CANADIAN ASSOCIATION
OF PETROLEUM PRODUCERS

BEST MANAGEMENT PRACTICES

Natural Gas in Coal (NGC)/ Coalbed Methane (CBM)

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The Canadian Association of Petroleum Producers (CAPP) represents 150 companies that explore for, develop and produce natural gas, natural gas liquids, crude oil, oil sands, and elemental sulphur throughout Canada. CAPP member companies produce more than 98 per cent of Canada's natural gas and crude oil. CAPP also has 125 associate members that provide a wide range of services that support the upstream crude oil and natural gas industry. Together, these members and associate members are an important part of a $90-billion-a-year national industry that affects the livelihoods of more than half a million Canadians.

Throughout the development of this document, CAPP worked with members of the Multi-stakeholder Advisory Committee (the MAC) who reviewed the document and provided comments and suggestions. CAPP wishes to acknowledge the interest and support from these members and from other stakeholders whose joint efforts have helped make this a more useful document for all.

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Appendices

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1 Overview of Best Management Practices

The following summarizes the Best Management Practices for NGC development set forth in this document in Section 4.0, Planning, Public Involvement and Regulatory Approvals, and in Section 5.0, NGC Operations.

1.1 Planning, Public Involvement, and Regulatory Approvals (Section 4.0)

Project Management (Section 4.1.1)

- Implement a project management system tailored to the characteristics of the particular NGC development.
- Ensure that landowners, occupants, land managers, local governments, mineral rights owners and regulatory agencies are consulted about NGC developments, starting early in the planning process.

Cumulative Effects Management (Section 4.1.2)

- Ensure NGC activities and operations minimize cumulative effects wherever practical.

Development Stages and Project Scope (Section 4.1.3)

- Develop a project description for the purposes of project management, public involvement, landowner consultation and regulatory approvals.

Planning Considerations and Opportunities (Section 4.1.4)

- Evaluate the NGC development area to identify land use, environmental and scheduling constraints.
- Plan NGC activities to minimize surface disturbances.

Regulatory Approvals (Section 4.1.5)

- Ensure that all regulatory requirements are identified, and that necessary regulatory approvals are included in the planning for NGC developments.
- Ensure that project management allocates sufficient resources and time for preparation of applications, for public consultations, notifications and input, and for reviews by regulatory agencies.

Well Spacing Considerations (Section 4.1.6)

- Plan NGC well spacing to effectively and efficiently optimize recovery of the natural gas resource from coals, using cost-effective technologies and operating practices, while minimizing surface disturbance.

Well Siting Considerations (Section 4.1.7)

- NGC development plans should allow flexibility in selecting sites for individual NGC wells so that operators can address planning considerations and opportunities, and address concerns identified by affected parties through landowner consultations and public involvement programs.

Gas Production Commingling (Section 4.1.8)

- Commingling of multiple zones should be considered where NGC can be more economically and efficiently recovered, and to minimize the number of wells required.

Production Facilities and Pipelines (Section 4.1.9)

- Design and locate NGC production facilities and pipelines with consideration for current and potential future land use, and to minimize cumulative land disturbances, and to address landowner concerns.

Groundwater Protection (Section 4.1.10)

- Plan NGC activities to protect and conserve groundwater resources, and to avoid impacts to groundwater users.
- Assess groundwater conditions and groundwater use in the NGC development area prior to commencing exploration and development activities.

Evaluate Groundwater Resources (Section 4.1.10.1)

- Support the collection and submission of groundwater and water well data to a public database.
- Compile an inventory of publicly available water well data pertaining to the NGC project area, and conduct a testing program for water wells near planned NGC wells, prior to drilling.
- For NGC developments targeting production from coals expected to produce non-saline groundwater, thoroughly evaluate the hydrogeology of the development area and, with landowner consent, conduct a testing program for all water wells within 600 metres of an NGC well, when the well is expected to be completed above the base of the groundwater protection.

Water for NGC Operations (Section 4.1.10.2)

- NGC operators should determine water needs for developments, and select water sources carefully to avoid impacts to water and groundwater resources.

Conservation of Non-Saline Produced Water (Section 4.1.10.3)

- Minimize production of, and protect and conserve non-saline produced water.
- Investigate beneficial uses of non-saline produced water, in conjunction with regulatory agencies and local stakeholders.

Management of Saline Produced Water (Section 4.1.10.4)

- Safely manage production of saline produced water.
- Assess beneficial uses of saline produced water.

Prevention of Gas Migration and Release (Section 4.1.10.5)

- Design drilling and completions programs for NGC wells to protect groundwater resources and water wells, and prevent migration of natural gas from coal zones to other aquifers.

Emissions Management (Section 4.1.11)

- Plan NGC developments to minimize emissions during well testing and production operations.
- Design and operate NGC facilities to minimize emissions.
- If benzene is present in the gas stream, design and operate glycol dehydrators to minimize benzene emissions.

Noise Management (Section 4.1.12)

- Locate, design, build and operate NGC facilities to mitigate noise impacts.
- Integrate noise mitigation features in NGC plans and schedules.

Mineral Tenure (Section 4.2)

- Ensure that appropriate mineral rights are in place prior to initiating NGC developments.
- Support coordination of NGC development activities on a local basis, through acquisition of mineral rights and working with other mineral rights owners.

Public Involvement (Section 4.3)

- Plan and conduct public involvement programs for each NGC development, consistent with the location, scope, schedule and duration of NGC activities.

Company Responsibilities (Section 4.3.1)

- Operators should design and implement a public involvement program early in the development and planning processes.

Role of Landowners, Occupants and Other Stakeholders (Section 4.3.2)

- Landowners, occupants, and other stakeholders should be invited to participate fully in public involvement programs.

Surface Rights and Landowner Consultation (Section 4.4)

- Ensure that landowners, occupants and land managers are appropriately consulted during the course of NGC development planning and surface rights acquisition activities, and that their concerns are addressed.
- Ensure that landowners, occupants and land managers are appropriately notified prior to on-the-ground NGC operations activities, including survey activities, and throughout the life of the project.
- Ensure landowner is aware of applicable regulations and where this information can be accessed.

Appropriate Dispute Resolution (Section 4.5)

- Make every reasonable effort to resolve issues by negotiation.
- Use appropriate dispute resolution methods when issues cannot be satisfactorily resolved by negotiation.

1.1.1 NGC Operations (Section 5.0)

Landowner and Community Relations during NGC Operations (Section 5.1)

- Continue the public involvement program for NGC developments during NGC operations.
- Respond to landowner and community concerns promptly and appropriately.

Geophysical Operations (Section 5.2)

- NGC operators should consult with landowners, occupants and land managers prior to commencing geophysical operations.
- Ensure that geophysical agents and service companies are informed of and comply with the NGC operator's best practices.

Lease and Road Construction (Section 5.3)

- Plan and construct NGC well leases, facility leases, and access in order to minimize surface disturbances and to support effective reclamation in the future.
- Plan and construct NGC well leases, facility leases, and access in order to control surface runoff and to protect surface water quality.

Drilling (Section 5.4)

- Design and conduct drilling programs for NGC wells to protect and conserve groundwater resources, conserve the NGC resource, and prevent migration of natural gas from gas-bearing formations.

Well Completions (Section 5.5)

- Design and implement well completion programs to ensure well control, protect groundwater resources, and avoid damages to the NGC coal zones.

Well Testing (Section 5.6)

- Design, schedule and conduct NGC well test programs to minimize venting and flaring of natural gas, balanced with the need to obtain appropriate well test information.

Pipelines (Section 5.7)

- Route, design, construct and operate NGC pipelines to minimize surface disturbances and to provide for effective reclamation.

Production Operations (Section 5.8)

- Design, build and operate NGC production facilities in accordance with relevant regulatory requirements, industry standards, and commitments made to landowners and other stakeholders.

Well Suspension and Abandonment (Section 5.9)

- Suspend and abandon NGC wells to maintain groundwater protection and well control integrity.

Facilities Decommissioning (Section 5.10)

- Decommission NGC production facilities in accordance with relevant industry standards and regulatory requirements.

Land Reclamation (Section 5.11)

- Reclaim surface disturbances from NGC wells, facilities and pipeline activities in accordance with regulatory requirements, as soon as possible after disturbance activities are completed.

2 Scope

2.1 Introduction

Natural gas in coal (NGC) is natural gas that occurs in coal deposits. NGC is also referred to as coalbed methane (CBM) and coalbed gas (CBG). All three terms refer to the same resource. In Alberta, the Department of Energy has chosen to use the term NGC to associate NGC with the Alberta regulations that govern natural gas -- regulations that also apply to NGC. The term “natural gas in coal” and the abbreviation “NGC” will be used in this document.

Exploration for, and development of, NGC in Canada has increased in recent years. It is expected that new NGC developments will continue to be proposed in the coming years. NGC is a growing component of Canada’s natural gas supply, with corresponding contributions to economic benefits (e.g., payments to landowners for surface rights, payments for mineral rights, and payments to governments), employment, technology development, and infrastructure improvements.

NGC operations generally use the same or similar technology and practices to drill and complete wells, and to build and operate pipelines and facilities, as conventional oil and gas activities. NGC activities in Alberta are currently regulated under the same legislation and regulatory requirements as conventional oil and gas activities.

In Alberta, the provincial government is reviewing the regulations for NGC development to ensure a balance of economic benefits for Albertans while still protecting the land, air, and water resources. The Alberta government established the Coalbed Methane / Natural Gas in Coal Multi-Stakeholder Advisory Committee (MAC) in November 2003. The MAC is co-chaired by Alberta Energy (ADOE) and Alberta Environment (AENV). Members represent environmental organizations, landowners, agriculture, local government, the energy industry, and provincial government departments. The MAC established working groups on

surface/air, water, tenure and royalty issues, which submitted detailed reports to the MAC in January, 2005. As part of its mandate to consult with the community, the MAC held public information sessions throughout the province in the first half of 2004.

A variety of issues were discussed at the Committee's meetings over the course of a year and a half, including those raised at the public information sessions. While the MAC determined that there were a number of issues unique to NGC development -- primarily dealing with water -- most of the issues identified were not specific to NGC development alone, but related to all oil and gas development. However, the MAC believes that the potential high intensity associated with NGC development could intensify cumulative effects and therefore ultimately create unique concerns and issues.

The MAC released its preliminary findings document for public review and comment in July, 2005. After public comments had been received and reviewed by the MAC members, the final MAC report was issued publicly in May of 2006. At the same time, the document was distributed to appropriate government departments and agencies for implementation. Several of the MAC recommendations had already been initiated by this time.

Information on the Alberta government's review process and the MAC can be viewed at: http://www.energy.gov.ab.ca/245.asp

The development of a Best Management Practices (BMP) document was determined to be the eighth key priority for MAC members, as per the Committee's preliminary findings document, which states that "Industry, government and other stakeholders should work together to develop, document and implement best practices for CBM/NGC operations."

2.2 Document Purpose and Application

This Best Management Practices document is intended to provide guidance and encouragement to all stakeholders to consistently produce superior results.

Best Management Practices can be defined as:

Management practices or techniques recognized to be the most effective and practical means to develop the resource, while minimizing adverse environmental and other negative effects (MAC, Preliminary Findings document).

This document is intended to:

- Promote effective planning for NGC developments, appropriate to the nature of the particular NGC development and its location with respect to other land uses.
- Promote effective public involvement during all stages of development.
- Promote coordination and cooperation between NGC operators and others (e.g., other oil and gas companies, landowners, occupants, synergy groups,

other industries, local communities, and other land users) during all stages of NGC development.

- Provide guidance on how to minimize negative impacts to the environment, including land, water resources and air quality.
- Provide current information on effective and efficient NGC operating practices, for industry, the public, government and regulatory agencies, and other stakeholders.
- Promote industry compliance with regulatory requirements, and support the sharing of Best Management Practices information among NGC industry members.
- Promote development and use of NGC technologies and operating practices to mitigate potential negative effects of NGC development.
- Provide references to other information sources and regulatory requirements specific to NGC.

The Best Management Practices set out in this document are intended to be applicable in a broad range of situations. Specific technologies or practices may be more or less suitable for a particular NGC development, depending on the characteristics of the NGC geology, the nature of the development, and land use and environmental conditions in the development area.

This document applies to NGC activities in Alberta. It is intended to complement current provincial, municipal and federal regulatory requirements, and help produce superior outcomes compared to those obtained if operators only met regulatory requirements.

A listing of regulatory references applicable to NGC activities in Alberta is provided in Appendix C. For NGC activities that have been identified by the public as potential concerns, more detailed discussions of regulatory requirements and industry standards are provided in sections 4.0 and 5.0 of this document.

In order to remain current with regulatory requirements and NGC Best Management Practices, this document will be reviewed and updated on a regular basis.

2.3 Background - Natural Gas in Coal

NGC is a clean source of energy. The natural gas found in coal and produced from NGC wells requires little, if any, processing to meet specifications for pipeline transportation and distribution to markets. Natural gas produced from NGC wells in Alberta is very similar in composition to the natural gas distributed to residences and used to fuel furnaces, hot water heaters, and other household appliances.

NGC is formed during the process of coalification, as buried layers of plant material form coal. Natural gas is stored in the coal as an adsorbed component on or within the coal matrix, and as free gas within the micropore structure or cleats

within a coal bed. Cleats are a series of closely-spaced small fractures in coal beds formed by compressional stress in the coal. The natural gas is held in place mainly by reservoir pressure; reducing the reservoir pressure allows gas to be released from the coal. The NGC content in coals is believed to increase with increased depth. However, deeper coals are subject to increased overburden pressure, which may restrict permeability by closing the coal cleats. Permeability is necessary for the gas to flow through the formation. A challenge in NGC exploration is finding coals with suitable NGC content, but not so deep as to restrict permeability (Alberta Geological Survey).

NGC may occur as “dry coals” or as “wet coals”.

Dry coals are coals that contain little or no free water (water occurring in liquid phase) in the coal cleats. Dry coals may contain water in vapour phase, with the natural gas. This water vapour may condense to liquid during NGC production, as changes to the pressure and temperature of the natural gas occur in the wellbore, in pipelines, and during compression and processing.

Wet coals are coals that contain free, or mobile water. This water may contain various concentrations of dissolved solids, and be classified as “non-saline” or as “saline”. In Alberta, non-saline water is defined as produced water that contains total dissolved solids (TDS) of less than or equal to 4000 milligrams per litre (mg/l).

2.3.1 NGC Resources in Alberta

Alberta contains vast amounts of coal distributed throughout the southern Plains, Foothills, and Mountain regions. Coal-bearing formations gently dip from the Plains down toward the west, where the coals are folded and abruptly turn toward the surface to be exposed in the Foothills and Mountains. Many of these coals outcrop on the surface, and have been mined at or near the surface in Alberta, with some mines remaining active today.

Information on Alberta’s NGC resources is available from the Alberta Geological Survey (AGS) at their website http://www.ags.gov.ab.ca/.

The distribution of coal formations in Alberta can be viewed at http://www.ags.gov.ab.ca/activities/CBM/coal_and_cbm_intro.shtml

A cross-section of coal-bearing formations across Alberta can be viewed at: http://www.energy.gov.ab.ca/docs/daturalgas/pdfs/cbm/AGS_Section_ab.pdf

The coal formations of the Alberta Plains and Foothills are a relatively consistent resource occurring over very large areas, although the number of coal seams and their continuity, natural gas content, and permeability may vary from section to section and from township to township. The major coal zones in the Plains are found in the Scollard (or Ardley), Horseshoe Canyon, Belly River, and Mannville

strata. Coal resources in the Alberta Foothills include the Coalspur, Luscar and Kootenay coal zones.

2.3.2 NGC Development in Alberta

There are generally three stages to NGC development – early evaluation, pilot project(s), and commercial development. Early evaluation may include geophysical operations and drilling of one or more wells. The main objective of early evaluation is to confirm the existence, depth, and thickness of the coals at the well location and to estimate the gas resource in place by using core or cuttings samples. Generally, the location of the coals is fairly well understood, however “exploration” or “evaluation” wells are still required for tests to estimate the permeability and producibility of the coals.

When early evaluation results are promising, pilot projects are usually conducted. Pilot projects typically include drilling, testing, stimulation and extended production testing of a small number of wells close to each other (often closer than development well spacings). Pilot projects primarily evaluate reservoir and well producibility continuity in the area around a promising evaluation well. These pilot production tests can last up to two years or more.

When pilot project results are promising, full-scale commercial development may be considered. Commercial NGC developments typically occur over a large area, ranging from a number of sections to a township or more. They also require multiple wells, optimally spaced, to cost-effectively recover the NGC.

In Alberta, it is expected that optimal vertical NGC well spacings will range from two to eight wells per section. As with many other conventional oil and gas projects with similar or greater well densities in Alberta (at the time of writing), this requires special applications for reduced well spacing. The default well spacing in Alberta, based on older conventional gas well characteristics, is one well per section. In some areas where NGC is likely to be developed, the expected well densities will be more intense than previous oil and gas activity and will need to be managed responsibly to accommodate all surface use of the land.

NGC has been the subject of evaluation in Alberta for a number of years, starting in the 1980s. In anticipation of increased NGC activity in the province, the Alberta Energy and Utilities Board (EUB) issued Bulletin IL-91-11: Coalbed Methane Regulations in the 1990s. However, commercial production of NGC in Alberta only began on a significant scale in 2002.

As of December 31, 2004, there were 3,575 NGC wells in Alberta, including almost 700 existing wells that were recompleted for NGC. Some 1,735 NGC wells had produced or were producing at that time. NGC production in Alberta during 2004 totaled 600 106m3, less than 0.5 percent of the province’s total gas production for the year (EUB Bulletin 2005-15: 2004 Alberta Coalbed Methane Activity Summary and Well Locations).

NGC production generally requires very low well producing pressures to optimize the gas desorption volumes from the coals. In the case of many shallower Alberta coals (e.g., Horseshoe Canyon, Belly River), the initial reservoir pressure is much lower than "normal", further increasing the need to produce at low pressures to optimize gas rates. These producing pressures (10 psi or less) are similar to the pressure of residential gas distribution lines. Unlike conventional gas wells, compression right from the start of production is required in order to get these low pressure produced gases into "high-pressure" sales lines at 800 psi or more. This additional compression adds to the cumulative impact of NGC projects and needs to be managed, especially to reduce noise levels below those acceptable in the area surrounding the compressor sites. So far in Alberta, gas production per well is relatively low (< 300 Mcf/D/well), but most NGC wells are expected to remain productive for many years -- as long as 20 to 40 years or more.

Maps showing the location of NGC wells in Alberta (as at December 31, 2004) are available at the Alberta Energy website http://www.energy.gov.ab.ca/2423.asp

These maps are updated regularly.

The coal zones of the Alberta Plains have attracted the most attention for NGC development to date. Table 2.1 shows well activity and cumulative production for various coals in Alberta.

Table 2.1. NGC Activity in Alberta as of December 31, 2004.

Coal zone / formation	Total Wells	Wells with Production	Cumulative Gas Production from only coals ($10^6 m^3$)	Cumulative Water Production from coals only ($10^3 m^3$)
Ardley	58	32	19	21
Horseshoe Canyon & Belly River	3240	1560	657	62*
Mannville	240	127	79	548
Kootenay	37	16	<1	<1
Total	**3575**	**1735**	**755**	**631**

* Most wells produced little or no water; three wells account for 24 103m3 of the reported cumulative water production.

Source: EUB Bulletin 2005-15: 2004 Coalbed Methane Activity Summary and Well Locations.

Early evaluation of the Scollard/Ardley coals has occurred on a limited basis in the Pine Creek area (north of Edson) and central Pembina area (Buck Lake, Drayton Valley). Ardley coals have been reported to be dry at some locations, and to contain free flowing water at other locations. In some cases, the water has been saline and in others, non-saline. As a result of this uncertainty regarding the water content and salinity in the Ardley coals, as of July 1, 2005, most of these wells are shut in awaiting guidance from the Alberta government (EUB, Alberta Environment, Alberta Energy) on how or whether these wells can be produced when non-saline water may be involved (refer to the AENV 2004 publication titled: Guidelines for Groundwater Diversions – For Coalbed Methane/Natural

Gas in Coal Development) The MAC report will provide some direction to government agencies on this important issue.

Most Horseshoe Canyon and Belly River coals are “dry coals”, although some shallow coal seams on the eastern and northern flanks of the Horseshoe Canyon Formation may contain non-saline water. NGC production from the Horseshoe Canyon and Belly River coals has occurred without the need to dewater the coal seams. Consequently, NGC from the Horseshoe Canyon coals has been developed using equipment and practices similar to those used for conventional gas.

Horseshoe Canyon and Belly River coals have been a focus of NGC activity in Alberta during the past few years. The first commercial NGC development in Canada commenced production from Horseshoe Canyon coals in 2002. Over 90 percent of the NGC wells in Alberta at the end of 2004 targeted these coals and most of the production (estimated over 150 MMcf/D) comes from these coals. Most of this activity is in the Highway 2 Corridor between Calgary and Edmonton in south central Alberta. Industry estimates around 3,000 new Horseshoe Canyon wells will be drilled in 2005 in this area.

The Belly River coals, often referred to individually as the Lethbridge, Taber and McKay coal zones, have undergone extensive NGC evaluation and development where they co-exist with shallower Horseshoe Canyon coals. However, where they occur in the absence of these shallower coals, they have not been extensively evaluated. Relative to the other Plains coal zones discussed, these zones are discontinuous and have less net coal thickness.

Oil and gas companies are also actively evaluating and assessing the production potential of the Mannville coals. The Mannville coals, with a resource in place of close to 300 Tcf, contain more gas than all of Canada’s other coals combined. Several exploratory wells have been drilled to date and there are a number of ongoing pilot projects as well as directional and horizontally drilled wells being evaluated. Currently there is one commercial operation in the Mannville region. The Mannville coals are generally found to contain very saline water. This saline water must be pumped to reduce the pressure in the seams and allow gas production. Consequently, NGC developments in the Mannville coals require additional water lifting, handling, and disposal infrastructure, including wellsite pumping equipment, wellsite gas-water separation equipment, produced water handling equipment (including pipelines and trucking), and deep water disposal wells.

The Alberta oil and gas industry has been responsibly producing and disposing of salt water for decades. The existing EUB and AENV regulations for managing this process and protecting the non-saline ground and surface waters are strict and actively enforced. However, the added cost of managing this water is a significant obstacle to achieving economic results in the Mannville coals. One approach being considered for long-term Mannville development is to install water pipelines alongside the gas pipelines to transport the saline produced water from

wellsites to a central facility. The water can then be stored temporarily at the facility site and injected into disposal wells.

The Kootenay, and other Alberta coals, have seen limited activity to date, and relatively little is known of the development potential for these coals. The complex geological faulting structure in the Foothills region has contributed to lack of activity in this area.

Drilling, completions, and testing of wells for NGC developments may occur simultaneously and/or sequentially with pipeline and facility construction activities over a relatively short timeframe. The NGC industry is using existing oil and gas industry technology and operating practices, and developing new technologies and practices adapted to Alberta's NGC resources.

Further information on natural gas in coal is available from:

Canadian Association of Petroleum Producers	www.capp.ca
Canadian Society for Unconventional Gas	www.csug.ca
Alberta Energy	www.energy.gov.ab.ca/245.asp
Alberta Energy and Utilities Board	www.eub.gov.ab.ca
Alberta Geological Survey	www.ags.gov.ab.ca
Alberta Environment	www3.gov.ab.ca/env/

2.4 Public Considerations with NGC Development

As with all oil and gas development, the development of natural gas in coal must be managed responsibly. Stakeholders in Alberta have expressed concern that the large numbers of wellsites, roads, pipelines, compressors and other associated infrastructure are increasing cumulative impacts on both private and public lands. The following key issues of concern were identified by landowners and other public stakeholders, and considered by MAC members.

- Confirmation that, where NGC projects add to the effects of other existing or future developments, potential negative cumulative effects will be minimized in order to protect the environment.
- Assurance that potential negative effects to groundwater and surface water resources from all NGC operations will be effectively regulated. This may involve new regulations.
- Assurance that timely, accurate and accessible information about NGC developments will be available to affected landowners and other stakeholders. This may include the coordination of industry notifications and consultations for regulatory approvals, and the addressing of all components of an NGC development together.
- Confirmation that relevant government departments and other appropriate stakeholders will obtain and disseminate improved scientific information on the water resources in Alberta and the use of these resources.
- Assurance that the potential for methane migration to water wells in an area of NGC operation will be avoided as much as possible.

- Assurance that all stakeholders will work towards operating with the best available practices. It is hoped that specific landholder concerns will be managed through the sharing of best practices. These concerns include;
  - the potential for sighting and density of wells to affect current land uses,
  - the potential for surface disturbances to affect property values,
  - the potential for affects to groundwater,
  - the potential for increased vehicle traffic, dust, noise, safety and road maintenance requirements, and
  - the potential that landowners may experience reduced enjoyment of their lands (e.g., noise, additional light, and visual impacts).

The Best Management Practices discussed in sections 4.0 and 5.0 of this document together with regulatory requirements are intended to address key concerns raised.

3 Regulatory Framework

Alberta's oil and gas industry is regulated by several departments and agencies, in particular the EUB, which is guided by its mandate to consider the public interest. In one of its 2005 decisions, the EUB emphasized this mandate by noting its requirement "to consider the public interest in its deliberations when deciding whether to grant licenses requested," and it is empowered to "apply conditions to mitigate site-specific or local impacts." Thus, NGC operators should evaluate and consider public interest, in addition to addressing the prescribed regulatory regime.

All aspects of the oil and gas industry in Alberta have been closely regulated for many years. Effective environmental protection is required for groundwater, surface water, produced water disposal, emissions, and waste management, land disturbance, and reclamation. The oil and gas industry has adapted technologies and operating practices to meet these requirements. Current requirements are updated as new technologies, operating practices, and issues emerge.

Refer to Appendix C for a list of key regulatory requirements for NGC activities in Alberta. Please note this list may not include all regulatory requirements.

3.1 Government of Alberta

The Government of Alberta has a major role in the regulation of NGC activities in the province, through its ownership of:

- natural gas and mineral resources,
- provincial Crown lands,

and in accordance with its jurisdiction for:

- environmental protection,
- fish and wildlife resources,
- historical resources,

- surface rights,
- land use,
- industrial activities,
- workplace health and safety, and
- municipal governments.

A number of provincial government departments and agencies administer legislation and programs relating to NGC activities in Alberta. A summary of the roles of Alberta Energy, the EUB, AGS, AENV, Alberta Human Resources and Employment (AHRE), Alberta Sustainable Resource Development (ASRD), Alberta Surface Rights Board, Alberta Community Development (ACD), and the Farmers' Advocate of Alberta is provided in Appendix A.

Government of Alberta legislation is available from the Queen's Printer at http://www.qp.gov.ab.ca/index.cfm

3.2 Municipal Governments

Municipal governments include those of cities, towns, villages, counties, municipal districts and improvement districts. Municipal governments commonly administer local land use planning, property subdivision, development controls, municipal roads, water supply, wastewater treatment, storm drainage, fire protection, and weed control.

Refer to Appendix C for a summary of provincial legislation for municipal government in Alberta.

3.3 Government of Canada

The federal government has jurisdiction over certain NGC activities, depending on the nature and location of the NGC activity. Areas of federal government jurisdiction include fish habitat, navigable waters, and some aspects of environmental protection. The federal government has ownership and management responsibilities for federal lands, including national parks and military reserves. The federal government regulates NGC activities on Aboriginal and/or Treaty lands.

Refer to Appendix C for a summary of federal government roles and responsibilities, and legislation that regulates NGC activities.

4 Planning, Public Involvement, and Regulatory Approvals

This section of the document discusses the elements of effective project management for NGC developments, including planning, mineral tenure, public involvement, surface rights landowner consultation, and appropriate dispute resolution.

Section 5.0 discusses NGC operations, and provides examples of how NGC operations can be designed and implemented to meet the objectives of an NGC development plan.

4.1 Planning for NGC Developments

This subsection discusses project management and planning for NGC developments. Additional detail is provided for matters of particular concern for NGC developments, including land use, well density and siting, groundwater protection, air quality, and noise. Effective management of these issues will encourage appropriate management of the concerns identified with respect to cumulative effects.

4.1.1 Project Management

Best Management Practice	**Implement a project management system tailored to the characteristics of the particular NGC development.**

Effective project management for NGC developments requires the NGC operator to:

- Evaluate geological conditions in the development area.
- Acquire mineral and surface rights.
- Develop objectives for economic, safety, environmental, and public involvement performance.
- Bring together a project team and assign roles and responsibilities.
- Develop a description of the project scope and project schedule.
- Develop a project communications and/or public involvement plan, including landowner consultations.
- Identify regulatory requirements and develop a plan and schedule to obtain regulatory approvals.
- Select engineering strategies, technologies, and operating practices to be used.
- Collaborate with relevant government and public stakeholders to evaluate environmental conditions and land use in the development area, and to identify sensitivities that may require additional efforts and/or mitigative measures.
- Identify strategies and assess opportunities to minimize surface disturbance and adverse effects, and utilize identified opportunities where appropriate.
- Develop plans to coordinate infrastructure with other parties.
- Determine procedures to manage consulting and service companies according to best practices determined for project.

The project team for an NGC development is responsible for the following functions:

- Team leader/coordinator.
- Environment, health, and safety.

- Mineral lands.
- Exploration/geology.
- Reservoir engineering.
- Surface lands and landowner consultation.
- Public involvement program.
- Regulatory applications and approvals.
- Lease construction and reclamation.
- Drilling, completions, and well testing.
- Pipeline and facilities, engineering and construction.
- Production operations.

Project team members should be actively involved throughout NGC development planning, including participation in public involvement activities. Such involvement promotes good communications within the project team, as well as with consultants and service companies (e.g., land agents, drilling supervisors and contractors, completions supervisors, and service contractors, etc.). Communications and reporting systems should be developed in accordance with the complexity of the project.

Best Management Practice	**Ensure that landowners, occupants, land managers, local governments, mineral rights owners and regulatory agencies are consulted about NGC developments, starting early in the planning process.**

Planning for NGC developments must be reasonable, flexible, and responsive. Operators should initiate a public involvement program and landowner consultations early in the planning stage. Appropriate information on the full potential development should be disclosed to the extent possible (e.g., exploration, pilot, and commercial development stages). All stakeholders (government, industry, and public) should listen and attempt to understand the needs and concerns of others. The operator's development plan should address appropriate concerns to the greatest extent possible.

Operators should ensure that all commitments made to landowners, occupants, land managers, municipalities, local communities, regulatory agencies, and other stakeholders are actively managed through the following activities:

- Maintain a master listing of commitments made by all project personnel, including contract landmen (e.g., in printed materials, during open houses, during meetings, in applications for regulatory approvals, etc.)
- Assign responsibilities for implementing commitments.
- Assign responsibility for tracking status of commitments.
- Communicate commitment status regularly to all company project personnel, landowners/occupants, municipalities, local communities, and others.
- Seek feedback from stakeholders.
- Provide a mechanism to address issues that are not resolved.

4.1.2 Cumulative Effects Management

Best Management Practice	Ensure NGC activities and operations minimize cumulative effects wherever practical.

Concerns about cumulative effects may arise when new NGC developments are either individually very intensive or are planned near existing and/or future oil and gas developments, near other industrial activity, near semi-urban or rural developments, or near other infrastructure. The MAC Preliminary Findings report identified protecting the environment and minimizing cumulative effects as the Committee's number one priority.

Understanding how NGC developments may impact an area in terms of the environment and other land users is an important step in designing effective mitigation solutions, Such an understanding will assist NGC operators who must address cumulative effects by incorporating mitigative measures wherever possible. Operators should follow effective project-planning consultation methods through a two-way disclosure and listening process that provides the parties involved with a real opportunity to offer input and to affect outcomes. Practical, cost-effective methods to minimize cumulative effects can be identified using various approaches, including, but not limited to:

- Cooperation between companies (e.g., between NGC operators to share production infrastructure and access, or between NGC operator and service companies to develop new technology or practices, etc.) i.e., facilities, roads, utility corridors, disposal wells, etc.
- Integration of land management through cooperation between industries (e.g., between an NGC operator and a forestry company to coordinate clearing locations and schedules, to share access roads, and to coordinate access controls).
- Collaboration between industry and municipalities (e.g., sharing development plans).
- Conducting effective public involvement programs and effectively addressing issues identified.

Other alternatives to mitigate potentially negative cumulative effects are discussed in section 5.0.

4.1.3 Development Stages and Project Scope

Best Management Practice	Develop a project description for the purposes of project management, public involvement, landowner consultation and regulatory approvals.

A well-defined project scope is required for effective landowner consultation and public involvement and to ensure efficient regulatory approvals. The scope for NGC developments should consider available land area (e.g., mineral rights held

by company), well spacing, approximate number of wells, compression requirements, anticipated sites for wells and facilities, etc. The project scope should identify the following:

- The development stage – evaluation, pilot, commercial.
- The geographical area of potential NGC development.
- The geographical area of potentially affected parties (e.g., landowners, road users, nearby municipalities, etc.)

Each stage of development will differ with regards to the availability of information, the scale of development, and the degree of effort required for public involvement, landowner consultation, and regulatory approval activities.

An early evaluation or exploration project commonly includes one well, or a number of single wells, to evaluate the NGC resource in a chosen area. At this stage, little information on the ability to produce NGC effectively and economically may be available and operators may be able to provide only limited information on development plans.

When early evaluation provides promising results, the NGC operator may plan a pilot project to evaluate development technologies, operating practices, and costs. A pilot project commonly involves drilling additional wells near an exploration well. Natural gas will be produced from the pilot project wells, so the NGC operator can evaluate production data and operating costs.

In order to increase stakeholder understanding of anticipated well densities in the area, NGC operators should provide landowners, occupants, land managers, and the public with the following information on the pilot project:

- Objectives of the pilot project.
- Number and general location of wells, pipeline routes, and compressor sites. If specific location information is uncertain, then information on potential area development (eg. likely range of well densities, typical pipeline routing, and compressor siting) should be provided.
- Planned operating practices (e.g., drilling, completions, well testing, compression equipment, etc.)
- Plans for producing natural gas.
- Plans for handling and disposal of produced water (if any).
- Project schedule and anticipated duration.

Additional notifications and consultations may be appropriate, depending on the nature and scale of the pilot project, and pursuant to regulatory requirements.

Once the operator has evaluated the NGC resource and has confirmed appropriate development technologies and production practices, commercial development may be planned. The remainder of section 4.0 discusses planning considerations for a commercial NGC development.

4.1.4 Planning Considerations and Opportunities

Best Management Practice	**Evaluate the NGC development area to identify land use, environmental and scheduling constraints.** **Plan NGC activities to minimize surface disturbances.**

NGC operators should evaluate the development area to determine constraints and opportunities for siting and designing wells, pipelines, facilities, and access. A thorough evaluation of the development area, together with a meaningful consultation program, will provide the basis for an effective project design. This will support optimized resource recovery, an efficient approval process, and the greatest number of beneficial effects for landowners and communities. Such an evaluation will provide opportunities to minimize negative cumulative effects.

Considerations include:

- Land use;
  - Land ownership,
  - Government jurisdictions,
  - Municipal land use plans,
  - Agricultural operations,
  - Residences,
  - Water use (including groundwater),
  - Forestry operations,
  - Mineral rights,
  - Existing oil and gas infrastructure,
  - Parks and protected areas,
  - Traditional land use areas,
  - Recreation sites,
  - Historical resources,
  - Roads,
  - Electrical power lines, and
  - Natural gas distribution pipelines.
- Environmental;
  - Topographic features,
  - Unstable slopes,
  - Soils, including soils sensitive to disturbance (e.g., organic soils, solonetzic soils),
  - Natural areas, and vegetation sensitive to disturbance (e.g., forested areas, native grasslands),
  - Surface waters (springs, creeks, rivers, sloughs, lakes, etc.),
  - Groundwater conditions, and
  - Sensitive and/or critical wildlife and habitat.

Scheduling constraints may include:

- Weather and ground conditions:

    - summer – dry or wet ground.
    - winter – frozen ground and snow cover,
    - spring – break-up conditions, and
    - road bans.
- Agricultural activities:
    - seeding operations,
    - pesticide application operations,
    - calving (specific to individual livestock operations), and
    - harvest operations.
- Other land use activities:
    - forestry operations,
    - recreational activities, and
    - fish and wildlife critical periods (e.g., spawning, seasonal ranges).
- Statutory holidays.

Maps of land use and environmental conditions are a valuable tool for planning, consultation and regulatory application purposes. Information sources to create maps include government publications and data held by regulatory agencies, land managers, landowners, and municipalities. Mapping can incorporate ranking systems to evaluate the suitability of lands for various NGC activities, and to identify lands to avoid or lands requiring additional mitigation efforts.

Opportunities for minimizing surface disturbances may include (subject to technical, regulatory and/or economic limitations):

- Siting NGC wells in locations that suit long-term land use management, based on discussions with the specific landowner
- Drilling NGC wells from existing wellsites.
- Using minimum disturbance methods for well sites and access roads.
- Sharing existing or new access roads.
- Using access controls.
- Using existing gas gathering systems.
- Installing pipelines along existing rights-of-way.
- Utilizing existing capacity or adding capacity at existing facilities.
- Using existing gas pipelines and tie-in locations (meter stations).
- Negotiating road use sharing agreements with existing or planned forestry and other industrial roads.
- Planning access roads and forest disturbances in cooperation with forestry operations.
- Utilizing directional drilling technologies and multi-well sites.
- Optimizing existing electrical power infrastructure.
- Managing contractor traffic.

4.1.5 Regulatory Approvals

Best Management Practices	**Ensure that all regulatory requirements are identified, and that necessary regulatory approvals are included in the planning for NGC developments.** **Ensure that project management allocates sufficient resources and time for preparation of applications, for public consultations, notifications and input, and for reviews by regulatory agencies.**

Preparation of applications for regulatory approvals (i.e., for all wells, pipelines, and facilities for each development stage) should be coordinated and filed jointly as much as possible. This will minimize the number of follow-up landowner and public consultations and notifications, as well as allow regulatory agencies to coordinate review of the various applications. This may also reduce overall regulatory risk for NGC operators.

4.1.6 Well Spacing Considerations

Best Management Practice	**Plan NGC well spacing to effectively and efficiently optimize recovery of the natural gas resource from coals, using cost-effective technologies and operating practices, while minimizing surface disturbance.**

Regulatory requirements for well spacing set out rules for the number of wells allowed to produce from the same pool at the same time in a section of land, and the subsurface location of those wells, in order to protect the interests of adjoining mineral rights owners.

The number of wells allowed according to subsurface spacing regulations and spacing approvals does not necessarily mean that the same number of surface locations will be required, or that all surface locations for wells are either suitable or will be licensed. Sub-surface spacing rules provide flexibility for locating wellsites on the surface.

Subsurface spacing of NGC wells is primarily a function of the NGC resource and the ability to optimize recovery efficiently and economically in a reasonable period of time. NGC developments can be expected to require between two and eight wells per section of land. It is in NGC operators' best interests to minimize the number of wells, as each well requires significant capital and operating costs. NGC operators should continue to pursue options to minimize surface disturbance and disruptions to other land users.

Alberta Regulatory Requirements

Subsurface spacing of NGC wells is regulated by the EUB, under the same rules that apply to conventional oil and gas. The *Oil and Gas Conservation Regulations* currently set out a baseline well density per drilling spacing unit of one well per pool per section. Production of NGC typically requires reduced well spacing, and NGC operators may apply to the EUB for either:

- a "Special Drilling Spacing Unit (DSU) Order", or
- a "Holding".

Both Special DSU Orders and Holdings are administered by the EUB pursuant to Directive 65: Resources Applications for Conventional Oil and Gas Reservoirs.

Special DSU Orders allow a reduction in size of a DSU, and an increase in well density. Directive 65 sets out the EUB's requirements for applicants to notify potentially adversely affected parties prior to submitting applications, including industry, as well as landowners and occupants in the area of the application.

A Holding allows DSU and target area provisions to be suspended for an area, where (in the case of NGC) local geological or topographical conditions make them impractical. Instead, the EUB may order a minimum inter-well distance, a buffer zone distance between a well and the boundary of the development, and where necessary, a maximum well density. A Holding provides greater flexibility in selecting well site locations.

The EUB released Bulletin 2005-08 on March 10, 2005 respecting "Consultation Regarding Proposed Changes to Reservoir-Related Well Spacing Regulations, Application Requirements, and Application Review Process". The EUB proposed to:

- Require pre-application notification by the applicant to potentially affected subsurface parties only (public notification will continue to be required for wells, pipelines and production facilities in accordance with Guide 56: Energy Development Application Guide).
- Provide for higher baseline well densities for the Mannville and shallower formations in that part of Alberta east of the 5th Meridian and south of Township 53.
- Revise and improve application processing.

4.1.7 Well Siting Considerations

Best Management Practices	**NGC development plans should allow flexibility in selecting sites for individual NGC wells so that operators can address planning considerations and opportunities, and address concerns identified by affected parties through landowner consultations and public involvement programs.**

When possible, the NGC operator should select proposed surface locations for wells after considering the constraints and opportunities discussed in section 4.1.3, and consultations with landowners, occupants and land managers.

Concerns about well siting may be identified as a result of:

- Notifications to mineral rights owners.
- Consultations and surface rights negotiations with landowners, occupants, and land managers.
- Consultations with municipal governments.
- Public involvement programs.

Well sites must comply with regulatory requirements for setbacks. Setbacks are minimum distances between a well and some other feature. NGC operators must have direct discussions with landowners potentially affected by setback requirements. For example, the setback from a well on one property may impose restrictions on an adjoining property.

Subject to technical, landscape, regulatory and/or economic limitations, options for mitigating well siting concerns include:

- Existing wellsites

Existing wellsite leases may be suitable for drilling new NGC wells, or suitable to extend the surface lease, to minimize the need for new access roads and surface disturbances.

- Existing access and/or shared access

Existing access roads or trails should be utilized where practical to minimize new surface disturbance. Road use may be shared between company operations, between companies, and between the NGC operator and another land user (e.g., forestry company). Road use agreements should be used where more than one company uses an industry access road on a regular basis.

- Existing wells

Existing oil and gas wells may be recompleted for NGC production. This may involve abandonment of a wellbore for formations below the targeted NGC coal formation, and recompleting the well in the NGC coal formation. The NGC operator must ensure the integrity of the existing well casing and cementing prior to pursuing this option. As per existing regulations, the NGC operator must report the recompletion data and any production from the new formation to the EUB.

- Dual completions

A dual completion involves the production of natural gas from two pools within one wellbore. Typically, gas from one pool produces up the tubing and gas from the other pool produces up between the tubing and the casing. Gas production from each pool is typically metered separately at the surface, and then production may be mixed in the gas gathering pipeline.

- Alternative drilling and completion technologies

While not always possible, alternative technologies such as directional drilling and slant drilling allow the surface well site to be in a different location than the bottom hole of the well. As well, a number of wells can be drilled from a single surface location.

Alberta Setback Requirements

Section 2.110(1) of the *Oil and Gas Conservation Regulations* states that: "No well shall be drilled at any point that is within (a) 100 metres of any surface improvement other than a surveyed roadway or road allowance, or (b) 40 metres of a surveyed roadway or road allowance, unless there exist special circumstances which in the opinion of the Board justify the drilling of a well within a lesser distance."

Section 2.120 of the *Oil and Gas Conservation Regulations* stipulates that a well may not be drilled "…closer than 100 metres, or such greater distance as the Board may direct, to the normal high water mark of a body of water or permanent stream…" unless the Board provides written approval of the applicant's pollution prevention plans.

Section 11 of the *Subdivision and Development Regulation* states that a subdivision application or a development application must not be approved by a municipality if it would result in a permanent residence or public facility being located within 100 metres of a gas or oil well, or within a lesser distance approved in writing by the EUB.

For further information, refer to the EUB publication EnerFAQs No. 5 – Explaining EUB Setbacks.

4.1.8 Gas Production Commingling

Best Management Practice	**Commingling of multiple zones should be considered where NGC can be more economically and efficiently recovered, and to minimize the number of wells required.**

Commingling is the production of gas from more than one pool within a single wellbore, without measuring production from each pool separately.

Gas production commingling allows for efficiencies in drilling, completions, and production. In turn, commingling reduces overall surface disturbance because the drilling of separate individual wells for each formation is not required. Such efficiencies in land use and resource development are further increased when operators work together to develop joint applications for review by regulators and local stakeholders, thereby making better use of the limited time of all stakeholders.

A number of NGC operators have developed the Horseshoe Canyon and Belly River coals in conjunction with conventional gas production. The NGC is produced from the same wellbores as natural gas from sandstones, where there are similarities in reservoir pressures, gas compositions, and little or no free water. This is an efficient method for development of Horseshoe Canyon coals, which contain numerous thin and discontinuous coal seams, interbedded with or adjacent to other gas-bearing formations. In such situations, commingling is the best method to ensure the resource is not wasted through inefficient production methods.

To commingle gas production, an operator needs to collect data, and apply for and receive regulatory approval. At the time of writing, the EUB is developing a directive for this issue. Readers should contact the EUB for further information on the directive, which should be released early in 2006.

4.1.9 Production Facilities and Pipelines

Best Management Practices	**Design and locate NGC production facilities and pipelines with consideration for current and potential future land use, and to minimize cumulative land disturbances, and to address landowner concerns.**

The NGC operator should identify proposed facility locations and pipeline rights-of-way after determining the considerations and opportunities discussed in section 4.1.4.

Concerns about proposed facility locations and pipeline rights-of-way may be identified through:

- Notifications to mineral rights owners.
- Consultations with landowners, occupants and land managers.
- The public involvement program.

NGC production facilities may include booster compressors and/or central compressor stations, and produced water handling and disposal facilities.

Design, sighting and layout of production facilities are based on many factors, including:

- Optimizing operating pressures and conditions for NGC wells.
- Minimizing potential noise impacts.
- Managing potential visual impacts.
- Managing facility security.
- Managing potential public safety risks.
- Complying with setback regulations.

Production from NGC wells may be tied in to existing gas gathering systems. Booster compressors may be required where the NGC production pressure is less than the pressure in the existing pipeline.

Existing natural gas compression stations and gas processing plants may have capacity for new NGC production, or may be suitable locations to install additional compression capacity for NGC production.

(Noise management for NGC facilities is discussed in section 4.1.12 below.)

Visual impacts of NGC facilities can be mitigated by various methods, including:

- Avoid locating facilities on the tops of hills or ridges.
- Locate facilities where visibility is screened by forested areas or terrain.
- Install perimeter berms and/or plant trees to screen facilities.
- Select building designs and colour schemes consistent with those used by other local land uses.

Gas gathering pipelines for NGC wells may be aligned alongside existing pipeline rights-of-way.

4.1.10 Groundwater Protection

Best Management Practices	**Plan NGC activities to protect and conserve groundwater resources, and to avoid impacts to groundwater users.** **Assess groundwater conditions and groundwater use in the NGC development area prior to commencing exploration and development activities.**

Groundwater and surface water are valuable resources that must be protected. Potential groundwater concerns for NGC developments include:

- Protection of groundwater resources and springs during geophysical, drilling, well completions (including fracturing), production and well abandonment operations.
- Ensuring isolation of groundwater aquifers.
- Potential impacts of groundwater withdrawals on hydraulically connected aquifers.
- Use of non-saline groundwater for NGC operations.
- Potential negative impacts to water well users, such as damage to wells, reduced water quality or quantity, or occurrence of natural gas in water wells.
- Handling and disposal of saline produced water.
- Conservation and beneficial use of non-saline produced water.

Water production from NGC wells is managed according to whether the water is non-saline or saline. In Alberta, non-saline water is defined as produced water that contains total dissolved solids of less than or equal to 4000 mg/L. A diversion permit application must be submitted to and approved by AENV prior to producing non-saline water. Application requirements are outlined in the AENV document titled: Guidelines for Groundwater Diversion – For Coalbed Methane/Natural Gas in Coal Development (2004).

NGC developments targeting wet coals containing non-saline groundwater cause the most concern among groundwater users and regulatory agencies. Such conditions may occur in the Horseshoe Canyon and Belly River coals, but are mainly associated with the Ardley coals.

Underpressured, dry coal zones are not expected to be connected to any aquifers, and cause less concern about groundwater resources. Most NGC wells in Alberta have been drilled in the Horseshoe Canyon and Belly River coals under these conditions.

The relatively deep Mannville coals contain saline water. In Alberta, saline produced water must be disposed of in deep disposal zones and isolated from all non-saline water sources. NGC developments in the Mannville coals are expected

to follow these procedures. These operations cause less concern than those affecting non-saline water.

The Alberta government provides various sources of information to assist landowners with gaining information about their water sources. Examples of such information include the following:

- Drillers in Alberta are required to submit drilling records to Alberta Environment. Landowners can access information on how and when their well was drilled by contacting the Alberta Environment Groundwater Information Centre at (780) 427-2770, or through the website at http://www3.gov.ab.ca/env/water/groundwater/index.html
- Landowners wanting general, practical information on water wells and water well maintenance can obtain a free copy of "Water /wells that Last for Generations" by contacting the Publications Office of Alberta Agriculture Food and Rural Development at 1-800-292-5697.
- Landowners who wanting information about household water quality can contact their local health unit to discuss having a thorough chemical and bacteriological analysis completed. Water samples for agricultural purposes can be taken to private labs for testing.
- Alberta Environment has a 24-hour Environment Hotline (1-800-222-6514) to assist landowners with concerns about specific impacts to their water wells. Complaints to this 1-800 number are tracked and investigated by Alberta Environment Staff. If an Alberta Environment water well investigation indicates a water well has been impacted by oil and gas activity, Alberta Environment will refer the complaint to the Energy and Utilities Board.
- Alberta Environment will investigate all water well complaints, except those related to seismic activity. Landowners with such concerns should contact Alberta Sustainable Resource Development at (780) 427-3932. Alberta Environment will also refer such cases to Sustainable Resource Development.
- EUB Documents: "Shallow Well Operations," Bulletin 2005-04, and "Shallow Fracturing Operations-Interim Controls, Restricted Operations, and Technical Review," and Directive 035 and Bulletin 2006-15 regarding baseline water well testing. Alberta Environment introduced its related Testing Standards document in April of 2006.

A distinguishing feature of some NGC developments is that water may need to be withdrawn from the coal to initiate natural gas production. The volume of produced water may be relatively high initially, but will reduce significantly after production commences.

Planning for produced water management requires information on the anticipated quality and production rates for each stage of the NGC development. All produced water must be sampled and analyzed pursuant to regulatory requirements (e.g., during well testing and production operations).

Produced water from NGC wells must be contained in storage tanks, and handled and disposed of through methods that will not contaminate land, surface water or groundwater.

Alberta Regulatory Requirements

Production, handling and disposal of non-saline produced water from NGC wells are regulated by AENV and the EUB. Production, handling and disposal of saline produced water from NGC wells are regulated solely by the EUB.

Groundwater protection during drilling, completion, production, and abandonment operations is regulated by the EUB pursuant to the *Oil and Gas Conservation Regulations* and:

- Guide 8 – Surface Casing Depth Minimum Requirements
- Guide 9 – Casing Cementing Minimum Requirements
- Guide 10 – Guide to Minimum Casing Design Requirements
- Directive 013 – Suspension Requirements for Wells
- Guide 20 – Well Abandonment Guide

The production, handling and disposal of produced water (saline and non-saline) from NGC wells are regulated by the EUB pursuant to the *Oil and Gas Conservation Regulations* and:

- Directive 004 – Determination of Water Production at Gas Wells
- Guide 55 – Storage Requirements for the Upstream Petroleum Industry
- Guide 51 – Injection and Disposal Wells
- Guide 65 – Resource applications for gas reservoirs
- Directive 035 – Baseline water well testing requirements for NGC

The production, handling and disposal of non-saline water from NGC wells are regulated by AENV under the *Water Act* and *Water (Ministerial) Regulation*. Early in 2006, AENV will formally introduce a non-saline produced-water threshold below which an Approval will not be required. The current interim number is 30m3 per well per month, or 100 m3 per section per month. Beyond the threshold number, NGC operators must obtain an Approval from AENV. Applications for an Approval must include the expected volumes of produced water and the proposed methods of produced water use or disposal. NGC operators must comply with the conditions of the Approval issued for each NGC project. Conditions of an Approval may require the NGC operator to meter production volumes, analyze water quality, monitor water levels in specific aquifer intervals and neighboring water wells, etc.

Further information is available through the AENV Guidelines for Groundwater Diversion for Coalbed Methane Development (April 2004), and its Standard for water well testing (April 2006).

Evaluate Groundwater Resources

Best Management Practices	**Support the collection and submission of groundwater and water well data to a public database.** **Compile an inventory of publicly available water well data pertaining to the NGC project area, and conduct a testing program for water wells near planned NGC wells, prior to drilling.** **For NGC developments targeting production from coals expected to produce non-saline groundwater, thoroughly evaluate the hydrogeology of the development area and, with landowner consent, conduct a testing program for all water wells within 600 metres of an NGC well, when the well is expected to be completed above the base of the groundwater protection.**

Prior to commencing operations, NGC operators should conduct a baseline testing program for water wells near planned NGC wells for due diligence purposes (please see EUB Bulletin 2006-15). NGC operators targeting production from coals containing non-saline groundwater must conduct a testing program. The baseline data should be shared with the landowners. In the event of water well complaints, the baseline information will help determine the nature and cause of the problem.

Determining the appropriate distance for testing water wells is a matter of risk management on the part of the NGC operator. The NGC operator may select distances based on:

- Experience.
- Depth.
- Age and condition of the water well.
- Landowner concerns.
- The potential of the NGC operation to cause negative impacts.

Water well testing should include the following steps:

- Contact the water well owner and review the testing protocols and tester to be used.
- Obtain a copy of the driller's report for the water well, if available.
- Inspect the water well location for potential contamination sources.
- Inspect the water well, pump, and related equipment such as filters, water softener, storage tanks, water heaters, hydrants, etc.
- Complete an inspection report.
- Confirm water well servicing and disinfecting history.
- Check well water for presence of natural gas.

- Check well and well water for presence of bacteria.
- Collect samples of the well water, following laboratory protocols for water quality.
- Analyze the water samples at an accredited laboratory for potability (pH, electrical conductivity, major ions, total hardness, total alkalinity, total dissolved solids) and presence of coliform bacteria.
- Notify the water well owner in writing of any problems found during inspection and testing.
- Provide a copy of the water well test to the owner, and submit a copy to the public database.

NGC operators should use trained and experienced personnel to test water wells, and ensure that sampling and pump testing follow acceptable practices.

NGC operators targeting production from coals containing non-saline groundwater must evaluate groundwater resources.

Alberta Regulatory Requirements

The *Water (Ministerial) Regulation* regulates the siting, drilling and installation of water wells. AENV is expected to establish production thresholds on both a well and area basis; NGC developments with non-saline produced water volumes above the threshold would be subject to a more rigorous application and review process than those developments with volumes below the threshold.

AENV and the EUB regulate non-saline produced water pursuant to the *Water Act*. Handling and disposal of non-saline water is subject to the requirements of the *Environmental Protection and Enhancement Act* and its associated regulations, codes and guidelines, including the AENV Guidelines for Groundwater Diversion for Coalbed Methane Development (April 2004) and EUB regulations D-035 (May, 2006).

Prior to starting drilling, recompletion or production activities, NGC operators must conduct and submit to AENV a Preliminary Groundwater Assessment (PGA) if the target coal formation may contain and produce non-saline groundwater. The PGA provides baseline information on geology and hydrogeology, and an inventory of groundwater users, in the potentially affected area The PGA must include a conceptual Operational Water Management Plan (OWMP), describing how water will be handled during exploration and testing activities. The plan should describe the proposed method of produced water disposal, and potential effects on the environment such as soil, surface water, groundwater, etc.

Water for NGC Operations

Best Management Practice	**NGC operators should determine water needs for developments, and select water sources carefully to avoid impacts to water and groundwater resources.**

While there has been no evidence that surface water used for drilling fluids and fracturing fluids in coals containing non-saline water has contaminated aquifers, NGC operators should be aware of the concern where it exists. Only licensed water well drillers should be used for water well drilling.

Alberta Regulatory Requirements
The *Water (Ministerial) Regulation* sets out requirements for siting, drilling, installing, and completing water wells. Groundwater and surface water withdrawals for industrial use are regulated by AENV under the *Water Act.*

Conservation of Non-Saline Produced Water

Best Management Practices	**Minimize production of, and protect and conserve non-saline produced water.** **Investigate beneficial uses of non-saline produced water, in conjunction with regulatory agencies and local stakeholders.**

Non-saline groundwater is a valuable natural resource. The protection and sustainability of non-saline aquifers is a priority objective of all stakeholders. NGC operators must ensure their operations protect the sustainability of non-saline aquifers.

Alberta Regulatory Requirements

The production, handling and disposal of non-saline water from NGC wells are regulated by both AENV and the EUB. Handling and disposal of non-saline water are subject to the requirements of the *Environmental Protection and Enhancement Act* and its associated regulations, codes and guidelines in addition to EUB requirements.

Prior to starting drilling, recompletion or production activities, NGC operators must conduct and submit to AENV a Preliminary Groundwater Assessment (PGA) if the target coal formation may contain and produce non-saline groundwater above the previously-noted threshold. The PGA provides baseline information on geology and hydrogeology, and an inventory of groundwater users, in the potentially affected area.

The PGA must include a conceptual Operational Water Management Plan (OWMP), describing how water will be handled during exploration and testing activities. The conceptual plan should describe the proposed method of produced water disposal, and potential effects on the environment such as soil, surface water, groundwater, etc.

Prior to producing any non-saline groundwater from a target coal zone, an NGC operator must obtain an authorization for groundwater diversion from AENV, pursuant to the *Water Act*. Currently, the NGC operator must submit an application, prepare a Technical Report including hydrogeological tests, water quality and natural gas analyses, and an OWMP, as well as confirm public notification. The OWMP must address all issues relating to the handling of produced water during all phases of the development. AENV, in consultation with the EUB, must approve the OWMP prior to the discharge of any water.

Authorizations issued by AENV may contain conditions:

- to meter groundwater production volumes
- to test water quality
- to monitor water levels in the target aquifer and other aquifers, and
- which specify the use or disposal of produced water.

For further information, refer to the publication Guidelines for Groundwater Diversion – For Coalbed Methane / Natural Gas in Coal Development (AENV, 2004).

The requirements of the EUB for non-saline produced water are the same as for saline produced water (refer to section 4.1.10 above). The EUB does not allow discharge of non-saline produced water to the land surface. Requests for alternate disposal schemes will be considered by AENV/EUB, but need to be supported by technical information that confirms no environmental impact and indicates how alternate use/disposal will be monitored.

Management of Saline Produced Water

Best Management Practices	**Safely manage the production of saline produced water.** **Assess beneficial uses of saline produced water.**

In Alberta, saline produced water is defined as produced water that contains TDS of more than 4000 mg/L.

NGC operators must obtain the appropriate regulatory approvals from the EUB for the production, handling, storage, and disposal of saline water produced from NGC wells.

NGC operators should investigate alternative disposal methods and/or beneficial uses for saline produced water, such as re-use for oilfield injection (e.g., to displace the use of surface water or non-saline groundwater). However, operators will likely have to wait for government assessment and the development of protocols before alternative surface uses will be permitted.

Alberta Regulatory Requirements

The production, handling and disposal of produced water (saline and non-saline) from NGC wells is regulated by the EUB pursuant to the *Oil and Gas Conservation Regulations* and:

- Directive 004 -- Determination of Water Production at Gas Wells
- Guide 55 -- Storage Requirements for the Upstream Petroleum Industry
- Guide 51 -- Injection and Disposal Wells.

An EUB approval is required for a scheme for:

- the gathering, storage and disposal of water produced in conjunction with oil and gas, and
- the disposal of any fluid or other substance to an underground formation through a well.

Applications for these EUB approvals are administered under:

- Directive 065 -- Resources Applications for Conventional Oil and Gas Reservoirs
- Guide 51 -- Injection and Disposal Wells.

Prevention of Gas Migration and Release

Best Management Practice	**Design drilling and completions programs for NGC wells to protect groundwater resources and water wells, and prevent migration of natural gas from coal zones to other aquifers.**

The EUB currently views gas migration as gas that comes up the outside of the surface casing due to poor cement integrity. However, operators are encouraged to consider issues beyond this regulatory definition, as follows.

Gas migration can be defined as the unintended movement of natural gas from a natural gas bearing formation (e.g., coal seams) to other formations that may include groundwater aquifers. While some aquifers naturally contain methane and some water wells already produce associated methane, concerns have been expressed about the potential for natural gas to migrate to water wells due to NGC operations. To address this, the MAC's recommendation 3.6.1 states that, "AENV and the EUB should work with industry to investigate the potential for methane migration or release to water wells as a result of CBM/NGC depressurization." Shallow fracturing operations may also create potential gas migration conditions.

NGC operators must pay particular attention to the practices described in section 4.1.10.1 when shallow wet coals containing non-saline groundwater are being targeted for NGC production. Groundwater conditions and local water wells should be carefully evaluated in these areas. If the NGC wells are completed in the same aquifer as local water wells, the operator should closely monitor

groundwater and natural gas rates in both NGC wells and water wells. Changes in the water wells can then be detected and appropriate responses taken.

Gas migration between formations can be prevented through the design and implementation of appropriate drilling and completion programs. Further details on drilling and completions practices are provided in sections 5.4 and 5.5, respectively.

4.1.11 Emissions Management

Best Management Practice	**Plan NGC developments to minimize emissions during well testing and production operations.** **Design and operate NGC facilities to minimize emissions.** **If benzene is present in the gas stream, design and operate glycol dehydrators to minimize benzene emissions.**

Natural gas from coal is composed primarily of methane and is a clean-burning fuel. As a result, venting and flaring of NGC will not create potentially harmful emissions such as those associated with natural gas containing hydrocarbon liquids or hydrogen sulphide. However, since methane and carbon dioxide are greenhouse gases, management of emissions from NGC activities is a necessary component of climate change initiatives. NGC operators should refer to various CAPP publications on minimizing and reporting emissions of greenhouse gases.

NGC operators should consult the document Flaring and Venting Recommendations for Coal Bed Methane – Final Report (Clean Air Strategic Alliance, 2005) for proposed emission limits. Further information on the Clean Air Strategic Alliance is available through its website (**www.casahome.org**). It is anticipated that these limits will be adopted by the EUB in 2006 and incorporated into Directive 60 -- Venting and Flaring.

Subject to technical, regulatory and economic limitations, well test flaring and venting may be minimized by:

- Test well to a pre-built pipeline.
- Test well to a temporary pipeline.
- Limiting well test venting and flaring durations to those required for evaluating each NGC well.

NGC compressor installations must comply with appropriate regulatory requirements as outlined in Appendix C for emissions of oxides of nitrogen (NOx). Such emissions can be reduced through the use of lean burn compressors.

NGC operations must comply with applicable ambient air quality standards. In Alberta, NGC companies are encouraged to participate in regional airshed monitoring organizations that are set up through the Clean Air Strategic Alliance. Further information can be obtained through www.casahome.org.

4.1.12 Noise Management

Best Management Practice	**Locate, design, build and operate NGC facilities to mitigate noise impacts.** **Integrate noise mitigation features in NGC plans and schedules.**

In Alberta, a noise impact assessment is required for all new facilities, and for modifications to existing facilities. Noise issues must be assessed on a site-specific basis.

NGC operators should consult with potentially affected landowners and other stakeholders early in the planning process regarding noise issues. NGC operators should also follow up on any noise complaints in a timely manner.

MAC members discussed the need for NGC operators to make reasonable efforts to control noise whenever possible. The MAC Preliminary Findings document recommends that operators and landowners be better informed on mitigation options, suggesting that a Best Management Practices document would be an appropriate vehicle for such information sharing (such as the SPOG Best Practices Document on Noise Control).

Noise issues can arise from:

- Short-term activities - (e.g., drilling, completions, testing operations, pipeline and facility construction).
- Long-term activities - (e.g., wellsite facilities, compressor stations).
- Periodic activities - (e.g. vehicle traffic, well maintenance, pipeline maintenance).

Noise sources at NGC facilities may include:

- Compressor drivers (e.g., reciprocating engines using natural gas as fuel).
- Engine exhaust stacks/mufflers.
- Engine cooling fans.
- Heat exchanger / gas cooling fans.
- Pumps and pump drivers.
- Building ventilation (e.g., vents, open windows, open doors).

NGC operations must be planned and conducted pursuant to regulatory requirements for noise control. NGC operators should also be aware of local noise concerns that may relate to their specific situations. Where necessary, noise abatement technologies should be used to meet or exceed regulatory requirements. NGC operators should also inform contract staff of noise control practices.

NGC operators are encouraged to use acoustical engineering consultants and noise suppression service companies to assess potential noise impacts and to assist in designing facilities to meet noise objectives. Noise mitigation is usually

most effective when implemented at the planning and design stage of a project, rather than retrofitting existing facilities.

Noise impacts from short-term NGC activities may be managed using various methods, for example:

- Notify nearby residents of activity schedules in advance.
- Adjust activity schedules to meet local concerns.

Potential noise impacts from ongoing NGC facilities can be mitigated through a combination of site selection, equipment selection, equipment layout, noise suppression systems, and operating practices.

Equipment selections that may assist in meeting noise objectives include:

- Horizontal mounted cooling fans.
- Electric-drive cooling fans.
- Variable frequency drive electric motors.
- Screw compressors.
- Heat exchangers.

NGC operators may install supplementary noise suppression systems if the desired noise levels are not achieved through preliminary efforts, including:

- Acoustic enclosures for cooling fans and building ventilation.
- Engine silencers (i.e., higher grade silencers).
- Vibration isolation.
- Insulation blankets.
- Sound barriers.

4.2 Mineral Tenure

Best Management Practice	**Ensure that appropriate mineral rights are in place prior to initiating NGC developments.** **Support coordination of NGC development activities on a local basis through acquisition of mineral rights and working with other mineral rights owners.**

"Mineral Tenure" refers to the ownership of mineral resources, and the rights to explore for and produce minerals. "Minerals" includes petroleum and natural gas (P&NG) and coal. The mineral rights in approximately 81 percent of Alberta's 66 million hectares are owned by the provincial Crown and are managed by Alberta Energy (ADOE). These are referred to as "Crown rights".

The Mines and Minerals Act and the Petroleum and Natural Gas Tenure Regulation set out the management of Crown rights for NGC in Alberta. The legislation is administered by ADOE. Crown NGC rights are leased through conventional P&NG agreements. Crown coal rights are managed through a different disposition system under the Mines and Minerals Act.

The Mines and Minerals Act was amended in 2003 to clarify that in situations where both the P&NG rights and the coal rights are owned by the Alberta Crown, NGC belongs to the P&NG lessee and not to the coal lessee.

Mineral rights for the remaining 19 percent of Alberta are owned by:

- The federal government (including lands within national parks and lands administered under the federal *Indian Act*).
- The successors in title to the Hudson's Bay Company.
- The successors in title to various railway companies.
- The descendents of homesteaders who received title to the minerals from the federal government before 1887.

Except for federal Crown lands, these rights are referred to as "freehold rights".

There are also lands with "split title", i.e., where one of the following situations occurs:

- Coal rights are Crown; petroleum and natural gas rights are freehold.
- Coal rights are freehold; petroleum and natural gas rights are Crown.
- Coal rights are freehold; petroleum and natural gas rights are freehold (held by a different party than the coal rights).

It is Alberta Energy's current position that, where there is split title, NGC ownership is a matter to be determined by the parties involved. Where the parties are unable to reach an agreement, the matter is to be ruled on by the courts.

Project planning should factor in crown mineral lease expiries and operators must plan ahead to avoid the sense of urgency that sometimes leads to poor or artificially accelerated landowner consultation. Although the ADOE can provide mineral lease extensions, this is the exception and steps should be taken to limit the need for an extension.

4.3 Public Involvement

Best Management Practice	**Plan and conduct public involvement programs for each NGC development, consistent with the location, scope, schedule and duration of NGC activities.**

CAPP believes that public involvement should be an integral part of member companies' business planning processes and overall corporate strategic plans. A well-planned and effective communication process among industry, landowners and occupants, land managers, municipal governments, and other stakeholders in a development area will help ensure a better level of understanding of:

- The business, land use, and land enjoyment of other parties.
- The potential effects (negative and positive) of NGC development to each party.

In addition, it should be noted that in the EUB's Guide 56, public involvement program requirements are considered "minimum" and operators are expected to go beyond these minimum requirements.

4.3.1 Company Responsibilities

Best Management Practice	**Operators should design and implement a public involvement program early in the development and planning processes.**

A public involvement program should be initiated early in the planning stage of each NGC project. Public involvement is a key component of effective planning. Operators should be encouraged to use open houses and other communication vehicles to inform landowners, the local community, and municipality on the project scope and density of their proposed program. Operators should listen and work to understand the concerns of stakeholders, in addition to providing information about proposed developments. Stakeholder input should be considered in each development planning and facilities design stage to identify opportunities to improve the project for the benefit of all parties.

Timely and recurring communications is critical during the initial development period, when potential for negative effects may be greatest. While relatively short in duration, this period is likely to see the highest number of contractors, most vehicle traffic and movement of heavy equipment, and the greatest potential for noise, dust, and other traffic related effects.

A successful public involvement program will continue into the NGC operations phase, and will support positive landowner and community relations.

The public involvement program should be tailored to the location, scope, schedule, and duration of the NGC development. NGC operators should consult CAPP's Guide to Effective Public Involvement (CAPP, 2003) for practical guidance on planning and conducting public involvement programs. This document is available on CAPP's website, www.capp.ca

The company should also advise stakeholders that the specifics of a planned NGC development are subject to change over time, for example:

- Seismic programs.
- Well locations and anticipated densities.
- Pipeline alignments.
- Facility locations.

NGC operators should actively identify and engage all affected parties, in addition to adhering to the highest standards of surface land rights acquisition practices. NGC operators should also consider contacting local synergy groups that involve industry and community participants. Landowners, occupants and land managers in the development area are critical stakeholders for every NGC development.

Land managers include:

- ASRD (e.g., forestry officers, grazing reserve managers) on provincial Crown lands.
- ACD – provincial parks and natural areas.
- Forestry companies (land use coordinators) – forest management agreement areas.
- Grazing leaseholders.
- Municipalities.
- Irrigation districts.
- First Nations, IOGC on Reserve Lands.

NGC operators should plan and implement activities to minimize potential negative economic effects on private land, as identified through consultation with landowners. Commitments made during public consultation must be actively managed. The following is a list of potential tools that may assist with consultation management:

- Maintaining a master listing of commitments made by all personnel (including contractors) in printed materials, during open houses, during meetings, etc.
- Ensuring that all staff and contractors are aware of the commitments made.
- Tracking the status of the commitments.
- Communicating the status of commitments on a regular basis.
- Providing ongoing opportunities for feedback from stakeholders.

The NGC operator should commit to providing updated information in a reasonable timeframe, if and when changes occur to the project scope and schedule.

Further information is available through the EUB's EnerFAQs 13 publication. Refer to EUB IL 2004-08, which encourages applicants to develop and share project plans and/or pool and area development plans to the extent feasible.

4.3.2 Role of Landowners, Occupants and Other Stakeholders

Best Management Practice	**Landowners, occupants, and other stakeholders should be invited to participate fully in public involvement programs.**

A proposed NGC development imposes new responsibilities on landowners, occupants, and other land users. Some of the new responsibilities may not be anticipated, fully understood, or even welcomed by some parties. (Section 2 of Guide 56 helps explain landowners' rights.)

An effective public involvement program will provide a forum for sharing information and concerns among all the parties involved. The NGC operator and affected parties are obliged to work towards understanding each other's needs and concerns, and to seek mutually beneficial agreements.

Landowners, occupants and other land users should consider potential effects of a proposed NGC development on both current and future land use. Ideally, feedback can be provided on:

- Landowners' anticipated plans for the future (e.g., future building sites, subdivision plans, etc.)
- NGC development options that may least affect current or planned land use.
- NGC development options that may benefit current land use or future plans of the landowner.

Municipalities should identify potential concerns regarding NGC development, such as impacts on land use strategies and development plans, municipal services and utilities, traffic, and other socio-economic effects.

Alberta Regulatory Requirements

EUB Directive 065 -- Resources Applications for Conventional Oil and Gas Reservoirs sets out minimum consultation and notification requirements for well spacing and commingling applications.

EUB Guide 56 -- Energy Development Application Guide sets out the minimum consultation and notification requirements for various components of an NGC development (i.e., wells, facilities and pipelines).

Certain activities regulated by AENV also require public notification, e.g., water wells for industrial withdrawal (*Water Act*), pipeline construction in the White Area with an index number of 2690 or greater (*Environmental Protection and Enhancement Act*).

4.4 Surface Rights and Landowner Consultation

Best Management Practice	**Ensure that landowners, occupants and land managers are appropriately consulted during the course of NGC development planning and surface rights acquisition activities, and that their concerns are addressed.** **Ensure that landowners, occupants and land managers are appropriately notified prior to on-the-ground NGC operations activities, including survey activities, and throughout the life of the project.** **Ensure landowner is aware of applicable regulations and where this information can be accessed.**

NGC development operators require surface rights on lands owned by other parties. Lands may be owned by the Crown (i.e., provincial or federal governments) or by private parties. Surface rights allow the NGC operator to enter the land legally (e.g., conduct various activities, survey locations, drill wells, install and operate pipelines, build and operate production facilities, and ensure access to NGC sites).

As the surface rights owner, the landowner should be consulted early about decisions regarding siting of wells, facilities, pipelines and access. The landowner

may have specific requests regarding the timing of NGC activities, dust control, weed control, crop and livestock protection, and renegotiation of disturbed lands.

NGC operators must use only licensed land agents or legal counsel to negotiate surface rights agreements.

On private lands, surface rights are negotiated in the form of surface lease agreements (for wellsites, facility sites, and access roads) and pipeline easement agreements (for pipelines and related facilities). The parties may choose to use a standardized agreement form (e.g., Canadian Association of Petroleum Landmen form, or standard NGC operator form), and attach any additional terms and conditions that are agreed to.

On Alberta public lands, surface rights are issued in the form of:

- Mineral surface leases (MSL) – for wellsites.
- Licences of Occupation (LOC) – for access roads.
- Pipeline Agreements (PLA) – for pipeline rights of way.
- Pipeline Installation Leases (PIL) – for pipeline related facilities.
- Powerline Easements (EZE) – for electrical power lines.

On Indian Reserve lands, surface rights are issued through Indian Oil and Gas Canada.

The NGC operator's construction personnel should meet with landowners. Personnel responsible for construction of access roads, wellsites, pipelines and facilities can provide information on intended construction methods, consult with respect to concerns of the landowner/occupant/land manager, and seek solutions that address both parties' interests. Such consultation must not conflict with S.17 of the *Land Agents' Licensing Act* regarding the 48-hour "free and clear" time frame.

Planning the location of wellsites, pipelines, and infrastructure in consultation with the landowner/occupant/land manager should help minimize the amount of land that may be compromised from their financial and operational point of view, while allowing the NGC operator reasonable access to the NGC resource.

In Alberta, the Farmers' Advocate provides a point of contact for rural landowner issues by providing information and some resources on farm-related issues, including issues related to the energy industry. Further information on the Farmers' Advocate is available at: www1.agric.gov.ab.ca.

While industry will assist landowners with identifying applicable regulations and related sources of information, landowners are recommended to search further, as appropriate.

Alberta Regulatory Requirements

EUB Guide 56 (Section 2.2.2) specifies information that NGC operators must provide to landowners, occupants, and land managers, including a project-specific information package and copies of EUB publications, as follows:

- letter from the Chairman of the EUB
- brochure 'Understanding Oil and Gas Development in Alberta'
- EnerFAQs No. 8 – Proposed Oil and Gas Development: A Landowner's Guide.
- Other EnerFAQs that relate to the type of energy development proposed *(*e.g., EnerFAQs No. 10 – Coalbed Methane, EnerFAQs No.13 – The EUB and You*)*

EUB Guide 56 also requires P&NG lessees to notify coal lessees when they are planning to undertake activity within a mine licence area.

On provincial public lands, the *Public Lands Act* and various ASRD requirements (e.g. Directives, Alberta Public Lands Operational Handbook, Information Letters, wildlife land use guidelines, wildlife and fisheries referral maps) set out consultation and notification requirements with other land users (e.g., forestry companies, trappers, recreation area users, grazing lease holders, etc.).

4.5 Appropriate Dispute Resolution

Best Management Practices	**Make every reasonable effort to resolve issues by negotiation.** **Use appropriate dispute resolution methods when issues cannot be satisfactorily resolved by negotiation.**

NGC operators are required to identify, contact, and consult with stakeholders who may be affected by proposed NGC developments. Such stakeholders may include other mineral rights owners, other oil and gas operators, landowners, occupants, land managers, the public, and other individuals or organizations. If the parties are unable to resolve differences following regular negotiation processes, other dispute resolution methods may be appropriate, such as facilitation, mediation, arbitration, a formal hearing before a regulatory agency, or the court system.

Dispute Resolution Options in Alberta

Applications to the EUB may be submitted as "non-routine" where there are, or are expected to be, objections to proposed developments. The parties may continue to negotiate and/or may choose to engage the EUB's Appropriate Dispute Resolution (ADR) process. The EUB's ADR process is described in EUB Information Letter IL 2001-1: Appropriate Dispute Resolution and Guidelines for Energy Industry Disputes. EUB staff may act as facilitators, or third-party mediation may be used. Further information is available on the EUB website **www.eub.gov.ab.ca**. It is important to note that the EUB's ADR process is not available to subsurface rights owners. Holders of those rights should contact the Alberta Department of Justice directly.

When a NGC operator and a landowner or occupant fail to reach an agreement regarding entry or compensation, the parties may go before the Alberta Surface Rights Board to obtain a decision, Refer to the Alberta Surface Rights Board website **www.surfacerights.gov.ab.ca** for more information.

Farmers may request assistance from the Office of the Farmers' Advocate of Alberta to provide information and/or assistance in dispute resolution instances. Further information on the Farmers' Advocate is available at: **www.agric.gov.ab.ca/farmersadvocate**.

Either party in a dispute may request government agencies to assist in resolving an issue. For example, depending on the issue, the EUB, AENV, ASRD, Farmers' Advocate of Alberta or other agencies may be called on to provide information or inspect operations for regulatory compliance.

5 NGC Operations

This section discusses Best Management Practices for the different types of operations that occur after an NGC development has progressed through the planning, public involvement and landowner consultation stages, has obtained surface rights, and has received regulatory approvals.

5.1 Landowner and Community Relations during NGC Operations

Best Management Practices	**Continue the public involvement program for NGC developments during NGC operations.** **Respond to landowner and community concerns promptly and appropriately.**

NGC operators must ensure commitments and agreements made during the planning, consultation, and surface rights processes are met during operations. They should ensure that operations supervisors and service companies are informed of, and comply with, such commitments and agreements, as well as terms and conditions of regulatory approvals.

Operators of NGC developments should continue to keep affected landowners, local municipalities, nearby communities, and the public informed of project activities and schedules. The nature and frequency of communications will vary depending on the scope and complexity of the project, its location, and the type of operations occurring at any given time. Communications should be most frequent during the initial period of drilling wells, completing and testing wells, constructing pipelines and facilities, and production start-up.

In addition, certain NGC operations (such as well test flaring and pipeline maintenance flaring) may require notification to adjacent landowners and/or the public.

Operators should consider various communication methods, including:

- Project newsletters.
- Notices of project plans and activity schedules.
- Open houses.
- Liaison with local municipalities.
- Mail and e-mail address lists for local residents and agencies.
- Contact information for the NGC operator's local office.

Operators should refer to CAPP's Guide for Effective Public Involvement for further information.

Complaints about NGC operations must be addressed promptly, and resolved appropriately. Complaints may relate to matters such as noise, vehicle traffic, dust from traffic, weeds, surface runoff, fencing, and failure to secure gates.

5.2 Geophysical Operations

Best Management Practice	**NGC operators should consult with landowners, occupants and land managers prior to commencing geophysical operations.** **Ensure that geophysical agents and service companies are informed of and comply with the NGC operator's best practices.**

When geophysical operations are conducted, geophysical personnel are often the first industry contact with landowners, occupants, and land managers. The conduct of the geophysical operation may well set the tone for future relations with the NGC operator. If the geophysical operation creates a bad impression with the local community, the NGC operator is likely to encounter a lack of trust and resistance in future consultations and negotiations. The NGC project manager must ensure that any concerns or complaints about the geophysical operation are addressed promptly and completely.

Where the mineral rights have already been secured, the NGC operator should include discussion of geophysical programs planned on the lands (if any) in the public involvement and landowner consultation processes. In this case, there is the option of discussing the potential development openly with landowners, occupants and land managers.

Where the mineral rights have not yet been secured, exploration programs may need to be conducted on a confidential basis. In this case, the NGC operator can discuss limited potential development plans publicly. However, the NGC operator should take steps to ensure that the geophysical operations occur with proper notifications and minimal disruption to land owners, occupants and land managers.

5.3 Leases and Road Construction

Best Management Practice	**Plan and construct NGC well leases, facility leases, and access in order to minimize surface disturbances and to support effective reclamation in the future.** **Plan and construct NGC well leases, facility leases, and access in order to control surface runoff and to protect surface water quality.**

Surface leases for NGC wells range in size from 90 m by 110 m for shallow depth wells, to 120 m by 120 m for deeper wells. Surface leases for multiple-well pads may be larger in size, e.g., 100 m by 200 m. Wellsite surface leases should be prepared to the minimum size required for drilling, completion, testing and production operations.

The area required for a producing NGC well is typically small (e.g., about $4m^2$ for a dry NGC well without any additional wellsite equipment). Larger working areas may be required at wellsites with additional wellsite equipment (e.g., wellsite compressor, produced water equipment, storage tanks). Wellheads, pipeline risers, and production equipment, if any, are typically enclosed by fencing for safety purposes.

NGC facility sites are typically constructed using conventional methods (e.g., conserve topsoil, and prepare working area of the lease for production operations traffic). Typically, the working area is covered with a layer of gravel and is graded to control surface water runoff.

Options that may be appropriate for minimizing surface disturbances during lease and road construction include:

- Drilling NGC wells from existing wellsites.
- Utilizing directional drilling technologies and multi-well sites.
- When appropriate for landowner, locating NGC wells along developed roads and fence lines (e.g., rather than in the centre of cultivated and irrigated fields).
- Using minimum disturbance methods.
- Avoiding the use of heavy equipment when weather conditions may make roads less stable (e.g., during wet weather).
- Ensuring vehicles are appropriately cleaned in order to minimize the possibility of spreading seeds.
- Sharing existing or new access roads with other parties.
- Commingling or dual-producing NGC production with existing producing wells.
- Negotiating road use sharing agreements with existing or planned forestry and other industrial roads.
- Planning access roads and forest disturbances in cooperation with forestry operations.
- Using access controls.
- Managing contractor traffic.

NGC developments, particularly for dry coals such as the Horseshoe Canyon formation, are well suited for employing minimum disturbance construction methods for wellsites and access. These practices minimize disturbances to soils, vegetation and crops, cause the least disruption to existing land use, and reduce clean-up and reclamation requirements.

Equipment for drilling, completions, and testing NGC wells are typically on a wellsite for short periods of time -- less than one day to a number of days for each operation. These operations must be scheduled to avoid or minimize soil disturbance, for example, during frozen ground and dry ground conditions. Access to wellsites may or may not require stripping of topsoil, in order to prevent disturbances caused by vehicle traffic and heavy equipment (e.g., mixing of topsoil with subsoil, compaction, rutting, erosion).

NGC wells producing from dry coals typically do not require all-weather access roads. NGC production personnel inspect individual wells on an infrequent basis, e.g., once a month. All-weather access roads are typically required for NGC wells with additional production equipment (e.g., wellsite compressor, produced water equipment, storage tanks), and for NGC facility sites, e.g., compressor stations.

Wellsite leases may be partially reclaimed once production facilities and gathering pipelines are installed. This helps minimize the footprint of the well, and allows the remainder of the lease to be returned to other uses, e.g., cropland, pasture, etc. However, the NGC operator retains the right to utilize the entire wellsite for operations when required.

The Alberta Surface Rights Act awards annual compensation payments to the landowner for the entire area until a Reclamation Certificate is awarded to the operator by AENV. Operators should use only native species or certified seed for interim reclamation of disturbed areas, unless requested otherwise by the landowner. On agricultural lands, operators should consult the landowner / occupant / land manager about revegetation plans.

5.4 Drilling

Best Management Practice	**Design and conduct drilling programs for NGC wells to protect and conserve groundwater resources, conserve the NGC resource, and prevent migration of natural gas from gas-bearing formations.**

NGC drilling programs are similar for wells within a particular NGC development. Specific equipment and operating practices may vary depending on the nature of the coal formations (dry coals or wet coals; non-saline or saline water) and the depth of the target coal seams.

NGC wells are typically drilled as conventional vertical wells. Shallow NGC wells have to be drilled as vertical wells, in order to maximize the recovery of natural gas. However, deeper NGC wells may be candidates for directional drilling or slant drilling technologies that allow for more than one well to be drilled from a single surface location.

Conductor casing and/or surface casing are installed for NGC wells, typically by a water well rig or a drilling rig. Conductor casing and surface casing are steel pipe

installed for well control and for groundwater protection. The conductor casing and surface casing are cemented into place before the main hole is drilled. Cementing is done by pumping cement down the inside of the casing and back up the annular space between the casing and the walls of the drill hole.

A conventional drilling rig or a coiled-tubing rig is used to drill the main hole of the NGC well. Additional equipment typically includes drilling mud tanks, mud pumps, utility buildings, pipe racks, and trailers for personnel.

Drilling fluids or alternatives are used to assist in the rotary drilling process, to carry drill cuttings to surface, and for well control. Drilling fluids or alternatives for drilling NGC wells are selected based on a number of factors, including:

- Well depth.
- Geological conditions over the depth of the well.
- Groundwater conditions.
- Whether the target coal zone is dry or wet.
- Whether the target coal zone contains non-saline or saline water.
- Expected pressure of gas.

Protection of non-saline groundwater is a primary consideration. No toxic chemicals or hydrocarbon-based drilling fluids can be used when drilling above the base of groundwater protection. Operators must use only non-toxic drilling fluid additives for drilling through the groundwater protection zone.

Preferred drilling methods for Horseshoe Canyon NGC wells include:

- Fresh water and natural clays (bentonite) drilling fluid.
- Fresh water only underbalanced drilling.
- Air only underbalanced drilling.

The above drilling methods would also be suitable for other coal zones that are dry or contain non-saline water. Other drilling methods can be considered for deeper coal zones containing saline water, such as certain Mannville coals.

Depending on the well classification, samples must be collected during drilling and may be required to be submitted to the EUB, unless the NGC operator has applied for and obtained a sampling waiver. Open hole logging may also be required prior to setting production casing.

When the well has been drilled to total depth, production casing is installed to the bottom of the wellbore, and the casing is cemented in place. Some wells may be completed as open hole in the target zone, or may be completed with a slotted liner, only if completed within one pool and below the base of groundwater protection.

Horseshoe Canyon wells are typically drilled in one or two days. Drilling rigs are usually transported and set up on skids; coiled-tubing rigs are typically mounted on wheeled trailers.

Drilling fluids are transported, stored and handled in tanks. Typically, drilling fluid waste will be transported off-site for re-use and treatment/disposal, pursuant to regulatory requirements.

Following drilling operations, a wellhead will be installed on the well. The well is then ready for completions operations.

5.5 Well Completions

Best Management Practice	**Design and implement well completion programs to ensure well control, protect groundwater resources, and avoid damages to the NGC coal zones.**

Completions begin after drilling operations are completed. A typical completions program for an NGC well includes a sequence of activities, as summarized below. The completion employs technologies and practices for well control, groundwater protection and avoiding formation damage. Operators should be aware of technologies and practices being adopted or specially developed for NGC in Alberta.

NGC wells that produce non-saline groundwater must be completed in one single hydrostratigraphic unit to avoid commingling of waters.

5.5.1 Logging

Logging is used to pinpoint the depth intervals where coals are present in a wellbore. During this process, truck-mounted equipment lowers electronic instruments down the well. Logging instruments record the characteristics of the geology over the depth of the well. The logging data is processed and reviewed to determine the zones (coal seams and other sediments) where natural gas is likely to be present. This information is used to design the rest of the completions program for the well.

5.5.2 Perforating

Perforating operations on NGC wells typically use truck-mounted equipment. A cylindrical perforating tool containing explosive charges is lowered into the wellbore to depths indicated by the electronic logging data. Holes are shot through the production casing and the cement, into the coal seams targeted for NGC production. Perforating creates a pathway for natural gas to flow from the coal seams into the well's production casing. Perforating operations typically can be completed in one day.

Multiple coal seams are perforated in typical Horseshoe Canyon NGC wells. Additional gas bearing zones are commonly perforated in Horseshoe Canyon NGC wells completed for commingled production. An application and approval is required from the EUB prior to commingling production

5.5.3 Fracturing

Coals targeted for NGC production typically require stimulation by hydraulic fracturing to improve the flow of natural gas from the coals to the wellbore. Fracturing involves the injection of liquids or gases under high pressure into the perforated zones of the well. Most Horseshoe Canyon/Belly River NGC wells are fractured with nitrogen gas. Typical fracturing equipment for NGC wells includes storage tanks, pumpers, data monitoring van, iron/manifold treating unit, coiled-tubing rig or service rig, a rig tank for flowback, a portable flare stack, and one or more trucks for supervisory personnel. Fracturing operations on NGC wells are typically completed in less than one day, but can take several days, depending on the formation targeted and the evaluation process being followed.

Fracturing programs in non-saline wet coals must be designed and conducted carefully to prevent unintended damages to the coal zone. As with other operations, concerns have been raised over the potential for natural gas to migrate to other aquifers or water wells (please see section 4.1.10.4 on Gas Migration). Computer models may be a useful tool for designing fracturing programs for NGC wells in non-saline wet coals.

Note: Operators should see the EUB Documents: “Shallow Well Operations,” Bulletin 2005-04, and “Shallow Fracturing Operations-Interim Controls, Restricted Operations, and Technical Review” (issued in draft form in January of 2006). Further information may also be available shortly through Alberta Environment.

5.5.4 Recompletions

Recompletions of existing wells use similar practices as completions for new wells. However, additional attention must be given to recompletions to confirm the integrity of the existing well, to isolate other sections of the wellbore from the recompleted section, and to protect groundwater. For example, for existing Cardium oil wells being recompleted for Ardley coal zone NGC wells, bridge plugs should be installed both above the Cardium formation and below the Ardley coal zone to prevent Ardley groundwater draining into the intervening 1000m of casing.

Operators should inform public stakeholders of the change from conventional operations to natural gas from coal.

Alberta Regulatory Requirements

Refer to EUB Bulletin 2005-04: Shallow Gas Operations.

The *Water (Ministerial) Regulation* prohibits:

- the completing of wells capable of producing from multiple aquifers
- the co-mingling of non-saline groundwater of different quality
- the co-mingling of non-saline and saline groundwater
- well completion intervals greater than 7.62 m (25 feet) unless a distinct aquifer unit of greater thickness is present.

5.6 Well Testing

Best Management Practice	**Design, schedule and conduct NGC well test programs to minimize venting and flaring of natural gas, balanced with the need to obtain appropriate well test information.**

There are different requirements for testing dry vs. wet NGC wells due to the dewatering required for wet coals. Operators should consider the following issues:

- Typical testing programs.
- Produced water handling and disposal.
- Venting / flaring practices and duration.
- Gas conservation options (e.g., test in-line).
- Enhanced combustion options and limitations.

Clean-up of the well involves flowing back the fracturing materials from the well. The initial flowback from NGC wells is at high pressure, is composed primarily of the fracturing material (e.g., nitrogen) and is directed to a vented tank. Nitrogen is vented to atmosphere. As the fracturing material flows back from the coal seams and the wellbore, natural gas begins to flow into the wellbore. The gas must be flared when there are sufficient gas volumes to support combustion.

Further information is available in the following documents:

- EUB's Directive 60.
- Clean Air Strategic Alliance (CASA) 2005 report, "Flaring and Venting Recommendations for Coal Bed Methane."

5.7 Pipelines

Best Management Practice	**Route, design, construct and operate NGC pipelines to minimize surface disturbances and to provide for effective reclamation.**

NGC developments for dry coals typically only require a single pipeline (flowline) connecting an individual well to the pipeline gathering system.

NGC developments for wet coals may require a natural gas flowline connecting the well to the pipeline gathering system, and separate pipelines for produced

water. In some cases, a fuel gas pipeline may be used to provide dry fuel gas to wellsite production equipment.

Pipeline routing considerations are discussed in section 4.0.

Methods for minimizing surface disturbances and cumulative effects include:

- Utilize existing gas gathering systems.
- Utilize existing tie-in locations (e.g., meter stations for gas transmission pipelines).
- Use plow-in construction methods.
- Install multiple pipelines for wet coal wellsites in the same right-of-way.
- Install new pipelines alongside existing pipeline rights-of-way (i.e., develop a pipeline corridor).
- Comply with regulatory requirements for soil conservation and reclamation.
- Consult with landowners about revegetation plans.

It is important to ensure that pipeline construction and clean-up activities comply with commitments made in surface land agreements, and with the terms and conditions of regulatory approvals.

5.8 Production Operations

Best Management Practice	**Design, build and operate NGC production facilities in accordance with relevant regulatory requirements, industry standards, and commitments made to landowners and other stakeholders.**

NGC production facilities may include wellsite facilities, compressor stations, dehydration equipment, and produced water handling and disposal facilities. In addition, exploration or pilot NGC wells with onsite temporary compressors should be monitored to determine appropriate long-term compressor requirements and locations.

NGC developments for dry coals (e.g. Horseshoe Canyon formation) typically do not require wellsite production equipment. Compression facilities are required to produce the natural gas, and may include booster compressors stations that supply gas to a central sales compressor station depending on the extent of the gathering system. Dehydration equipment is typically located at the sales compressor station.

NGC developments for wet coals require additional production facilities. Pumping equipment is required at the wellsite, to remove water from the coal seams and wellbore. Either conventional pumpjacks or electric submersible pumps may be used. A disposal well or wells may be drilled and completed for disposal of produced saline water.

NGC production facilities must be operated in compliance with regulatory requirements for noise control (refer to section 4.1.12).

NGC production operations generate relatively few waste types, typical of sweet gas wells, pipelines and compressor stations. Common waste types may include used lube oil from compressor engines and compressors, and waste lube oil filters from compressor engines and compressors, and waste glycol filters and spent glycol from dehydrators.

Refer to section 4.1.10 (Groundwater) for further information on produced water handling and disposal.

5.9 Well Suspension and Abandonment

Best Management Practice	**Suspend and abandon NGC wells to maintain groundwater protection and well control integrity.**

Suspension and abandonment of NGC wells are closely regulated to maintain well control, groundwater protection, and public safety.

5.10 Facilities Decommissioning

Best Management Practice	**Decommission NGC production facilities in accordance with relevant industry standards and regulatory requirements.**

Decommissioning of NGC production facilities (i.e., wellsite equipment, pipelines, and compressor facilities) includes the shutdown of operations, suspension or abandonment of pipelines, and the dismantling and removal of equipment and buildings from facility sites. Decommissioning should be undertaken in a timely manner.

5.11 Land Reclamation

Best Management Practice	**Reclaim surface disturbances from NGC wells, facilities and pipeline activities in accordance with regulatory requirements, as soon as possible after disturbance activities are completed.**

The basis for effective land reclamation of NGC surface disturbances relates back to the planning, siting, and consultation processes described in section 4.0, and the construction and initial reclamation methods used for the wellsites, facilities, pipelines and access. To the degree that the NGC operator can avoid environmentally-sensitive lands, minimize surface disturbance, and start reclamation activities as early as possible, final land reclamation requirements will also be minimized. Government will assume liability for reclamation after a reclamation certificate is issued, and subject to the time periods specified in regulations.

Appendix A Regulatory Framework for NGC in Alberta

Government of Alberta

Alberta Energy

In Alberta, the province owns some 81 percent of oil, natural gas and other mineral resources. Alberta Energy manages provincial Crown natural gas and coal tenure systems (e.g. petroleum and natural gas leases), and administers various fiscal programs (e.g., royalties on production from provincial Crown resources, freehold mineral taxes, corporate income tax credits). The department's website is at http://www.energy.gov.ab.ca/

The Mines and Minerals Act was amended in 2003 to clarify that in situations where both the petroleum and natural gas (P&NG) rights and the coal rights are owned by the Alberta Crown, NGC belongs to the P&NG lessee and not to the coal lessee.

NGC production in Alberta falls under the Natural Gas Royalty Regulations and is treated no differently than conventional gas production under this regulation.

Alberta Energy and Utilities Board

The Alberta Energy and Utilities Board (EUB) is an independent, quasi-judicial agency of the Government of Alberta. The EUB regulates the safe, responsible, and efficient development of Alberta's energy resources, including natural gas and the pipelines that transport natural gas to markets. The EUB's stated mission is "To ensure that the discovery, development, and delivery of Alberta's energy resources and utilities services takes place in a manner that is fair, responsible, and in the public interest."

The EUB administers various legislation and regulatory programs. NGC activities are regulated under the same legislation as conventional oil and gas activities, such as the Oil and Gas Conservation Act and the Pipeline Act. The EUB administers legislation through directives, guides, and other publications, and a compliance enforcement program.

The EUB regulates coal mining activities under the Coal Conservation Act and the Coal Conservation Regulation.

The EUB's website can be viewed at http://www.eub.gov.ab.ca/bbs/default.htm, and the EUB's NGC fact sheet at:
http://www.eub.gov.ab.ca/BBS/public/EnerFAQs/EnerFAQs10.htm

Alberta Geological Survey

The Alberta Geological Survey (AGS) is part of the EUB. The AGS provides geoscience information and services for government, industry and the public. The AGS is a source of information on Alberta's coal and NGC resources, including a

database of analyses of groundwater from water wells known or strongly suspected to be completed in coal seams. Information on NGC may be viewed at the AGS website http://www.ags.gov.ab.ca/

Orphan Well Association

Operating under the delegated authority of the EUB, the Orphan Well Association (OWA) manages the abandonment of upstream oil and gas orphan wells, pipelines, facilities, and their associated sites. An orphan site is one not having any legally responsible or financially able party to deal with its abandonment and reclamation. The OWA is overseen by a stakeholder group comprised of industry associations and provincial regulatory agencies. Industry provides funding to cover all of the costs incurred by OWA, mostly through the Orphan Well Levy charged to companies. The OWA website address is http://www.orphanwell.ca/

Alberta Environment

Alberta Environment (AENV) manages Alberta's air, land, and water pursuant to the Environmental Protection and Enhancement Act, the Water Act, and related regulations.

NGC activities are regulated under the same legislation and AENV requirements as conventional oil and gas activities.

AENV, along other government departments, is developing integrated resource management programs and practices to support Alberta's Commitment to Sustainable Resource and Environmental Management.

Further information is available at the AENV website at: http://environment.gov.ab.ca/default.aspx.

Alberta Human Resources and Employment

Alberta Human Resources and Employment (AHRE) regulates workplace health and safety in the oil and gas industry, including NGC operations. NGC operations must comply with various legislation, including:

- *Occupational Health and Safety Act.*
- *Occupational Health and Safety Regulation.*
- *Occupational Health and Safety Code.*
- *Employment Standards Code.*

AHRE also administers the Land Agents Licensing Act and the Land Agents Licensing Regulation, under which land agents are licensed and regulated for negotiating surface rights agreements with landowners.

Additional information is available at http://www3.gov.ab.ca/hre/whs/index.asp

Alberta Sustainable Resource Development

Alberta Sustainable Resource Development (SRD) is responsible for managing Alberta's public lands, forests, fish, and wildlife.

SRD manages land use on provincial Crown lands ("public lands") pursuant to various legislation, including the Forests Act, the Public Lands Act, and related regulations. SRD administers the disposition of surface rights on public lands. NGC industry access to public lands is regulated under the same legislation and programs as conventional oil and gas activities. NGC activities on public lands are managed pursuant to various SRD land use planning tools and requirements.

NGC geophysical activities are regulated by SRD under the Exploration Regulation. SRD also manages reclamation of public lands used for NGC activities.

SRD is implementing integrated resource management programs and practices to support Alberta's Commitment to Sustainable Resource and Environmental Management.

Additional information is available at http://www3.gov.ab.ca/srd/

Alberta Surface Rights Board

The Surface Rights Board is a quasi-judicial board which issues right-of-entry orders and holds compensation hearings when an operator and a landowner or an occupant fail to reach an agreement regarding entry or compensation related to resource activity on privately-owned or crown-occupied lands. The Surface Rights Board also holds hearings regarding offsite damages and annual compensation reviews. The Surface Rights Board operates under the authority of the Surface Rights Act.

Further information is available at www.surfacerights.gov.ab.ca

Alberta Community Development

The Heritage Resource Management Branch of Alberta Community Development (ACD) manages Alberta's historical resources, including the Historical Resources Impact Assessment program pursuant to the Historical Resources Act, and maintaining historical resource site inventories for the province. Further information is available at: http://www.cd.gov.ab.ca/preserving/heritage/index.asp

ACD also manages Alberta's network of parks and protected areas, under the Provincial Parks Act, the Wilderness Areas, Ecological Reserves and Natural Areas Act, and the Willmore Wilderness Park Act. Further information is available at: www.cd.gov.ab.ca/preserving/parks/index.asp

Farmers' Advocate of Alberta

The office of the Farmers' Advocate of Alberta provides assistance to rural landowners on issues related to the oil and gas industry. In the summer of 2005, the Farmers' Advocate underwent a renewal initiative in order to better support rural landowners in the future. Some of its past responsibilities have been altered and it recommended that interested readers contact the Farmers' Advocate at (780) 427-2433, or look for further information on the website at: www.agric.gov.ab.ca/farmeradvocate

Municipal Governments

In Alberta, the Municipal Government Act and the Subdivision and Development Regulation provide the authority for municipal governments to adopt plans and land use bylaws, make planning decisions, administer subdivision applications, and set out conditions for developments. The EUB requires all applicants for surface development to notify local authorities as part of its Guide 56 pre-application consultation requirements. This contact is an opportunity to exchange information, gain advice on local concerns and to understand how energy and local developments may fit together. NGC operators are encouraged to incorporate this feedback and future local planning into their project plans as much as possible.

Some local authorities may require a development permit for some parts of energy development. Generally, oil and gas wells, and pipelines, are exempt from requiring development permits. When a company cannot fully address municipal government requirements, it may file a non-routine Guide 56 application to the EUB explaining the situation and providing evidence to the merits of the proposed development. Section 619(1) of the Municipal Government Act notes that EUB approvals prevail over any statutory plan, land use bylaw, subdivision decision, or other development decision of a municipality.

For further information, refer to www.municipalaffairs.gov.ab.ca

Government of Canada

Industrial activities in or near water (e.g., pipeline crossings) are reviewed by Fisheries and Oceans Canada (DFO) to ensure compliance with the *Fisheries Act* and the *Policy for the Management of Fish Habitat*. Activities that are likely to alter or damage fish habitat are required to obtain an Authorization pursuant to Section 35(2) of the *Fisheries Act*. The DFO website is at www.dfo-mpo.gc.ca.

Transport Canada administers the *Navigable Waters Protection Act*. Works (e.g., pipeline crossings) in, on, over, under, through, or across any navigable water are prohibited, unless, in the opinion of the Transport Canada, the activity does not interfere substantially with navigation. The practical effect of this legislation is that parties must obtain a clearance statement from Transport Canada, stating that

the Act does not apply to their proposed work. Transport Canada's website is at **www.tc.gc.ca**.

The *Canadian Environmental Protection Act* (*CEPA*) sets out various requirements for pollution prevention and management of toxic substances and hazardous waste. Under *CEPA*, the National Pollutant Release Inventory (NPRI) requires companies to report information on releases and transfers of pollutants. One example of a pollution prevention initiative pursuant to *CEPA* sets limits on benzene emissions from glycol dehydrators used in the natural gas industry (CAPP, 2000). Information on the NPRI program is available at: **www.ec.gc.ca/pdb/npri/npri_home_e.cfm).**

The *Species at Risk Act* was created to protect wildlife species from becoming extinct, and includes prohibitions against killing or harming species at risk, and against destroying their critical habitats. Environment Canada and DFO share administration of the Act, including development of Recovery Strategies, Action Plans, and Management Plans. Further information on the *Species at Risk Act*, and the current listing of species at risk, is available at the website **www.sararegistry.gc.ca**.

Indian Oil and Gas Canada (IOGC) is an agency of Indian and Northern Affairs Canada, and manages the development of oil and gas resources on First Nation lands. IOGC operates pursuant to the *Indian Oil and Gas Act* and the *Indian Oil and Gas Regulations*. IOGC is responsible for surface rights dispositions and mineral disposition agreements, environmental protection, approving exploration and production activities, and collecting royalties. Further information is available at www.ainc-inac.gc.ca/ps/lts/iogc_e.html.

Appendix B Glossary

Abandonment: The permanent dismantlement of an oil or gas well or facility in the manner prescribed by the regulations including any measures required to ensure that the facility is left in a permanently safe and secure condition.

Appropriate Dispute Resolution (ADR): a term that reflects a number of alternatives or means to resolve conflicts between parties. It can include direct negotiations, facilitated sessions, mediations, or arbitration between conflicting parties, as well as the public hearing process. The EUB encourages conflicting parties to use available ADR options when conflict arises with respect to energy development.

Aquifer: As defined by the Alberta Government's Water Act, an underground water-bearing formation that is capable of yielding water to wells or springs.

Best Practices: management practices or techniques recognized to be the most effective and practical means to develop the resource, while minimizing adverse environmental and other effects.

Casing: A series of tubular pipes joined by threads and couplings that line a wellbore to prevent water and rock from entering into the wellbore.

Checkerboard: The configuration of freehold and Crown mineral ownership as a result of the Canadian Pacific Railway (CPR) Company grant. To subsidize the building of a trans-continental railway, the Dominion of Canada granted to the CPR a large area of land adjacent to the right-of-way. The grant, which included both surface and mineral rights, was for every odd-numbered section in each township except sections 11 and 29.

Coal: A black or brownish-black solid combustible substance, consisting of more than 50 percent by weight of organic matter, and formed by the partial decomposition of organic matter without access to air.

Coal seam: Descriptive term for individual layers of coal found in the geological strata. It is also called a "bed" in the coal industry.

Coalbed methane (CBM): Methane found in coal deposits. Also called Natural Gas in Coal (NGC).

Commingling (oil & gas): Producing oil and gas from two or more reservoirs at different depths.

Commingling (water): Producing water of different quality from two or more aquifers or zones.

Conventional natural gas: Natural gas consisting of a mixture of hydrocarbon compounds, primarily methane, and small quantities of various non-hydrocarbons

that exist in gaseous phase or in solution with crude oil in natural underground reservoirs.

Crown: Depending on jurisdiction, the Crown is either represented by the federal or Alberta government.

Crown Mineral Disposition Review Committee: All land requested for sale (mineral lease) is submitted to the Crown Mineral Disposition Review Committee who reviews the land for any surface restrictions.

Deeper Rights Reversion Zone Designation (DRRZD): Identifies a zone by its name. As noted in ERCB Decision 95-10, historically, the name of the zone takes precedence over the depths, in terms of utilizing a DRRZD. DRRZDs are used primarily for deeper rights reversion, but can also be used for other purposes such as offsets.

Drilling fluid: The circulating fluid (mud) used to bring drilling cuttings out of the well bore, cool the drill bit, and provide hole stability and pressure control. Drilling mud includes a number of additives to maintain the fluid at desired viscosities and weights. Some additives may be caustic, toxic, or acidic. Drilling fluids are also needed to complete water wells.

Environmental Protection and Enhancement Act (EPEA): Provincial legislation that takes an integrated approach to the protection of Alberta's air, land, and water. One of the Act's cornerstones is the guarantee of public participation in decisions affecting the environment. Public involvement includes access to information, participation in environmental assessment and approval processes, and the right, when directly affected, to appeal certain decisions.

Footprint (also called environmental footprint): The impact of an organization, company or business entity in environmental terms (resource use, waste generation, physical environmental changes, etc.).

Formation: A designated subsurface layer that is composed of substantially the same kind of rock or rock types.

Fracturing: A method of improving the permeability of a reservoir by pumping fluids such as water or carbon dioxide and nitrogen into the reservoir at sufficient pressure to crack or fracture the rock. Also known as "fracing".

Freehold rights: Mineral rights not owned by the Crown in right of Alberta. These mineral rights may be owned by the Crown in right of Canada, by corporations, or individuals.

Gas-in-place: The amount of gas in a reservoir at any time calculated at standard conditions. This includes both recoverable and nonrecoverable gas.

Groundwater: Water that occurs under the surface of the ground.

Initial gas-in-place: The volume of raw natural gas calculated or interpreted to exist in a reservoir before any volume has been produced.

In place: See 'Initial gas-in-place'

Landowner: See 'surface rights holder'.

Lessee: defined in the Mines and Minerals Act as the holder of an agreement, according to the records of the Department of Energy. The term 'lessee' may, therefore, refer to a holder of leases or licences or both, depending on the context in which it is used.

Methane: The most prevalent component of most natural gas produced in Alberta. Chemical notation: CH4. The most common hydrocarbon gas.

Mineral Rights: Entitlement, through ownership or a leasing arrangement, to produce and sell the minerals in a parcel of land.

Migration: Movement from one place to another.

Natural Gas in Coal: Methane found in coal deposits. Also called Coalbed Methane (CBM).

Non-saline water: Fresh water with total dissolved solids of less than 4,000 milligrams per litre. See also Saline groundwater.

Operator: The company or individual responsible for managing an exploration, development, or production operation.

Pool: A natural underground reservoir containing an accumulation of oil or gas or both, separated or appearing to be separated from any other such accumulation.

Porosity: Open spaces within a rock that contain fluids such as water, oil, or natural gas.

Potentially Productive: Refers to a well, a zone, or a spacing unit that cannot be demonstrated to be productive at the required level of proof, but displays indications that it might be productive if further work were conducted.

Produced water: The water extracted from the subsurface along with produced oil and gas, including water from the reservoir, water that has been injected into the formation, and any chemicals added during the production/treatment process.

Recompletion: A recompletion occurs when the producer re-enters a well to complete (i.e., perforate) a new formation in a previously completed well.

Saline groundwater: Water that has total dissolved solids exceeding 4,000 milligrams per litre as defined in the Water (Ministerial) Regulation.

Section: The size of a section may deviate from the standard, but for most purposes it is deemed to contain 256 hectares. In the Imperial system, it was one square mile or 640 acres.

Sensitive areas: Lands or associated features requiring protection, including critical wildlife habitat, rare and endangered plant species, native prairies, areas prone to erosion or other geotechnical failure, or cultural heritage sites.

Split title: Where subsurface rights are owned by different parties, e.g., the Crown owns the coal rights and the P&NG rights are freehold.

Subsurface: Below the surface.

Subsurface rights holder: The owner of the mineral rights who has the right to explore for and produce oil, gas, and other minerals. The owner may be a freehold rights owner or the Crown.

Surface rights holder: The owner of the surface rights (the landowner) has control of the land's surface and the right to work it, in addition to any sand, gravel, peat, clay or marl which can be excavated by surface operations.

Total Dissolved Solids (TDS): A measure of concentration or how much substance is in a given sample of liquid.

Tenure: Term used to describe the system whereby mineral rights are managed by the Department of Energy and sold to individuals and companies through 'agreements'.

Township: A term used in the Alberta Township System. Depending on the context in which it is used, it refers either to a six-square-mile area comprising 36 sections or a row of townships spanning from east to west across Alberta. Township 1 lies at the southernmost boundary of Alberta and Township 126 lies at the northernmost boundary.

Unconfined aquifer: An aquifer containing water that is not under pressure. The water level in a well completed in an unconfined aquifer is the same as the water level outside the well.

Underbalanced drilling: Drilling that occurs where formation pressure may exceed the hydrostatic pressure of drilling fluids.

Water Act: The Alberta Water Act protects the quality of water and manages its distribution. The legislation regulates all development and activities that might affect rivers, lakes, and groundwater.

Water quality: Refers to a set of chemical, physical, or biological characteristics that describe the condition of a river, stream, lake, or aquifer.

Water well: An opening in the ground, either drilled or otherwise altered from its natural state that is used for:

1. the production of groundwater for any purpose,
2. obtaining data on groundwater, or
3. recharging an underground formation from which groundwater can be recovered and includes any related equipment; buildings, structures and appurtenances.

Well density: The concentration of wells on the land surface (per unit area).

Well spacing: The distance between wells producing from the same reservoir. Spacing is often expressed in terms of area (e.g., 40-acre spacing) and is usually established by regulatory agencies.

Zone: Defined in the *Petroleum and Natural Gas Regulation* as a stratum or series of strata considered by the Minister to be a zone for the purposes of this regulation. In many cases, zones may be geological formations, but in some instances where they are larger (geological groups) they may include more than one formation (the Mannville zone, for instance, includes numerous formations).

Appendix C Summary of Regulatory Requirements for NGC Activities

All Acts, regulations and requirements that pertain to natural gas also pertain to CBM/NGC development in Alberta; therefore, knowledge of all Acts, regulations and requirements that pertain to natural gas is required in the development of CBM/NGC.

This table provides only a summary of the main areas of regulation. This summary is extracted from the current draft (June 2005) of the CBM/NGC Best Practices document that is being prepared for the MAC. Changes to this summary will be incorporated in the final MAC report.

Activity		**Approvals or Authorizations Required** (Regulatory Agency)	**Legislation/Regulatory References**
Notifications and Consultations	Notification & consultation with landowners/ managers, public, mineral rights owners, etc.		• EUB Directive 56: Energy Development Application Guide • EUB Guide 60: Upstream Petroleum Industry Flaring Guide (plus updates) • EUB Directive 65: Resources Applications for Conventional Oil and Gas Reservoirs. • EUB Guide 71: Emergency Preparedness and Response Requirements for the Upstream Petroleum Industry
Mineral Tenure	Petroleum & Natural Gas Rights - provincial Crown lands	Petroleum & Natural Gas Rights (Alberta Energy)	• Mines and Minerals Act (Ch. M-17, RSA 2000) • Petroleum and Natural Gas Tenure Regulation (AR 263/97)
	Petroleum & Natural Gas Rights - provincial freehold lands	Petroleum & Natural Gas Rights (freehold mineral rights owner)	
	Petroleum & Natural Gas Rights on Indian lands	Permit or Lease (IOGC)	• Indian Oil and Gas Regulations (SOR/94-753). • Indian Oil and Gas Canada. 2001. Disposition of Oil and Gas Rights Policy.
Exploration	Geophysical operations on provincial lands	Exploration Approval (ASRD)	• Public Lands Act (Ch. P-40, RSA 2000) • Exploration Regulation (AR 214/98)

Activity		Approvals or Authorizations Required (Regulatory Agency)	Legislation/Regulatory References
	Geophysical operation on Indian lands	Exploratory Licence (IOGC)	• Indian Oil and Gas Regulations (SOR/94-753). • Canadian Environmental Assessment Act (1992, c.37) • Indian Oil and Gas Canada. Information Letter IOGC IL-2000 How to Prepare the Environmental Assessment Required Pursuant to the Canadian Environmental Assessment Act
Well Spacing	Special drilling Spacing unit	Special Drilling Spacing Unit Order (EUB)	• Oil and Gas Conservation Regulations (AR 151/87) • EUB Directive 65: Resources Applications for Conventional Oil and Gas Reservoirs
	Holding	Holding Approval (EUB)	• Oil and Gas Conservation Regulations (AR 151/87) • EUB Directive 65: Resources Applications for Conventional Oil and Gas Reservoirs
Well Siting	Well location less than prescribed setback distances	Approval (EUB)	• Oil and Gas Conservation Regulations (AR 151/87)
	Municipal development (residential, agricultural, industrial) location less than prescribed setback distances	Approval (EUB)	• Subdivision and Development Regulation (AR 43/2002)
	Well siting on provincial private lands		AENV. 2003. Information Letter R&R/03-2. Siting an Upstream Oil and Gas Site in an Environmentally Sensitive Area on Private Land: Guidance for Private Land

Activity		Approvals or Authorizations Required (Regulatory Agency)	Legislation/Regulatory References
Surface Rights	Surface rights on private lands for wellsites, facility sites, access roads and related developments	Surface Lease (landowner), or Right of Entry Order (SRB)	• Surface Rights Act (Ch. S-24, RSA 2000) • Surface Rights Act General Regulation (AR 189/2001) • Surface Rights Act Rules of Procedure and Practice (AR 190/2001)
	Surface rights on provincial Crown lands wellsites, pipelines, facility sites, access roads and related developments	Mineral Surface Lease (wellsite); Licence of Occupation (road); (ASRD)	• Public Lands Act (Ch. P-40, RSA 2000) • ASRD. 2004. Public Lands Operational Handbook. • ASRD. 2004. Area Operating Agreement Guidelines for Public Lands • ASRD. 2004. Instructions for Submission of Environmental Field Reports with Surface Disposition Applications under the Public Lands Act
	Surface rights on Indian lands for wellsites, pipelines, facility sites, access roads and related developments	Surface Lease, Right-of-Way, or Right of Entry (IOGC)	• Indian Oil and Gas Act (R.S. 1985, c. I-7) • Indian Oil and Gas Regulations, 1995. (SOR/94-753) • Canadian Environmental Assessment Act (1992, c. 37) • Indian Oil and Gas Canada. Information Letter IOGC IL-2000 How to Prepare the Environmental Assessment Required Pursuant to the Canadian Environmental Assessment Act
Wellsite, Facility Site and Access Road Construction	Design and construction of wellsites, facility sites and related access roads.	Surface Lease Agreement with Owner/Occupant of Private Land or Disposition from Manager of Public Lands	• EPEA (Ch.E-12, RSA 2000) • EUB Information Letter IL 2002-01: Principles for Minimizing Surface Disturbance in Native Prairie and Parkland Areas • EUB Information Letter IL 90-21: Oil and Gas Development – Rumsey Block • AENV. 2003. Information Letter R&R/03-07: Wellsite Construction: Guidelines for No-Strip and Reduced Disturbance. ASRD. 2004. Public Lands Operational Handbook

Activity		Approvals or Authorizations Required (Regulatory Agency)	Legislation/Regulatory References
	Historical resources assessment and mitigation	Clearance (ACD)	• Historical Resources Act (Ch. H-9, RSA 2000)
	Watercourse Crossings	Notification (AENV)	• Water Act (Ch. W-3, RSA 2000) • Water (Ministerial) Regulation (AR 205/1998) • AENV. Code of Practice for Watercourse Crossings
	Activities in or around navigable waters	Clearance or Approval (Canadian Coast Guard)	• Navigable Waters Protection Act (R.S. 1985, C. N-22)
	Activities that may affect Species at Risk	(ASRD)	• Wildlife Act (Ch. W-10, RSA 2000) • Wildlife Regulation (AR 143/97)
	Activities in or near fish habitat	Letter of Advice or Authorization (Fisheries and Oceans Canada)	• Fisheries Act (R.S. 1985, c. F-14) • Fisheries and Oceans Canada. Policy for the Management of Fish Habitat • Species at Risk Act (2002, c. 29)
Well Drilling	Drill and complete a well on provincial lands	Well Licence (EUB)	• Oil and Gas Conservation Regulations (AR 151/87) • EUB Directive 56: Energy Development Application Guide • EUB Bulletin 2005-04
	Drill and complete a well on Indian lands	Well Licence (IOGC)	• Indian Oil and Gas Regulations, 1995. (SOR/94-753) •
	Drilling rig operations		• EUB Directive 036: Drilling Blowout Prevention Requirements and Procedures
	Surface Casing		• EUB Guide 8: Surface Casing Depth Minimum Requirements
	Casing Cementing		• EUB Guide 9: Casing Cementing Minimum Requirements
	Casing		• EUB Guide 10: Guide to Minimum Casing Design Requirements

Activity		Approvals or Authorizations Required (Regulatory Agency)	Legislation/Regulatory References
	Drilling Waste Management		• EUB Guide 50: Drilling Waste Management • EUB Guide 70: Drilling Waste Disposal Inspection Manual
Well Completions	Commingling Production	Commingling Approval (EUB)	• Oil and Gas Conservation Regulations (AR 151/87) EUB Directive 65: Resources Applications for Conventional Oil and Gas Reservoirs
	Service rig operations		• EUB Guide 37: Service Rig Inspection Manual
	Completing a well for water injection or disposal	Well Licence	• EUB Guide 51: Injection and Disposal Wells – Well Classifications, Completions, Logging and Testing Requirements
Well Testing	Venting and Flaring	Flaring Permit (EUB)	• Oil and Gas Conservation Regulations (AR 151/87) • EUB Guide 60: Upstream Petroleum Industry Flaring Guide (plus updates) • AENV. 2004. Alberta Ambient Air Quality Objectives
	Pressure and Deliverability Testing		• EUB Guide 40: Pressure and Deliverability Testing Oil and Gas Wells – Minimum Requirements and Recommended Practices
CBM/NGC Wells – Produced Water Measurement	Determine Water Production at Gas Wells		• EUB Directive 004: Determination of Water Production at Gas Wells
	Reduction or exemption from well testing requirements (once every 12 months)	Approval (EUB)	• EUB Directive 004: Determination of Water Production at Gas Wells

Activity		Approvals or Authorizations Required (Regulatory Agency)	Legislation/Regulatory References
Disposal Well	Complete and operate a disposal well on provincial lands	Ministerial Approval (AENV) Well Licence (EUB)	• Environmental Protection and Enhancement Act • Oil and Gas Conservation Regulations (AR 151/87) • EUB Directive 56: Energy Development Application Guide • EUB Guide 51: Injection and Disposal Wells – Well Classifications, Completions, Logging and Testing Requirements
	Complete and operate a disposal well on Indian lands	Approval (IOGC)	• Indian Oil and Gas Regulations, 1995 (SOR/94-753)
Well Integrity	Well Integrity Testing, Reporting and Repairs		• EUB Interim Directive ID 2003-01: 1) Isolation Packer Testing, Reporting and Repair Requirements; 2) Surface Casing Vent Flow / Gas Migration Testing, Reporting and Repair Requirement; 3) Casing Failure Reporting and Repair Requirements.
Groundwater	Withdraw non-saline water from CBM/NGC formation	Authorization (AENV) License (EUB)	• Water Act. (Ch. W-3, RSA 2000) • Water (Ministerial) Regulation (AR 205/1998) • Alberta Environment. 2004. Guidelines for Groundwater Diversion – For CBM/NGC Development. • Alberta Environment. 2003. Groundwater Evaluation Guideline (Information Required when Submitting an Application under the Water Act). • Oil and Gas Conservation Act (Ch. O-6, RSA 2000). • Oil and Gas Conservation Regulations (AR 151/1971). • EUB Directive 56: Energy Development Application Guide. • EUB Directive 035: Baseline Water Well Testing Requirement for NGC Wells

Activity		Approvals or Authorizations Required (Regulatory Agency)	Legislation/Regulatory References
	Produce and dispose saline water from CBM/NGC formation	Licence (EUB)	• Oil and Gas Conservation Act (Ch. O-6, RSA 2000) • Oil and Gas Conservation Regulations (AR 151/1971) • EUB Directive 56: Energy Development Application Guide
	Discharge of non-saline groundwater	Approval (AENV)	• Environmental Protection and Enhancement Act • Surface Water Quality Guidelines for Use in Alberta, November 1999
	Drill a water well (e.g., for drilling operations; for CBM/NGC facility utility water)	Authorization (AENV)	• Water Act. (Ch. W-3, RSA 2000) • Water (Ministerial) Regulation (AR 205/1998) • AENV 2003. Groundwater Evaluation Guideline (Information required when submitting an application under the Water Act)
Production Facilities	Construct and operate a compression or pumping facility (> 75 kW)	Facility Licence (EUB)	• Oil and Gas Conservation Regulations (AR 151/87) • EUB Directive 56: Energy Development Application Guide • AENV. 2004. Alberta Ambient Air Quality Objectives • EUB Directive 017: Measurement Requirements for Upstream Oil and Gas Operations • EUB Interim Directive ID 99-8: Noise Control Directive • EUB Guide 38: Noise Control Directive – User Guide • EUB Guide 55: Storage Requirements for the Upstream Petroleum Industry • EUB Guide 58: Oilfield Waste Management Requirements for the Upstream Petroleum Industry • EUB Guide 71: Emergency Preparedness and Response Requirements for the Upstream Petroleum Industry

Activity		Approvals or Authorizations Required (Regulatory Agency)	Legislation/Regulatory References
	Construct and operate a compressor station	Development Permit (local municipality)	• Municipal government (local authority)
	Construct and operate a compressor or pumping station, or sweet gas processing plant (emitting greater than 16 kg/hr NOx)	Registration (AENV)	• Environmental Protection and Enhancement Act (Ch.E-12, RSA 2000). • AENV – Code of Practice for Compressor and Pumping Stations and Sweet Gas Processing Plants
	Install a boiler or pressure vessel	Registration (Alberta Boilers Safety Association)	• Safety Codes Act (Ch. S-1, RSA 2000) • Boilers and Pressure Vessels Regulation (AR 227/75) • Design, Construction and Installation of Boilers and Pressure Vessels Regulation (AR 293/94)
	Install a pressure piping system.	Registration (Alberta Boilers Safety Association)	• Safety Codes Act (Ch. S-1, RSA 2000) • Boilers and Pressure Vessels Regulation (AR 227/75) • Design, Construction and Installation of Boilers and Pressure Vessels Regulation (AR 293/94)
	Install electrical systems		• Electrical Code Regulation (AR 145/2002)
	Install fire protection		• Fire Code Regulation (AR 52/98)
	Install buildings		• Building Code Regulation (AR 50/98)
	Production Operations		• EUB Guide 64: Facility Inspection Manual
	Install on-site power generating equipment	(EUB)	• EUB Guide 28: Applications for Power Plants, Substations and Transmission Lines

Activity		Approvals or Authorizations Required (Regulatory Agency)	Legislation/Regulatory References
	Reporting emissions	(AENV) (Environment Canada)	• AENV – Terms and Conditions of Approval issued for production facility under EPEA • Environment Canada: National Pollutant Release Inventory
Pipelines	Construct and operate pipelines	Permit to Construct Licence to Operate (EUB)	• Pipeline Act (Ch. P-15, RSA 2000) • Pipeline Regulation (AR 91/2005) • EUB Directive 56: Energy Development Application Guide • EUB Guide 66: Pipeline Inspection Manual • Canadian Standards Association Standard Z662: Oil and Gas Pipeline Systems • EPEA (Ch.E-12, RSA 2000) • AENV. Conservation & Reclamation Information Letter 94-5: Environmental Protection Guidelines for Pipelines • AENV Conservation & Reclamation Information Letter 01-04: Ploughed-in Pipelines
	Construct and operate pipelines with a length (in km) times outside diameter (in mm) with an index number of 2690 or greater – in White Area	Approval (AENV)	• EPEA (Ch.E-12, RSA 2000) • Activities Designation Regulation (AR 276/2003). • AENV. 1994. Guide for Pipelines: Pursuant to EPEA. ENV-66-P
	Pipelines - in the Green Area	(ASRD)	• Project-specific Environmental Field Report or a company's Area Operating Agreement
	Release greater than 1,000 m3 of water from hydrostatic testing of a pipeline	Notification (AENV)	• Water Act. (Ch. W-3, RSA 2000). • Water (Ministerial) Regulation (AR 205/1998). • AENV Code of Practice for the Temporary Diversion of Water for Hydrostatic Testing of Pipelines

Activity		Approvals or Authorizations Required (Regulatory Agency)	Legislation/Regulatory References
	Watercourse Crossings	Notification (AENV)	• Water Act (Ch. W-3, RSA 2000) • Water (Ministerial) Regulation (AR 205/1998) • AENV Code of Practice for Pipelines and Telecommunication Lines Crossing a Water Body
	Activities likely to alter or damage fish habitat	Authorization (Fisheries and Oceans Canada)	• Fisheries Act (Canada Ch. F-14) • Fisheries and Oceans Canada. Policy for the Management of Fish Habitat.
	Crossing navigable waters	Clearance Statement or Approval (Transport Canada - Canadian Coast Guard)	• Navigable Waters Protection Act (Canada Ch. N-22)
CBM/NGC Operations	Spill response contingency plans for saltwater disposal well or liquid pipeline	Approval (EUB)	• Oil and Gas Conservation Regulations (AR 151/1971) • Pipeline Regulation (AR 91/2005) • EUB Guide 71: Emergency Preparedness and Response Requirements for the Upstream Petroleum Industry
Well Suspension	Suspend a CBM/NGC well	(EUB)	• Oil and Gas Conservation Act (Ch. O-6, RSA 2000) • Oil and Gas Conservation Regulations (AR 151/1971) • EUB Directive 013: Suspension Requirements for Wells
Well Aban-donment	Abandon a well on provincial lands	(EUB)	• Oil and Gas Conservation Act (Ch. O-6, RSA 2000) • Oil and Gas Conservation Regulations (AR 151/1971) • EUB Guide 20: Well Abandonment Guide
	Abandon a well on Indian lands	Written Approval (IOGC)	• Indian Oil and Gas Regulations, 1995. (SOR/94-753)

Activity		Approvals or Authorizations Required (Regulatory Agency)	Legislation/Regulatory References
Facility De-commission	Decommiss'n a facility	(EUB, AENV)	• Oil and Gas Conservation Regulations (AR 151/1971) • Conservation and Reclamation Regulation (AR 215/1996) • EUB Information Letter IL 98-02: Suspension, Abandonment, Decontamination, and Surface Land Reclamation of Upstream Oil and Gas Facilities
Land Reclamation	Reclaim provincial public lands used for geophysical program	Letter of Clearance (ASRD)	• Public Lands Act (Ch. P-40, RSA 2000) • Exploration Regulation (AR 214/98)
	Reclaim surface lease on provincial private lands	Reclamation Certificate (AENV)	• EPEA (Ch.E-12, RSA 2000) • Conservation and Reclamation Regulation (AR 215/1996) • AENV. Information Letter R&R/03-11: Upstream Oil & Gas Reclamation & Remediation Program – Information for Landowners
	Reclaim surface lease on provincial public lands	Reclamation Certificate (ASRD)	• Public Lands Act (Ch. P-40, RSA 2000) • ASRD. 2004. Public Lands Operational Handbook
	Reclaim surface lease on Indian lands	(IOGC)	• Indian Oil and Gas Act. (R.S. 1985, c. I-7) • Indian Oil and Gas Regulations, 1995. (SOR/94-753)
Royalties		Governs management & disposition of rights in Crown-owned mines and minerals, including levying and collecting bonuses, rentals and royalties	• Mines and Minerals Act • Natural Gas Royalty Regulation

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