

Introduction

Mineral Resources in Our Lives

Importance of Minerals in the Nova Scotia Economy

Nova Scotia has a long and rich mining history producing fuels, metals and building materials on a continuous basis for over 300 years. The production of minerals remains an important component of the provincial economy directly employing over 1 600 people and generating over \$270 million worth of marketable products annually. Figure 1 shows the location of active mines and larger construction aggregate quarries operating in the province.

Mineral resources form the foundation of our society and virtually everything we build or use either contains mineral products or is produced by machines that are built from minerals. A quick survey of our daily surroundings would create an exhaustive list of mineral and metal-based goods.

Figure 2 illustrates some of the many mineral resources required each day to maintain our contemporary lifestyle. It would be difficult, if not impossible to imagine human civilization without mineral-based products.

Ensuring that raw-materials are available is the primary role of the minerals industry in our society. The trade of raw-materials and manufactured products is important both locally and globally and Nova Scotia has participated in the import and export of minerals for centuries often leading the country in production of valuable minerals. Much of our mineral production is used within the province for things like road construction, residential buildings and power generation.

Sources of Minerals and Metals

Nova Scotia has supplied more than 20 different mineral products to domestic and export markets around the world. Certain commodities such as gypsum and coal have been continuously produced for centuries while other commodities have had more sporadic periods of production due to market economics and/or mineral deposit depletion. Increasingly in Nova Scotia and around the world, we are recycling and recovering more and more materials instead of discarding them in landfills however it is expected that mining and refining of mineral deposits will continue to be required well into the future to satisfy local and global requirements for mineral products.

As illustrated in Figure 1, we continue to produce a variety of mineral products across the province mostly in rural communities. Mines and quarries are located throughout the province as a result of the location of mineral deposits and the economics of bringing products to market.

Unlike a manufacturing plant's location that can be set with some degree of freedom, the location of a mine is dictated by the position of a mineral occurrence which was fixed by

past geological processes. This characteristic of mineral deposits creates the requirements for trade as minerals are found and developed and then shipped to manufactures around the world who require raw-materials sometimes well after the depletion of a mineral resource at a specific mine site.

In addition to the mineral exports from our province, there is also significant importation of minerals. For example almost all our electrical generation is from burning imported coals. An almost endless list of consumer goods from bicycles to cars are imported into the province and those goods are manufactured from minerals and metals from some other part of Canada or place on the planet.

This flow of materials and goods has been occurring since the earliest days of human civilization and Nova Scotia has participated in this trading activity for centuries and will continue to do so for the foreseeable future.

Mineral Production in Nova Scotia, Canada and the World

Canada's Mineral Wealth

Canada is one of the most productive mining nations in the world, producing more than 60 minerals and metals. The Canadian mining industry is often characterized as a leader in the use of state-of-the-art technology and procedures to maximize resource recovery while minimizing environmental impacts in many of our operations.

At the end of 2003, there were approximately 190 principal metal, non-metal and coal mines, more than 3,000 stone quarries and sand and gravel pits, and about 50 non-ferrous smelters, refineries and steel mills operating in Canada. Nova Scotia had about 80 operating mines or quarries. Even with all this production, it has been estimated by Natural Resources Canada that less than 0.03% of the nation's land area has been used to produce minerals and mineral products.

In 2003 the total value of mineral production was over \$20 billion and in 2006 this figure had risen to \$36 billion. More than 70% of the value of Canadian mineral production was accounted for by Ontario, Quebec, Saskatchewan and British Columbia. In comparison, the value of Nova Scotia's production in 2003 (\$278 million) represented only 1.3% of the national total. Nova Scotia's ranking is, however, directly related to our small land-base.

The reality is that Nova Scotia continues to have one of the highest values of minerals produced per square kilometre in Canada and therefore the impacts of the industry on our local economy are as important or more so than in some other provinces.

National Economic Impact

In terms of gross-domestic-production (GDP), in 2003 the mining and mineral-processing industries contributed \$45.3 billion to the Canadian economy, or 4.0% of the national GDP. This includes mining, primary metal manufacturing, and the manufacturing of non-metallic and metal products.

Total direct industry employment in Canada was 389 000, or 2.5% of total employment. About 47 000 were employed in mining, 59 000 in smelting and refining, and 283 000 in mineral-processing industries. The mining and mineral-processing industries continue to provide some of the highest weekly earnings in the Canadian economy.

Across Canada, more than 100 communities with a total population of over 600 000 exist primarily because of the presence of the minerals industry.

International Mineral Markets and Demand

Canada is one of the world's leading exporters of minerals and mineral products. Some 80% of Canada's mineral production is exported. These products make a significant contribution to Canada's international trade, accounting for about 13% of Canada's total

domestic exports.

Canada continues to be the world's leader in the production of potash and uranium, and ranks in the top five for the production of nickel, aluminium, magnesium, gold, zinc, gypsum, molybdenum, platinum group metals, salt, cadmium, titanium concentrate, asbestos and diamonds.

While we are a major exporter of mineral commodities, Canada, like most other countries also imports mineral commodities for manufacturing or power generation.

** Statistics on minerals and metals have been obtained from the Minerals and Metals Sector of Natural Resources Canada. For further information visit Natural Resources Canada: <http://www.nrcan.gc.ca/statistics/minerals/default.html>

Nova Scotia's Mineral Industry

Nova Scotia currently has about 80 operating mines or quarries directly employing over 1 600 people. The major commodities produced in Nova Scotia are gypsum, salt, limestone, construction aggregates and coal.

Figure 5 illustrates the value of mineral production from 1987 to 2003 by sector.

Industrial minerals and construction aggregate production currently lead the industry and they have been steady, predictable sectors for several decades. The production of coal and metals, however, has declined significantly over the same period because of economic factors or depletion of the resource.

Gold and base-metal had not been regularly produced during the past 15 years, however the recent sharp increases in the world-price of metals has renewed interest in previously identified metal occurrences. The mining of base-metals re-commenced in 2007 with the production of lead and zinc concentrates in Halifax County and there is a gold mining project currently undergoing environmental assessment.

Underground coal mining ceased in 2001 after nearly 300 years of continuous production due to economic and technical issues. Today, coal production is limited to a few surface reclamation-mining projects conducted in Pictou County and in Cape Breton County. Underground mining potential is currently being evaluated in the Sydney Coalfield and may resume if the investigation of the resource indicates that a profitable mine could be operated.

Diversity and Markets

A large component of Nova Scotia's mining production is consumed in the province. For example, nearly 75% of construction aggregates and 100% of coal production is consumed in local markets for building projects and power production.

Most of the value-added products we produce such as agricultural limestone, clay-bricks,

Portland cement and salt are shipped to a wide market throughout Atlantic Canada using a combination of truck, rail and sea transport. As with many goods, the costs of shipping often dictate the limits of the market place.

Other high volume commodities such as gypsum and anhydrite are mostly shipped in raw state by rail and sea to markets in the United States and central Canada for further processing into wallboard, plaster and cement. Some aggregate products are shipped as far as the Caribbean islands due to the scarcity of suitable materials in those locations and the favourable coastal position of some Nova Scotia aggregate deposits which have resulted in economic transportation costs.

Resource Sector Profiles

Overview of the Mineral Resources Industry

History

Commercial mining has been conducted in Nova Scotia for over 300 years, and this is still a mining province as illustrated in Figure 1. We have produced significant volumes of coal, gold, lead, iron, gypsum, anhydrite, limestone, tin, zinc, silica, marble, sandstone, clay, barite and salt during this period.

Coal and iron ore were important commodities produced during the early industrialization of the province and these materials were used in many other manufacturing processes. Coal was one of the first mineral commodities to be commercially exploited as deposits were readily accessed in many locations in the province. Coal provided a stable energy source for local and export markets and many large communities were developed around coal mining operations.

Coal is still an important commodity for supplying the energy needs of Nova Scotia, however domestic coal production does not lead the provincial mining industry the way it once did. We now import most of the coal used to generate electricity.

Iron ore has not been mined since the early 1900s and steel making in the province has also ceased after a long period of continuous production. We are now reliant on imports of steel products for use in local manufacturing.

Other commodities such as gypsum, salt and construction aggregates have had continuous production and steady growth for well over 200 years and identified deposits are sufficiently large to allow continued production into the foreseeable future.

Today's Industry

DNR recently commissioned a study entitled *Economic Impact of the Mineral Industry in Nova Scotia*, which was released in May 2006. The results of the study confirm that the mineral industry continues to be an important component of the overall economy. Some of the results of the study are referred to in this document and the entire report can be found on the DNR website at <http://www.gov.ns.ca/natr/meb/pdf/06ofr02/06ofr02.pdf>

Figure 1 indicates the location of mines and large quarries active in 2007. Numerous smaller aggregate pits and quarries are also operated and they are important in supplying affordable construction materials to local markets.

Industrial minerals such as gypsum, salt and limestone currently dominate the industry along with construction aggregates and other structural materials used for building. Most

of Nova Scotia's mineral production is used in the construction industry, either as a component of manufactured products (for example gypsum wallboard, clay brick and Portland cement) or in a more raw state (for example crushed aggregates used in road beds).

Several mineral producers also manufacture products such as clay bricks, table salt and cement from materials produced on site. These operations contribute significantly to the provincial economy by increasing employment opportunities and adding value to locally produced geological resources.

The coal produced in the province is almost exclusively used in power generation, with a small domestic heating market in some areas. As previously noted current production levels represent only a small percentage of the coal consumed in the province. Currently a handful of reclamation-mining projects produce coal from surface mines, however, there has been recent interest in pursuing large-scale underground mining opportunities in the Sydney Coalfield where resources are known to be substantial.

Relatively little metal production has occurred over the past twenty years. Current exploration activity related to metals, especially gold, has increased significantly as commodity prices have risen and new geological models are applied and evaluated during exploration. Rising base-metal commodity prices have been noted as a primary factor in the start-up of a new surface mine at Gays River, Halifax County.

Based on annual expenditures reported to governments, rising commodity prices have also stimulated more activity in the mineral exploration business, which had been less active in recent years.

Employment

Employment opportunities provided by mineral production are important to many communities. Several mineral producers have operated for decades, and some are expected to operate for many more years if reserves and economic conditions remain favourable.

Most mining employment in the province is permanent year-round work and pays a higher average wage than comparable industry sectors. The mining industry in Nova Scotia ranks first in terms of average weekly wages paid among the various resource sectors. The average wage in the primary mining sector is over \$1,000 per week, which is more than 40% higher than the average of all economic sectors in the province.

In 2003, there were 5,260 person-years of employment created through direct and indirect (spin-off) jobs related to all mineral production. Over 1,600 people were employed directly by mineral and aggregate producers. Total direct employment, however, has dropped significantly since the cessation of underground coal mining, which had directly employed nearly 2,000 in 1997. In comparison, coal mining employed fewer than 100 persons in 2003.

Economic Impacts

The estimated gross domestic product (GDP) contribution for both primary extraction and secondary processing was calculated to be over \$400 million in 2003. The mining industry ranks second among resource industries in terms of contribution to GDP. Primary mining activity accounts for almost one quarter of a billion dollars in GDP in our province.

Along with employment benefits, a large portion of the economic spin-offs of mineral production is directly beneficial to the rural communities where many operations are situated. Positive economic benefits are realized as mineral producers purchase goods and services from local suppliers.

Mineral Exploration

Mineral production can only begin following the discovery of an ore deposit. The search for economic mineral deposits is called exploration. Many minerals that are located on the Earth's surface have been identified and mined without requiring an active search, for example coal seams that outcrop in accessible areas. Other deposits are buried and can only be identified using advanced mineral exploration methods. Today, mineral exploration activity is carried out by individual prospectors and larger organizations. The work conducted during exploration can lead to mineral discoveries that sometimes become new mines. Exploration work initially takes place over large areas of land, but the area of interest usually becomes smaller as the search progresses and more information is collected and analyzed. Once an interesting area is located, a more refined geological model is developed allowing for an economic evaluation to be conducted to determine whether or not a mine could become financially viable and socially acceptable.

Exploration activity is generally controlled by mineral market requirements which historically have fluctuated. These fluctuations in mineral markets can greatly influence exploration activities and expenditures for any given year. For example, various commodities have been sought at differing intensities of interest over the past fifty years as can be seen in Figure 9. Commodities specifically sought have included lead and zinc in the mid 1970s, tin and uranium in the early 80s, gold in the late 80s, and gold and kaolin in the late 90s. The recent upward trend in mineral exploration expenditures in Nova Scotia is directly related to higher gold and base metal prices.

Mineral exploration can entail many activities, including:

- determination of initial exploration targets,
- research and compilation of existing data,
- geological mapping and prospecting,
- geochemical surveys, geophysical surveys, and remote sensing,
- trenching, drilling, and bulk sampling, and
- underground exploration using shafts or declines.

The exploration industry is made up of individual mineral prospectors, existing mineral producers and specialized exploration companies. Exploration companies are often categorized as either 'junior' or 'senior' based on their overall size.

Economic Impact

Provincial exploration expenditures were approximately \$9.1 million in 2004, which is a ten year high for the sector but significantly less than the 1989 expenditure of over \$70 million (adjusted to 2005 dollars). The overall expenditures on exploration in Nova Scotia are relatively small in comparison to the expenditures in other areas of Canada. In terms of unit land area, however, Nova Scotia has twice the annual national average spent on mineral exploration. The results of all this exploration is an extensive and detailed geological knowledge base for many areas of the province.

The exploration industry is highly specialized, often employing proprietary equipment and techniques. The industry also requires many other goods and services from local suppliers including:

geological/engineering design services,
mapping and land surveying services,
geophysical and geochemical surveying services (airborne and ground),
contract excavation services,
transportation services,
environmental management services, and
laboratory analysis.

Government Support of Mineral Exploration

As owner of the province's mineral wealth, the Government of Nova Scotia is active in promoting sustainable mineral development. Mineral exploration is normally conducted under the authority of an Exploration Licence issued by the Department of Natural Resources (DNR) and all exploration work activity on the ground requires consent of the landowner before commencing. The purpose of the exploration licence is to allow the licensee to determine the physical and chemical characteristics of a geological formation. A licensee is required to conduct a specified value of exploration work each year in order to maintain the licence. If an economically viable mineral deposit is located, the Exploration Licence provides the licence holder with an exclusive right to apply for a Mineral Lease for the production of minerals.

In addition to administering the Mineral Resources Act, DNR is involved in geoscience activities throughout the province, including conducting basic geological mapping and mineral deposit evaluation. These studies help DNR understand the nature of mineral concentration and to make inferences of how the deposits were formed and where the potential lies for finding similar types of deposits. The results of geoscience studies are published by DNR and used by mineral development proponents to locate areas of interest for further examination. Broad areas of current exploration interest are shown in Figure 10.

DNR also maintains a comprehensive mineral occurrence database, which contains information on most of the known mineral concentrations in the province. The department also provides geological information and staff expertise to exploration geologists and prospectors. Particular emphasis is placed on assisting and training prospectors.

Industrial Minerals and Structural Materials

Economic Benefits

Nova Scotia has large deposits of materials classified as industrial minerals and structural materials. These two broad classifications include most materials that are not considered metals, fuels or construction aggregates. Most of the production of the Nova Scotia mining industry results from this industrial sector.

Industrial minerals and structural materials are some of the most common materials found on the planet and include salt, limestone, marble, slate, granite, common clay, silica sand, anhydrite and gypsum. Many industrial minerals are used for construction purposes while others like salt are used for human consumption or industrial applications such as road de-icing. Table 4 includes a list of industrial minerals and structural materials produced in the province and some of their more common uses. This sector has experienced steady growth in the production of most commodities over a very long period of time and Fig. 5 indicates that this sector has had relatively stable production during the past 15 years. As shown in Table 2, production of gypsum, salt and limestone continue to lead the mining industry in terms of overall value and volume produced.

Gypsum/Anhydrite

The earliest report of gypsum mining by settlers was 1779. At that time gypsum was produced for manufacturing plaster-of-paris or for soil conditioning purposes. Nova Scotia currently accounts for approximately 80% of the total annual production in Canada. Six mines annually produce nearly 8 million tonnes of crushed rock for use in gypsum wallboard manufacturing and cement production. Most gypsum mines have operated for a long period of time; for example, the Milford gypsum quarry has operated for over 50 years at its current location and is believed to be the largest gypsum mine in the world in terms of annual production. Most gypsum mines in the province could continue to operate for several decades before depletion of the deposits.

Salt

Salt is currently produced from two underground mines. The Nappan salt mine uses a 'solution' mining technique to dissolve the salt by pumping water into the ground and recovering the associated brine, while the Pugwash Harbour mine uses a 'room and pillar' mining method employing a conventional mine shaft to hoist extracted rock from the ground. Both facilities produce a range of consumable salt products and the Pugwash mine also produces nearly a million tonnes per year of de-icing salt for winter road safety. Both of these facilities have been operating for over 40 years.

Limestone

Like gypsum and salt, many limestone operations have had continuous production for several decades providing stable employment and raw materials for secondary manufacturing or processing. Limestone is used in many applications, from agriculture soil-amendments to cement manufacturing. Limestone is also an important material for environmental management often used in the treatment of industrial effluents, especially for the treatment of acidic water or to reduce emissions from coal-fired electrical generating plants.

Limestone deposits are found throughout the province and mining limestone has contributed significantly to the agriculture and construction industry, where materials have been used both in relatively raw crushed form or processed through rotary kilns to produce quick-lime or Portland cement.

Economic Benefits

\$165 million value of primary production in 2003. Employing over 1,000 people full-time.

Additional \$42 million value of products generated from processing and manufacturing barite, limestone and clay into pharmaceutical-grade barite, Portland-cement and clay bricks.

Long-term operations provide stable employment for communities.

Recent increases in production of high value dimension stone products from slate, marble, and granite deposits.

Significant spin-off employment including shipping of large volumes of raw-products and value-added manufacturing.

Gypsum wallboard production expected to resume in 2006.

Interesting Fact

An average new American home contains more than 7 metric tonnes (t) of gypsum (Mineral Information Institute, 1994). The 8 million tonnes produced annually in Nova Scotia, therefore, is equivalent to the construction of approximately 1.1 million homes per year.

Aggregate Materials

The provincial aggregate resource consists mainly of deposits of naturally sorted sand and gravel associated with glacial meltwater sediments deposited near the end of the last ice age, and igneous, sedimentary and metamorphic bedrock units containing hard, durable stone suitable for the construction industry. There is also a relatively minor, but increasingly important source of aggregates created from processing recycled concrete and asphalt, and industrial by-product materials such as slag recovered from the steel manufacturing industry.

The Department of Environment and Labour classifies operations that excavate and produce aggregate materials as either pits or quarries, depending on whether or not they use explosives to break the materials. Pits do not use explosives.

A Strategic Resource

Aggregates are among the most widely used materials in our contemporary society. They are required in almost all residential, commercial and industrial building projects. They also form a major component of many public works projects such as highways, underground services, bridges, railroads, airports, hydro-electric dams and wharves. Aggregates can be used in relatively raw forms or are incorporated into other construction materials such as concrete and asphalt.

Figure 10 shows the location of larger aggregate pit and quarry operations. There are also a number of smaller operations that supply local markets throughout the province. Transportation costs often form the largest component in the price of delivered aggregate products; therefore, proximity to markets is an important consideration when evaluating the potential viability of a deposit. Access to lower cost ocean transportation has made some of Nova Scotia's aggregate resources attractive as an export commodity.

Currently, there are no economically viable substitutes for natural aggregates that could supply the demand for aggregates used in Nova Scotia. Obtaining these materials from outside the province would significantly increase the costs of almost every construction project.

Interesting Facts

Approximately 4 million tonnes of sand and gravel are produced annually in Nova Scotia. More than 7 million tonnes of quarried and crushed stone are produced each year. Nova Scotia projects consumed nearly 9 million tonnes of aggregates in 2003, which equates to approximately 10 tonnes per resident per year.

On average, 300 - 400 tonnes of stone are used in the construction of a new 'wood-frame' home in Canada.

Approximately 27 000 tonnes of aggregate are required for the construction of each

kilometre of new, two lane paved highway in Nova Scotia (enough to cover a soccer field with two metres of rock).

The product quality specifications for aggregates have changed over time and it is imperative that materials being used by the construction industry meet existing industrial standards. Applications such as road bases, asphalt pavement and structural concrete require specific characteristics of the raw materials to improve safety and product life expectancy thereby reducing overall life-cycle costs. For example, the premature replacement or repair of structures such as highways and bridges can be extremely costly for public works agencies. It is, therefore, in the best interests of government, industry and the public to have an accessible, high quality aggregates resource base identified throughout the province.

Economic Benefits

Aggregates produced are worth approximately \$66 million annually, representing nearly one quarter of the value of primary production from mines and aggregate producers in 2003.

580 people were directly employed by the aggregate industry in 2003.

Approximately 2 million tonnes of quarried stone (25% of total crushed stone production) are exported annually to destinations along the east coast of North America and the Caribbean islands.

DNR Aggregate Resource Initiatives

Continue the province-wide assessment of aggregate resources (both bedrock and surficial) to ensure their long-term availability with respect to acceptable quality and affordability of supply.

Promote the wise use of the aggregate resource to government and industry.

Promote the concept of strategic aggregate resource protection to the planning community and other stakeholders.

Identify and promote opportunities to export aggregate deposits and other specialty stone.

Coal Resources

The sedimentary rocks of Nova Scotia contain a relatively large coal resource that is concentrated in the coalfields of northern Nova Scotia and Cape Breton Island (Fig. 11). The historic pattern of settlement in the province has been strongly influenced by the location of these coal resources, and coal mining has provided an important economic base for many communities in the province. Coal has been mined in Nova Scotia since the early 1600s and large-scale commercial mining began in earnest in the mid-1800s.

From the early 1900s to the late 1960s coal production in Nova Scotia averaged over 4.5 million tonnes annually and the province was a net exporter of coal fuels. Production dropped in the late 1970s to approximately 2.5 million tonnes annually until the closure of a number of underground mining operations in the Sydney Coalfield beginning in the late 1990s. In 2001 the Prince Mine at Point Aconi, the last remaining underground mine, ceased production.

Recent coal production in Nova Scotia has been limited to a few surface operations that collectively produce approximately 300 000 tonnes of coal annually. Surface coal production is mostly associated with reclamation mining projects that focus on the recovery of coal pillar remnants at sites that contain abandoned underground mine workings. Most coal seams that outcrop to surface have been subject to some underground mining activity, much of which was illegal and often referred to as “bootleg” mining. Many sites of past underground mining require remediation due to the presence of unsecured mine openings (shafts and slopes) and ground subsidence associated with the collapse of near-surface underground workings.

Economic Benefits

During the 1990s coal mining annually produced over 3 million tonnes with a market value of over \$200 million while employing over 2,000 people.

At one time Nova Scotia coal mines supplied all of the province’s coal-fired power generating plant requirements.

In contrast, in 2003 approximately 300 000 tonnes of coal worth \$20 million were produced with total direct employment of less than 100 persons.

Consumption and Markets

Approximately 75% of the electricity generated in Nova Scotia comes from burning coal. Nova Scotia consumes approximately 3 million tonnes of coal per year for domestic power production.

In 2003, Nova Scotia power plants burned approximately 300 000 tonnes of indigenously produced coal while nearly 2 million tonnes of coal were imported from other countries.

World coal prices have more than doubled in the past three years, in keeping with rising energy costs for all fuels.

Some homes in Nova Scotia continue to use coal as their main heating fuel.

The Future

Coal fuels are expected to be a major source of energy for power generation internationally and locally well into the future.

Potential surface coal mine projects could see annual production increases in the range of 250 00-500 00 tonnes per year.

Reclamation mining projects will continue to be evaluated in areas negatively impacted by past mining.

Exploration work is expected to continue with a primary focus on previously identified coal deposits.

The Harbour Seam in the Donkin area represents the largest identified underground coal resource that may be currently feasible to mine.

A significant volume of coal is known to exist at depths that are currently considered uneconomic for mining. This deep coal may represent an important resource for the province if it can be accessed in the future.

Emerging technologies such as coal bed methane (CBM) recovery and *in-situ* underground coal gasification offer new approaches for extracting energy products from coal.

Metal Mining

Nova Scotia has a long history of metal mining. Metals have been recovered from a number of diverse geological environments throughout the province, as shown on Figure 12. Since the middle part of the 19th century, mines producing gold, iron, zinc, lead, copper, tin, antimony, tungsten and silver have been significant contributors to the provincial economy. Currently there is only one active metal mine in the province, but there has been a growing interest in metals exploration and mineral staking during the past several years, which is associated with a sharp increase in world prices for most metal commodities.

Gold Mining

Nova Scotia has experienced three major gold rushes and produced gold almost continuously from 1860 to the 1940s.

Nova Scotia gold mines produced a total of 1.2 million ounces (oz.) of gold.

Many mines were shallow, small-scale operations mostly following quartz veins enriched with gold-bearing minerals.

The eastern and southern mainland had dozens of gold mines.

Several sites produced more than 20,000 oz. each and directly employed between 100 and 200 people while a few larger mines employed between 500 and 600 mine and mill workers.

During peak production from 1890-1900 several thousand miners worked in Nova Scotia gold mines.

Several of the larger mines supported towns with populations of 2,000-3,000 such as Goldenville, Caribou, Moose River and North Brookfield.

Many of Nova Scotia's gold deposits have the potential for further resource delineation at depths below the existing mine workings.

Base Metal Mines

In the late 19th and early 20th centuries, Nova Scotia mines produced copper and gold at Coxheath, Cape Breton Co., copper at Cap d'Or, Cumberland Co., and antimony and gold at West Gore, Hants Co. These relatively small-scale operations employed up to 50 men. Antimony concentrates were shipped to England for use in paint manufacturing, as a hardener of lead and for production of munitions.

Medium-size, modern era mining operations at Stirling, Richmond Co. (1936-1956, 143 employees), Walton, Hants Co. (1958-1977, 98 employees), Gays River, Colchester Co. (1978-1981, 191 employees), and Yava, Cape Breton Co. (1979-1981, 88 employees) produced zinc, lead, copper and silver. All four locations continue to have mineral exploration activity near the original mining targets.

The most recent large-scale base-metal mine was an open-pit operation at East

Kemptonville, Yarmouth Co., between 1985 and 1991. The mine's primary product was tin concentrates with additional recovery of copper, zinc and silver and directly employed 210 permanent and 100 seasonal employees. The East Kemptonville mine cost \$160 million to develop and added \$3 million/month to the southwest Nova Scotia economy. Unfortunately, a steep decline in tin prices caused the operation to shut down prematurely.

Iron Mining

Nova Scotia was one of the British Commonwealth's most important producers of iron for steel in the 19th Century and was Canada's foremost iron mining region.

Most iron production was from Londonderry, Colchester Co., and Bridgeville, Pictou Co., where iron mines operated between 1847 and 1906. In the Torbrook-Nictaux area of the Annapolis Valley several mines produced iron intermittently between 1855 and 1890, and continuously from 1891-1913.

The Londonderry operation employed over 1,200 men in its mine and blast furnace works in the 1880s. The town had a population of 5,000 and was northern Nova Scotia's economic hub. The Bridgeville operations consisted of mines at Bridgeville and a blast furnace at nearby Ferrona, and together were about a quarter of the size of the Londonderry operation.

The Future

Spot market prices for most metals have increased significantly recently, especially gold, and have led to a renewed exploration focus on potential metal production in the province. Large areas of the province have recently been staked and explored for metals. This trend is expected to continue while metal commodity prices remain high.

Other Valuable Geological Resources

In addition to mineral and aggregate resources, Nova Scotia contains other valuable earth-resources such as freshwater and groundwater, geothermal energy, and petroleum and natural gas. The Department of Environment and Labour regulates the use of groundwater and freshwater resources. Geothermal energy resources are managed and regulated under the *Mineral Resources Act*, while the Department of Energy administers oil and gas resource regulations. The split in administrative responsibilities for various resources sometimes leads to overlapping interests among the mineral industry, the oil and gas sector, and other private and public interests.

Geothermal Energy

Geothermal energy is utilized in many regions of the world including Iceland, Hawaii and parts of the southwestern U.S. In these regions, hot springs associated with volcanic activity are harnessed as a source of thermal energy. Nova Scotia does not have active near-surface volcanoes to provide geothermal energy, but several former mine sites have the potential for development of geothermal energy resources. Groundwater can gain heat while in contact with abandoned mine workings and this concentrated energy may become a geothermal energy resource regulated under the *Mineral Resources Act*.

DNR has designated three regions of the province, principally abandoned coal mining areas, as Geothermal Resource Areas. This resource designation allows for exploration and potential development of geothermal resources, which are defined as a substance, including water, steam, and water vapour, that is found anywhere below the surface and derives an added value from the natural heat of the earth. Designated Geothermal Resource Areas include areas around Springhill, Cumberland Co., and Westville-Stellarton and Coalburn-Thorburn, Pictou Co.

In the 1980s, the Town of Springhill decided to investigate the possibility of extracting geothermal energy from water contained in abandoned coal mines under and/or adjacent to their town. The result was the establishment of one of the first geothermal energy projects in North America using a combination of groundwater from the mine workings and heat-pump technology to concentrate and distribute heated and cooled fluids to users. The town currently operates the Springhill Geothermal Industrial Park where a number of users employ geothermal technology to help heat and cool their facilities.

Freshwater and Groundwater

Water is crucial for life and is therefore one of our most important natural resources. Freshwater resources include lakes, rivers and streams. Many communities and individual residences use these bodies of water for potable water supplies. A typical example of freshwater resources that most people are very familiar with is shown in Figure 13. Potable water for many other Nova Scotians comes from local groundwater resources. Groundwater is found in spaces and cracks in unconsolidated soil and underlying bedrock. An understanding of the bedrock and overlying glacial till and soil is

fundamental to interpreting the distribution and composition of groundwater. DNR staff expertise and geoscientific resources continue to be used to understand Nova Scotia's groundwater resources.

Many issues associated with groundwater can be explained by interpreting available geoscience information. For example, high concentrations of arsenic in groundwater, especially in southern Nova Scotia, may result from naturally occurring concentrations of arsenopyrite, a metallic mineral that is often associated with gold deposits. Similarly, high concentrations of uranium and radon in groundwater can be explained by high background concentrations of uranium in bedrock, including granite and to a lesser extent sedimentary rocks throughout the province.

Management of Nova Scotia's water resources requires the balancing of competing needs of water users with public health and safety issues. Public issues include the management, conservation and treatment of drinking water, groundwater, surface water, and wastewater. The Nova Scotia Department of Environment and Labour administers legislation related to water resources under provisions contained in the *Environment Act* and the *Water Resources Protection Act*. Rules exist to ensure that water resources are developed in a sustainable manner without causing unacceptable environmental, economic or social consequences.

Petroleum and Natural Gas

Exploration and development of onshore and offshore oil and gas resources are managed and regulated by the Department of Energy. The Department of Energy administers the *Petroleum Resources Act*, and the *Energy Resources Conservation Act*. Petroleum rights, however, are issued through the Department of Natural Resources' Registry of Mineral and Petroleum Titles.

Nova Scotia has thick deposits of sedimentary rocks, called sedimentary basins, which have high potential for hosting commercial deposits of oil and gas. DNR and the Department of Energy both have in-house geoscience expertise in the geology of these sedimentary basins. Over time, DNR has conducted regional bedrock mapping projects in the basins to evaluate the potential for commodities including base metals, gypsum, salt, potash, and other industrial minerals. The geological information gathered during DNR projects can also provide valuable information for petroleum exploration projects, leading to synergies between the government departments and the private sector.

Underground Hydrocarbon Storage

Many regions around the world use geological formations to store hydrocarbons underground, including both oil and natural gas. Storing large volumes of gas near existing transmission pipelines allows suppliers to adjust for large seasonal fluctuations in energy demand. Thick salt formations are by far the most common geologic formation

used for hydrocarbon storage. Nova Scotia has large deposits of salt, and currently salt deposits at Napaan and Pugwash are being mined as sources of salt; however, other deposits remain undeveloped. Many of these salt deposits are located close to natural gas pipelines and are potentially suitable for hydrocarbon storage.

Development of storage caverns in salt structures is achieved by solution mining, which involves pumping fresh water down a drill pipe into a salt deposit, dissolving the salt, and retrieving the salt brine through another pipe. The resulting cavern can then be filled with hydrocarbons using the existing brine pipe system.

The Department of Energy administers all legislation related to the storage and distribution of hydrocarbons including the *Underground Hydrocarbons Storage Act*. The Department of Natural Resources maintains geoscience information related to the geology of salt deposits and also administers legislation for salt mining under the *Mineral Resources Act*. Before a geological formation, such as a salt structure, can be used for hydrocarbon storage, the Minister of Natural Resources must first determine that this is the best use of the mineral resource. The applicant for a hydrocarbon storage area lease must provide the Minister of Energy with a written statement from the Minister of Natural Resources approving the use of the geological formation for the development of a storage reservoir. This collaborative management approach to the extraction of salt resources derives the maximum benefit for Nova Scotians.

Non-traditional Geological Resources

Nova Scotia also hosts a variety of geological resources that are not strictly mineral related and are enjoyed by residents and visitors year round. DNR directly manages some of these resources, such as provincial parks. The Mineral Resources Branch provides geological context to aid in the interpretation of features such as scenic vistas and gem and fossil occurrences.

Tourism

Scenery

Nova Scotia is renowned for its varied scenery that attracts national and international visitors. These scenic vistas were sculpted by a combination of geological processes, including plate tectonics and weathering, which reflect the underlying bedrock and surficial geology.

Granite bedrock near Halifax forms prominent sea cliffs. Erosion of joints and fractures in granite by glaciers and water has led to the current sculptured coastline and its many harbours, such as Peggys Cove.

The Annapolis Valley was formed by the erosion of soft sedimentary rocks that lie between the highly resistant volcanic lava flows of the North Mountain and the granites of the South Mountain.

The spectacular Cabot Trail in Cape Breton reflects the region's erosion-resistant igneous and metamorphic rocks, including those underlying Cape Smokey.

Fertile farmland in the central Nova Scotia lowlands are underlain by sedimentary rock units that host deposits of limestone, salt and gypsum, which often present themselves as white cliffs.

Fossils

The sedimentary rocks throughout Nova Scotia are host to world-renowned fossil locales. Geoscientists from the Department of Natural Resources are currently taking a lead role in the bid to obtain UNESCO World Heritage Designation for the fossil cliffs at Joggins. Fossils from this location have been studied by scientists for nearly two centuries, and received mention in Darwin's pivotal publication *The Origin Of Species*. Plans are underway to construct a \$5 million interpretive centre dedicated to the story revealed by

the fossils of Joggins, including broad treatment of the connection between geology and evolution, as part of the UNESCO initiative.

DNR has cooperated with the Office of Economic Development, several regional development agencies and local communities in northern parts of the province and Cape Breton Island to investigate tourism-related opportunities relating to fossils. Specific sites include 290 million year old animal tracks at Brule, and plant fossils in the Sydney-Glace Bay region.

An interpretive hiking trail and support literature have been developed in conjunction with the Arisaig Provincial Picnic Park for fossil sea creatures found along the Northumberland Strait.

Fossils in Nova Scotia are a valued resource and are protected under the *Special Places Protection Act*, administered by the Nova Scotia Museum.

Mineral and Gem Collecting

Nova Scotia has many well-known mineral and gem collecting sites, such as the Parrsboro area where an annual summer festival is held to celebrate the local deposits of amethyst, agate and zeolite minerals including stilbite, Nova Scotia's provincial mineral. Minerals and gems are owned by the Crown and are subject to the *Mineral Resources Act*. Individuals interested in collecting specimens must check with the Registry of Mineral and Petroleum Titles at DNR to discuss restrictions on mineral and gem collecting.

Museums

The Nova Scotia Museum of Natural History in Halifax and the Fundy Geological Museum in Parrsboro have information and displays dedicated to the province's rich heritage of rocks, minerals and fossils.

Several community-based museums and interpretive centres throughout Nova Scotia also highlight the geological wealth of the province. Well known examples include the Springhill and Cape Breton miners museums, which feature the history of coal mining in these communities, or the much smaller Londonderry Mining Museum, containing historical information on this once bustling town of 5,000 where iron ore was mined and smelted, and the products were shipped throughout Canada and as far away as Sheffield, England.

The Arts Community

The scenic vistas favoured by landscape artists are perhaps the most obvious contribution of geological resources to Nova Scotia's vibrant arts community. There are many other

connections, however, between the geology of the province and artists.

Recent research by geologists from DNR has revealed large hidden deposits of high-purity red clay that are suitable for use by pottery makers. Potential development of these clay resources as a source of potter's clay could give a complete 'made in Nova Scotia' aspect to local pottery.

DNR geologists also helped identify a red marble deposit near River Denys that is now quarried. Marble from the quarry is being exported nationally and internationally, including destinations in Italy. Marble blocks from the quarry were used in the first Atlantic Stone Carving Symposium held in 2005 at Inverness. The festival featured eight internationally-renowned sculptors and highlighted the contribution that mineral resources can make to the arts community.

Recycling of Minerals and Metals

The demand for minerals and metals is expected to continue to increase as human populations rise and the demand for material goods increases throughout the world. The majority of mineral commodities used today are produced through primary production at mines, but a significant component is now produced through the recovery of resources from end-of-life products.

When the *Nova Scotia Environment Act* became law in January 1995, the province formally adopted the Canadian target of 50% diversion of solid wastes collected from disposal by the year 2000. The *Environment Act* also committed the Department of Environment and Labour (NSEL) to develop a Solid Waste-Resource Management Strategy to modernize our waste management practices. In the early 1970s there were more than 100 municipal dumps operating, most of which employed open burning with little or no pollution control. On April 1, 1996, the province banned open burning as a means of disposal. All existing dumpsites were subsequently shut down and replaced with 'engineered landfills' designed for the long-term management of wastes.

The province's Solid Waste-Resource Management Strategy was the result of extensive consultation with people involved in all aspects of the solid waste management system. Municipalities, industry representatives and members of the general public all took part in discussions. The strategy was developed to provide the following benefits:

- maximize environmental protection,
- maximize economic activity, and
- minimize potential increases in the cost of managing solid waste.

Compared to before the release of the strategy in 1996, Nova Scotians are now sending about half the amount of waste to municipal disposal sites. Nova Scotia is currently recognized as a world leader in waste diversion from landfills and incineration.

Recycling and re-use of waste resources requires close cooperation among residents, solid waste collectors and municipalities. The province has worked closely with municipalities to provide the infrastructure and facilities to allow for enhanced resource recovery. Many materials previously discarded are now collected and segregated for re-use and our systems and procedures continue to be refined to allow for more recovery.

Information from 2004 indicates the following:

99% of Nova Scotians have curbside recycling;

76% have curbside collection and compost collection;

87% of households are within 20 km of an ENVIRODEPOT™;

1.5 billion beverage containers were recycled between 1996 and 2004;

900,000 tires are re-used or recycled each year;

over 400,000 litres of leftover paint have been recycled;

Nova Scotians diverted 46% of solid waste from landfills and incinerators;

solid waste disposal has dropped from 747 kg per person in 1989 to roughly 400 kg in 2004; and

1,000 jobs have been created by the strategy to date.

The Solid Waste Management Division of NSEL provided the statistics shown in Table 5 indicating the volume of recycling of minerals and metals in 2005. As the market value of minerals and metals increases, the economics of recovering resources from waste improves and more recovery takes place. For primary mineral producers, resource recovery provides opportunities to integrate primary production with recovered materials.

Secondary Processing and Manufacturing

The transformation of raw materials into finished products takes place through secondary processing and manufacturing. The wide variety of manufactured products available today requires an extensive transportation and trading network to move raw materials to processing facilities and finished products to markets. Nova Scotia is tied into the global “trading network” through the supply of raw materials for manufacturing and the trading of numerous finished products produced both locally and abroad.

The activities associated with secondary processing and manufacturing provide a net benefit to the economy of Nova Scotia. Adding value to raw materials through manufacturing requires long-term investment in human resources and in processing equipment. The benefits to our local economies are derived from increased employment, an improved balance of trade and a supply of locally produced goods.

Raw Materials to Finished Products

Most materials recovered through mining or quarrying require at least a minimal amount of secondary processing to make them into saleable commodities. For example, sand and gravel deposits normally require the screening and sorting of materials prior to further use in manufacturing. Mineral processing using a screening plant is a relatively simple method of mineral processing, however, it is an important first step in creating higher “value-added” products for many materials produced in the province. Once materials are segregated through secondary processing they can be marketed to a variety of manufacturers or users.

Long History of Creating Value-Added Products

Historically the province has had a significant secondary processing and manufacturing industry. This is consistent with most areas around the world where commercial manufacturing often took place close to where natural resources were located. For example, in Londonderry, Colchester County concentrations of iron-rich minerals were transformed from raw ore into finished steel products on a relatively large operating scale around the end of the 19th century. Because of the available local supply, industries requiring iron and steel for manufacturing developed and produced goods such as rail-track, wood-cook stoves and a number of other consumer items.

Eventually, as a result of ore deposit depletion, large scale iron production declined and ultimately ceased about 100 years ago. The lack of a competitively available iron ore source resulted in the shut down of iron smelters in the province and we subsequently began to import iron and steel for manufacturing plants. Eventually, other manufacturing plants dependant on low cost iron and steel materials shut down due to economic constraints.

Industry Perseverance and Current State of Value-Added

Manufacturing and Processing

Metal mining and processing has declined over time, however in contrast, many of Nova Scotia's industrial mineral manufacturing industries operating today began well over 100 years ago. This sustained economic viability is a notable accomplishment considering the changes that have occurred in the marketplace. These industries have survived and adapted to change through periods of war, economic depression and recession, changes in quality demands from consumers and, more recently, increased global competition. Industries which have endured for over a century are the gypsum, limestone, dimension stone and clay brick production. The finished products have changed by adapting to the requirements of the marketplace, however, the mineral sources are fundamentally unchanged. Many industrial mineral producers have reserves that can sustain production for many decades which attracts long-term investment.

The majority of existing mineral processing and manufacturing industries are related to industrial minerals, building stone, and aggregates. These products are marketed throughout Atlantic Canada and the rest of the world. Today there are 11 (or so) industrial minerals and rocks mined in Nova Scotia that are used regularly to manufacture finished products. These materials are required by a number of sectors of society including:

- medical,
- agricultural,
- construction,
- fishing,
- food processing,
- landscaping,
- environmental management,
- pulp and paper,
- power generating.

Virtually everyone uses and benefits from manufactured mineral products, many of which originate from the province, for example we produce:

- Clay products including bricks,
- Pharmaceutical-grade barite,
- Agricultural lime,
- Portland cement products,
- Ready-mix and pre-cast concrete products,
- Dimension stone (marble, slate, granite, sandstone) products,
- Construction aggregates,
- Gypsum wallboard,
- De-icing and consumable salt products.

Socio-Economic Impacts Associated with the Processing of Minerals into Products

As can be seen in Table XX, the economic benefits associated with secondary processing and manufacturing are tangible and important to Nova Scotia's overall well being. As with many of the benefits of mineral production, much of the wealth generation is in rural communities providing economic opportunities for local residents. Nearly 2 500 person years of employment are related to secondary processing and manufacturing of mineral materials.

Table XX

For further information related to this subject, the reader is encouraged to review DNR Information Circular No. 53, *Secondary Processing of Industrial Minerals in Nova Scotia*. A version (without accompanying photographs) is available on the DNR website at: http://www.gov.ns.ca/natr/meb/pubs/pubs2_ic.htm

(Insert images of finished products in use from Information Circular No. 53)

Sustainable Development

Understanding the Environment

Nova Scotia values its cultural heritage and considers it to be one of our most important social and economic resources. Our heritage is a combination of human activity and the natural processes that effect the environment.

Environmental integrity is affected by all natural and man-made processes. The planet's environment is in a constant state of change. Understanding environmental changes and their sources is fundamental to the concept of sustainable development.

The ability of scientists to synthesize and analyze information has increased tremendously over the past few decades, thanks to computing power and Geographic Information Systems. In addition to the improvements made in our traditional analytical abilities, we can now observe the planet from outer-space, or within a computer-model while simultaneously monitoring a large number of variables over a long period of time. We have developed a more holistic representation of the planet and the environmental issues that require attention and further analysis.

Human Impacts on the Environment

The recent accelerated increase in human population on the planet and our increasing use of natural resources to support our contemporary lifestyle has created measurable impacts on the environment. Impacts from human activities are often local in nature but can also contribute to larger scale changes.

An example of this is global climate change which, while it is a natural continual process, appears to be significantly affected by recent human activity. The production of greenhouse gases and the release of other chemical emissions to the air, land and water at ever increasing rates is now recognized as a world-wide issue affecting the environment and human health.

Role of Geoscience in Understanding the Environment

The geoscience information contained in the Mineral Resources Branch knowledge base is critical in understanding existing conditions, the history of an area, and predicting the potential for future environmental impacts.

The Mineral Resources Branch collects and manages geoscience information related to mineral exploration and mining from mineral rights holders. In addition, geological surveys are conducted by staff geologists who use all available information to develop or refine geological models of the province.

A good illustration of the unique and valuable information contained in the department's

geoscience knowledge base is the department's Core Library in Stellarton, which retains drill cores from diamond-drilling exploration programs conducted under the authority of the *Mineral Resources Act*. This asset allows staff and clients to investigate the geology of many areas of the province without the expense and time required to re-drill a site. As more drilling information is collected, the ability to refine models and understand the geology increases. These models are used by a number of sectors of society, from municipal planning to mineral production.

In the future there may be other applications of the department's geoscience information base, which may improve our understanding of the environmental impacts of human activity and natural processes. Therefore, it is important to ensure that existing and future information is maintained and accessible for these potential applications.

Mining in the Context of Sustainable Communities

What is 'Sustainable Development'?

In 1987 the World Commission on Environment and Development (the Brundtland Commission) defined sustainable development as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs.” This definition has been accepted by the governments of Canada and Nova Scotia and many other jurisdictions throughout the world.

The primary goal of sustainable mining is to produce raw materials to support the needs of society while minimizing adverse effects.

The concept of sustainable mineral development presents major challenges to society as experience has shown that providing for contemporary lifestyles requires increasing volumes of raw or recycled mineral products. For example, in North America every year more than 21,000 kg (21 tonnes) of new minerals are required for each person to maintain our standard of living**. As the planet's human population continues to increase, providing resources in a sustainable way is an issue that will forever confront society.

Measuring Sustainability

How to measure sustainable development is often a topic of much debate. Sustainability can be described as creating an appropriate balance between economic development, environmental protection, community benefits and government responsibilities. Developing consensus on what constitutes an appropriate balance can lead to conflicts between differing viewpoints.

Sustainability could be described as maximizing the benefits derived from mining as widely as possible while minimizing the negative impacts on people and the environment.

Sustainable mining recognizes that economic and social benefits of mineral development are not totally consumed by the current generation and that investments in human and physical capital will benefit future as well as present generations. This long-range outlook allows for appropriate planning for issues such as sequential land use and planning for the consequences of the depletion of mineral deposits.

Principles for Sustainable Development of Minerals

Sustainable development in the context of mining could be considered as incorporating the following elements:

- applying the highest standards for environmental management;

- finding, extracting, producing, adding value to, using, re-using, recycling and, when necessary, disposing of mineral products in an efficient and environmentally responsible manner while using recognized good practices at all stages of mineral use;
 - early planning for mine closure;
- respecting the needs and values of all resource users, and considering those needs and values in government decision-making;
- maintaining or enhancing the quality of life and the environment for present and future generations; and
- securing the involvement and participation of stakeholders, individuals and communities in decision-making.

The sustainability challenge is to ensure that the results of mining are positive for people and ecosystems over the long term: these are the aspects that need sustaining. Sustainability objectives can be met if mining projects are designed and implemented in ways that build viable longterm capacities, strengthen communities and rehabilitate damaged ecosystems.

Seen in this way, the concept of sustainability is much more than environmental protection in another form. It is a positive concept that has as much to do with achieving well-being for people and ecosystems as it has to do with reducing stress or impacts.

Benefits and Costs of Mineral Development

The production and consumption of mineral based products is a requirement for the survival of the human species. In the Introduction of this discussion paper, the benefits of using mineral products are discussed in some detail and there is generally consensus on the benefits.

Alternatively, there is the perspective that mineral development presents real costs related to its associated activities. Mineral production requires that materials be excavated and processed. Excavation and refining create residual effects, some of which require careful attention in order to minimize undesirable impacts. Some effects are unavoidable, for example if residents live near a mineral deposit it is likely they will notice the operation of a mine. In these cases mitigation and negotiation may be the only ways to resolve contentious issues. As a mineral deposit is in a fixed location in the earth, conflicts with other potential land users often occur.

Because of the large volumes of materials normally required to be moved, there are inevitably changes in the local environment. On the one hand this earth-moving is unavoidable and costly for the mine operator and often distressing to local residents. On the other hand, movement of large volumes of materials can present opportunities to create alternate but desirable landforms for the local community and residents. There are many examples of formerly mined lands being restored to productive and beneficial land uses such as agriculture, recreation, residential and commercial development.

One of the challenges for officials responsible for long- and short-term regional planning

is that many residents are not aware of the source of raw materials that are used to produce the material goods that surround them. This disconnection of the consumer from the source of raw materials can lead to misunderstandings as to the benefits and costs of mineral production, especially when negative impacts are not balanced against positive impacts.

Education and exposure to all aspects of manufacturing should help to ensure that any debates regarding future mineral development requirements are fair and contain a wide perspective on the issue. As mineral based goods are now freely traded around the globe, it is important to look at issues from both a local and global point of view.

Table 6 is a list of some of the benefits and costs of mineral production that may help to put sustainability issues into context.

The Social Licence to Operate

Global Mining Industry

The mining industry is influenced and shaped by the changing dynamics of the global marketplace and increasingly by public opinion related to the environmental and social consequences of industrial activities. Many mining companies have become large multi-national organizations with global operations. Other companies remain smaller and operate mostly in their local communities. Nova Scotia has mine operators that fall into both categories. Mineral products are consumed locally and exported or imported on a continual basis throughout the province.

In spite of numerous changes in mining practices over the past three decades, a broad range of technical, environmental and social issues continue to face the minerals industry. The regulatory approval process and public expectations for mineral development continue to change, which requires adaptation by existing and future operations.

The increasing scrutiny applied to mining projects is a direct result of increased social awareness. The nearly instantaneous communications available today allow the reporting of industrial incidents, which often become global news overnight. Information related to these events is effectively shared by organizations and individuals that are interested in demonstrating that mining activity continues to negatively impact the environment.

The entire mineral industry is adversely impacted when negative aspects of mineral development are brought to light. These unfavourable images have contributed to the erosion of support for mineral development in many places. The benefits of mineral production are, for the most part, downplayed or disregarded when reporting on industrial activities.

Global Mining Initiative

In 1999, nine chief executive officers of some of the world's largest mining companies met in Davos, Switzerland, to discuss their perception that a widening gap had emerged between mining/minerals-related practices and the social values of today's society. Industry representatives voiced a concern that their "social licence to operate" was in jeopardy.

Working through the World Business Council for Sustainable Development (WBCSD), the mining industry initiated the Global Mining Initiative (GMI). They carried out a review that led to the identification of how mining and minerals can best contribute to the global transition to sustainable development. The resulting project, Mining, Minerals and Sustainable Development (MMSD), has focused on the following four goals:

1. to assess global mining and minerals use in terms of the transition to sustainable development—its track record in the past and its current contribution to and detraction from economic prosperity, human well-being, ecosystem health and accountable

decision-making;

2. to identify if and how the services provided by the mineral industry can be delivered in accordance with sustainable development in the future;
3. to propose key elements of an action plan for improvement in the minerals system;
4. to build a platform of analysis and engagement for continual cooperation and networking among all communities of interest.

From this initiative, industry is now engaged with the public and governments on how best to maintain their “social licence to operate”. Work on the Global Mining Initiative continues with recommendations and action plans being developed to guide mineral operators. The initiative provides a consistent philosophy and approach for a more sustainable and socially acceptable mineral industry.

Nova Scotia’s Social Licence

Commercial mining has been conducted for approximately 300 years following the establishment of European settlers in the province. The province’s coal and iron deposits were exploited very early during this period. These early mineral-producing sites generated significant economic and social wealth and were the foundations of many large communities.

Inevitably, there were mine closures associated with mineral development activities. In many cases, as primary employment ended, maintaining self-sufficient communities became difficult and sometimes whole communities ceased to exist due to the lack of wealth generation following a mine closure.

Today, a more diversified economy in most communities in the province may imply a reduced importance for mineral development projects. The recent closure of underground coal mines in Cape Breton and the resulting negative economic impacts, however, show how important mineral development can be to the social well being of a community. The loss of long-term, well-paying employment has caused an increase in unemployment and created stress on the local economy. There was also a loss of locally supplied coal to generate electricity and for use in local manufacturing. This has increased costs for other local industries, costs that are passed on to the consumer, making these industries less competitive in the global marketplace.

Mine Legacy Issues

As with most industrial based societies, there is a legacy of impacted mine areas throughout the province. Changing environmental standards are noticeable in the varying state of sites of past mining. Contemporary mineral development has resulted in fewer undesirable impacts and more acceptable site re-integration upon mine closure. In spite of recent achievements there still remains significant public concern surrounding mineral development and its potential impacts on the local environment.

The Way of the Future

The province's *Mineral Resources Act*, the *Environment Act* and the *Occupational Health and Safety Act* are the primary legislation that guide mining activities in Nova Scotia. All of the aforementioned legislation has been recently revised and amended with attention to the concerns of communities in developing sustainable mining practices.

The province's environmental assessment process for mineral development projects helps government and industry improve development standards. For example, the Department of Environment and Labour, in consultation with numerous stakeholders, recently developed the following guidance documents for environmental management at surface coal mines:

Guide to Surface Coal Mine Reclamation Plans

Study on Surface Coal Mining Cumulative Effects in Cape Breton Regional Municipality

Surface Coal Mining Action Plan.

These documents were created as a result of comments from the public during the environmental assessment review of a proposed surface mine. The documents assist the public, regulators and developers in better understanding and mitigating individual mine effects and the cumulative effects of concentrated mine development in certain regions of the province.

The recognition by mineral producers that continual improvement is required to achieve sustainability from an environmental and economic perspective, is expected to help the mineral industry maintain its "social licence to operate" in the province.

Some of the text in this section is based on the September 2002 publication:

Towards change: the work and results of Mining, Minerals and Sustainable Development North America, published by the International Institute for Sustainable Development.

The Legacy of Abandoned Mines

Governments have the role of setting and enforcing environmental standards for all industrial activity. Environmental regulations, however, have not always provided the same protections as they do today. The resulting legacy from earlier mineral development includes environmental degradation, and human health and safety issues that require remediation or monitoring at some sites.

Increased Social Awareness

During the 1950s and 1960s there were significant changes in societal attitudes regarding the impacts that industrial activities were having on the environment and human health. Many mining practices were recognized as being unsustainable. Examples of these practices include direct discharge of tailings into streams and lakes, discharge of untreated acidic drainage, and lack of re-integration of disturbed lands into existing landscapes.

Since the 1960s, substantive changes have been made to mining practices to comply with contemporary environmental standards. Canadian environmental protection standards continue to evolve as information is obtained on past reclamation performance and longer-term mining impacts.

Observations taken over a long period of time have shown that mineral development practices have had varying success in re-integrating mined lands. Past experience has allowed mine developers and government regulators to better understand mining impacts and develop appropriate mitigation and re-integration strategies.

National Orphaned or Abandoned Mines Initiative (NOAMI) **http://www.abandoned-mines.org/intro_e.htm**

Orphaned or abandoned mines are those mines for which the owner cannot be found or for which the owner is financially unable or unwilling to carry out rehabilitation. They can pose environmental, health, safety and economic concerns for communities, the mining industry and governments. This situation is not unique to Canada.

Abandoned mines exist in most jurisdictions in Canada. Many sites, however, are not well documented with respect to their associated impacts and liabilities. Research and compilation of information on abandoned mines is necessary to enable sound decision-making and sustainable rehabilitation.

In 1999 and 2000, a number of stakeholders put forth requests to Mines Ministers in Canada to establish a joint industry-government working group to review the issue of abandoned mines. The Ministers supported this initiative and organized a multi-stakeholder workshop in June 2001 to identify key issues and priorities.

The Workshop on Abandoned Mines identified five major issues or themes to move

forward:

building a National Inventory;
community perspectives;
setting standards and rational expectations;
ownership and liability issues; and
identification of funding models.

Following recommendations from the workshop, the National Orphaned/Abandoned Mines Advisory Committee was struck in March 2002. The Committee reports back to Mines Ministers via the Intergovernmental Working Group on the Mineral Industry (IGWG).

Initial cost estimates for remediation of mine legacy issues in Canada range from \$1 to \$2 billion.

Potential Hazards at Abandoned Mines

Hazards can sometimes be hidden and difficult to identify. In many cases all surface buildings and structures associated with a former mine are gone, and open holes or unstable ground can be encountered without warning.

Potential hazards associated with abandoned mine sites include:

- falling into open excavations,
- rock falls from unstable rock faces,
- drowning in flooded workings,
- ground subsidence resulting from the collapse of near-surface underground workings,
- unstable explosives and blasting caps,
- unsafe and rotten structures and ladders,
- hazardous materials and chemicals, and
- dust and effluents from tailings.

In addition, within underground mine workings the hazards and dangers include:

- roof falls and cave-ins,
- poisonous gases and oxygen deficiency, and
- potentially explosive methane gas.

Status of Abandoned Mine Sites in Nova Scotia

Mining has taken place in the province since the early 1700s. Some mines were strictly surface excavations, while at many locations underground mining took place. Abandoned surface mines in the province can present environmental and safety issues, but the risks to human health and safety are typically greater at unreclaimed underground mining sites due to the presence of hidden or undetectable dangers such as mine shafts.

Underground mining requires excavation of vertical shafts, horizontal tunnels (adits), or

ramps (slopes) to access minerals. Collectively, these features are termed “mine openings” to reflect the fact that an excavation exists which interconnects with underground workings. In addition, as a consequence of the collapse of underground mine workings, ground subsidence has created additional hazardous mine openings in some places.

Current mining standards require that mine openings be sealed to prevent entry, but numerous openings were either never sealed or the seals have failed over time and the excavation is now open or could become hazardous in the future.

DNR has compiled a database of information related to abandoned mine openings in the province including their approximate location and, if available, the last observed condition. Over 6600 mine openings have been identified from literature reviews or through field surveys (Fig. 14). The majority of these excavations are related to small-scale gold mining (67%) and illegal coal mining (21%).

Over 1800 mine openings have been identified on provincial Crown lands and approximately 500 of these mine openings were identified as requiring continuing monitoring or remedial work. The cost of managing mine openings is estimated at an average cost of \$2500 per opening or potentially over \$4 million for all openings on Crown lands.

The responsibility to secure mine openings (or any man-made excavation) rests with the landowner. Landowners have legal obligations to protect against injury related to open excavations.

Abandoned Mine Lands in Nova Scotia

Devco Legacy Issues

There is a significant legacy of environmental damage at many former coal mining sites on Cape Breton Island. Many of these sites are the responsibility of the Cape Breton Development Corporation (Devco). Approximately 80 sites have been identified as requiring remediation. Issues include unreclaimed lands, acidic drainage, and numerous abandoned mine openings. The initial estimated cost for reclamation work required is \$220 million.

Mine Records Retention

Most provinces have formal protocols for managing information related to abandoned mines. For example, mine operators are required to file closure plans upon abandonment that provide the location of mine workings and other related features of the mine. These plans are retained at DNR and can be accessed in case there are questions raised about the past activity in an area. For example, during environmental assessment reviews, DNR checks as to whether or not documented mining has taken place to ensure any future development can consider the presence of abandoned mines.

Abandoned Mine Legacy Management Programs

In Nova Scotia there are several safety/environmental management initiatives currently underway related to the evaluation of abandoned mine sites. These include:

- inventory of abandoned mine openings;
- public safety information program;
- Crown lands abandoned mine openings remediation program;
- underground mine workings compilation-mapping;
- gold mine tailings evaluation project.

Crown Lands Abandoned Mine Openings Remediation Program

Each year a DNR committee identifies abandoned mine openings on Crown lands to be remediated through the department's Integrated Resource Management (IRM) process. Public safety, environmental impacts and animal habitat are some of the issues considered when developing departmental and regional priorities. Since initiation of the remediation program in the mid 1990s, approximately 140 mine openings have been secured under this program. Another 110 openings were secured as a result of cooperative partnerships with Crown land lease holders when new agreements were being negotiated. Figure 15 shows an example of an abandoned mine opening that was secured against human entry while retaining passage for bats.

Inventory of Abandoned Mine Openings and Public Information Program

In 1997 DNR issued a press release announcing the availability of an inventory of abandoned mine openings. In addition, DNR published two documents to increase public awareness and provide advise on how to secure mine openings. The brochures *A Sign to Watch Your Step* and the *Hazards and Remediation Handbook* (Fig. 16) were the result an initiative funded under the federal/provincial Cooperation Agreement on Mineral Development.

Because of the large number of abandoned sites on Crown land, the abandoned mine openings remediation program is required for the foreseeable future. In addition, the requests for information from private landowners and municipalities are expected to increase as more areas are developed in the province.

Accommodating Climate Change

Recent investigations by government sponsored researchers and other parties around the world have focused considerable attention on the subject of global climate change and the need for human beings to consider our effects on the natural environment.

There is considerable debate regarding what planetary processes and forces contribute most to changes in climate and the relative impact of recent human behaviours. The fact that human adaptations will be required as climates change is perhaps less contentious than determining all of the factors implicated in climate change. So-called “greenhouse gas” production is closely tied to our recent use of hydrocarbon based fuels at ever increasing rates. Changes in human behaviour related to fossil fuel consumption may take a long time as alternative ways of using energy are developed and disseminated around the planet. There are some predictions that our climates will continue to change rapidly in the near-term no matter what human behaviour changes are initiated today, therefore, adaption to changes caused by climate (for example, mean sea-level rise) will need to be accommodated.

Geoscience and Climate Change

From a geoscience perspective it is not a straightforward task to be able to define all of the major sources and the mechanisms involved with the patterns of climate change we are currently observing. What is known, with more certainty through geoscience research, is that the planet has undergone a number episodes of dramatic climate change, many of which occurred prior to the recorded history of human civilizations or during periods when human behaviours were thought to have had minimal impacts on the “natural pace” of on-going climate change.

The Mineral Resources Branch employs staff who are part of a network of geoscientists throughout Canada some of whom are studying climate change. Climate change studies often require information from numerous sources, for example, carbon-dioxide content of drill-cores taken from glaciers. Geoscientists employed with the Department of Natural Resources are in a position to provide information to researchers to assist in our overall understanding of climate change and possible mitigation strategies.

Climate Change Issues for Geological/Mineral Resources

There are many potential scenarios as to how climate change may effect the planet over the next century. Some more commonly discussed issues are related to effects on vegetation, precipitation, severity of storms, seasonal temperatures and mean sea-level elevations.

The issue of sea-level rise is an obvious concern for many residents of the province who either live on or work lands that may be subject to flooding in the future. With our maritime background, much of our infrastructure is close to the oceans and the low-lying river environments connected directly to the oceans.

Some of the mineral resources of our province are shipped by ocean vessels and these loading facilities could be required to relocate or develop other protective methods such as dykes to allow continued operations. All adaptations to major sea-level rise are likely to be expensive and potentially disruptive.

Other areas of concern for mine operators are issues of water management due to more frequent or more severe precipitation events. Precipitation patterns alone have major impacts on how a mine can be operated, including the size of sumps, water treatment ponds, and the pumping equipment required to ensure that a surface mine does not become flooded.

Climate change could bring challenges or opportunities depending on the individual business situation and therefore all planning, especially for long-term projects such as mines, should consider the potential impacts of climate change to ensure that issues that could become a concern are identified.

The Regulatory Process

Coordinated Regulatory Review for Mineral Management

Mineral development projects must be planned and operated in a safe and environmentally prudent manner and there are a number of established standards defined in legislation to help ensure that this is the case. Mining projects are subject to a number of laws and regulations both prior to and during active operations. Various provincial, federal and municipal government departments administer statutes that directly or indirectly apply to mineral development.

Prior to 1994, proponents for new mineral development projects were challenged with having to schedule numerous meetings with different government departments to initially outline their project and receive comments regarding regulatory requirements. Organizing and attending separate project introduction meetings created unnecessary duplication of efforts for mineral development proponents and often contributed to delays in the overall review process. The province recognized that aspects of mineral exploration and mining activities are within the scope of several departments' legislative and regulatory responsibilities and that the public interest requires that the departments cooperate in carrying out their responsibilities in a coordinated manner.

'One Window' Process

For Mineral Development Approvals

In 1994, the departments of Natural Resources, Environment, and Labour formally entered into a Memorandum of Understanding (MOU) that set out the roles and responsibilities of the three departments to cooperate by sharing information and technical expertise related to active mineral development projects and abandoned mine sites. The departments of Environment and Labour were subsequently amalgamated to form Nova Scotia Environment and Labour (NSEL). Building on the concept of a coordinated provincial review, the 'One Window' process for mineral development approvals was formally adopted by the province. Signatories to the MOU established a 'One Window' Standing Committee to meet regularly and address regulatory issues related to mineral resources management, environmental assessment, environmental approvals and compliance, and occupational health and safety compliance. The Standing Committee is chaired by DNR, which has primary management responsibilities for mineral resources.

Depending on the nature of a mineral development project, other government departments or agencies may become involved in the 'One Window' review process. The Office of Economic Development, Department of Transportation and Public Works,

Environment Canada, and Fisheries and Oceans Canada are examples of the other provincial and federal departments that sometimes participate in the coordinated review.

Government and industry experience through the 'One Window' process has shown that significant benefits resulted when mining proponents and government officials share project-related information early in the review process. Areas where regulators can cooperate may be more quickly identified, for example in determining whether a joint provincial/federal environmental assessment is required. Early identification of issues to be addressed during the regulatory review process can help proponents focus on providing the required information, making the review process more efficient for all.

Provincial Regulatory Responsibilities

Department of Natural Resources (DNR), Mineral Resources Branch

DNR's Mineral Resources Branch is often the first point of contact in government for persons interested in mineral rights or mineral development. DNR's role is to manage the beneficial use of the province's mineral resources through application of the *Mineral Resources Act*. The department also supports the development of mineral resources through its associated geoscience programs. Branch activities include generation and distribution of geological information, promotion of the province's mineral resources, and administration of regulations pertaining to mineral exploration and mining.

Mineral Management Division

The Mineral Management Division administers the *Mineral Resources Act* (MRA) and *Regulations*. The division evaluates applications, notifications and registrations, and issues mineral rights for exploration and mining through the Registry of Mineral and Petroleum Titles. Primary regulatory functions include:

- recording prospector registrations,
- receiving applications for and issuing exploration licences,
- receiving drill notifications,
- evaluating and recording excavation registrations,
- determining reclamation security bond values,
- issuing letters of authorization, and
- receiving applications for and issuing mineral leases and non-mineral registrations.

The division maintains maps showing the disposition of lands currently encumbered with mineral exploration licences, mineral leases, non-mineral registrations, and petroleum rights agreements. This allows the province's mineral rights and petroleum rights to be simultaneously displayed for all interested parties.

The Mineral Management Division also receives and reviews annual reports from mineral producers (lessees and non-mineral registrants) and exploration expenditure and assessment work reports from licensees for areas maintained under an exploration

licence. The division monitors some exploration work in the field as a compliance audit function and to assist in evaluating work reports submitted by exploration licence holders.

The division also produces annual summaries of mineral and aggregate industry activities from information it receives in cooperation with Statistics Canada and Natural Resources Canada.

Other DNR Responsible Authorities

Other areas within DNR's regulatory jurisdiction that may relate to mining include issues related to Crown lands, wildlife and forestry management. Representatives from these branches of DNR provide input to all environmental assessments conducted by the province and they may become involved with the 'One Window' process depending on the project description and details.

Environment and Labour (NSEL)

NSEL is responsible for administering statutes related to environmental protection and occupational health and safety aspects of mineral development. NSEL's regulatory authority comes primarily from the *Environment Act*, and the *Occupational Health and Safety Act* and other associated laws and regulations. NSEL responsibilities include administration of the environmental assessment process, evaluating applications for industrial approvals, and on-going monitoring for environmental and health and safety compliance during active operations.

Environmental Assessment Branch

All proposed mining projects are required to undergo an environmental assessment prior to receiving an operating approval. Environmental assessment is a decision-making process used to promote sustainable development by evaluating the potential environmental effects of major developments before they proceed. This is accomplished by involving the public along with various government departments and agencies during the assessment. Environmental assessment also promotes better

project planning by identifying and addressing environmental effects at the earliest stages of project development.

Environmental Monitoring and Compliance Division

All mining projects and some advanced mineral exploration activities require the proponent to apply for and receive an industrial approval from NSEL prior to starting the activity. The Environmental Monitoring and Compliance Division are responsible for the majority of NSEL field operations relating to environmental protection. Activities in this division include processing applications for industrial approvals, inspection and monitoring of sites operating under an approval, enforcement of regulations, and responding to public enquiries and complaints. NSEL has a network of regional and district offices to manage the workload of the division.

Occupational Health and Safety Division

The Occupational Health and Safety (OH&S) Division concentrates its efforts on supporting safe and healthy workplaces and developing minimum safety standards at workplaces. Regulatory authority is based on the *Occupational Health and Safety Act* and related regulations. The OH&S Division affects public and workplace health and safety by providing inspection, certification and enforcement services related to the *OH&S Act* and related regulations.

The *OH&S Act* is based on the principals of the internal responsibility system (IRS) that requires workplace parties (employers, employees and contractors) to establish safety programs that conform to legislation and establish protocols to manage health and safety issues identified at a work site. The legislation establishes the specific responsibilities of employers and employees for workplace health and safety and the OH&S Division's role is to ensure that all parties are meeting their obligations and to intervene when workplace parties cannot come to an agreement regarding the health and safety of all parties at a workplace.

In addition, ongoing monitoring of compliance with laws and regulations is also a primary function of the division. With respect to mineral development, there are specific

regulations for surface and underground mining that provide guidance to mine operators, both before they begin operations and during the active phase of the project. The OH&S Division establishes a level of surveillance to monitor worksite conditions and may issue orders for corrective actions when conditions are not in keeping with the requirements of existing legislation. The enforcement provisions also ensure that where violations of the legislation are identified, appropriate action is taken, providing both general and specific deterrence.

Municipal Government

In addition to federal and provincial jurisdictions, Nova Scotia has another tier of government related to municipalities. Municipal government, which may represent a town, regional municipality or county, has responsibility for municipal development plans, planning strategies, building permits, streets and secondary roads, and municipal bylaws. Thus for mine development, a proponent may need to obtain municipal permits and approvals for specific activities, for example for building permits.

Federal Government

Federal government departments administer laws that apply throughout the country. There are several departments administering federal legislation that could have an interest in mineral development activities. Departments that often become involved with the provincial reviews include the Canadian Environmental Assessment Agency, Environment Canada, and Fisheries and Oceans Canada.

These agencies normally participate in the ‘One Window’ review process during the initial project description meetings and thereafter may communicate directly with proponents to address specific issues of concern.

List of Acts and Regulations

Appendix 1 provides a list of some of the acts and regulations related to exploration and mining activities.

Mineral Rights Tenure and Land Access

All minerals located in or upon land in the province are reserved to the Crown. As such, the Crown maintains the right to explore for, work and remove minerals, or may delegate those rights through a licence or lease to a private interest. Under the *Mineral Resources Act* (MRA) the Crown has the authority to provide access to minerals to qualified parties for exploration and development purposes upon the receipt of certain prescribed fees, royalties and other information.

A 'mineral' for the purposes of regulation and determining ownership is defined under the *Mineral Resources Act*. According to the MRA:

"mineral" means a natural solid inorganic or fossilized organic substance and a substance prescribed to be a mineral, but does not include

(i) ordinary stone, building stone or construction stone,

(ii) sand, gravel, peat, peat moss or ordinary soil,

(iii) gypsum,

(iv) limestone, except that which is vested in the Crown, and

(v) oil or natural gas,

unless declared to be a mineral by the Governor in Council;

The rights to so-called "non-minerals" (including limestone and all stone, sand, gravel, peat, soil and gypsum) are attached to ownership of the surface lands (private or Crown), unless they are specifically declared to be minerals by the government.

A number of deposits of limestone have been designated by the province to be considered minerals. In addition, certain areas have been designated to be "Geothermal Resource Areas" where warm water is subject to the provisions of the MRA.

Identification of Mineral Rights

Mineral rights in Nova Scotia are acquired from the Crown by means of a map-based claim-staking system. Figure 17 shows an example of a mineral claim map sheet and the associated mineral rights. Mineral claim maps are updated and maintained by the Registry of Mineral and Petroleum Titles in Halifax and can be accessed during normal business hours. Qualified persons or corporate entities can apply for an exploration licence or a mineral lease for any lands in the province that are not currently staked or restricted from staking. The map based staking procedure eliminates the necessity of establishing claim boundary lines on the ground and the associated line cutting, blazing and flagging. If required, claim boundaries may be located in the field by a qualified land surveyor, but this practise is seldom necessary, at least until a mining stage is reached.

Land Access

Most of the land in Nova Scotia is available ('open') for mineral rights staking unless it is

specifically withdrawn or otherwise restricted for mineral exploration and development by the government. It is, therefore, possible to stake mineral claims on privately held property or Crown owned property or a combination of both without requiring consent of the landowner. In Nova Scotia, landowners' control surface rights and own materials not defined or designated as minerals; however, as noted previously, mineral ownership remains vested with the Crown.

Mineral exploration and development is encouraged by government policy. Access to land for mineral exploration conducted under an exploration licence, or mineral production under the authority of a mineral lease or non-mineral registration, requires the written permission of the landowner. If a mineral rights holder and landowner cannot come to an agreement, there are provisions in the MRA to resolve land access issues between the parties.

In the case of an exploration licence, a licensee who is unable to obtain an agreement with a landowner may apply to the Minister of Natural Resources for a surface rights permit, which may be granted after the Minister hears both parties and makes a determination of any compensation to be paid to the landowner.

Following an unsuccessful negotiation between a mineral lease holder (or non-mineral registrant) and a land owner for surface access for the production of minerals, the lessee or registrant may make an application to the Minister requesting that the Minister make an order that the right or interest in the lands required by the lessee be vested in the lessee. Any such application is subject to provisions of the province's *Expropriations Act* to determine if such action is warranted and to determine any compensation to be paid to the landowner in such a case.

Restricted and Prohibited Areas

Although most land in Nova Scotia is open for mineral rights staking, there are a number of areas where mineral related activity is restricted or prohibited due to various constraints on development. Figure 18 shows some of the larger areas of the province subject to constraints on mineral development.

Areas where mineral exploration and mining are strictly prohibited include designated:
federal and provincial parks,
park reserves and protected areas,
ecological areas, and
protected beaches.

Areas where mineral development activity is permitted but may be allowed only under special conditions include:
provincial or federal wildlife management areas,
nature conservancy areas,
designated water supply areas,
first nation reserves,

major airports, and
abandoned rail corridors.

Access to Crown Lands

Of the 5.8 million hectares (ha) of land in Nova Scotia, about 1.4 million ha (or approximately 24%) is provincial Crown land administered by the DNR Land Services Branch. The percentage of Crown land in Nova Scotia represents one of the smallest Crown land holdings of any province in Canada and a portion of these Crown lands are also subject to the above noted constraints to mineral development.

Provincial Crown lands are subject to an Integrated Resource Management (IRM) review process by DNR. IRM is a planning and decision-making process for activities proposed on Crown lands. IRM includes planning for minerals, forests, recreation, wilderness, energy, wildlife and parks. IRM helps ensure that long-term sustainable benefits are accrued to the province and that conflicts among potential Crown land users are minimized. All DNR branches provide input during IRM to provide a balanced view of the economic, environmental and social impact of all major decisions surrounding Crown lands.

In order to access Crown land for the purpose of mineral exploration, the licensee must contact the area supervisor at the DNR area office for an access permit, which authorizes entry on to Crown lands for a specified purpose and stipulates the conditions under which access is provided. A financial security for site reclamation could be required to be posted depending on the nature of the proposed activity.

If the activity proposed on Crown land is anticipated to be significant, a Crown land lease may be required, which establishes annual rentals and other conditions for use of the land including site restoration. All Crown Land Lease applications are subject to approval from the Governor-in-Council (provincial Cabinet) upon a recommendation from the Minister of Natural Resources.

Mineral Exploration

Mineral exploration is the physical search for concentrations of materials such as gold, barite, coal and salt, with a goal of defining an economically viable mining target. Exploration activity ranges from simply walking the ground and making observations, to drilling holes and examining the cores and cuttings, to the excavation of larger bulk samples for industrial testing.

Numerous individuals and organizations ranging from so-called grass-roots prospectors to major international mining companies conduct mineral exploration in Nova Scotia. Each year significant resources are expended during the search for mineral deposits that help to replace mineral inventories consumed by mining. Very limited exploration work can take place without government authority, but the majority of exploration work is conducted under an Exploration Licence issued by the Registrar of Mineral and Petroleum Titles. In every case, all work on the ground must have authorization of the landowner.

It is common in Nova Scotia to find sites with mineral concentrations greater than the surrounding background concentrations. DNR geoscientists often categorize these concentrations as “mineral occurrences” to indicate an anomalous field result. Discovery of an elevated mineral concentration, however, does not mean that a mine will be established. In most cases detailed exploration work is necessary to determine if a particular mineral occurrence is part of a larger geological formation that might be considered an economic mineral deposit.

Beyond the direct physical and chemical properties determined by mineral exploration, many other factors need to be taken into account when making a decision on whether exploration has defined an economic mining deposit. Factors such as commodity market-price, mining method, environmental management, labour and transportation costs, and regulatory requirements are some of the primary considerations when determining whether or not a mineral deposit may be brought into production as a mine.

It is widely estimated that for every 1,000 to 10,000 mineral occurrences identified in the field, only one will result in a commercial mining operation. Because of the low success rate in converting identified mineral occurrences into economic deposits, mineral exploration activity is considered to be a high-risk financial investment that might bring high rates of return to investors if a successful mining operation is ultimately established. Because of this low success rate, large areas need to be explored in order to locate economically viable mineral deposits.

Land Access for Mineral Exploration

Some mineral exploration work can be conducted from aircraft or satellites, but eventually there is a need to explore the ground where minerals may be concentrated. In the very early stages of mineral exploration, individual prospectors or exploration

companies may approach landowners to request permission to enter upon land to look at exposed rocks and soils and to collect samples. The collection of soil samples, stream sediment samples, and rock samples is among the most common “grass-roots” type of exploration. If elevated mineral concentrations or interesting geological formations are found, a prospector or exploration company may want to conduct more advanced exploration requiring mechanical trenching and/or drilling to help define the geology and mineralized zones in more detail. Any drilling or mechanical excavation activity related to mineral exploration requires notification and registration with the Registry of Mineral and Petroleum Titles and could be subject to the requirement to post a reclamation bond to ensure site rehabilitation.

In the case of mineral exploration, many landowners have granted permission to licencees for specific work with site-specific terms for use of the lands. Landowners’ concerns are often related to site restoration when site disturbance is expected. As noted previously, disputes regarding land access can be brought to the Minister of Natural Resources for resolution.

Land Access Constraints

A number of constraints on land access are described previously under *Restricted and Prohibited Areas*. Generally speaking, prospecting and mineral exploration are prohibited on lands designated as National Parks, Provincial Parks, Protected Areas, and Special Places or on lands for use by the Department of National Defence or for the purpose of Federal Penitentiaries. Exploration on Indian Reserves requires the consent of the landowner.

DNR must be consulted regarding any proposed exploration activity in defined Municipal Water Supply Watershed areas. Consultation with the Department of Environment and Labour and the operator of the local water-works may also be necessary.

Exploration on lands previously closed or withdrawn for mineral staking by the government is possible through an application to DNR for a “Special Licence or Special Lease”; however, all such requests require an approval from the Governor-in-Council before mineral rights may be issued.

Prospecting and Regional Exploration

The *Mineral Resources Act* allows an individual or a company to conduct limited prospecting or regional exploration upon lands that are “open” (available for staking). Such persons may conduct a preliminary assessment of available ground before committing to an exploration licence, provided that the following conditions are met:

that such persons register with DNR and receive a Prospectors Identification card, that only work that does not disturb the land (e.g. outcrop mapping, soil sampling, most geophysical surveys) is carried out, and that permission to enter the land be obtained from the relevant landowners before prospecting commences.

Acquiring Exploration Licences

The Registry of Mineral and Petroleum Titles issues exploration licences following its review of applications. An exploration licence entitles the holder to the exclusive right to conduct exploration upon the licence area and to remove minerals from it for test purposes (i.e. not for sale). A licensee also has the exclusive right to apply for a mineral lease for production within the boundaries of the licence.

Once an exploration licence has been issued then assessment work targeted to prove the existence of an economic mineral deposit may begin. Minimal-disturbance activities such as geological, geochemical and geophysical surveying may proceed without further authorization from the department while more advanced exploration activities require notifications, registrations or authorizations from DNR depending on the scale of the activity.

Requirement for Special Licences

The Minister of Natural Resources may withdraw land from mineral rights staking for resource management purposes. For example, in 1975 the Minister of Mines withdrew all areas of the province from mineral rights staking for coal, uranium, salt and potash. This withdrawal of lands by the Minister was in response to rapidly changing world energy markets and the government's desire to maintain control of strategic energy reserves. Since then, exploration for these specific minerals can only be conducted under a Special Licence.

When areas are withdrawn for staking, an interested party may make an application for a Special Licence for all or certain minerals contained in the area withdrawn. Special Licence applications must be approved by the Governor-in-Council and are subject to special terms and conditions.

Uranium Exploration and Production Moratorium

In addition to the constraints placed on the exploration and production of fuel minerals in 1975, a specific Uranium Moratorium was proclaimed by the Minister of Mines and Energy in 1982. The moratorium was the result of public concerns related to potential negative health and environmental effects from uranium exploration and mining. As a result of the Uranium Moratorium every person exploring for minerals is now required to notify the Registrar of Mineral and Petroleum Titles as soon as they identify uranium-bearing materials and to cease work if the concentration of uranium exceeds 100 parts per

million (ppm).

Later in 1982, the government appointed Judge Robert McCleave as Commissioner under the *Public Inquires Act* to make recommendations respecting uranium exploration and mining and the enacted Uranium Moratorium. Following extensive public hearings, Judge McCleave submitted his report "Commission of Inquiry on Uranium" to the Governor-in-Council in January 1985. Judge McCleave concluded that the health and safety of workers at a uranium mine could be adequately protected with appropriate workplace safeguards. The commissioner recommended that government further study issues related to long-term uranium mining waste management and potential public health effects related to uranium mining sites.

Judge McCleave recommended that the Uranium Moratorium continue until at least 1990 to allow the government to study the environmental and health issues identified in his report. In 1989 the government extended the moratorium until 1995, and the moratorium continues to be in force until such time as the government decides to make changes to this policy.

Drilling, Excavation and Bulk Sampling Activities

Whenever holes are to be drilled to obtain geological, geochemical or geophysical data, the Registrar must be provided a Drilling Notification Form prior to the commencement of drilling. The licensee is required to restore disturbed lands and to seal drillholes at the bedrock interface to prevent possible migration of water from or into exploration drillholes.

In the case of trenching, pitting or stripping by mechanical means (or by hand if exceeding one metre in depth), information to support an Excavation Registration must be submitted to the Registrar at least seven days prior to commencement of the activities so that the registration may be evaluated and recorded. In some circumstances a reclamation bond may have to be posted. The excavation registration allows the department to monitor the activity, notify other regulators at the Department of Environment and Labour, and ensure that reclamation is carried out in a timely manner. If the information submitted is incomplete or insufficient to describe the proposed activities, the Registrar may refuse to record an excavation registration.

If extraction of a bulk sample greater than 100 tonnes of mineral-bearing materials is proposed, a Letter of Authorization is required from the Registrar to conduct the activity. The proponent must provide a detailed description of the proposed activity to allow DNR to understand the scope of the activity and establish the value of a reclamation security.

All information submitted to DNR related to drilling notifications, excavation

registrations and letters of authorization, is immediately forwarded to the provincial 'One Window' Standing Committee on Mineral Development to allow for an evaluation with respect to environmental and occupational health and safety regulations.

Maintaining an Exploration Licence

An exploration licence issued by DNR has a term of one (1) year and may be renewed indefinitely if certain requirements are met annually. Foremost of these is the requirement to conduct mineral exploration work and report the results of this work to the Registrar of Mineral and Petroleum Titles. The minimum value of "assessment work credits" to maintain an exploration licence in good standing is \$200 per year per claim during the first 10 years that a licence is held. The assessment work credit requirement increases to \$400 per year per claim for years 11 to 15 and to \$800 per year per claim for all subsequent years. The escalating annual work credit requirement is structured to encourage more advanced activity on an exploration licence the longer that it remains in good standing.

A wide variety of exploration activities can qualify for work credits, including prospecting, excavating, line cutting, surveying (geological, geochemical, geophysical, topographical), drilling, assaying and underground exploration.

Work credits exceeding the minimum annual licence requirements may be "banked" and used in subsequent years to renew a licence. In essence, all costs associated with mineral exploration may be claimed in a single year, but the licensee can ask for excess credits to be applied to future years when an application for renewal is submitted to DNR.

A bona fide prospector is entitled to seven renewals of his licence upon the annual submission of a prescribed prospector's statement and renewal fees.

Filing Assessment Work

An assessment work report is required annually to maintain a licence in good standing. Assessment work must be reported in either a technical report or in a prospector's statement, accompanied by a statement of expenditures.

A technical report must include specific information and be prepared in a prescribed format by a qualified person. For departmental purposes the required information provides for uniform format, content and document dimensions, which makes it more valuable to a variety of potential users and simpler to archive.

A prospector's statement requires less information than a technical report, however, it still must contain information sufficient to understand the activity conducted and its location.

All reports respecting assessment work are held in confidence by DNR for two years

from the date of submission, unless the licence is terminated for some reason or if the licensee requests that the report be released early. At the end of this two-year period, reports are released through the DNR Library in Halifax. Licence holders can make an application to DNR to maintain confidentiality of the report for an additional period of time.

Mining and Reclamation

Mining involves the extraction of materials from the earth and the segregation of valuable materials from less valuable materials. In some cases all the materials excavated may become saleable or useable products. In most cases there are unprofitable materials with no commercial value that have to be removed to access the minerals of interest. In addition to direct excavation and segregation of materials from the ground, further processing and refining of mined materials is often required before products can be used or made suitable for further manufacturing. A successful mining process thus creates valuable products while simultaneously managing mining residues in a socially and environmentally acceptable manner.

Mineral Lease and Non-Mineral Registration

A mineral exploration licence issued by DNR authorizes the search for minerals but does not provide a right to extract minerals for sale. A mineral lease or a non-mineral registration is required to extract and sell minerals or gypsum and limestone, the so-called non-minerals. A mineral exploration license holder has the exclusive right to apply for a mineral lease within the area of an existing licence. This exclusivity provides the licensee with surety of mineral rights tenure while an area is investigated and expenditures are incurred usually over a number of years.

Areas that are not currently staked under an existing mineral right are also available for application for a mineral lease or non-mineral registration.

A mineral lease or non-mineral registration can only be obtained if the applicant can demonstrate that a study has been undertaken that indicates that a successful mining project can be carried out based on relevant information currently available to the proponent.

Figure ??? illustrates the major phases of a mining project. Following mineral exploration activity and the definition of a mineral deposit, the next step in the evaluation process is to conduct a feasibility study to determine whether the deposit can be economically mined. A feasibility study takes into consideration all information related to a deposit and

applies an engineering-economics approach to determine whether or not a particular mineral deposit can be profitably mined including the costs to reclaim any land disturbance to an acceptable state at the conclusion of the project.

An applicant for a mineral lease must provide a technical report indicating that an economically viable mining operation can be conducted and provide the rationale for its conclusions. The applicant must also commit to beginning mineral production within two years of the issuance of a mineral lease and post a financial security to provide for the reclamation of areas that may be disturbed by proposed activities.

The technical report supporting an application for a mineral lease must include:

- a general location map of the area showing all claim boundaries, surface rights ownership, topography and other surface features in the vicinity of the deposit;
- resource information, including a map showing the location of all drillholes, trenches, test pits and sample locations;
- geological maps showing the known location of the deposit with geological cross-sections;
- a table of ore reserves, including grades and quantities, categorized as proven, probable or possible;
- the location of proposed surface facilities, including buildings, water diversions and water treatment, and ore and waste management areas;
- a description of the proposed mining methods and schedules for all surface and underground development work, and a description of the mineral processing method including the projected recovery factor for valuable minerals;
- a description of the methods to be used for the reclamation of all areas disturbed by the project, including a site plan; and
- any additional information that the Registrar of Mineral and Petroleum Titles considers necessary for the purposes of the MRA.

The technical report must be submitted with an author's certificate of qualifications. The author of any technical report submitted to DNR must be a qualified geoscientist or engineer, or a person with experience or qualifications acceptable to the Registrar.

A similar technical report is required from applicants for a non-mineral registration to mine gypsum or limestone. If all of the requirements of the MRA and regulations are fulfilled, a lease or registration may be issued by the Minister of Natural Resources. All lessees and registrants are required to submit an annual report on mining operations, which are used by DNR to monitor the development of mines to ensure that work is conducted in accordance with the mining and reclamation plan on file with DNR.

Environmental Approvals

All mining projects also require environmental approvals from the Department of Environment and Labour (NSEL) to operate. The *Environment Act* is the primary legislation that provides guidance and rules for most industrial activities in the province. Applications for approvals required under the *Environment Act* can be evaluated in

parallel with applications for mineral rights. The provincial 'One Window' review process ensures that both DNR and NSEL are aware of the progress of various applications related to a project.

Environmental Assessment

All proposed mineral development projects are required to be registered as undertakings under the *Environmental Assessment Regulations*. Environmental assessment provides an opportunity for the public and regulatory agencies to comment on a project's potential environmental impacts based on the proponent's project description and supporting documentation.

NSEL staff receive comments from the public and government regulators and make recommendations to the Minister of Environment and Labour based on these comments. The initial review of a project can lead to the following decisions by the Minister of Environment and Labour:

a rejection of the project due to unacceptable environmental impacts;
a request for further information from the proponent before making a final decision;
ordering public hearings to resolve significant environmental or social concerns;
or an approval from the Minister of Environment and Labour to proceed within a prescribed time period and under conditions as set out by the Minister.

Industrial Approval

If the proposed project receives approval to proceed following the environmental assessment process, the proponent is then required to apply for and obtain an industrial approval from NSEL to conduct operations. The Environmental Monitoring and Compliance Division at NSEL is responsible for reviewing applications and issuing industrial approvals. This division also responds to non-compliance issues related to operating facilities and investigates complaints from the public.

An industrial approval stipulates the range of activities covered by an approval and the environmental standards that are to be met by the proponent. Standard stipulations include setting limits for liquid effluents, air emissions such as noise and dust, blasting effects and hours of operation. Issues identified in the environmental assessment process must also be incorporated into an industrial approval. Most mines are required to regularly submit environmental monitoring results to NSEL to show compliance with conditions of the approval.

An applicant for an industrial approval must also provide a reclamation plan for the mining project and is required to post a financial security to achieve the reclamation plan. As both NSEL and DNR have requirements for financial securities for site reintegration in their respective legislation, the departments cooperate in

determining an appropriate reclamation security for mining projects.

Occupational Health and Safety

Workplace occupational health and safety is specifically addressed through the *Occupational Health and Safety Act* and its associated regulations. The Occupational Health and Safety Division of NSEL is responsible for administering the *OH&S Act* and division staff participate in the 'One Window' review process. The OH&S Division's role during the project review process is to indicate whether or not a proponent's proposed operating plan will likely be out of compliance with existing OH&S regulations prior to issuance of an industrial approval to operate. The OH&S Division does not provide an approval to operate prior to commencement of activity at a mine site; however, the division is concerned with compliance with established rules and regulations and may issue enforcement orders to mine operators to take corrective actions or to stop work if conditions so warrant.

The division also provides information to the 'One Window' standing committee regarding ongoing monitoring and enforcement activities conducted by the OH&S Division at active sites.

With respect to start-up of mining operations, there are legislated requirements for mine operators to provide notice of the commencement and suspension of operations at mine sites to the OH&S Division. This allows for timely and effective monitoring of these facilities.

In addition, for proposed underground mining activities, there are specific regulations that require information to be filed with the OH&S Division by the proponent prior to the commencement of operations or in the case where an existing mine operator intends to modify its mining method or equipment. These filings include providing health and safety plans related to ventilation, ground control and other site-specific operating procedures to protect the health and safety of employees.

Reclamation and Reintegration

Reclamation is the process of reintegrating areas disturbed by mining back into the surrounding landscape. The reclamation process begins prior to any physical disturbance of the ground when mining plans are initially developed. Once mining methods and boundaries are established for a mineral deposit, a plan to reclaim the site is also developed into the mining sequence. The reclamation plan becomes an integral part of mine operations and it is a requirement under the terms of a mineral lease and industrial approval to follow the reclamation plan.

Some mining projects may operate over a relatively long period of time, so issues can arise that may require the mining plan and reclamation plan to be revised or refined from time to time. For example, this could be the result of finding additional mineral reserves,

which could require the mine layout to be revised. A mining proponent may make a written request to modify or deviate from the original reclamation plan, however, if significant changes to the mining and reclamation plan are proposed, the project could be subject to additional environmental assessment to ensure that the proposed changes and methods of mitigation are vetted in a public forum.

In many cases, concurrent or progressive reclamation takes place during mining operations thereby reducing the overall disturbed land area throughout the project life. Examples of progressive reclamation and final reclamation can be seen in the photographs of recent surface mines in Stellarton and Westville shown in Figures ? and ?.

The financial security required by the provincial government for reclamation of a mine site may be administered by either DNR or NSEL, but in all cases both departments need to be satisfied that the reclamation objectives have been met for a site prior to the security being returned to the proponent.

Aggregate Pits and Quarries

The *Mineral Resources Act* specifically states that minerals, defined for the purpose of the Act, do not include ordinary building materials such as construction aggregates from pits and quarries; therefore, there is no requirement for a mineral lease or non-mineral registration from the Department of Natural Resources to allow for the production of these materials. Aggregate materials are regulated under the provisions of the *Environment Act* administered by the Department of Environment and Labour (NSEL). Aggregates are used in almost all construction projects and are produced at numerous locations throughout the province to minimize transportation costs for customers. Figure 10 shows the location of larger pits and quarries around the province and there are a number of smaller or intermittently operated sites that provide these essential building materials.

Current Regulatory Framework

NSEL has defined a pit to be an excavation that does not require blasting while a quarry is defined as an excavation that requires blasting to break and move consolidated deposits of rock. Excavated rock normally requires further crushing and sorting to produce finished construction aggregate products.

Since 1995, any adverse effect caused by a pit or quarry operation can lead to charges under the provincial *Environment Act*. In order to ensure uniform regulatory treatment of aggregate operations, NSEL has developed and used *Pit and Quarry Guidelines* as the standard for assessing aggregate operations since 1978. The guidelines were last updated in 1999 and were originally developed as a result of a Deputy Minister's Task Force on Land Use, in which pit and quarry operations were identified as a significant issue facing communities and the environment. The guidelines were developed in consultation with the Department of Transportation and Public Works, and the Nova Scotia Road Builders Association. The guidelines address issues such as noise, dust, siltation, and minimum separation distances to dwellings, watercourses or roads. The guidelines also include provisions for financial securities related to final site rehabilitation plans.

All pit and quarry operations were designated as activities requiring approval under the *Nova Scotia Activities Designation Regulations* until 17 June 2005. After that date, pits under 2 hectares (ha) in area were exempt from requiring an industrial approval to operate. This change was made to reflect that small pits present a lower risk for adverse environmental effects. The change has also reduced costs for small pit operators and allowed for more flexibility in their operations. For quarries that conduct blasting there remains a requirement to obtain an industrial approval to operate, no matter what the overall aerial extent.

Any proposed aggregate pit activity that is greater than 2 ha in area is required to register as an undertaking and is subject to the *Environmental Assessment Regulations* prior to operating and also require an industrial approval from NSEL to operate.

Currently, pits and quarries used solely for road building or maintenance contracts undertaken by or for the Department of Transportation and Public Works are exempt from the requirement for an industrial approval. These operations are required, however, to follow the *Pit and Quarry Guidelines* and are subject to other requirements of the *Environment Act* and associated regulations.

Environmental Regulations for Pits and Quarries vs. Mining Operations

Any mineral development proposal regulated under the *Mineral Resources Act* is subject to *Environmental Assessment Regulations* and must register for review. In comparison, proposed pit and quarry operations are only subject to the *Environmental Assessment Regulations* if they are projected to exceed 2 ha in total area or are expected to create a significant environmental impact.

The *Pit and Quarry Guidelines* restrict blasting within 800 metres of the nearest residence, unless the proponent has written permission from the residence owner. While the *Pit and Quarry Guidelines* are not directly applicable to mining operations, many of the established environmental standards in the guidelines are applied to mines because of the similar nature of the operations.

Occupational Health and Safety

As with most workplaces, the *Occupational Health and Safety Act* applies to most pit and quarry operations. The *Occupational Safety General Regulations* contain specific standards for surface mining operations that apply to pit and quarry operators. Other regulations related to workplaces and public safety may apply depending on the number of employees and the nature of the operation.

2005 Discussion Paper on Pits

Nova Scotians have recently been asked for their input to update standards for pit operations. In 2005 the Minister of Environment and Labour released a discussion paper to help gather input on future standards for pit operations. The discussions focus on issues such as minimum rehabilitation requirements and environmental noise and dust limits. In the future NSEL would like to enter into a similar dialogue with respect to quarry standards.

Need for Regulatory Certainty

In Nova Scotia, the aggregate sector has recently experienced rapid growth. For example, the number of applications received by NSEL for quarries has risen from 10 in 2000 to 27 in 2004. There has been public opposition to the establishment of some new pits and quarries, especially those close to residential areas.

Besides public concerns, the industry has its own concerns. Industry representatives have

expressed a desire for a level playing field, where all operators follow the same regulatory requirements. For example, a quarry operator may not be allowed to blast within 800 metres of a dwelling without landowner consent, while a mine operator or municipal developer conducting similar activity may not be so constrained.

Industry stakeholders have also expressed concerns about the costs associated with environmental applications and the approval process, not just in financial terms, but also the time associated with regulatory processes.

Overview of Mineral Regulations in Nova Scotia

The Government of Nova Scotia supports responsible mineral development and understands that mining is essential for the prosperity and well-being of the province. Mineral ownership is vested variously in the Crown and private interests, and as such these resources are considered valuable provincial assets.

Government's role is to set standards, monitor and enforce compliance with established rules, and maximize socio-economic benefits for residents of the province. Sustainable mineral development is controlled through statutes, regulations and policies that are administered by a number of provincial, federal and municipal government agencies. Existing rules and policies provide the framework and specific requirements for mineral development. Issues include mineral tenure, occupational health and safety, public safety, and environmental integrity during all phases of a project.

In Nova Scotia, there are two provincial government departments that administer the majority of regulations related to mineral development. The Department of Natural Resources (DNR) is responsible for administering the *Mineral Resources Act (MRA)*, which defines what materials are considered minerals and the process to follow for the orderly development of minerals.

The Department of Environment and Labour (NSEL) is responsible for administration and enforcement of numerous statutes including the *Environment Act* and the *Occupational Health and Safety Act*. Mineral development requires an approval from NSEL to operate in addition to mineral rights issued by DNR.

'One Window' Regulatory Process

In 1994, the Province of Nova Scotia initiated the design of a 'one window' process to review and monitor mine development and mine closure issues. The overall goal was to improve the efficiency of the regulatory review process for both the mining industry and government.

The 'one window' process is supported through a Memorandum of Understanding between DNR and NSEL. The memorandum outlines the expectations of each department during reviews of mineral development projects.

Depending on the nature of the development project, other government departments may become involved, for example, the Nova Scotia Office of Economic Development, Nova Scotia Department of Transportation and Public Works, Environment Canada, and Fisheries and Oceans Canada often become involved in the 'one window' process due to their respective regulatory responsibilities.

Proponents of new or expanding projects are invited to use the 'one window' process to

obtain guidance on regulatory requirements that may apply to the project.

Monitoring of active mineral development projects is conducted by various government agencies as required by their legislation. The results of monitoring or compliance action is shared through the 'one window' process at regularly scheduled meetings, or sooner if warranted.

The 'one window' process does not apply to pit and quarry operations producing construction aggregates as these commodities are specifically excluded from regulation under the *Mineral Resources Act*. Pit and quarry operations are still subject to the provisions of the *Environment Act* and the *Occupational Health and Safety Act*.

Mineral Rights Administration

The Department of Natural Resources is responsible for managing the province's mineral assets on behalf of the Crown. The *Mineral Resources Act* (MRA) sets out the rules for obtaining mineral rights and maintaining tenure. DNR collects fees, royalties and taxes on all mineral exploration and mine development activity in the province.

In addition, DNR retains geoscience information related to mineral exploration and development activities conducted by private interests and makes this information public after an initial period of business confidentiality has expired.

Definition and Ownership of Minerals

Minerals are defined in the MRA as follows:

"Mineral" means a natural solid inorganic or fossilized organic substance and a substance prescribed to be a mineral, but does not include

- (i) ordinary stone, building stone or construction stone,
- (ii) sand, gravel, peat, peat moss or ordinary soil,
- (iii) gypsum,
- (iv) limestone, except that which is vested in the Crown, and
- (v) oil or natural gas.

Ownership of minerals is vested in the Crown and any proposed mineral exploration or mining requires an authority (mineral right) through the *Mineral Resources Act*. Mineral rights are conveyed through the issuance of an exploration licence or a mineral lease for a specific period of time.

Definition of Non-Minerals

As noted above some geological resources, such as construction aggregates and building stone, are specifically excluded from the definition of "minerals" and, therefore, are not subject to the *Mineral Resources Act*. There are some materials that are an exception to this rule, for example, gypsum is also not considered a mineral under the *Mineral Resources Act*, but there are provisions under the Act to regulate gypsum-mining

operations.

The province may declare any substance to be considered a mineral and to be subject to the *Mineral Resources Act*.

Exploration Licenses and Mineral Leases

A mineral resource can only be defined after conducting exploration work and interpreting the results. This includes a detailed study of the geology and other chemical and physical properties of the materials of interest.

The usual first step in obtaining an authority to produce minerals from the Crown is for an interested party to make an application for an exploration license. It is not necessary to own lands or have landowner permission to stake lands for exploration; however, landowner permission must be obtained before exploration activity on the ground takes place.

When a mineral development proponent believes that there is enough information available to outline an economic mineral deposit they can make an application for a mineral lease. Upon issuance, a lease provides an authority to mine minerals for up to 20 years. All production under a mineral lease agreement is subject to payment of royalties to the province. The lease also contains conditions for annual reporting and the leaseholder is required to maintain a reclamation security (financial bond) appropriate to remediate disturbance at the site.

Restrictions to Obtaining Mineral Rights

The *Mineral Resources Act* authorizes the Minister of Natural Resources to withdraw lands from application for mineral rights. For example, in 1975 fuel-related minerals were withdrawn from general staking by the Minister. The specific minerals subject to this withdrawal are coal, uranium, salt and potash. These minerals were withdrawn because of their potential strategic importance to the province's future energy needs. Other lands may be withdrawn from staking if the Minister believes it would be in the best interests of the province to do so, for example, following the premature closure of an operating mine where mineral resources remain.

In addition to areas withdrawn for mineral staking, in 1984 a moratorium on uranium exploration and mining was imposed by the government because of health and safety, and environmental concerns related to uranium mining and long-term management of radioactive wastes. The moratorium remains in place today.

Anyone interested in exploring for or mining the above noted minerals or for other minerals on grounds withdrawn for staking requires a Special Licence or Special Lease that is subject to approval of the Governor-in-Council (Provincial Cabinet). Applications

for a Special Licence or Lease are reviewed by the Minister of Natural Resources prior to being recommended to Executive Council for issuance.

The Minister may also tender mineral rights on withdrawn lands and call for competing bids before deciding whether or not it is in the best interest of the province to open the lands for mineral rights staking.

Environmental Approvals and Monitoring

Extraction of minerals requires environmental approvals and monitoring of compliance at several stages of a project. The Department of Environment and Labour (NSEL) is responsible for administering the *Environment Act* and several other statutes related to environmental protection during active operations.

Environmental Assessment

Proposed mineral development projects are subject to the environmental assessment process. Proponents must register their project and submit a detailed project description with anticipated environmental impacts and proposed mitigation activities. The registration document is provided to the public and other government agencies for comment. All comments become part of the public record and are considered by NSEL staff during the review process. Depending on the scope of the project, and the comments received by NSEL, there may be a requirement for further information and/or public hearings to allow greater community discussion of the impacts and benefits of a proposed undertaking.

Industrial Approval

If a mineral development proponent successfully passes through the environmental assessment process, they are then required to obtain operating approvals from NSEL that stipulate the terms and conditions to be met during operations. An “industrial approval” is the primary authorization provided by NSEL. Depending on the project, several other approvals may be required, for example for water withdrawal and usage, or an authorization for on-site sewage treatment.

Approval holders must conform to approval conditions during the life of the project, unless variances are subsequently authorized by NSEL. Most facilities are required to monitor and meet stipulations related to air quality, water quality, noise and blasting effects, and to report their monitoring results on a regular basis to NSEL.

Occupational Health and Safety

The Department of Environment and Labour (NSEL) is also responsible for workplace safety through application of the *Occupational Health and Safety Act (OH&S Act)*, which defines the responsibility of all persons at a worksite. The *OH&S Act* is based on the internal responsibility system (IRS). The underlying philosophy behind IRS is that

workplace health and safety is best managed by workplace parties. Under the *OH&S Act* all employers and employees are required to understand their legal duties and rights, and are expected to understand their specific workplace requirements and develop a safety program to address recognized risks.

In addition to the *OH&S Act* there are regulations that specify workplace standards for a variety of activities in the province. There are specific regulations related to surface and underground mining operations. NSEL has the responsibility to enforce legislation and intervene if there are disputes in the workplace that are not resolved to the satisfaction of the workplace parties. Additionally, if complaints are filed regarding alleged non-compliance with the Act, the department is mandated to investigate.

Following the recommendations of the Westray Mine Public Inquiry in 1997, changes were made to the *Mineral Resources Act* and the *Environment Act*, and new underground mining regulations were developed and proclaimed under the *Occupational Health and Safety Act*. In particular, changes were made to remove sections related to occupational health and safety from the *Mineral Resources Act* to ensure that DNR's resource management functions were clarified.

Site Reclamation and Re-integration

All mineral development projects that require an authority under the *Mineral Resources Act* or require an Industrial Approval under the *Environment Act* are required to submit a reclamation plan for any activity they plan to undertake. The reclamation plan must be acceptable to both DNR and NSEL. A reclamation plan sets out the approach to return disturbed lands to an acceptable state following mineral extraction.

The proponent's reclamation plan is used by DNR and NSEL to determine the bond (financial security) required for the project. A financial security is maintained until such time as the reclamation work has been completed to the satisfaction of both departments. DNR and NSEL coordinate their mine site reclamation responsibilities through the 'one window' review process.

Pits and Quarries

As previously noted, certain materials, such as sand and gravel and other construction aggregates, are not regulated under the *Mineral Resources Act*. The extraction of these materials is regulated under the *Environment Act* and NSEL applies *Pit and Quarry Guidelines* to establish operating standards for these types of operations.

While not directly involved with regulation of pits and quarries, DNR is involved with this industrial sector through its Geological Services Division. The Division supports the industry by maintaining a substantive geoscience resource that contains information on aggregate resource potential in various parts of the province.

In addition, DNR collects and compiles production statistics from pits and quarries, in cooperation with Statistics Canada and Natural Resources Canada, but otherwise does not exert any regulatory control on this activity.

Existing Legislation and Mineral Policy

There are three primary statutes that guide mineral development activities in Nova Scotia. In addition, the province has developed policies, guidelines and procedures to assist in mineral management.

Mineral Resources Act (DNR)

The *Mineral Resources Act* is the authority under which mineral development activities are conducted in the Province of Nova Scotia. The *Mineral Resources Act (MRA)* provides guidance on the following issues:

- definition of minerals and other substances subject to the *MRA*;
- mineral exploration licences and tenure;
- mineral leases and tenure;
- registration and notification of advanced exploration activities;
- payment of royalties on production;
- annual reporting to government of activities;
- public safety at mine operations; and
- reclamation obligations and financial securities.

The *MRA* is revised from time to time and the most recent changes became law in 2004.

Environment Act (NSEL)

Guidance and rules for environmental protection standards are contained in the *Environment Act* and associated regulations. The Act is administered by NSEL and provides for the following:

- environmental assessment of new or expanding operations including an opportunity for public commentary;
- industrial approvals, which specify the environmental limits for site emissions and impacts anticipated during operations;
- incorporation of the *Pit and Quarry Guidelines* into industrial approvals;
- establishing reclamation obligations and financial securities; and
- continuous monitoring and enforcement of approval conditions during operations.

Occupational Health and Safety Act (NSEL)

Guidance for occupational health and safety standards comes through the *Occupational Health and Safety Act*, also administered by NSEL.

The Occupational Health and Safety Act:

defines the responsibilities of all workplace parties (employers, employees, and contractors);
establishes standards for workplace behaviours and industrial hygiene through regulations; and
monitors and enforces occupational health and safety regulations for the duration of the project.

1996 Mineral Policy

The overall goals of the Department of Natural Resources are contained in its current mission statement:

to build a better future for Nova Scotians through responsible natural resource management.

The 1996 Mineral Policy was developed to support the stated mission and goals of DNR. These goals are further stated:

to achieve sound natural resources stewardship and sustainable development;
to maintain the diversity of the province's natural environment;
to maintain the economic base for jobs and incomes; and
to improve the quality of life for Nova Scotians through effective use of our natural and human resources.

The existing Mineral Policy was developed to support a successful mineral resource sector in Nova Scotia by providing for:

a thorough understanding of the geology and mineral resources of Nova Scotia, gained through continuing research and exploration activities;
a business climate that is competitive at national and international levels, and supported by clear, fair and effective policies and regulations and promotion of the province's mineral potential;
increased public knowledge of the province's geology and mineral resources and greater public support for mineral-based activity;
integrated land-use planning that considers minerals with other land-use and resource interests and provides greater certainty for land access and mineral rights tenure;
protection of the environment through a close working relationship among regulatory agencies, and consultation with the industry and the public in achieving standards for environmentally sustainable economic development;
protection of health and safety for workers and the general public through a close working relationship among regulatory agencies, and consultation with industry, labour and the public in achieving the highest possible standards; and
cooperative working relationships among stakeholders that result in compatible policies, decisions and actions from other government departments, agencies and communities.

The existing policy has been in place for 10 years and is still considered by DNR to be a valuable guiding document. Recent regulatory amendments, however, require that some

components of the policy be reviewed to ensure they are still relevant and effective.

'One-Window' Review of Mineral Projects

Since 1994, the province has used an inter-departmental review committee to evaluate proposed mineral development projects and monitor ongoing operations.

The 'One-Window' committee meets regularly and consists of representatives from the Department of Natural Resources and the Department of Environment and Labour. The committee operates under a memorandum of understanding between the two departments. Other government departments or agencies are invited to participate in the one-window process as identified through the project description.

The coordinated multi-department review of projects has improved the process for both regulators and mineral development proponents. The simultaneous disclosure of operational plans and regulatory requirements helps reduce delays, confusion and allows for better upfront planning from mineral development proponents.

Geoscience in Nova Scotia

History

Contemporary geoscience, the study of earth processes, has gone hand in hand with the Nova Scotia mineral industry since at least the early 1800s and continues today. The Geological Survey of Canada was instituted in 1843 to manage geoscience information and develop models of the geology of our nation, primarily to establish the potential for mineral development. Current research projects are conducted by staff geologists at DNR, federal scientists at the Bedford Institute of Oceanography, university researchers at several local and national academic institutions, and geologists in the mineral industry.

Early geoscience research by DNR was designed to assist in the exploration and development of commercial or strategic mineral deposits. Most work consisted of bedrock geological mapping, detailed mineral deposit mapping, and fossil studies. Refinement of geologic models is an ongoing initiative of DNR as more information is obtained and modelling tools evolve.

Current Research

Current DNR geoscience research includes the following focused activities:

- preparation of geological maps that outline the distribution of igneous, metamorphic and sedimentary rock units in Nova Scotia, as shown in Figure 6;
- studies of mineral and non-mineral deposits;
- geochemical analysis of rock, soil, vegetation and water;
- preparation of surficial geology maps outlining the distribution and composition of glacial deposits, as well as peat, stream (alluvium) and marine deposits; and
- paleo-topographical and paleo-climatological studies based on the composition, age and distribution of surficial deposits.

The Future

Future geoscience research will continue to support society's need for minerals, aggregates and energy resources.

Geoscience will also play an ever increasing role in land-use planning, public health and safety and protection of our environment

Improvements in analytical methods and the ability to overlay multiple sets of information have allowed more accurate and holistic models of the earth to be created, and information can be accessed by a wider user base than in the past. Accurate and current geochemical and geophysical information is required to understand existing 'baseline' conditions and to evaluate the changes that result from human activities. For example, information related to the natural concentrations of major and trace elements (e.g. arsenic, mercury, uranium) are of interest for public health in areas where humans may establish residences or alter the natural environment.

Current DNR Geoscience Research

The geoscience program for the Department of Natural Resources is delivered by three sections in the Geological Services Division:

Geological Mapping and Geochemistry,
Resource Evaluation and
Geoscience Information Services.

Geological Mapping and Geochemistry

The Geological Mapping and Geochemistry section conducts activities to acquire, analyze and interpret the bedrock and surficial geology of Nova Scotia and the geochemical composition of bedrock and surficial materials. Results of the section's activities include an increase in staff expertise, published maps and reports, databases and a variety of graphic representations of information. These products are used to assist in mineral and energy resource evaluations and integrated resource management for land-use planning.

Current Project Highlights

Bedrock geological mapping of the metamorphic and igneous rocks in southwestern and central Nova Scotia. These rocks have good potential for deposits of aggregate, gold and base metals, and several industrial minerals including, but not restricted to, quartz, kaolin, mica and feldspar.

Mapping the distribution of high-purity red clay deposits that are suitable for manufacturing bricks, pottery and tiles, and for use as impermeable caps in landfills.

Bedrock geological mapping of sedimentary rocks in central Nova Scotia, including 3-dimensional models, to assist oil and gas, coal, base- and precious-metal, and industrial mineral exploration.

Identifying and mapping the aerial extent of paleo-landscape features, using glacial deposit studies, to assist archeological investigations of the 10,000 year old human settlements near Debert, the oldest such archeological sites in Eastern Canada.

Geochemical studies of the concentration and distribution of arsenic and mercury in historic gold mine tailings in southern Nova Scotia to assist in evaluation of the potential environmental and human health risks.

Resource Evaluation

The Resource Evaluation section conducts activities that support exploration for, and development of, mineral and non-renewable energy resources. Specific activities include the maintenance of comprehensive mineral occurrence databases, studies to characterize the geology and genesis of mineral and energy deposits, development of new deposit models to assist mineral and energy exploration, and studies of industrial mineral commodities and aggregates.

Activities also include the documentation of geological resources that can contribute to tourism and culturally related industries. Identification of mineral and fossil collecting

sites, and providing input for interpretive signs at geologically interesting sites are examples of this support. The section also provides prospector assistance services.

Current Project Highlights

- Detailed studies of base metal, precious metal and industrial mineral deposits throughout the province.
- Regional study of mineral occurrences along a major fault system in central Nova Scotia, focusing on gold-copper deposits.
- Mapping the distribution of sand and gravel, and igneous and metamorphic rock units with potential for use as construction aggregates. Studies include standardized testing of materials to evaluate physical and chemical properties to meet local, national and international specifications.
- Detailed paleontological and sedimentological studies of the Joggins Fossil Cliffs in support of the proposal to have this location designated a UNESCO World Heritage Site.
- Development of an assistance program for Nova Scotia prospectors to market their mineral claims to an international audience at conferences such as the annual meeting of the Prospectors and Developers Association of Canada.
- Geological mapping and follow-up studies of the North Mountain lava flows to determine the potential for commercial deposits of aggregate and zeolite minerals.
- Asset mapping initiatives for municipalities, including identification and evaluation of mineral deposits. An example is recent work to evaluate the dimension stone potential of sandstone in southwestern Cape Breton Island.

Geoscience Information Services

The Geoscience Information Services section edits, formats and distributes all of the geoscience information published by DNR. The principal outputs are open file maps, reports and information circulars.

The section is also responsible for developing and maintaining the Mineral Resources Branch website, operation of the DNR library in Halifax, and maintaining the department's drill core library in Stellarton, where more than 500 000 metres of government and private sector drill core and related information is archived.

Current Project Highlights

- Long-term projects to digitize existing 'legacy' information, including historic regional geological maps, detailed maps of gold deposits, reports and other 'hard-copy' publications, and geochemical databases.
- Maintenance and management of approximately 85 downloadable digital information products, including maps, images, and databases that total more than 1,000 files. In the 2004-05 fiscal year, clients made nearly 49,000 downloads of these products, representing an increase of more than 25% from the previous year.
- Continuation of the development of data-capture software to assist in digital recording of new geoscience data.

Vision for Nova Scotia's Mineral Resources

Mission

In developing a new Mineral Strategy we will engage the public, development proponents, government and other stakeholders to identify policies and actions that can help us optimize the benefits that Nova Scotia derives from its geological resources in a sustainable manner.

Nova Scotia's Mineral Strategy will be guided by the vision of a province where: geological resources are effectively managed for the benefit of all Nova Scotians. the socio-economic contribution of geological resources is widely recognized and applauded, and the principals of sustainable development form a cornerstone for present and future development of geological resources.

Need for Review of the Mineral Strategy

Introduction

Civilization as we know it could not exist without mineral products. Mineral resources form the foundation of our society and virtually everything we build or use either contains mineral products or is produced by machines that are built with minerals. Mining provides most of the raw materials for our consumer products and public infrastructure, and Nova Scotia has a long, rich mining history.

It is important to recognize, however, that the province's geology provides benefits well beyond the extractive mineral industry. Increasingly, the province's geological resources are used for recreation opportunities including eco-tourism, enjoyment of our beaches, fossil hunting, and searching for rare mineral specimens.

In addition, the study of the earth, "geo-science" is required in matters as diverse as the quality of groundwater, the health of the environment, and other issues related to public safety.

The province must have up to date laws, policies and programs in order that Nova Scotians derive the greatest benefit from our geological endowment. It has been 15 years since the last comprehensive review of the *Mineral Resources Act*, and 10 years since release of the Nova Scotia Mineral Policy. In that time, there have been significant changes in the global marketing and management of geological resources, therefore, it is an appropriate time to reflect on how these changes can be best managed, and to consider recommendations for the future.

Nova Scotia's Long Mining History

Nova Scotia's diverse geology has provided the province with a wide variety of useful and valuable mineral commodities. Commercial mineral exploration in this province dates back to the 1602 voyages of Samuel de Champlain, and mineral production to coal mining in Cape Breton to supply the garrison at Louisburg in the early 1700s. During the past 300 years, Nova Scotia has supplied more than 20 different mineral products to domestic users and export markets around the world.

Mining remains an important component of the provincial economy. The benefits include both the annual economic impact of recovering almost 250 million dollars worth of products from the ground, and the opportunities that the resources afford to Nova Scotians, including:

materials for local economic development (e.g. construction aggregate),
fuel to generate electrical power (e.g. coal)
value-added manufacturing (e.g. clay bricks), and
improved public safety (e.g. salt for de-icing roads).

We would be very much poorer as a province without a healthy mineral industry.

Mining Legacy

It is recognized that mineral development requires some disruption to the existing environment. Extraction of most mineral products requires temporary or permanent change to landscapes. If potential impacts are not properly identified and mitigated, mining can impact the aquatic, terrestrial and atmospheric environments. There is a legacy of environmental damage left by historical mining activities in some parts of the province. Community perceptions of the industry have been affected by past environmental practices, which often overshadow the benefits of mining.

The Strategy Review Process

Given the importance of geological resources to many sectors of the province, the Department of Natural Resources (DNR) is embarking on a process to renew our current policies. To ensure that interested parties have an opportunity to participate as the strategy is being developed, we are providing a number of ways to provide input. These include:

participating at public meetings
submitting written comments (mail or through the Internet)
participating in Focus Groups

A better understanding of the benefits and costs of mineral development projects should help to improve decision making. The new Mineral Strategy will be an important tool in supporting the mission of the Department of Natural Resources to build a better future for Nova Scotians through responsible natural resource management.

The Changing Landscape

The past two decades have witnessed significant changes to the way geological resources are managed and administered. Some of the changes that have occurred during this time include:

1990 comprehensive review of the *Mineral Resources Act*,
1994 Introduction of the 'One Window' regulatory review process,
1996 *Minerals - a Policy for Nova Scotia*, and
2004 amendments to the *Mineral Resources Act*.

In 1990, a comprehensive review of the *Mineral Resources Act* (MRA) was completed. The revised MRA included the requirement for an additional operating authority (a mining permit) to extract minerals. The mining permit was introduced primarily to bring gypsum mining operations under the regulatory authority of the MRA. The Act also provided more guidance to mine operators on the requirements for mine site rehabilitation and reclamation security.

In 1994 the province introduced a 'One Window' regulatory review process to improve the inter-departmental provincial review of mineral development projects. Federal and municipal regulators were also invited to participate in the One Window review process as dictated by project requirements.

In 1996, the department issued a document entitled *Minerals - A Policy for Nova Scotia*, which reinforced Nova Scotia's commitment to supporting responsible mineral development. This document presented the first comprehensive strategy to recognize the wide range of activities necessary to support the mineral development sector. It emphasized that geoscience information collected and maintained by the Mineral Resources Branch is widely used in the province, and also recognized the concept of geological resources as being more than the products of the extractive industry.

In 1997, the Westray Mine Public Inquiry report was released. The report contained a number of recommendations for change to the way mining is regulated, all of which were accepted and subsequently implemented by the Nova Scotia government.

In 1999, government carried out major reviews of all programs as it moved to balance the provincial budget. Budget reductions at DNR resulted in a decline of about 25% in human and fiscal resources available to the Mineral Resources Branch. These financial constraints have impacted the programs and scope of activities of the branch. At the same time, a broader awareness of the importance of geoscience throughout society as a whole has resulted in an increase for government geoscience information to support recreation and tourism, environmental protection, public safety and regional economic development.

In 2001, coal production from underground mining ceased following closure of the Prince colliery in Cape Breton. The end of this longstanding industry has resulted in higher unemployment rates and the need to import coal and other solid fuels into the province, negatively impacting our balance of trade. Coal is expected to continue as the primary fuel source for the province's electrical generating plants for the foreseeable future and there are substantial coal deposits that may be economical to mine in the

Sydney coalfield.

In 2001, gold prices hit the bottom of the current price cycle, then began to climb upward. Since 2003, they have remained mainly above US\$400/ounce, which has had a dramatic impact on attracting new exploration investment to Nova Scotia.

In 2004, amendments to the *Mineral Resources Act* and the *Occupational Health and Safety Act* clearly defined the role of DNR as a resource manager, administrator and promoter of the province's mineral resources. The Department of Environment and Labour (NSEL) retained responsibility for occupational health and safety matters. The activities of the two departments in support of these respective roles are governed by a Memorandum of Understanding that guides the 'One Window' review process.

The Way Forward

Public consultation is an essential first step in ensuring that issues are identified and discussed, and that actions taken in the future provide optimal benefits for the province and its people. This paper attempts to provide a factual base for further discussions. As we develop plans for the future administration and management of the province's geological resources, it is critical that government incorporate these ideas in its strategic thinking.

Major Goals

The following goals have been established for the Mineral Strategy.

To ensure that geological resources are managed in a way that provides for continuing economic development, enhances the quality of life of Nova Scotians, and supports the concept of environmental protection and sustainable development.

To increase public awareness of the value of the province's geological resources.

To ensure that the regulatory regime supports competitive free-market development of mineral commodities, providing benefits to Nova Scotians through employment, private investment and collection of royalties and taxes.

To continue to be a leader in the country in providing valuable earth science (geoscience) information that provides significant benefits to the province today and in the future.

Values and Principles Guiding the Review

The following values and principles will guide this review of the Mineral Strategy.

The principals of sustainability, including environmental protection and public safety, will be the foundation of all discussions leading to a revised Mineral Strategy.

Integrated Resource Management (IRM) will continue to be the fundamental guiding principal with respect to reviewing mineral resource strategies for Crown lands.

All provincial resources are considered to be valuable and policies developed for mineral resources will recognize this fact.

Use of natural resources is a fundamental requirement for human survival. Mineral resources are required for virtually every aspect of contemporary life. Increases in human population and a demand for manufactured goods will inevitably require more of the planet's resources to sustain this trend.

A balanced economy with important contributions from all natural resources sectors is desirable. Orderly development of geological resources, is required by the province. Mineral development projects from grass-roots exploration through to final site reclamation require significant capital investment with long-term vision and commitment.

Free-market investment in mineral resources is encouraged by the province.

Good decisions require relevant, up to date geoscience information in a suitable form for a variety of potential users.

Nothing is permanent. All geological resources are subject to change over time. Changes caused by human activity should be considered in relation to the overall health of the environment, including the well being of its residents.

Issues and Questions

Geological resources continue to be a primary source of socio-economic stability for many Nova Scotia communities, particularly in rural areas. Nova Scotia's new Economic Growth Strategy, entitled *Opportunities for Prosperity*, recognizes that traditional foundation industries "will remain crucial to the future of our economy."

Nova Scotia has produced a variety of mineral commodities including metals, fuels and building materials. Many of these deposits have been depleted and we no longer produce the diversity of minerals we mined in the past. Today, industrial minerals and construction aggregates account for the majority of the geological resources produced in the province.

Mineral commodities are now traded farther than ever before around the world and the commercial requirements of investors must be met when evaluating mineral deposits. There is a general world-wide trend towards larger mineral extraction projects that can more readily support many of the project overhead costs including environmental assessments, environmental management and site rehabilitation. Most of Nova Scotia's mineral production sites would be considered small-scale compared to sites in many other areas of Canada and the rest of the world.

The Economic Growth Strategy also places a high priority on promotion of the province's recreational opportunities to residents and tourists. There are many examples where the Mineral Resources Branch has contributed its scientific expertise to enhance the experience of visitors. The Mineral Resources Branch works closely with the Regional Services Branch of Natural Resources to provide meaningful interpretation of geological environments for Provincial Park visitors.

Provincial efforts regarding environmental protection require the department's geoscience information. The department has been collecting and interpreting geoscience

information for nearly 100 years and is the only place where a continuous and relatively complete set of information resides. Management of the knowledge base needs to be supported to ensure its value and integrity.

Public expectations related to mineral production activities are also changing. There is greater awareness of how mineral production affects the natural environment both during and following production. Maintaining environmental integrity and biological diversity are now fundamental principals that pervade most planning exercises in the province.

Competition for land access has increased from many sectors of society. As mineral resources are depleted in one area, the search for alternate sources continues. Conflicts do arise and there needs to be a way to accommodate the land access requirements of various sectors of society. The relatively small land mass of the province produces the potential for more land-use conflicts in the future. Land access, overlapping rights, appropriate buffer-zones and sequential land use are issues requiring further discussion.

All of these are areas we wish to explore in greater detail. To aid us in our evaluation of issues important to Nova Scotians, we ask for responses to the following questions and ask for any other comments that would assist the development of new policies.

Importance of Geological Resources for Society

Most Nova Scotians are integrated into the free-market economy, which buys and sells goods and services. Minerals are the basis for most manufactured products.

What is the scope of geological resources available in Nova Scotia and how does use of these resources benefit Nova Scotians?

Impact of Geological Resources on Provincial and Local Economies

Some geological resources contribute to the economy directly, for example a gypsum mine that creates direct employment, purchases goods and services, and ships mineral products by rail and sea. Other geological resources, such as the province's shorelines and beaches, also contribute substantially to our social and economic well being.

How does the development and use of geological resources benefit the local and regional economies in the province?

Public Geoscience Program

The Mineral Resources Branch is the primary source of earth science information for Nova Scotians. Staff of the department have specialized education and extensive experience in many fields of geology. Much of the department's information is directly applicable to mineral resource evaluation; however, there is an increasing demand for detailed geoscience information for other purposes. More and more of this information is now available digitally and through the department's Internet web site.

What role should government geoscience programs play in providing for:
a competitive minerals industry?
environmental stewardship?
public health and safety?
recreation and tourism?
others?

How can access to the province's geoscience information base be improved?

Economic Impacts of Mineral Production in Nova Scotia

Mineral production is a significant contributor to our province's economic and social well being. A recent study (released in 2006) of the economic impact of the industry shows that the mineral industry continues to be the highest paying and one of the most stable employment sectors in the province and in Canada.

Increased global competition and changes in the way materials are managed, for example more recycling of wastes, creates challenges and opportunities for existing and prospective mineral producers.

How can we build upon the experience we have in providing high-quality mineral products to Nova Scotians and the rest of the world?

What are the strengths and weaknesses of our current industry in contributing to the provincial economy?

Business Climate

Nova Scotia has at times led the nation in mineral production in commodities such as gypsum, iron, salt and coal. This mineral development activity produced a large number of commercial ventures, which often included value-added manufacturing.

The province's geographic location and transportation infrastructure, especially access to ocean vessels and rail, provide a competitive advantage for production of many mineral commodities. A long history of mining and the availability of a stable workforce also adds to our global competitiveness. Still, the challenges of competing in a large international free-market economy requires a local business climate that is supportive of the industry while protecting the interests of other Nova Scotians.

Does the existing business climate in Nova Scotia encourage or discourage investment in developing mineral resources and how can we improve our attractiveness?

What changes should be considered to make mineral production more acceptable to local communities?

To what extent can or should local interests, represented through municipalities, influence mineral development activities?

Access to Land

With a relatively small land mass and a Crown land holding that represents approximately 25% of the province, access to land can be more of an issue in Nova Scotia than in other jurisdictions. There are very few areas of the province that might be considered remote, leading to frequent contact between residents, visitors, and resource users.

Do current rules respecting land access for mineral exploration and development adequately address the interests of land-owners and mineral rights holders?

What changes could improve and clarify land access issues for mineral development proponents and land owners?

Mineral Tenure Regulations and Overlapping Interests

Ownership of geological resources in Nova Scotia is vested variously in the Crown or the landowner, under the auspices of the Mineral Resources Act:

- minerals as defined in the *Mineral Resources Act* are vested in the Crown which may issue mineral leases to private interests;
- other geological materials including gypsum, some limestone, construction aggregates, sand and gravel, and peat belong to the land owner;
- development of gypsum and limestone mines requires registration under the *Mineral Resources Act*;
- other materials such as construction aggregates or dimension stone are not required to register under the MRA and are not subject to the collection of royalties on production.

There can be overlapping interests between land owners and mineral rights holders wishing to explore for or extract publicly or privately owned resources. Certainty of mineral tenure is an important aspect of evaluating the economic viability of mineral deposits.

What aspects of Nova Scotia's land ownership and mineral tenure system encourage or discourage mineral development and where are the opportunities to make improvements?

Materials Not Regulated Under the Mineral Resources Act

Most common building materials including naturally occurring sand and gravel, crushed aggregates and dimension stone are produced in pits and quarries. Production of these materials is subject to the *Environment Act* and the *Pit and Quarry Guidelines*. In contrast, many North American jurisdictions administer these materials under legislation and regulations similar to those in place for minerals.

Should Nova Scotia have a legislative regime for materials not subject to the *Mineral Resources Act* similar to that in place for minerals?

What alternatives to the current regulatory regime that could improve the effectiveness

and efficiency of this industrial sector?

Secondary Manufacturing and Value-added Opportunities

Secondary manufacturing requires raw materials and increases opportunities for employment and capital investments. Some raw materials can be shipped in bulk over long distances, for example gypsum, however, as transportation costs rise there may be more opportunities for adding value locally.

A number of value-added products are currently manufactured directly from minerals mined in the province. Products include Portland cement, clay bricks, ready-mix concrete, pre-cast concrete pipes and decorative cut-stone. In the past we also produced steel products and gypsum wallboard.

What opportunities and constraints exist to add value to mineral production through secondary manufacturing?

Environmental Management and the Social License to Operate

The acceptance of mineral production activities by local communities and the broader Nova Scotian public is sometimes difficult to gauge. Many communities exist near mineral production or secondary manufacturing sites. The type of material being excavated and the mining method employed have a significant effect on potential off-site impacts. Some mineral production sites are relatively short lived while others can exist for decades. The issues of concern for local residents can be different from site to site.

What are the environmental costs of mining and secondary manufacturing?

How can we evaluate costs versus benefits?

What are the factors that should most influence decision-makers when they are evaluating the relative cost/benefit of a specific mineral development project?

Mineral Production Legacy Issues

Many former mineral production sites lie on Crown land and require monitoring and in some cases remedial work to address public safety or environmental issues that currently exist.

What issues are of most concern to residents related to abandoned mine sites that pre-date existing reclamation standards?

To whom should the responsibility fall to address the environmental and public safety issues left by historical mining activities?

Resource Promotion - 'Worth Exploring'

Promotion of mineral resources has been undertaken by DNR for several decades. As geoscience information is collected and synthesized, staff of the department's Geological Services Division use this information to evaluate and promote the mineral resource potential of the province at industry trade shows and conferences.

How can we improve the department's promotion of Nova Scotia's mineral resources to potential developers?

Orderly Development of the Province's Mineral Resources

Provincial laws, regulations and policies control and monitor the activities at mineral production sites. Several provincial acts and regulations apply, including the *Mineral Resources Act*, the *Environment Act* and the *Occupational Health and Safety Act*. The province's One Window review process coordinates the provincial regulation of the mineral industry.

What improvements can be made to our regulatory processes to ensure that the Province's geological resources are developed in an orderly, consistent and beneficial manner?

The Future of Mining in Nova Scotia

Consumption of mineral-based commodities is likely to increase with an increase in population. In addition, as we expand and rebuild our current infrastructure, materials such as construction aggregates and Portland cement will be required in greater quantities.

Mineral production requires a team of specialized tradesmen and professionals to be successful. The skills required include equipment operations, construction, mechanical repair, geology, engineering and environmental science.

Given the province's endowment of useful mineral commodities, should Nova Scotia pursue an active policy of encouraging development of these resources?

If mineral development is to be an important part of the province's economic future, how can the importance of this activity be effectively communicated to Nova Scotians?

How do we attract people to work in the mineral industry to ensure appropriate skills are developed to achieve operational excellence?

~~In Nova Scotia products such as table salt, brick and concrete are produced within the province from minerals mined in the province. The secondary manufacturing industry employs thousands of people within the province and many would not exist without the materials produced by mining.~~

~~In addition there is a large export market for some materials mined in the province, for example, gypsum for wallboard manufacturing.~~

Figure 5 shows that between 1987 and 1996, when underground coal mining was operating at near peak production the value of coal produced was between \$200 and \$250 million per year. During this same period coal mining operations employed more than 4,000 people.