the industry (Environmental Law Centre, 2012, pp. 10-16). The Office of the BC Auditor General (2010) has also expressed concern that while the OGC is mandated to foster a healthy environment, no formal provincial program exists to manage environmental impacts from development.

Groundwater has never been regulated in British Columbia. Therefore, any groundwater accessed for the purpose of hydraulic fracturing does not require a water licence. Regulations exist around the construction and maintenance of a water well, but the volume of water accessed in that well is entirely unregulated. The newly enacted *Water Sustainability Act* will seek to address this regulatory gap, but so far industry has not been affected, although much of the water used in the Horn River Basin has involved surface water sources.

Surface water resources for the purpose of hydraulic fracturing are governed under two provincial acts: the Oil and Gas Activities Act and the *Water Act*. While short-term water permits for water use in oil and gas development (often called “Section Eights”) have long been under the authority of the OGC, in 2013, long-term licences were also transferred to the OGC from the Ministry of Environment. In May 2014, the provincial government passed its *Water Sustainability Act* (to replace the *Water Act*). Analysts have suggested that the Act may result in certain environmental protections, such as through the regulation of groundwater, but have also expressed concern about how the Act made more short-term water authorizations available for hydraulic fracturing (see West Coast Environmental Law 2014, and Curran [2014] for the UVic Environmental Law Centre’s response to the new act.)

New Brunswick: Two Departments and an Environmental Impact Assessment Process

The Department of Environment and Local Government (DELG) manages water resources including surface and ground water extraction. The Department of Energy and Mines manages the province’s mineral resources. DELG also manages the EIA process to which oil and natural gas development projects are subject. Several Acts govern projects involving water allocations for natural gas development, including but not limited to: the *Clean Environment Act* (1973), the *Oil and Natural Gas Act* (1976), and the *Clean Water Act* (1989). The *Oil and Natural Gas Act* deals mainly with the engineering-related aspects of the oil and gas industry (e.g. well-casing integrity).

All projects involving natural gas development activity or shale gas extraction in New Brunswick must undergo an environmental impact assessment (EIA) (see Department of Environment and Local Government 2012). Specifically, under the *Clean Environment Act's* Environmental Impact Assessment Regulation, all proponents must register the proposed project with the Department of Environment and Local Government, including a project description that includes the project environment, anticipated impacts and proposed mitigation. The project then undergoes a “Determination Review,” conducted by a technical committee of representatives with expertise on different aspects of the project. If committee members determine that a project has the potential to result in significant potential impacts with the proposed mitigations in place, they may recommend a “Comprehensive Review,” which includes an additional EIA study and an opportunity for public comment (Department of Environment and Local Government, 2012). Otherwise, the Minister of Environment and Local Government issues a “Certificate of Determination” describing the conditions that the proponent must follow. To date, however, oil and gas registrations have not yet triggered a Comprehensive Review (Merrill, personal communication).

Similarly to EIA requirements in other provinces, all registered EIA projects require the proponents to undergo public consultation, typically in the form of public information sessions and meetings, and information brochures. All registration documents must also be made available to the public (see Department of Environment 2011; Department of Environment and Local Government 2012). In 2011, the province began applying the “phased” EIA approach to oil and gas activities: review of work begins much earlier in the project planning, but exploration activities may now occur simultaneously with the EIA process (Environment and Local Government 2014).

A growing number of actors have begun to demand increased involvement in and control over natural gas production–related activities. Although the provincial government has jurisdiction over mineral rights, municipalities have begun to pass bylaws and resolutions related to hydraulic fracturing (Patterson 2014; Sierra Club n.d.). The authority of these municipal initiatives is as yet untested. Meanwhile, Indigenous Nations and a wide range of groups – including stakeholders, environmental and religious organizations, medical associations, and other industry groups (like those representing tourism companies) – seek a higher degree of involvement in the decision-making process.

Nova Scotia: Departments of Energy and Environment and the KMKNO

Under the *Petroleum Resources Act* (1989), the Department of Energy holds authority for shale gas. The Department puts out calls for exploration proposals; successful proponents are invited to sign a lease agreement. Hydraulic fracturing on the lease must be approved through a separate application through the Department of Energy (Nova Scotia 2011). Proponents of an exploration project must hold a public meeting and reach a lease agreement with the private landowner before submitting an application to the Department of Environment. The application includes information about proximity to watercourses and wells, the location and quantity of water to be withdrawn for the project, and other issues of drilling technology, waste disposal, and monitoring. Proponents require a permit for the use of groundwater or surface water in any amount exceeding 15,000 litres per day. While the legal duty to consult

with Indigenous nations lies with the Province on any resource-based projects or projects that may impact the environment, the Province will often delegate the consultation to the proponent (see mikmaqrights.com for additional information). Thus, numerous proponents may be in consultation with the Kwilmu'kw Maw-klusuaqn Negotiation Office (KMKNO) Mi'kmaq Rights Initiative at any time.

Under the provincial *Water Act* (1919) and the provincial *Environment Act* (1990, part 10), the Nova Scotia Department of Environment's Drinking Water, Water Resources & Industrial Management Branch and the Compliance Branch hold authority for water.

Northwest Territories: Current Restructuring and a Territorial Water Strategy

The framework for water governance is changing with the current devolution, under Bill C-15, of authority over lands and resources from the federal government to the Government of the Northwest Territories (GNWT). Prior to devolution, the federal government retained exclusive control of water rights except in areas where this authority had been transferred through land claim agreements. In land claims settlement regions like the Sahtu, where shale oil development is concentrated, authority over land and water management lies with co-management resource boards, where First Nations and non-First Nations governments share equal membership. The Sahtu Land and Water Board (SLWB) receives applications for all projects including water permits and licences for hydraulic fracturing. The SLWB will generally consult community organizations and its strategic land use plan, and has forty-two days to issue or deny a licence/permit or to refer the project to the MVEIRB for further environmental assessment. In areas not covered by land claims, currently the regional land and water boards govern water use for oil and gas activity in the NWT.

The water governance framework appears to be changing with devolution, though the extent and timing of changes is somewhat uncertain. As of April 2014, onshore water resources are the jurisdiction of the GNWT, but regional governance structures across the NWT including the Sahtu appear to be changing. The establishment of an eleven-person territorial board in Yellowknife is a key part of this restructuring; some analysts have noted that this centralization will reduce the proportional representation of each Aboriginal government (Morgan 2014). Some Aboriginal leaders and governments have expressed frustration with the changes, noting that land claim settlements took years of negotiations and the bill will void key pieces of these agreements (see Alexie 2014; Morgan 2014; Wohlberg 2014b). Greater power for the federal government is another key element in Bill C-15 and a point of concern for some local residents and critics of the restructuring, who perceive that the changes are intended to enable more intensive, less regulated resource development in the North (Morgan 2014).

Territorial water management is guided by the GNWT Water Strategy – *Northern Waters, Northern Voices* (GNWT 2010) – which is currently in its implementation phase. The strategy has progressive elements, like a greater focus on public engagement and on building collaborative relationships and monitoring programs, but critics argue that it lacks regulatory teeth and defined standards for water management (personal communication, S. Morgan, July 2014).

Ontario: No Existing Framework

Ontario does not have a “single-window” regulator agency with authority over water allocations for oil and gas development. If the province does in future allow hydraulic fracturing, multiple government agencies could be involved: the Ministry of Natural Resources regulates the permitting, construction, and inspection of natural gas wells; the Ontario Energy Board oversees production and price setting (Shroeck and Karisny 2013). The Ministry of Environment (MOE), meanwhile, holds authority over water use and waste; the MOE implements the *Ontario Water Resources Act* (OWRA) and the *Environmental Protection Act* (1990).

Ontario has legislation that could provide some enhanced protection for water resources:

- Since the passage of the *Safe Water Drinking Act* (2002), decision-makers can require permit holders to develop water conservation plans or other measures to promote efficient water use to minimize water losses through consumptive use (and water takings for hydraulic fracturing would be categorized as “consumptive”).
- The *Ontario Water Resources Act* and the Water Taking Regulation also include some groundwater regulation that applies to water takings.
- Ontario’s *Clean Water Act* (2006) established source water protection committees to represent municipalities, industries, and individuals at the watershed scale (Ontario Water Works Association 2014). The committees assess risks to source water quality and quantity and write plans for mitigating drinking water impacts, either through existing regulatory requirements or the creation of voluntary initiatives.
- Municipalities, through control of bylaws and land use planning, have some authority over managing a significant water threat, though their ultimate authority in relation to the province over issues of oil and gas development remains untested.

Quebec: A Governance Framework under Review

That Quebec has no framework to regulate water use for shale gas development was part of the justification for the moratorium in the Utica Shale (Rivard et al. 2014). Quebec’s Ministry of Environment, which governs surface and groundwater withdrawals, is guided by the *Environmental Quality Act* and the Water Policy legislation (2002). In 2013, the government published a draft Water Withdrawal and Protection Regulation intended, in part, to strengthen the regulatory rigour for water withdrawal authorizations; the regulation, however, is not yet finalized. The environment minister has stated that before companies begin operations, measures to regulate and control development must be in place.

Quebec is undertaking two key initiatives to acquire governance knowledge to inform a regulatory approach for shale gas development and hydraulic fracturing, including the creation of (1) the program for groundwater knowledge acquisition (PACES), and (2) a strategic environmental assessment (SEA) committee on shale gas. The PACES program – which is being carried out by the MOE and a coalition of local watershed groups, universities, students, and experts – seeks to understand risks to aquifers, on which Quebecers rely for drinking water. The SEA committee has undertaken a program of knowledge acquisition

regarding the Utica Shale; an SEA on Anticosti's oil potential should begin in 2015. The SEA currently argues for a "single window" regulatory agency for oil and gas permitting (BAPE 2014).

The Utica Shale lies within the traditional territories of three First Nations: the Mohawk community of Kahnawake to the west, and the Abenaki communities of Odanak and Wolinak in the heart of the zone (BAPE 2014). The Kahnawake Mohawk protested in solidarity with the Mi'kmaq in New Brunswick; Kahnawake is a member nation of the Haudenosaunee Six Nations who condemn hydraulic fracturing. The Abenaki Nations, meanwhile, in 2011, gave comments to the BAPE. They did not condemn hydraulic fracturing outright but stated that a decision should not be made until a full environmental assessment is conducted.

Municipalities in Quebec might have some authority to enact in relation to oil and gas operations, under two pieces of legislation: (1) the *Municipal Powers Act*, which covers environmental issues, traffic and nuisance control, and public health; and (2) the *Act to Affirm the Collective Nature of Water Resources and Provide for Increased Water Resource Protection*. In opposition to shale gas, some municipalities have passed resolutions on the transport of hazardous materials and the protection of water within their boundaries (BAPE 2014).

PART III. Priority Governance Challenges

Water governance in Canada is shifting in the context of many fast-changing social and ecological dynamics. Many communities are asking for greater authority in water-related decision-making, and the overall effects of a complex interplay of developments and uses are challenging for decision-makers to address, particularly in the context of unpredictable but likely widespread climate change–related impacts on water (Morris and Brandes 2013). In response to these dynamics, some provincial governments are overhauling current water policy regimes, while others are seeking to adapt existing frameworks to account for new challenges. Federal legislation and municipal by-laws, too, are changing.⁶ It is within this complex landscape of water governance that social negotiations and conflicts over hydraulic fracturing now arise.

Key governance challenges related to water allocation for use in hydraulic fracturing include (1) concerns over the capacity, transparency, and accountability of regulators; (2) the need to better include Indigenous nations; (3) scientific uncertainty regarding risks and cumulative effects; and (4) the need to better address community concerns and issues associated with “sense of place.” Within each of these four broad challenges, regional differences arise; we have sought to note and explain these differences, particularly through use of examples.

Table 1. Summary of governance challenges and issues

THEME 1 Capacity, accountability, and transparency of regulators	THEME 2 Scientific uncertainty and lack of data	THEME 3 The need to better include Indigenous nations	THEME 4 The need to better address community concerns and “sense of place”
<ul style="list-style-type: none"> - Lack of capacity - Policy and regulatory gaps - Lack of accountability - Lack of transparency - Lack of public trust 	<ul style="list-style-type: none"> - Uncertainty regarding the hydrological impacts of hydraulic fracturing - Lack of baseline data, monitoring, and cumulative effects assessment - Difficulties in governing the data: fragmentation, funding, and mistrust 	<ul style="list-style-type: none"> - Disproportionate burden of impacts tend to be found in Indigenous communities - Treaty rights and relationship not fully recognized - “Consultation is not consent” 	<ul style="list-style-type: none"> - High degree of public concern - Need for improved community engagement processes - The need to consider “sense of place” as a value

⁶ Hydraulic fracturing governance must also contend with many issues that related to water more indirectly – such as certain land-based development impacts and public concern over climate change. However, in this report, we focus specifically on governance issues most directly related to water.

THEME 1: Capacity, Accountability, and Transparency of Regulators

Overall, we found regulator-related issues to be the governance-related challenges most commonly identified and prioritized in the literature, through the Delphi study, and among workshop participants alike.

Lack of Capacity

In part, regulator-related governance challenges occur due to the nature of the shale gas industry itself – the industry is global and fast moving, and includes multi-national corporations with petroleum investments all over the world. Thus, while the industry is potentially very lucrative, it is also global and highly competitive (Blackwill and O’Sullivan 2014). Scholars have argued that the challenges regulators face are caused by the pressure to facilitate expansion (Boersma and Johnson 2012). The result is industry-led development that is outpacing the creation of new policies and regulation (Stefik and Paulson 2011). For example, research shows that high natural gas prices globally resulted in development pressures in British Columbia (although have also slowed the pace of development more recently), and critics argue that the provincial government’s desire to compete for industry investments has resulted in a lack of robust regulation (e.g. Parfitt 2011; Stephenson and Shaw 2013).

In its physical form on the ground, too, shale gas development is complex and fast changing in ways that present governance challenges for regulators. The water-related risks associated with unconventional gas development are different – and, some scholars argue, higher – than with conventional gas development (see Konschnik and Boling 2014).⁷ Unconventional gas development is also, per well pad, more intense than conventional; after two to three years, production decreases and new sources of gas need to be exploited in order to maintain supply (Konschnik and Boling 2014). In addition, technological innovation results in fast-changing extractive practices (Konschnik and Boling 2014) and regulators must struggle to keep pace. But all of these issues create a concern about capacity – Delphi and workshop participants and previous research (e.g. Fershe 2011; Garvie and Shaw 2014) indicate a lack of confidence that the current governance approach, which relies on government to assess, allocate, and enforce, has sufficient capacity to complete these tasks with high levels of competence.

At our October workshop, participants from across Canada questioned the ability of regulators to monitor the rapid developments on the ground. The physical infrastructure

⁷ According to one study, the potential water-related risks specifically associated with unconventional development include “surface water contamination and habitat disruption from construction; methane and volatile organic compounds (VOC) air pollution; freshwater depletion; surface water contamination from fracturing fluid spills and wastewater discharges; surface water and groundwater contamination by leaking wastewater impoundments; and contamination of groundwater from poorly constructed or maintained wells” (Konschnik and Boling 2014, 8404). These researchers also notes that question remains about the extent, probability, and best mitigation of such risks (Konschnik and Boling 2014); in fact, as we soon describe, ongoing scientific uncertainty about the water-related effects of hydraulic fracturing remains a key governance challenge overall.

associated with shale gas developments can be complex. Unconventional gas developments are often spread over large areas of land, through thousands of wells, and possible pollution sources – such as wells, storage tanks, borrow pits, and pipelines – are numerous (Konschnik and Boling 2014). The layers of actors involved in an operation also becomes complex, given the different investors, the primary operator, and the numerous sub-contractors. Therefore, having sufficient capacity to detect compliance violations at all of the different sites, or across the practices of the different sub-contractors involved in an operation and across vast areas, is a challenge (Ibid). Additionally, it was recognized that in some regions, the staff turnover rates in regional government offices can be high. Thus, staff are not only minimal but those present are often inexperienced and do not stay long enough to build strong relationships to the communities observing changes on the ground.

In turn, industry operators have various levels of expertise and hold varying degrees of regional knowledge, attitudes towards environmental protection, public consultation, health and safety (Small et al. 2014). Given that many of the companies involved in shale gas are multi-national corporations (MNCs) and that the resource extraction activity itself is temporary in nature, the hydraulic fracturing industry is perceived as different from other industries that may have local companies that remain in the community long-term. Well-established relationships between the communities and the MNCs (or their many sub-contractors) were rare amongst those that participated in our research, although exceptions did exist. The on-the-ground complexity of the industry, combined with the lack of relationships between communities and government and communities and industry, means that regulators may not be able to track all developments since they cannot access local knowledge and they were widely recognized as failing to prove that they are ensuring compliance among diverse companies with complex operations.

While inexperience, turnover, and the rapid pace of technological development do affect capacity, the overall capacity of regulators is also limited as a result of government restructuring. Previous water governance research has highlighted the serious issues that have resulted from the deregulation and staffing reductions associated with neoliberal approaches that have been widely adopted in governments across Canadian jurisdictions (see for instance, Prudham's [2001] discussion on drinking water, Small et al.'s [2014] analysis of hydraulic fracturing, and Norman and Bakker's [2009] research on the effects of devolution in transboundary basins). Scholars have noted that the restructuring of governments in many shale gas regions – in combination with the competitive global gas market – is resulting in a decreased capacity to protect non-industry values and interests (Rabe and Borick 2013; Willow 2014).

Government capacity for oversight might be further compromised by institutional fragmentation. At the workshop, several participants noted that government “silos” meant that water-related decision-making was poorly coordinated among agencies. Participants in the Delphi study also noted the issue of fragmentation: survey respondents suggested that “defining, through legislation, who has the right to and who holds responsibility for water resources” was a key decision challenge.⁸ As the description of policy frameworks by region

⁸ Furthermore, two provinces with shale gas potential, Ontario and Quebec, have fragmented regulatory frameworks for water governance of hydraulic fracturing. In the Ontario context, Schroeck and Karisny (2013)

(above) noted, Alberta and British Columbia have sought to address one aspect of this fragmentation issue by creating a “single-window” regulator that has responsibility for oil and gas development decision-making, including in regards to water. However, participants at the workshop noted that (a) because the regulatory role is to facilitate development, they may not offer necessary environmental protections, and (b) water-related decision-making should be coordinated across the resource, rather than at the industry level.

Given the lack of government capacity to regulate and enforce, questions remain about whether government is truly accountable for upholding its legislated obligations with regards to water allocation and use for hydraulic fracturing, and whether it can be assumed that industry is being held accountable for its water use (and the related waste) requirements. A model of governance that provides support for these responsibilities has not been developed or sought by governments in general.

In short, our research suggests that regulators currently lack the capacity to meet the water governance–related challenges raised by the shale gas industry and its complex infrastructure. In some instances, survey and participant workshops also doubted the willingness of regulators to acknowledge and confront the water governance challenges, regardless of capacity. (This doubt is related to the idea of an industry-influenced regulatory structure, described in the “Lack of Transparency” section, below.) Workshop participants identified several challenges result when regulators are unable to “get out in front” of industry and plan development on a watershed, regional, or provincial scale: policies become reactionary and lacking in vision; the water cycle is not governed in a coordinated way; and cumulative effects are poorly understood. We describe these planning-related challenges in the following section. Overall, workshop participants suggested, because of a lack of regulator capacity, regulatory processes are reactionary – they lack vision and do not encourage innovative approaches to governance.

Policy and Regulatory Gaps

Detailed regulatory reviews have already been conducted by various scholars and government agencies for both Canada and the US (e.g. Wiseman, 2009; AER 2011; Gradijan et al. 2012; Richardson et al. 2013). These reviews, along with other research and the results of our study, indicate two major regulatory gaps surrounding water allocation processes and hydraulic fracturing: regulatory requirements for monitoring and a legally enforceable threshold for water development in a watershed. We discuss the issue of monitoring below, in the section on the lack of scientific data. Here we focus on the regulatory gaps that exist with regard to water volumes. As the Alberta Energy Regulator (2011, 11) has noted:

assessed the regulatory frameworks in the Great Lakes region of Canada and the US and found that governments in both countries lack comprehensive hydraulic fracturing regulation, and regulation at the state/provincial scale is fragmented. In Quebec, the Strategic Environmental Assessment (SEA) analyzed a range of governance scenarios and argued that a mix of centralization and decentralization would be necessary; however, there is currently no legislation that could enable the delegation of authority within the Sustainable Development Act.

The very large volumes of water needed to hydraulically fracture shale gas wells with current technology make water consumption a critical issue in shale gas development. With hundreds of wells to be drilled over large shale gas plays, water management warrants considerable regulatory attention and could limit where, when, and how fast shale gas development occurs.

Although each water licence or permit will specify the volume of water that can be used and the time period of the year in which that water may be accessed, an overall diversion limit for all of the hydraulic fracturing activities in a watershed has not been developed through comprehensive planning and regulation in Canada. Participants in both the Delphi survey and the workshop asserted the need for a set threshold of water use that would be legally enforceable (e.g. x proportion of water flows per year). This threshold would affect the rate of development and ensure only a certain amount of hydraulic fracturing activity could occur at any one time in a watershed, and even then, only if the watershed could sustainably host the industry activity. This type of regulatory tool could not be implemented without a comprehensive water supply and demand analysis of each watershed in a shale gas play, an assessment that no shale-producing region has yet conducted (and which would also face the challenges of capacity we described above).

Lack of Accountability

In our research and collaborations with diverse experts, we came to understand that the lack of capacity and regulatory gaps were only part of the story. Workshop participants perceived government agencies as working primarily to facilitate industrial and economic development rather than to balance social interests, thereby creating concerns about accountability – a basic tenet of “good” water governance (see Rogers and Hall 2003). Thus, lack of capacity was one thing, partiality was another. This public concern – a governance challenge in its own right – is supported in many cases by scholarly research. For example, researchers have found that, in some jurisdictions, because politicians and regulators believe that new regulation-related costs might mean that producers move elsewhere, the industry has heavily influenced legislative and regulatory agendas in natural gas producing regions (see Centner and O’Connell 2014 for analysis of this effect in the US; see also Allen 2012; Rahm, 2011). Worse, the result is that governments are perceived as not holding industry accountable for their actions related to water use for hydraulic fracturing (both in terms of quality and quantity). Additionally, governments are not perceived as accountable for upholding the environmental protection responsibilities legislated in various acts or sufficiently representing the interests and values of the public (Garvie and Shaw 2014). Furthermore, no Canadian jurisdiction has created an independent “watchdog” (beyond the formal Auditor General offices, which are not exclusively focused on water or environmental issues). Accountability is thus perceived as lacking in two ways: government not holding industry to account, and government not upholding legislation to which it is accountable.

At the workshop, participants spoke of the “industry capture” of the regulatory process – of governments’ “extremely close relationship with industry” and the lack of an “independent regulator.” They suggested that, overall, there was a lack of political will to meaningfully address the water governance-related challenges associated with hydraulic fracturing and that

regulators often saw economic development as a priority, with all other concerns or mandates considered secondary. Participants described how it was common for governments to equate the notion of “public interest” with economic growth, and thus, acting on behalf of the public interest always privileged industry above other goals or actors. This lack of political will was the challenge identified as most significant by participants in a ranking process in the workshop; they suggested that decision-makers were reluctant to even acknowledge governance challenges. In general, workshop participants suggested that water governance in Canada still operates according to a top-down approach, but one that is driven by politics and corporate interests rather than by science, the environment, or other non-economic priorities of the public. Two participants raised the idea that governments were more concerned with managing their legal responsibilities and liabilities, rather than with exploring ways to improve the overall governance of water.

The review of literature and the interviews that we conducted for the regional briefing notes suggested that this challenge of regulator accountability might be particularly acute in both Alberta and British Columbia – jurisdictions with a “single window” system wherein regulators are responsible for both water allocation but also energy development. Participants suggested that the “single window” approach creates a conflict of interest that is the single biggest problem with regulation in these regions. In the Alberta context, criticism has been put forward by media, stating that the Alberta Energy Regulator is funded by industry levies, as is the Oil and Gas Commission, and representatives on the board of the regulators come straight from industry (Nikiforuk 2014). Critics regularly charge that Alberta is enabling oil and gas development at a scale and pace that overpower the ability of regulators (and the regulatory framework) to protect social and environmental values (see, for example, Nikiforuk 2014; Vlavianos 2012).⁹ In BC, constructive criticism of the system has been put forward by a number of researchers who note that benefits, including royalties, to BC residents are inadequate relative to that of extractive industries in general (Parfitt 2011), though the provincial government is currently redesigning the royalty structure (MOE 2014).

Workshop participants did acknowledge that accountability within the current governance system was difficult to assess. Participants suggested that individuals who were not deeply embedded in the process of water allocation could not fully evaluate accountability. Many participants agreed that “government” is seen as a vast, single agency to the public, whom lack familiarity about the multiple agencies at all different levels (local, provincial, federal, Indigenous) and the differences in roles and responsibilities among them, particularly between the political and administrative arms of government. Thus, making distinctions about accountability vary depending on time, place (e.g. specific regional office), legal mandates, and agency visions.

A recent court decision appears to offer some assertion of the legal responsibilities of provincial regulators to protect certain public interests. Back in 2007, a scientist and oil patch

⁹ Royalties to the province of Alberta are a substantial: in 2013/14, Alberta received \$1.10 billion in revenue from natural gas and by-product – a total of about 11.4 percent of non-renewable resource revenue and 2.4 percent of total government revenue. (Alberta Energy 2015). Workshop participants called attention to this type of government revenue, arguing that it creates a bias of wanting to maintain that revenue, which inevitably means maximizing production.

consultant named Jessica Ernst filed a \$33-million lawsuit against Calgary-based Encana Corporation and the Alberta government, alleging that hydraulic fracturing had resulted in contamination of her local groundwater supply with toxic chemicals and methane (Ernst 2015; Nikiforuk 2013); the claim reports how the province's two key groundwater regulators "failed to follow the investigation and enforcement processes that they had established and publicized" (cited in Ernst 2015). The resulting case has held the activities of provincial oil and gas regulators up for public scrutiny (Nikiforuk 2014a). The Alberta government had argued that its regulator – the AER – was "exempt from civil action due to its immunity clause" (Nikiforuk 2014b). However, in November 2014, a judge concluded that the lawsuit against the provincial government could in fact proceed (Ibid). Though the long-term effects of the decision remain to be seen, the case appears to suggest that provincial governments hold a duty of care (i.e. are accountable) with respect to the environmental effects of hydraulic fracturing.

In the US, both Maryland and Pennsylvania have taken one step to increase the accountability of industry by creating a "rebuttal presumption." This legal principle is an attempt to address concerns that the negative impacts from oil and gas activities cannot be traced to a specific source and that individuals (such as the case of Ernst cited above) typically have to prove the intent or neglect of industry to contaminate water or use more water than permitted beyond a reasonable doubt. The rebuttal presumption reverses the accountability and assumes oil and gas activities are impacting the environment and people unless proven otherwise (Kulander 2011; Pennsylvania Consolidated Statutes 2012).

Lack of Transparency

Scholars identify transparency as a key principle of "good governance" (see Lautze et al., 2011). In the case of water governance, transparency can be understood to be the principle that those affected by water allocation decisions know not only the data that informed a decision, but also the process for arriving at the decision to ensure that decisions are visible and understandable (see Transparency International [2008] for a more detailed discussion).

At the workshop, participants returned again and again to the issue of a lack of transparency within governments' water-related decision-making for hydraulic fracturing. They described a "closed policy context" and "black box decision-making." They suggested that decision-makers were inaccessible to the public and that, as a result, decision-making processes were one-sided as industry typically could access decision-makers if they desired whereas the general public and non-governmental organizations encountered difficulties and delays. One participant said that the decision-making structure was "pyramid shaped," with certain individuals – often ministers but also statutory decision-makers – holding a great deal of power. Previous studies by Garvie and Shaw (2014) have also highlighted that in British Columbia, the Fort Nelson First Nation were unable to get an account of whether or how their viewpoints, gathered through consultation, were considered or weighed in the process.

As workshop participants discussed, it is possible that decision-makers are not accessible because they are often located in sites away from the actual shale gas deposits and affected watersheds in many of the regions. But the inaccessibility also relates to capacity – with the

drastic staffing cutbacks to many government agencies in the past two decades, there are few staff remaining to be “accessed.” Remaining staff are often too busy to engage with communities for general question and answers on a regular basis.

Several participants suggested that – in a reflection of this one-sidedness – policy-making agendas were only made public once there was a clear trajectory. In the literature on collaboration, multi-stakeholder processes, and community engagement, it has become common wisdom that early engagement is essential; otherwise, engagement and consultation are processes of “telling and selling”, and not attempts to collaboratively develop a vision for the watershed and to govern it accordingly (e.g. Taylor and de Loe, 2012; Innes et al., 2004). Workshop participants repeatedly commented that members of the public were not invited to help shape the overall policy direction (a challenge of public participation we address again below), even though they had been asked for input on numerous other policy initiatives, such as the *Water for Life* framework (AB), *Living Water Smart* (BC), and federal strategies for specific species-at-risk. Participants commented, too, that there was often no mechanism for an external review of a decision or a second opinion, particularly in cases of expropriation for large-scale energy development projects.

Participants suggested that transparency-related problems also developed because members of the public often lack information; the water permitting system can be very bureaucratic, and community members frequently do not understand the process. This issue of lacked information is another one to which we return, below.

Result: A Lack of Trust and Social Licence

Different social scientific disciplines define the concept of “trust” differently, but Bellaby (2010, 2615) identifies a common foundation among the diverse definitions: “Trust is a feeling or belief that someone (or some institution) will act in your best interest.” In many jurisdictions with active or proposed hydraulic fracturing, analysts and practitioners have identified that regulators’ lack of capacity, accountability, and transparency is resulting in a lack of public trust and industry faces the costs of this lack, as it affects their social licence. Trust is a quality harder to create than destroy; this is an idea referred to as the “asymmetry principle” (Slovic et al. 1991; cited in Wüstenhagen et al. 2007). Furthermore, a basic degree of trust (or mistrust) exists as a product (or cumulative effect) of past transgressions between, for example, communities and project developers or governments (Bradbury et al. 2009). However, research also suggests that trust can be built when governance processes are fair; the result is an increased public perception of institutional legitimacy (e.g. Suchman, 1995). At the workshop, participants agreed that trust could be built, calling it an “emergent property” of good governance.

THEME 2: Scientific Uncertainty and Lack of Data

Workshop and Delphi participants noted that water governance for hydraulic fracturing is often not informed by data in a robust or transparent way. In general, the scientific evidence

on the hydrological impacts of hydraulic fracturing remains limited and often inconclusive or conflicting (see CCA 2014 and Rivard et al. 2014 for a survey in the Canadian context). At the scale of the region, many jurisdictions face a lack of data regarding baseline hydrological conditions and the possible or actual effects of single or multiple projects on those conditions. Here we assess these two areas of scientific uncertainty and limited data before exploring trust-related issues regarding how information is generated and used; findings presented in this final sub-section suggest that many groups are skeptical of the research of others.

Uncertainty Regarding the Water-Related Impacts of Hydraulic Fracturing

Two major 2014 Canadian studies analyzed the current scientific evidence on hydraulic fracturing: the Council of Canadian Academies' *Environmental Impacts of Shale Gas in Canada* and the Report of the Nova Scotia Independent Review Panel on Hydraulic Fracturing (the Nova Scotia review also assessed social, economic, and health impacts; see <https://www.cbu.ca/hfstudy>). Another two CWN-funded teams (Goss et al. and Ryan et al.) are also working to assess the state of knowledge regarding environmental and human health risks from the water-related effects of hydraulic fracturing. Here we analyze two significant areas of uncertainty that are key concerns for actors involved in water governance in relation to hydraulic fracturing: uncertainty regarding contamination risks and uncertainty regarding thresholds and volume-related effects.

Uncertainty regarding contamination risks

Concerns about water use and contamination arise virtually everywhere the shale gas industry has expanded (Lave and Lutz 2014; Boudet et al. 2014). In Canada, concern regarding contamination risks is the foremost cause of public opposition to hydraulic fracturing; it is an issue that arose among both survey respondents and workshop participants, as well as in the literature. The Council of Canadian Academies report summarizes local concerns by region (see table 2.3 [CCA 2014, 43]); the risk of water contamination appears in all regions. In Alberta, the *Ernst v. Encana* case, described above, has received ongoing media coverage and drawn attention to groundwater-related risks of hydraulic fracturing (Nikiforuk 2014a, 2014b), and many Albertans – including those in the vicinity of actual or potential hydraulic fracturing – are very concerned about water contamination from this extractive practice (Parks 2013). For example, when a Calgary-based company, Goldenkey Oil, applied to drill three wells within Lethbridge city limits, potential groundwater contamination was a key reason why homeowners and city council fought the application (Bennett 2014).

Scholarly research, too, has focused on contamination risks. Environmental studies on the impacts of shale gas development and hydraulic fracturing on local water sources focus primarily on the potential for the contamination of surface and groundwater and its implications for human and animal health (Bamberger and Oswald, 2012; Colborn et al., 2011; Rozell and Raven, 2012).¹⁰ All studies conclude that more knowledge is needed to set

¹⁰ Shale gas drilling and fracturing create several potential pathways for methane leakage, which exposes groundwater aquifers to possible contamination; methane was found in drinking water well testing in the United States, which correlated with proximity to active shale gas wells (Fontenot et al., 2013; Holzman, 2011; Jackson

policy around the mitigation of impacts, and to better understand the level of risk that humans and ecosystems are being exposed to in relation to the shale gas industry (CCA 2014). While the literature on groundwater contamination has grown substantially over the past three years, the Council of Canadian Academies report notes, “the data are commonly limited and do not support definitive conclusions” (2014, 61). Research on surface water is even thinner, as “little attention has been paid to monitoring surface water quality” (CCA 2014, 86).

Furthermore, much of the work on water-related risks has been U.S. based; the findings from such studies – while important for identifying possible risks – may not be readily transferable to other contexts given differences in socio-political and physical geographies. In short, the water-related impacts of hydraulic fracturing are highly site and region specific.

Delphi respondents and workshop participants emphasized the need for public information on the chemicals used in hydraulic fracturing. In fact, the identification of chemicals in the fluid used for hydraulic fracturing, as well as amounts, was the governance challenge that the Delphi participants ranked highest overall in term of both desirability and feasibility.

Workshop participants also agreed that companies needed to make public the chemicals used in the hydraulic fracturing process. The Council of Canadian Academies report (2014, Box 4.1) notes that Alberta and British Columbia do in fact require operators to post online each well’s chemical additives along with their maximum concentration; operators must disclose this information within thirty days of completing a fracturing job (Ibid). However, there is a separate process for ingredients that operators consider to be trade secrets, which adds to the governance challenges of accountability and transparency. The website for these posts is fracfocus.ca, the “Chemical Disclosure Registry,” which was established by the BC Oil and Gas Commission and modeled after a similar site in the U.S. (FracFocus 2014). FracFocus now also hosts registries for New Brunswick and the Northwest Territories. Members of the public can search the site by region, well, or operator, in order to find out chemical mixes and concentrations in fracturing fluid of specific wells. However, our own experience is that this site is not user-friendly given that you cannot bulk download data in a readable format for searching, and you cannot search by known city names; rather you must know the operator name or the well. Moreover, as workshop participants noted, the scientific understanding is still limited regarding the interaction of these chemicals and their additive or compounding effects on water quality; as such, many uncertainties still exist in the governance of these chemicals despite the attempts at transparency that FracFocus aims to achieve.

Perhaps most challenging from a governance perspective is the fact that this information (albeit limited) becomes available *after* water has been approved and allocated to hydraulic fracturing. Delphi survey participants indicated that they perceived little recourse exists for people living within the watershed to have government alter or withdraw the rights to a water allocation if contamination occurs.

et al., 2013; Osborn et al., 2011). Other research focuses on pathways for surface water contamination created during the various stages of development. Entekin et al. (2011) describe how surface water quality may be affected by sediment runoff from newly cleared lands, from the alteration of streamflow due to surface water withdrawals, and from contamination from the chemicals involved in fracturing and wastewater disposal; Olmstead et al. (2013) and Warner et al. (2013) focus explicitly on surface water quality in jurisdictions of the United States where treated flowback – also called “wastewater” or “frack fluid” – is released back into rivers and streams, finding that local concentrations of radioactive elements, chlorine, and total suspended solids (TSS) can far exceed threshold regulations.

Uncertainty Regarding Thresholds and Volume-Related Effects

More research is needed, too, on the volume-related impacts of hydraulic fracturing. The Canadian Council of Academies report notes that while the *total* water demand for hydraulic fracturing in Canada might be proportionally quite small, the use is intensive and can create water stresses at times of peak demand, and in different seasons (CCA 2014, chap. 4). Delphi participants noted the challenge of understanding the environmental impacts of water withdrawals (both surface water and groundwater, including aquifers) for the purpose of hydraulic fracturing. These survey participants noted that reducing hydraulic fracturing's demand for freshwater resources was another key decision challenge.

Water scarcity has been a public concern in various parts of Canada; for example, in Alberta critics have noted that fracturing demands massive quantities of freshwater while the province faces greater risks of water scarcity than other provinces (Christensen and Droitsch 2008). Shale gas development is proposed in areas where it will compete with other water uses (CCA 2014; see Reig, Luo, and Proctor [2014] for a global analysis of the relationship between fracturing and water scarcity worldwide). The threat of scarcity led to the creation of the 2004 "Water for Life" strategy, but due to a lack of funding, implementation has been slow. While the AER suggests that in shale gas development, no "technical issues" related to quantity have been identified and that this regulator is concerned with quantity for "social reasons" (Parks 2013), others have suggested that scarcity continues to be an issue in the province (see Christensen and Droitsch 2008; Schindler and Donahue 2006). Therefore, concerns exist that because of the nature of the industry's large scale and rapid development – sufficient water today does not automatically mean sufficient water tomorrow.

Furthermore, participants at the workshop reflected on the broader question about whether water use for hydraulic fracturing would ever be considered the "best" use in a watershed, or whether there should be a threshold or limit to how much could be available for this one particular use, when demands for other water uses are also increasing (e.g. such as for agriculture in light of growing concerns about food security).

Lack of Baseline Data, Monitoring Programs, and Cumulative Assessments

Our research suggests that as shale gas development is proposed or expanding in many places in Canada, the people involved in governance face a great deal of uncertainty regarding the region-specific water-related risks, as there is a lack of data regarding baseline hydrological conditions and cumulative effects. Researchers have noted that, with hydraulic fracturing, development often begins before adequate baseline data has been collected – such as on nearby groundwater quality and critical wildlife habitat (CCA 2014). For example, in terms of water data, five–six years of reliable flow data is necessary in order to understand the hydrology of a river (Carey 2013); however, many developments proceed before that information is gathered. Furthermore, scholars have pointed out that in many regions, the baseline data that is now being collected is from an already industrialized landscape, as development proceeds before any data is collected (CCA 2014; Garvie et al. 2014). The absence of regulatory requirements for monitoring has contributed to these challenges of data.

Workshop participants suggested that, due to the limited availability of baseline data and ongoing monitoring, water allocation decision-makers lacked a clear understanding of risks. There is not only a lack of knowledge of industry’s rapidly advancing hydraulic fracturing technologies – there is also a great deal of uncertainty about how government expects to manage these risks through regulation. Even when monitoring programs exist, they may not be comprehensive or systematic enough to provide complete data sets for decision-makers or for the concerns most relevant to communities. That is, data may be collected on the concentrations of specific chemicals, but may not be collected on the long-term health implications for humans, or how the concentrations of chemicals may be interacting with other chemicals in the aquatic system. Therefore, concluding that risks exist or do not exist become nearly impossible. Our case study data (from the literature review and collaboration with regional partners) suggests that some small, region-specific monitoring programs exist (box 2), but that no systematic or comprehensive programs have been developed. Participants in the Delphi survey reiterated the need to establish “consistent baseline and environmental monitoring regimes in the context of hydraulic fracturing and water resources.”

Box 2.

Examples of region-specific monitoring programs

- In Nova Scotia, community monitoring programs exist, and government and academic researchers have begun to map water resources (e.g. Water Canada 2014). However, the province lacks an official government water quality monitoring program and data collected by community-based organizations do not often transfer into governmental decision-making. Monitoring has been done primarily by industry, as areas have been mapped out for exploration permits. One promising area is in the work being done through CURA H2O (curah2o.com), an intersectoral research partnership.
- In the Sahtu Region of the Northwest Territories, the sub-surface effects of hydraulic fracturing are unmonitored due to the lack of local hydrological expertise. Dr. Erin Kelly with the GNWT is conducting some community-based water monitoring, but these local programs are not specifically designed to be an oil and gas industry monitoring program, but rather to gather baseline information. In 2013, the GNWT allocated funds through the Environmental Studies Research Fund (ESRF) for regional monitoring, water baseline studies, and wildlife and wildlife habitat studies (GNWT 2013), but these projects are behind schedule due to devolution (personal communication, Shauna Morgan, July 2014).¹

That regulators may lack the capacity (a point introduced in the previous section) also means that they may be unable to develop comprehensive monitoring programs. Other groups – other levels of government, Indigenous nations, non-Indigenous communities, and NGOs – also lack this capacity. But, the lack of monitoring also points to a lack of regulatory requirements surrounding monitoring. Regulatory developments are currently focused on well-casing standards, which could help prevent contamination that occurs via leaks. However, largely absent across Canadian jurisdictions are regulations that require baseline monitoring before the application is made for a water licence/permit, ongoing monitoring

while water is in use for hydraulic fracturing activities, and monitoring after hydraulic fracturing activity ends but infrastructure still exists.

Given our focus on governance, as opposed to monitoring network design, our research highlighted only general parameters to consider for monitoring: surface-groundwater interactions, biogeochemistry, chemical interactions (both between chemicals used for hydraulic fracturing and between those chemicals and other chemicals such as PPCPs that may be present in the ecosystem), bioaccumulation in aquatic species, and environmental flow needs. Without comprehensive monitoring, the water allocation process lacks robust data before, during, or after hydraulic fracturing. Despite the costs involved for the industry and the complexity of designing any water monitoring system (e.g. Strobl and Robillard, 2008; Government of Canada and Government of Alberta, 2012), regulatory requirements that ensure consistent standards for data collection and reporting have been recognized as urgently needed, both in existing research reports and by workshop participants.

The Need for Cumulative Effects Assessment

Researchers have repeatedly noted that – along with the need for baseline data and monitoring – good governance for hydraulic fracturing requires cumulative effects assessments that would consider the impacts of a series of projects on human and environmental health (CCA 2014; Garvie and Shaw 2014; Rahm and Riha 2012). The CCA states: “Large-scale shale gas development may represent the start of several decades of production and the drilling of tens of thousands of wells in Canada. This development will have both local and dispersed land effects. The assessment of the environmental effects of shale gas development cannot, therefore, focus on a single well or well pad, but must also consider regional and cumulative effects” (2014, xv). The ability to develop a cumulative effects management framework, however, requires data on environmental impacts, which might not be available (see Gosselin et al. [2010] for a description of this data-related challenge in the Alberta context). The additive effects of expanding natural gas and other forms of energy will require comprehensive strategies for managing and mitigating their cumulative effects (Jacquet and Stedman 2013). Researchers have noted, too, important links between cumulative assessments and the protection of human health (Centner and O’Connell 2014) and argued that health-specific cumulative assessments are needed (see Colborn et al. 2012; Jenner and Lamadrid; 2013).

In the Canadian context, several analysts have noted a lack of cumulative effects assessments of hydraulic fracturing. In New Brunswick, while the province has introduced its new “phased” EIA, it does not have a strategic cumulative impact phase that considers the impacts of the industry as a whole (Merrill, personal communication). In northeast British Columbia, lands managers of Treaty 8 First Nations described a lack of cumulative assessment as one of the main problems associated with the shale gas industry; one interviewee in a previous study suggested that the landscape was facing “death by a thousand cuts” (Garvie and Shaw 2014). Workshop participants, too, identified the lack of cumulative impact assessment as a key governance challenge; the issue rose repeatedly throughout the workshop. Participants noted that once an activity is permitted, there is no sense of how it will interact long term with other water allocation decisions in the area (both past and future). They suggested, too, that

regulators failed to link water-related decisions to other land and water decisions. Delphi participants also raised the issue of larger and more integrated assessments; they identified “Understanding landscape scale and surface impacts associated with hydraulic fracturing activities (i.e. access roads, traffic and noise)” as a key decision challenge.

Difficulties in Governing the Science: Data Fragmentation, Funding, and Mistrust

A key finding from the workshop – and a source of ongoing discussion – was the fact that the fragmentation of data presents a water governance challenge because of the impacts it may have on both the level of informed decision-making and on the trust and legitimacy that is perceived by the communities in the watersheds from which water is being allocated. Workshop participants noted that data are collected by different groups for different purposes and are not always being linked together for decision-making. Each company is doing its own monitoring, academics are conducting research, and First Nations are also doing their own research and data collection. The extent to which these efforts overlap is not known, and to some extent, is a secondary concern to the groups. Rather, participants agreed that the primary concern is that these groups generally do not trust each other’s data. Overall, research shows that “to increase knowledge and to build trust, there is a need for continued information dissemination on the processes and impacts of gas development by sources perceived as unbiased and/or apolitical” (Stedman et al. 2012, 390).

Workshop participants went on to discuss the issue of funding for data collection and analysis. Many agreed that current funding options lead the public to assume that the data are biased; for example, if research is paid for and collected by an NGO, others (e.g. the industry, government, and some members of the public) do not trust it. If it is paid for by industry, then Indigenous nations, NGOs, members of the public, and possibly local governments assume it is biased. Even if the data are collected by an NGO or community-led group, if the study is funded by industry or government, both Indigenous and non-Indigenous community groups alike have faced criticism for accepting the funds, and their group and the data are perceived as biased, as opposed to serving as a third-party verification system. Yet, given the high costs associated with sophisticated monitoring programs on cumulative effects to inform water allocation decisions, very few groups (e.g. NGOs, Indigenous nations) beyond industry have sufficient funds. This is further complicated by the fact that different companies will compete with each other for access to data. If a NGO, Indigenous Nation, or government were to share one company’s data with other companies, the company that funded the data collection may lose its comparative advantage.

Workshop participants also noted that conversely, discussing data can, in some areas, prove overwhelming both in terms of volume and technical jargon. In these instances, a lack of synthesis among different data sets can make it difficult for people to access and use the data in their decisions or discussions with other actors. Therefore, the governance challenge is that simply collecting more data or establishing more monitoring stations will not address the mistrust that people have in the water allocation decision process, unless the process of data collection, the funding of the data collection, and the actors involved in the data management are changed from the current system. In particular, workshop participants identified a need for

long-term, well-resourced, unbiased, and transparent systems of data collection, along with ways to make that data publicly available for all user groups.

In one nascent example of such a system, the Fort Nelson First Nation has collected data on a number of issues on the extent of shale gas development in its territory and has made this information publicly available (e.g. Garvie et al. 2014). Under a new collaboration with Apache Energy, FNFN has begun collecting data on a number of wildlife- and water-related indicators, and the Nation will make this data public too (see Box 6). Models for collectively sharing data exist in other industries; for example, in British Columbia, the Coast Forest Conservation Initiative (CFCI) – a collaboration involving five forestry companies and three environmental organizations – sought to develop an ecosystem-based plan for the province’s central and north coast (CFCI 2014a). In 2004, an independent scientific team conducted a comprehensive analysis of the forests, which then fed into an extensive planning process involving First Nations and many stakeholders, and the open and transparent sharing of scientific and technical data was central to the planning process (which, in 2014, resulted in final recommendations for implementation) (CFCI 2014b). In short, models for information sharing – which are well developed in forestry but nascent in the shale gas industry – may help address the governance challenges related to data.

Box 3.
Shale Gas, Climate Change, and Water

Many consider natural gas a clean energy because of a relatively low release of carbon during burning; however, in order for natural gas to be usable, CO₂ has to be stripped away beforehand, releasing large amounts of greenhouse gas into the atmosphere (Jaccard and Griffin 2010). The CCA report notes that experts disagree on the climate change–related effects of shale gas and that greenhouse gas emissions vary by region (CCA 2014, xiv). In British Columbia, certain shale gas plays such as the Horn River, are particularly high in carbon dioxide compared to other areas in Canada (CCA 2013). Methods of accounting for provincial greenhouse gas targets do not currently include these production-related emissions (Ibid), thereby privileging shale gas as a “clean” energy source compared to other sources.

The climate-related effects of shale gas remain a concern for many researchers, who argue that the life-cycle and cumulative effects of shale gas developments should be considered through a climate change lens (see Horne and McNab [2014] regarding this argument in the BC context). Workshop participants, too, identified the “framing out” of the carbon emissions question in governance for hydraulic fracturing to be a significant problem. Climate change has significant – though unpredictable – effects on water and hydrological systems (see David Suzuki Foundation 2014; Environment Canada 2014). As such, workshop participants that assessments of the industry’s impacts should consider climate change.

THEME 3: The Need to Better Include Indigenous Nations

Some researchers have suggested that Indigenous communities are “canaries in the coal mine” when it comes to the impacts of resource extraction and environmental degradation (Weaver 2010; cited in Willow 2014). Specifically, Indigenous communities are vulnerable to environmental impacts, particularly contamination, because members harvest from the land for the purposes of food security, cultural and spiritual revitalization, and social reproduction (Mascarenhas 2012; see also O’Faircheallaigh [2013] for an Australia-based explanation of why Indigenous communities are particularly susceptible to risks from LNG developments). In Canada, resource development projects, that both fail to fully consult and accommodate aboriginal interests and are poorly regulated or managed by governments, often result in opposition by Indigenous peoples and/or negative impacts on Treaty rights – resulting in protracted legal suits and substantial delays. Concerns about both Treaty rights and the current approach to government-government relationships, and the processes surrounding the legally required duty to consult are the two main problematic areas described below.

Treaty Rights and Relationship Not Recognized

Canadian Indigenous Nations (Aboriginal peoples – First Nations, Metis and Inuit) hold a unique position as constitutionally protected rights holders. In any process to develop and implement new governance arrangements, attention to international Indigenous rights, constitutional and treaty rights, and evolving legal precedents is required (Prno and Slocombe 2012). In the context of Canadian governance for hydraulic fracturing, discussion of the potential impacts on Indigenous peoples’ land and water based activities – such as fishing, hunting, and food gathering – is a central focus of governance debates.

At the workshop, several participants noted that the actual or potential impacts of hydraulic fracturing on constitutionally guaranteed treaty rights had a significant impact on Indigenous peoples, which has informed their responses to the existing and proposed decision-making processes. In northeast BC, for example, the Fort Nelson First Nation (FNFN) has already seen extensive changes in the landscape as a result of shale gas development, changes that have an impact on well established Treaty practices (Garvie et al. 2014). The FNFN’s concern over shale gas governance has often focused on water. For example, the Nation reports the provincial government took more than six months to respond to the Nation’s appeal of a water licence, during which time the licensee withdrew more than 180,000 cubic metres of water from a lake during a drought (Chapman 2013). The licensee has since been charged under the *Water Act* for breaching the licence and diverting more water than authorized (BC Court registry no 11680). However the repercussion and implication from that breach still remains uncertain.

In other regions, where shale gas development is proposed or nascent, such as on the East coast, concerns from Indigenous peoples regarding the uncertainty of the environmental impacts have driven opposition to hydraulic fracturing. For example, in a presentation to the Nova Scotia Wheeler Commission, Diana Campbell of the Union of Nova Scotia Indians said that “before any decisions are made in regards to fracturing, it is critical that we all have a

complete understanding of how ‘environmental contaminates from the fracking process [can enter] into the food chain’ so that, the Mi’kmaq especially, will know how this type of drilling could impact the harvest and reliance on traditional foods” (Mi’kmaq Rights Initiative 2013). In other cases, the interaction of hydraulic fracturing with treaty rights remains to be seen. For example, in the Northwest Territories, where the federal government has made development a priority, some analysts have expressed concern regarding how development will be balanced with environmental protection and protection of the interests of local people who still rely on land-based practices for their economic and cultural survival (Morgan 2014). In short, the legal and constitutionally guaranteed rights of Indigenous people in Canada will inevitably shape water governance for hydraulic fracturing, though in ways that vary greatly by region and in the context of existing treaties, land claim agreements, or claims of aboriginal title in areas without treaties (such as BC).

As workshop participants pointed out, the treaty relationship is much broader than the right to continue traditional food procurement strategies (such as hunting and fishing simply for nourishment). Several scholars of Indigenous governance have noted that land-based practices are critical to maintaining the community-homeland relationship that is fundamental to cultural identity and self-determination (e.g. Alfred and Corntassel 2005; Corntassel 2008). The protection of these practices and connections over the long-term, scholars argue, requires an approach to governance broader than one based on rights alone, as a “rights-based” approach often focuses – too narrowly – on the ability to continue to procure food in a traditional way (Corntassel 2008; Schreiber 2006). In the context of water and hydraulic fracturing, research has explored instances where governance processes have failed to protect treaty rights but also, more broadly, to meaningfully include Indigenous nations in decision making related to water resources in their traditional territories (Garvie and Shaw 2014). Workshop participants noted that the lack of meaningful inclusion in decision-making limits genuine “government-to-government” relationships. The consequence is further discord over final decisions. When a nation perceives that it has not been included, and when the provincial or federal governing body does not indicate an understanding that Indigenous rights includes more than food procurement, it becomes difficult to understand how governments can claim that in fact they have appropriately accommodated Treaty rights.

Workshop participants also noted two instances in which Indigenous nations did, in fact, have meaningful authority to help shape decision-making around hydraulic fracturing. In the Northwest Territories, Indigenous nations have substantial influence to veto developments and the ability to trigger an environmental assessment (see box 44). As well, the Kwilmu’kw Maw-klusuaqn Negotiation Office (KMKNO), which is part of the Mi’kmaq Rights Initiative, seeks to “address the historic and current imbalances in the relationship between Mi’kmaq and non-Mi’kmaq people in Nova Scotia” (Mi’kmaq Rights Initiative 2014).¹¹ Workshop participants noted that all corporate and government entities in Nova Scotia must go through a negotiation process with KMKNO and have to receive approval from the Assembly of Nova Scotia Mi’kmaq Chiefs. Among these chiefs, there was no support for hydraulic fracturing, a

¹¹ The KMKNO seeks to “undertake the necessary research, develop consensus positions on identified issues, and create public and community awareness in a manner that supports the ability of the Assembly to fully guide the negotiations and the implementation and exercise of constitutionally protected Mi’kmaq rights” (Mi’kmaq Rights Initiative).

position revealed during consultation as part of the Nova Scotia Hydraulic Fracturing Review (the “Wheeler Review”) (described below).

Box 4.

REGIONAL DIFFERENCES IN INDIGENOUS AUTHORITY

Case Study: The Northwest Territories

As described above, the lack of authority for Indigenous nations was a key governance challenge identified by participants. In the context of this challenge, participants discussed the decision-making opportunities available to Indigenous nations in one particular region: the Northwest Territories. In NWT, the population outside Yellowknife is approximately 50 percent Aboriginal; these people are out on the land and have a very strong physical presence; their voices are powerful in decision making.

These nations have substantial influence to veto power over developments, though this power is rarely exercised (as people prefer to say yes, so as not to lose economic opportunities, but with conditions). First Nations’ authority in decision making is apparent in three main ways:

- (1) As in the rest of Canada, the government in NWT is constitutionally required to consult with Aboriginal people before issuing any leases for oil and gas development. However the stronger Aboriginal influence within the governance arrangements in NWT ensures that these requirements are generally followed in a more meaningful way. In practice, the government will not issue a lease if the Aboriginal government says no; this is the main influence on the decision - the opportunity for Aboriginal government on behalf of their people to say whether the development is done..
- (2) Every project requires an impact and benefits agreement; companies will sign these with Aboriginal governments. While these agreements mostly deal with the economic aspects of a project – with jobs and impacts – environmental clauses may also be included.
- (3) There are co-management regulatory boards (with First Nations representation) that issue licenses and permits or do environmental assessments. Aboriginal governments can trigger these environmental assessments, which is a significant power. The review board that undertakes these assessments is also co-managed as set out in the NWT *Resource Management Act*.

Legal Duty to Consult: “Consultation Is Not Consent”

The imbalance in authority – where Indigenous authority is generally under-recognized by federal and provincial governments – is a major ongoing issue in governance related to hydraulic fracturing and land and resource governance more broadly in Canada (von der Porten and de Loe 2013). The Government of Canada has a fiduciary responsibility and legal duty to consult with Aboriginal people whose traditionally territories comprise the proposed spaces of industrial development (Natcher 2001; Newman 2009). A number of recent court cases have set out the legal meanings of Aboriginal rights and title and provide substantial guidance regarding the responsibilities of governments in this realm (see CCA 2014, chap. 2, sec. 2.3 for a summary). Most recently, in June 2014, the Supreme Court of Canada passed down a unanimous decision that, in the words of Mandell Pinder LLP (2014), “significantly alters the legal landscape in Canada relating to land and resource entitlements and their governance.”¹² In the *Tsilhqot’in* case, the court for the first time in Canada recognized Aboriginal Title in a specific region of British Columbia and gave the concept meaning by defining it as “the right to control the land conferred by Aboriginal title means that governments and others seeking to use the land must obtain the consent of the Aboriginal title holders” (Mandell Pinder 2014).

This Supreme Court of Canada decision noted the necessity of consultation, but placed specific emphasis on *consent*. That is, the need exists for more than simply sharing information and is now recognized by this decision, potentially strengthening the legal position of Aboriginal peoples across Canada in relation to land and resource governance. The full impacts of the *Tsilhqot’in* case remains uncertain and will be unfolding over years to come; for example how the decision will be interpreted in the context of Treaty nations remains to be seen (as many nations, especially on the east coast, assert that existing treaties were for peace and friendship and did not surrender aboriginal title) (see Miller 2014 for further discussion). However, in the context of water governance and hydraulic fracturing, the case suggests that the legal burden that Aboriginal title imposes on the Crown will necessitate the creation of new institutions of consultation and negotiation (and ultimately to build partnerships and trust) that respect the need to obtain consent prior to development taking place.

On the ground, though, where shale gas development is unfolding, concerns about consultation remain (Garvie et al 2014). Workshop participants noted that consultation is not substantive, meaningful, or timely, and yet is often seen as a “green light” for shale gas projects. Participants repeatedly said that “consultation is not consent,” thereby suggesting that processes of negotiation and accommodation needed to be more meaningful before Indigenous nations would feel that governance processes for hydraulic fracturing were equitable. Our regional analysis identified examples of these problems with consultation in multiple jurisdictions. In British Columbia, First Nations have demanded inclusion in decision-making processes surrounding oil and gas referrals and governance of resources on their land. Consultation processes have been deemed inadequate at addressing impacts to treaty rights.

¹² *Tsilhqot’in Nation v. British Columbia* 2014 SCC 44

Work by members of our research team in the British Columbia context has shown that consultation processes – while legally mandated – are based on a fragmented permit-by-permit approach and have little effect on development outcomes (Garvie and Shaw 2014; Garvie, Lowe, and Shaw 2014). In the case of the Fort Nelson First Nation, consultation processes are being renegotiated to give the Nation more authority (Lana Lowe, personal communication; see also Garvie and Shaw forthcoming). However, as stated earlier in the report many people involved in consultation processes and ongoing negotiations over shale gas have noted that a culture of mistrust has built up between First Nations in BC and government because of past conflicts and the two groups have different ideas about what effective water governance looks like. Moreover, many of those outside of the consultation process “looking in” are highly skeptical of any outcomes for various reasons. For instance, confidentiality clauses often shroud such negotiation in secrecy and the result is that many observers are chiefly concerned that only personal economic gain is the end result rather than strong water governance structures. Similarly, in New Brunswick, First Nations have demanded that their rights be upheld and that they be consulted regarding shale gas development (Assembly of First Nations Chiefs, New Brunswick 2013). A high degree of uncertainty exists regarding the processes through which consultation should occur.

Similarly, members of various provincial governments and industry express frustration with consultation processes. In previous case study research conducted by members of the research team, government staff have acknowledged that the process often seems futile (Breiddal, unpublished). Staff often believe that they have gone out of their way to host numerous meetings and discuss interests with different Nations, only to have the respective Nation still be opposed to a proposal. But herein lies the issue – consultation is not consent, and approaching a Nation with a plan that is already well developed is not likely to yield a successful, inclusive result.

A different approach – and one that workshop participants deemed more equitable – can be found in Nova Scotia. Workshop participants reported that the Assembly of Nova Scotia Mi’kmaq Chiefs created its own working group to develop a summary of the organization’s concerns to submit to the 2013–14 review process and supported the recent ban (Assembly of Nova Scotia Mi’kmaq Chiefs 2014). David Wheeler, the chair of the panel and other experts were invited to meet with Chief Paul Prosper, the Assembly of Nova Scotia Mi’kmaq Chiefs’ (ANSMC) Lead of the Energy Portfolio and the Assembly’s Hydraulic Fracturing Committee, who was heading the working group.¹³ The Wheeler Review included a discussion paper on “Hydraulic Fracturing and the Aboriginal, Treaty and Statutory Rights of the Mi’kmaq” (lead contributor Constance MacIntosh), which was part of the content posted online for public comment. The paper summarized the importance of addressing Aboriginal rights in Nova Scotia:

“...the Mi’kmaq people possess robust treaty rights, as well as Aboriginal rights in Nova Scotia. These rights have considerable consequences for provincial deliberations over hydraulic fracturing, as the Province is constitutionally obliged to honour these rights... The province is also constitutionally required to respect the Mi’kmaq’s Aboriginal rights and to consult with the Mi’kmaq, so as to understand those inherent rights. In each case, the

¹³ The ANSMC is comprised of the thirteen Mi’kmaq Chiefs of Nova Scotia and is the highest level of decision making for the Mi’kmaq of Nova Scotia.

province is required to seek to honour and accommodate those rights. In some circumstances, the Province may be able to infringe upon the Mi'kmaq's Aboriginal rights but only if a strict justification test is met. If the Mi'kmaq people possess Aboriginal title rights over portions of Nova Scotia where there is subsurface unconventional gas, unless an exceptional justification test is met, the Mi'kmaq have the right to decide whether that gas will be exploited. Regardless, they have the right to receive any economic benefits arising from the land" (MacIntosh 2014, p. 282).

In short, the Nova Scotia review noted that consultation was a constitutional requirement and that the province could not legally infringe upon these rights without Mi'kmaq consent. Despite the legal requirements, public statements about the importance of government-government relationships, and the acknowledgement of Indigenous rights in documents such as the Wheeler Review, the actual processes of consultation (or any governance arrangement that is inclusive beyond consultation) with Indigenous Nations remains a key issue in relation to water governance for hydraulic fracturing.

THEME 4: The Need to Better Address Community Concerns and “Sense of Place”

As we explore in this section, members of the Canadian public are very concerned about the prospect or practice of hydraulic fracturing and, in particular, the technology's risks to water. The need to better engage the public was a key challenge identified by workshop and Delphi participants alike. Workshop participants argued water governance for hydraulic fracturing could only be socially resilient if it receives buy-in from the public; as such, the lack of meaningful mechanisms of for public engagement remains a key challenge.

A High Degree of Public Concern about Hydraulic Fracturing

In Canada, public concern over hydraulic fracturing is high. An October 2014 EKOS poll found that 70 percent of Canadians support a moratorium on the technology (Council of Canadians 2014). In several places, environmental organizations and citizens' groups have formed active opposition to the hydraulic fracturing. For example, in Nova Scotia, the freshwater policy community, including NGOs like Ecology Action Centre and No Frack Nova Scotia, is very vocal on the subject of hydraulic fracturing. Furthermore, the Native Council of Nova Scotia (which represents Mi'kmaq living off reserves) recently released a statement opposing all hydraulic fracturing in the province (Ross 2014). Meanwhile, in Quebec, the BAPE (2014a) (environmental assessment agency) found that the prospect of shale gas development in the Utica Shale does not have “social acceptability” for several reasons that relate to governance; citizens were skeptical that decision-making processes could reflect their interests. Public concern over hydraulic fracturing has been one of the main causes (along with the decline in natural gas prices) of recent slowdown in shale gas development in Canada (CCA 2014).

The Need for Improved Community Engagement Processes

Community perceptions of a hydraulic fracturing development's relationship to a place can be shaped by several governance-related factors: trust that industry will mitigate the most severe impacts (Devine-Wright and Howes 2010), trust in the government institutions managing the risks (Brasier et al. 2013), and the distribution of a project's costs and benefits (Jaquet and Stedman 2013; see also, BAPE, 2014 for example). Workshop participants reported that actors outside the state and industry often felt marginalized in the decision making process. They noted evidence, too, that local governments or decision-makers had been undermined or not systematically included. As one example, one First Nation participant explained forging an agreement with a local government representative, and the agreement was sent "up to Ottawa" and when the local government returned to meet the Nation, the decision had been overturned. When such occurrences are repeated, trusting relationships break down and Indigenous Nations, local communities, and to some extent, the local government may feel undermined by agencies with legal authority. The CCA report notes that the "potential impacts of shale gas development, as well as strategies to manage these impacts, need to be considered in the context of local concerns and values" (2014, xvi).

The type and scope of community engagement surrounding hydraulic fracturing depend on the region. In Quebec, the Strategic Environmental Assessment found that the province needs new mechanisms for consultation; in particular, consultation prior to development is needed to identify and mitigate potential conflicts. In Alberta, only those members of the public who can prove that they are "directly and adversely affected" by a proposed development can have standing for an appeal or opportunity for ongoing engagement with a project. As such, only a small group – mostly landowners adjacent to energy projects – has a say in the direction of provincial oil and gas development. Critics of Bill 2, the Responsible Development Energy Act, have noted that this legislation further shifts rights away from landowners and toward oil producers (see Brown 2012). However, these engagement and consultation processes are triggered only when a broader environmental assessment review is being conducted. That is, public engagement is not a required process for every water licence or permit application. The result is that community engagement specifically focused on water governance and water allocation for hydraulic fracturing has been limited. The Nova Scotia Wheeler Review was one model of community engagement that workshop participants noted as being inclusive of diverse social groups (see box 5). In British Columbia, meanwhile, a comprehensive engagement process was developed during the creation of the new *Water Sustainability Act*. In general, the approach for engagement has been widely lauded, but the BC Ministry of Environment's engagement with Indigenous Nations was criticized (von der Porten and de Loe, 2013). Ultimately, a formal evaluation of the effectiveness has not yet been conducted and workshop participants were uncertain about whether it provided a model that could be adopted for other water governance processes beyond legislative reviews.

Box 5.**Public Engagement During the Wheeler Review**

The Wheeler Report was a review of hydraulic fracturing in Nova Scotia that sought to take account of the state of current knowledge and of public opinion. A key innovation of the Wheeler Report was the involvement of the public throughout the process, including in the selection of panelists and through an online, interactive scheme for consultation.

Background: In 2009, the provincial government in Nova Scotia decided to commission a review of hydraulic fracturing, hoping to develop a new regulatory framework. They turned this review over to a committee of officials; the result was a two-year process.

Context: Concurrent with the review process were two other big events that helped shape outcomes: the development of a report on hydraulic fracturing by the Council of Canadian Academics (CCA 2014) and a Nova Scotia inquiry into provincial economic futures. Panelists consistently referenced the CCA and economic futures processes, thus situating themselves in a large context.

Public review process: Each panelist conducted a series of public hearings across the province. (At these hearings, they heard a high degree of concern about hydraulic fracturing and a high level of public distrust.) Subsequently, each panelist was responsible for writing a chapter, and then each chapter was posted online for public comment. The time frame for public response was two–three weeks per chapter.

Outcomes: The public was 65 percent against licensing hydraulic fracturing operations. Panelists concluded that significant knowledge gaps needed to be addressed before hydraulic fracturing could proceed in the province; more scientific information was needed before a full decision could be reached (and some controlled shale operations might therefore be necessary for the purposes of research). As a result of the report, the province established a moratorium on hydraulic fracturing. The report continues to be available online at <http://www.cbu.ca/hfstudy>.

The Need to Address “Sense of Place” in Water Governance

A growing literature suggests that, in order to avoid intractable conflicts, governance processes must meaningfully account for “sense of place” issues. The Council of Canadian Academies report notes that, “the potential impacts of shale gas development, as well as strategies to manage these impacts, need to be considered in the context of local concerns and values” (2014, xvi). The ability of governance processes to take account of local place-based values and attachments will shape community responses (Devine-Wright and Howes 2010). A growing body of scholarship investigates how concepts related to “sense of place,” such as place attachment and identity, affect local responses to industrial projects like shale gas developments (e.g. Brasier et al. 2013; Devine-Wright and Howes 2010; Jacquet and Stedman 2013; Stedman et al. 2012). Theories of place attachment and place identity are based on the recognition of emotional bonds between people and places, the idea that the “physical and symbolic attributes of these locations contribute to a positive sense of personal or social identity” (Devine-Wright and Howes 2010, 337). Changes that disrupt these affective connections to place can lead to place-protective behaviours (Ibid). In other words, the

specific ways in which residents perceive a particular place affects how they relate to projects that will change or pose risks to it.

Some sense of place studies have shown that ethnic minority populations are more likely to have higher risk perceptions because they have often experienced “historical patterns of racism and differential exposure to environmental problems” and they may hold different attitudes and worldviews about the developments being proposed (Brasier et al. 2013, 110). Other studies of risk perception and sense of place have shown that attitudes towards development are shaped by the dominant environmental attitudes of the population, such as its familiarity with industrial development (Stedman et al. 2012), and by community attachment to place, particularly given the length and type of residency (Jacquet and Stedman 2013). Communities’ economic status also shapes their willingness to accept certain developments (Stedman et al. 2012) such that economic need has been known to outweigh local concerns over the potential human health risks.

Research has shown that public perceptions of natural gas developments – and, more specifically, of hydraulic fracturing – are also shaped by place-based attachments. For example, one study showed that when members of the public saw places as threatened, psychologically restorative, or ecologically significant, they were more likely to have negative responses to natural gas (Jacquet and Stedman 2013). In a country such as Canada, where national and regional identities are often tied, and have even been “branded” as being linked to watershed and landscape features (see the “SuperNatural BC” or “Ontario: Yours to Discover” campaign materials), it is not surprising that hydraulic fracturing activities have been resisted. Hydraulic fracturing has been a strong part of this public perception of “threat” or risk; Jacquet and Stedman (2013) found that water quality impacts were the most consistent negative perceived impact with natural gas drilling. Scholars note that local and ethnographic studies on the impacts of fracking and shale gas development are needed to understand the significant social, political, and economic transformations associated with this industry (Willow and Wylie 2014).

PART IV. Governance Knowledge Gaps and Research Proposals

Section Highlights

- We identify seven knowledge gaps that relate to the core governance challenges. These seven gaps are summarized in four separate categories, describing that improved knowledge and understanding are needed about:
 - Transparent and accountable governance approaches that can build (or rebuild) public trust,
 - Best practices for knowledge sharing and information dissemination in governance,
 - Opportunities to better address Indigenous Nations rights in the context of water governance, and
 - Processes to meaningfully engage diverse actors in governance.
- For each knowledge gap, we propose a general research approach that could be used as a platform by water governance scholars to develop and test how to best address the priority governance challenges surrounding water use for hydraulic fracturing.

Although we highlighted (above) that one of the major governance challenges involves a lack of scientific data and scientific certainty, other CWN-funded projects are studying these scientific knowledge gaps in depth. Thus, here, we focus mainly on the knowledge that would be needed to create and support more equitable, socially resilient systems of governance and to address the lack of capacity, transparency and accountability, the lack of social licence and trust, the need to better include Indigenous Nations in water allocation decision processes, and the community concerns and issues surrounding sense of place. We identified seven knowledge gaps; these fall under four themes that parallel the governance challenges outlined in the previous section (table 2).

For each of these knowledge gaps, we have proposed general research approaches that could be used to build such knowledge and capacity for governance. We have purposefully kept these research approaches general, given that any funder or interested party that requests a proposal will want to keep the terms of reference broad to ensure that researchers can draw on their own methodological expertise. In most cases, a number of different methods, or combinations thereof, could be used. In terms of feasibility, we would like to highlight that research capacity and expertise in Canada on the topic of water governance is somewhat limited, which would also affect the scale and magnitude of any research project that could be undertaken.

Table 2. The seven governance knowledge gaps – by theme

<p>THEME 1 Transparent and accountable governance approaches that can build (or rebuild) public trust</p> <ul style="list-style-type: none"> • Knowledge Gap 1: How to Design Processes in which Good Governance Principles Are Embedded • Knowledge Gap 2: The Relationship Between Transparency and Trust in Water Governance
<p>THEME 2 Best practices for knowledge sharing and information dissemination in governance</p> <ul style="list-style-type: none"> • Knowledge Gap 3: Opportunities for Developing and Sharing Rigorous Data • Knowledge Gap 4: Publicly Available Information on the Scope and Availability of Industry Data
<p>THEME 3 Opportunities to better address Indigenous Nations’ rights</p> <ul style="list-style-type: none"> • Knowledge Gap 5: Comparative Analysis of the Experiences of Indigenous Peoples in North America with Respect to Water Governance and Hydraulic Fracturing
<p>THEME 4 Processes to meaningfully engage diverse actors in governance</p> <ul style="list-style-type: none"> • Knowledge Gap 6: Collaborative Watershed Planning for Rural Areas • Knowledge Gap 7: Definition of the “Public Interest” in Water in the Context of Hydraulic Fracturing

THEME 1: Transparent and Accountable Governance Approaches That Can Build (or Rebuild) Public Trust

Findings from the literature review, Delphi survey, and workshop all suggested that that water governance for hydraulic fracturing lacks the basic principles of good governance of transparency and accountability. What redesign of governance processes might better embed these principles in the planning and day-to-day management of water-related decision-making and management in this extractive context? What opportunities exist for an independent regulator? What, too, might be the effects of improved transparency on public trust? Do actors necessarily or automatically trust a transparent process? These questions are fundamental to understanding what might constitute “good water governance” in the context of hydraulic fracturing.

Knowledge Gap 1: How to Design Processes in which Good Governance Principles Are Embedded

The fact that transparency and accountability were problematic in the current water allocation process for hydraulic fracturing (including related regulatory enforcement and monitoring) in turn led to several distinct issues related to trust. For example, workshop participants and partners suggested that a conflict of interest in single-window regulator contexts – such as in Alberta and British Columbia – was the single biggest problem with regulation in these regions. Less obvious from our data though is how to address these concerns. How can we

design processes to ensure principles of “good governance” (e.g. transparency, accountability) are embedded?

RESEARCH PROPOSAL 1A: Experiments would need to be designed in different regions where exploratory drilling was being undertaken to test different accountability and transparency mechanisms. Specifically, researchers could establish specific water use reporting mechanisms that improve transparency and accessibility for the communities in affected watersheds, and compare across watersheds and across mechanisms.

RESEARCH PROPOSAL 1B: Another option for improving accountability (discussed by workshop participants) was the development of an independent regulator. More research is needed into the options for designing an independent regulatory body for water allocation in the context of hydraulic fracturing. This could be achieved through a two-part research projects that first conducted a review of existing independent regulators (e.g. the BC Safety Authority, the Ontario Securities Commission), examining these models’ structures, legislated mandates, and decision-making processes. Researchers would also assess what aspects of these models might viably transfer to different water allocation processes across Canada. Second, a particular model could be implemented in a watershed where actors were willing and interested, and researchers could track whether this new governance structure improved accountability and transparency.

Knowledge Gap 2: The Relationship Between Transparency and Trust in Water Governance

As we described above, the role of trust in the development of energy projects has received a significant amount of attention in the social scientific literature (e.g. Bradbury et al. 2009; Wüstenhagen et al. 2007). However, as workshop participants noted, research into the role of trust and its relationship to transparency in the often-polarized governance context of hydraulic fracturing is greatly needed. We need a better understanding of the types of transparency mechanisms that will build trust, so that investments in various activities, such as developing chemical disclosure websites, address the root of the problem.

RESEARCH PROPOSAL: Conduct comparative work across regions where both hydraulic fracturing activity and water governance frameworks are different in order to understand how different actor groups (government, including Indigenous nations, industry, NGOs, academics, consultants, local groups) perceive the relationship between transparency and trust. Also, the study should identify what other characteristics of governance instill trust (e.g. appeal mechanisms, relationship building). This research could be accomplished through either a detailed survey or through detailed interview data across multiple case studies.

THEME 2: Best Practices for Knowledge Sharing and Information Dissemination

Knowledge sharing and information dissemination are key elements in any community engagement strategy. Participants in the Delphi study noted a need for “resources for public education that cover the positive and negative social, political, environmental, and economic implications of hydraulic fracturing.” Workshop participants were also interested in knowledge sharing in water governance in relation to hydraulic fracturing. They raised two key questions focused specifically on this topic:

- How do we ensure that communities have access to information about specific projects that are proposed or underway?
- What are the key tools of effective communications and engagement strategies that ensure that people have the information they need to participate fully in decision-making processes over the long term?

Knowledge Gap 3: Opportunities for Developing and Sharing Rigorous Data

A key question is how to ensure groups have access to data that they both need and trust, without having every group need to conduct their own scientific data collection. The example of Fort Nelson First Nation and the data-sharing agreement with Apache (see Box 6) provides one model of how data governance could be designed to build trust between industry and First Nations. However, other models are possible.

RESEARCH PROPOSAL: Explore data ownership models for scientific data collection in water and other resource-related governance regimes. Since descriptions of the funding models for watershed monitoring or scientific data collection are not always discussed in the literature, researchers would need to undertake interviews in specific watersheds where trust in the science has been limited but solutions have been established (e.g. the Murray-Darling Basin) (or in other resource-related areas, such as air quality monitoring). Moreover, researchers could analyze the protocols for all aspects of the process: from design of/decisions about what data must be collected, to how that data is collected, to how it is reported, analyzed and utilized in decision-making, and how the full process is funded. Criteria for choosing specific case studies should reflect a diversity of possible funding options. A second phase could explore options for social finance mechanisms, building on discussions that were initiated at the CWN-funded Watersheds 2014 event (see Baltutis et al. 2014).

Knowledge Gap 4: Publicly Available Information on the Scope and Availability of Industry Data

Confusion exists about the type and scope of data that industry actors collect about water quantity and quality at specific sites and about the extent to which their data collection and monitoring covers an entire watershed. For decades, scholars (and their funders) have been researching questions about how to ensure Indigenous knowledge and local community knowledge is better represented in decision-making processes for water and other resources. Similar efforts towards understanding how to engage private actors have not been undertaken.

At the same time, it must be recognized that industry participants indicated their own lack of trust in academics and viewed a bias in some members of the scholarly community, making the research proposals below challenging to achieve. Thus, there is a need to advance the understanding of how to engage with private actors and how to bring their knowledge into governance without other actors assuming that the information or process is biased.

RESEARCH PROPOSAL: Identify what hydraulic fracturing corporations (and/or the investors and sub-contractors) perceive as their desired role in water governance across Canada and the training or tools needed to support their capacity to engage in collaborative models of governance. Conducting such a study could be done through an online survey, or a Delphi approach, which would enable a high number of industry participants for low costs. The first challenge will be identifying the sub-contractors and investors, who may not be members of CAPP or any of the other industry associations. Alternatively, interviews or focus groups may yield more detailed insights than a survey, and could help to begin to build the relationships between industry and academics.

THEME 3: Opportunities to Better Address Indigenous Nations' Rights

Overall, our research identified several challenges in the ways in which different jurisdictions sought to recognize Aboriginal rights and title, and, when water governance for hydraulic fracturing has failed to take account of Aboriginal rights, conflict and mistrust have developed. Through our regional analyses and the workshop discussions, we found distinct regional differences regarding the ways in which water governance processes took account of Aboriginal title and rights. In fact, at the workshop, an identified knowledge gap was:

- What are the differences in governance structures on the East Coast (Nova Scotia and New Brunswick), the west (British Columbia and Alberta), and the north (the Northwest Territories) that shape how and when First Nations are consulted during permitting/lease processes and water allocations for hydraulic fracturing developments?

Our regional analysis suggested that there are significant knowledge gaps around the design of governance structures that respect the constitutional and/or Treaty rights of Indigenous people.

Knowledge Gap 5: Comparative Analysis of the Experiences of Indigenous Peoples in North America with Respect to Water Governance and Hydraulic Fracturing

Workshop participants saw opportunities for comparative case study analyses of different Indigenous nations' experiences with water governance and hydraulic fracturing. Innovative approaches to shifting authority in governance – as, for example, in the case of the Fort Nelson First Nation (box 6) – need to be shared and analyzed. Additional questions included:

- What governance processes currently exist within Canada wherein First Nations have authority to meaningfully shape decision-making regarding hydraulic fracturing in their territories (e.g. Mi'kmaq Rights Initiatives)?

- How have Indigenous communities in the US, Australia, and New Zealand – who share similar colonized histories, despite numerous other differences with regards to water governance – been engaged in issues of hydraulic fracturing, particularly those who have had a longer history of these developments in their communities?

RESEARCH PROPOSAL: An examination of the governance processes that currently exist within Canada wherein Indigenous nations have jurisdictional authority to shape decision-making regarding hydraulic fracturing in their territories (e.g. Mi'kmaq Rights Initiatives, the right to request an environmental assessment in NWT). Implementing such a proposal would require a targeted study that involved participant observation and interviews with Indigenous nations where shale gas deposits exist in their territories. The study could compare and contrast Indigenous autonomy, recognition of rights and title, and Indigenous methodologies in the water governance decision processes and their effectiveness in these contexts.

Box 6.

A CASE STUDY IN INNOVATION

The Fort Nelson First Nation's Experience Working Directly with Industry in Northeast BC

The traditional territory of the Fort Nelson First Nation (FNFN) overlies three of the province's four large shale gas plays, and since the provincial government has been selling tenures for shale gas extraction in the region. The FNFN participated in the Oil and Gas Commission's (OGC) permitting process, commenting on the individual permits that were brought to the Lands Department, but believed that their community's concerns were going unaddressed. The FNFN believed that development was proceeding without assessing or planning for sustainable water allocation in the region as a whole.

In 2012, the FNFN started to explore how the nation could undertake the planning-related activities that they had previously been requesting government to complete, including baseline data collection. A key innovation was to work directly with a company, developing a protocol that included the creation of a water monitoring program (wildlife, too, is being monitored) within the project area. Working directly with the company, FNFN installed forty-eight shallow groundwater, thirty-two bathymetric, fifteen water quality and flow, ten precipitation and 2 climate monitoring stations; the sites were identified as priorities by the FNFN, and the company paid for the water stations and for the training of FNFN field technicians. The data from this monitoring will all be held by the FNFN, but will be made publicly available through an information-sharing agreement with the Province. Although this data collection model is industry driven, and relies a great deal on the company, the FNFN thought that it was the best way to address the lack of "higher level" planning that the nation felt was needed to make better decisions in regards to hydraulic fracturing in their territory.

THEME 4: Processes to Meaningfully Engage Diverse Actors in Governance

In our regional analyses, we found evidence that there was a need for new frameworks for community engagement in water governance for hydraulic fracturing. For example, participants in BC suggested that current regulatory frameworks have insufficiently engaged communities in water-related governance and that more information is needed regarding what communities really want and how to involve them systematically in decision-making. In their assessment of knowledge gaps, workshop participants expressed a desire to see water governance for hydraulic fracturing that was more equitable and inclusive. As such, they showed an interest in new networks and partnerships that could support this kind of shift in governance by facilitating better inclusion of different social groups and of local communities. This need for inclusive governance leads to two linked issues – collaborative planning and definition of the “public interest” – on which further information is needed.

Knowledge Gap 6: Collaborative Watershed Planning and Governance for Rural Areas

The shift from government to governance has been unfolding across Canada in recent years (Bakker 2006; Brandes et al. 2014; de Loë 1995). However, existing proposals and studies that engage the range of actors that now shape water governance have focused on various collaborative and watershed-based models that have mostly been developed in watersheds with populations that are relatively dense (for Canada).¹⁴ The challenge is in understanding how to adapt these models in areas that are remote, and/or rural, and may have low-density populations. Moreover, none of the existing models are widely recognized for their approach in including Indigenous nations. The NWT provided one optional model (see Box 3), but given the changing political context of the territory under devolution, questions remain about the model’s sustainability, effectiveness, and overall applicability in other contexts.

RESEARCH PROPOSAL: Explore the possible designs for collaborative or watershed-based governance models for remote and rural regions where extractive industry development is possible, reviewing other resource sectors and other countries. While a literature review could provide some information, any number of social science research methods could be used to develop an agreement among the relevant actors about the most appropriate governance body, including scenario processes or Participatory Action Research methods. Any research team would benefit from rural economic development or rural sociology experts, sense of place scholars, along with water governance experts, Indigenous nations, provincial and local governments, and water suppliers. The process might involve approximately two to three years of establishing and tracking the developments of this governance body to determine if perceptions of trust, transparency, accountability, and overall collaboration improve. Surveys would be needed before and after.

¹⁴ One example of a rural initiative is the Bras d’Or Collaborative Environmental Planning Initiative (CEPI) (www.brasdorcepit.ca) in Cape Breton, which has worked to create an “overall environmental management plan for the Bras d’Or lakes and watershed lands” (Bras d’Or Lakes CEPI 2015). The CEPI has a multi-sectoral, multi-organizational structure and an extensive history of community engagement.

Knowledge Gap 7: Inclusion of the “Public Interest” in Water Governance Processes

We described above the concern – shared among workshop participants – that governments often equate “public interest” with economic development, when in fact, that singular focus is not representative of numerous public opinion polls (Council of Canadians 2014; Morris and Brandes 2013). But that concern also raises questions about how each of the actors engaged in water governance and hydraulic fracturing discussions defines “public interest” in water. How does each of the actor groups involved in water governance define the “public interest” in water? For what reasons do Canadians value water? What research programs might be possible to assess Canadians’ water values?

RESEARCH PROPOSAL: Compare and contrast how each of the actors involved in water governance and hydraulic fracturing define “public interest” for water allocation to better understand the root of conflicts about trust, priorities, and accountability. A survey technique, such as the Delphi method, could be used to establish consensus on statements defining the “public interest.”

Part V. Concluding Comments and Recommendations

The use of water in hydraulic fracturing activity in Canada has not caused, but has certainly illuminated, the fractured nature of existing water governance arrangements.

One could conclude from our findings that if there is a water governance crisis in Canada, it is a crisis of trust. Trust is diminished because many realize that government agencies simply do not have sufficient levels of staffing and resources to conduct rigorous assessments during the water allocation process, to develop a robust understanding of the cumulative effects of all developments (in which hydraulic fracturing may be just one of many) in a watershed, and to enforce any water quality and quantity requirements. Trust can become limited when, regardless of the outcomes of a consultation process, decisions are made to favour economic values over all other community and Indigenous values. Moreover, trust in the water allocation process for hydraulic fracturing is absent when government or Indigenous nations differ in opinion about whether Treaty relationships are being upheld. Groups want more data to inform decision-making, but no group trusts another's data, and assumptions are made that any source of funding automatically biases the data and the related analyses. Discourses from all parties involved are often degenerative – that is, they tend to “break down” any trust that may be invested by the public in any other actor group. Yet, for water governance to be effective, we need generative actions – ones that build capacities for accountability, transparency, for engaging Indigenous and non-Indigenous communities, and for making informed decisions.

Therefore, recognition of the lack of trust is essential to understanding each one of the governance challenge areas identified in Part III. We grouped these challenges into four themes:

1. Capacity, transparency, and accountability of regulators,
2. Scientific uncertainty regarding risks and cumulative effects,
3. Inclusion of Indigenous nations in water allocation decisions, and
4. Community concern and sense of place.

The scope of these challenges and how they have manifested in the water governance processes differs across the various regions of Canada explored in this report. But regardless of whether hydraulic fracturing developments were present and encouraged by government, or moratoria were in place, these challenges in water governance were widely recognized by Delphi and workshop participants, and often substantiated empirically by the existing literature. Thus, we believe the knowledge gaps and research proposals put forward in Part IV will be relevant and helpful to each jurisdiction.

The seven knowledge gaps that we determined were essential to fill if the priority governance challenges are to be addressed included the need to consider:

- How to design processes in which “good governance” principles are embedded
- The relationship between transparency and trust in water governance
- The comparison of experiences of Indigenous Peoples in North American with respect to water governance and hydraulic fracturing

- Collaborative watershed planning and governance approaches in rural and remote areas
- The definition of “public interest” in water in the context of hydraulic fracturing
- Opportunities for developing and sharing rigorous data sets
- Establishing publicly available information on the scope and availability of industry data.

For each knowledge gap, we put forward brief research proposals. We recognize that governance “experiments” are not easy to conduct – they require the willingness of all key actors groups involved in, and affected by, water governance to participate and test ideas, whether those are related to regulations, transparency mechanisms, or new organizational models and decision-making processes for collaboration. But it is possible that the results of such research could inform those involved in water governance and hydraulic fracturing about how to build or rebuild trust to ensure that decision-making is competent and thoughtful, and not be perceived as simply blind opposition to specific actor groups (which each actor group could report as experiencing). Therefore, we believe that such research will be an essential first step towards improving water governance across Canadian jurisdictions.

Appendix 1. Delphi Participants By Affiliation and Province/Territory

Participants in the Delphi Study, by Affiliation

Role ¹	Round 1	Round 2	Round 3
ENGO	—	18 (25.3%)	7 (12.2%)
NGO	40 (28.3%)	12 (16.9%)	10 (17.5%)
Academia	26 (18.4%)	9 (12.6%)	9 (15.7%)
Provincial government	22 (15.6%)	13 (18.3%)	10 (17.5%)
Industry	16 (11.3%)	4 (5.6%)	0
Other	15 (10.6%)	11 (15.4%)	8 (14%)
Aboriginal organization	12 (8.5%)	7 (9.8%)	7 (12.2%)
Consulting	—	16 (22.5%)	12 (21%)
Municipal government	5 (3.5%)	4 (5.6%)	4 (7%)
Federal government	4 (2.8%)	6 (8.4%)	5 (8.7%)
TOTAL ²	141	100	72
Actual number of participants	112	71	57

¹ This table reveals some of the complexities within participant self-identification/affiliation. Some participants changed affiliation – e.g. from “industry” to “consulting,” or from “NGO” to “ENGO” – over the course of the study.

² Some of the participants who registered in each round identified with more than one field; thus, the number of *total* participants is larger than the *actual* number of participants.

Participants in the Delphi Study, by Province

Province/Territory	Number of panelists
BC	23
YK	1
NWT	5
AB	21
SK	2
MB	1
ON	18
QC	7
NB	9
PEI	5
NS	16
NL	2
Other	2

Appendix 2. Delphi Study Participants' Statements Regarding Priority Decision Challenges

TOP DECISION CHALLENGES

- Defining, through legislation, who has the right to and who holds responsibility for water resources
- Improving knowledge transfer among industry, individuals, Aboriginal groups, and government for the purpose of public education and informed dialogue.
- Reducing the demand for freshwater resources in the hydraulic fracturing process
- Establishing consistent baseline and environmental monitoring regimes in the context of hydraulic fracturing and water resources
- Understanding the environmental impacts of water withdrawals (both surface water and groundwater, including aquifers) for the purpose of hydraulic fracturing
- Understanding landscape scale and surface impacts associated with hydraulic fracturing activities (i.e. access roads, traffic and noise)

KEY KNOWLEDGE GAPS

- Resources for public education that cover the positive and negative social, political, environmental, and economic implications of hydraulic fracturing
- How can better enforcement of regulatory requirements be ensured?
- Best regulatory management practices for carrying out hydraulic fracturing activities
- Regulations and monitoring on the integrity of hydraulic fracturing wells (casing and cement) and their performance over time
- Baseline data and ongoing project monitoring in areas where hydraulic fracturing is being considered or is occurring
- Identification of the chemicals used (and their amounts) in the hydraulic fracturing process
- Wastewater disposal options for hydraulic fracturing activities, including injection of wastewater underground

HOW TO ADDRESS THE GAPS

- Fund research conducted by independent organizations, including academically led research teams
- Support and encourage collaborative and multi-disciplinary research between academia, industry, government, individuals and Aboriginal groups
- Develop programs of public education and citizen engagement
- Create forums for clear communication and knowledge sharing between industry, individuals, Aboriginal groups, and government
- Clarify governance roles and jurisdictions
- Enforce existing regulations and develop stronger regulations where required
- Develop regulations for baseline data collection and long-term monitoring

Appendix 3. Summary Tables of the State of the Industry and Overall Framework for Water Governance, by Region

Status of the Industry

Alberta	Large and well-established oil and gas industry; 6,300 wells fracked since 2008
British Columbia	Fast-moving (especially between 2005 and 2009) industry; a key part of provincial economic strategy
New Brunswick	Long history of oil and gas development but shale gas industry is small; newly elected premier intends to move ahead with his party's plan for a moratorium
Nova Scotia	Fierce public opposition; in September 2014, the government introduced a bill to ban high volume hydraulic fracturing (except for testing and research)
Northwest Territories	Companies exploring in the Canol shale play (Central Mackenzie Valley), but development is slow moving
Ontario	Starting in 2010, geological researchers identified potentially productive reserves; province currently lacks regulatory framework to govern hydraulic fracturing
Quebec	Quebec has a high potential shale gas landscape; the provincial government instituted a moratorium in 2011

Overall Framework for Water Governance

Alberta	Alberta Energy Regulator (AER) is responsible for all oil and gas development and accepts applications for water licences under the <i>Water Act</i> .
British Columbia	BC Oil and Gas Commission (OGC) is responsible for the development of petroleum resources and the management of its impact, and has delegated authority to approve water licences. Key legislation is the <i>Oil and Gas Activity Act</i> and the <i>Water Act</i> .
New Brunswick	Department of Energy and Mines has authority over natural gas; Ministry of Environment regulates water. Key legislation is the <i>Clean Environment Act</i> (1973), the <i>Oil and Natural Gas Act</i> (1976), and the <i>Clean Water Act</i> (1979). All gas projects must complete and Environmental Impact Assessment.
Nova Scotia	Department of Energy holds authority for shale gas; Department of Environment receives application on potential impacts. Key legislation is the <i>Water Act</i> (1919), the <i>Petroleum Resources Act</i> (1989), the <i>Environment Act</i> (1990, part 10), and the <i>Environmental Goals and Sustainable Prosperity Act</i> (2007).
Northwest Territories	Governance changing with current process of devolution under Bill C-15, including the creation of a new eleven-person territorial board in Yellowknife; all water management is guided by the GNWT's Water Strategy – <i>Northern Water, Northern Voices</i> .

Ontario	Multiple agencies could be involved in regulation of shale gas development and water governance: the Ministry of Natural Resources, the Ontario Energy Board, and the Ministry of Environment. Key legislation includes the <i>Ontario Water Resources Act</i> and the Water Taking Regulation, the <i>Ontario Clean Water Act</i> , the <i>Environmental Protection Act</i> , and numerous municipal bylaws.
Quebec	Ministry of Environment governs surface and groundwater withdrawals. Key legislation includes the <i>Environmental Quality Act</i> and Water Policy legislation (2002). Two processes to acquire governance knowledge regarding shale gas development: (1) the program for groundwater knowledge acquisition (PACES) and (2) a strategic environmental assessment (SEA) of shale gas.

GLOSSARY

Accountability: the fact of being required to account for one’s conduct. In the case of water governance, accountability “ensures that all levels of government fulfill their roles” (c.f. Furlong, Cook, and Bakker 2008).

Baseline data: A basic level or standard, which serves as a basis (Can. Ox. 2006). In the case of water governance, baseline data is scientific information on the ecological (and particularly hydrological) conditions that has been gathered in advance of development in a given region.

Consultation and accommodation: The Crown’s legal obligation, as found in Haida and Taku River decisions (in 2004) to consult Aboriginal peoples when it is contemplating “conduct that might adversely impact potential or established Aboriginal or Treaty rights” (Aboriginal Affairs and Northern Development Canada 2011). This legal principle was developed further in a unanimous 2014 Supreme Court decision, which noted the necessity of consultation but focused on the idea that the Crown should seek the *consent* of Aboriginal nations (Mandell Pinder 2014).

Cumulative effects assessment: The systematic consideration of the total and additive impacts from a number of developments or projects within a given area. The Council of Canadian Academies (2014, xv) notes that the “assessment of the environmental effects of shale gas development cannot ... focus on a single well or well pad, but must also consider regional and cumulative effects.”

Delphi method: A research approach used to structure an anonymous conversation among a group of experts, engaging these experts anonymously and over multiple rounds of study. The purpose of the Delphi method is to generate ideas and find common ground among participants who may or may not have similar credentials or perspectives on a particular phenomenon.

Desirability: The characteristic of being worthwhile or advisable. In this report, “desirability” is a subjective ranking, used by participants in the Delphi method to rate different statements in relation to one another. We asked participants to consider “desirability” as the “importance” of a given statement.

Feasibility: The characteristic of being practicable – easily or conveniently done. In this report, “desirability” is a subjective ranking, used by participants in the Delphi method to rate different statements in relation to one another. We asked participants to consider “feasibility” as “the ease with which this [i.e. a given statement] can be accomplished.”

“First in time, first in right” allocation system: An approach that prioritizes water rights based on their dates of registration. For example, a “water licence with a 1930 priority date would have precedence over a licence with a 1960 priority date, regardless of the purpose for which the water is used” (Government of British Columbia 2015).

Governance: The act or manner of governing (Can. Ox. 2006).

Hydraulic fracturing: An extractive technique that involves injecting hydraulically pressurized liquid down a well into shale rock in order to fracture it and release the natural gas inside. Hydraulic fracturing techniques have been used since the 1960s; however, recent advances in technology have enabled horizontal as well as vertical fracturing, thereby increasing the amount that can be extracted from a single well pad. Consequently, their use has proliferated or been proposed in several regions of Canada.

Legitimacy: When there is widespread acceptance or support for the system of governance in place, and the actions of an entity are perceived as desirable, proper, and appropriate (Bernstein, 2005; Suchman, 1995).

Participatory Action Research: A research approach that emphasizes the co-development of the research questions between the community and scholar. The research tends to focus on testing action strategies to be implemented by the community (McIntyre, 2008).

Rebuttal presumption: A legal principle, active in some US states, that is intended to address the problem that negative environmental impacts from oil and gas activities (such as water contamination) cannot be traced to a specific source and that individuals typically have to prove – beyond a reasonable doubt – the intent or neglect of industry. The rebuttal presumption reverses the accountability and assumes that oil and gas activities have impacts on the environment and people unless proven otherwise.

Regulator: the entity in charge of governing or controlling by law, subject to legal restrictions (as per Can. Ox. 2006). In the case of hydraulic fracturing and water governance in Canada, the regulator is a government agency, most often within the provincial government.

Shale gas: Natural gas that is “found in very fine-grained sedimentary rock. The gas is tightly locked in very small spaces within the reservoir rock requiring advanced technologies to drill and stimulate (fracture) the gas bearing zones” (CAPP 2015).

“Sense of place”: An affective dimension of communities’ relationship to their local surroundings. Place attachment and place-based identity – important emotional bonds between people and places – are key elements of “sense of place,” and can shape local responses to industrial projects (Devine-Wright and Howes 2010). Theories of place attachment and place-based identity recognize that “physical and symbolic attributes of these locations contribute to a positive sense of personal or social identity” (Devine-Wright and Howes 2010, 337).

“Single-window” regulator: The institutional arrangement (as in Alberta and British Columbia) wherein a single agency is responsible for all activities related to oil and gas development, including energy-related water allocations and management.

Stewardship: Actions contributing to ecosystem protection – i.e. people, collectively or individually, “caring for or being responsible for a local area or resource” (Roach et al. 2006, 48). A steward is “someone who looks after something that does not belong to them” (Schaefer 2006, 2).

Resilience: Systems’ capacity to withstand disturbances while maintaining their structure, function, and identity, and ability to learn and/or transform in response (Walker and Salt 2006).

Social licence: the notion that a social contract needs to exist among industry, government, Indigenous nations, and communities, and that the terms of that “contract” (which may be informal or embedded in tacit knowledge) indicate the preferred relationships and modes of operating.

Transparency: The characteristic of being open to examination by the public (Can. Ox. 2006). Scholars identify transparency as a key principle of “good governance” (see Rogers and Hall 2003). In the case of water governance, transparency can be understood to be the principle that those affected by water allocation decisions know not only the data that informed a decision, but also the process for arriving at the decision to ensure that decisions are visible and understandable (see Transparency International [2008] for a more detailed discussion)

Treaty rights: Refer to “Aboriginal rights set out in a treaty” (Aboriginal Affairs and Northern Development Canada 2015). Aboriginal Affairs and Northern Development Canada (2015) notes: “While no two treaties are identical, examples of treaty rights across Canada included such things as reserve lands, farming equipment and animals, annual payments, ammunition, clothing and certain rights to hunt & fish. Treaty rights are protected under S.35 of the Constitution Act, 1982.” The Supreme Court has ruled that the section 35(1) provision “did not create aboriginal rights; rather, it accorded constitutional status to those rights which were existing” (Aboriginal Rights Coalition 2015).

Trust: At its most basic level, trust is a “confident expectation” (Can. Ox. 2006). Bellaby (2010, 2615) identifies a common foundation among the diverse definitions: “Trust is a feeling or belief that someone (or some institution) will act in your best interest.”

Watershed governance: A set of social and political arrangements that shifts decision-making authorities and processes to align with watershed boundaries, rather than traditional political jurisdictions and borders (Brandes et al., 2014). As the POLIS Project notes, a “key factor” for the success of watershed governance is “improved collaboration and connections between citizens and decision-makers at the watershed scale” (POLIS 2015).

Water governance: In general, water governance refers to “the processes and institutions by which decisions that affect water are made” (Lautze et al. 2011, 7). In this report, we have understood water governance to have three elements: (1) who decides who may use water and for what purposes; (2) what standards must be met during that use to protect disparate but

important ecological, economic, social, or cultural values; (3) how that decision process is undertaken.

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