

Oil and Gas Land Use in the Fort Nelson LRMP area of British Columbia

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Photo sources:

Flower photo shot at Toad River, page 10: Tim Vo Photography.

Other photos, Commission staff.

About the

BC Oil and Gas Commission

The BC Oil and Gas Commission (Commission) is the single-window regulatory agency with responsibilities for regulating oil and gas activities in British Columbia, including exploration, development, pipeline transportation and reclamation.

The Commission's core services include reviewing and assessing applications for industry activity, consulting with First Nations, cooperating with partner agencies, and ensuring industry complies with provincial legislation and all regulatory requirements. The public interest is protected by ensuring public safety, respecting those affected by oil and gas activities, conserving the environment, and ensuring equitable participation in production.

For general information about the Commission, please visit www.bcogc.ca or phone 250-794-5200.



Mission

We regulate oil and gas activities for the benefit of British Columbians.

We achieve this by:

- Protecting public safety,
- Respecting those affected by oil and gas activities,
- Conserving the environment, and
- Supporting resource development.

Through the active engagement of our stakeholders and partners, we provide fair and timely decisions within our regulatory framework.

We support opportunities for employee growth, recognize individual and group contributions, demonstrate accountability at all levels, and instill pride and confidence in our organization.

We serve with a passion for excellence.

Vision

To be the leading oil and gas regulator in Canada.

Values

Respectful

Accountable

Effective

Efficient

Responsive

Transparent

Oil and Gas Land Use

This report is produced by the BC Oil and Gas Commission (Commission) to provide government, industry, First Nations and stakeholders with an understanding of the surface area used to date by oil and gas activities in the Fort Nelson Land and Resource Management Plan (FNL RMP) area and a description of the methodology used to calculate the areas by activity.

The Commission identified a need for a standardized methodology for the measurement of surface disturbances caused by oil and gas activity. The measurement standards defined here are what the Commission will build on to calculate the changes in surface area used by oil and gas activity going forward. The report focuses on two aspects of oil and gas activity in the FNL RMP area:

- The type of surface activity.
- The surface area used by each activity.

This report provides an overview of surface land use by well sites, pipelines, roads, geophysical exploration programs, facilities and associated oil and gas activities up to and including January 2013 for the FNL RMP area. It also explains the methodology used to collect data, sources, assumptions and limitations and how the Commission is actively working to improve future statistical reporting.

Future reports, including Area-based Analyses, will use the methodology and measurements outlined in this report and are available online at www.bcogc.ca.



What Does the Commission Regulate?

The Commission's core services and related processes are governed by the Oil and Gas Activities Act (OGAA). OGAA provides statutory authority to the Commission to permit oil and gas activities. Under OGAA, the Commissioner is the statutory decision maker, with authority to make or delegate decisions enabled by specified enactments.

OGAA enables regulation of surface land use primarily through the Environmental Protection and Management Regulation (EPMR). The EPMR regulates actions a permit holder and a person carrying out an oil and gas activity must take, or refrain from taking, to protect and/or effectively manage the environment. The regulation also outlines procedures for site restoration and reclamation by permit holders when the site is no longer required for oil and gas activities. Authority for certain activities has been delegated to the Commission through specified enactments (see Appendix I for a list of the OGAA specified enactments and provisions).

These enactments also establish compliance and enforcement oversight. Memoranda of Understanding (MOUs) and other agreements also provide the Commission with regulatory guidance. As a result, the Commission acts as a single-window agency with responsibility for regulating nearly all aspects of oil and gas activities.

What Is Not Regulated By The Commission?

Certain activities associated with oil and gas activities are not regulated by the Commission. Other agencies are involved in the regulation of these associated activities in British Columbia.

These include but are not limited to:

- Ministry of Energy, Mines and Natural Gas for associated activities falling under the Mines Act (such as large quarries).
- National Energy Board for the regulation of interprovincial pipelines and facilities integral to those pipeline systems, although the Commission has been given the authority to issue authorizations under some of the specified enactments for these pipelines (except the Enbridge Northern Gateway Pipeline).
- Ministry of Environment for wildlife and contaminated sites.
- Ministry of Forests, Lands and Natural Resource Operations for long term water licenses.

For the purposes of this report the Commission has calculated results based on the use of land to support oil and gas activities, regardless of the responsible regulatory agency. Data has been obtained from other regulatory agencies; however, the Commission does not manage this data and has merely accepted and used the data as provided.

Why Measure Oil and Gas Activity?

In British Columbia, government establishes strategic land and resource objectives by way of legislation, policy, and land use planning. The Commission regulates crude oil and natural gas (oil and gas) activities by following legislation and policies. The Commission permits oil and gas exploration and development and protects public safety, respects those affected by oil and gas activities, conserves the environment and supports resource development.

A shift to "unconventional" gas development is opening up opportunities to improve the understanding of the interplay between surface use and subsurface resource development and assess the surface area used by oil and gas activities. The Commission and the provincial government are working together to enhance resource stewardship by collaborating with industry, First Nations and other stakeholders to increase land, water, wildlife and forest conservation.

The Commission is undertaking an Area-based Analysis approach to enhance resource stewardship and reduce the environmental and social effects of oil and gas activity in British Columbia. This approach gathers information specific to unconventional gas basins and other defined areas to support informed regulatory decisions. Area-based analysis evaluates oil and gas activity at the landscape level in order to better understand the

relationship between various oil and gas activities, and to implement initiatives to reduce overall surface impacts.

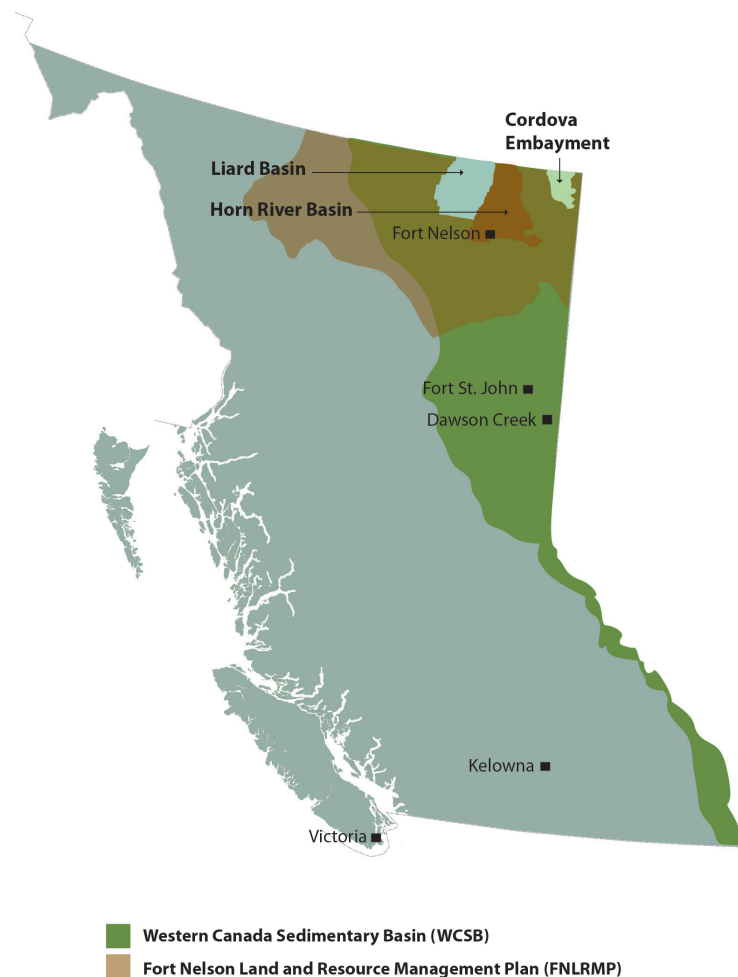
The Commission recognizes area-based analysis requires a baseline calculation of the surface area used to support oil and gas development and identified a need for a standardized methodology for the measurement of surface area disturbances for oil and gas activity. The analyses for the Liard, Horn River, Montney and Cordova basins will be summarized in area-based analyses produced by the Commission using the methodology and measurements outlined in this report.

The measurements used here serve as a template for future reporting of oil and gas land use. For this report, the Commission chose to concentrate on the FNL RMP area (Figure 1) since it is managed under a comprehensive land use management framework encompassing three active shale basins: Liard, Horn River and Cordova.

In developing the Area-based Analysis approach, the Commission will build on the methodology explained in this report on future analyses of oil and gas activity in British Columbia.

Figure 1

The FNL RMP encompasses approximately 9.8 million hectares of Crown land and is represented by the brown shaded area.



What and Where is Oil and Gas Activity?

Oil and gas exploration and development is concentrated in northeast British Columbia, particularly in the Montney and Horn River Basins. As the resource potential of these areas continues to grow and industry shifts from land acquisition to gas extraction, expanded infrastructure will be required for development, production, processing and transportation of gas. Directional and horizontal drilling used in unconventional technologies is reducing the effects of new development on plants and wildlife since companies can locate operations where there is less impact.

The Commission works proactively to reduce environmental and social impacts at all stages of oil and gas activity including: reviewing and assessing applications for industry activity, consulting with First Nations, ensuring industry complies with provincial legislation and cooperating with partner agencies. The public interest is protected through the objectives of ensuring public safety, protecting the environment, conserving petroleum resources and ensuring equitable participation in production.



Patterns of Oil and Gas Development

Oil and gas development in British Columbia is referred to as either conventional or unconventional. Conventional oil and gas exploration refers to the exploration and development of porous and permeable rock formations in the subsurface. These types of reservoirs are typically less than 20 metres in thickness and have well defined and limited areal extent. By comparison, unconventional reservoirs such as fine grained sandstones, siltstones and shales are widespread. They occur over large areas and individual formations can reach thicknesses in excess of 300 metres. During both conventional and unconventional drilling operations, sumps or tanks are used to contain drilling and waste fluids. Pipelines connect all producing gas wells to markets and most oil wells will have pipeline infrastructure in place to transfer the oil to a facility. Wellpads are accessed by a combination of all-season and/or winter access roads, and occasionally by air.

Conventional Development

Conventional development targets porous formations where oil and gas will flow to the surface from a large area surrounding the wellbore. Conventional gas plays are called “pools” and are typically limited in areal extent and have discrete boundaries. When developing conventional oil and gas pools, drilling and production operations typically require well pads separated by 500 to 1,500 m (photo top left) with one vertical well per pad. Land use patterns associated with single pool oil and gas development have changed little over the years.



Unconventional Development

Unconventional gas resources cover vast subsurface areas and are often referred to as “shale basins” or simply “basins”. Unconventional development in British Columbia primarily focuses on gas held in formations with less porosity that cannot be produced from using conventional drilling and completion methods. These “tight” formations must be fractured to allow the gas to be extracted. The technology used to extract gas by unconventional means is evolving rapidly and surface development patterns are changing with the advancements.

A typical unconventional development model is to space drill pads relatively uniformly across the basin on the premise gas is evenly distributed and equally accessible throughout the targeted area (photo to bottom right). Drilling is typically continued horizontally when the target formation is reached, extending 2,500 metres or more from the surface location. Unconventional well pads can be widely spaced several kilometres apart and one pad can accommodate 16 wells or more. As a result, less total surface area and fewer wellpads are required to access the same subsurface volume as conventional development.

Oil and Gas Activities

Seismic Lines

Oil and gas companies use geophysical exploration to indicate the location and characteristics of subsurface formations. The surveys send mechanical energy into the ground and record reflected or refracted energy waves. This activity requires linear clearings called seismic lines to allow the use of sounding equipment.

The Commission issues permits for geophysical exploration and regulates the activity. Geophysical exploration programs can be conducted by any qualified contractor without the need to hold subsurface tenure.

Historically, seismic lines were cleared with a bulldozer (“cat-cut”) and the wide clearings disturbed mineral soils which were slower to regenerate. Over the past 10-15 years, low impact seismic techniques have been developed. Seismic lines are now often cleared manually or using a mulching machine and meander to avoid important ecological features such as wildlife trees. This results in significantly less surface disturbance (Figures 3 and 4) and a much faster return to a natural state.

Figures 3 and 4: Seismic Line Cleared Manually and Seismic Line Cleared with a Mulching Machine



Figure 5: Photo of Typical All Season Road



Roads

Roads are constructed and maintained by industry operators to facilitate exploration and production of oil and gas. Special terms and conditions may be applied to any road permit.

Centralized facilities and multi-well pads reduce the number of roads needed and focus truck traffic on trunk roads, since multi-well pads can house equipment for multiple wells at one location. Existing roads such as highways and forestry roads are used where possible and in some areas snow or ice roads may be constructed during the winter. If there is significant projected activity for an area, a winter road may be upgraded, or an all season road built (Figure 5), to allow year round access. The Commission provides approvals for roads directly associated with oil and gas development.

Pipelines

Pipelines are constructed to transport oil and gas products from operations. Flowlines connect most producing wells to larger trunk lines to take the oil or gas to processing facilities or directly to market. The majority of pipelines in British Columbia are buried and are regulated by the Commission.

Figure 6: Example of Multi Wellpad Facility



Wells

Oil and gas companies drill wells to extract oil and gas. Wells are also drilled to produce or dispose of water used in exploration and development. To drill a well, operators must hold subsurface tenure and obtain a permit to build a wellpad. The wellpad houses the equipment required to drill and complete one or more wells (Figures 6 and 7). If the well proves successful, the wellpad will also be used for the production wellhead and the necessary equipment to produce oil or gas.

Unconventional technology has allowed for more wells on a single wellpad, creating a larger footprint in one area, but reducing the overall number of wellpads in a given area.

Facilities

Facilities are defined as systems of vessels, piping, valves and other equipment used to gather, process, measure, store and/or dispose of petroleum, gas, water and waste. Oil and gas are processed at these facilities for transport to market. Oil and gas facilities also include batteries (for storage of crude oil and other liquids), compressors, dehydrators, flare sites and metering sites. The Commission permits and regulates the majority of oil and gas facilities in the province.

Other Oil and Gas Infrastructure

Other oil and gas activities that do not fit into the above categories include borrow pits (to obtain fill material), above ground water lines, flare stacks (to burn gas for flow testing or to reduce pressure), helipads, airstrips, power lines and campsites. The Commission regulates the majority of these activities where they are directly related to oil and gas operations.

Figure 7: Example of Multi Wellpad





Methodology and Data Limitations

The calculation of the total surface area used by oil and gas activities is primarily based on interpretation of industry submitted spatial data, satellite imagery and government mapping. The majority is Commission data with supplemental checks against other data sources. The calculations are derived from a Commission developed methodology using the data sources, assumptions and limitations detailed in Appendix II.

Anthropogenic disturbances were classified and responsibility for each disturbance was assigned to the appropriate industrial use wherever possible, which allowed a calculation of the net surface area used by oil and gas activities. The analysis will be refined and

updated as data and methodologies are improved.

Given the known data limitations, the Commission's methodology errs on the side of a larger number of surface disturbances than may actually exist. For example, Terrain Resource Information Management Program II (TRIM II) data, which is largely based on the interpretation of older aerial photographs, likely overestimates the number of seismic lines in the FNL RMP. To reduce this error, the Commission has used a preliminary sampling method to identify seismic lines versus other linear features such as roads; however, vegetation regrowth that has restored ecological function to old seismic lines has not been factored into the calculations presented.



Land Use Results – FNL RMP

The Commission calculated the surface footprint resulting from the following disturbances:

- Seismic lines (resulting from geophysical exploration)
- Roads
- Wells
- Pipelines
- Facilities
- Other oil and gas Infrastructure (such as camps)

As shown in Table 1, the area used by all oil and gas activities in the FNL RMP is 1.51 per cent of the total area. The Horn River and Cordova basins are the most developed, approaching three per cent due to existing conventional development, while the Liard Basin is relatively untouched at 1.28 per cent. This report also isolates oil and gas surface activity in the Western Canada Sedimentary Basin since this provides a more accurate picture of the percentage of surface disturbance where oil and gas is found, at 2.36 per cent of the area.

Table 2 summarizes the surface area used by oil and gas activities within the FNL RMP. Detailed analysis of each of the basins is shown in Table 3 with corresponding map of each basin in Figure 8.

Table 1: Summary of Results

Reporting Area	Total (ha) of Area	Net Area Used for Oil and Gas Activities**	Per cent of Reporting Area
FNL RMP	9,868,063	148,832	1.51
WCSB within FNL RMP	6,310,587	148,728	2.36
Horn River*	1,145,989	36,473	3.18
Liard*	934,304	11,938	1.28
Cordova*	315,867	9,734	3.08
* These areas may vary in other surface area related reports due to data uncertainties, improvement activities, different assumptions and more detailed analyses of oil and gas surface area use through area-based analysis.			
** The Net area occurs when there are overlapping permit types sharing the same area, this overlap is removed in the Net area.			

Table 2: Surface Area Used for Oil and Gas Activities in the FNL RMP

Activity	Total (ha)	Per cent of FNL RMP
Wells	6,415	0.065
Pipelines	13,149	0.130
Roads	30,835	0.310
Facilities	514	0.005
Other Oil & Gas Activities	6,120	0.062
Geophysical Exploration (seismic lines)	100,898	1.020
Total Area	9,868,063	
Total Area Used for Oil and Gas Activities	157,931	1.600
Net Area* Used for Oil and Gas Activities	148,832	1.510
* The Net area occurs when there are overlapping permit types sharing the same area, this overlap is removed in the Net area.		

Figure 8: Shale Gas Basins within the FNL RMP

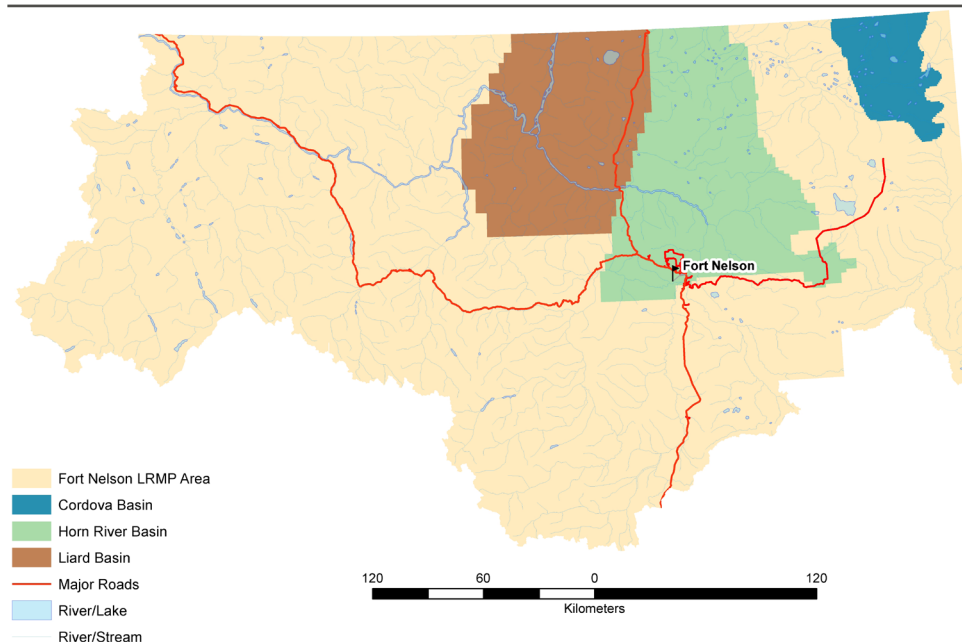


Table 3: Surface Area Used for Oil and Gas Activities by Shale Gas Basins Within the FNL RMP

Activity	WCSB Area (ha)	Per cent of WCSB	Horn River Basin* (ha)	Per cent of Horn River Basin	Liard Basin* (ha)	Per cent of Liard	Cordova Basin* (ha)	Per cent of Cordova
Wells	6,400	0.10	1,240	0.11	367	0.04	498	0.16
Pipelines	13,140	0.21	2,630	0.23	1,176	0.13	1,182	0.37
Roads	30,804	0.49	6,489	0.57	3,612	0.39	2,973	0.94
Facilities	514	0.01	285	0.02	45	0.005	15	0.01
Other Oil & Gas Permits	6,101	0.10	3,838	0.33	506	0.05	347	0.11
Geophysical Exploration (seismic lines)	100,860	1.60	23,941	2.09	7,280	0.76	5,633	1.78
Total Area	6,310,587		1,145,989		934,304		315,867	
Total Area Used for Oil and Gas Activities	157,821	2.50	38,424	3.35	12,989	1.39	10,651	3.37
Net Area** Used for Oil and Gas Activities	148,728	2.36	36,473	3.18	11,938	1.28	9,734	3.08

* These areas may vary in other surface area related reports due to data uncertainties, improvement activities, different assumptions and more detailed analyses of oil and gas surface area use through area-based analysis. ** When oil and gas activities share the same area with other uses, the overlap is removed to calculate the Net area.

Next Steps

This report presents a snapshot of existing oil and gas land use in support of analyses specific to the Liard, Horn River and Cordova basins and provides a baseline to compare future development to.

Measuring oil and gas activity is one way the Commission is enhancing its resource stewardship and increasing its understanding of the interplay between surface and subsurface impact. The Commission is undertaking an Area-based Analysis approach to gather information and data specific to each basin to allow for better informed regulatory decisions. The approach evaluates oil and gas activity in order to improve understanding of the relationship between various oil and gas activities across a specific basin, and to implement initiatives to reduce the surface and subsurface impact.

A key element of each area-based analysis is the baseline definition of the surface area already used for oil and gas activity. A large proportion of this area is presently taken up by seismic lines resulting from geophysical exploration. The land use will change over time as the pattern of land use changes to unconventional development and as anthropogenic impacts are reclaimed or naturally recover. Ultimately, natural succession and reclamation will restore the surface area used to a biologically functional state. As a result, the land use report will be updated periodically to reflect landscape changes. The analysis for each basin

will be summarized in basin-specific analysis reports produced by the Commission and updated regularly to reflect current land use reporting.

Next steps include:

- Periodically updating analyses through basin-specific reports to reflect future oil and gas activities and to report on outcomes.
- Investigating knowledge gaps to improve the data. The Commission recognizes the limitations with the data used for these calculations and the methodology errs on the side of a higher number of surface disturbances than may actually exist.
- Reviewing and improving the data assumptions providing the framework for analysis. For example, vegetation regrowth and potential surface recovery have not been factored into any of the calculations presented. Future reporting may incorporate calculations of vegetation regrowth and other relevant parameters.
- Continually updating processes and procedures in response to public input gained through project notification and consultation, and in response to feedback from industry, First Nations and stakeholders.
- Working with government to improve outcomes and incorporating new government direction as it becomes available.

More Information

Contact www.bcogc.ca

This report is updated as required. For specific questions or enquiries regarding this report, please contact:

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Appendix 1: OGAA Specified Enactments

Authority for certain activities has been delegated to the Commission through Specified Enactments. These enactments set approvals or authorizations and establish compliance and enforcement oversight. Specified enactments for oil and gas activities and related provisions are listed below in Table 4.

Table 4: OGAA Specified Enactments and Provisions

"Specified Enactment"	"Specified Provision"
Environmental Management Act	(a) any of the following provisions of the Environmental Management Act: (i) section 9 (hazardous waste storage and disposal). (ii) section 14 (permits). (iii) section 15 (approvals).
Forest Act	(b) section 47.4 (licence to cut for persons occupying land or for oil and gas purposes) of the Forest Act, but only in relation to a master licence to cut, and section 117 (road use permits for industrial use) of the Act.
Heritage Conservation Act	(c) section 12 (permit authorizing certain actions) of the Heritage Conservation Act.
Land Act	(d) any of the following provisions of the Land Act: (i) section 11, but only in relation to a lease or grant described in section 11 (2) (b) to (d) (disposing of Crown land). (ii) section 14 (temporary occupation of Crown land). (iii) section 38 (lease of Crown land), but not to the extent that it relates to the granting of an option to purchase land. (iv) section 39 (licence of occupation). (v) section 40 (right of way and easement). (vi) section 96 (1) (occupational rental).
Water Act	(e) any of the following provisions of the Water Act, but only in relation to an approval as defined in section 1 of the Water Act: (i) section 8 (short term use of water). (ii) section 9 (1) (a) (changes in and about a stream). (iii) section 26 (permits over Crown land). (f) a prescribed regulation under a specified enactment.

Appendix II. Data Sources, Assumptions and Limitations

Standards and criteria have been established for data and specific data sets have been chosen for calculating surface area used by the oil and gas industry in B.C. Data assumptions act as the framework for analysis results and are continually being upgraded and improved. For the purposes of this report, where the data is potentially inaccurate, the most conservative numbers have been used and regrowth is not factored into the calculations. As a result, the surface area used by the oil and gas industry may be overstated.

While calculations produced for this report are derived from a Commission developed methodology, the available data is known to contain limitations preventing the exact reporting for certain oil and gas activities within the FNL RMP area. Data collection and management technology has advanced and changed dramatically over time and the vast size of the study area has placed limitations on the precision of some data values. The Commission is working to improve the data and will use the most accurate data available for future reporting.

Data Sources:

A description of spatial and non spatial data is provided below and data sources are listed in Table 5. The data sets are combined to provide estimates of the amount of the surface area currently being used for oil and gas activity.

Spatial Data

Spatial data is currently collected by the Commission mainly through the Electronic Petroleum Application Spatial Submission System (ePASS). This tool was originally developed and implemented for pipelines in Oct. 2004, then expanded in 2006 to include all other surface applications. It requires industry to submit spatial files detailing location information (for oil and gas applications) to the Commission. Spatial data submitted through ePASS is updated daily to the Commission ftp site, as well as the BC Geographic Data Warehouse.

Other spatial data is collected from internal and external databases such as:

- Integrated Resource Information System (IRIS).
- Spot 5 satellite imagery.
- Terrain Resource Information Management Program (TRIM II).
- Knowledge, Enterprise, Resource, Management, Information and Technology (KERMIT).
- Historical information prior to the implementation of ePASS is collected for the Commission through the process of digitizing or is provided by other agencies.

Non Spatial Data

Non-spatial data used in the calculations is extracted from KERMIT and IRIS. KERMIT is a database

application where industry makes electronic submissions for pipelines and facilities. Data extracted from KERMIT includes information such as the status and total surface area of applications.

IRIS is an internal database storing information on all other oil and gas applications including wells, geophysical exploration and roads. Data extracted from IRIS also include the status and total surface area of applications.

Table 5 lists the data sources used to calculate the amount of surface area used by oil and gas activities in British Columbia. The sources are organized by type of activity (roads, pipelines, wells, etc.).

Data Limitations

The majority of data used in the analysis is provided to the Commission by industry and therefore the accuracy of the data is dependent on the quality of data submitted. Though quality assurance techniques are in place when submissions reach the Commission, historically there have been limitations on data administration accuracy due to technology, systems and processing procedures. The issues surrounding data limitations are a priority and the Commission is committed to continuing to develop a plan to fill knowledge gaps and improve data management systems.

Other Spatial Data

Historical oil and gas spatial application data used in the analysis has been collected through in-house digitizing and from external GIS sources. For example:

- The historical petroleum development roads (PDR) spatial file used in the analysis was created by the Ministry of Energy, Mines and Natural Gas (MEMNG) using historical datasets.
- Historical geophysical exploration data compiled by MEMNG from disks provided to the Commission with the final plan locations.
- Crown Tenures data was used for estimates of historical application of surface areas.
- The Commission currently holds no historical spatial data for some oil and gas features including facility sites, pipelines, access roads and miscellaneous applications (gravel pits, campsites, pullouts, etc.). In order to create a more accurate calculation, the Crown Tenures data is used to estimate locations of these features.
- Pre-1996 Geophysical Exploration Data: Prior to 1996, GIS capable spatial technology was not in place to capture or collect data specifically for geophysical exploration in B.C. TRIM II data is available for historic land use in British Columbia, however it does not exclusively distinguish between geophysical exploration activities (i.e. seismic lines) and

other cutline-linear features, such as roads, trails, and pipeline rights-of-way). Therefore, use of the entire TRIM II data file is expected to overestimate the amount of geophysical exploration activity in the FNL RMP. The Commission used the methodology described in the Geophysical section of the Data Assumptions table to address this issue. A more detailed explanation of the pre-1996 geophysical sampling methodology can be obtained from the Commission.

Data Assumptions

In all cases the Commission has erred on the high side with its assumptions in order to calculate oil and gas activity in the FNL RMP. All historical activity has been captured with no attempt to remove activities from the calculation where surface disturbances may have recovered.

Data assumptions are further detailed in Table 6.

Table 5: Data Sources for Land Use Calculations

Oil and Gas Activity Type		Source	File Name	Geometry	Timeline	Update Cycle	Notes
Roads	Access Roads	Commission	aaoa_BC	polygon	>2006	Nightly	Current ePASS data
	Development Roads	Commission	aaoa_BC	polygon	>2006	Nightly	Current ePASS data
	Access and Development Roads	GDM	ard_gdm	line	all	Quarterly	Data use agreement with GDM
	Crown Licences	ILMB	WHSE_TANTALIS.TA_CROWN_LICENSES_SVW	polygon	all	Daily	Used for historical Access and Development Roads
Pipelines	Pipelines	Commission	aprow_BC	polygon	>2004	Nightly	Current ePASS data, actual clearing application size
	Crown Licences	ILMB	WHSE_TANTALIS.TA_CROWN_LICENSES_SVW	polygon	all	Daily	Used for historical pipelines
Wells	Wellsites	Commission	awsit_bc	polygon	>2006	Nightly	Current ePASS data, actual clearing application size
	Well location	Commission	awell_bc	point	all	Nightly	Coordinates from IRIS, Average 1.44ha applied
Facilities	Facility Sites	Commission	afsit_bc	polygon	>2006	Nightly	Current ePASS data
	Crown Licences	ILMB	WHSE_TANTALIS.TA_CROWN_LICENSES_SVW	polygon	all	Daily	Used for historical facility and site locations
Other Oil and Gas Permits	Ancillary and Other Applications	Commission	aaoa_BC	polygon	>2006	Nightly	Current ePASS data
	Crown Licences	ILMB	WHSE_TANTALIS.TA_CROWN_LICENSES_SVW	polygon	all	Daily	Used for historical facility and site locations
Geophysical	Geophysical	Commission	ageo_bc	line	>2006	Nightly	Current ePASS data
	Historical Geophysical	Commission	agphys1996_2004	line	1996-2004	NA	Historical data collected from multiple sources
	Historical Geophysical	Commission	agphys2002_2006	line	2002-2006	NA	Historical data collected from multiple sources
	Historical Geophysical	GeoBC	TRIM II – ShapeID: tcull, TRIM Class: Corridor Landmark, and Description: Cut Line/Seismic Line	line	<1996	NA	Historical data from aerial photography to TRIM II standards

Table 6: Data Assumptions

Oil and Gas Activity	Data Assumptions
Roads	<p>The Commission began to collect data on Access and Development roads in October 2006 and actual widths are used for these calculations. The Ancillary and Other Applications (AAOA) file is tested to pull out ROAD data and roads associated with specific wells are tested for the status of the associated well (note, same criteria as Wells script, below).</p> <p>To capture roads constructed prior to October 2006, the Commission utilizes a private sector database from Geomatics Data Management Inc. (GDM). This data is tested to pull out all Oil and Gas roads, and these roads are assigned an average width of 20m for calculation purposes.</p> <p>The 20 metre average is based on average road widths from submitted data and has been verified by a sample test of the roads within the LRMP. The results of the sample showed road widths varying between 12.75 and 19.45 metres.</p> <p>All road data is then combined, compared and overlapping areas are removed.</p>
Pipelines	<p>Pipeline Right of Way (RoW) data has been collected since 2004 and includes actual RoW widths. The Pipeline Right of Way script queries all pipelines that have a 'construction start' date. Pipelines that do not have a construction start are tested to determine if they have a 'leave to open' (LTO) date. The LTO date informs the query that the pipeline has been constructed to prescribed standards.</p> <p>For pipelines constructed prior to 2004, the Crown Tenures file is used to query 'Oil and Gas Pipeline' then queried further for the tenure type 'Right of Way'. This data provides the actual widths of the historical pipelines.</p> <p>All pipeline data is then combined, compared and overlapping areas are removed.</p>
Wells	<p>Wells data has been collected by the Commission since 2006 and provides the actual well pad size. The data is queried to filter out wells that are cancelled or do not yet have a well authorization date. The wells that are queried out are then tested to add back in any cancelled well that has surface disturbance.</p> <p>Wells constructed prior to 2006 are queried through IRIS and are assigned an average size of 1.44ha. This number is based on a typical well pad size under permit regulations of the day. This average was tested based on sampling within the Liard Basin. Results show an average well pad size of 1.37 ha; providing verification that 1.44 ha is a reasonable assumed average.</p> <p>All well data is then combined, compared and overlapping well areas are removed.</p>

Oil and Gas Activity	Data Assumptions
Facilities	<p>The Commission began collecting data on facilities in 2006. This data is tested to identify those facilities that have a 'leave to open' (LTO) date. The LTO date informs the query that the facility has been constructed to prescribed standards.</p> <p>To capture information on facilities that were built prior to 2006, the Commission queries the Crown Tenures file for Oil and Gas features that are NOT Pipelines or Well sites and ARE classified as facilities (for example, a compressor site as opposed to a decking site).</p> <p>All facility data is then combined, compared and overlapping areas are removed.</p>
Other Oil and Gas Permits	<p>This is a catchall category which includes all oil and gas activities that do not fit into the following categories: wells, pipelines, roads, geophysical programs or facilities. The Commission has been collecting this data since 2006.</p> <p>From the Ancillary and Other Applications (AAOA) file all data is tested to remove 'ROAD' data because it is captured in other queries.</p> <ul style="list-style-type: none"> • AAOA features that are associated with pipelines are queried for construction start and or leave to open (LTO) date (the same criteria as the pipelines script). • AAOA features that are associated with specific wells are tested for the status of the associated well (the same criteria as the wells script). • AAOA features that are not associated with wells or pipelines are tested to determine if they are related to KERMIT oil and gas activities or 'Other'. Once tested all KERMIT files are tested for LTO status; the 'Other' are tested to determine if they are approved. <p>To capture information on other Oil and Gas Permits that were built prior to 2006, the Commission queries the Crown Tenures file for Oil and Gas features that are NOT already captured.</p> <p>Features associated with energy production data that are NOT wellsites or facilities are included here (i.e., campsite, inlet site, landfarm etc.). Quarrying and Industrial permits that are issued by the BC Oil and Gas Commission are also included in this query.</p> <p>All other oil and gas permit data is then combined, compared and overlapping areas are removed.</p>

Oil and Gas Activity	Data Assumptions
Geophysical	<p>Data has been collected and managed by the Commission on geophysical activities since 1996. This data is tested as follows:</p> <ul style="list-style-type: none"> • 2006 to current uses the actual width associated with each line because it is available in the data. • Pre-2006 data does not include seismic line width information and therefore the following assumptions have been made: <ol style="list-style-type: none"> 1. Two Dimensional programs – cat cut is assumed at seven metres wide. 2. Three Dimensional programs – source Lines are assumed at seven metres and Receiver Lines are assumed at two metres. <p>The seven and two metre width assumptions are based on submitted geophysical exploration data and sample testing.</p> <p>Prior to 1996 spatial technology did not exist to capture or collect data specifically for geophysical exploration in British Columbia. In response to this issue, the Commission developed a preliminary sampling method to assess the potential magnitude of TRIM II data needed to represent the area used by the pre 1996 geophysical activity in the FNL RMP. The method involves combining TRIM II data with other newer data sets to display all linear features. These features are put into a mapping program with the latest spot satellite imagery, zoomed in upon, and sample areas are tested and interpreted to assess how much of the data is interpreted as seismic and how much may be other linear features. The width of the interpreted lines was also tested. The sampling did not assess the level of potential vegetation regrowth for the pre-1996 geophysical exploration activity.</p> <p>A five per cent sample of the 89,976 km TRIM II sourced miscellaneous cut lines (excluding lines that overlapped with other linear features such as roads, pipes, etc.) was completed with the following results:</p> <ul style="list-style-type: none"> • Ninety-seven per cent of the samples were classified as visible and geophysical based. • 1.7 per cent were classified as visible and partly geophysical. • One per cent was classified as not visible/not geophysical. <p>This report uses the above results to calculate the pre-1996 geophysical exploration area used. The resulting number is added to the Commission's post-1996 data to arrive at a total for surface area used for geophysical exploration.</p> <p>A more detailed explanation of the pre-1996 geophysical exploration sampling methodology can be obtained from the Commission.</p>

