



# **YUKON OIL AND GAS**

## **A Northern Investment Opportunity**

**2011**



## Introducing the 2011 Edition of *Yukon Oil and Gas: A Northern Investment Opportunity*

I invite you to learn about Yukon's wealth of oil and gas resources and the opportunities to invest in our growing industry.

For those ready to seize the opportunity, Yukon boasts an abundance of oil and gas resources. We have an estimated onshore potential of 17 trillion cubic feet of gas and 800 million barrels of oil. In addition, there is an offshore potential of 40 trillion cubic feet of gas and 4.5 billion barrels of oil.

Up until now, Yukon's resources have remained largely untapped due to their remoteness from market. However, with progress on the Alaska Highway Pipeline Project and the Mackenzie Gas Project this is expected to change within the next decade. An investment today means being prepared for the future.

In addition to exceptional resources, Yukon offers many competitive advantages, including:

- Progressive oil and gas legislation developed with First Nations;
- A flexible land tenure structure and competitive royalty rates;
- A well educated and skilled labour force with northern expertise;
- Pipeline access for southeast Yukon natural gas via the Duke pipeline to processing facilities in British Columbia; and,
- Proposed northern pipelines that will provide access to Yukon's oil and gas resources.

Twice a year, Yukon holds oil and gas rights dispositions with disposition dates advertised two years in advance. Our disposition process provides investment certainty for industry over the long term.

We hope that within these pages you will find the information to make an informed investment decision. If you require further information on Yukon's oil and gas resources please visit [www.yukonoilandgas.com](http://www.yukonoilandgas.com) or feel free to contact the Oil and Gas Resources branch through the information provided on the following page.

I encourage you to look through this publication and discover the outstanding opportunities that await your investment in Yukon.

A handwritten signature in black ink, appearing to read 'Patrick Rouble', written in a cursive style.

The Honourable Patrick Rouble  
Minister, Energy, Mines and Resources



## Yukon Oil and Gas: A Northern Investment Opportunity

May 2011 Edition

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## How to use this publication

This publication provides a general introduction to oil and gas in Yukon.

While it will be of general interest, it is written to address matters of interest to company officials, landmen, geologists, engineers and investors who may want to participate in Yukon's oil and gas sector.

The text is divided into two main parts.

Part 1: Provides information on the oil and gas regime and useful information on Yukon. It has six sections: responsibilities of governments; legislative and regulatory framework; managing oil and gas rights; licensing of activities; fiscal regime; and pipelines and infrastructure.

Part 2: Describes recent activity, provides an overview of the oil and gas resource potential, and contains summaries of resource assessments.

Each section in the first part provides an introduction to a topic, explains the main steps or requirements to obtain your goal, and ends with details on how to reach a contact person.



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## Why Invest in Yukon?

The oil and gas industry has the potential to be a major driver of Yukon's economy.

Significant unexplored and untapped resources, a competitive fiscal environment and a stable political and legal framework make Yukon a unique and competitive place to do business.

In economic terms, Yukon has a very attractive climate for oil and gas investment and development. Yukon has a competitive regime built on the experience and proven practices of other jurisdictions. Yukon's key advantages include:

- Progressive oil and gas legislation – the Yukon *Oil and Gas Act (YOGA)*.
- A unique common regulatory regime jointly developed by Yukon and First Nations governments.
- Competitive royalty rates.
- A well-educated and skilled labour force with northern expertise.
- A well-developed infrastructure that includes communications, an extensive network of paved roads and a recently expanded electrical grid.

- Direct access to year-round ocean ports through Skagway and Haines, Alaska.
- Pipeline access – natural gas from southeast Yukon is transported via the Spectra Energy Gas Transmission Pointed Mountain Pipeline to processing facilities in British Columbia.
- Potential northern pipelines will provide Yukoners access to gas, and tie in Yukon's eight sedimentary basins, allowing Yukon gas access to North American markets.

This publication provides information on these advantages and other oil and gas matters of interest to investors.

# Part 1: Information on Yukon's Oil and Gas Regime

## 1. Roles and Responsibilities of Governments

Yukon is a territory within the Canadian confederation and has powers similar to those of a province. It has been a separate geographical and political entity within Canada since 1898.

Yukon obtained administration and control over its land and resources through a process of negotiated devolution. Responsibility for onshore oil and gas resources was transferred to the Yukon government on November 19, 1998. Federal and Yukon legislation implemented the transfer of responsibility for public lands, forests, water and minerals, and gas from coal from the federal government to Yukon, as provided for in the April 1, 2003 Devolution Transfer Agreement.

With these transfers, Yukon obtained the resource management powers and responsibilities similar to a province. Nevertheless, the Government of Canada continues to have a regulatory role with respect to international and interprovincial pipelines, and offshore management. In addition, First Nations which have concluded land claims agreements own the resources on the surface of their lands, and on specific parcels, subsurface resources.

	<b>GOVERNMENT OF YUKON</b>	<b>FIRST NATIONS</b>	<b>GOVERNMENT OF CANADA</b>
Primary role/responsibilities	<ul style="list-style-type: none"> <li>• Owns oil and gas resources on Yukon public lands and has legislative authority over them</li> <li>• Responsible for surface access and permitting on Yukon public lands</li> <li>• Responsible for water rights and permitting</li> <li>• Developing a common regime for oil and gas in cooperation with Yukon First Nations</li> <li>• Shared management with Canada of oil and gas resources in the Beaufort Sea in accordance with 2008 MOU</li> </ul>	<ul style="list-style-type: none"> <li>• With settled land claims own oil and gas resources on their Category A settlement lands</li> <li>• With settled land claims have jurisdiction and legislative authority over their resources which are implemented when they enact their own laws</li> <li>• With settled land claims are responsible for authorizing surface access on Category A and B settlement lands</li> <li>• Developing a common oil and gas regime in cooperation with the Yukon government</li> </ul>	<ul style="list-style-type: none"> <li>• Has jurisdiction over the Beaufort Sea offshore</li> <li>• Has shared management with Yukon of oil and gas resources in the Beaufort Sea in accordance with 2008 MOU</li> <li>• Has jurisdiction over international and interprovincial pipelines</li> <li>• Has responsibility for authorizations when federal laws apply</li> </ul>
Primary Departments/Agencies	Department of Energy, Mines and Resources Executive Council Office	Each First Nation with settled land claims will have its own administration for resources for which it controls	National Energy Board Indian and Northern Affairs Canada Other Federal departments



## A. Government of Yukon

On November 19, 1998, Yukon assumed the administration and control of oil and gas resources in the territory.

Yukon's resources are being developed in a way that reflects Yukon's interests and in a manner that is responsive to industry needs. Prior to the transfer of responsibility to Yukon, most oil and gas projects required a land use permit from the federal government and an oil and gas licence from the Yukon government. Now, both the land use permit and the licence are issued by the Department of Energy, Mines and Resources (EMR).

EMR manages the natural resources and regulates development within the territory.

Oil and Gas Resources (OGR) within EMR deals with all oil and gas matters. OGR is responsible for managing oil and gas resources, regulating oil and gas activity, encouraging the responsible development of Yukon's oil and gas resources and the development of an emerging oil and gas industry. In carrying out its responsibilities, OGR is engaged in:

- Conducting oil and gas rights dispositions.
- Managing continuances of oil and gas rights.
- Registering transfer of rights and security notices.
- Licensing oil and gas activities and operations.
- Administering oil and gas royalties and resource revenues.
- Monitoring and inspecting operations for regulatory compliance.

- Developing and implementing oil and gas legislation.
- Continuing to work with First Nations on the common oil and gas regime.
- Supporting and coordinating capacity building, education programs and training initiatives related to oil and gas.
- Promoting northern infrastructure development such as pipelines.
- Supporting the growth of Yukon's service and supply sector.
- Negotiating benefits agreements.
- Marketing Yukon's oil and gas potential and development activities.
- Managing Yukon's interests in offshore Beaufort Sea development.
- Implementing with Canada the MOU which outlines Yukon's enhanced role in offshore oil and gas management.
- Liaising with industry.
- Representing the Yukon government on intergovernmental committees dealing with oil and gas development and pipeline matters.

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## B. Yukon First Nations

Yukon First Nations play a very important role in resource development in three significant ways.

First, as a result of land claims settlements, they own surface and/or subsurface rights as follows:

- Category A settlement lands: Yukon First Nations own the surface rights and subsurface mineral rights which include oil and gas resources. As resource owners, Yukon First Nations are responsible for managing and regulating oil and gas on Category A lands, subject in part to passing their own legislation.
- Category B settlement lands: Yukon First Nations own the surface rights but not the subsurface mineral rights.

Second, as owners of oil and gas resources, Yukon First Nations are working with the Yukon government in continuing to develop a common oil and gas regime (see page 10).

Third, Yukon First Nations are involved in development of legislation and are consulted through various oil and gas related processes, notably the disposition and licensing process. In addition, they are entitled to be parties to benefits agreements (see page 17) for oil and gas activities planned within their traditional territories.

### Land Claims Negotiations

Land claims is the term used to describe the process of negotiating final and self-government agreements respecting aboriginal rights and title to land. Historically, the Government of Canada negotiated treaties with aboriginal peoples. As treaties were never concluded in Yukon, the governments of Canada and Yukon had to settle comprehensive land claims in Yukon. To date, 11 of 14 Yukon First Nations have settled.

Settlement of land claims provides Yukon First Nations with rights and obligations to land and resources, and the ability to govern their own affairs. It also provides certainty with respect to land management and resource development, and charts a stable future for social, economic and political development of the territory.

The Umbrella Final Agreement (UFA) is the framework agreement for all Yukon land claims negotiations and settlement agreements. As outlined in the UFA, settlement lands will collectively total approximately 41,500 square kilometres or about 9% of the total land area of Yukon once all Final Agreements are in place. A portion of these settlement lands include subsurface oil and gas rights which will encompass approximately 6% of Yukon.

Yukon First Nations acquire ownership of their own oil and gas lands as each Final Agreement comes into effect.

### Status of Land Claims Negotiations

There are a total of 14 Yukon First Nations. The following 11 Yukon First Nations have concluded and are implementing final and self-government agreements. The year in which each agreement came into effect is in brackets.

- Vuntut Gwitchin First Nation (1993)
- First Nation of the Nacho Nyak Dun (1993)
- Champagne and Aishihik First Nations (1993)
- Teslin Tlingit Council (1993)
- Selkirk First Nation (1997)
- Little Salmon/Carmacks First Nation (1997)
- Tr'ondëk Hwëch'in First Nation (formerly Dawson First Nation) (1998)
- Ta'an Kwäch'än Council (2002)
- Kluane First Nation (2004)
- Kwanlin Dun First Nation (2005)
- Carcross Tagish First Nation (2006)

White River First Nation, Ross River Dena Council and the Liard First Nation have not yet concluded land claims agreements.

### Transboundary Agreements

Some Yukon First Nations share traditional use and occupancy of Yukon land with First Nations in both British Columbia and the Northwest Territories. In B.C., those First Nations are within the Kaska Dena Council, the Tahltan Tribal Council and Taku River Tlingit First Nation. In the N.W.T., they are the Tetlit Gwich'in, the Inuvialuit and First Nations of the Dene/Metis. The Tetlit Gwich'in and the Inuvialuit have Transboundary Agreements which are in effect, while negotiations with other Transboundary First Nations remain outstanding and are not currently active.

### First Nations Powers to Create and Enforce Laws on Settlement Lands

The self-government agreements of Yukon First Nations provide them with law-making authority over their citizens and lands. Of importance to oil and gas companies interested in investing in Yukon are the following law-making powers of First Nations:

- The authority to enact laws of a local or private nature on settlement land with respect to subjects such as land use and management, licensing and regulation of businesses and the establishment and regulation of local services and facilities.
- The authority to enact laws for their citizens in Yukon in the areas of language, culture and spiritual beliefs; health care and services; social and welfare services; training programs; adoption, guardianship, custody, care and placement of children; education programs and services; estates; resolution of disputes outside the courts; and licenses to raise revenue.
- The authority to enact laws in relation to property taxation, personal income taxation, corporate income tax and other forms of direct taxation of residents on settlement land.

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## C. Federal Government

Although the federal government transferred responsibility for onshore oil and gas to Yukon, it continues to have responsibility for oil and gas management and development in the Beaufort Sea, and continues to regulate interprovincial and international pipelines.

The Department of Indian Affairs and Northern Development (DIAND) manages the development of northern oil and gas resources in the Beaufort Sea.

### Offshore Areas

The federal government retains responsibility and authority in the offshore area. Significant oil and gas resources exist in the Beaufort Sea as identified in a report by Dixon et al (Petroleum Resources of the Mackenzie Delta and Beaufort Sea-1994). This report estimates 12 Tcf of discovered conventional natural gas plus 54 Tcf of potential, for an ultimate potential of 66 Tcf of conventional natural gas; and 1.7 billion barrels discovered crude oil and 5.4 billion barrels potential, for an ultimate potential of 7.1 billion barrels of crude oil.

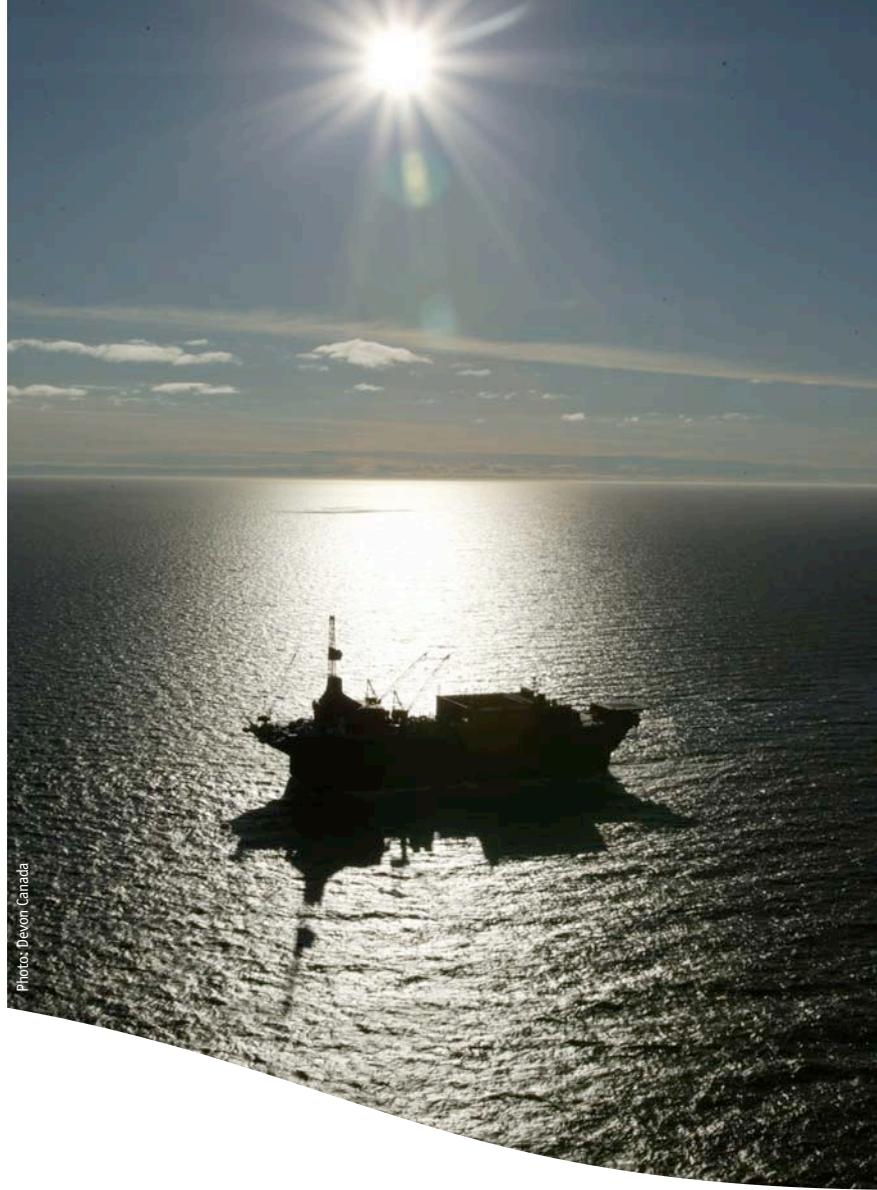
Oil and gas resources in the Beaufort Sea are regulated under two federal statutes: the *Canada Petroleum Resources Act (CPR)*; and the *Canada Oil and Gas Operations Act (COGOA)*. DIAND governs the allocation of oil and gas rights to the private sector and all related conditions under *CPR*. The National Energy Board regulates the industrial activities regarding resource conservation, protecting the environment and workers' safety primarily under *COGOA*.

Under the 1993 *Canada Yukon Oil and Gas Accord*, the federal government made a commitment to complete a shared offshore management regime and revenue sharing arrangement in the Beaufort Sea with Yukon. To ensure Yukon's interests are met and regulatory certainty is provided to the oil and gas industry, concluding shared offshore arrangements is a priority for Yukon. Until such arrangements are finalized, an interim joint Federal/Territorial Offshore Committee has been established as part of the *Accord*.

Yukon government's Department of Energy, Mines and Resources (EMR) and DIAND in December 2008 signed an MOU which outlines Yukon's enhanced role in offshore oil and gas management. The MOU will now provide the opportunity for Yukon to be actively involved in many aspects of Beaufort Sea activity, such as review and input into industry-produced Benefits Plans and input into the call for nominations process for new exploration rights.

Industry interests in oil and gas exploration and development in the Beaufort Sea region have increased significantly in the past few years, driven mainly by the proposed Mackenzie Gas Project. In 2008 and 2007, nearly \$2.5 billion was successfully bid for offshore rights, largely by BP Exploration, Imperial Oil/ExxonMobil and ConocoPhillips.

In early 2011, industry nominated several new areas in the Beaufort Sea and currently two parcels are out for bids which are due on June 21, 2011.



In 2010 Chevron was the successful bidder for a new offshore rights parcel. (\$103 million bid)

In the past few years, considerable 2D seismic has been undertaken throughout the Beaufort Sea, with 3D seismic undertaken in various areas.

EMR continues to participate in and monitor a number of regional, national and international initiatives and issues related to the Beaufort Sea. Some of these include: the NEB Arctic drilling review, the Beaufort Regional Environmental Assessment, (BREA), the Integrated Oceans Management Plan for the Beaufort Sea; various initiatives led by the Arctic Council; and the Canada/U.S. boundary dispute.

### Interprovincial and International Pipelines

Under the Canadian constitution the federal government is responsible for interprovincial and international trade and commerce. As such, the National Energy Board regulates and is responsible for international and interprovincial pipelines. The federal minister of Natural Resources Canada is responsible for the Northern Pipeline Agency. See section on pipelines, pages 20-21.

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## 2. Legislative and Regulatory Framework

### A. Common Oil and Gas Legislative Regime

Since 1997 the Yukon government and Yukon First Nations have worked together to coordinate the development of an oil and gas regime in Yukon.

The objective of the common oil and gas regime is to provide a consistent regulatory process throughout Yukon. This cooperative effort has many advantages:

- It clearly defines the rules, thereby creating more certainty for industry.
- Common conservation rules make it easier to deal with resources that straddle boundaries.
- Common management of data makes it easier and quicker to learn about Yukon's oil and gas resources.
- Adoption of Yukon legislation and regulations by First Nations is a cost-effective method of developing their respective oil and gas regimes.
- Common administration of oil and gas activity is more efficient and less costly.
- Adoption of a common regime avoids legal disputes.

#### The Legislation

The Yukon *Oil and Gas Act (YOGA)*, which consists of five parts, is the nucleus of the regime and addresses:

- Part 1: administration
- Part 2: oil and gas rights
- Part 3: operations
- Part 4: general matters such as audits, offences and penalties, and evidence
- Part 5: transitional and commencement matters

#### YOGA Applies to all Oil and Gas Operations

YOGA was structured and written to apply to all oil and gas operations in the territory. For example, Part 3 of the *Act*, dealing with oil and gas operations, applies throughout Yukon. It is a law of general application under which approved operations apply to both Yukon First Nations and Yukon oil and gas lands. If the operations relate to Yukon First Nations lands, an agreement may be concluded with the relevant Yukon First Nation respecting the coordinated management and regulation of oil and gas activities, and the recovery of oil or gas from a field or pool.

#### Adoption of Laws by Reference

To ensure that the same rules apply throughout Yukon, Yukon First Nations have the option of incorporating by reference the Yukon *Oil and Gas Act* or parts of it relating to the disposition and management of oil and gas rights. At this time, Yukon First Nations have not passed any legislation relating to oil and gas.

#### Integrated Management

The *Act* allows for the possibility that Yukon First Nations oil and gas interests form part of an overall, integrated management approach. Three examples of such provisions are:

- Grouping of Yukon government and Yukon First Nation permits.
- Negotiating joint benefits agreements that pertain to both Yukon lands and Yukon First Nation settlement lands between the Yukon government, affected Yukon First Nations and the licensee.
- Potential for pooling and unitization which could involve both Yukon government and Yukon First Nations settlement lands.

## B. Regulations

The Yukon government has enacted five regulations under the Yukon *Oil and Gas Act*. Pipeline Regulations are under development.

REGULATION	ENACTED
<i>Gas Processing Plant Regulations</i> (Draft)	In Progress
<i>Oil and Gas Pipeline Regulations</i> (Draft)	In Progress
<i>Oil and Gas Disposition Regulations (amended)</i>	February 2008
<i>Oil and Gas Royalty Regulations</i>	February 2008
<i>Oil and Gas Drilling &amp; Production Regulations</i>	July 2004
<i>Oil and Gas Geoscience Exploration Regulations</i>	July 2004
<i>Oil and Gas Licence Administration Regulations</i>	July 2004

The regulations can be found on line at [www.yukonoilandgas.com](http://www.yukonoilandgas.com).

### **Oil and Gas Disposition Regulations**

The *Oil and Gas Disposition Regulations* establish the rules regarding the issuance and management of oil and gas rights in Yukon. They outline:

- Yukon's land division system.
- How oil and gas rights in the territory can be issued.
- The management of dispositions (grouping, conversion, amendment, cancellation, surrender).
- The requirements for permits and leases, fees and rentals.
- The reporting requirements and confidentiality.
- The process for registering transfers and security notices with respect to Yukon oil and gas dispositions.
- The management of dispositions transferred in 1998 from the federal government to the Yukon government.

### **Oil and Gas Royalty Regulations**

The *Oil and Gas Royalty Regulations* regulate the payment of royalties. Royalty revenues are the principal fiscal means by which the resource owner is compensated for the extraction of its oil and gas resources.

These regulations play a pivotal role in creating a competitive fiscal environment necessary to attract new investment and activity.

Yukon's *ad valorem* system has a base rate of 10%.

The royalty regime is intended to be both competitive and administratively simple (see page 19).

### **Draft Oil and Gas Pipeline Regulations**

The draft *Oil and Gas Pipeline Regulations* regulate the design, construction, operation and abandonment of oil and gas pipelines wholly within Yukon.

### **Draft Gas Processing Plant Regulations**

The draft *Gas Processing Plant Regulations* regulate the operation, maintenance and abandonment of gas processing plants in Yukon.

### **Oil and Gas Drilling and Production Regulations**

The *Oil and Gas Drilling and Production Regulations* regulate drilling operations, well operations, field facility construction and operations, and production and conservation activities in Yukon. They cover:

- Well licensing and well operations approval processes.
- Safety and environmental protection.
- Inspection and investigations.
- Reporting, compliance and enforcement.
- Well evaluation and abandonment requirements.

### **Oil and Gas Geoscience Exploration Regulations**

The *Oil and Gas Geoscience Exploration Regulations* regulate petroleum exploration activities throughout the territory. Geoscience involves all aspects of preliminary surface and near-surface exploration such as:

- Geological field studies.
- Aerial magnetic and gravity surveys.
- Seismic programs.

The regulations describe licensing and reporting requirements, penalties, geophysical and geological operations, safety and health as well as environmental safeguards.

### **Oil and Gas Licence Administration Regulations**

The *Oil and Gas Licence Administration Regulations* establish the rules for obtaining licences to conduct oil and gas operations in Yukon. They outline:

- Administrative procedures for the licensing of oil and gas activity in Yukon.
- The levels of liability and financial responsibility.
- Application fees for oil and gas licences.
- The rules for appeals to the Minister with respect to oil and gas activity on First Nation Category A Settlement Lands.
- The rules for surveying and survey monuments.
- The threshold level for benefits agreements.
- The rules for gas export licences that must be in place before gas can be removed from the territory.

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### 3. Oil and Gas Rights

Companies that undertake drilling and production operations must hold the oil and gas rights to the location being explored and developed. The legal framework for issuing and managing oil and gas rights is provided under the *Yukon Oil and Gas Act* and the *Oil and Gas Disposition Regulations*.

#### A. Acquiring Rights

Rights are issued through a competitive bidding process. There is one criterion for issuing rights - the highest cash bid or the highest cash value of a work bid. When bids are submitted as a “work bid,” the successful bidder is required to submit a refundable work deposit equal to one quarter the value of the bid. The deposited money will be refunded on a pro-rata basis as work is performed and funds are spent. The minimum work bid is \$400,000.

The process for issuing oil and gas rights on Yukon lands takes approximately five months to complete and requires a significant amount of consultative work by the Yukon government.

The disposition process involves: persons submitting a Request for Posting for the acquisition of rights to explore for oil and gas; a review of the requested location with Yukon First Nations, government departments and agencies, and the Yukon public with respect to environmental, socio-economic, and surface access concerns; a Call for Bids where persons are invited to submit bids on posted locations; and finally the issuance of an Oil and Gas Permit to successful bidders. The maximum size of a location submitted in a Request for Posting is 500 square kilometres.

In the event Request for Postings are not received, the disposition process is concluded.

The table below provides current disposition information.

#### Schedule of Request for Postings Closing Dates

Submitted Request for Postings are reviewed semi-annually in accordance with the schedule below.

Date of Disposition	Request for Posting: Closing Date for Submissions	Request for Posting Review	Call for Bids
Fall 2011	July 13, 2011	August and September 2011	Mid-October to mid-December 2011
Spring 2012	January 18, 2012	February and March 2012	End of April to mid-June 2012
Fall 2012	July 11, 2012	August and September 2012	End of October to mid-December 2012
Spring 2013	January 16, 2013	February and March 2013	May to mid-June 2013

The Call for Bids is an invitation to companies to bid on locations posted for bid. The successful bidder will be awarded the rights to explore and produce oil and gas.

#### Beyond the Disposition Process

Although the disposition process results in the granting of rights to oil and gas, specific authorizations are needed to proceed with specific oil and gas activities and operations (see page 16). Prior to any oil and gas exploration or development, companies must obtain an *Oil and Gas Act* licence pursuant to Yukon’s *Oil and Gas Act* and associated regulations. Most licenses will trigger a public environmental screening process under the *Yukon Environmental and Socio-economic Assessment Act*. Companies are invited to examine Yukon’s Oil and Gas Best Management Practices (see page 18) before deciding on the type and timing of activities. Other authorizations such as a Land Use Permit or a Water License may also be required, depending on the nature and scope of the project.



## B. Permits and Leases

Oil and gas rights are granted through two types of dispositions: a permit or a lease.

A permit grants the holder the right to:

- Explore, drill and test for oil and gas in a specific location.
- Recover and remove the oil or gas produced as a result of the testing.
- Apply for a lease at the location of a discovery.

A lease grants the holder the right to produce oil and gas.

A permit has a maximum duration of 10 years and consists of two terms. At least one well must be drilled during the first term of a permit to extend the permit to a second term. Permits issued to date have had initial terms of six years and second terms of four years. A permit may also be extended to allow completion of drilling already underway.

A permit holder may apply for a lease on the location of a discovery any time before the permit expires. The lease will consist of the area within the permit location that contains one or more productive zones. The lease is issued to the bottom of the deepest productive zone.

The term of a lease is 10 years, and can be renewed for terms of five years. A lease renewal will only cover spacing areas that contain productive zones.

### Registration of Transfers and Security Notices

A company that acquires Yukon oil and gas rights may transfer them to another company and the transfer may be registered with the Division Head.

A security notice in respect to a security interest may be registered with the Division Head. A registered security notice has priority over an unregistered notice or a subsequently registered notice or transfer.

A security notice registered against an oil and gas permit will be extended to an oil and gas lease issued in the permit area.

If the Minister reinstates a cancelled or surrendered disposition, all prior security notices will be applicable.

## Rentals

Rentals for oil and gas dispositions are not set in regulation. Rather, rentals are indicated in the Call for Bids and set contractually in the permit. Currently, rentals are not assessed during the initial term of permits. In the second term of the permits, and in leases, rentals are set at \$5/hectare.

## Grouping

The grouping of permits allows for obligations in adjacent permits to be combined. The permits remain as individual dispositions, but the drilling obligations are shared.

The application for grouping must state that a well will be drilled prior to the expiry date of the earliest expiring permit and must specify in which disposition it will be drilled. It must also be demonstrated that the well will evaluate oil and gas in both permits. Grouped permits can be terminated at any time by the designated representative. Also, a grouping expires at the date of expiry of the first permit, with the exception of extensions for active drilling. No permit can belong to more than one group. Grouping of permits can involve both Yukon government and First Nations lands.

## C. Former Federal Oil and Gas Dispositions

Oil and gas dispositions, as defined in the *Yukon Oil and Gas Act* and granted by the federal government prior to the transfer of administration and control of oil and gas resources in 1998, remain in effect until they expire, are cancelled, surrendered or until otherwise agreed upon by the holder and Yukon. These former federal dispositions include Significant Discovery Licences, and an Explorations Licence. The table on page 14 provides information on these rights.

The rights granted by the federal government are continued under *YOGA* and the *Yukon Oil and Gas Disposition Regulations*.

All Yukon laws of general application apply except that rights under the federal disposition cannot be diminished.

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## D. Yukon Oil and Gas Dispositions

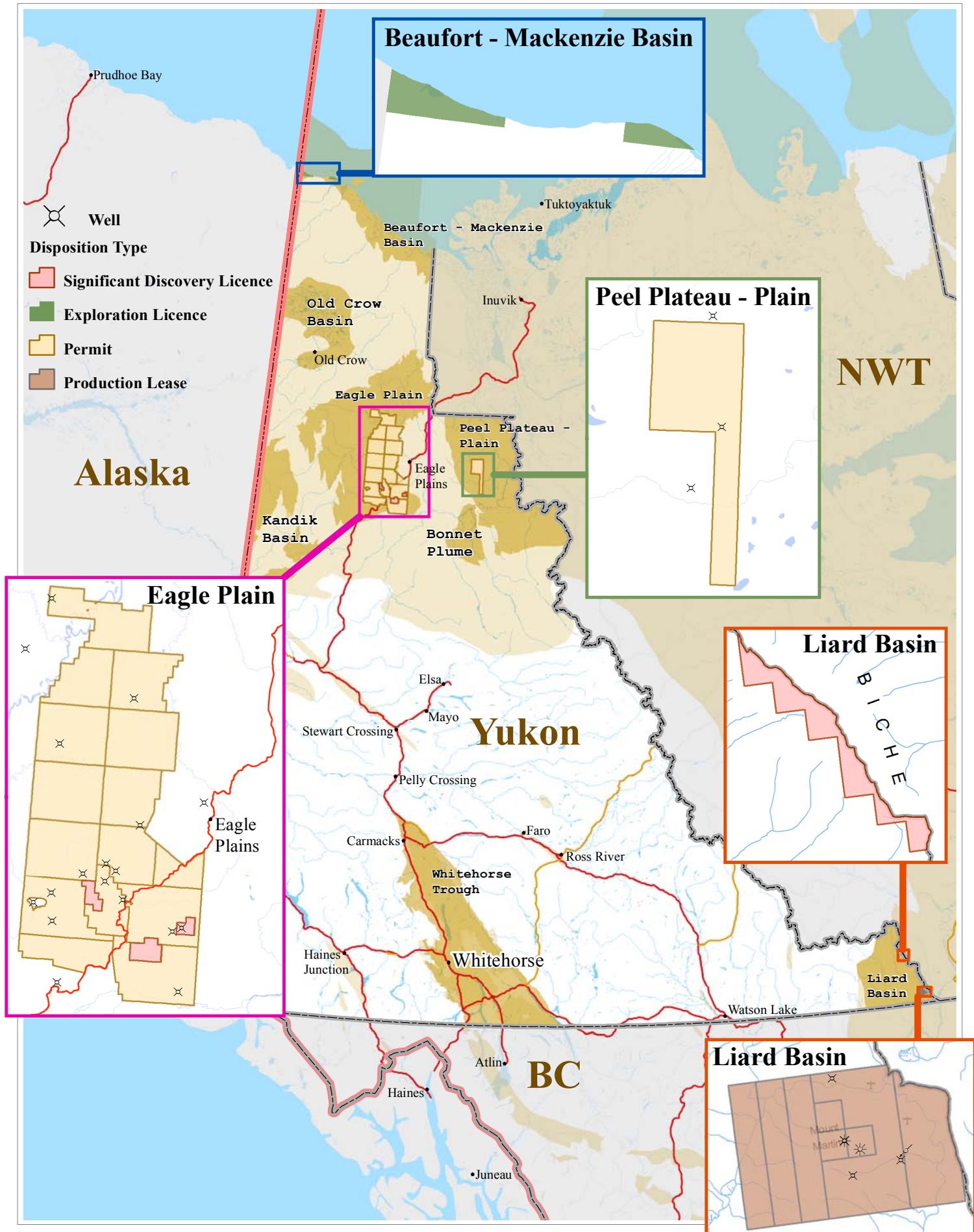
DISPOSITION NAME	LOCATION	SIZE (ha.)	ISSUE DATE	TERM
<b>EXPLORATION LICENCES</b>				
Y-EL-329 (Pattern 2)	Beaufort - Mackenzie Basin	18,069.02	9/5/87	Dependent upon international off-shore moratorium
Y-EL-329 (Pattern 7)	Beaufort - Mackenzie Basin	27,105.18	9/5/87	Dependent upon international off-shore moratorium

<b>PERMITS</b>				
Permit No. 0005	Eagle Plain Basin	38,638.32	08/31/07	6 Years
Permit No. 0006	Eagle Plain Basin	30,211.67	08/31/07	6 Years
Permit No. 0007	Eagle Plain Basin	34,291.46	08/31/07	6 Years
Permit No. 0008	Eagle Plain Basin	41,228.58	08/31/07	6 Years
Permit No. 0009	Eagle Plain Basin	41,226.66	08/31/07	6 Years
Permit No. 0010	Eagle Plain Basin	41,504.13	08/31/07	6 Years
Permit No. 0011	Eagle Plain Basin	31,880.67	08/31/07	6 Years
Permit No. 0012	Eagle Plain Basin	41,779.18	08/31/07	6 Years
Permit No. 0013	Eagle Plain Basin	30,164.59	08/31/07	6 Years
Permit No. 0014	Eagle Plain Basin	40,323.61	08/31/07	6 Years
Permit No. 0015	Eagle Plain Basin	42,770.40	08/31/07	6 Years
Permit No. 0016	Eagle Plain Basin	38,193.26	08/31/07	6 Years
Permit No. 0017	Eagle Plain Basin	25,054.91	08/31/07	6 Years
Permit No. 0018	Peel Plateau - Plain	39,509.89	04/30/08	6 Years
Permit No. 0019	Eagle Plain Basin	16,153.00	08/31/09	6 Years
Permit No. 0020	Eagle Plain Basin	19,773.00	08/31/10	6 Years

<b>YUKON LEASES</b>				
YL-001	Liard Basin	2,552.9	07/30/10	07/29/20
YL-002	Liard Basin	3,857.4	07/30/10	07/29/20
YL-003	Liard Basin	1,613.0	07/30/10	07/29/20
YL-004	Liard Basin	1,613.0	07/30/10	07/29/20
YL-005	Liard Basin	1,613.0	07/30/10	07/29/20
YL-006	Liard Basin	322.4	07/30/10	07/29/20
YL-007	Liard Basin	322.5	07/30/10	07/29/20
YL-008	Liard Basin	322.5	07/30/10	07/29/20

<b>SIGNIFICANT DISCOVERY LICENCES</b>				
SDL-020 (Pattern 1)	Eagle Plain Basin	1,315.44	3/1/88	No expiry date
SDL-020 (Pattern 1)	Eagle Plain Basin	263.27	3/1/88	No expiry date
SDL-020 (Pattern 2)	Eagle Plain Basin	1,052.55	3/1/88	No expiry date
SDL-021 (Pattern 1)	Eagle Plain Basin	3,694.34	3/1/88	No expiry date
SDL-021 (Pattern 1)	Eagle Plain Basin	264.11	3/1/88	No expiry date
SDL-021 (Pattern 1)	Eagle Plain Basin	263.55	3/1/88	No expiry date
SDL-021 (Pattern 2)	Eagle Plain Basin	1,319.50	3/1/88	No expiry date
SDL-021 (Pattern 3)	Eagle Plain Basin	791.52	3/1/88	No expiry date
SDL-022 (Pattern 1)	Eagle Plain Basin	3,148.05	3/1/88	No expiry date
SDL-022 (Pattern 2)	Eagle Plain Basin	262.55	3/1/88	No expiry date
SDL-022 (Pattern 2)	Eagle Plain Basin	261.77	3/1/88	No expiry date
Y-SDL-012 (Pattern 1)	Liard Basin	7,317.70	2/15/87	No expiry date
Y-SDL-012 (Pattern 4)	Liard Basin	2,859.28	2/15/87	No expiry date

# Yukon Oil and Gas Dispositions



## 4. Oil and Gas Activities

Companies proposing to conduct a new oil and gas project in Yukon are typically required to:

- Subject the project proposal to an environmental assessment pursuant to the *Yukon Environmental and Socio-Economic Assessment Act*.
- Obtain a licence pursuant to the *Yukon Oil and Gas Act*.
- Obtain a Land Use Permit pursuant to the *Territorial (Yukon) Lands Act, Territorial Land Use Regulations*.
- Obtain a Water Licence, if required, under the *Waters Act*.
- Negotiate a benefits agreement pursuant to the *Oil and Gas Act*.

Yukon regulatory authorities simultaneously conduct operation reviews under their respective legislation, and conduct a joint, coordinated environmental assessment which includes consultation with affected Yukon First Nations.

Operators are encouraged to carry out activity using best management practices and innovative technologies appropriate to Yukon's unique operating environment.

### A. Licences

Under the *Yukon Oil and Gas Act*, a licence is required to carry out all oil and gas activity in the territory. Oil and gas activity includes:

- Exploration, such as seismic or geological mapping.
- Drilling of oil and gas wells.
- Construction and operation of:
  - A pipeline wholly contained in Yukon.
  - A gas processing plant.
  - An oil and gas facility.

### Geoscience Exploration Licences

A Geoscience Exploration Licence is required for any oil and gas exploration activity. This includes investigations of the subsurface of the earth using direct or indirect methods. A direct method would be to conduct geological mapping over an area of interest. An indirect method would be to complete a seismic survey. A Geoscience Exploration Licence may be obtained in Yukon without holding an oil and gas disposition.

### Well Licences

A Well Licence is required to drill an oil or gas well. A company must hold a disposition which grants subsurface oil and gas rights before it can obtain this licence.

### Pipeline Licences

A Pipeline Licence is required for the construction and operation of a pipeline that is wholly contained in Yukon. A transboundary pipeline falls under the jurisdiction of the federal government.

### Gas Processing Plant Licences

A Gas Processing Plant Licence is required for any activity related to the construction and operation of a plant that extracts hydrogen sulphide, helium, natural gas liquids and other substances from raw natural gas.

### Field Facility Licences

A Field Facility Licence is required for activity related to the construction and operation of an oil and gas facility such as a battery, an oil treater, a pumping station, a waste disposal facility, or a compressor station.

Geoscience Exploration Licences				
LICENSEE	LICENCE #	YEAR	DESCRIPTION	STATUS
CHEVRON CANADA	1004	1999	Heli 2D seismic	Completed
EXPLOR DATA	1005	1999	Heli 2D seismic	Completed
ANDERSON	1025	1999	Aeromagnetic survey	Completed
NORTHERN CROSS	1026	1999	Geological mapping	Completed
CDN FOREST OIL	1066	1999	Heli 2D seismic	Not initiated
WASCANA	1069	2000	Heli 2D seismic	Not initiated
CHEVRON CANADA	1070	2000	Heli 2D seismic	Completed
DEVON	1071	2000	Geological mapping	Completed
WASCANA	1074	2000	Geological mapping	Completed
EXPLOR DATA	1100	2001	Heli 2D seismic	Not initiated
DEVON	1102	2001	Heli 2D seismic	Completed
CDN FOREST OIL	1103	2001	Geological mapping	Completed
DEVON	1104	2002	2D seismic	Not initiated
CONOCOPHILIPS	1105	2002	Geological mapping	Completed
DEVON	1106	2002	Geological mapping	Completed
NORTHERN CROSS	1107	2002	Geochemical survey	Not initiated
DEVON	1110	2003	Heli 2D seismic	Completed
ENCANA CORP	1111	2003	Gravity survey	Completed
DEVON	1112	2003	Geological mapping	Completed
DEVON	1113	2003	Gravity survey	Completed
NORTHERN CROSS	1114	2003	2D seismic	Not initiated
CONOCOPHILIPS	1116	2004	Geological mapping	Completed
DEVON	1118	2004	Geochemical survey	Completed
DEVON	1122	2005	Geological mapping	Completed
EXPLOR DATA	1125	2006	Heli 2D seismic	In progress
NORTHERN CROSS	1131	2009	Seismic processing	In progress

Well Licences		
LICENSEE	LICENCE #	YEAR
DEVON CANADA	1117	2004
Devon et al Kotaneelee L-38		
DEVON CANADA	1120	2005
Devon EaglePlains K-58		
NORTHERN CROSS	1128	2008
NCY Aitch Hill H-60		
NORTHERN CROSS	1129	2008
NCY Aitch Hill G-50		
NORTHERN CROSS	1130	2009
NCY East Chance A-17		

## A. Licences *(continued)*

The licence applicant's proposed project undergoes an operations review to ensure that it will be conducted safely and to accepted industry standards. The project is examined to ensure that the proposed operations comply with the *Yukon Oil and Gas Act* and the appropriate regulations. Adherence to other territorial legislation and standards from the Department of Environment, the Department of Community Services, the Yukon Worker's Compensation Health and Safety Board, the Heritage Branch of the Department of Tourism & Culture, and acts and regulations from Indian and Northern Affairs Canada are also verified.

The operations review is complete when all the required information has been received and examined and the program operations are deemed to be acceptable or unacceptable. Conditions to the licence regarding operations may be stipulated or the licence may be denied.

Since 1998, 26 geoscience exploration licences have been issued by the Yukon's Oil and Gas Resources branch. Eleven 2D seismic surveys have been completed. See table on page 16.

A total of 72 wells have been drilled in Yukon (see page 25). More than 20 wells had hydrocarbon shows. The Kotaneelee field located in Liard Plateau in the southeast produced approximately 2.4 Bcf of natural gas in 2009, and is connected to the Duke Energy Gas Transmission Pointed Mountain Pipeline that carries the gas south to Fort Nelson, B.C. for processing. Limited crude oil test production has occurred at Eagle Plain.

## B. Land Use Permits

Land use permits are required for most activities on Yukon lands. The *Territorial Land Use Regulations* specify project requirements for permits and would apply to such oil and gas projects as clearing seismic lines, constructing an access route, or clearing a well site. Land use permits are typically issued for a period of two years with an option for a one-year extension.

A permit does not provide the holder exclusive rights, interest, or tenure to the land. Permits typically include terms and conditions to ensure that work is conducted in an environmentally safe and responsible manner.

## C. Water Licences

A water licence under the *Waters Act* and *Waters Regulation* may be required for certain oil and gas activities depending on the water usage and the need to discharge into a water body:

- During exploration and ice road construction, the proponent may require a water licence if water use is more than 100 m<sup>3</sup>/day.
- Stream crossings greater than five metres in width may require a water licence for culvert installation.
- Camps with a capacity of greater than 50 people per day will require a water licence for waste disposal.
- Drilling mud and cutting disposal sumps will not require a water licence if the Alberta Energy Resources Conservation Board directive 50 is followed.
- During well drilling, produced water may be extracted from the formation and re-injected back to the formation or another formation that is not connected to surface or groundwater, without a licence.

## D. Environmental Assessments

Most projects and activities will be subject to an environmental assessment (EA) before a licence is issued.

Assessments are done pursuant to the *Yukon Environmental and Socio-Economic Assessment Act (YESAA)*. YESAA was given royal assent on May 8, 2003 and came into full force in Yukon on November 28, 2005. This *Act* replaced previous EA processes and applies throughout Yukon and to projects under the authority of federal, territorial and First Nations governments. A YESAA Board and regional designated offices have been established to conduct these environmental and socio-economic assessments.

An applicant is requested to provide information on the project and the surrounding environment, the potential environmental effects and directly related socio-economic effects of the project and the mitigation to eliminate or reduce these effects. The Board seeks input from governments, advisory committees and the public in conducting the environmental assessment. The Board then recommends whether the project should proceed, whether mitigation measures are required, or whether further assessment is required.

Oil and Gas Resources works with other agencies to coordinate the application submission requirements, the YESAA process, the regulatory review of the YESAA recommendations and the development of appropriate licence terms and conditions. Coordinating with other agencies streamlines the EA and licensing processes.

## E. Benefits Agreements

A benefits agreement is required for all projects with estimated expenditures of more than \$1 million over a 12-month period in Yukon. A benefits agreement identifies employment and training opportunities for Yukon residents including Yukon First Nations and residents of communities affected by oil and gas activity. It also identifies opportunities for Yukon businesses to supply goods and services to the licensee and the licensee's contractors. The benefits are to be commensurate with the nature, scale, duration and cost of the project, and shall not place an excessive burden on the licensee. The agreement is negotiated by the licensee, the Yukon government and the affected Yukon First Nation(s).

## Contact Information

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Photo: Lormel Consultants



Photo: Cowley Marine Corporation

## F. Best Management Practices

Oil and Gas Resources has developed a Best Management Practices (BMP) guide for oil and gas exploration and development activities in Yukon. The guide focuses on best industry practice in areas of geographical, biological and cultural sensitivities unique to Yukon.

In response to interest expressed during previous disposition processes in North Yukon, the guide, as it develops, will look at broad integrated resource management objectives for a number of key values and issues such as wetlands, caribou habitat, heritage values and key wilderness tourism areas. The intent of the guide is to provide operators, managers, planners and field staff with recommended processes and practices for meeting a series of operating practice objectives.

To date Best Management Practices have been published for heritage values, wilderness tourism operations, seismic operations (currently under revision to incorporate recent research results), trapline concessions and invasive plants. In 2011-12 expect to see BMP guidelines provided for caribou, wetlands, migratory birds, greenhouse gas emissions and permafrost. These BMPs will help guide the oil and gas industry and others to plan activities around these values ([http://www.emr.gov.yk.ca/oilandgas/best\\_management\\_practices.html](http://www.emr.gov.yk.ca/oilandgas/best_management_practices.html)).

These practices are designed to reduce the effects and footprint of oil and gas exploration and development activity on the ecological, cultural and competing economic landscapes, providing common sense and cost effective suggestions within targeted social and economic constraints.

While the guide has some limitations, it marks a significant step toward responsible stewardship of all the resources within the identified oil and gas regions. As scientific understanding and social values change over time, the scientific and value-based choices presented in the guide will be revisited.

The BMP guide is also intended to:

- Help streamline regulatory and environmental assessment reviews by providing up-front assistance or “guidance” to industry and reduce time spent on permit by permit reviews.
- Improve efficiency, consistency and defensibility of regulatory decisions based on current scientific understanding and public policy objectives.
- Allow industry, governments and stakeholders to identify issues, and propose mitigative strategies in a value-free or pre-project setting.
- Assist with long-term planning for research and development initiatives and cumulative effects modeling.
- Focus information gathering and assessment on the issues of most concern from a scientific and public policy perspective.
- Ensure the standards of care being applied are at a landscape level that can reflect regional ecological, cultural and economic values.

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## 5. Fiscal Regime

The Yukon government developed a competitive oil and gas fiscal regime. In designing it, the government was mindful that Yukon is a resource-rich frontier with challenging high-cost investment opportunities.

The principal source of revenue will be from royalties. Other sources of revenue will be rental payments, cash bids, forfeited work commitment deposits and administrative and licensing fees.

### Royalties

Yukon's Royalty Regulations were promulgated in February 2008. The regulations adopt an *ad valorem* royalty system.

The base oil and gas royalty is 10%, and increases to a maximum of 25% in accordance with a price sensitive formula. A 2.5% royalty rate is applied during an initial period of production.

### Rentals

Rentals for oil and gas dispositions are indicated in the Call for Bids and set contractually in the disposition. To date, rentals have been set at zero for the initial term and for the second term of a permit. Rentals for leases are also \$5/hectare.

### Fees

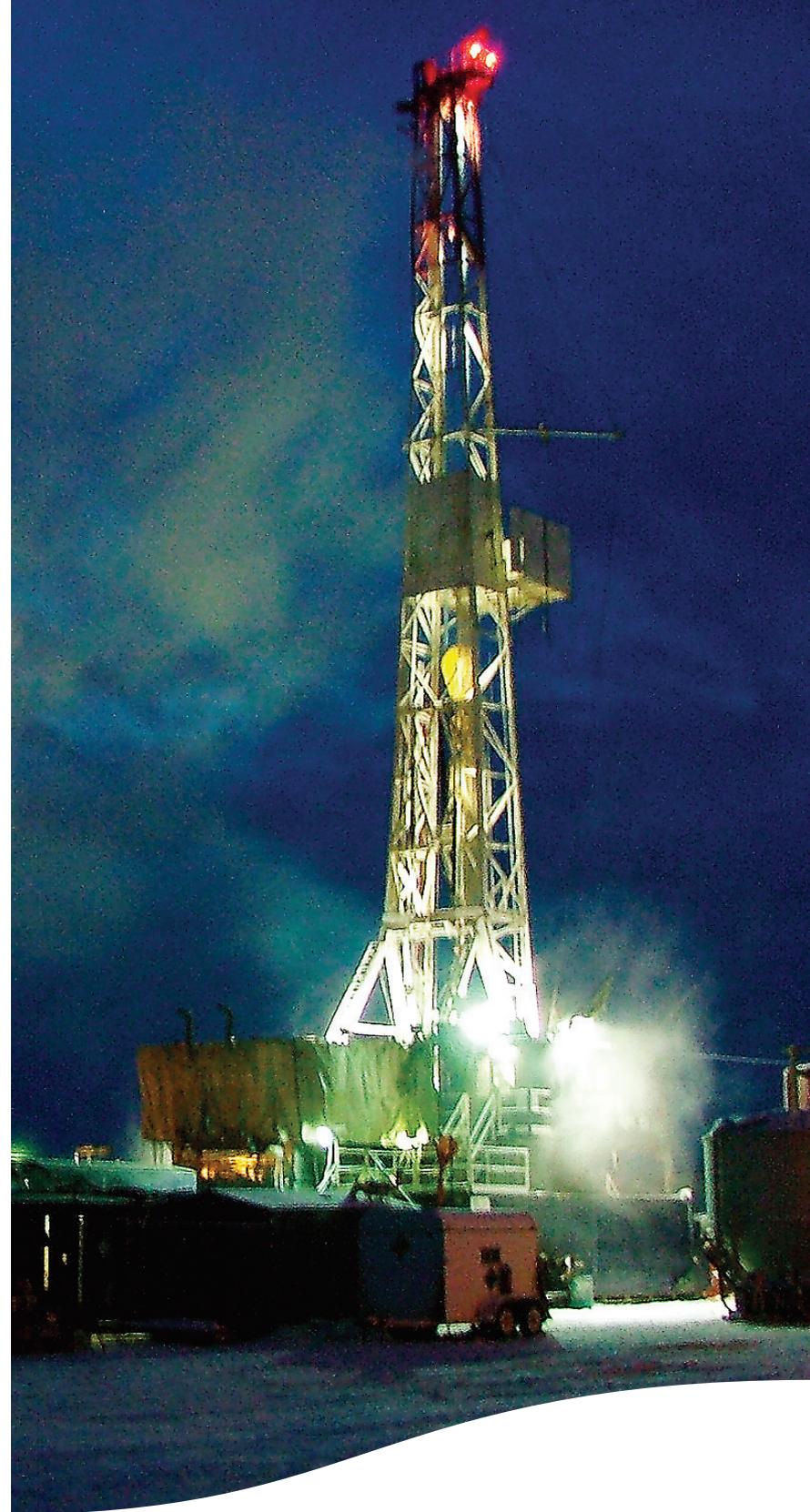
The following fees are charged applicants seeking to acquire or transfer Yukon oil and gas activity licenses:

Geophysical Licence	\$500
Geochemical Licence	\$300
Geological Licence	\$300
Test Hole Licence	\$500
Well Licence	\$500
Pipeline Licence	\$500
Transfer of Licence	\$200
Gas Processing Plant Licence	\$500
Gas Export Licence	\$500
Other Licences	\$300

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## Northern Natural Gas Pipeline Options



## 6. Pipelines and Transportation Infrastructure

### A. Pipelines

There is a great deal of interest in Yukon's oil and gas prospects, and a dramatic increase in oil and gas investment is anticipated once construction is announced of the Alaska Highway Pipeline Project (AHPP) or the Mackenzie Gas Project (MGP).

The Yukon government supports the construction of both the AHPP and the MGP, and believes northern natural gas will be needed to supply growing demand. Yukon is preparing for the opportunities and benefits of both pipeline developments.

#### Proposed Pipelines

Two major pipeline projects (MGP and AHPP) are being proposed to transport natural gas from the Mackenzie Delta and Prudhoe Bay, Alaska, respectively, to southern markets. A route down the Dempster Highway to the AHPP for stranded Mackenzie gas remains an option.

The Yukon government has prepared a pipeline strategy for both the AHPP and MGP, and has identified seven key Yukon interests:

- Fiscal advantage.
- Social investment.
- A clear, efficient Canadian regulatory process.
- Environmental stewardship.
- Community, municipal and First Nations interests.
- Connecting Yukon natural gas.
- Access to energy from pipelines.

#### Alaska Highway Pipeline Project

Foothills Pipelines was awarded Certificates of Public Convenience and Necessity under the *Northern Pipeline Act* in Canada and by the *Alaska Natural Gas Transportation Act* in the United States in the late 1970s. Southern portions of the project, called the pre-build, were constructed in parts of Alberta, British Columbia and Saskatchewan in the 1980s and 1990s. Construction of the northern portion of the pipeline would complete the project.

Current proposals call for the construction of a pipeline from Prudhoe Bay to Fairbanks, from Fairbanks along the Alaska Highway corridor in Yukon and then through B.C. into Alberta.

In 2007, the State of Alaska enacted the Alaska Gasline Inducement Act (AGIA), and determined that TransCanada Alaska was the only qualified applicant, and an AGIA licence was issued. This allows TransCanada access to up to \$500 million USD in State funds to advance the project.

BP and ConocoPhillips have also announced "Denali – The Alaska Gas Pipeline," a pipeline proposal outside AGIA.

Both the Alaska Pipeline Project (APP) proponents (TransCanada/ExxonMobil) and Denali (BP/ConocoPhillips) completed their 'open season' and both have stated more negotiation is required to achieve firm shipper commitments. Both projects would deliver 4.5 Bcf to 5.9 Bcf of gas per day to southern markets

Open season is the period that pipeline companies finalize their cost and revenue projections. This includes taxes and tariffs, as well as direct and indirect construction and operating costs, and provides the opportunity for gas producers interested in seeking space on the line to commit their product at an economically feasible carrier price.

The Alaska Highway Aboriginal Pipeline Coalition (AHAPC), initiated in July 2003, serves as a central coordinating body for Yukon First Nations; acts as a conduit for unbiased information on pipeline developments; and is working to ensure full participation of First Nations during all stages of the project. It continues to receive the encouragement and support of the Yukon government.

The Canada-Yukon Work Plan provides the opportunity to discuss areas of direct shared interest, such as fiscal, regulatory, aboriginal consultation and funding issues, with respect to a potential AHPP. In addition, Yukon, B.C. and Alberta are working together on a joint Strategic Action Plan.

#### Mackenzie Gas Project

The MGP would run from Inuvik into the Nova system in Alberta. The project would deliver about 1.2 Bcf of gas per day.

In March, 2011, the National Energy Board issued a Certificate of Public Convenience and Necessity for the project and the proponents will now determine whether the project is commercially viable. They have until December 2013 to signal intent to act on their Certificate.

The Yukon is pleased that the NEB and federal government have approved the proposed project; and that in the NEB's 'Reasons for Decision' the majority of Yukon interests will be met.

#### Existing Pipeline: Pointed Mountain Pipeline

The Spectra Energy Gas Transmission Pointed Mountain Pipeline serves the southeast Yukon. It originates in the southwestern Northwest Territories and gathers raw natural gas at the Kotaneelee facility in southeast Yukon for processing in Fort Nelson, B.C.

### B. Energy for Yukon

Yukon is facing unprecedented growth in demand for energy from new mines throughout Yukon and base load growth on the electrical grid, and forecasts show a shortage of hydro generated energy by 2012.

Yukon has one of the highest economic growth rates in Canada driven in large part by investment in the mining sector. Sustaining this growth requires a reliable and competitive price source of energy. Yukon has abundant natural gas resources. The initiative, Energy for Yukon : The Natural Gas Option, examines the feasibility of developing Yukon's significant natural gas resources to meet Yukon's current and future energy demands and examines what is required to develop these valuable resources.

Unless new sources of renewable energy are developed, the current alternative is diesel generation which is costly and contrary to Yukon's Climate Change Action Plan.

Yukon's natural gas resources are sufficient to meet Yukon's pending energy needs with clean, cost effective and reliable energy for decades.

#### Contact Information

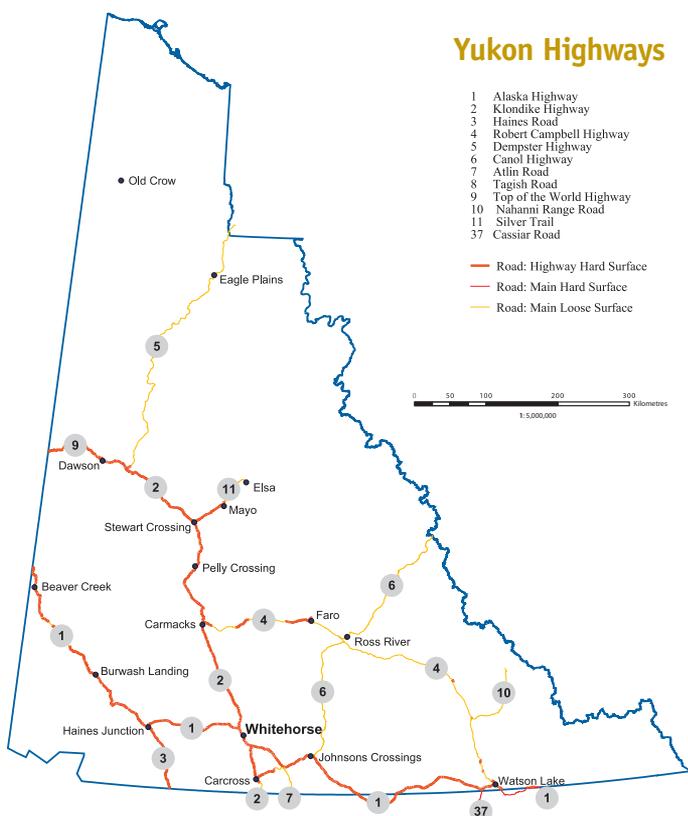
**Brian Love – Executive Director**  
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## C. Transportation and Infrastructure

### Roads and Highways

Yukon has 129 bridges and more than 4,800 kilometres of roads that link to Alaska, the Northwest Territories, southern Canada and the United States. Yukon's highway system consists of approximately 2,150 kilometres of Bituminous Surface Treatments (BST) and paved highway, with the remainder loose surface, or gravel. BST has been used on Yukon highways since the late 1970s to provide an improved level of service to the traveling public.

Yukon's year-round highway system is built and maintained to accommodate a maximum allowable Gross Vehicle Weight of 63,500 kg and may be reduced in spring depending on the structure of a highway. A higher limit may be allowed under closely controlled and unusual conditions pursuant to a bulk haul agreement. Yukon has two permanent weigh stations, one in Whitehorse and the other in Watson Lake.



### Air Travel

Whitehorse is home to an international airport with the capacity to handle 747-sized airplanes. There are 10 airports throughout the territory, with many smaller airstrips and aerodromes in remote areas.

Whitehorse is served by Air Canada and Air North. Flights serve Edmonton, Calgary, Vancouver, Alaska, and the Northwest Territories as follows:

Air Canada:

- three flights daily to Vancouver in summer
- two flights daily to Vancouver in winter
- daily flight to Calgary in summer

Air North:

- daily to Vancouver
- three days/week to Edmonton/Calgary
- daily route connecting Dawson, Old Crow, Inuvik
- twice weekly to Fairbanks, Alaska (summer only)

### Freight and Passenger Service

#### Freight/Courier Services

Many private trucking companies operate in Yukon - both national and Yukon based. There is daily service from Edmonton and several times per week from Vancouver. There are a few for hire LTL (Less than Truck Load) operators within Yukon, and several private trucking firms (groceries, fuel etc.).

Yukon is served by more than a dozen national and local courier services, including DHL Express, Fedex, Greyhound Canada and Purolator.

#### Passenger Services

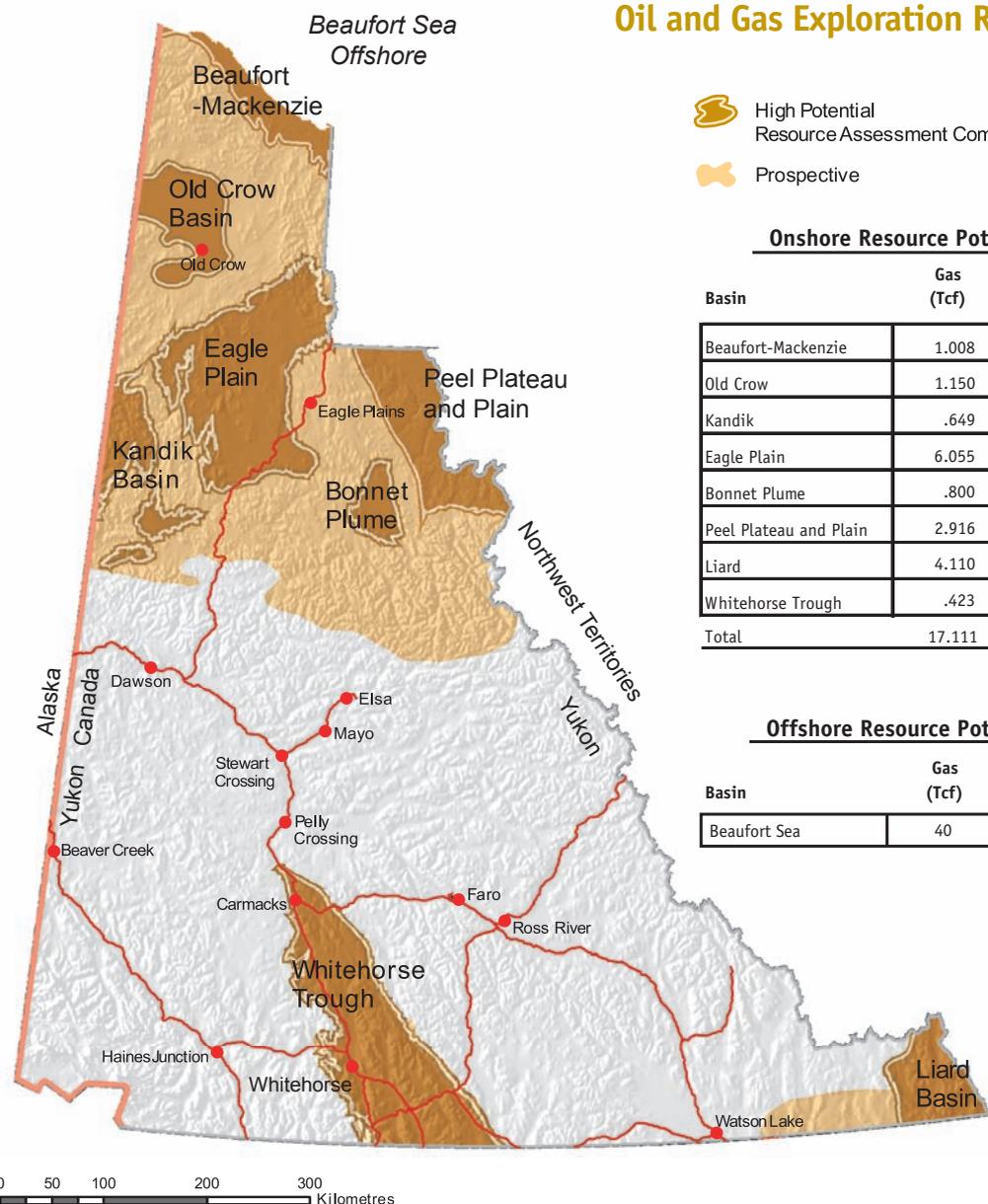
Yukon has one scheduled interprovincial carrier - Greyhound Canada - and numerous charter operators in summer. There are also a few small scheduled carriers on local routes.

#### Rail System

The White Pass and Yukon Route (WP&YR) railway narrow gauge railroad was completed in 1901. There are 170 kilometres of track between Whitehorse and Skagway, Alaska, however, operations to Whitehorse were halted in 1982 following mine closures. In the summer of 2007, a tourist passenger service began which operated six days a week between Skagway, Alaska, historic Bennett, B.C. and Carcross, Yukon. This service will continue for the summer of 2011. There are no plans to resume freight operations.

The Yukon government contributed \$3 million toward a joint feasibility study with Alaska to build a rail link from Alaska through Yukon and into northern B.C. Such a railway would provide benefits to Yukon and Canada and would support key industries in the North such as oil and gas, mining and tourism.

## Oil and Gas Exploration Regions



-  High Potential Resource Assessment Complete
-  Prospective

### Onshore Resource Potential

Basin	Gas (Tcf)	Oil (MMbbls)
Beaufort-Mackenzie	1.008	216.7
Old Crow	1.150	0
Kandik	.649	99.3
Eagle Plain	6.055	436.7
Bonnet Plume	.800	0
Peel Plateau and Plain	2.916	0
Liard	4.110	0.1
Whitehorse Trough	.423	19.2
<b>Total</b>	<b>17.111</b>	<b>772.0</b>

### Offshore Resource Potential

Basin	Gas (Tcf)	Oil (MMbbls)
Beaufort Sea	40	4,500

## Oil and Gas Resource Potential

Basin	Mean Gas Play Potential (Tcf)	Mean Oil Play Potential (MMbbls)	Discovered Resource Gas (Tcf)	Discovered Resource Oil (MMbbls)	Wells to date
Kandik	.649	99			3
Beaufort-Mackenzie	1.008	217			3
Bonnet Plume	.800	0			0
Eagle Plain *	6.054	436	.084	11	34
Liard *	4.110	0.1	.417		12
Old Crow	1.149	0			0
Peel Plateau and Plain	2.916	0			19
Whitehorse Trough	.423	19			0
Other					1
<b>Total</b>	<b>17.111</b>	<b>771.1</b>	<b>.501</b>	<b>11</b>	<b>72</b>

\*discovered resource based on NEB resource assessment report

## Part 2: Yukon Geology, Geoscience and Oil and Gas Potential

### Oil and Gas Basins in Yukon

Hydrocarbon potential has been identified in Yukon in both offshore and onshore sedimentary basins. Onshore, these include, in northern Yukon, Beaufort-Mackenzie, Old Crow, Eagle Plain, Peel Plateau and Plain, Kandik, Bonnet Plume basins, and in southern Yukon, Whitehorse Trough and Liard Plateau. Offshore potential exists in the Yukon portion of the Beaufort Sea basin. Yukon Geological Survey, locally in partnership with other government surveys and academic researchers, has recently conducted or currently conducts hydrocarbon-related geoscience studies in several of these basins.

### Overview of Yukon Geology

Yukon is located in the northern part of the North American Cordillera, the mountainous backbone of the western part of the continent, extending from Alaska to Mexico. Like most of the Cordillera, Yukon is composed of a diverse array of rocks that record more than a billion years of earth history.

The northwest-striking Tintina fault, a physiographically prominent dextral strike-slip fault with about 430km of Paleogene displacement, and the Inconnu thrust, a Jura-Cretaceous terrane-bounding fault, together separate the Yukon into two geologically distinct regions. Northeast of these features is a sequence of Proterozoic to Mesozoic sedimentary rocks deposited along the western margin of ancestral North America. Upper Proterozoic through Middle Devonian rocks preserved in Mesozoic thrust sheets exhibit a post-Early Cambrian rift platform carbonate (northeast) to basin (southwest) transition; this transition is marked by local embayments and promontories at different times and places. This phase in the evolution of the margin is abruptly terminated in the Middle Devonian with an extensive transgression of basinal marine facies far to the east, associated with the onset of arc magmatism at the continental margin and subsequent rifting away of the outer part of the continent during the opening of the Slide Mountain back-arc ocean. The Late Paleozoic is characterized by the evolution of this new passive margin with a platform-to-basin transition of this age overlying the older one. The Early Mesozoic saw an abrupt change to a convergent margin tectonic regime: the Slide Mountain ocean closed by subduction beneath the previously rifted-off pericratonic terranes, leading to collision between those terranes and the North American. Convergence continued episodically throughout the Mesozoic, resulting in the development of the Cordilleran foreland fold-and-thrust belt and its paired foreland basin.

Southwest of the Tintina and Inconnu faults, Yukon consists of a complex mosaic of terranes with a range of paleogeographic affinities. Although parts of the Insular terranes, of Baltican-Siberian affinity, may have arrived in the Paleozoic, the mosaic really started to form in the Early Triassic with the re-attachment of the pericratonic Yukon-Tanana terrane, upon which the Triassic continental margin arcs (Quesnellia and Stikinia) subsequently formed. By the late Early Jurassic, the oceanic Cache Creek terrane and the Insular terranes were firmly embedded in the mosaic. Later Mesozoic oblique convergence across the continental margin, coeval with extensive and voluminous granitoid magmatism, and Tertiary strike-slip faulting resulted in the current distribution of terranes in the Cordillera.

### Geological Context of Yukon's Oil and Gas Basins

Yukon's eight onshore basins with hydrocarbon potential formed as part of, or were deposited on, a variety of basement terranes. Two (Beaufort-Mackenzie and Old Crow) are successor basins developed on the Arctic-Alaska terrane, the Baltican-Siberian basement terrane to Alaska's hydrocarbon-rich North Slope. Five (Kandik, Eagle Plain, Peel Plain and Plateau, Bonnet Plume and Liard) have plays (conceptual or in the case of Liard, producing) in either outliers or extensions of the prolific Western Canada Sedimentary Basin, comprising the Paleozoic rocks of the North American continental margin and a Mesozoic successor basin. Whitehorse Trough of south-central Yukon evolved from a basin marginal to the Late Triassic Stikinia arc to a syn-orogenic flysch basin which formed during subsequent continental margin orogeny.

Currently, the only hydrocarbon production comes from the Kooteneelee Field in the Liard Basin, in the far southeastern corner of Yukon.

### Yukon Geoscience

#### Yukon Geological Survey

The Yukon Geological Survey [www.geology.gov.yk.ca](http://www.geology.gov.yk.ca) is the authority and provider of choice for geoscience and related technical information required for the responsible stewardship and sustainable development of Yukon's energy, mineral and land resources. YGS, commonly in partnership with the Geological Survey of Canada (GSC), university and industry, collects, compiles and communicates information on the geology and earth resources of the Territory. Its work informs the activities of natural resource exploration and extraction industries; Federal, Territorial and First Nation government departments and the general public. Contact Carolyn Relf (*full contact information for YGS on page 43*).

### Petroleum Geoscience Initiatives: selected highlights

#### Peel Plateau and Plain

Joint publication (with NWT Geoscience Office) of the final volume of the four-year Regional Geoscience and Petroleum Potential, Peel Plateau and Plain project, (Pyle and Jones, 2009). Contact Tiffani Fraser or Tammy Allen.

Conventional reservoir petrophysical property assessment of 17 Peel exploration wells (Fraser, 2010) in partnership with Petrel Robertson Consulting Ltd. (Calgary) Contact Tiffani Fraser.

Source rock potential of Middle to Upper Devonian Canol Formation and Upper Devonian Ford Lake Shale. Contact Tammy Allen.

#### North Yukon

Various GSC and university projects conducted under GSC's Geo-mapping for Energy and Minerals Program, Yukon Basins Project [gsc.nrcan.gc.ca/gem/energ/index\\_e.php](http://gsc.nrcan.gc.ca/gem/energ/index_e.php) Contact Larry Lane, Geological Survey of Canada at [larry.lane@nrcan.gc.ca](mailto:larry.lane@nrcan.gc.ca)



### Eagle Plain

Shale gas potential in Devonian strata from mineral exploration drill core, western flank of Richardson Anticlinorium (Allen et al., 2011) Contact Tammy Allen or Tiffani Fraser.

Assessment of conventional reservoir potential from petrophysical properties of geophysical logs, 34 Eagle Plain oil and gas wells, in partnership with Petrel Robertson Consulting Ltd. (Calgary). Contribution to GEM Program Contact Tiffani Fraser.

High-resolution aeromagnetic survey of the Eagle Plain area. Data available from YGS Geoscience Information and Sales or GSC. Contact Karen MacFarlane at karen.macfarlane@gov.yk.ca

### Whitehorse Trough

Depositional settings and source rock/reservoir potential of Upper Triassic carbonate of the Lewes River Group Contact Grant Lowey.

Geological compilation map of Yukon portion of Whitehorse Trough Contact Maurice Colpron at maurice.colpron@gov.yk.ca

Geological interpretation of joint YGS-GSC seismic line across northern Whitehorse Trough Contact Maurice Colpron.

### Bonnet Plume

Petroleum source rock potential of the Cretaceous-Tertiary Bonnet Plume Formation from Rock-Eval 6 data Contact Grant Lowey.

### Liard Basin

Bedrock geological map of Coal River map area and integration with recent work in Labiche under GSC Central Foreland NATMAP project Contact Lee Pigage at lee.pigage@gov.yk.ca

### Corporate Initiatives

New Yukon digital bedrock geology map to be updated in 2011. New map of Whitehorse Trough will be the first part to be integrated into existing version, with new compilations of parts of southeastern and southwestern Yukon to follow. Contact Maurice Colpron.

Yukon digital surficial geology map data are currently available through an ftp site and work is progressing to have it accessible through a map viewer. Contact Jeff Bond at jeff.bond@gov.yk.ca

Strategic planning process to define priorities for YGS oil and gas geoscience activities. This will involve convening a new oil-and-gas-specific Technical Liaison Committee and a scoping study of the roles and activities of geological surveys in the oil and gas sector. Contact Carolyn Relf, Don Murphy or Tiffani Fraser.

Scoping study of Yukon's potential for unconventional natural gas and oil resources including shale gas, tight gas, coalbed methane, and oil shale Contact Tiffani Fraser.

Scanning of historical unpublished petroleum-related studies for website access. Contact Tammy Allen or James Ewert at james.ewert@gov.yk.ca

### Research Partnerships

YGS encourages partnerships in their research to provide publicly available geoscience information. If you are interested in participating, please contact one of the scientists listed under contact information.

### References

Allen, T.L., Fraser, T.A. and Lane, L.S., 2011. Preliminary results from a diamond drill hole study to assess shale gas potential of Devonian strata, Eagle Plain, Yukon. In: *Yukon Exploration and Geology 2010*, K.E. MacFarlane, L.H. Weston and C. Relf (eds.), Yukon Geological Survey, p. 1-17.

Fraser, T.A. 2010. *Conventional reservoir petrophysical property assessment for 17 wells, Peel Plateau and Plain, Yukon Territory (65° 00' to 67° 00' N; 132° 00' to 136° 00' W)*. Yukon Geological Survey, Open File 2010-35, 91 p. plus appendices.

Pyle, L.J. and Jones, A.L. (editors), 2009. *Regional Geoscience Studies and Petroleum Potential, Peel Plateau and Plain: Project Volume; Northwest Territories Geoscience Office and Yukon Geological Survey, NWT Open File 2009-02 and YGS Open File 2009-25*, 549 p.

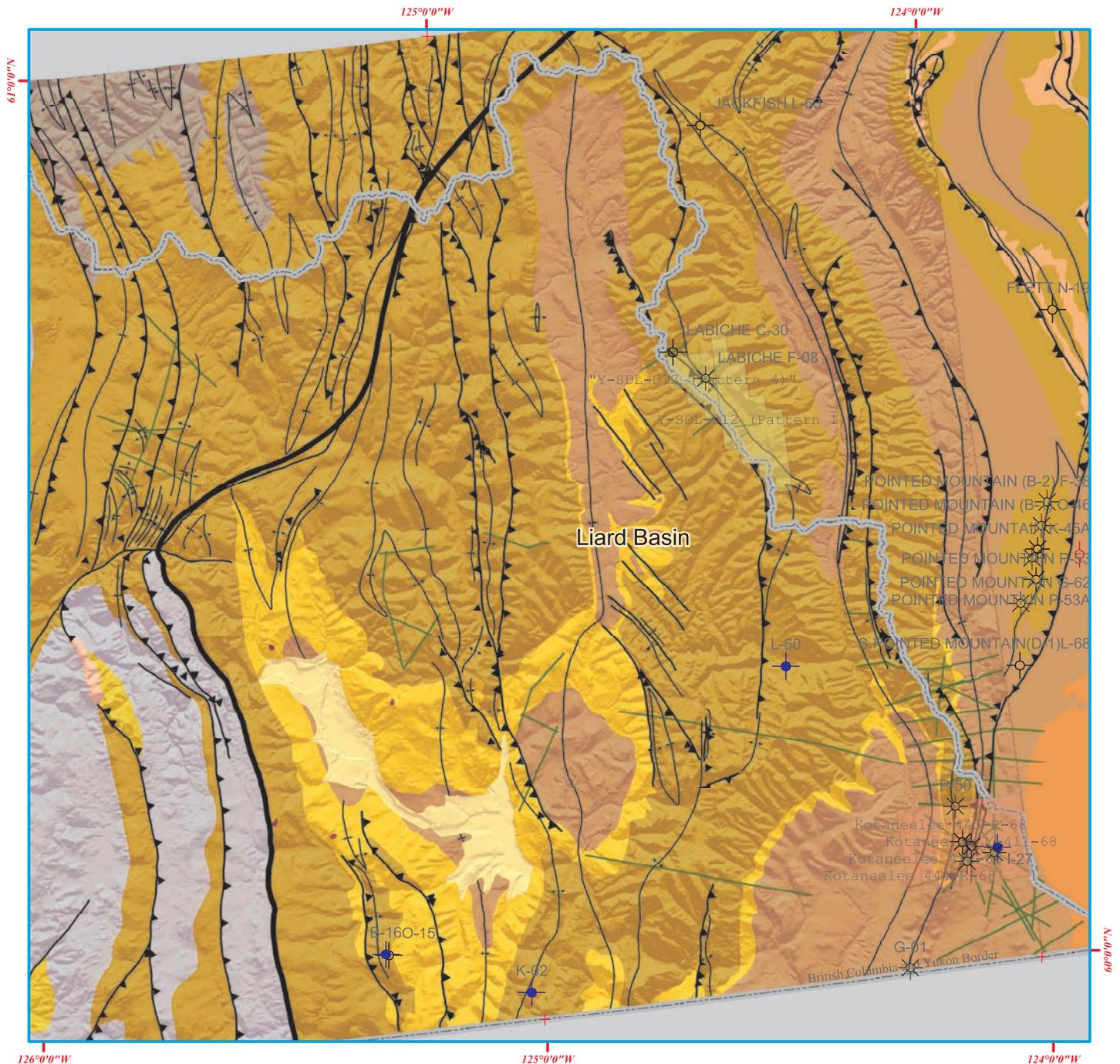
### Contact Information

**Don Murphy – Head, Regional Geology**

(867) 667-8516 E-mail: don.murphy@gov.yk.ca

# A. Liard Basin Oil and Gas Resource Assessment

National Energy Board (February 2001)



- Oil Well
- ☼ Gas Well
- ☼ Oil and Gas Well
- Dry and Abandoned Well
- ◆ Condensate, Water; Unknown
- 🌳 National Park
- 🌳 Territorial Park
- 📄 Exploration Licence
- 📄 Permit
- 📄 Production Lease
- 📄 Significant Discovery Licence
- ⚡ Faults
- ⤵ Folds
- 📡 Oil and Gas Seismic Lines
- 🗺 Exploration Regions

- Bedrock Geology**
- Quaternary**
    - unconsolidated glacial, alluvial, colluvial deposits
  - Late Cretaceous - Tertiary**
    - foredeep shale and sandstone
    - volcanic rocks
  - Cretaceous**
    - foredeep shale and sandstone
  - Jurassic - Cretaceous**
    - shale, interbedded sandstone and conglomerate
    - volcanic rocks
  - Triassic**
    - shale, sandstone, limestone
    - volcanic rocks
  - Permian**
    - shale, sandstone, conglomerate, chert
    - volcanic rocks

- Devonian - Carboniferous**
  - limestone
  - shale, sandstone, conglomerate
  - volcanic rocks
- Cambrian - Devonian**
  - platform carbonate, siltstone, sandstone
  - basinal shale, siltstone, sandstone
  - volcanic rocks
- Lower Cambrian**
  - carbonate
  - shale, siltstone, sandstone
- Proterozoic - Tertiary**
  - metasedimentary and siliciclastic rocks, volcanic rocks
  - undifferentiated intrusions

Bedrock Geology  
 Gorday, S.P. and Makepeace, A.J. (compilers), 2003.  
 Yukon Digital Geology,  
 Geological Survey of Canada, Open File 1749, and  
 Yukon Geological Survey, Open File 2003-9(D).

Sedimentary Basins  
 Mossop, G.D., Wallace-Dudley, K.E., Smith, G.G and  
 Harrison, J.C. (compilers), 2004.  
 Sedimentary Basins of Canada,  
 Geological Survey of Canada, Open File 4673.



## Geological Summary

The Liard Basin lies between the Rocky Mountains to the south and the Mackenzie and Franklin Mountains to the north. The area includes the physiographic Liard Plateau and portions of the southern Mackenzie and Franklin Mountains. It constitutes the northernmost extension of the Western Canada Sedimentary Basin.

Cambrian through Middle Devonian sedimentary rocks consist dominantly of miogeoclinal platform limestones and dolostones transitioning westward to marine shales. Within the carbonates is locally a Manetoe facies dolomite consisting of coarsely crystalline, diagenetic, hydrothermal dolomite. This diagenetic facies has cavernous porosity and is the principal reservoir and target for gas in the area.

Unconformably to conformably overlying the carbonates are fissile, grey to black marine shales of the Devonian to Carboniferous Besa River Formation. To the east the Besa River Formation is transitional to carbonates of the Flett and Prophet formations. The Carboniferous deltaic complex of the Mattson Formation overlies the marine shales of the Besa River Formation. The Mattson Formation delta prograded to the west-southwest. It contains friable and porous sandstones interbedded with siltstones and shales. Some coal measures are present. Permian and Triassic strata consist dominantly of shallow water shales and siltstones of the Fantasque and Toad-Grayling formations. Cretaceous marine sandstones and shales unconformably overlie all other units in the map area.

Several small hornblende-bearing Tertiary trachytes intrude the sedimentary rocks in the westernmost part of the basin.

Structures within the Liard Basin are characterized by northwesterly to northeasterly trending box folds and east-verging and west-verging thrust faults. Topographic lows are typically underlain by synclines containing Triassic and Cretaceous siliclastic sedimentary rocks.

## Exploration History

The first recorded evidence of active petroleum exploration was in 1955 with reconnaissance field work by California Standard (Chevron). The first well in Yukon was SOBC Shell Beavercrow YT K-02 completed in 1963. Thirteen wells have been completed in Yukon. Approximately 570 line-kilometres of two-dimensional seismic has been completed.

Yukon contains portions of three fields: Beaver River Field, Kotaneelee Field, and La Biche Field. The Beaver River Field in Yukon is a former producer from well PanAm C-1 Beaver River YT G-01. Production from the Kotaneelee gas field is ongoing. Both of these fields consist of pools and prospects hosted in fractured, diagenetic hydrothermal dolomites of the Manetoe facies within carbonates of the Middle Devonian Arnica, Landry and Nahanni formations. Gas is structurally trapped in closures formed by anticlines, normal faults, and reverse faults. Seal and source for the reservoirs is provided by shales of the Besa River Formation. Commonly, gas is trapped on top of water.

## Plays

Six expected plays were identified in the Liard Basin area. Five are gas with one (Cretaceous Chinkah clastics) being gas with potential oil. One play, the Manetoe facies dolomite play is established with proven discoveries, former production from the Beaver River gas field and current gas production from the Kotaneelee gas field (two wells, Duke Energy gas pipeline). This play is a sour, acid, dry gas play and is considered the most significant one for the region.

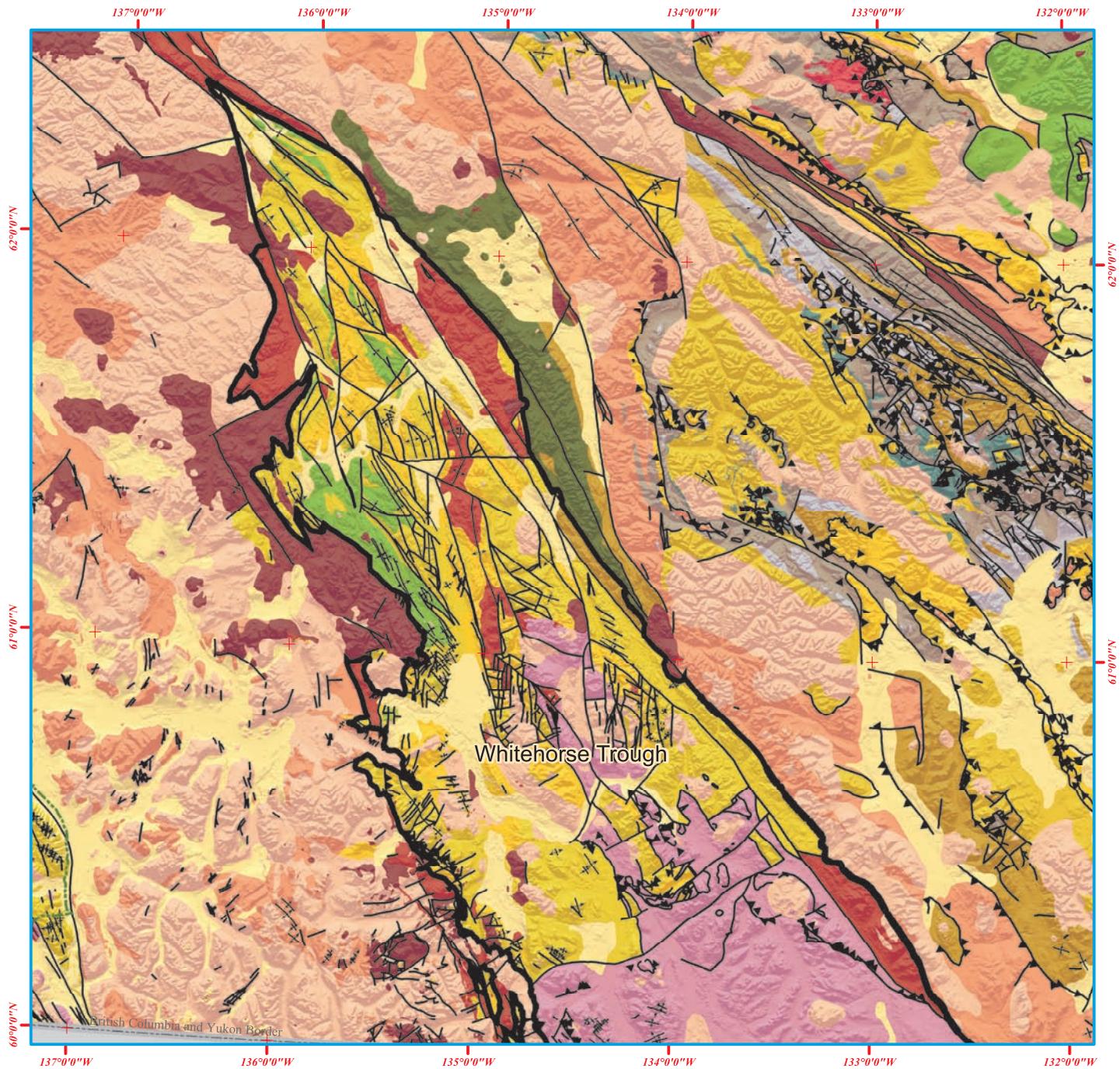
Gas Plays (Bcf)	Mean Play Potential (in place)	Play potential-80% prob. (in place)	Play potential-20% prob. (in place)
Manetoe Facies	3,392.0	1,332.4	4,722.4
Chinkeh Clastics	1.6	1.0	2.2
Fantasque	1.8	0.8	2.7
Mattson	3.6	165.7	525.4
Prophet/Flett	188.9	101.2	256.8
Besa R/Muskwa	521.8	212.1	783.0
<b>Total</b>	<b>4,109.7</b>		
Oil Plays	Median Marketable Oil (MMbbls)	Mean Marketable Oil (MMbbls)	
Chinkeh Clastics	0.1	0.1	0.1

## Wells

Well Name	Class	Status	Gr. Elev (m)	Total Depth (mKB)	Spud	Rig Release
SOBC Shell Beavercrow YT K-02	Expl	D&A	1,129.3	3,976.1	03/20/62	01/11/63
Pan Am et al A-1 Kotaneelee YT P-50	Expl	AB	449.6	4,410.5	03/16/62	08/23/63
Canada S et al N Beaver R YT I-27	Dev	AB	435.6	4,418.1	03/24/63	08/29/64
Pan Am Shell Merrill YT L-60	Expl	D&A	590.4	1,634.3	01/24/69	03/06/69
Pan Am Beaver YT G-01	Expl	AB GAS	792.5	4,499.5	12/06/68	08/20/69
Gulf et al West Beaver Crow YT O-15	Expl	D&A	1,144.8	1,727.3	02/03/70	06/01/70
Bluemount et al Beavercrow YT B-16	Expl	D&A	1,148.2	2,288.4	02/03/71	05/09/71
Columbia et al Kotaneelee YT B-38	Dev	GAS	678.2	3,898.1	04/06/77	10/21/77
Columbia et al Kotaneelee YT E-37	Dev	AB GAS	613.6	4,191.0	01/21/78	12/05/78
Columbia et al Kotaneelee YT M-17	Dev	DISP	411.5	1,332.0	01/01/79	02/26/79
Columbia et al Kotaneelee YT I-48	Dev	SP GAS	827.3	3,915.0	04/18/79	04/11/80
Devon et al Kotaneelee L-38	Dev	GAS	805.0	-	08/22/04	03/27/05

## B. Whitehorse Trough Oil and Gas Resource Assessment

National Energy Board (February 2001)



- Oil Well
- ☼ Gas Well
- ☼ Oil and Gas Well
- Dry and Abandoned Well
- ◆ Condensate, Water; Unknown
- ▭ National Park
- ▭ Territorial Park
- ▭ Exploration Licence
- ▭ Permit
- ▭ Production Lease
- ▭ Significant Discovery Licence
- ~ Faults
- ⋈ Folds
- Oil and Gas Seismic Lines
- ⊞ Exploration Regions

### Bedrock Geology

- Quaternary**
  - unconsolidated glacial, alluvial, colluvial deposits
- Late Cretaceous - Tertiary**
  - foredeep shale and sandstone
  - volcanic rocks
- Cretaceous**
  - foredeep shale and sandstone
- Jurassic - Cretaceous**
  - shale, interbedded sandstone and conglomerate
  - volcanic rocks
- Triassic**
  - shale, sandstone, limestone
  - volcanic rocks
- Permian**
  - shale, sandstone, conglomerate, chert
  - volcanic rocks

- Devonian - Carboniferous**
  - limestone
  - shale, sandstone, conglomerate
  - volcanic rocks
- Cambrian - Devonian**
  - platform carbonate, siltstone, sandstone
  - basinal shale, siltstone, sandstone
  - volcanic rocks
- Lower Cambrian**
  - carbonate
  - shale, siltstone, sandstone
- Proterozoic - Tertiary**
  - metasedimentary and siliciclastic rocks, volcanic rocks
  - undifferentiated intrusions

Bedrock Geology  
Gorley, S.P. and Makepeace, A.J. (compilers), 2003.  
Yukon Digital Geology,  
Geological Survey of Canada, Open File 1749 and  
Yukon Geological Survey, Open File 2003-9(D).

Sedimentary Basins  
Mossop, G.D., Wallace-Dudley, K.E., Smith, G.G and  
Harrison, J.C. (compilers), 2004.  
Sedimentary Basins of Canada,  
Geological Survey of Canada, Open File 4673.

**Yukon**  
Energy, Mines and Resources

3170-30-Investment Booklet: Geology  
4 February, 2005

## Geological Summary

Whitehorse Trough in south-central Yukon is a mainly gas-prone basin containing Mesozoic to Cenozoic strata in an intensely faulted and folded intermontane setting. It is elongate and extends in a northwest-southeast trend from just north of Carmacks to the near Dease Lake, British Columbia.

Whitehorse Trough contrasts with all other hydrocarbon areas in Yukon in that it is underlain by oceanic basement of the allochthonous Stikine and Cache Creek suspect terranes. Basement therefore consists of basalt flows with associated shales, bedded cherts and limestones.

Whitehorse Trough was first initiated in Middle to Late Triassic as a forearc basin located immediately east of an emerging ancestral Lewes River volcanic arc and west of a west-dipping subduction zone. Deposition within the basin continued through Middle Jurassic with more than 7,000 metres of basin fill constituting the Lewes River and Laberge groups. Lithologic facies delineate a general west to east transition in depositional environments from prograding deltas with associated coarse and fine clastic rocks (west) to marine, fine clastic rocks (east). Conglomerate occurs throughout the succession as localized deposits. Limestone reefs are locally present in the lower part of the stratigraphy in linear belts along the west and central portions of the Trough.

Unconformably overlying this sequence is a succession of Jurassic to Lower Cretaceous fluvial conglomerates with associated sandstones and shales constituting the Tantalus Formation. This non-marine succession marks closure of Whitehorse Trough and deposition of a molasse succession shed from uplift of the former trough and surrounding terranes.

The entire stratigraphic succession is intruded by Cretaceous to early Tertiary granitoids, mainly in the south part of the Trough. These granitoids formed largely in response to an east-dipping subduction zone located west of the Whitehorse Trough.

The dominant structural trend in Whitehorse Trough is northwest-southeast with abundant folds and faults. The core of the Trough is an anticlinorium with younger rocks occurring on both the west and east margins. Deformation occurred in the interval between Middle Jurassic and Middle Cretaceous.

## Exploration History

The first recorded active petroleum exploration was in the 1950s. Exploration was ongoing sporadically until 1981, consisting largely of evaluation of the stratigraphic sections for petroleum prospectivity. Since 1981, no permits have been issued for the area.

No private seismic surveys or wells have been completed for the area. During 2004, a two dimensional seismic survey was jointly funded by Yukon Geological Survey and Geological Survey of Canada across the northern part of the Trough. Results from that survey are still pending.

## Plays

Five gas plays and two oil plays were identified for Whitehorse Trough. Six of the plays are structural and only one is stratigraphic. The Tantalus plays include all the Mesozoic clastic rocks above the sub-Middle Jurassic unconformity and therefore includes the Tanglefoot Formation in the Laberge Group. The Takwahoni plays include the coarse clastic rocks in the Laberge Group, and the Inklin plays correspond to the fine clastic rocks in the Laberge Group. The Lewes River structural play includes all structural traps in the mainly clastic strata in the Lewes River Group. The Lewes River stratigraphic play is restricted to the Upper Triassic carbonate reefs in the Lewes River Group.

All plays are based on analogies with established plays in other basins. The plays are conceptual in nature and therefore highly risky.

Whitehorse Trough contains abundant bituminous to semi-anthracite grade coal measures in the Jurassic Laberge Group and the Jurassic-Cretaceous Tantalus Formation. Coals have been mined historically in the Carmacks area for local use. Potential for gas from coal methane exists but has not been considered in this assessment.

### Gas Plays (Bcf)

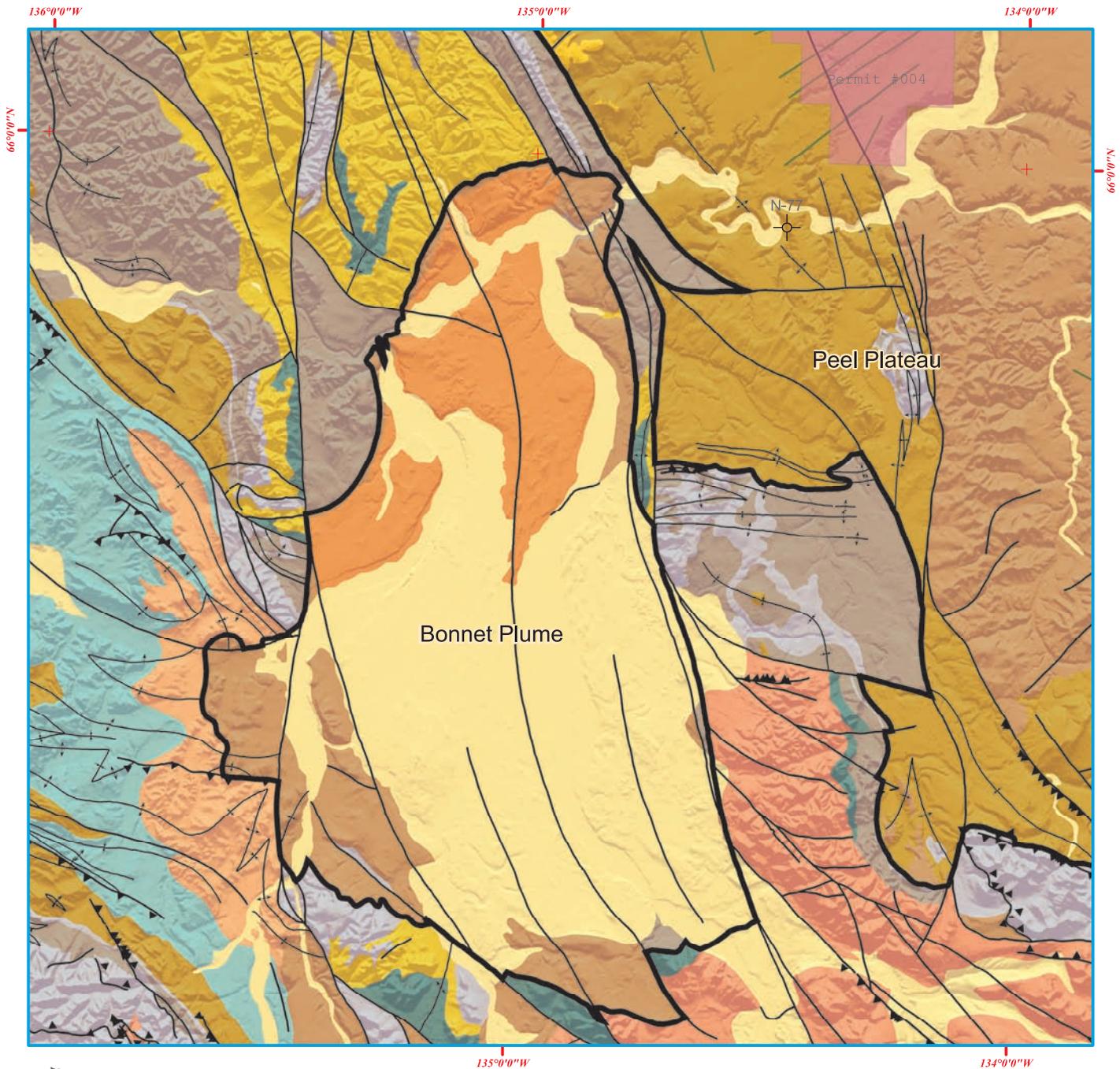
Gas Plays (Bcf)	Mean Play (Yukon)
Cache Creek-Nakina carbonate stratigraphic gas	3.3
Lewes River-Hancock carbonate stratigraphic gas	112.3
Conglomerate-Richthofen stratigraphic gas	47.3
Conglomerate-Nordenskiold stratigraphic gas	0.1
Hancock-Conglomerate structural gas	129.4
Tantalus stratigraphic gas	92.5
Tantalus structural gas	28.8
Alluvium and till stratigraphic gas	9.6
<b>Total</b>	<b>423.3</b>

### Oil Plays (MMbbls)

Oil Plays (MMbbls)	Mean Play (Yukon)
Conglomerate-Richthofen stratigraphic oil	5.5
Tantalus stratigraphic oil	13.8
Hancock-Conglomerate structural oil	15.4
Tantalus structural oil	4.9
<b>Total</b>	<b>39.6</b>

# C. Bonnet Plume Oil and Gas Resource Assessment

Bonnet Plume Basin Resource Assessment (Hannigan, 2000)\*



Bedrock Geology  
Gorday, S.P. and Makepeace, A.J. (compilers), 2003.  
Yukon Digital Geology,  
Geological Survey of Canada, Open File 1749 and  
Yukon Geological Survey, Open File 2003-9(D).

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Mossop, G.D., Wallace-Dudley, K.E., Smith, G.G and  
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Geological Survey of Canada, Open File 4673.

- Oil Well
- ☼ Gas Well
- ☼ Oil and Gas Well
- Dry and Abandoned Well
- ◆ Condensate, Water; Unknown
- National Park
- Territorial Park
- Exploration Licence
- Permit
- Production Lease
- Significant Discovery Licence
- Faults
- Folds
- Oil and Gas Seismic Lines
- Exploration Regions

### Bedrock Geology

- Quaternary**
  - unconsolidated glacial, alluvial, colluvial deposits
- Late Cretaceous - Tertiary**
  - foredeep shale and sandstone
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- Cretaceous**
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  - volcanic rocks
- Triassic**
  - shale, sandstone, limestone
  - volcanic rocks
- Permian**
  - shale, sandstone, conglomerate, chert
  - volcanic rocks

### Devonian - Carboniferous

- limestone
- shale, sandstone, conglomerate
- volcanic rocks

### Cambrian - Devonian

- platform carbonate, siltstone, sandstone
- basinal shale, siltstone, sandstone
- volcanic rocks

### Lower Cambrian

- carbonate
- shale, siltstone, sandstone

### Proterozoic - Tertiary

- metasedimentary and siliciclastic rocks, volcanic rocks
- undifferentiated intrusions



\*Assessment completed using program PETRIMES

## Geological Summary

The Bonnet Plume Basin is an intermontane, fault-bounded basin within the Northern Yukon Fold Complex located at the intersection of the north-trending Richardson fault array with the Mackenzie fold front. The basin developed as a depositional site in early Late Cretaceous in response to strike- and dip-slip faulting. It contains extensive non-marine late Cretaceous to Tertiary sandstone, shale, conglomerate and coal which constitute the Bonnet Plume Formation.

Unconformably underlying the Bonnet Plume Formation are Lower Paleozoic marine shales and limestones of the ancestral North America miogeocline. Most of the Bonnet Plume Basin coincides with the Richardson Trough, a north-trending zone of marine deep water shale and chert deposition with shallow water carbonate platform deposition occurring both to the west (Yukon Stable Block) and the east (Mackenzie-Peel shelf). This platform to basin transition is uniformly overlain by euxinic siliceous black shales of the Middle Devonian Canol Formation and shales and siltstones of the Late Devonian Imperial Formation.

Compressional deformation occurred during Late Cretaceous to Early Tertiary as part of the Cordilleran Orogen.

## Exploration History

No seismic surveys have been completed, and no wells have been drilled. The nearest well is the Toltec Peel River YT N-77, drilled 20 kilometres to the northwest in the Peel River valley in 1968. An east-west gravity profile was completed across the centre of the basin in 1979 to determine if gravity methods could be used to interpret structure in areas with limited surface control and no subsurface information.

The Bonnet Plume Formation contains some of the thickest and most extensive coal deposits in Yukon. Drilling by Pan Ocean Oil of 37 shallow holes in 1978-1980 delineated a proven reserve in one deposit of 121 million tonnes. Coal within the basin is considered to have extensive gas-from-coal potential.

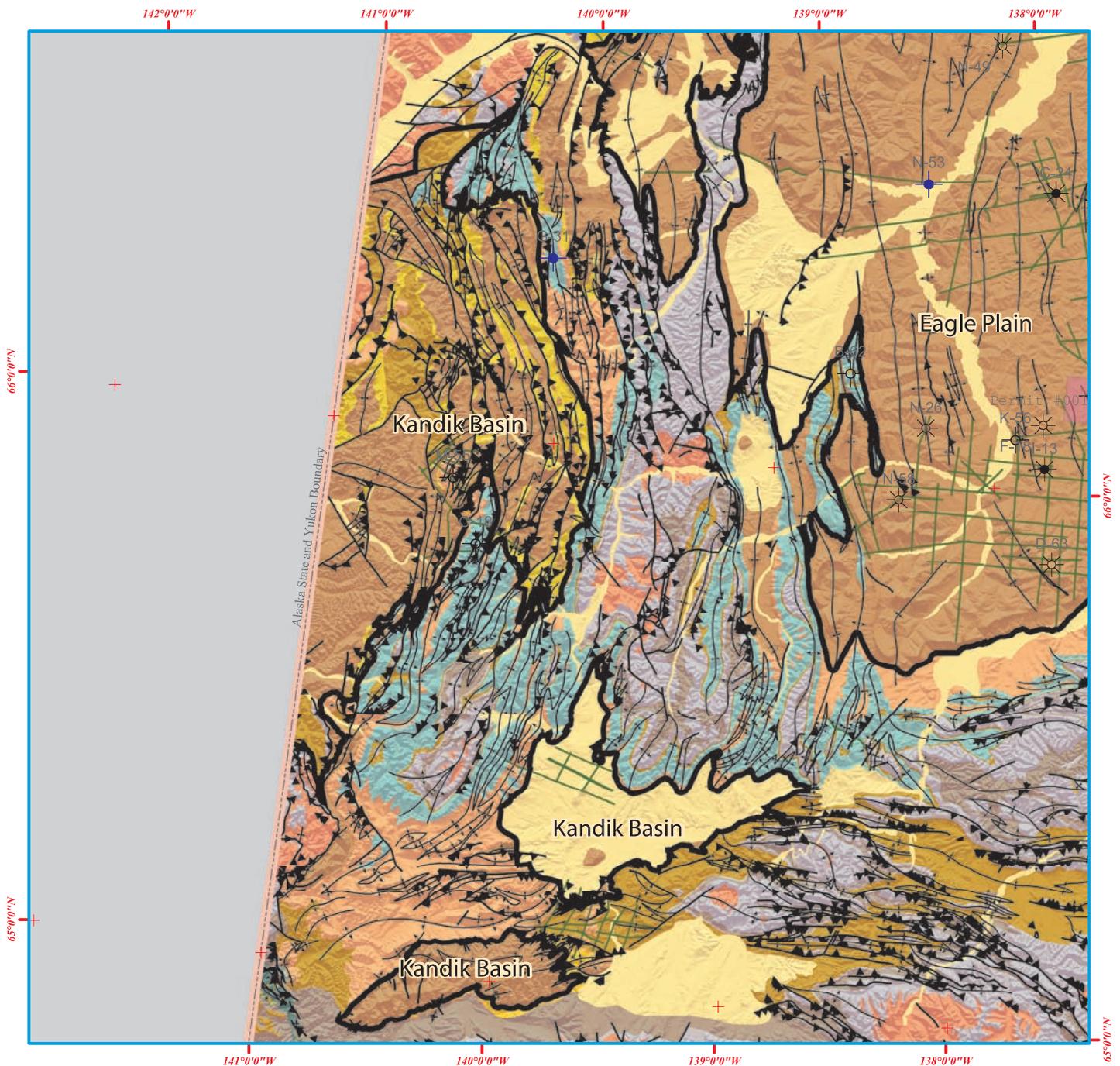
## Plays

Three conceptual gas plays and three speculative gas plays have been identified within the Bonnet Plume Basin. Statistical analysis has been completed for the conceptual plays. Significant gas potential is predicted for stratigraphic and structural traps within the Lower Paleozoic facies transition from carbonate to shale. Gas potential from stratigraphic and structural traps related to the non-marine Bonnet Plume Formation is much smaller. Geochemical evidence indicates that there is probably not much oil potential in the area.

Gas Plays (Bcf)	No. fields (mean)	Mean play potential (in place)	Play potential-80% prob. (in place)	Play potential-20% prob. (in place)
Lower Paleozoic carbonate \ shale facies transition	6	720	291	1,068
Upper Cretaceous-Tertiary clastics	6	61	17	103
Upper Cretaceous clastic subthrust	2	19	5	31
<b>Total Gas (Bcf)</b>	<b>14</b>	<b>800</b>		

## D. Kandik Basin Oil and Gas Resource Assessment

Kandik Basin Resource Assessment (Hannigan, Osadetz, Dixon and Bird, 2000)\*



- Oil Well
- ☀ Gas Well
- ⊙ Oil and Gas Well
- Dry and Abandoned Well
- ◆ Condensate, Water; Unknown
- 🏞 National Park
- 🏞 Territorial Park
- 📄 Exploration Licence
- 📄 Permit
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- 📄 Significant Discovery Licence
- ⚡ Faults
- ⤵ Folds
- Oil and Gas Seismic Lines
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### Bedrock Geology

- Quaternary**
  - ☐ unconsolidated glacial, alluvial, colluvial deposits
- Late Cretaceous - Tertiary**
  - ☐ foredeep shale and sandstone
  - ☐ volcanic rocks
- Cretaceous**
  - ☐ foredeep shale and sandstone
- Jurassic - Cretaceous**
  - ☐ shale, interbedded sandstone and conglomerate
  - ☐ volcanic rocks
- Triassic**
  - ☐ shale, sandstone, limestone
  - ☐ volcanic rocks
- Permian**
  - ☐ shale, sandstone, conglomerate, chert
  - ☐ volcanic rocks

- Devonian - Carboniferous**
  - ☐ limestone
  - ☐ shale, sandstone, conglomerate
  - ☐ volcanic rocks
- Cambrian - Devonian**
  - ☐ platform carbonate, siltstone, sandstone
  - ☐ basinal shale, siltstone, sandstone
  - ☐ volcanic rocks
- Lower Cambrian**
  - ☐ carbonate
  - ☐ shale, siltstone, sandstone
- Proterozoic - Tertiary**
  - ☐ metasedimentary and siliciclastic rocks, volcanic rocks
  - ☐ undifferentiated intrusions

Bedrock Geology  
Gordley, S.P. and Makepeace, A.J. (compilers), 2003.  
Yukon Digital Geology,  
Geological Survey of Canada, Open File 1749 and  
Yukon Geological Survey, Open File 2003-9(D).

Sedimentary Basins  
Mossop, G.D., Wallace-Dudley, K.E., Smith, G.G and  
Harrison, J.C. (compilers), 2004.  
Sedimentary Basins of Canada,  
Geological Survey of Canada, Open File 4673.

**Yukon**  
Energy, Mines and Resources  
3170-30 Investment Booklet Geology  
4 February, 2005

\*Assessment completed using program PETRIMES

## Geological Summary

Kandik Basin is a structural basin containing Paleozoic-Mesozoic sedimentary rocks within the Northern Yukon Fold Complex. It straddles the Yukon-Alaska border 650 kilometres north-northwest of Whitehorse and 907 kilometres southeast of Prudhoe Bay, Alaska. The basin is elongate to the southwest with about 60% of the area located in Alaska. It consists of three separate areas with preserved Mesozoic sedimentary rocks which are surrounded by exposed Precambrian-Paleozoic outcrops. To the south, the Basin is bounded by the Tintina Fault with some 420 km of right-lateral strike-slip displacement.

Basin basement consists of marlstones, diamictites, quartzites and siliceous carbonates of the Proterozoic Tindir Group. Unconformably overlying these strata are numerous Lower Paleozoic carbonate-shale cycles with lesser intermittent siliciclastic sedimentation intervals. Recurrent Cretaceous marine clastic wedges separated by unconformities overlie the earlier interbedded carbonate-shale intervals. The uppermost succession consists of non-marine conglomeratic sandstone and grit which unconformably overlie the Cretaceous marine succession. The area was unglaciated during the Pleistocene; alluvial sediments occur along river valleys.

The basin formed as a structurally controlled depositional site in late Early Cretaceous. Subsequent Cordilleran Orogen compressional tectonics in Late Cretaceous and early Tertiary produced folds and faults within the basin.

## Exploration History

Petroleum exploration in Kandik Basin began in 1970 with the drilling of the INC Husky Amoco Black-Fly YT M-55 well. Inexco conducted a reflection and refraction seismic survey in the winter of 1971 which acquired approximately 180 line-km of data in three areas along the eastern margin of the basin. Two additional holes were drilled in 1971 (Porcupine YT G-31) and 1972 (Mallard YT O-18). All three holes were drilled on structures. None of the wells encountered hydrocarbons.

In Alaska three wells were drilled in the interval 1976-1977. Two of these wells were spudded north of the area considered to be part of Kandik Basin for assessment purposes.

## Plays

There are no discovered reserves in the basin. Oil staining has been observed in outcrop in carbonates and calcareous sandstone in the Alaska portion of the basin. Six conceptual oil and gas plays (three for oil and three for gas) were identified in the Kandik Basin. The Upper Cretaceous/Tertiary non-marine play has limited extent, occurring dominantly in the southern part of the basin. Reservoirs for Mesozoic marine structural plays are dominantly clastic sedimentary rocks, and reservoirs for Paleozoic structural plays are mainly carbonate rocks. The Mesozoic marine structural oil play occurs entirely within Alaska. All plays are considered to have a high probability of existing. An important risk in each of the plays is the extent of erosion and unroofing which may have increased the chance of breached seal or closure.

Gas Plays (Bcf)	No. fields (mean)	Mean play potential (in place)	Play potential-80% prob. (in place)	Play potential-20% prob. (in place)
Tertiary/Upper Cretaceous non-marine	30	99.0	33.5	172.9
Mesozoic marine structural	8	189.1	67.5	299.0
Paleozoic marine structural	10	360.8	124.3	572.8
<b>Total Gas (Bcf)</b>	<b>48</b>	<b>648.9</b>		

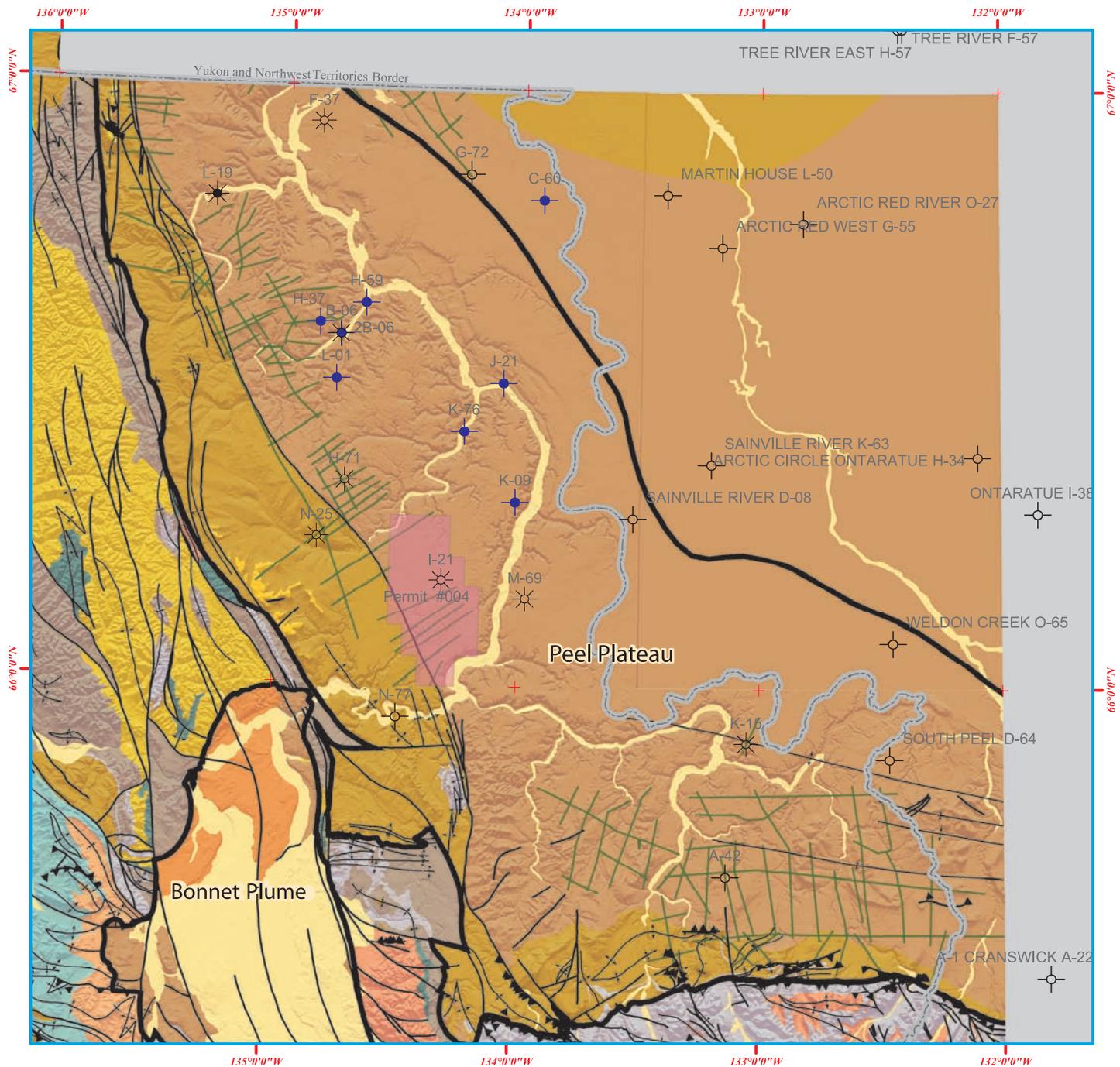
Oil Plays (MMbbls)	No. fields (mean)	Mean play potential (in place)	Play potential-80% prob. (in place)	Play potential-20% prob. (in place)
Tertiary/Upper Cretaceous non-marine	30	77.8	26.6	135.9
Paleozoic marine	3	21.5	3.1	36.8
<b>Total Oil (MMbbls)</b>	<b>33</b>	<b>99.3</b>		

## Wells

Well Name	Class	Status	Gr. Elev (m)	Total Depth (mKB)	Spud	Rig Release
Inc Husky Amoco Black-Fly YT M-55	Expl	D&A	749.8	2,069.6	01/13/70	04/01/70
Inexco Husky et al. Porcupine YT G-31	Expl	D&A	917.4	2,657.9	12/31/71	03/24/72
Inexco et al. Mallard YT O-18	Expl	D&A	470.6	3,200.1	05/02/72	08/19/72

# E. Peel Plateau and Plain Oil and Gas Resource Assessment

Peel Plateau Resource Assessment (Osadetz, MacLean, Morrow, Dixon and Hannigan, 2005)\*



Bedrock Geology  
Gordley, S.P. and Makepeace, A.J. (compilers), 2003.  
Yukon Digital Geology,  
Geological Survey of Canada, Open File 1749 and  
Yukon Geological Survey, Open File 2003-9(D).

Sedimentary Basins  
Mossop, G.D., Wallace-Dudley, K.E., Smith, G.G and  
Harrison, J.C. (compilers), 2004.  
Sedimentary Basins of Canada,  
Geological Survey of Canada, Open File 4673.

- Oil Well
- ☀ Gas Well
- ☀ Oil and Gas Well
- Dry and Abandoned Well
- Condensate, Water; Unknown
- 🌿 National Park
- 🌿 Territorial Park
- 📄 Exploration Licence
- 📄 Permit
- 📄 Production Lease
- 📄 Significant Discovery Licence
- Faults
- Folds
- Oil and Gas Seismic Lines
- 📄 Exploration Regions

### Bedrock Geology

- Quaternary
  - unconsolidated glacial, alluvial, colluvial deposits
- Late Cretaceous - Tertiary
  - foredeep shale and sandstone
  - volcanic rocks
- Cretaceous
  - foredeep shale and sandstone
- Jurassic - Cretaceous
  - shale, interbedded sandstone and conglomerate
  - volcanic rocks
- Triassic
  - shale, sandstone, limestone
  - volcanic rocks
- Permian
  - shale, sandstone, conglomerate, chert
  - volcanic rocks

### Devonian - Carboniferous

- limestone
- shale, sandstone, conglomerate
- volcanic rocks

### Cambrian - Devonian

- platform carbonate, siltstone, sandstone
- basinal shale, siltstone, sandstone
- volcanic rocks

### Lower Cambrian

- carbonate
- shale, siltstone, sandstone

### Proterozoic - Tertiary

- metasedimentary and siliciclastic rocks, volcanic rocks
- undifferentiated intrusions



\*Assessment completed using program PETRIMES

## Geological Summary

The Peel Plateau and Plain is a prospective hydrocarbon region in the Northern Interior Platform north of the Mackenzie Mountains and east of the Richardson Mountains. It contains a Lower Cambrian to Upper Cretaceous stratigraphic succession with a maximum thickness of approximately 4.5 km. Geologically, it is similar in setting to the Western Canada Sedimentary Basin.

Lower and Middle Paleozoic sedimentary rocks were deposited in a continental margin setting and contain the platform carbonate to basinal shale transition. Upper Paleozoic interbedded shales, siltstones and shales overlie this carbonate to shale transition. Locally isolated carbonate mounds may be present within this Upper Paleozoic clastic succession. The Paleozoic successions are unconformably overlain by a Mesozoic clastic succession of sandstone, siltstone and shale deposited within a developing foreland basin east of the Cordilleran Orogen.

The Peel Plateau encompasses all sedimentary rocks which exhibit folding and thrusting related to the Cordilleran Orogen. It has been subdivided into two structural domains with the surface trace of the Trevor fault being the boundary between the two domains. The Plateau domain west of the Trevor fault is underlain largely by Lower Paleozoic basinal shales of Richardson Trough. The Lower Paleozoic stratigraphy in the Peel Plateau domain east of the Trevor fault consists dominantly of platform carbonate. The Peel Plain is east of the Peel Plateau and corresponds to all the undisturbed, relatively flat-lying sedimentary rocks east of the Cordilleran Orogen deformation front.

## Exploration History

Surface exploration began in the mid 1950s. The first well (Shell Peel River YT-J21) was completed in 1965. Eighteen additional wells were drilled between 1965 and 1977 for a total of 42,319 metres. Drilling resulted in several gas shows but no established economic reserves or production.

Over 3,000 line-kilometres of seismic surveys were completed in the 1960s and 1970s. 500 line-kilometres of this data, ranging from fair to good quality, is available to the public in the information files of the National Energy Board.

## Plays

Peel Plateau and Plain was divided into three structural domains (two within Peel Plateau and one constituting Peel Plain) for assessment purposes. Eight gas plays have been identified within these three structural domains. The plays consist of different structural and stratigraphic traps in the Paleozoic sedimentary rocks and the overlying Mesozoic sedimentary rocks. Gas prospectivity increases in an overall easterly direction with the greatest prospectivity being for the Peel Plain. There is significant potential for natural gas with a summed mean play potential of approximately 2.9 Tcf in 88 pools. The largest pool is expected to occur in Mesozoic clastic rocks of the Peel Plain.

No crude oil potential was estimated due to the lack of suitable maturation and source. Subsequently YGS geologists have discovered visible oil stains in three areas within the Peel Plateau and Plain assessment area.

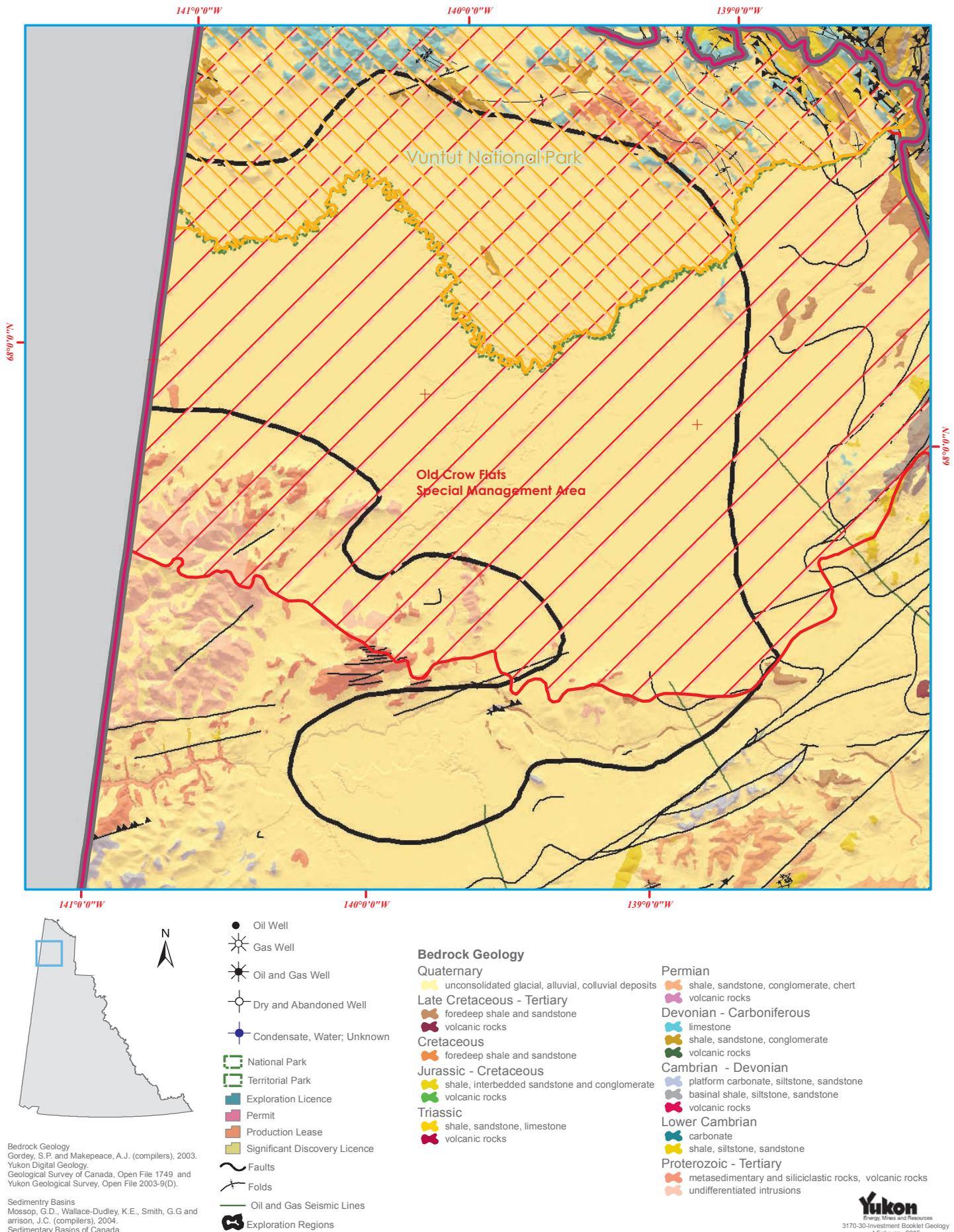
Gas Plays (Bcf)	No. fields (mean)	Mean play potential (in place)	Play potential-80% prob. (in place)	Play potential-20% prob. (in place)
<u>Peel Plateau west of Trevor fault</u>				
Upper Paleozoic clastics	1	3.7	< 9.1 (10%)	< 9.1 (10%)
<u>Peel Plateau west of limit of deformation</u>				
Paleozoic carbonate margin	7	157.0	45.0	257.0
Upper Paleozoic clastics	2	275.0	< 71.0 (70%)	488.0
Mesozoic clastics	12	465.0	259.0	656.0
<u>Peel Plain east of limit of deformation</u>				
Paleozoic carbonate platform	1	9.6	< 1.4	17.2
Horn Plateau reef	1	0.9	< 80.0 (8%)	< 80.0 (8%)
Upper Paleozoic clastics	9	256.0	112.0	389.0
Mesozoic clastics	55	1,748.0	853.0	2,636.0
<b>Total Gas (Bcf)</b>	<b>88</b>	<b>2,915.2</b>		

## Wells

Well Name	Class	Status	Gr. Elev (m)	Total Depth (mKB)	Spud	Rig Release
Gulf Mobil Caribou YT N-25	Expl	D&A	487.7	3,600.3	05/01/74	08/31/74
IOE Satah River YT G-72	Expl	D&A	86.0	2,286.0	01/13/67	03/09/67
McD GCO Northup Taylor Lake YT K-15	Expl	D&A	464.8	2,378.7	02/05/69	03/29/69
Mobil Gulf Peel YT H-71	Expl	D&A	506.0	3,392.1	02/05/77	06/12/77
Pacific et al Peel YT F-37	Expl	D&A	48.8	3,368.0	02/13/72	04/20/72
Shell Peel R YT 2B-06	Expl	D&A	62.5	1,066.8	01/03/67	01/25/67
Shell Peel R YT B-06	Expl	D&A	61.6	430.4	12/14/66	12/31/66
Shell Peel R YT H-59	Expl	D&A	29.6	763.2	03/11/67	04/01/67
Shell Peel R YT I-21	Expl	D&A	377.3	2,072.6	02/20/66	03/30/66
Shell Peel R YT J-21	Expl	D&A	41.8	1,219.2	07/31/65	09/01/65
Shell Peel R YT K-09	Expl	D&A	345.4	1,554.5	02/03/67	03/07/67
Shell Peel R YT K-76	Expl	D&A	72.5	1,386.8	10/07/65	11/25/65
Shell Peel R YT L-01	Expl	D&A	390.8	1,834.9	12/12/65	02/07/66
Shell Peel R YT L-19	Expl	D&A	91.4	1,981.2	04/11/66	06/12/66
Shell Peel River YT M-69	Expl	D&A	282.5	3,272.6	10/06/74	12/04/74
Shell Trail River YT H-37	Expl	D&A	385.3	3,721.6	11/27/73	03/26/74
Skelly Getty Mobil Arctic Red YT C-60	Expl	D&A	86.9	2,599.9	01/15/72	03/26/72
Toltec Peel River YT N-77	Expl	D&A	146.3	1,122.6	10/07/68	07/23/70
Amoco PCB B-1 Cranswick YT A-42	Expl	D&A	613.3	4,267.2	04/14/72	03/20/73

# F. Old Crow Basin Oil and Gas Resource Assessment

Old Crow Basin Resource Assessment (Hannigan, 2001)\*



\*Assessment completed using program PETRIMES

## Geological Summary

In northwestern Yukon, the Old Crow Basin is a Tertiary intermontane basin within the Northern Yukon Fold Complex. It is flanked by intensely deformed and uplifted Proterozoic to Mesozoic sedimentary rocks of the British Mountains, Richardson Mountains, Old Crow Range and Keele Range. The Old Crow Basin consists of essentially flat-lying Tertiary to Recent, non-marine sediments with coals unconformably overlying a Proterozoic to Mesozoic basement with a suggested relief of up to 800 m. This basement relief is caused by either east-west trending marginal faults or syncline-anticline fold structures. Mesozoic strata are thought to be imperfectly preserved beneath this Eocene unconformity with their erosion occurring over the structural highs.

Rocks in the region have been deformed by two major orogenic episodes: an Early Devonian Ellesmerian compressional orogeny, and the latest Cretaceous to Tertiary Cordilleran compressional orogeny.

## Exploration History

Petroleum exploration in the Old Crow Basin has been quite limited. Approximately 2,000 line-kilometres of reconnaissance seismic was shot in the basin between 1969 and 1972. An extensive gravity survey was completed by Gulf Oil Canada Ltd. in 1973. No wells have been drilled. The nearest well is the Socony Mobil-W.M. Molar P-34 well drilled in northern Eagle Plain, 50 kilometres to the southeast. Areas within Vuntut National park and Old Crow Flats Special Management Area are withdrawn from exploration and development.

## Plays

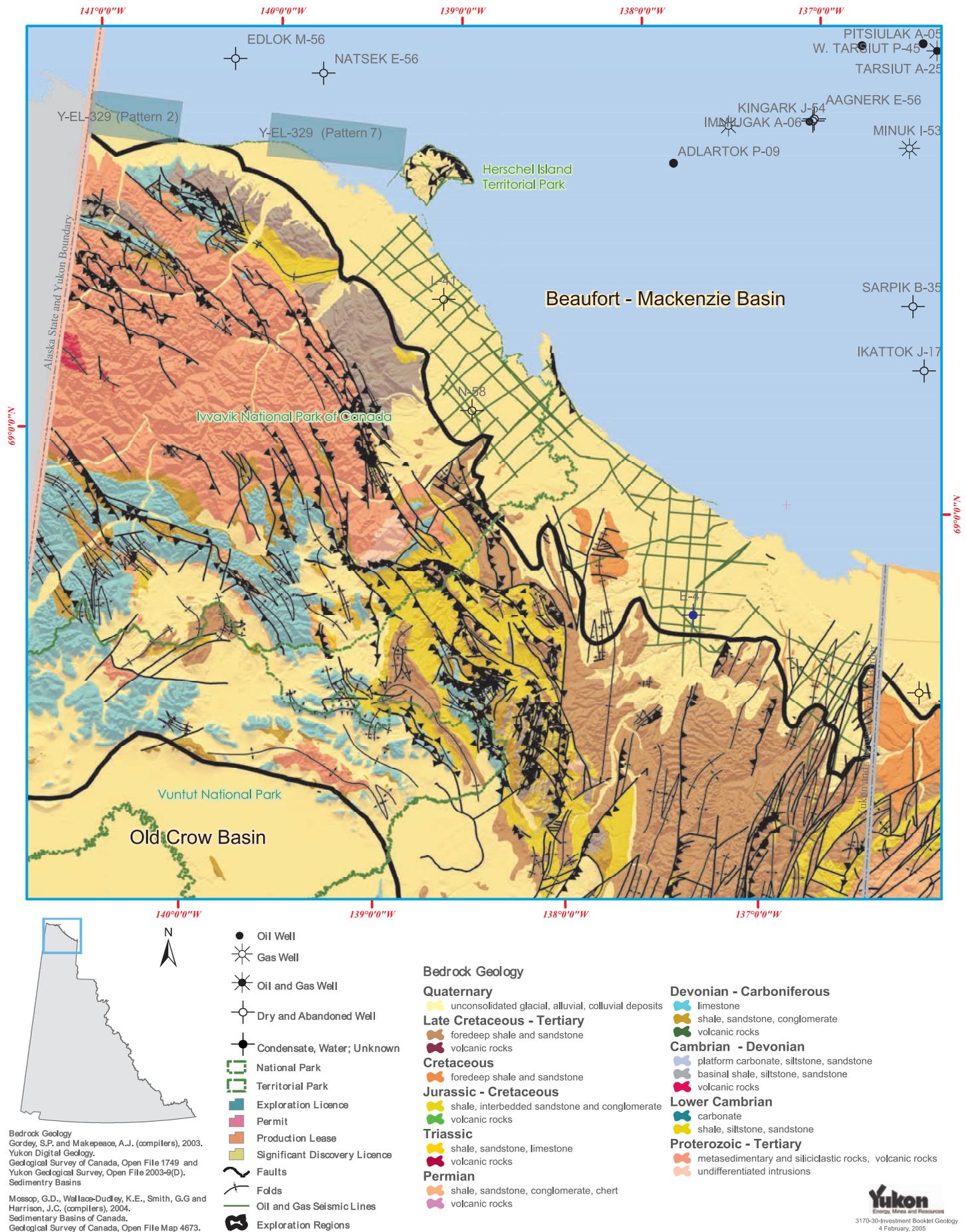
Tertiary sediments are likely too immature and sparingly structured to have significant hydrocarbon potential, although there is some potential for biogenic gas. There is little, if any, oil potential in the area.

Three conceptual gas plays and three speculative gas plays were defined in the Old Crow Basin area on the basis of petroleum geology considerations such as structural style, dominant reservoir lithology and thermal maturity. Conceptual gas plays for the Old Crow Basin consist of conglomerates of the Carboniferous Kekiktuk Formation, carbonates of the Carboniferous Lisburne Group and Mesozoic sandstones preserved beneath the Tertiary cover. The greatest gas potential or volume occurs in the Upper Paleozoic carbonate play.

Gas Plays (Bcf)	No. fields (mean)	Mean play potential (in place)	Play potential-80% prob. (in place)	Play potential-20% prob. (in place)
Kekiktuk conglomerate	5	422	100	689
Upper Paleozoic carbonate	5	686	123	1,107
Mesozoic clastic	0.6	41	0	66
<b>Total Gas (Bcf)</b>	<b>10.6</b>	<b>1,149</b>		

# G. Beaufort-Mackenzie Basin Oil and Gas Resource Assessment

2001 Geological Survey of Canada (Calgary) P. Hannigan\*



\*Assessment completed using program PETRIMES

## Geological Summary

The Beaufort-Mackenzie basin of northern Yukon is an Arctic margin basin underlain by complexly faulted and folded Proterozoic through Tertiary sediments. The area is flanked to the south by exposed Proterozoic and Lower Paleozoic sediments of the British Mountains and Richardson Mountains. It contains four tectono-stratigraphic assemblages separated by major regional unconformities: a lowermost Proterozoic clastic assemblage forming the economic basement, Lower Paleozoic sedimentary rocks delineating a carbonate platform to marine basin transition with dominantly basinal shales in the area of interest, Carboniferous to Lower Cretaceous non-marine clastic sedimentary rocks transitioning to shallow marine and intertidal deposits, and Lower Cretaceous to Tertiary northward prograding delta deposits. Upper Cretaceous sedimentary rocks include foreland flysch deposits from extensively eroding uplands of the Cordilleran Orogen.

The dominant structural fabric is related to Cretaceous-Tertiary contractional deformation of the Cordilleran Fold Belt during the Cordilleran Orogeny. Structures form an arcuate trend with east to southeast strikes in northwestern Yukon rotating to a north-south trend in eastern Yukon. Tight folds, thrust faults, strike-slip faults, and extensional faults all formed as part of this deformation. Earlier deformation features related to the Ellesmerian Orogeny and Jurassic-Cretaceous extension are locally discernable through the later overprinting.

## Exploration History

Seismic surveys in the Mackenzie Delta area in the early 1960s delineated large structures in favourable stratigraphic successions. These early surveys led to the drilling of two dry wells in 1962. Further exploration led to the discovery of oil in Cretaceous sandstones in 1969. In 1970, a major gas find was made in Lower Cretaceous sands. In 1977, the focus of exploration switched offshore to Tertiary targets. In the Beaufort-Mackenzie region, 53 oil and gas discoveries, both onshore and offshore, have been made. Forty-four of these discoveries occur in the Tertiary basin. 247 wells have been completed to date. Drilling on the Yukon portion of the basin to the west has been very limited. Three wells were completed showing no hydrocarbons and limited reservoir potential.

## Plays

The potential for significant hydrocarbon accumulations in the region is derived from the combined presence of numerous and diverse trapping configurations, good to excellent petroleum source rocks in favourable stratigraphic positions and reservoir-quality strata in the sedimentary succession. However, significant risks associated with lack of porosity development in Paleozoic and Mesozoic strata and thermal maturity considerations reduce overall hydrocarbon potential. The complex geology and anticipated high exploration risks associated with all defined exploration plays in the region suggest that considerable seismic survey work and exploration drilling are required to properly evaluate the North Coast hydrocarbon potential.

There are no discovered reserves in the Yukon portion of the Beaufort-Mackenzie basin. Hydrocarbon resource assessment for the area encompasses portions of Yukon and GNWT. The assessment analyzed six conceptual and immature plays. The mean estimates for total oil and gas potential for all coastal plain plays are 294 MMbbls of oil and 1,473 Bcf of gas. The results indicate that four gas fields greater than 100 Bcf are expected in the region. Even though geological risk factors are substantial, significant gas potential is predicted.

Gas Plays (Bcf)	No. fields (mean)	Mean play potential (in-place)	Play potential-80% prob. (in-place)	Play potential-20% prob. (in place)
South Delta-Mesozoic	8	2.1	1.0	3.1
South Delta-Paleozoic	15	6.4	2.8	9.6
Herschel	5	560.1	182.7	868.7
Yukon Coastal Plain	2.5	439.4	63.2	724.4
<b>Total Gas (Bcf)</b>	<b>30.5</b>	<b>1,008.0</b>		

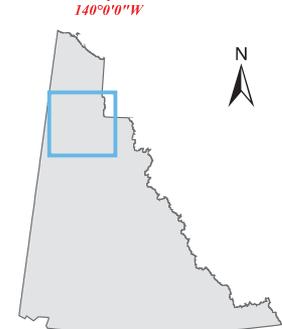
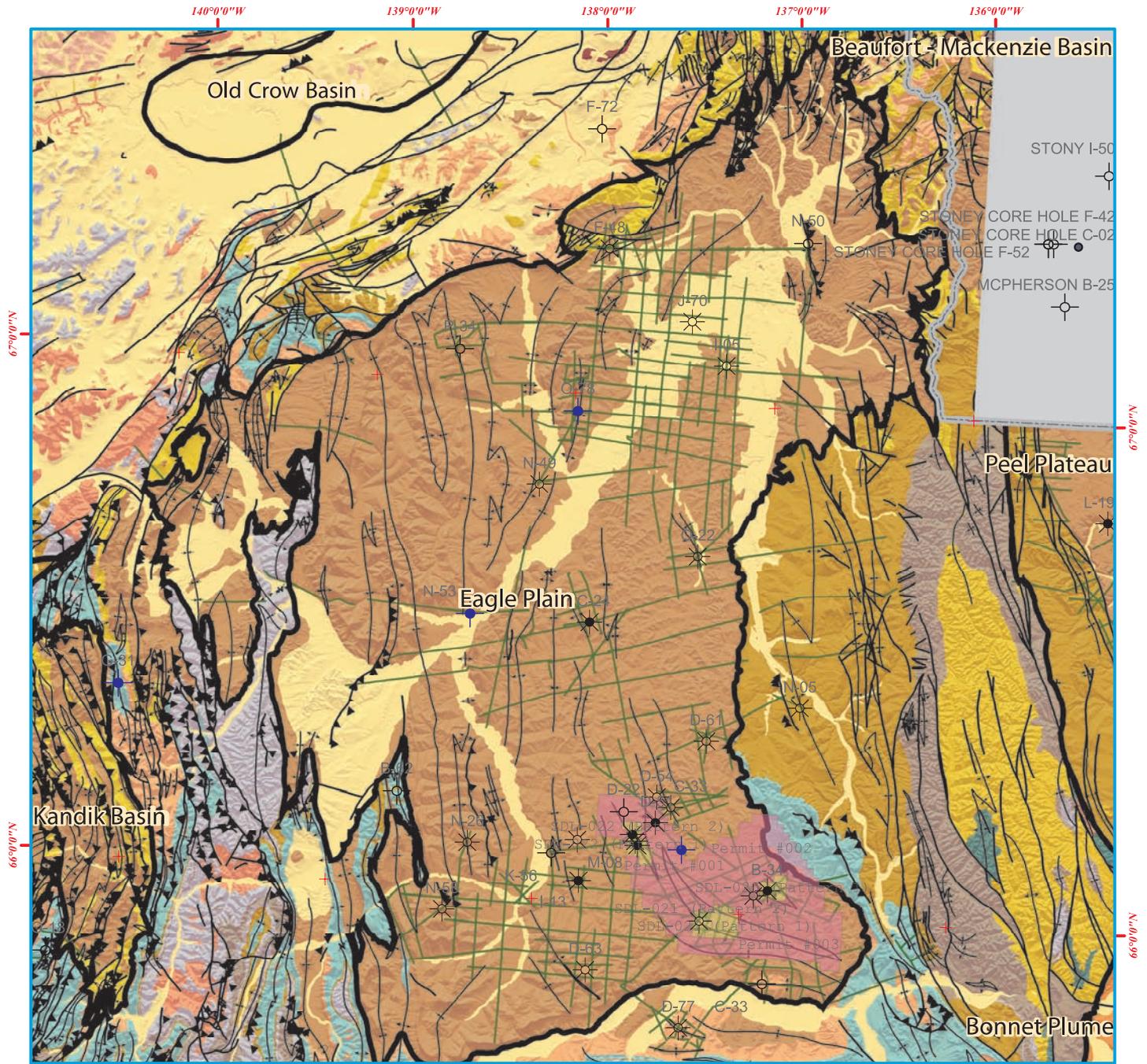
Oil Plays (MMbbls)	No. fields (mean)	Mean play potential (in-place)	Play potential-80% prob. (in-place)	Play potential-20% prob. (in place)
South Delta-Mesozoic	4	0.7	0.1	1.0
Herschel	5	216.0	69.6	335.2
<b>Total Oil (MMbbls)</b>	<b>9</b>	<b>216.7</b>		

## Wells

Well Name	Class	Status	Gr. Elev (m)	Total Depth (mKB)	Spud	Rig Release
IOE Blow River YT E-47	Expl	D&A	112.2	4,269.9	05/08/70	11/15/70
IOE Spring River YTN-58	Expl	D&A	92.7	2,141.5	01/19/71	03/18/71
Pacific Imp et al Roland Bay YT L-41	Expl	D&A	12.5	2,752.3	12/22/72	04/20/73

# H. Eagle Plain Oil and Gas Resource Assessment

Eagle Plain Resource Assessment (Bird, Chen, Osadetz, 2005)\*



- Oil Well
  - ☀ Gas Well
  - ☀ Oil and Gas Well
  - ⊗ Dry and Abandoned Well
  - ⊕ Condensate, Water; Unknown
  - 🌳 National Park
  - 🌳 Territorial Park
  - 📄 Exploration Licence
  - 📄 Permit
  - 📄 Production Lease
  - 📄 Significant Discovery Licence
  - ⚡ Faults
  - ⚡ Folds
  - ⚡ Oil and Gas Seismic Lines
  - 🗺 Exploration Regions
- Bedrock Geology**
- Quaternary**
    - unconsolidated glacial, alluvial, colluvial deposits
  - Late Cretaceous - Tertiary**
    - foredeep shale and sandstone
    - volcanic rocks
  - Cretaceous**
    - foredeep shale and sandstone
  - Jurassic - Cretaceous**
    - shale, interbedded sandstone and conglomerate
    - volcanic rocks
  - Triassic**
    - shale, sandstone, limestone
    - volcanic rocks
  - Permian**
    - shale, sandstone, conglomerate, chert
    - volcanic rocks
  - Devonian - Carboniferous**
    - limestone
    - shale, sandstone, conglomerate
    - volcanic rocks
  - Cambrian - Devonian**
    - platform carbonate, siltstone, sandstone
    - basinal shale, siltstone, sandstone
    - volcanic rocks
  - Lower Cambrian**
    - carbonate
    - shale, siltstone, sandstone
  - Proterozoic - Tertiary**
    - metasedimentary and siliciclastic rocks, volcanic rocks
    - undifferentiated intrusions

Bedrock Geology  
Gordley, S.P. and Makepeace, A.J. (compilers), 2003.  
Yukon Digital Geology,  
Geological Survey of Canada, Open File 1749 and  
Yukon Geological Survey, Open File 2003-9(D).

Sedimentary Basins  
Mosop, G.D., Wallace-Dudley, K.E., Smith, G.G and  
Harrison, J.C. (compilers), 2004.  
Sedimentary Basins of Canada,  
Geological Survey of Canada, Open File 4673.

\*Assessment completed using program PETRIMES

## Geological Summary

Eagle Plain, in northcentral Yukon, is an underexplored structural basin with proven Cretaceous, Carboniferous, and Devonian gas and oil measures within the Northern Yukon Fold Complex. It has a maximum sediment thickness of 5,800 m. During Cambrian through Carboniferous time it was the site of continuous subsidence and deposition as part of the western continental margin miogeocline. Lower Paleozoic platform carbonates of the Bouvette and Ogilvie formations are bounded and interfinger with carbonaceous basinal shales of Richardson Trough on the east. During Late Paleozoic sedimentation is dominated by clastic sediments with lesser carbonate. Paleozoic sedimentary rocks are in turn unconformably overlain by Cretaceous marine siltstone, shale and sandstone deposited as a foreland succession in response to Cordilleran deformation.

North-trending anticlines, synclines and thrust faults related to Cordilleran deformation occur throughout the basin. The basin is divided into the northern Bell sub-basin and the South Eagle sub-basin, the sub-basins being separated by the east-west trending Eagle Arch.

## Exploration History

Surface exploration began in the mid 1950s. The first well (Peel Plateau Eagle Plain YT No. 1 N-49) was completed in 1958. The first discovery well (Chance YT No. 1 M-08) was completed in 1960. The most recent wells were drilled in 1985. A total of 33 wells have been drilled; several of these contained hydrocarbons in one or more zones.

A total of 9,952 line-kilometres of two-dimensional seismic survey lines have been completed in Eagle Plain with only 8% of that being shot since 1975. Seismic coverage is largely in the southern end of the basin. In most cases gravity and magnetic surveys were conducted concurrently with the seismic. Discovered resources contain 83.7 Bcf gas and 11.1 MMbbls oil. All of the currently discovered hydrocarbons are found in the South Eagle sub-basin.

## Plays

Fifteen different petroleum plays were identified in the Eagle Plain area (nine gas and six oil). These encompass a variety of structural and stratigraphic traps. Several plays are considered established as they have yielded proven discoveries. The others have petroleum shows in this basin or other basins and are therefore considered immature. Most of the wells drilled to date have stopped in Devonian and younger rocks; only six wells have tested the Lower Paleozoic stratigraphy.

Gas Plays (Bcf)	No. fields (mean)	Mean play potential (in place)	Play potential-75% prob. (in place)	Play potential-25% prob. (in place)
Cretaceous stratigraphic gas	16	118	81	145
Cretaceous structural gas	16	231	165	279
Permian stratigraphic gas	16	2,160	1,333	2,701
Permian structural gas	5	72	34	95
Carboniferous stratigraphic gas	11	1,705	1,178	2,099
Carboniferous structural gas	6	118	68	150
L. Carboniferous stratigraphic gas	18	323	237	388
L. Paleozoic stratigraphic gas	20	879	607	1,061
L. Paleozoic structural gas	6	448	153	564
<b>Total Gas (Bcf)</b>	<b>114</b>	<b>6,054</b>		

Oil Plays (MMbbls)	No. fields (mean)	Mean play potential (in place)	Play potential-75% prob. (in place)	Play potential-25% prob. (in place)
Cretaceous stratigraphic oil	7	40	25	51
Cretaceous structural oil	6	67	40	86
Permian structural oil	4	105	50	140
Carboniferous stratigraphic oil	5	78	45	101
Carboniferous structural oil	5	77	47	98
L. Carboniferous stratigraphic oil	5	69	43	88
<b>Total Oil (MMbbls)</b>	<b>32</b>	<b>436</b>		

(See page 42 for listing of Wells)

## Wells

Well Name	Class	Status	Gr. Elev (m)	Total Depth (mKB)	Spud	Rig Release
Peel Plateau Eagle Plains YT No 1 N-49	Expl	D&A	444.0	2,922.7	04/17/57	07/16/58
Western Minerals Chance YT No 1 M-08	Expl	SP O&G	534.0	2,635.9	05/30/59	05/25/60
Amerada et al Crown YT-A No 1 N-50	Expl	D&A	313.0	2,439.6	02/29/60	03/04/79
SOBC Blackstone YT D-77	Expl	D&A	640.1	4,028.5	03/10/62	01/08/63
Socony Mobil WM E Porcupine R YT K-56	Expl	D&A	494.1	2,590.8	03/26/63	07/23/63
Socony Mobil WM Blackie #1 YT M-59	Expl	SP GAS	557.5	1,931.8	12/11/63	03/27/64
Socony Mobil WM Whitestone YT N-26	Expl	D&A	691.3	2,464.3	04/07/64	08/06/64
Socony Mobil WM Molar YT P-34	Expl	D&A	799.2	2,653.0	03/29/64	08/13/64
Socony Mobil WM Chance YT G-08	Expl	SP O&G	518.8	1,579.8	12/04/64	02/18/65
Socony Mobil WM Ellen YT C-24	Expl	D&A	410.0	2,174.4	12/25/64	04/03/65
Socony Mobil WM W Parkin YT D-51	Expl	D&A	470.6	1,508.8	02/24/65	04/03/65
Socony Mobil WM Birch YT B-34	Expl	D&A	663.5	1,649.9	04/08/65	06/08/65
Socony Mobil WM N Cath YT B-62	Expl	D&A	534.9	2,138.5	04/16/65	07/08/65
Socony Mobil WM S Tuttle YT N-05	Expl	D&A	500.5	3,513.4	02/18/65	07/08/65
Canoe River Chance YT J-19	Expl	SP O&G	514.2	1,446.3	12/17/67	02/17/68
Canoe River East Chance YT C-18	Expl	D&A	531.3	1,540.8	02/28/68	04/06/68
Western Minerals N Hope YT N-53	Expl	D&A	346.3	4,280.3	04/18/70	08/13/70
SOBC WM E Porcupine YT I-13	Expl	D&A	501.4	2,439.6	02/10/71	05/02/71
SOBC WM Shaeffer Ck YT O-22	Expl	D&A	347.2	3,161.7	01/12/71	05/09/71
Chevron SOBC WM W Parkin YT C-33	Expl	D&A	514.5	1,256.7	11/29/71	01/15/71
Chevron SOBC WM E Pine Creek YT O-78	Expl	D&A	384.4	947.6	12/25/71	01/26/72
Chevron SOBC WM Birch YT E-53	Expl	D&A	617.2	684.3	01/20/72	02/21/72
Chevron SOBC WM Whitefish YT I-05	Expl	D&A	342.3	1,498.4	02/23/72	03/30/72
Chev SOBC Imp S Chance YT D-63	Expl	D&A	701.0	2,020.8	02/21/72	05/01/72
Chevron SOBC WM E Porcupine YT F-18	Expl	D&A	518.5	2,050.7	03/06/72	05/01/72
Chevron SOBC WM N Parkin YT D-61	Expl	D&A	483.1	3,352.8	01/04/72	05/06/72
Chevron SOBC Gulf Ridge YT F-48	Expl	D&A	315.2	1,868.7	01/03/73	04/02/73
Chevron SOBC WM Whitefish YT J-70	Expl	D&A	326.1	2,127.5	01/17/73	04/10/73
Murphy Mesa PB S Whitestone YT N-58	Expl	D&A	886.1	2,131.5	02/10/73	04/17/73
Westcoast et al Porcupine YT F-72	Expl	D&A	344.1	2,251.9	01/17/73	04/06/74
Aquit Alder YT C-33	Expl	D&A	523.6	3,714.0	03/08/78	03/04/79
Exco West Parkin YT D-54	Expl	D&A	502.5	1,811.0	12/20/84	02/19/85
Exco et al N Chance YT D-22	Expl	D&A	531.5	1,830.0	03/01/85	04/09/85
Devon Eagle Plains K-58	Expl	D&A	599.3	1,300.0	02/22/05	04/03/05

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or visit the Yukon Geological Survey website [www.geology.gov.yk.ca](http://www.geology.gov.yk.ca).

Core and other well materials from Yukon wells are stored in the Geological Core and Sample Repository at the Geological Survey of Canada-Calgary office, 3303-33rd St. N.W., Calgary, AB.

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To obtain sampling permission and access to Yukon well core, cuttings, or related samples, please contact [tiffani.fraser@gov.yk.ca](mailto:tiffani.fraser@gov.yk.ca)

