

Identifying Health Concerns

relating to oil & gas development in northeastern BC

human health risk assessment – *phase 1 report*



A report of the Fraser Basin Council
to the BC Ministry of Health

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Fraser Basin Council



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David Marshall
Executive Director
Fraser Basin Council

FRASER BASIN COUNCIL

1st Floor, 470 Granville Street, Vancouver, BC V6C 1V5

- T 604 488-5350
- F 604 488-5351
- E info@fraserbasin.bc.ca

To learn more about FBC and to reach our regional offices, visit us online: www.fraserbasin.bc.ca



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In BC's Northeast – Dawson Creek
Courtesy of Picture BC

Executive Summary

In late 2011 the Government of British Columbia launched a three-phase project to identify, explore and assess concerns about human health risks relating to oil and gas development in British Columbia. Led by the BC Ministry of Health, the Human Health Risk Assessment (HHRA) was undertaken in response to a number of human health concerns raised by the public, the Northern Health Authority, First Nations, environmental groups, local governments and non-government organizations. Because the majority of oil and gas activities in British Columbia are currently taking place in Northeastern BC, this region is the focus of the HHRA.

The Human Health Risk Assessment consists of three phases:

Phase 1: Public engagement to inform the scope and terms of reference and identify concerns relating to oil and gas development.

Phase 2: a human health risk assessment based on findings from Phase 1 and a comprehensive scientific review of evidence.

Phase 3: reporting of findings to the Province, stakeholders and the public.

The Fraser Basin Council was contracted to conduct Phase 1 of the HHRA and to prepare a report based on the findings. This report describes the targeted public engagement process followed during Phase 1 and sets out issues of concern associated with possible human health risks, including concerns that relate to changes to land, air, drinking water and food quality.

It is noteworthy that concerns identified during Phase 1 relate to different aspects of oil and gas development, including gas extraction and production methods, emergency events such as well blowouts and pipeline breaks, chemicals used in drilling and well stimulation techniques, chemicals in drilling waste, air quality issues, on-site and off-site waste management, transportation and disposal activities, and land reclamation activities. Oil and gas development is at different phases in different communities, and therefore the concerns expressed in those communities also vary. For this reason, identifying the types of oil and gas activity underlying the concerns is important to the Human Health Risk Assessment.

Because oil and gas resource development has the potential for direct and indirect environmental and socio-economic effects, a comprehensive understanding of the human health risk implications of oil and gas development needs to be framed by an understanding of the social and environmental determinants of health. Phase 1, therefore, was designed to take a holistic and integrated approach in identifying the key issues of concern. A range of potential health issues have been raised – physiological, psychological and social/cultural – that relate to a range of sources. Some health issues, such as direct exposure to toxic emissions or contaminated water or food may be immediate and easily observed and measured, whereas others are less noticeable or difficult to substantiate, such as those from exposure to smaller quantities of toxins over time and those that relate to changes in social and economic conditions.

At the outset of Phase 1, the public engagement process was developed to provide opportunities for local communities, local and regional governments, First Nations, non-government organizations, environmental organizations, regulatory agencies, ministry representatives, health authorities, the oil and gas industry and the public to provide their input on issues of concern regarding current and future oil and gas development. The engagement activities took place between mid-January and early March. The focus of the outreach was to introduce the HHRA project, to encourage participation and to explain how both individuals and

organizations could submit their comments and concerns or request a one-on-one meeting with the Fraser Basin Council. An HHRA backgrounder was created for use in meetings, electronic communications and a print distribution to rural households in the region.

More than 300 unique comments or submissions were received through the project website, by email, on a toll-free message line, by regular mail or in a meeting. Individuals, organizations and government used all of these avenues to comment, but the majority chose to submit their comments via email or to arrange one-on-one meetings with the Fraser Basin Council's Executive Director.

Formal submissions were received from a variety of groups, including local governments, the oil and gas industry, academics, and professional, community and environmental organizations. As expected, the majority of the comments came from Northeastern BC due to the targeted nature of this engagement process. Many respondents addressed one or two issues; others provided valuable information on multiple issues and included commentary on the HHRA process and suggestions for moving forward. A number of respondents also raised suggestions for how their concerns could be addressed.

Based on respondents' concerns, the following seven theme categories were identified:

- Personal Health Issues
- Environmental Pathways of Exposure
- Related Environmental Issues
- Changes to Community
- Community Service Issues
- Oil and Gas Operational Issues
- Institutional Framework Issues.

Although respondents recognize the contribution of oil and gas activity as a significant economic generator for Northeastern BC, many attributed personal health problems — such as asthma and bronchitis, cancer, stress and sleep deprivation — directly to exposure to oil and gas operations. Others believe their health is being compromised by exposure to hazards through a natural pathway, such as air, water or food. Examples include exposure to hydrogen sulphide, contaminated water and diesel dust, and ingestion of adversely affected livestock and/or wildlife.

Some respondents expressed concerns about the risk of harm from incidents such as well-site accidents, pipeline leaks and spills, and noise and light pollution. Others were concerned about the health of ecosystems and the effect a contaminated ecosystem would have on their health and the health of their families.

Many respondents stated that rapid social and cultural changes could have effects on the socio-economic and demographic structure of their communities, resulting in increasing pressure on existing health-care services, social and community services, and municipal and regional infrastructure. Others expressed concern with human health risks emanating directly from specific oil and gas operations. For example, one of the most common issues raised was hydraulic fracturing and the perception that this activity could lead to

seismic activity, water quality issues, or the potential to trigger sour gas releases. An increase in traffic and the number of vehicles travelling at greater speeds, often with inexperienced drivers, were also cited as major concerns.

Many institutional issues associated with such activities were also raised. These include monitoring and compliance, regulation and enforcement, communications, emergency response, and tracking and reporting of adverse health effects. For example, some concern was expressed about the degree to which the industry is regulated. Some respondents were dissatisfied by what they saw as insufficient information available to them from both the government and the oil and gas sector, and a lack of transparency with respect to specific oil and gas development activity. Others made specific reference to the lack of coordinated emergency response measures or expressed concern regarding the tracking and reporting of adverse health effects caused by oil and gas incidents.

The above themes interrelate and influence or affect one another; for example, regulations have a direct effect on how the oil and gas industry operates, which in turn has the potential to affect water quality. Current and potential issues of concern are described in Section 6 of the report.

Although many issues of concern were identified in Phase 1, the overall concern of many respondents was uncertainty and not being fully informed of the extent and nature of possible long-term health effects on individuals and communities within close proximity of oil and gas operations. Many of the respondents believe their health and the health of their families and friends has been adversely affected or may be affected in the future by increased oil and gas activity. Some are frustrated by this situation and want some help in having their concerns resolved by the regulator (i.e., the Oil and Gas Commission), the provincial government, organizations such as the Northern Health Authority, and the oil and gas companies. There appears to be an opportunity here for all concerned to work together in subsequent phases of this project.

While respondents appreciated having ample opportunity and options for providing input in Phase 1, they made it clear they wanted the momentum from Phase 1 to continue. They asked that Phase 2 begin as soon as possible, with continued transparency on the process and continued public involvement.



In BC's Northeast – Pouce Coupe

Courtesy of Picture BC

1 Introduction

1.1 Background

In late 2011 the Government of British Columbia, led by the Ministry of Health, launched a three-phase project to focus on the human health risks associated with oil and gas development in British Columbia. This initiative was in response to a number of human health concerns raised by the public, the Northern Health Authority, medical health officers, First Nations, local government, and non-government organizations.

1.2 Three Phases of the Project

The overall Human Health Risk Assessment (HHRA) consists of three phases:

Phase 1: Public engagement to inform the scope and terms of reference and identify concerns relating to oil and gas development.

Phase 2: A human health risk assessment based on findings from Phase 1 and a comprehensive scientific review of evidence.

Phase 3: Reporting of findings to the Province, stakeholders and the public.

Phase 1 of the HHRA was designed to help the provincial government better understand what human health concerns exist about oil and gas development in BC. The Fraser Basin Council (FBC), a not-for-profit organization with a mandate to advance sustainability in British Columbia, was contracted to carry out Phase 1 by the Ministry of Health following a competitive bid process.

This report sets out the results of Phase 1, consisting of a public engagement designed to:

- give community members and other interests in Northeastern BC an opportunity to provide input on potential human health risks related to oil and gas development; and
- identify areas of possible concern to inform the scope of the subsequent phases of the human health risk assessment.¹

Phase 1 does not include any validation or analysis of the concerns provided by respondents during the public engagement. Analysis of the validity of the concerns and submissions received during Phase 1 will most likely be a key component of subsequent phases of the Human Health Risk Assessment.

¹ *Ministry of Health News Release – January 3rd, 2012*

1.3 Scope of Project

Because oil and gas development has the potential for direct and indirect environmental and socio-economic effects, a comprehensive understanding of the human health risk implications of oil and gas resource development needs to be framed by an understanding of the social and environmental determinants of health. Phase 1 was designed to take a holistic and integrated approach to identifying the key issues of concern. A range of potential health issues have been considered – physiological, psychological and social/cultural – and these relate to a range of sources. Some health issues, such as direct exposure to toxic emissions or contaminated water or food may be immediate and easily observed and measured, whereas others are less noticeable or difficult to substantiate, such as those from exposure to smaller quantities of toxins over time and those that relate to changes in social and economic conditions.

In Phase 1, concerns were raised about possible human health risks associated with changes to land, air, drinking water and food quality. These related to various activities and events: gas development, extraction and production methods, emergency events such as well blowouts and pipeline breaks, chemicals used in drilling and well stimulation techniques, chemicals in drilling waste, air quality issues, on-site and off-site waste management, transportation and disposal activities, and land reclamation activities. Because the majority of oil and gas activities in British Columbia are currently taking place in Northeastern BC, the project focuses on this geographic region.

An essential component of Phase 1 was the participation and contribution of multiple interests in helping to identify possible issues of concern. To scope an appropriate health risk assessment that addresses a range of views and concerns, the engagement process included the public, municipal and regional governments, First Nations, non-government organizations, regulators (BC Oil and Gas Commission), ministry representatives (Ministry of Health, Ministry of Energy and Mines, Ministry of Environment, Ministry of Forests, Lands and Natural Resource Operations, and the Ministry of Aboriginal Relations and Reconciliation), Northern Health Authority, and the oil and gas industry.

1.4 Report Overview

The first four sections of the report and its associated appendices provide useful background information on the provincial government's regulatory framework, the regional setting of northeastern British Columbia and the evolution of the oil and gas industry in the province. This information provides valuable context within which to appreciate and understand the diversity and significance of the issues of concern expressed by respondents during Phase 1.

Section 5 provides an explanation of the engagement processes used during Phase 1 to enable as many people as possible to have an opportunity to express their concerns. Section 6 is a description of the nature and extent of the issues of concern identified during the public engagement process.

A separate **Compendium of Submissions** sets out the formal submissions received from organizations and individuals.

2 Regulatory Framework

In the Province of British Columbia, the responsibility for regulatory oversight of oil and gas development and human health protection spans several government and non-government agencies.

The Ministry of Health has the overall responsibility for ensuring quality, appropriate, cost-effective and timely health services are available to all British Columbians. This Ministry works with health authorities, care providers, and other groups and ministries (e.g., Environment, Energy and Mines) to provide access to care and health protection.

The Health Protection Branch, under the *Ministry of Health*, is responsible for developing and implementing legislation, policies and programs in the area of environmental health protection. The Branch works to protect public health and safety for drinking water and recreational water quality and other environmental health risks. The Health Protection Branch provides advice on legislation and policy issues to the health authorities, the BC Centre for Disease Control and the Provincial Health Officer. Environmental health protection programs are administered by the health authorities' medical health officers (MHOs) and environmental health officers (EHOs). MHOs and EHOs inspect and monitor activities and premises that may affect the public's health. They also administer and enforce provincial legislation related to environmental health, and provide interventions to minimize health and safety hazards. BC Health Protection legislation includes the *Public Health Act*, the *Drinking Water Protection Act* and the Drinking Water Protection Regulation.

The **Ministry of Energy and Mines** manages the development of policy for the responsible exploration and development of British Columbia's energy and mineral resources. This Ministry's mandate includes developing tenure, royalty and regulatory policy for BC's petroleum and natural gas industry, thereby ensuring the effective and environmentally responsible management of the province's petroleum and natural gas resources. It manages the issuance of Crown subsurface resource rights and public geoscience information to support and implement the Government of BC's 2007 Energy Plan, the Natural Gas Strategy, and the Liquefied Natural Gas (LNG) Strategy.

The **Oil and Gas Commission (OGC)** was established in 1998, replacing the Field Operations Office of the Energy and Minerals Division, at that time under the Ministry of Employment and Investment. The OGC is responsible for regulatory oversight of oil and gas activities ranging from geophysical exploration through to drilling, production, pipelining and processing operations as well as reclamation. The *Oil and Gas Activities Act* (OGAA) establishes the OGC's mandate and the framework under which the OGC provides its core services. The OGAA was passed in the BC Legislature in May 2008. The Act and regulations came into force in October 2010. The OGAA updated and consolidated the *Oil and Gas Commission Act*, the *Pipeline Act* and portions of the *Petroleum and Natural Gas Act*. By continuing the OGC's regulatory authority under other BC legislation such as the *Land Act*, the *Water Act* and the *Forest Act*, the provincial government has affirmed the OGC's single-window regulatory model.

The **Ministry of Environment** is responsible for standards, policy and monitoring as it relates to air and water for the protection of human health and some oilfield water and waste issues.

The **Ministry of Forests, Lands and Natural Resource Operations** was created in 2011 to deliver integrated land management services for British Columbians. It is responsible for establishing the policy and conditions for access to and use of the province's forests, land and other natural resources, with the exception of the petroleum and natural gas sector, for which the Oil and Gas Commission has specific legislative authority.

The **Ministry of Aboriginal Relations and Reconciliation** is the BC government's lead agency for reconciling provincial interests with First Nations' aboriginal and treaty rights. This Ministry negotiates treaties and other lasting agreements, including Consultation Process Agreements, on behalf of the Oil and Gas Commission and the Ministry of Energy and Mines.



In BC's Northeast – Fort St. John
Courtesy of Picture BC

3 Regional Overview of Northeastern British Columbia

Northeastern BC borders the Yukon and the Northwest Territories (NWT) to the north, Alberta to the east, the Carrier Mountains to the south and the Rocky Mountains to the west. It is the largest of BC’s regions, representing 21.8% of the land area of the province (20,494,470 ha), but the least populated, with 1.6% of the population (69,068 people).

Because of the vastness and diversity of Northeastern BC, possible human health effects associated with the oil and gas industry may not be equally distributed demographically or geographically throughout the region. The severity of the potential impact on an individual, a community or a region could vary depending on how long oil and gas development has been in the area. Newly developed areas experience the effects differently than do areas that have been dealing with this type of development for a longer period of time.

Overviews of the many environmental, social and economic features of Northeastern BC are found in **Appendix 1**.



In BC’s Northeast – Fort St. John
Courtesy of Picture BC

4 Evolution of the Oil and Gas Industry in British Columbia



In BC's Northeast – Natural gas handling facility

Courtesy of Encana Corporation

4.1 History

Oil and gas exploration and production is influenced by many factors, including the resource geology, the technology to extract it, the transportation infrastructure to move it, government policies and market conditions and outlook. Historically, exploration activity accelerates when a promising new oil or gas resource is discovered or prices strengthen as a result of economic prosperity or geopolitical events. Activity often slows when events combine to force prices down.

Oil seeping from the banks of the Peace River had long signalled the oil and gas potential of BC's Northeast, but early drilling occurred in more accessible parts of the province, including the Crowsnest Pass and the Fraser Delta, with unsatisfactory results. Interest eventually shifted to Northeastern BC, where drilling led to oil and natural gas discoveries. Oil and gas resource development activity increased after World War II, prompted by the building of the Alaska Highway, roads built to serve agricultural expansion, and the subsequent Leduc discovery in Alberta in 1947.

In the late 1950s, the Boundary Lake oil field began production, and a small oil refinery was built in Taylor. Westcoast Transmission Co. Ltd. built a gas processing plant in Taylor and a pipeline to Vancouver and the

US border. By the late 1960s, 1,700 wells had been drilled in Northeastern BC and 1,000 wells were producing.

The 1970s and 1980s were characterized by political discord between the federal government and the industry, price volatility and market deregulation. Well drilling in Northeastern BC averaged around 300 wells per year during this period; the majority were natural gas, as the region has more gas than oil deposits.

In the 1990s, technology advancements, including 3D seismic imaging and horizontal drilling, opened up possibilities for production from previously uneconomic oil and gas reserves and helped to extend the life of mature wells. New pipelines and gas processing plants supplemented and competed with the Westcoast plants and pipelines. These factors contributed to a steady escalation in drilling activity after 1993, which was further bolstered by oil and gas price recovery in 1998. Thereafter, the steady rise in prices, combined with technological innovations, has led to unprecedented levels of drilling and gas production in Northeastern BC.

4.2 Provincial Oil and Gas Policies

British Columbia's first comprehensive Energy Plan was *An Energy Secure British Columbia: The Challenge and the Opportunity*, released in 1980. Its prominent theme was ensuring security of supply by reducing dependence on imported oil, increasing the role of natural gas, and expanding conservation efforts:

*British Columbia's abundant natural gas reserves and anticipated future discoveries will ensure our supply of this energy resource well beyond the year 2000. Nevertheless, the Government will have to continue (as with oil) to maintain a climate encouraging ongoing development and production.*²

Gas production in the late 1970s averaged approximately 320 billion cubic feet (Bcf) per year, split evenly between intra-provincial and export sales. As for oil, approximately 25% of the province's 60 million barrel annual consumption requirements came from wells in Northeastern BC. Revenues to the provincial government from oil and gas production averaged \$325 million per year in the late 1970s.

The 1990 Energy Plan, *New Directions for the 1990s*, focused on the rise of environmental issues as a public priority. Appropriate price signals and environmental standards were highlighted as ways to address air quality issues, global warming, acid rain, water pollution and land-use conflicts arising from energy production and use. This plan noted that the provincial government's royalty and taxation regime must be conducive to oil and gas development, while also providing a fair share of resource revenue to British Columbians. Revenues to the provincial government from oil and gas production had fallen to around \$280 million per year in the late 1980s.

The 2002 Energy Plan, *Energy for Our Future: A Plan for BC*, stated that continued high activity levels in the oil and gas industry would be critical to realize the province's potential as a leading energy supplier in North America. Development of coalbed methane and other unconventional gas resources would be encouraged. Pre-tenure and land-use planning, as well as northern road improvements, would improve access to resources, and the BC Oil and Gas Commission would further streamline single window approval processes.

² Government of British Columbia, "An Energy Secure British Columbia: the Challenge and the Opportunity", February 1980, pg.21

The 2007 BC Energy Plan, *A Vision for Clean Energy Leadership*, emphasizes three themes regarding oil and gas:

- promoting environmentally responsible oil and gas development;
- being among the most competitive oil and gas jurisdictions in North America; and
- working with communities and First Nations.

Commitments and initiatives include eliminating all routine flaring by 2016 (a target that has already been met); measures to reduce air emissions; no surface discharge of produced water from coalbed gas operations; establishing a Petroleum Registry; improving access; royalty incentives; more geoscience to support unconventional resources; improved tenure issuance policies; and building better relationships among industry, local communities and First Nations.

The provincial government released two new strategy documents in early 2012 as a follow-up to the BC Jobs Plan released in 2011:

- British Columbia's Natural Gas Strategy: Fuelling BC's Economy for the Next Decade and Beyond (Gas Strategy); and
- Liquefied Natural Gas: A Strategy for BC's Newest Industry (LNG Strategy).

The Gas Strategy contains several actions and initiatives to keep BC competitive in the global LNG market, to promote natural gas as a transportation fuel, and to develop new markets. Resource inventories are to be enhanced to ensure reliable supplies, and royalty regimes are to be reviewed to ensure the province remains highly competitive. Infrastructure programs are to be continued to encourage investment. Several strategies are specific to the Northeastern environment, communities and First Nations, including health, air quality, water quality, boreal caribou and community engagement matters.

The vision of the LNG Strategy, initially outlined in the BC Jobs Plan, is to have three LNG facilities in operation by 2020, which could mean more than \$20 billion in new direct investment and more than \$1 billion a year in additional revenues to the provincial government. In Northeastern BC, natural gas production could increase from 1.2 trillion cubic feet (Tcf) to 3.1 Tcf per year.

4.3 Conventional and Unconventional Gas

More than 90% of the 22.7 Tcf of natural gas produced to date in BC has been conventional gas. This is gas found in a reservoir that is sufficiently permeable to allow the gas to move easily from the reservoir rock to the well bore and ultimately to the surface. The reservoir contains gas that is confined by impermeable rock or water barriers.

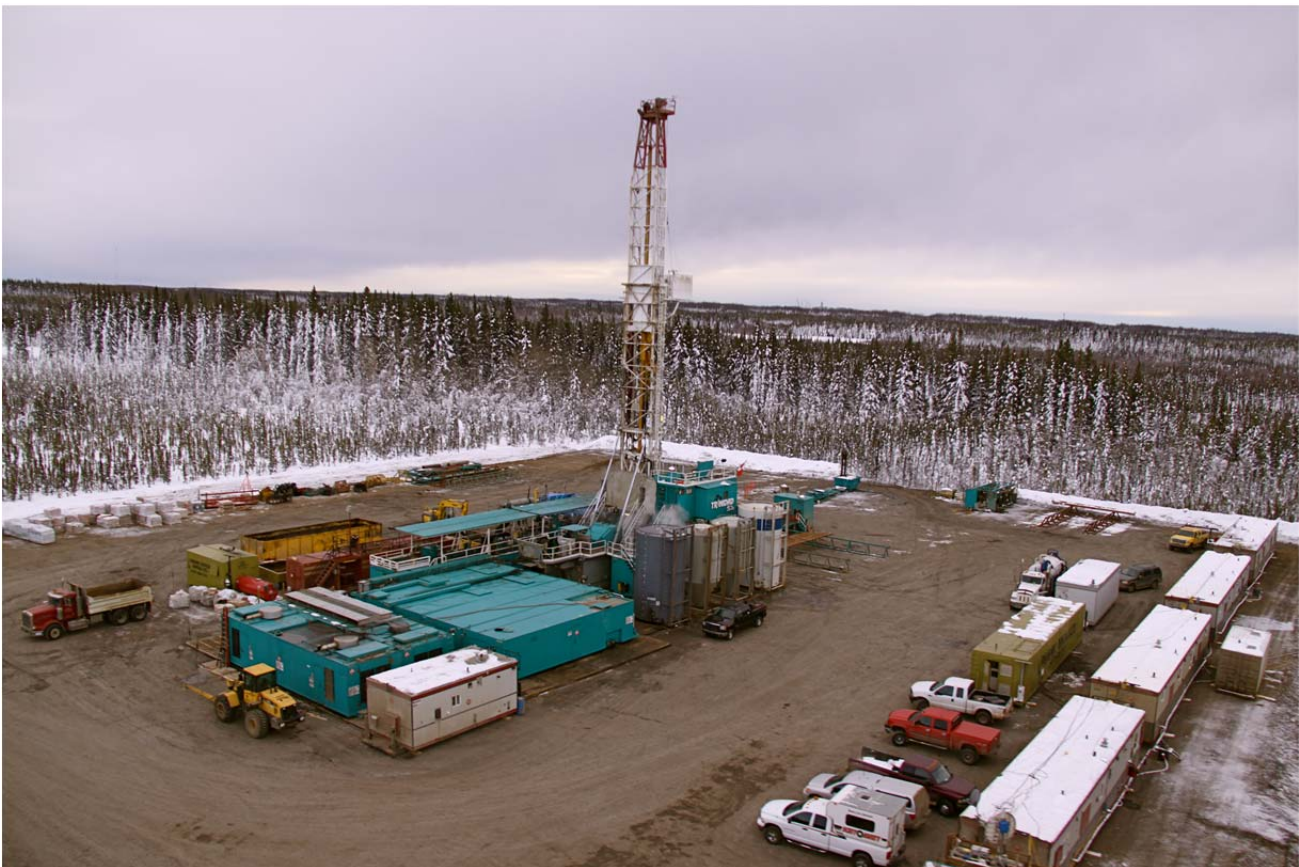
Unconventional gas is contained in reservoir rock that is not sufficiently permeable to allow natural gas to flow to the well bore and, therefore, requires additional stimulus to enable the gas to flow to the surface. There are three main types:

- "Tight gas" is gas held in the pore spaces of rocks with low permeability;

- “Shale gas” is gas trapped within shale, a sedimentary rock originally deposited as clay or silt that is characterized by extremely low permeability; and
- Coalbed methane is natural gas trapped in coal seams (currently, there is no coal-bed methane produced in BC).

The reservoir characteristics of conventional gas enable the gas to flow readily from the formation to a well. However, unconventional gas extraction relies on a combination of techniques that were not technologically or economically feasible until the past seven years, especially:

- horizontal and directional drilling, which exposes the well bore to a larger section of the producing formation and allows multiple wells to be drilled from a single pad, and
- multi-stage hydraulic fracturing, which involves injecting pressurized water, sand and chemicals into wells to fracture the rock and allow the gas to flow more easily (see **Figure 1**).



In BC's Northeast – Drilling rig pad, Horn River Basin
Courtesy of Encana Corporation

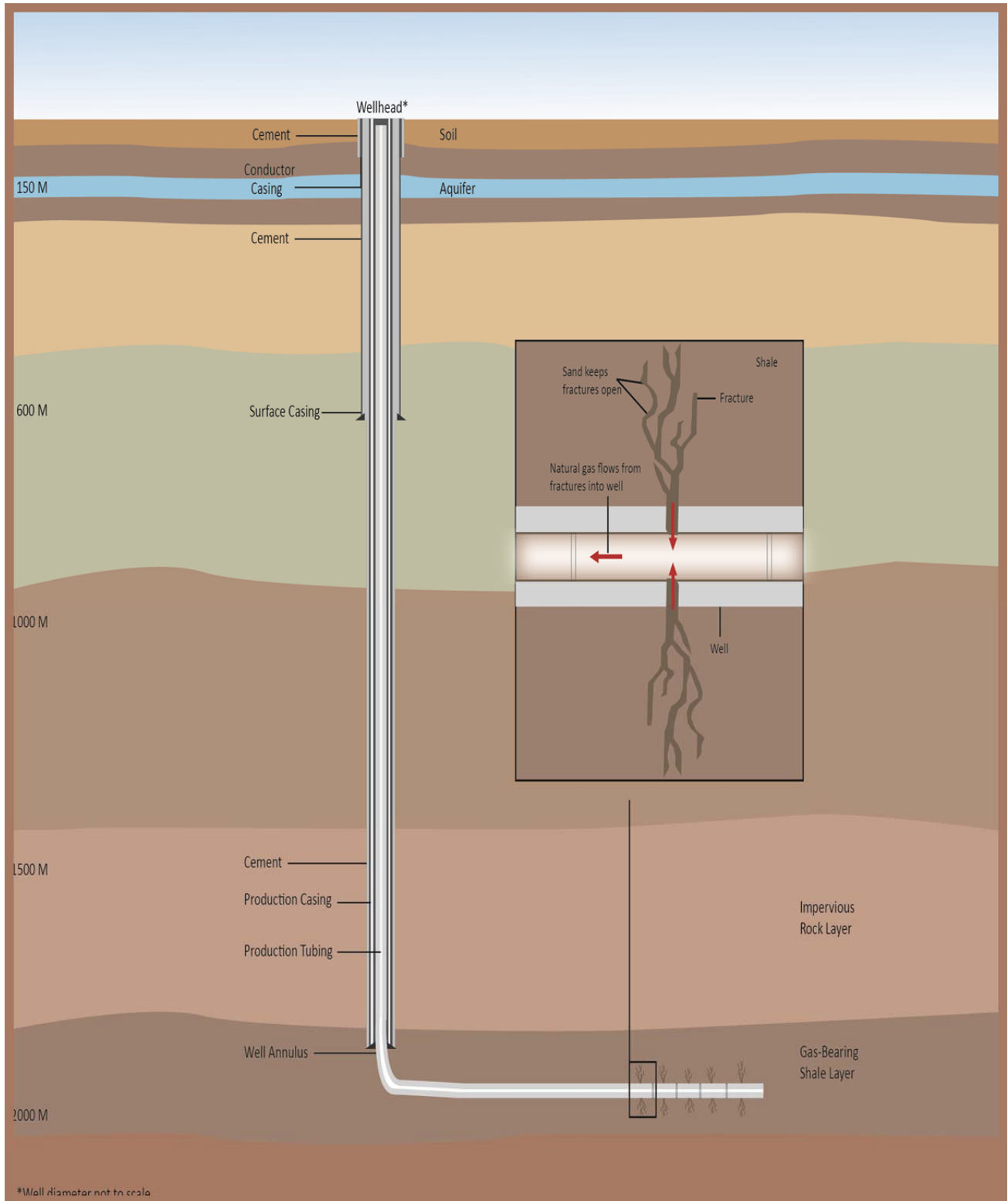


Figure 1: Hydraulic Fracturing

Multi-stage hydraulic fracturing involves injecting pressurized water, sand and chemicals into wells to fracture the rock and allow the gas to flow more easily.

There are four shale basins in Northeastern BC that are being explored and/or developed at present: the Montney Play Trend, the Horn River Basin, the Cordova Embayment and the Liard Basin (see **Figure 2**). Production growth in BC in the last decade comes largely from unconventional gas. Shale gas and tight gas now account for about 55% of BC's annual gas output of 1.1 Tcf.

Commercial shale gas production is taking place in the Montney Play Trend (roughly paralleling the Alaska Highway northwest of Fort St. John and southeast to the Alberta border) and the Horn River Basin (north of Fort Nelson).

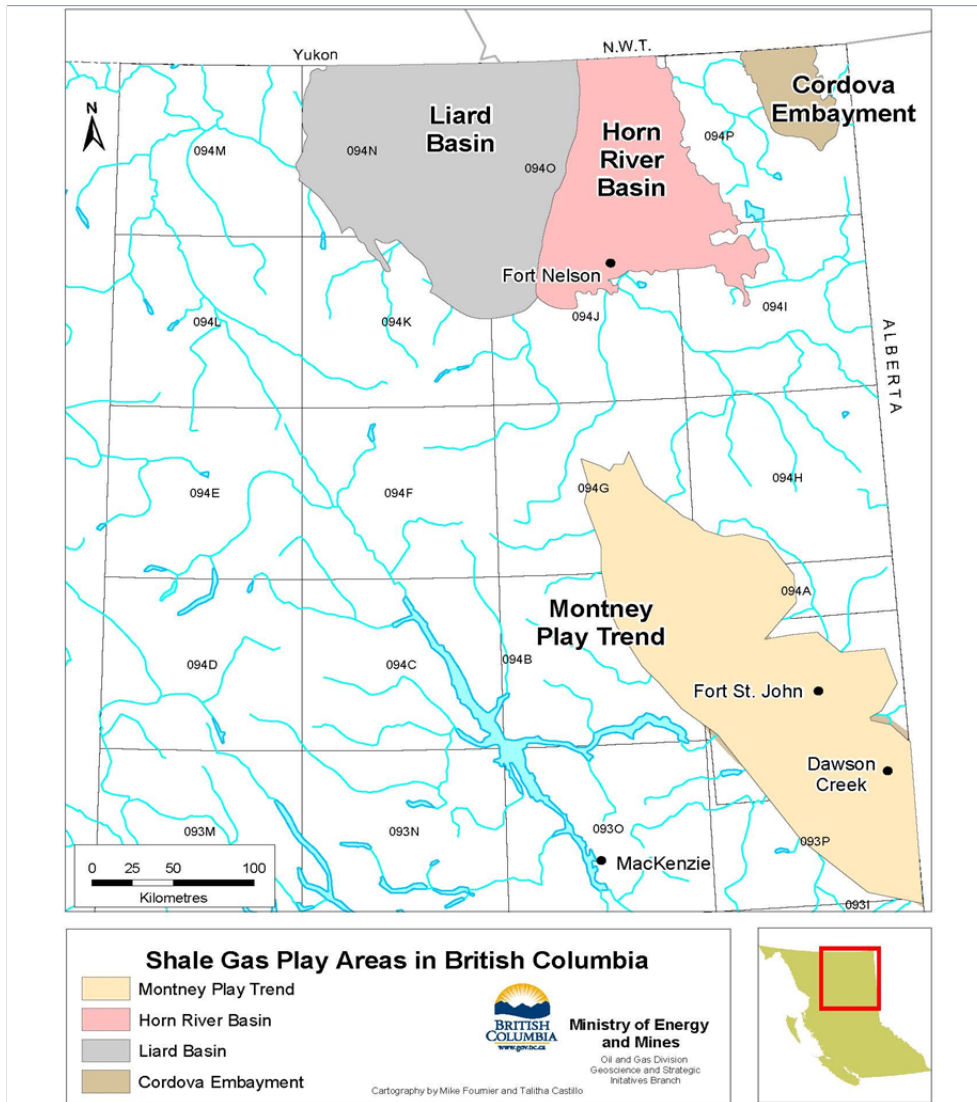


Figure 2: Shale Gas Areas under Exploration or Development in Northeastern BC

Some of the gas from the Montney Trend is rich in gas liquids and close to both pipelines and processing plants; this increases the value of the produced gas and reduces production costs, making the Montney area currently a highly competitive and active area. The Horn River Basin gas contains “dry gas” with high levels of carbon dioxide that need to be removed. Tight gas production occurs primarily in the “Deep Basin” south of Dawson Creek. The Liard Basin and the Cordova Embayment are in the early stages of exploration development for shale gas.

Unconventional gas extraction has dramatically increased natural gas reserves in North America, especially in the US, and has driven down prices.

4.4 Trends and Outlook³

Industry activity over the last decade has focused on acquiring Crown petroleum and natural gas rights in areas prone to unconventional gas. The provincial government recorded a record \$2.66 billion in bonus bids in 2008 for about 700,000 hectares of subsurface rights, but since then the annual bonus amounts, hectares sold and price per hectare have declined. Similarly, the number of wells drilled peaked in 2006 at 1,435 wells, and then fell to an average of around 760 per year for the last five years (see **Figure 3**).

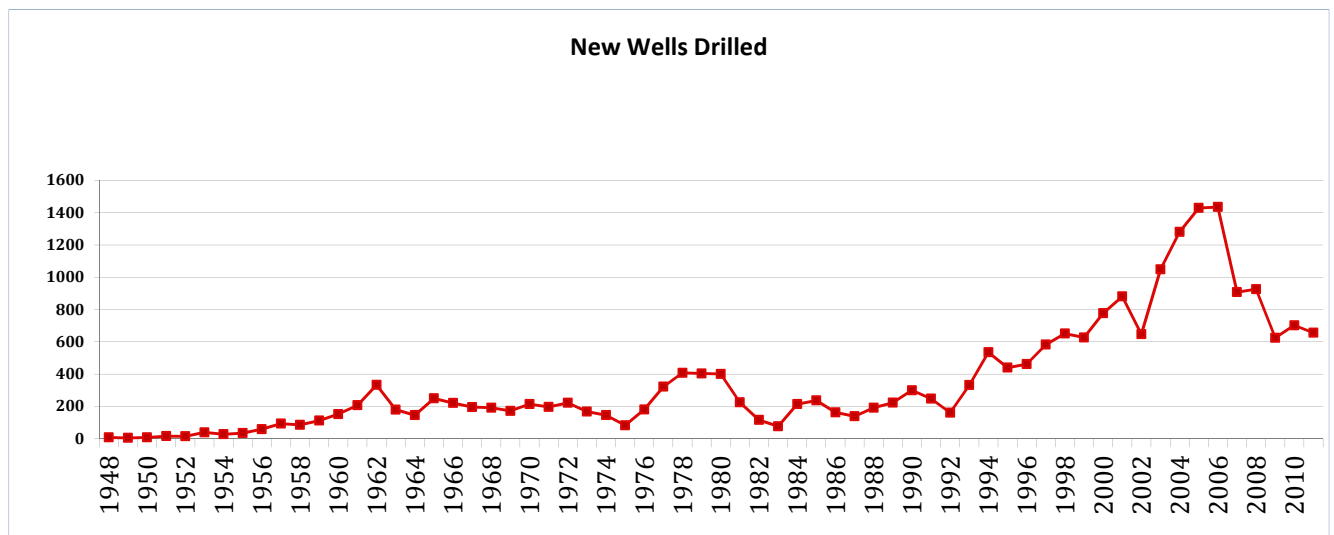


Figure 3: Well Drilling in BC (1948–2011)

British Columbia’s natural gas annual reserve additions have exceeded annual production in every year since 1998: discoveries and revisions in 2010 of 9.7 Tcf of raw gas exceeded production by a factor of eight. This represents the highest level of remaining gas reserves and the largest yearly increase in the province’s history.⁴

Estimates from the BC Ministry of Energy and Mines on the ultimate potential for marketable gas have risen sharply to 130 Tcf, with unconventional gas accounting for 78 Tcf of this amount and expected to increase.

Oil and gas revenues account for between one-half and two-thirds of government revenues generated by BC’s natural resource sector, and more than 3% of total government revenues. The industry spent \$7.1

³ The bonus bid, drilling and reserves statistics in this section are taken from “Exploration and Development Activity in Northeast BC’s Shale Gas Regions,” a presentation of the Ministry of Energy and Mines to the Canada and US Midstream Summit, Calgary, March 14, 2012.

⁴ BC Oil and Gas Commission, “2010 Hydrocarbon and By-Products Reserves in British Columbia,” December 14, 2011, pg. 7.

billion in BC in 2010: industry investment in BC rose from 6% of total Canadian investment in 1981 to 20% in 2010. The Canadian Energy Research Institute estimates that 50,000 jobs were created in Canada as a result of drilling for gas in BC in 2010, and that this will increase to more than 160,000 jobs by 2035.⁵

Unconventional gas drilling and production is not unique to BC. Drilling for shale gas in the US has brought more gas into an already oversupplied market, resulting in a pull-back in prices that has been exacerbated by a soft economy and warmer winters. British Columbia is losing market share in its traditional Pacific Northwest and eastern Canadian export market, and some major producers are curtailing production. The attraction of BC LNG projects is market diversification and long-term contracts, particularly for gas from relatively remote and high-cost areas such as the Horn River Basin. Asian demand is strong, and prices, which are up to four times higher than in North America, are expected to remain high well into the future. Without the creation of a new LNG export market, growth in BC’s natural gas industry will be difficult to sustain.

The following table shows provincial government forecasts for the main indicators of oil and gas activity over the next few years.

Province of BC Forecasts for Main Oil and Gas Indicators				
Indicator	2011–12	2012–13	2013–14	2014–15
Gas Price Forecast (\$/GJ, plant inlet)	\$2.32	\$2.52	\$3.04	\$3.56
Gas Production (Tcf)	1.27	1.48	1.63	1.80
Gas Royalties (\$ millions)	\$367	\$398	\$652	\$846
Crude Oil Production (million barrels)	7.63	7.94	7.78	7.27
New Well Applications	1195	1250	1300	1300
Industry Investment (\$billions)	\$5.8	\$5.1	\$5.9	\$6.6

Sources: BC Ministry of Finance, “Budget and Fiscal Plan 2012/13 to 2014/15” (pg 137, Table A6); British Columbia Economic Review and Outlook (pg.83); Ministry of Energy and Mines “2012/13-2014/15 Service Plan,” February 2012; Oil and Gas Commission, “Service Plan 2012/13 -2014/15,” February 2012.

Based on more than 25 private sector forecasts, the provincial government expects prices for natural gas to strengthen somewhat to approximately \$4.51/GJ by 2016–2017. Production volumes will also rise. As royalty rates are price sensitive, natural gas royalties are also forecast to increase, although to levels will still be well below their peak of \$1.9 billion in 2005.

Annual crude oil production, now in the 7 to 8 million barrel range, will continue its slow, steady decline: BC’s oil production peaked at 25.4 million barrels in 1969. The OGC expects new well applications to rebound to 1,200-1,300 per year, and the Ministry of Energy and Mines targets industry investment to rise modestly to \$6.6 billion in 2014-2015.

⁵ Canadian Energy Research Institute, “Economic Impacts of Drilling, Completing, and Operation of Gas Wells in Western Canada (2010-2035)”, June 2011, Figure 4.1, pg.15.

5 Public Engagement Process

The objective of the public engagement process in Phase 1 of the Human Health Risk Assessment was to provide opportunities for local communities, local and regional governments, First Nations, non-government organizations, environmental groups, regulatory agencies, ministry representatives, health authorities, the oil and gas industry, and the public to provide their input on issues of concern regarding current and future oil and gas development in Northeastern BC.

5.1 Initial Briefing and Review

Early in Phase 1, the Fraser Basin Council received a preliminary briefing from the Ministry of Health about concerns the provincial government had received from some residents in Northeastern BC to that point in time. In addition, the FBC conducted a limited literature review on human health risks associated with oil and gas development.

5.2 Summary of Engagement Activities

The public engagement activities took place between mid-January and early March 2012.

Audiences

The Fraser Basin Council reached out to multiple interest groups across Northeastern BC and encouraged participation of everyone with a concern to express.

Outreach included meetings and/or conversations with municipal and regional governments, First Nations, members of the public who live and work in areas where oil and gas development is taking place, environmental and community groups, provincial government ministries, and other individuals, authorities and organizations that might wish to comment on human health concerns relating to oil and gas development.

Messages

The focus of the outreach was to introduce the Human Health Risk Assessment (HHRA) project, to encourage participation and to explain how prospective respondents could submit their comments and concerns. An HHRA backgrounder was created for use in meetings, in electronic communications and in a print distribution to rural households in the region.

Activities

Here is a summary of the outreach activities carried out from mid-January to March 2012:

- **Media Stories:** Two news releases about the roll-out of the HHRA were sent to BC media in January: the first on January 3 from the Ministry of Health and the second on January 27 from the Fraser Basin Council, with follow-up interviews. One or more news stories about the HHRA

(and how to participate) appeared in local media, including the *Fort Nelson News*, Peace FM, CBC Prince George, CJDC Radio and TV, CKNL Radio, Sun FM, *Alaska Highway News*, Opinion 250, *Prince George Citizen* and Moose FM. Online versions of the stories were also posted on those media sites, and additional postings appeared on other websites.

- **Website Information:** Details on the HHRA were included on the Fraser Basin Council homepage and on a dedicated project website (www.hhra.ca).
- **Display Advertisements:** Quarter-page advertisements on the HHRA were run in February in the *Alaska Highway News* and the *Dawson Creek Daily News*.
- **Email Broadcasts:** In February, email broadcasts were made to more than 270 organizations and individuals in the region, to invite participation and to ask that the information be passed to their respective networks. The Northern Health Authority also sent a notice to its network of contacts.
- **Meeting Invitations:** FBC contacted interested individuals, organizations and communities to invite them to one-on-one meetings with FBC's Executive Director in late January (in Victoria, Fort Nelson and the Fort Nelson First Nation) and in mid-February (in Fort Nelson, Prophet River First Nation, Fort Nelson First Nation, Halfway River First Nation, Blueberry First Nation, Fort St. John, Taylor, Dawson Creek, Pouce Coupe, Tumbler Ridge, Chetwynd and Hudson's Hope). The invitations were extended to provincial ministries, local government, First Nations, the Northern Health Authority, health care organizations, community and environmental groups, oil and gas sector representatives, those in the oil and gas workforce, agricultural producers and individuals who had previously expressed health concerns about oil and gas development. There was also an open invitation for anyone to request a one-on-one meeting, and that offer was part of all communications.
- **Household Distribution to Rural Areas:** Print copies of the HHRA backgrounder were distributed via Canada Post to more than 6800 northern residences in early February to invite participation. The distribution was made to reach rural residents—those outside of Fort St. John and Dawson Creek.

Opportunities to Participate

Submission of Comments

The Fraser Basin Council invited comments through to March 7, 2012, and these could be submitted in one of four main ways:

- **Online:** Via a web form on the Human Health Risk Assessment webpage (www.hhra.ca)
- **Email:** By email, with or without attachments, to info@hhra.ca
- **Toll-Free Line:** By leaving a voice message on a dedicated toll-free information line
- **Mail:** By regular mail to the Fraser Basin Council office.

One-on-One Meetings

As noted, there was also an open invitation to request a one-on-one meeting with the Fraser Basin Council, by phone or in person. These meetings and telephone conversations were with FBC's Executive Director.

* * * * *

During Phase 1 outreach, FBC advised that the names of organizations making submissions would be included in the report (see **Appendix 3**) and their submissions would be appended (see separate **Compendium of Submissions**). To ensure the privacy of individuals and encourage their full participation in the process, the names of specific individuals are not appended, unless they so requested.

Comments on the HHRA and Next Steps

While many respondents were appreciative of being able to participate in Phase 1, they strongly expressed the importance of being able to participate in subsequent phases as well.

It was also pointed out to the Fraser Basin Council throughout Phase 1 that many landowners have family members, relatives and friends working in the oil and gas sector or in related businesses that rely on the oil and gas sector and thus were reluctant to express their views.

Some respondents mentioned that the timeline for Phase 1 was tight for them to participate effectively and requested much more time be allowed for Phase 2.

5.3 Overview of Comments and Submissions

More than 300 unique comments or submissions were received during the public engagement. Individuals, organizations and government used all of the avenues to comment, but the majority chose to submit their comments by email or arranged one-on-one meetings with FBC's Executive Director. A database management system was used to sort and track the information gathered during the engagement process.

Comments and Submissions Received

Meetings

In total, more than 200 participants took part in either one-on-one interviews or group meetings, which included six meetings with First Nations communities. The objectives of the meetings were to provide participants with contextual information about Phase 1 of the HHRA process and hear participants' issues of concern. These meetings helped to ensure that FBC's Executive Director heard first-hand the interests and ideas expressed by participants.

To obtain contextual information, FBC met with representatives of provincial ministries, including the Ministries of Health, Environment, Energy and Mines, Aboriginal Relations and Reconciliation, and also with the BC Oil and Gas Commission. In addition, FBC communicated with the Canadian Association of Petroleum Producers via teleconference to receive input.

Information from the meetings was summarized and entered into a database management system. In

addition to in-person meetings, a number of the organizations and government agencies chose to summarize their concerns in formal submissions (see separate **Compendium of Submissions**).

HHRA Website

FBC launched the Human Health Risk Assessment website on January 21, 2012. The website offered visitors the opportunity to use an online feedback form to make their submissions. A total of 41 submissions were collected through the online feedback form.

Toll-free Call-In Number

FBC received a total of 16 comments via the toll-free number. The comments were summarized and entered into a database. FBC's Executive Director connected either in person or by telephone with the individuals who had provided comments by voicemail and also requested a one-on-one meeting.

Email

FBC received over 200 emails setting out comments. The comments ranged from short statements to multi-paged, detailed submissions. The majority of comments received by email were from individuals. A few organizations and local governments also elected to email submissions.

Database Management and Theme Categorization

During the review of the comments and submissions, principal themes and concerns were identified, categorized and entered into a database.

To organize the large number and wide range of comments, the submissions were assigned to one or multiple themes in the database. For example, if a respondent's concern was air quality due to flaring and commercial vehicle traffic, the comment was entered into the database and tagged with the themes air quality, oil and gas activities and transportation. These themes were used within the report and were based on respondents identifying their issues of concern.

To reduce repetition, the issues that were assigned to more than one theme were only included under one section of the report. For example, if a respondent expressed concern about the impact of hydraulic fracturing is having on water quality and aquatic species, the comment would be identified under only one theme or heading such as "water quality."

Once all the comments and submissions were entered into the database, a summary was generated showing main themes of concern. It is important to recognize the limitations of the reporting of the input and note the results are intended to illustrate broad themes rather than detailed statistics, in-depth analysis or scientific research.



In BC's Northeast – Kinuseo Falls, Tumbler Ridge
Courtesy of Picture BC

Personal Health Issues (SECTION 6.1)

Physiological Psychological Cultural / Spiritual

Environmental Pathways of Exposure (SECTION 6.2)			Related Environmental Issues (SECTION 6.3)		
Air Quality	Water Quality, Quantity	Food Quality	Accidents, Spills and Explosions	Increased Traffic; Noise and Light Pollution	Impacts to Ecosystem

Community Service Issues (SECTION 6.5)			Changes to Community (SECTION 6.4)	
Health Care System	Social and Community Services	Municipal & Regional Infrastructure	Socio-economic	Demographic

Oil and Gas Operational Issues (SECTION 6.6)		
Exploration and Drilling	Processing and Pipelines	Transportation and Traffic

Institutional Framework Issues (SECTION 6.7)				
Monitoring and Compliance	Regulation and Enforcement	Communication	Emergency Response Planning	Tracking and Reporting

Figure 4: Categories of issues, based on respondents' concerns

6 Identified Human Health Issues of Concern

“Loss of millions of gallons of fresh water per frac; Disposal of contaminated water; Soil contamination; Noise contamination; Air contamination down wind, living near, working near or working on well sites; Stress; High rates of social problems ... (drugs, alcohol, family breakdowns); High rates of cancers and birth defects; Loss of cultural resource areas ... (traditional medicines, herbs, teas, berry picking); Habitat loss on properties ... (dens, nests, animal licks, forest); Loss of peaceful and quiet enjoyment.”

— Respondent (Individual)

Respondents were asked to identify issues of concern relating to activities associated with oil and gas resource development. Concerns related to a wide range of activities and events: gas development, extraction and production methods, emergency events such as well blowouts and pipeline breaks, chemicals used in drilling and well stimulation techniques, chemicals in drilling waste, air quality issues related to flaring and processing facilities, on-site and off-site waste management, transportation and disposal activities, and land reclamation activities. Oil and gas resource development also has the potential for both environmental and socio-demographic impacts; therefore, this project adopted a comprehensive understanding of health and well-being and included issues of concern relating to social and environmental determinants of health.

It is important to note that many respondents did not provide specific comments on all aspects of the challenges surrounding oil and gas resource development, but instead often chose to focus on areas of highest concern to them personally or to their respective organizations.

As noted in the previous section, over 300 respondents helped identify human health issues of concern. This input was offered through meetings, telephone interviews, formal submissions and other means. Formal submissions were received from a variety of groups, including local government, the oil and gas sector, and academic, professional, community and environmental organizations: see **Compendium of Submissions**.

As the input reflects a respondent’s knowledge, direct or indirect experience and understanding of a specific issue, this report offers no quantitative analysis or “weighing” of the significance of any issue or issue category. Many respondents addressed one or two issues; others provided information on many issues. Some included commentary on the HHRA process and suggestions for moving forward. A number of respondents raised suggestions for how their concerns could be addressed; these are summarized in the sections that follow.

Based on respondents’ concerns, seven categories were identified. The list below does not imply any ranking, importance or priority. The categories are described in greater detail in **Figure 4**:

- Personal Health Issues
- Environmental Pathways of Exposure
- Related Environmental Issues
- Changes to Community
- Community Service Issues
- Oil and Gas Operational Issues
- Institutional Framework Issues

These categories may interrelate and influence or affect one another. For example, regulations have a direct effect on how the oil and gas industry operates, which in turn has the potential to affect water quality.

The following section presents the concerns as reported to FBC. As mentioned in section 2, Phase 1 does not include any validation or analysis of the concerns provided by the respondents during the public engagement period. Analysis of the validity of the concerns and submissions received during Phase 1 will most likely be a key component of subsequent phases of the Human Health Risk Assessment.

6.1 Personal Health Issues

“Oil and gas development brings intensive 24 hours per day – 7 days per week work activity during development of well sites and pipelines to a wide region consisting of both private and crown lands. For the most part, this activity is in the rural areas and areas that historically have been very quiet and peaceful. A gas well development used to be a few weeks to a few months duration of intense activity, but now many well sites are multi-well pads and require drilling, fracking and testing activity that lasts many months or even up to years of intense activity.”

— Respondent (Local Government)

Personal health issues can be categorized as physiological, psychological or cultural/spiritual.

Many respondents reported personal health issues such as cancer or asthma but did not specifically identify an environmental pathway of exposure, such as air quality, or an activity of concern such as hydraulic fracturing. If a pathway of exposure or an activity was not identified, the health concern was categorized as a personal health issue. Respondents often stated they were concerned about health impacts of an activity but did not give specific details. Quality of life was a commonly cited concern and it was attributed by respondents to the rapid expansion of the oil and gas industry and changes in individuals’ understanding of their known environment.

Another personal health issue was increased anxiety due to the unknown. As one respondent stated, “One of the greatest health concerns generated by the general public associated with oil and gas development is the fear of the unknown.” Many respondents listed questions in addition to their concerns. For example, “what is happening to my drinking water?” or “who do I call if something goes wrong?” Many respondents identified specific personal health issues they perceived to be related to oil and gas development. The most commonly cited concerns were:

- lung-related issues such as asthma and bronchitis;
- cancer;
- sinus, throat and eye issues;
- stress;
- sleep deprivation; and

- reduced quality of life.

Respondents' suggestions included:

- conducting research on public health risks and potential mitigation; and
- increasing public education.

6.2 Environmental Pathways of Exposure

An individual's health can be compromised by exposure to a hazard through an environmental pathway such as air, water or food. Respondents expressed concern that pollutants from oil and gas development have either a current or potential effect on the quality of their water and air, and subsequently their food, by reason of livestock and wildlife coming into contact with contaminants. Examples include exposure to hydrogen sulphide, ingestion of contaminated water or diesel dust, and ingestion of contaminated wildlife.

Air Quality

"... We need a definitive study of air quality and its relationship to our communal health."

— Respondent (Local Government)

Many respondents expressed concern about gas well and facility emissions, fugitive emissions and the possible effects of increased particulate matter in the air from increased vehicle traffic. Some of the respondents pointed out that ambient air quality monitoring in the region was quite limited and they therefore believed that there was an inadequate understanding of ambient air quality levels of specific pollutants throughout the region.

Concerns expressed included:

- possible exposure to airborne contaminants associated with the flaring of gas and routine gas leaks from upset conditions at gas wells, pipelines and other gas gathering and distribution infrastructure;
- respiratory issues (e.g., asthma, sinus infections, coughing, etc.);
- sore eyes, headaches, digestive problems and other negative health impacts such as cancer, perceived to be the result of people living and/or working in close proximity to oil and gas activities;
- ambient air quality in Northeastern BC and perceived lack of comprehensive monitoring programs;
- current and future impact of poor air quality on human health and the health of livestock, wildlife, aquatic species and the natural environment;
- negative health impacts caused by acute and chronic low-level exposure to hydrogen sulphide and other compounds, including neurotoxins, related to oil and gas activities such as flaring;

- consequences of long-term exposure to low levels of hydrogen sulphide and sulphur dioxide;
- increased airborne contaminants from oil and gas development;
- cumulative impacts caused by emissions from increased transportation, including particulate matter;
- impacts of sweet gas on human health;
- respiratory impacts of sulphur dioxide;
- fugitive emissions;
- impacts of sulphur dioxide and hydrogen sulphide on individuals that are more susceptible such as the young, elderly and immune deficient.

Respondents' suggestions included:

- establishing a sentinel air monitoring system for the entire region, similar to Drayton Valley;
- investigating the potential effects of chronic exposure to hydrogen sulphide;
- investigating the potential risk of hydrogen sulphide exposure from sweet gas;
- performing further studies to determine what chemicals are present in Northeastern BC at quantities that may threaten public health;
- conducting a science-based study that reviews associated risks of air quality in close proximity to oil and gas wells and facilities with emissions;
- conducting a definitive assessment of air quality and its relationship to communal health;
- installing air quality monitoring stations, supported by local industry, in communities and near residents;
- making public the results from the monitoring stations, including advertising daily results on the local radio station;
- reviewing health records of respiratory issues reported in Northeastern BC;
- scientifically evaluating emissions materials to identify toxins and minimal exposure levels that are safe for human health;
- reducing the amount of flaring;
- correcting the lack of information on the baseline data that has been collected from well site emissions, processing facilities and flare stacks;
- revisiting the ambient air quality monitoring program in the region and monitoring for cumulative effects from small and unregulated sources associated with upstream oil and gas

development; and

- considering conducting a comprehensive emissions inventory and modelling study over the entire region to assess the cumulative impact of all of existing and new emission sources on ambient air quality.

Water Quality and Quantity

“A direct safety concern is the introduction of chemical pollutants into the water table. There are many potential sources of contaminants including the process of drilling and fracking wells, building and operating pipelines and surface drainage from heavy equipment and construction sites.”

— Respondent (NGO)

“A broader issue of concern for human health, safety and well-being may one day be access to sufficient quantities of fresh water...Conflicts over finite water resources can reasonably be expected to grow in the event that the shale gas industry expands dramatically and the region or portions of it undergo drought-like conditions once again.”

— Respondent (Individual)

Respondents are very concerned about current and potential health impacts related to water quality as a result of oil and gas resource development.

In addition to water quality, a broader issue of concern for human health, safety and well-being is access to sufficient quantities of fresh water. Many respondents expressed concern about the large quantity of water required for operations such as hydraulic fracturing. These respondents perceived that excessive water removals might place a strain on the water supply available to local communities.

Concerns included:

- negative impacts on water quality, aquatic health and human health from construction associated with oil and gas resource development, oil spills, hydraulic fracturing and disposal pits;
- increased, or introduction of, waterborne contaminants into the water table from drilling, hydraulic fracturing wells, oil and gas operations, transportation of goods, transmission lines and processing plants;
- increased sedimentation and turbidity as a result of increased road and pipeline construction;
- adverse effects on water safety in community watersheds due to increased oil and gas drilling and hydraulic fracturing;
- use and placement of recovered water from the industry’s recovery processes (regulation) and the downstream effects of impurities in that water as it is released back into the environment;
- cumulative effects on human health from wastewater;

- contamination of water bodies from oil and gas air pollution;
- lack of protection and preservation of freshwater resources; and
- lack of legislation acknowledging the problem of water extraction and use for the purpose of hydraulic fracturing and other oil and gas resource development.

Respondents' suggestions included:

- conducting a science-based study that reviews associated risks of water quality in close proximity to oil and gas wells and facilities;
- testing water bodies in the vicinity of oil and gas operations for the presence of Polycyclic Aromatic Hydrocarbons (PAHs) and other chemicals released into the air during oil and gas industry activity;
- researching industrial use of water associated with oil and gas resource development operations;
- scientifically evaluating the region's water and industry-recovered water, identifying toxins and minimal exposure levels safe for human health;
- examining the impact of oil spills in water bodies;
- examining the potential human health impacts resulting from water contamination by hydraulic fracturing fluids and wastewater;
- considering the use of cement evaluation tools to prevent the seepage of fracturing fluids into groundwater drinking sources;
- investigating the health risks associated with disposal pits leaching toxic oil and gas industry waste into nearby water sources;
- examining the human health risks posed by oil and gas industry air pollution in terms of contaminating water sources;
- examining the impact of sedimentation on water bodies resulting from oil and gas industry construction; and
- examining baseline measurements for water quality of surface and groundwater sources.

Food Quality

“Our family hunts in the south Peace and have a concern about the quality of the meat of the deer, moose and elk which reside in the areas occupied by oil and gas facilities. What are the long-term health concerns of eating affected wild game, and what are the earth effects to the wildlife?”

— Respondent (Individual)

The possible contamination of food — whether it is the contamination of agricultural products such as livestock or the contamination of wildlife such as moose — may pose a health risk to people living in Northeastern BC. Specifically, this was identified in relation to First Nations communities who rely on fish, and on moose and other ungulates as a food source.

Concerns included:

- human health impacts due to consumption of contaminated food, including fish, game, livestock, agricultural products and non-forest timber products;
- toxic dust on crops;
- decline in ungulate populations; and
- changes in health of ungulate populations, such as abnormalities in the organs due to exposure to contaminants from oil and gas industry operations.

Respondents' suggestions included:

- building adequate fencing around well sites in operation and contaminated sites;
- studying ungulate population health and abundance; and
- keeping roads near fields and residences sprayed with dust retardant.

6.3 Related Environmental Issues

The expansion of oil and gas development in BC's Northeast brings with it a range of concerns for the natural environment and for the well-being of neighbouring rural communities. Life can change — dramatically for some people — in the rural-industrial interface. Residents have flagged multiple concerns about their quality of life, health and safety from living alongside oil and gas operations. Concerns range from accidents and explosions to increased noise and light pollution, which can impact them physically and psychologically through sleep deprivation, mental anguish or stress-related illnesses. Other common concerns include an increase in road traffic, speeding and road accidents (see **Section 6.6: Transportation and Traffic** for details).

Explosions, Spills or Accidents

Although only 49 respondents specifically identified the risk of explosions, spills or accidents to be a concern, many respondents were concerned about being affected in some manner by possible explosions, spills or accidents. One cited example is a significant sour gas leak that took place in Pouce Coupe in 2009.

The key concerns identified included:

- accidental pipe failure in and close to streams and lakes;
- soil contamination that may affect humans and vegetation from spills, leaks and waste disposal;

and

- possible unreported and uninspected spills or leaks.

Noise and Light Pollution

"I would like to see what the impacts of noise pollution have on the public as a result of oil and gas development in the Peace."

— Respondent (Individual)

The issue many respondents cited as causing them stress and affecting their reduced quality of life was noise and light pollution. This was of particular concern to respondents who lived within close proximity to a high density of well sites. They attributed the possible sources of this type of pollution to drilling, hydraulic fracturing or increased vehicle traffic.

Concerns expressed included:

- chronic exposure to noise associated with compressors and other natural gas industry equipment and operations;
- site-specific, intense increases in truck and other vehicle traffic into and out of hydraulic fracturing operations; and
- light pollution from flaring and other oil and gas operations.

Impacts on Ecosystems

"...The resource users (industries) ...do not know for certain that they are managing sustainably. How do we know how much development is too much to sustain the resources on the land base without looking at cumulative effects?"

— Respondent (Individual)

Impacts on ecosystems were included as part of the scope because of the close connection between ecosystem health and human health. Many respondents did not differentiate or see a separation between human and ecosystem health. For this reason, a category for tracking impacts to ecosystems was included.

Respondents were concerned about the health of ecosystems and the impact that possible contamination of these ecosystems would have on their health and the health of their families and their communities. If a respondent noted a concern for the health of the environment or an ecosystem as a whole, but did not specify a health concern, it was noted in this category. Respondents identified the cumulative impacts of the oil and gas industry as a concern.

Concerns included:

- altered water flows, stream sedimentation caused by crossing streams by seismic lines, roads and pipelines and the effect on fish and their habitat;

- destruction of ungulate habitat;
- cumulative impacts of oil and gas operations on the ecosystem;
- lack of permitting that takes into account how many other wells and facilities are nearby (cumulative impacts);
- lack of a rigorous assessment process for individual gas industry developments in the region even through the impact on the environment is high; and
- difficulty in assessing health risks due to the fact that no environmental assessment of individual wells is required.

6.4 Changes to Community

“How can we continue practising our way of life and passing on our oral history, traditions and lessons without a healthy land base, no water or trees? Who can speak on behalf of the wildlife and fish populations — ultimately we need each other to survive.”

— Respondent (First Nations community)

Rapid social and cultural changes associated with oil and gas development can have current and/or potential future effects and can cause changes to the socio-economic and demographic structure of communities. These changes can have short- or long-term effects on residents and those who work in the sector.

Issues resulting from changes to community structure include disruption to traditional cultures and economies in the region; rapid population growth; problematic substance use; mental health issues; crime and social disruption; economic inequity; and marginalization of populations; reduced social cohesion and disrupted social dynamics through intensive work-camp and industry-sector schedules.

6.5 Community Service Issues

“The oil and gas industry pays well, requires long work hours and attracts a relatively young and aggressive work force – these cumulative factors attract a number of social vices: substance abuse, family stability, cumulative health effects of work schedules.”

— Respondent (local government)

Community services include health care services, municipal and regional infrastructure, and community and social services. Changes in the demographic and socio-economic composition of communities put pressure on health care services, social and community services, and municipal and regional infrastructure. The impacts can have short- or long-term effects on society and on the social programs that support community members, especially marginalized populations or populations at risk.

Health Care System

“Are medical facilities and services keeping up with the mushrooming population? This is an infrastructure issue, but important nonetheless.”

— Respondent (individual)

Northeastern BC is currently experiencing a “boom” economy. Given significant industrial expansion and population growth, there is ever-increasing pressure on the health care system, and this is a predominant concern of respondents. Shortages of medical staff and doctors, long wait lists for acute care facilities, and associated financial burdens were identified by families, seniors, health care providers and government officials as being indirectly caused by the pressure the oil and gas industry is putting on the health care system.

Concerns included:

- increased prevalence of chronic disease;
- increased pressure on health care services;
- increased demand for acute care beds;
- increased mental health issues;
- increase workplace injuries;
- shortages of medical staff and doctors;
- lack of appropriate funding because health services funding is by census and not by the number of workers in the area; and
- lack of a registry or tracking of individuals impacted by oil and gas development.

Respondents’ suggestions included:

- training for medical staff to respond to transient and permanent population increases, including response to medical emergencies.

Social and Community Services

With the influx of oil and gas activity in the Northeastern BC, there is increased pressure on social and community services. The oil and gas industry pays well, requires long work hours and attracts a relatively young workforce. As identified by respondents, these cumulative factors have a number of social impacts, such as:

- increased pressure on family services;
- drug- and alcohol-related issues that accompany an increase in population;

- cumulative health effects related to the demanding, high-pressure work of the oil and gas resource development industry; and
- decreased family stability.

Respondents' suggestions included:

- continuation of provincial revenue-sharing to keep up with accelerated demands on local government services;
- health records review of oil- and gas-related social issues;
- RCMP and Provincial Court records review to determine the complexity of social issues attributable to the oil and gas work force; and
- increase in funding to the Ministry of Health from the oil and gas industry in order to:
 - ❖ compensate strained local health authorities and hospitals,
 - ❖ provide specialized training for medical staff, and
 - ❖ fund future studies on health issues.

Municipal and Regional Infrastructure

The majority of respondents that identified municipal and regional infrastructure issues as a concern were organizations and local governments.

The comments included these concerns:

- increased pressure on community services such as water and sewage treatment facilities and community recreation facilities;
- negative impacts on streets and parking due to increased numbers of vehicles on roads;
- lack of adequate housing and inflated rents due to demand;
- increased need for enforcement and corrections due to a potential increase in crime and social disruption; and
- a transient workforce that uses services but lacks a commitment to the community.

6.6 Oil and Gas Operational Issues

There are concerns that oil and gas development, including exploration and drilling, transportation and pipelines, are causing, or have the potential to cause, effects on both the environment and surrounding communities.

Exploration, Drilling, Pipelines and Processing

“If the wellbore is not correctly cemented, how can you guarantee that the water aquifers are not contaminated due to seepage?”

— Respondent (local government)

Issues in this section include all activities related to oil and gas resource development, such as hydraulic fracturing, chemicals used in drilling and well stimulation techniques, chemicals found in waste products from drilling, on-site and off-site waste management, and disposal activities.

Many respondents identified seismic activity associated with hydraulic fracturing as a possible concern, as well as the integrity of the casing required for effective hydraulic fracturing operations.

The issues identified included:

- density of well sites in residential areas;
- quantity of waste products produced by oil and gas operations;
- ingredients of waste products;
- how radioactive material is being handled, identified, contained and/or disposed of on- or off-site;
- the potential risks to human health and the health of the environment that earthquakes would cause as a result of hydraulic fracturing;
- the potential for hydraulic fracturing activities to trigger potentially deadly sour gas releases;
- the potential for domestic water wells and homeowners’ properties to be contaminated with either gas or liquid contaminants associated with hydraulic fracturing;
- reporting of chemicals used, fracturing fluids and contaminants in wastewater;
- lack of information about what happens to the contaminated wastewater used in the hydraulic fracturing process;
- potential for the entire BC Peace region to suffer contamination issues in the future, given the exponential growth of drill and plant sites and the accumulation of toxins; and
- lack of information regarding water quality of residential water wells in proximity to industry disposal wells.

Transportation and Traffic

“Trucks hauling dangerous goods are often left parked for extended periods of time along our municipal roadways. Should a spill occur or vapour be released, there could be

negative impacts to the environment or worse – the loss of lives.”

— Respondent (local government)

Oil and gas resource development involves heavy road use during all phases of operation.

Concern was expressed regarding:

- additional traffic on public roads, including oversized and hazardous material loads;
- increased numbers of vehicles travelling at greater speeds, often with inexperienced drivers, thus creating the potential for more collisions with vehicles or wildlife;
- hazardous materials, such as radioactive substances, being transported in non-compliance;
- potential for hazardous materials to react with each other during transport;
- the number of hazardous spills that have occurred along public roads that are associated with the oil and gas industry.

Respondents’ suggestions included:

- Keep the roads that are near fields and residences sprayed with dust retardant to reduce negative effects on crops.

6.7 Institutional Framework

“Government and industry must develop legislation, regulations, policies and guidelines that will ensure all oil and gas wells drilled should be subject to an environmental impact study which includes reports from hydrologists, environmental conservationists, and/or health as indicated.”

— Respondent (non-profit organization)

Institutional framework issues, such as regulations, policies, communications and plans, provide direction to the oil and gas industry and thereby oversee the effects the industry will have on the natural environment and surrounding communities. The institutional framework concerns identified by respondents relate to monitoring and compliance, regulation and enforcement, communications, emergency response and tracking and reporting.

Monitoring and Compliance

“ We acknowledge the desire to have a human health risk assessment is a reflection that people want a greater understanding about how the natural gas industry operates and which processes we use. We support steps that increase the understanding of our industry.”

— Respondent (oil and gas sector)

Some respondents expressed concern that the current monitoring and compliance procedures may be insufficiently resourced to carry out adequate monitoring and compliance of current and expanded oil and gas activities. Concern was expressed regarding:

- the lack of baseline assessments of air, water and soil prior to oil and gas resource development or regular assessments during operation; and
- improper labelling of wastewater, which is subject to lax regulations in the event of a spill or surface contamination.

Respondents' suggestions included:

- environmental and health impact studies related to the exploration, extraction and transportation of hydrocarbons for all oil and gas developments, including mandatory cumulative impact studies;
- increased monitoring and disclosure of the amount of water that is being used within the industry;
- comprehensive testing to determine what contaminants exist before industry starts drilling, testing to determine what changes have occurred over time, and follow-up to determine if there is an accumulation of effects over a larger area after drilling commences;
- increased restrictions placed on industry when development is near watersheds or springs where there is human and animal consumption of the water;
- regular testing by the government of the lakes, streams and springs in the area where gas and oil development is being conducted;
- records of site inspections kept and made available on request;
- sampling water wells within a 5 km radius of a gas well before, during and after production; and
- full spectrum monitoring at all oil and gas facilities including well site compressors and gas plants to determine all air contaminants.

Regulation and Enforcement of the Industry

"It is commonplace to smell very strong H₂S odours while driving in the area, whether from sour water tank trucks or well sites. I spent 17 years working in the oil patch and am familiar with H₂S. The levels are much higher in some areas than should be allowed."

— Respondent (individual)

Many respondents were concerned about how the industry is regulated and how a perceived lack of regulation is negatively impacting their health. Concern was also expressed about a perceived lack of enforcement of regulations.

Concerns included:

- an insufficient number of inspectors involved with compliance and enforcement;
- insufficient setback distances from residential and community areas;
- oil and gas industry not being held to the same standards as some other sectors; and
- level of industry compliance with the requirement to release information on specific substances used during drilling/fracturing.

Respondents' suggestions included:

- implementation of a broader planning and consultation process that seeks the input of public health officials on what constitutes an acceptable number of wells, the location of such wells, well densities and spacing, and the proximity of wells to individual residences and local communities;
- review of, and increase in, the gas well setback zone around residences, schools and community centres;
- creation of an independent monitoring agency to patrol and enforce safety regulations;
- requirement for the oil and gas industry to follow the same rules as farmers when operating on farmland that is adhering to Environmental Farm Plan guidelines; and
- involvement of the BC Ministry of Health, specifically to:
 - ❖ be included in regulating the industry in order to protect the health of humans and livestock,
 - ❖ be involved in the permitting of individual drill and plant sites in order to foresee pertinent health and safety concerns in establishing a new site,
 - ❖ review the air quality guidelines to bring them in accordance with the World Health Organization Standards,
 - ❖ be involved in any OGC-reported incidents or complaints that affect air, water or soil in order to determine health consequences, and
 - ❖ be encouraged to benefit from enhanced understanding of best practices related to complex natural environment and human health relationships through the use of integrated environmental health impact assessments.

Communication

“I have been affected by this industry for over 30 years now and it gets worse as the years go by. My personal safety is always at risk...as I am subject to leaks and nobody does anything to contact me when they occur. ...”

— Respondent (individual)

Respondents expressed concern about the lack of information available to them and the lack of transparency surrounding oil and gas resource development. This was especially acute during emergencies such as gas leaks. As mentioned earlier in this report, the majority of respondents listed a number of questions along with their concerns; some respondents listed only questions. There is a desire for key information pertaining to possible health implications related to oil and gas resource development.

Concerns included:

- lack of communication regarding leaks;
- in the event of smelling gas, lack of information about what is going on;
- lack of information about future risks associated with oil and gas development; and
- lack of communication regarding future developments.

Emergency Response Planning

“Rather than leaving emergency response planning to the OGC, there needs to be broader stakeholder involvement to achieve better transparency and accountability – and, ultimately, to achieve better ERPs.”

— Respondent (educational body and non-profit organization)

Even though regulations are outlined to protect the public during various stages of oil and gas development, including setback distances from oil and gas facilities and emergency response planning, a number of respondents feel that emergency response and site setbacks are not sufficient to protect residents in locations close to oil and gas sites.

Concerns expressed included:

- lack of effective emergency response measures and coordination;
- lack of communication regarding how or if the oil and gas industry can be contacted during an emergency situation;
- lack of clarity around emergency procedures and whether OGC has emergency management regulations in place;
- lack of information regarding emergency preparedness zones; and
- lack of notification to the Ministry of Health in incidents affecting residents’ health, resulting in a

lack of injury reporting.

Respondents' suggestions included:

- a call centre set up by the Oil and Gas Commission to receive oil and gas emergency calls and a routing of calls through the 911 call answer service provided by the Peace River Regional District.

Tracking and Reporting of Adverse Health Effects

A number of respondents expressed concern about the tracking and reporting of adverse health effects caused by the oil and gas industry. They believe that, given a lack of tracking of toxic exposure occurrences, it is difficult to obtain a realistic assessment of health effects. In addition, they expressed concern about the lack of transparency and available information from both government and industry on specified occurrences. Some respondents also believe that non-disclosure agreements make it challenging to document the root causes of health concerns that relate to the industry.

Respondents' suggestions included:

- researching and compiling medical statistics in the Peace region and comparing them statistically to the national averages, looking for higher than normal incidents of diseases known to be caused by environmental contaminants;
- follow-up interviews with patients known to have been injured and compensated by industry to determine long-term health consequences;
- a system to track health over time, based on a broad interpretation of health, of those affected by the oil and gas industry;
- specific, independent medical testing, such as tissue sampling of the local human and animal population.

7 Conclusion

It was apparent throughout Phase 1 that respondents greatly appreciate the provincial government's three-phase initiative to identify and assess human health risks associated with oil and gas development in Northeastern BC. They particularly appreciate having had the opportunity to express their concerns and welcome the fact they will have access to the Phase 1 report once it has been reviewed by the provincial government.

Although many issues of concern were identified in Phase 1, the overall concern of many respondents was uncertainty and not being fully informed of the nature and extent of possible long-term health effects on individuals and communities within close proximity of oil and gas operations. Many believe their health and the health of their families and friends has been adversely affected or may be affected in the future by an increase in oil and gas activity. Some are frustrated by this situation and want help in having their concerns resolved by the regulator (i.e., the Oil and Gas Commission), the provincial government, and organizations such as the Northern Health Authority and the oil and gas companies. There appears to be an opportunity here for all concerned to work together in subsequent phases of this project.

Many respondents also made it clear that the momentum from Phase 1 should continue, and that Phase 2 should begin as soon as possible. They also strongly believe that the public involvement and process transparency developed in Phase 1 should be an integral component of Phase 2. Although they understand that Phase 1 was aimed at identifying key issues of concern, they also want to be part of the dialogue in Phase 2, which will focus on the assessment of the issues.

8 Appendices

8.1 Northeastern BC Regional Setting

This appendix provides an overview of the Northeastern BC region to give a broader understanding of its many natural and socio-economic attributes.

Environmental Overview

Biophysical⁶

Northeastern BC is drained by two major river systems: the Liard River system in the north and the Peace River in the south. Important drainages of the Liard system include the Sikanni Chief–Fort Nelson Rivers, the Muskwa River and the Prophet River. Major drainages flowing into the Peace River include the south-flowing Halfway River, the north-flowing Moberly River, and many others.

Northeastern BC is characterized by diverse topography and a variety of biogeoclimatic zones. From west to east, the landscape changes from Rocky Mountains and foothills with aspen, spruce and pine forests to flat ground (black spruce and tamarack) and muskeg. Knolls and eskers, or long narrow ridges, are often present within the muskeg. These features combine with its river systems, to create the landscape.

Ecology

Northeastern BC west of the Alaska Highway is renowned for its pristine wilderness, biological diversity and intact predator-prey ecosystems. Of particular note, the Muskwa-Kechika Management Area (M-KMA) is one of the largest, most diverse wilderness areas in North America, with forests, geological formations, lakes, rivers, waterfalls, hot springs, subalpine and alpine areas, and major wetlands.⁷

Established by provincial statute in 1998, the M-KMA is the largest wilderness area in the Rocky Mountains. It holds a globally significant population of grizzly bears as well as other species such as moose, Stone sheep (*Ovis dalli stonei*) and wolves.⁸

The comprehensive management plan negotiated for the M-KMA balances environmental sustainability and economic stability. The plan is aimed at both conservation and use, enabling highly regulated resource development while also protecting a large, intact and predominantly road-less wilderness. The M-KMA is composed of parks and protected areas, as well as management zones where extractive development is allowed under stringent, best-practice standards.⁹

⁶ T'q Chii Dq? Wadanaa Ne (Before A Long Time Ago People) Archaeological Reconstruction of the Peace River – Northern Region. June 2006 <http://www.livinglandscapes.bc.ca/prnr/index.html>

⁷ Muskwa-Kechika Management Area <http://www.muskwa-kechika.com/>

⁸ Yellowstone to Yukon <http://www.y2y.net/Default.aspx?cid=99&lang=1>

⁹ Ibid

Another critical factor in the ecology (and sustainability) of Northeastern BC is the presence of the forest-dwelling Woodland Caribou, boreal population (*Rangifer tarandus caribou*), which is red-listed by BC, considered threatened by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), and was listed in the federal Species at Risk Act (SARA) in May 2002. A draft recovery strategy for the species was released in 2011.¹⁰ A number of factors have contributed to the decline of caribou in Northeastern BC; however, it is noteworthy that scientists believe habitat alterations (natural and anthropogenic) that provide favourable conditions for prey species such as deer and moose allow predators such as wolves to increase in number and, therefore, have the potential to impact local boreal caribou populations as caribou are taken opportunistically. The goal of the SARA recovery strategy is to stabilize populations that are “not self-sustaining,” which is how populations in Northeastern BC are characterized. One of its series of recommendations is to undertake coordinated actions to reclaim boreal caribou habitat through restoration efforts (e.g., reclaiming industrial landscape features such as roads, old seismic lines, pipelines, cut-lines, temporary roads, cleared areas and reconnect fragmented ranges).

Social Overview

Past and Present

During the last 11,000 years, Northeastern BC witnessed the end of the last major glacial event in North America and the migration of First Nations people into the region. As is reflected in the stone tools they left behind, First Nations people have lived continuously in the region for during the last 10,000 years.¹¹ Today, First Nations in Northeastern BC remain key stewards of the land, and are seeking partnerships based on meaningful consultation and respect for their aboriginal and treaty rights. Many groups are working with non-aboriginal communities and companies towards a prosperous future for the region, building capacity in all types of business and services, and developing enhanced engagement in the regional economy. First Nations are also active investors within the region and many are directly involved in the oil and gas industry or receive remuneration as a result of activity within their respective areas.¹²

Travelling by canoe westward on the Peace river, the Northwest Company established a trading post at Fort St. John in 1806, making it the oldest non-aboriginal settlement on the BC mainland; however, the area did not see much more European settlement until the Klondike Gold Rush in 1898, when a few travellers remained in the Peace, and later when the federal government promoted the area to homesteaders in 1912.¹³ Early homesteaders gradually established communities, relying on the same hard work, self-reliance and friendly demeanour that characterize the region’s people today.

First Nations Communities

The Dunne-za (also known as the Beaver) live in the Peace River Basin and include the Doig River, Blueberry

¹⁰ http://www.sararegistry.gc.ca/default.asp?lang=En&n=B82CFC52-1#_Toc292445162

¹¹ T’q Chii Dq? Wadanaa Ne (Before A Long Time Ago People) Archaeological Reconstruction of the Peace River – Northern Region. June 2006 <http://www.livinglandscapes.bc.ca/prnr/index.html>

¹² North Peace Economic Development Commission

¹³ Excerpts from the historical archive called the “Calverly Collection” located in Dawson Creek. <http://www.calverly.ca/>

River, Halfway River and the Prophet River First Nations.¹⁴ The Beaver and Cree communities of the Sauteau and West Moberly First Nations live in the southern Peace River Basin as does the Tsek'ehne (also known as the Sekani) community of the McLeod Lake Indian Band. The Fort Nelson First Nation is composed of Dene and Cree cultures that live in Northeastern BC, bordered by the Northwest Territories and Alberta borders. Their land use area includes the Liard River Basin east of the Rocky Mountains. The Treaty 11 Dene of the Fort Liard First Nation (Acho Dene Koe) have registered trap lines in BC that border the NWT boundary and include the Liard Basin. The Treaty 8 Dene Tha First Nations from the Alberta-based community of Assumption have registered trap lines that straddle the BC-Alberta border. The Kaska Nation lives in the southeast Yukon, the southern Northwest Territories and in the western portion of the Liard River Basin in BC. The Kaska include the Dease River First Nation at Good Hope Lake; the Daylu Dena Council at Lower Post; and the Kwadacha First Nation at Fort Ware, north of Prince George.¹⁵

Treaty 8 is a historic treaty negotiated by the Government of Canada that includes First Nations in northern Alberta, northwestern Saskatchewan and the southern Northwest Territories. The official Treaty 8 document includes several adhesions from 1899 to 1911. Treaty 8 was extended into BC to include seven First Nations: the Blueberry River, Doig River, Fort Nelson, Halfway River, Prophet River, Sauteau and West Moberly First Nations. McLeod Lake signed the most recent adhesion to BC Treaty 8 in 2000.

The Treaty 8 Tribal Association, based in Fort St. John is a political association that represents five First Nations in Northeastern BC: Doig River, Halfway River, Prophet River, Sauteau and West Moberly. This association is a unified political body that acts as a coordinator, facilitator, and provider of technical support as mandated by the five Chiefs to protect and preserve their aboriginal and treaty rights.¹⁶

Regional Districts

Historically, Northeastern BC was governed by one regional structure called the Peace-Liard Regional District. In 1987, the area was split into the Peace River Regional District (PRRD), encompassing the land drained by the Peace River south of the 58th parallel, and the area north of the 58th parallel, which became the Northern Rockies Regional Municipality (NRRM). As of 2011, the majority (91%) of Northeastern BC's permanent residents live in the PRRD (63,033 residents), with a much smaller share living in the NRRM (6,035 residents).¹⁷ The PRRD is the largest (in terms of land area) regional district in BC and the NRRM—the first regional municipality in BC—encompasses 10% of the province.¹⁸

The biggest population centres in the PRRD are Fort St John (19,873 residents) and Dawson Creek (11,860), with all other towns (e.g., Pouce Coupe, Tumbler Ridge, Hudson's Hope, Taylor and Chetwynd) having much smaller populations. The majority of permanent residents in the NRRM live in Fort Nelson and its neighbouring communities.

The population of the NRRM is actually significantly higher because many of the oil and gas companies are developing their resource on the basis of a “fly-in, fly-out” arrangement whereby employees commute to

¹⁴ <http://www.bced.gov.bc.ca/abed/map.htm>

¹⁵ *Ibid*

¹⁶ <http://www.treaty8.bc.ca/welcome.php>

¹⁷ Assessing the Contribution of the Northeast & Peace River to BC's Exports October 2011, Urban Futures

¹⁸ <http://www.northernrockies.ca/EN/main/visitors/about-municipality.html>

their workplaces from communities outside of the NRRM. Because a high percentage of the workers live in communities outside of the province, many of the economic and financial benefits associated with the development of gas reserves in the area leave the province.

Health Services

The Northern Health Authority's Health Service Delivery Area (HSDA) in Northeastern BC includes a number of facilities, including the Fort Nelson Hospital (which is the only health service centre in the Northern Rockies Regional Municipality), Dawson Creek and District Hospital, and the new Fort St. John Hospital.¹⁹ There are Community Health Centres in Tumbler Ridge, Chetwynd and Hudson's Hope. Additional services for seniors operated by the Northern Health Authority include the North Peace Care Centre in Fort St. John and the Peace River Haven in Pouce Coupe.²⁰

Recruitment and retention of physicians and other health professionals is an ongoing challenge throughout Northeastern BC, particularly in smaller centres.

Education, Training and Regional Infrastructure

Northeastern BC is served by three school districts (SD 59 and 60 in PRRD; SD 81 in NRRM). The post-secondary institutions in the area direct their programs at people looking to become skilled and more qualified in the industries and work sectors found in the region. There is also opportunity for some university courses in the arts and sciences. Northern Lights College, "BC's Energy College," has four campuses in the area, from its original and administrative campus in Dawson Creek to campuses in Tumbler Ridge, Chetwynd and Fort Nelson. Northern Lights College is best known for its Aircraft Maintenance Program, which is internationally recognized. In addition, the University of Northern BC, located in Prince George, is a key educational institution serving the region.

Some important regional and community infrastructure projects include:

- North Peace Regional Airport's new terminal building, completed in 2005, in large part to serve the expanding oil and gas sector;
- current expansion of the Northern Rockies Regional Airport in Fort Nelson, as well as the long-term airport strategic plan in 2010 and business plan in 2011; and
- upgrade of the Sierra Yoyo Desan Road to support oil and gas development in the Horn River and Cordova areas north and east of Fort Nelson.

Economic Overview²¹

In 2006, Northeastern BC contributed 12% of the province's total exports, which is a striking statistic considering the region has only 2% of the province's labour force. Each worker in the region generated almost seven times more exports than the provincial average. The largest export sectors in Northeastern BC are the energy and fuels sector, followed by the mining sector and, to a lesser extent, forestry. The region

¹⁹ http://www.med.ubc.ca/education/md_uhrad/clerkship_electives/bc_community_hospitals/

²⁰ <http://www.northernhealth.ca/OurServices/Facilities.aspx>

²¹ Assessing the Contribution of the Northeast & Peace River to BC 's Exports October 2011, Urban Futures

accounted for 91% of the total value of BC's exports of energy and fuels and 14% of BC's mining exports.

Since 1995, total employment in Northeastern BC has increased by 14%, faster than the 10% increase in its permanent resident population. Despite this, employment growth in the region has not kept pace with employment growth in the rest of the province, which grew by 27% during the same period. This is a result of the nature of resource-based economic activity and the region's ties to international commodity markets, which have experienced many recent boom and bust cycles.

Despite commodity price fluctuations, total employment in Northeastern BC's goods-producing sectors increased by 6% between 1995 and 2010, with strong job growth in construction (86% increase), and forestry and mining (17% increase). Of this, the oil and gas sector accounted for 24% of the goods-producing sector and 27% of the construction employment. Most of the direct employment in the sector comes from initial exploration and drilling activities.

Several major new projects could influence the number of jobs and people in the Peace River and Northeastern BC over the coming years. The most notable of these is the proposed construction of BC Hydro's Site C Dam on the Peace River, which is anticipated to take up to seven years to build and is expected to generate 7,650 person-years of direct construction employment and up to 27,350 direct and indirect jobs during the project.²²

Oil and Gas

Located in the resource-rich Western Canada Sedimentary Basin, Northeastern BC has an abundance of natural gas (and to a lesser extent, oil) and other resources, making BC the second largest producer of natural gas in Canada. Much of the region's natural gas deposits—estimated to be among the largest in North America—are in the early stages of development. Industry has applied the use of proven drilling technology such as horizontal drilling and hydraulic fracturing to reach previously inaccessible gas supplies and significant quantities of conventional and unconventional natural gas (34.8 billion cubic metres in 2010, up 20% from 2001 levels) are extracted from wells, generating \$4.0 billion in land sales and \$500 million in royalties for the provincial government in 2009.²³

The growing supply of natural gas in BC has led to proposals for major export facilities of liquefied natural gas (LNG) on the BC coast and major transmission pipelines from Northeastern BC to these facilities. The realization of these projects could be a catalyst to export Canada's natural gas to international markets other than the United States. Within the oil and gas sector, continued exploration and development of the Horn River Basin and the Montney shale gas formation could boost natural gas production through 2025 and beyond.²⁴ If gas prices remain low, retirements will drive the need for 3,000 new workers by 2020. If prices rise and activity levels increase, 11,300 positions may need to be filled.²⁵ Hundreds of large and small pipeline, well-site construction, trucking, and seismic companies operate in the region, providing support to the industry. Road and facility construction, pipelines, safety and security services, environmental assessment services and land reclamation have created a large workforce directly related to the oil and gas industry. Remote locations and the need for skills to support new technology continue to create labour shortages in the region. Changes in employment demands, coupled with a rapidly retiring workforce

²² BC Hydro http://www.bchydro.com/energy_in_bc/projects/site_c/site_c_an_option/what_is_site_c.html

²³ Assessing the Contribution of the Northeast & Peace River to BC's Exports October 2011, Urban Futures

²⁴ Horn River Basin Producers

²⁵ <http://www.petrohrsc.ca/council-projects/project-list/labour-market-information/provincial-analysis/bc.aspx>

(because of population demographics) and issues of labour force and population growth may become increasingly important in Northeastern BC as economic activity expands.

As shale gas production expands across North America, there is a major shift developing in the North American natural gas industry. Current projections within the US show the demand for Canadian natural gas declining rapidly and approaching zero by 2030. Given the expanding reserves presented by Canadian unconventional gas, this means alternative markets must be developed for Canadian and BC production if BC is to maintain current demand for resources and support this important sector of its economy. Plans for LNG plants on the BC coast will allow Canadian gas to reach global markets and maintain a healthy and viable industry.

The evolution of the oil and gas industry in BC is described in more detail in **Section 4**.

Mining

In the 1980s, economic growth in Northeastern BC was largely due to the development of coal mines southwest of Dawson Creek, in the vicinity of the then new community of Tumbler Ridge. The mining sector still plays an important role in the region's economy, with coal originating from the Brule, Trend and Wolverine mines near Willow Creek and Tumbler Ridge, and barite from the mine in Fireside, close to the Yukon border.²⁶ It is anticipated that the mining sector will continue to play a significant role, with proposed new mining operations near Hudson's Hope (Gething coal project, 40-year mine life), Tumbler Ridge (Roman coal project, 15-year mine life) and near the existing Wolverine mine, also near Tumbler Ridge (Hermann project).²⁷

Forestry

Healthy, diverse forests remain a key long-term asset of Northeastern BC's economy. Although major operations were suspended in the Northern Rockies area when Canfor shut down two mills in Fort Nelson (causing many workers to move to the oil and gas sector), it is believed the high-quality timber basket will attract investment when the markets recover.²⁸ Louisiana Pacific built a new oriented strand board (OSB) plant in Fort St. John in 2005, which was touted to be one of the largest buildings in Northeastern BC. The Canfor sawmill near Fort St. John turns out high-quality, finished lumber products. The Canfor Taylor pulp mill converts sawmill wood waste into saleable wood fibres, marketed as far away as Japan and Germany. More than 350 trucking and logging contractors back up these major operators. The forestry sector generates spin-off jobs and income for many local businesses and has established the industry as a key component of Fort St. John's diversified economy.²⁹ Much forestry activity is generated from oil and gas landholders who have "extra fibre" on hand and are willing to receive bids on it via BC Timber Sales.

In recent years, the use of aspen has increased dramatically in Northeastern BC where it is the main fibre source for several OSB and veneer mills. Other aspen products include dimension lumber, paper, molded

²⁶ Assessing the Contribution of the Northeast & Peace River to BC's Exports October 2011, Urban Futures

²⁷ South Peace Economic Development Commission

²⁸ Northern Rockies Regional Municipality

²⁹ Northern Rockies Regional Municipality

wood composites, molding and trim, crates, pallets, pellets, chopsticks, fruit and vegetable boxes, furniture, fuel and forage for livestock. The combined Annual Allowable Cut (AAC) of deciduous species in the Dawson Creek, Fort St. John and Fort Nelson Timber Supply Areas is almost 2 million cubic metres per year. In 2006, the shipment value for OSB and aspen veneer produced in BC was \$2.2 billion.³⁰

Recreation and Tourism

Northeastern BC is a sought-after destination for adventure seekers, and tourism's importance to the regional economy is growing. The opening of the Alaska Highway to the public in 1948 dramatically increased access to the Northeast region.

Three hundred thousand people visit the region every year, many exploring the Alaska Highway and the region's beautiful parks, including the Northern Rocky Mountains and Kwadacha Wilderness Parks, Muncho Lake Provincial Park, Stone Mountain Provincial Park, the Liard River Hot Springs and many other regional parks and recreation facilities. The area is replete with mountains for hiking and skiing; lakes and rivers for swimming, canoeing and fishing; and a countryside and park system that provides for camping, snowmobiling, hunting and wildlife spotting. Among other attractions, the area boasts Kinuseo Falls, which surpasses the height of Niagara Falls, and the newly opened six-day Monkman Pass Memorial Trail through the Northern Rockies.

In the early 1990s, a large fossilized bone bed exposed on bedrock was discovered on the Sikanni Chief River. The find turned out to be an extremely large ichthyosaur, more than 20 m in length, spurring a new (but very old) dimension of the region's unique attributes. The community of Tumbler Ridge is now known as a destination for dinosaur enthusiasts and has a museum, anthropological society and walking trail dedicated to the history of the dinosaurs in the region.³¹

Power Generation

Two large facilities in the Peace Region (Peace Canyon Dam and WAC Bennett Dam) produce 38% of the province's hydroelectric power. The most relevant today, however, is the proposed Site C Dam project on the Peace River. First proposed in the 1970s, the Site C Dam has been revisited four different times. Site C is currently at Stage 3 of a joint BC Environmental Assessment Office (BC EAO)–Canadian Environmental Assessment Agency (CEAA) review process and consists of constructing and operating a dam and 1100 megawatt hydroelectric generating station, creating an 83 km long reservoir, and realigning four sections of Highway 29 and two 77 km transmission lines along an existing transmission line right-of-way connecting Site C to the Peace Canyon Dam.³²

The AltaGas Bear Mountain Wind Park, located to the southwest of Dawson Creek, is the first fully operational wind park in BC. The wind park was established by the Peace Energy Cooperative and contributes a total of 102 megawatts of power, enough to power most of the South Peace region. In addition, the Dokie Wind Project in Chetwynd is fully operational and is estimated to generate enough power for 32,000 homes (331 gigawatt hr/yr). Another wind park, the Finavera Wildmare Ridge Wind

³⁰ FORREX research paper

³¹ Northern BC Travel Guide 2012 <http://viewer.zmags.com/publication/30ec1aa3#/30ec1aa3/1>

³² BC Environmental Assessment Office

project near Chetwynd, may be operational by November 2012.

Agriculture³³

Agriculture was the first major driver in the “settler economy” of the Peace region and remains important to this day, with approximately 1,730 farms operating (the vast majority in the PRRD) and generating \$77 million in gross farm receipts per year. Unique among agricultural regions in BC, the Peace region is generally considered to be a prairie, boasting high agricultural productivity in part due to long daylight hours to compensate for a short growing season. Approximately 7.5% of the region’s area is within the Agriculture Land Reserve (ALR), which represents 32% of the total provincial ALR.

Wheat, and later barley and oats for livestock, were the first crops grown by settlers, and the 1930s began to see increased production and exports. Grains are still the mainstay of local agriculture. The region continues to ship large quantities of high-quality grain and oil seeds to world markets, and produces 90% of the province’s grain. The area supports a variety of other agricultural enterprises and is seeing growing diversification, including game farming of bison and reindeer, as well as exotic livestock such as llama, alpaca, fox, ostrich, emu and wild boar. The Peace region is home to some of the largest bison herds in the province, producing nearly three-quarters of BC’s bison. Beekeeping, once a major industry, has shown a decline in recent years.

³³ Guide to BC’s Agriculture Resources http://www.aic.ca/bc/uploads/growbc/5_regions.pdf

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8.3 List of Individuals and Organizations that Participated in the Public Engagement

This is a list of individuals and organizations that participated in the Phase 1 - HHRA public engagement process; in the case of individuals, those who gave consent to have their names listed. Formal submissions received are set out in a separate **Compendium of Submissions**.

Individuals

Abel, Dawn & Ken – Public Members, Rural Roots & Resources
Ackerman, Andy – President, Myriad Consulting Inc.
Ackerman, Lori – Mayor, City of Fort St. John
Anderson, Will – Public Member, Rural Roots & Resources
Andres, Katrina – Environmental Law Clinic, University of Victoria
Arnold, Jaylene – Northern Rockies Regional Municipality
Arsenault, Bennett – Environmental Law Clinic, University of Victoria
Avery, Wilma – Resident, Peace River Regional District
Badenhorst, Dr. Charl – Northeast Medical Health Officer, Northern Health Authority
Badine, Miranda – Fort Nelson First Nation
Bakker, Chris – Encana Corporation
Bamping, Hal – Process Improvement/Growth Lead, Shell Canada
Banham, Fred – Chief Administrative Officer, Peace River Regional District
Banman, Janet – Peace River Internet Society
Barradell, Bob – City of Fort St. John
Beck, Lucy – Northern Health Authority
Bell, Courtney – Lamplighters Hospice, Fort Nelson
Berg, Barry – Public Member, Rural Roots & Resources
Biggar, Liz – Northern Environmental Action Team
Bird, Bryant – Community Service Director, District of Taylor
Bolin, Trevor – Councillor, City of Fort St. John
Brenton, Kym – Fort Nelson First Nation
Brndiar, Leslie – Fort Nelson General Hospital
Brown, Mavis – Lamplighters Hospice, Fort Nelson
Brownlee, Alec – Councillor, District of Chetwynd
Burley, Richard – Resident, City of Fort St. John

Burton, Mary Jane – Resident, Hasler Flat

Burzek, Mike – Manager, Emergency Response and Safety Engineering, BC Oil & Gas Commission

Busch, Ernestine – Fort Nelson Employment

Caisley, Mike – Director, Peace River Regional District

Carroll, Kevin – Emergency Response Coordinator, Huron Energy

Case, Mark – Fort Nelson First Nation

Cavanagh, Mrs. – Resident, Peace River Regional District

Cheyne, Rob – Vector Geomatics

Chingee, Alec – Land Referral Office, McLeod Lake Indian Band

Chipesia, Dale – Blueberry River First Nation

Chipesia, Patrick – Blueberry River First Nation

Christensen, Bruce – Councillor, City of Fort St. John

Christman, Denise – Fort Nelson First Nation

Clarke, Brian & Catherine – Residents, Pink Mountain Area

Clayton, Anne – Farmers’ Advocacy Office

Colwell, Bill & Helen – Public Members, Rural Roots & Resources

Cote, Jeremy – Resident, Fort Nelson

Crop, Patty – Resident, Peace River Regional District

Daniel, Dean – Public Member, Rural Roots & Resources

Davies, Dan – Councillor, City of Fort St. John

Davies, Gordon – Public Works Superintendent, District of Taylor

Davis, Joe – Lands Technician, Blueberry River First Nation

Davis, Shawn – Blueberry River First Nation

Derfler, Brian – President, Peace Environment and Safety Trustees Society

De Smit, Angela – Health Service Administrator, Northern Health Authority

Dettieh, Laurelle – Fort Nelson First Nation

deWeerd, Melany – Director of Finance, District of Taylor

Dewetter, Brenda – Public Member, Rural Roots & Resources

deWolf, Julie – Environmental Law Clinic, University of Victoria

Dickie, Kathi – Chief, Fort Nelson First Nation

Dobrowolski, Greg – Deputy Chief Administrative Officer, City of Dawson Creek

Dolan, Laurie – Executive Director, Energy Services BC – Northern Rockies Region

Donaldson, Tria – Resident, Vancouver

Doornbos, Harv – Public Member, Rural Roots & Resources
Dueck, Joanne – Principal, Rolla Traditional School
Dunbar, Darwin – Public Member, Rural Roots & Resources
Dunk, Steve – Canadian Association of Petroleum Producers
Dunn, Richard – Encana Corporation
Eglinski, Kim – Councillor, Northern Rockies Regional Municipality
Elliott, Barry – Chief Administrative Officer, District of Tumbler Ridge
Embree, David – Resident, District of Chetwynd
Ewert, Tim – Peace Environment & Safety Trustees Society
Feeney, Kate – Environmental Law Clinic, University of Victoria
Felhauer, Dennis – Public Member, Rural Roots & Resources
Field, Betty & Bill – Public Members, Rural Roots & Resources
Field, William – Councillor, Halfway River First Nation
Fleming, Doug – Chief Administrative Officer, District of Chetwynd
Fitch, Rio – Resident, Rolla
Fynn, Larry – Mayor, Village of Pouce Coupe
Fosum, Mary – Resident, Tomslake
Galbraith, Rochelle – Councillor, District of Chetwynd
Gitscheff, Carl – Dawson Creek Trappers Association
Goodings, Karen – Chair, Peace River Regional District
Gowman, Elvin – Farmers’ Advocacy Office
Graff, Kathie – Public Member, Rural Roots & Resources
Granville, Geoff – Contractor, Canadian Association of Petroleum Producers
Green, Leona – Resident, Peace River Regional District
H, Wallace – Scotiabank, Fort Nelson
Haddock, Mark – Lawyer, Environmental Law Clinic, University of Victoria
Hadland, Arthur – Director, Peace River Regional District
Hake, Stacy – Administrative Assistant, Northeast Medical Health Office
Harris, Marilyn & Stan – Public Members, Rural Roots & Resources
Harsch, Greg – Fire Chief/Public Works, Village of Pouce Coupe
Heiberg, Dave – Councillor, District of Hudson’s Hope
Henderson, Deryl – Fort Nelson First Nation
Henderson, Kevin – Water Treatment Plant, City of Dawson Creek

Hiebert, Wayne – Director, Peace River Regional District
Hill, Lois – Director, Peace Environment and Safety Trustees Society
Hogberg, Glenn – Public Member, Rural Roots & Resources
Hogberg, Ulla – Resident, Progress
Homan, Megan – Resident, Peace River Regional District
Hunter, Marilyn – Resident, Peace River Regional District
Irwin, Don – Chair, Northeast Oil and Gas Health Advisory Committee
Jackson, Wayne – Talisman Energy Inc.
Jarvis, Art – Executive Director, Energy Services BC – Peace Region
Jarvis, Fred – Mayor, District of Taylor
Johansson, Gwen – Councillor, Hudson’s Hope
Jonsson, Corey – BC Oil and Gas Commission
Kalinczuk, John – Water Treatment Plant, City of Dawson Creek
Kalischuk, George – Resident, District of Chetwynd
Keeler, Val – Fort Nelson Community Literacy Society
Kenny, Sue – Councillor, City of Dawson Creek
Kettner, Marg – Public Member, Rural Roots & Resources
Klassen, Gord – Councillor, City of Fort St. John
Koechl, Rick – Old Hope Road Residents Group, City of Fort St. John
Krzyzanowski, Judi – Researcher/Consultant
Kunz, Johanna – Resident, Rolla
Kut, Gerta – Councillor, Village of Pouce Coupe
Laird, Brita – Health Planning Advisor, Blueberry River First Nation
Laird, David – Band Administrator, Blueberry River First Nation
Lee, Jason – Treaty 8 Tribal Association
Lehmann, August & Bonnie – Flying L Ranch Services
Lemmon, Sandra – Economic Development Officer, North Peace Economic Development Commission
Leverkus, Sonja – Resident, Fort Nelson
Lieverse, Brian – Community Relations Advisor, EnCana
Lindsey, Kiki – Fort Nelson First Nation
London, Clara – Resident, Peace River Regional District
Lowe, Lana – Fort Nelson First Nation
Lythall, Peter – Nortech

MacDonald, Toni – Fort Nelson Community Literacy Society
Mackey, Dr. Paul – Physician, Fort St. John
Malkinson, Duncan – Councillor, City of Dawson Creek
Mascarenhas, Audrey – Chief Executive Officer, Questor Technology Inc.
Matilpi, David – Fort Nelson First Nation
Maueld, Trina – Fort Nelson First Nation
McCarly, Charlie – Fort Nelson First Nation
McConnell, Skye – Team Lead, Public Consultation, Shell Canada
McCullough, Sarah – Spectra Energy, Vancouver
McFayden, Terry – Councillor, City of Dawson Creek
McGuiness, Dione – ConocoPhillips
McLean, Randy – City Manager, Northern Rockies Regional Municipality
McLeod, Charlette – Administrator, District of Taylor
McPhail, Michael – Finance Officer, Village of Pouce Coupe
Merrick, Gordon – Councillor, Village of Pouce Coupe
Merrick, Irene – Peace Environment and Safety Trustees Society
Miller, Mary – Resident, Rolla
Miller, Vincent – Resident, Peace River Regional District
Milner, Dave – President, Fort Nelson Chamber of Commerce
Moore, David – Manager, Woodlands Inn, Fort Nelson
Morrison, Geoff – Canadian Association of Petroleum Producers
Morey, Chris – Hospital Administrator, Fort Nelson
Murray, Ryan – Peace Region Internet Society, Tumbler Ridge
Neal, Dave – Resident, District of Taylor
Nefstead, Matthew – Environmental Law Clinic, University of Victoria
Neil, Jim & Helen – Public Member, Rural Roots & Resources
Neil, Les – Public Member, Rural Roots & Resources
Newby, Carson – Community Affairs, Shell Canada
Nichols, Merlin – Mayor, District of Chetwynd
Okada, Grace – Resident, District of Hudson's Hope
Osbourne, Todd – Councillor, Northern Rockies Regional Municipality
Parfitt, Ben – Resident, Victoria
Phillips, Rosemary – Resident, Peace River Regional District

Pimm, Pat – Member of Legislative Assembly, Peace River North

Pine, Jim – Resident, Peace River Regional District

Platman, Jen – Public Consultation, Shell Canada

Pokiak, Roslyn – Lands Manager, Halfway River First Nation

Prouse, Graham – Fort Nelson Chamber of Commerce

Quirk, Tim – Environmental Law Clinic, University of Victoria

Reade, Warren – Aboriginal Health Improvement Committee, Northern Health Authority

Rempel, Jake – Public Member, Rural Roots & Resources

Rempel, Paul – Public Member, Rural Roots & Resources

Rempel, Viktor – Public Member, Rural Roots & Resources

Ross, Kaleena – Business Retention & Expansion Coordinator, North Peace Economic Development Commission

Sabulsky, Leo – Fire Chief/Emergency Coordinator, District of Chetwynd

Sandborn, Calvin – Lawyer, Environmental Law Clinic, University of Victoria

Savor, Verna – Resident, Peace River Regional District

Schallock, Ernie & Linda – Residents, Peace River Regional District

Schembri, Jerrilyn – Director, Peace River Regional District

Scholten, John – Spectra Energy

Shadbolt, Donna & Ken – Public Members, Rural Roots & Resources

Shope, Helen – Resident, Cecil Lake Area

Shuman, Cheryl – Councillor, City of Dawson Creek

Simlik, Vicky – Peace Environment and Safety Trustees Society

Simpson, Bob – Member of Legislative Assembly, Cariboo North

Simpson, Lloyd – Resident, Peace River Regional District

Smalley, Colleen – Public Member, Rural Roots & Resources

Smithard, Ray – Public Member, Rural Roots & Resources

Smithard, Stanley – Public Member, Rural Roots & Resources

Stanek, Kandys – Imperial Oil

Stebbing, Alan – Fire Chief/Building Inspector, District of Taylor

Stewart, Byron – Councillor, City of Fort St. John

Strasky, Jim – Resident, Farmington

Streeper, Bill – Mayor, Northern Rockies Regional Municipality

Stuart, Rob – Consultant, Human Environment Group

Sutherland, Irving – Resident, Peace River Regional District
Sutherland, Pat – Public Member, Rural Roots & Resources
Taillefer, Brent – Councillor, District of Taylor
Temple, Becky – Northern Health Authority
Tietjen, Johann – Public Member, Rural Roots & Resources
Urt, Linda – Resident, Peace River Regional District
Verbruggen, Joanne & Tony – Public Members, Rural Roots & Resources
Vigeant, Ron – Councillor, Northern Rockies Regional Municipality
Wagar, Glenda – Resident, Peace River Regional District
Waldon, Lisa – Resident, Peace River Regional District
Weilinger, Gary – Spectra Energy, Vancouver
Weingart, Joe & Kathy – Public Members, Rural Roots & Resources
Weisgerber, Laura – Councillor, District of Chetwynd
Wetherill, John – Public Member, Rural Roots & Resources
White, Angela – Encana Corporation
Whiten, Reg. C – Watershed Steward, City of Dawson Creek
Wilbur, Shaely – Councillor, City of Dawson Creek
Wrangler, Colleen – Resident, City of Dawson Creek
Wood, Peter – Resident, Peace River Regional District

Organizations

BC Oil and Gas Commission
Blueberry River First Nation
Canadian Association of Petroleum Producers
City of Dawson Creek
City of Fort St. John
Dawson Creek Trappers Association
Dawson Creek Watershed Society
District of Chetwynd
District of Hudson's Hope
District of Taylor
District of Tumbler Ridge

Doig River First Nation
Energy Services BC
Environmental Law Clinic, University of Victoria
Farmers' Advocacy Office
Fort Nelson Chamber of Commerce
Fort Nelson First Nation
Fort St. John Chamber of Commerce
Halfway River First Nation
Ministry of Aboriginal Relations and Reconciliation
Ministry of Health
Ministry of Energy and Mines
Ministry of Environment
Northeast Economic Development Commission
Northeast Oil and Gas Health Advisory Committee
Northern Health Authority
Northern Rockies Regional Municipality
Old Hope Road Residents Group
Peace Environment and Safety Trustees Society
Peace Region Internet Society
Peace River Regional District
Progress Energy
Prophet River First Nation
Rural Roots & Resources
Saulteau First Nation
Tumbler Ridge Inter Agency Committee
Village of Pouce Coupe