MINERAL RESOURCES OF THE ATLIN TAKU REGION

BACKGROUND REPORT

Prepared by:
Anastasia Ledwon, B.Sc. Hungry Hill Geological, Ltd.

Prepared for:
Province of British Columbia, Integrated Land Management Bureau
Table of Contents:

1 CONTEXT ................................................................................................................ 4

2 INTRODUCTION...................................................................................................... 5

3 BRITISH COLUMBIA EXPLORATION HIGHLIGHTS FOR 2007 .................... 5

4 CURRENT UNDERSTANDING OF MINERAL RESOURCES ....................... 6

4.1 Bedrock Geology of Atlin-Taku Plan Area ................................................................. 6
  4.1.1 Introduction: ........................................................................................................ 6
  4.1.2 Geology of the Atlin-Taku plan area: ............................................................... 7

4.2 Mineral Assessment and known Mineral Deposits in the Atlin-Taku Plan Area ........ 10
  4.2.1 Metallic Mineral Resources ............................................................................... 10
  4.2.2 Placer Resources ............................................................................................. 22
  4.2.3 Industrial Mineral Resources ........................................................................... 24
  4.2.4 Energy Resources ............................................................................................ 25

4.3 Geographical Considerations for Mine Development and Mineral Infrastructure .... 25
  4.3.1 Geographical Consideration for Mineral Development .................................... 26
  4.3.2 Mineral Infrastructure in Atlin-Taku Communities .......................................... 27

4.4 Strategic Planning Considerations Related to Mineral and Energy Resources .......... 27

4.5 Economic Perspective on Mineral Development ..................................................... 28

4.6 Global Significance of Mineral Resources ............................................................... 30

5 ADMINISTRATION AND REGULATION OF MINERAL RESOURCES .... 30

5.1 Mineral Tenure ..................................................................................................... 31

5.2 Mineral Exploration Permitting ............................................................................. 32

5.3 Mine Development Permitting ............................................................................... 32

5.4 Access Management .............................................................................................. 33
  5.4.1 Mineral Resource Access .................................................................................. 33

6 ISSUES FACING THE MINERAL SECTOR ......................................................... 35

7 SUMMARY .............................................................................................................. 35

8 GLOSSARY .............................................................................................................. 37

9 REFERENCES .......................................................................................................... 39
LIST OF TABLES:

Table 1: List of “past producing” mines (compiled from the Ministry of Energy and Mines Minfile database). ................................................................. 12
Table 2: Summary of mineral exploration work. [Note: highlighted rows are those projects entering the mining phase.] ........................................................................... 16
Table 3: Hardrock and mineral deposits with known reserves ................................................................................................................................. 19

LIST OF MAPS:

Map 1: Atlin Taku planning area ................................................................................................................................. 41
1 Context

The Province of British Columbia, represented by the Integrated Land Management Bureau (ILMB) and the Taku River Tlingit First Nation (TRTFN), is preparing to undertake joint land use and fish and wildlife management planning in the Atlin Taku region of northwest British Columbia. These planning processes will result in increased certainty on the landscape through delineation of land use zones and criteria governing the management of fish and wildlife.

This report was commissioned by and completed for the province to improve understanding of the mineral resources associated with the Atlin Taku planning area. This background report summarizes and synthesizes the existing state of knowledge of mineral resources in the planning area including their global and historical significance, administration, regulation and tenure.
2 Introduction

This background report provides information on mineral resources in the Atlin Taku planning region. The Atlin Taku planning region, located in northwestern British Columbia, is approximately 5.5 million hectares in area (Map 1). It covers the Atlin Lake and Taku River watersheds. The mining and exploration sector is a significant economic contributor to the Atlin region—exploration expenditures for the Northwest Region in 2006 were $128M. As the province and the TRTFN undertake a land use plan in the Atlin Taku area that will delineate the two-zone system for mining, it is important to have up-to-date information about mineral resources in the planning area.

Key components of this document include:

- An overview of exploration highlights in British Columbia for 2007
- A background of the current understanding of mineral resources in the Atlin Taku Region including an overview of:
  - the major geological features of the area
  - mineral resources in the plan area
  - exploration: both past and potential future
  - other potential resources: placer, industrial minerals, energy and geothermal
- A review of development considerations
- An overview of the pertinent administration considerations and regulations
- A review of key issues facing the mineral sector

3 British Columbia Exploration Highlights for 2007

- Exploration expenditures were nearly $416 million, up 57 per cent from 2006 and 1,300 per cent over the 2001 investment level of $29 million.

- Total exploration drilling reached about 1.254 million metres during the year, up over 51 per cent from the 830,000 metres drilled in 2006.

- Number of exploration projects with budgets in excess of $1 million was 102, up 42 per cent from 2006.

- Number of major exploration projects with budgets in excess of $100,000 was 315, up 31 per cent from 2006.

- There were 472 exploration projects for minerals, coal, industrial minerals and aggregates throughout B.C.

- Number of new mine proposals is 23: 13 metal mines, 7 coal mines and 3 industrial
minerals operations.

- Number of mines in production is 57: 11 metal, 10 coal and 36 industrial minerals
- Number of projects under environmental review is just over 20
- Four new mines commenced production: Swamp Point (northwest) and Orca (southwest), Brule and MAX molybdenum
- Eight new mines in the last three years.
- B.C. is estimated to account for about 17 per cent of Canadian mineral exploration investments during 2007, up from about 7 per cent in 2000
- Exploration expenditures by mining region:
  - Northwest: $170.2 million, 144 projects
  - Northeast: $10.5 million, 10 projects
  - Central: $94.6 million, 88 projects
  - South Central: $84.4 million, 119 projects
  - Southeast: $43 million, 78 projects
  - Southwest: $13 million, 33 projects

- B.C. total: $415.7 million, 472 projects

4 Current Understanding of Mineral Resources

4.1 Bedrock Geology of Atlin Taku Plan Area

4.1.1 Introduction:
The science of geology, as in other fields, is replete with terminology that can overwhelm and confuse non-specialists. To facilitate the layperson’s understanding, the geologic terminology in this report has been simplified in regards to: (1) geologic time, (2) mineral and rock names, and (3) names of rock formations.

(1) Geologic Time: Geologic time is measured by two independent systems: a relative scale devised from paleontology (the study of ancient life) and an absolute scale derived from the precise radioactive decay of certain chemical elements. Just as carbon is used to date artifacts thousands of years old, isotopic pairs of potassium-argon, rubidium-strontium and uranium-lead are used to date rocks that are one million to hundreds of millions of years old. The paleontologic scale gives rise to geologic periods, each about 50-70 million years long (Mississippian, Permian, Triassic, Jurassic etc.) and a long and unwieldy series of 2- to 15-million-year-long stages. These appear in the legend of all geologic maps and convey a great deal of information.

\[1\] Section 3.1 from Wojdak, in Horn and Tamblyn, 2002, pgs19-22.
(to geologists) about how a map unit (rock formation) relates to other areas, its place in the evolution of Cordilleran geology and even the types of metallic and industrial mineral deposits that might be present, all of which might not be apparent to non-specialists. For this reason, geologic time periods are abandoned in this report in favour of the absolute time scale, a simplification that goes against certain geologic principles.

(2) **Mineral and Rock Names**: Only the most basic rock names are used in the report, such as limestone, basalt and granite and only a few mineral names are used.

(3) **Names of Rock Formations**: the geologic framework is presented as terranes, rather than a much larger number of rock formations. A *terranes* is a sequence of related rocks that formed in a single geologic setting. Only the names of a few distinctive formations are used that are likely to be familiar to residents of the area. Rock formations are named during geologic mapping of an area and are correlated to formations in adjacent areas. While some correlations are precise, others may involve changing facies (past depositional environments) or changes to the age range. Although geologists are familiar with the succession of formation names and appreciate the significance and subtleties of regional correlation, most laypeople would find this information meaningless.

### 4.1.2 Geology of the Atlin Taku plan area:

The Atlin Taku District presents a great transect of Cordilleran geology, including rocks of vastly different origin that span 500 million years representing more geologic diversity than any other land planning area in British Columbia. For this report, the geology is simplified into four northwesterly geologic *terranes*: Yukon-Tanana, Cache Creek, Stikine and Alexander. In their early history terranes developed independently, with a unique mineral endowment far from their present location. They were amalgamated with North America by processes of plate tectonics. Boundaries between terranes are major faults, sometimes called sutures. After continental accretion igneous intrusions, volcanic fields and sedimentary basins were superimposed onto this geologic collage. These are called *overlap* assemblages and provide evidence of when the terranes were bound together. The most extensive of these younger geologic events constitutes a fifth division of the Atlin Taku district, the Coast Range granite belt. The following paragraphs provide more technical information on the four northwesterly geologic terranes.

**Yukon-Tanana** terrane comprises two areas of metamorphic rocks in the Atlin-Taku district. The larger east arm is up to 70 km across and is that part of the district east of Teslin Lake. The Teslin fault, which bounds the east arm, underlies Teslin Lake and continues southeast along the Jennings River. The west arm lies along the B.C.-Alaska border and is just 10-20 km wide. It is bounded by the Llewellyn fault to the east and largely engulfed by Coast Range granite on the west, so that it is discontinuous. Yukon-Tanana metamorphic rocks were originally sedimentary and volcanic strata, derived from an arc of volcanoes on the continental margin of North America 325 to 390 million years ago. High temperature and pressure metamorphosed Yukon-Tanana rocks into quartzite, schist, gneiss and marble, while also deforming the layered rocks into tight folds. These folds are evident on a micro-scale (centimetres) as well as a macro-scale (tens of kilometers). As its name implies, Yukon-Tanana terrane extends across central Yukon into Alaska.
Cache Creek terrane consists of rocks formed 225 to 350 million years ago in an ocean basin that lay between the two arms of Yukon-Tanana rocks. Cache Creek terrane is the compressed remnant of that ocean basin and its rocks. The compression caused tight folding and thrust faulting and the stacking of older rock sequences on top of younger. Cache Creek terrane is 80 km wide and extends 150 kilometers across the plan area. It was joined to ancient North America along two plate-bounding subduction zones, the Teslin fault to the east and the Nahlin fault to the southwest. Cache Creek terrane extends to Dease Lake, and far beyond to its namesake locality in southern British Columbia. The rocks in this terrane consist of basalt lava formed at a mid-ocean ridge, deep water sedimentary rocks (argillite and chert), limestone reefs originally anchored to island volcanoes, and bodies of serpentine (a dense igneous rock brought up from the mantle along deep faults). Serpentine is particularly abundant east of Atlin village and some geologic theories link it to the area’s famous placer gold. Prominent grey limestone bluffs and orange-brown weathering serpentine are part of the distinctive geologic landscape of the Atlin area. Most of the Atlin (104N) map-sheet is underlain by Cache Creek terrane and, in 2000, the federal and provincial Geological Surveys began a joint program to improve the quality of geological mapping. This included an aeromagnetic survey, completed in 2002, providing important data that will assist with geologic interpretation.

Stikine terrane is a 200- to 225-million-year-old volcanic island arc. It is 100 km wide at the southern end of the Atlin Taku plan area but narrows to just 20 km wide north of the Taku River to the Yukon border. Rock textures show that eruptions ranged from violent explosions producing coarse debris to “quiet” effusions of lava. Chemically similar stocks (igneous bodies <5 km in size) that cut the volcanic rocks and are of similar age are interpreted to be bodies of magma that produced the eruptive rocks. Some of these granite to diorite intrusions contain vein stockwork deposits of copper and gold (see section 4.3.1). The volcanic rocks are overlain by a persistent limestone unit, the Sinwa formation, that extends from the Tulsequah map-area to Whitehorse. The geologic base upon which the volcanic arc developed is exposed in two principal areas: near the junction of the Tulsequah and Taku rivers where the Tulsequah Chief, Big Bull and Polaris Taku mines are found, and in the vicinity of Tatsamenie Lake where the Golden Bear mine is located. Stikine basement rocks are identical in age and similar in composition to the Yukon-Tanana terrane but were not subjected to high temperature and pressure of metamorphism. An important similarity is the presence of bedded copper-zinc-silver-gold deposits (see section 4.2.1).

Alexander terrane is largely restricted to the Alaska panhandle and has limited extent in British Columbia. Other than a small area on the north coast near Prince Rupert, the B.C. segment of Alexander terrane is essentially within Alsek-Tatshenshini Park. It lies west of the Haines highway, which approximately delineates the terrane-bounding Denali fault. Alexander terrane has been called a micro-continent and has its own long and complex history that is completely foreign to the terranes described above. Its major components are a 350- to 500-million-year-old succession of sandstone, shale, deep ocean basalt and shallow water limestone, overlain by mid-ocean rift volcanic rocks and deep water limestone (about 200 million years old) all of which are intruded by granites from 150 million years to as young as 20 million years old.

Other geological features:
The principal sedimentary overlap assemblage is called the **Whitehorse Trough**, a subsiding marine basin formed on top of Stikine and Cache Creek terranes 175 to 200 million years ago. A thick sequence of conglomerate, sandstone and argillite formed from material eroded from Stikine terrane and shed eastward and northward along the axis of the basin. As the name implies, the basin extends into southern Yukon. The strata were folded, faulted and weakly metamorphosed during younger geologic events. As in all sedimentary basins, the Whitehorse Trough has petroleum potential determined by amount of hydrocarbon in the source rocks, the temperatures attained during metamorphism and the presence of trapping structures, or reservoirs. In the Whitehorse Trough, temperatures may have exceeded the limit for survival of oil and gas and structural deformation may have ruptured potential reservoirs.

**Igneous intrusions** were emplaced during and after the amalgamation of Yukon-Tanana, Cache Creek, Stikine and Alexander terranes, and were derived from partial melting of crustal plates during collision. These can be divided into two groups: (a) numerous individual batholiths (igneous intrusions 5 to 30 km across) and stocks (bodies less than 5 km in diameter) that are widely distributed and (b) the **Coast Range** granite belt, a well-defined composite zone of batholiths that runs the length of the Canadian Cordillera. For simplicity in this report, all these igneous intrusions are referred to as granite. In detail, there is a spectrum of composition that includes granite, syenite, monzonite, granodiorite, diorite and various other varieties. The first group of isolated intrusions, at 75 to 180 million years old, is older than the Coast Range, which formed 50 to 100 million years ago. In the Atlin-Taku plan area, the Coast Range belt forms a zone 50 to 80 kilometres wide superimposed on Yukon-Tanana, Alexander and Stikine terranes. In width, it extends from the head of Tutshi Lake to the Haines Highway. Individual intrusions of the first group include the Fourth of July batholith north of Atlin, a particularly distinctive body with large pink feldspar crystals, and the Surprise Lake batholith. Granite bodies of this group are more important with respect to mineral deposits (see section 4.2.1) than the Coast Range belt, which contains few mineral occurrences throughout its length in British Columbia.

**Volcanic fields** that erupted at discrete time intervals during late Cretaceous to early Tertiary time comprise the youngest overlap assemblage. The most extensive is the Sloko volcanic field, formed about 55 million years ago. It covers a 20-kilometre by 35-kilometre area south of Atlin Lake. Remnants of its original distribution extend south to Tatsamenie Lake, north to the Bennett Lake caldera on the B.C.-Yukon border and west in the Coast Range. Sloko volcanism is a comparatively young geologic event. The Cordillera was nearly in its present form when these volcanoes erupted in a continental, subaerial setting. Sloko volcanic rocks were deposited onto Stikine terrane, western Yukon-Tanana, the Coast belt and a small part of Cache Creek terrane. Older volcanic centers, 80 to 90 million years old, are restricted in area and difficult to distinguish from Sloko volcanics, but are more important with respect to mineral deposits. Examples occur at Montana Mountain on the Yukon border, at Table Mountain near the head of Graham Inlet, and between Trapper Lake and the Sutlahini River. Small intrusions and dikes that supplied magma to these volcanoes are abundant between Tulsequah and Tatsamenie Lake and are responsible for certain mineral occurrences and prospects. Volcanic eruptions within the last million years include accumulations on Heart Peaks and the Ruby Creek lava flow. These are coeval with the Mount Edziza and Level Mountain volcanic edifices.
4.2 Mineral Assessment and known Mineral Deposits in the Atlin-Taku Plan Area

4.2.1 Metallic Mineral Resources

Metallic mineral deposits can be divided into two broad groups: those that form at the same time as their enclosing volcanic or sedimentary rocks are deposited, and those that are conformable with stratification, called bedded deposits. A variety of deposit types can form after sediments and volcanic deposits are consolidated into rocks. Those referred to in this report are vein, vein stockwork, replacement and skarn deposits.

The reader is advised to refer to Section 4.1 for an understanding of the geologic terminology and “terrane” descriptions and Section 1.0 for basic descriptions and definitions relevant to mineral resources.

Bedded deposits are most prevalent in 300- to 380-million-year-old volcanic rocks that comprise Yukon Tanana terrane and the oldest (basement) rocks of Stikine terrane. The most significant historic mines in the Atlin Taku area, Tulsequah Chief and Big Bull, are bedded deposits. Several large bedded copper-zinc-silver-gold deposits were discovered in Yukon-Tanana terrane in the Finlayson Lake area of southern Yukon in the late 1990s. These discoveries immediately raised the perceived potential for similar deposits in equivalent rocks in nearby British Columbia. Metamorphism masks the original nature of rocks in Yukon-Tanana and complex folding makes it challenging to map out. Although both recent mapping conducted by the B.C. Geological Survey (i.e. Mihalynuk in B.C. Geological Survey Paper 2000-1), and a geophysical survey completed in 2002, has refined our knowledge of areas that might contain bedded copper-zinc-silver deposits, follow-up prospecting is still required.

The 200-million-year-old mid-ocean rift volcanic rocks of Alexander terrane are extremely rich in bedded copper-cobalt and copper-zinc-silver-gold deposits. These rocks occur in two small areas in Canada, in the Tats Creek and Rainy Hollow areas. The Tats Creek area contains the enormous Windy Craggy deposit, discovered in 1958, and several other deposits nearby. A second area of these highly prospective rocks is south of Rainy Hollow and includes mineral prospects on Mount Henry Clay. This second area extends eastward into Alaska (south of the Klehini River) where other prospects are under active exploration. There are no other correlative rocks in the plan area.

Veins are the most common and widespread of mineral deposit types. They can be the least difficult to discover and many of the earliest mines were gold-bearing quartz veins. The Engineer, Polaris Taku and Venus mines (the latter just outside the planning area) are examples. Quartz veins in serpentine may be the elusive source of rich placer gold in the Atlin area. Large gold deposits in bedrock have been found in many placer districts in the world but only small deposits have been discovered to date near Atlin.

Vein deposits form from mineral-laden fluids that are channeled through faults and fractures. The fluids are often derived from intrusion of granite or eruption of volcanoes, but are also

---

2 Section 3.2.1 from Wojdak, in Horn and Tamblyn, 2002, pgs46-51.
driven out of sediments and rocks during compaction and metamorphism, so that veins can be found in almost all geologic environments. The richest vein deposits are those formed close to surface in areas of volcanic activity. Rich “bonanza-grade” gold and silver mines occur worldwide. This type of deposit is the target of active exploration of gold-silver-copper veins under on the Thorn property. Other examples are a cluster of gold showings near a Sloko volcanic caldera west of Bennett Lake and a history of exploration at Heart Peaks. Examples of veins associated with granite include the Atlin-Ruffner silver mine, gold-cobalt veins at Red Cap and antimony-gold-silver veins at Zohini. These deposits exhibit the diversity of metals that can occur in veins.

The largest vein deposits are those associated with long-lived and/or major faults. The Llewellyn fault, active during the time of Sloko volcanism, contains a series of gold and polymetallic vein deposits from the Taku River to the Yukon border, including Polaris Taku, Engineer and veins in the Teepee Peak and Pavey areas. The polymetallic veins contain copper, lead, zinc, silver, arsenic and antimony, but gold is the commodity generally of most interest. Commonly, the vein deposits occur in splay faults up to a kilometre from the Llewellyn fault.

**Replacement** gold deposits, such as Golden Bear, represent an unusual variation of the vein deposit type. At Golden Bear, the ore fluid migrated along a large fault until it encountered a reactive limestone within the 300-million-year-old basement rocks of Stikine terrane. Reaction of the fluid with the limestone produced a gold-bearing siliceous replacement instead of a quartz vein. The mineral fluids were probably related to the Sloko volcanic event. Inlaw, Outlaw, Bandit and Slam are other replacement gold prospects near Golden Bear.

**Vein stockworks** (known as porphyry deposits to geologists) are an important variation of simple vein deposits. They are within, or on the immediate periphery of, granite intrusions and result from complete fracturing of the rock and infilling by a myriad of narrow veins. The veins are too small to be mined individually; however, where they extend through a sizeable volume of rock mineralization may support bulk mining, as in open pit mines at Kemess, Highland Valley and elsewhere in British Columbia. Vein stockwork deposits occur in various small to mid-size granite stocks and batholiths in all terranes, but are notably absent from the large composite granite intrusions found in the Coast Range. The Surprise Lake batholith (in Cache Creek terrane) contains the large, stockwork Adanac molybdenum deposit and many other molybdenum and tungsten occurrences. Similar molybdenum, tin and tungsten mineralization is widespread in the area, occurring in the Parallel Creek batholith (at the head of Teslin River), the Christmas Creek stock (near Kedaha Lake, south of Jennings River) and at Mount Ogden. The large stockwork Logtung tungsten-molybdenum deposit (in Yukon-Tanana terrane) is only a few hundred metres north of the Yukon border, northeast of Swan Lake. In Stikine terrane, the many intrusions of granite to diorite that fed island-arc volcanoes stand a good chance of containing vein stockwork copper-gold deposits. The most significant area is at Kaketsa Mountain near the junction of the Sheslay and Hackett Rivers. There are many intrusions in the Atlin-Taku area (e.g. Llangorse, Nome Lake, Simpson Peak, Klinkit, and Glundebery batholiths) but only a few contain vein stockwork deposits.

**Skarn** deposits form by the reaction between granite magma and limestone, resulting in a complex mineral assemblage that can include copper, tungsten and other metals. The Maid of
Erin mine is a copper-silver-gold skarn deposit in Alexander terrane that operated intermittently from 1911 to 1956. It is one of many skarn deposits and silver-lead-zinc veins near Rainy Hollow that are associated with a granite and granite/limestone contact and are now within Alsek Tatshenshini Park.

4.2.1.1 Past Production Hard Rock Minerals

Though placer mining was the initial draw to the Atlin area, the search for the “mother lode” followed close on its heels. As available placer ground grew scarce in 1898, the interest in quartz properties increased, leading to extensive staking of mountains and high valleys around Atlin.

The first mining operations in the plan area were located half a kilometre south of Atlin, on the Anaconda property. In the spring of 1900, construction began on camp facilities, workshops and a stamp mill. Tunneling encountered low-grade ore that could not be profitably mined and the property was abandoned. Though this first mine failed, the investors were not ready to leave. Later in 1900, they opened the Imperial property and processed the ore at the Anaconda site. The mill was later moved to Munroe Mountain where it also processed ore for several other mine owners.

Table 1 is a list of past producing mines compiled from the Ministry of Energy and Mines Minfile database. The table only includes properties from which ore was shipped. Numerous lode mine prospects around Atlin, such as the Anaconda property, provided employment to miners developing shafts and tunnels to test the ore. However, as these properties do not have recorded ore production, they are not included on the list.

**Table 1**: List of past producing mines (compiled from the Ministry of Energy and Mines Minfile database).

<table>
<thead>
<tr>
<th>MINFILE #</th>
<th>Mine Name</th>
<th>Location</th>
<th>Years of Production</th>
<th>Commodities</th>
</tr>
</thead>
<tbody>
<tr>
<td>104N 008</td>
<td>Imperial</td>
<td>Atlin-Warm Bay Road</td>
<td>1899-1900</td>
<td>Gold</td>
</tr>
<tr>
<td>104N 006</td>
<td>Black Diamond</td>
<td>Atlin-Surprise Lake</td>
<td>1943</td>
<td>Tungsten</td>
</tr>
<tr>
<td>104N 044</td>
<td>Pictou</td>
<td>Atlin-Pine Creek</td>
<td>1968</td>
<td>Silver, Lead, Zinc</td>
</tr>
<tr>
<td>104M 014</td>
<td>Engineer</td>
<td>Tagish Lake</td>
<td>1913-18, 1925-28, 1932-34, 1944-46, 1949, 1952</td>
<td>Gold, Silver</td>
</tr>
<tr>
<td>104M 011</td>
<td>Ben-My-Chree</td>
<td>Tagish Lake</td>
<td>1911</td>
<td>Gold, Silver</td>
</tr>
<tr>
<td>104M 001</td>
<td>Gridiron</td>
<td>Bennett Lake</td>
<td>1901</td>
<td>Gold, Silver</td>
</tr>
<tr>
<td>104K 007</td>
<td>Banker</td>
<td>Tulsequah River</td>
<td>1935</td>
<td>Gold, Silver, Lead</td>
</tr>
<tr>
<td>104K 008</td>
<td>Big Bull</td>
<td>Tulsequah River</td>
<td>1951-57</td>
<td>Gold, Silver, Copper</td>
</tr>
</tbody>
</table>
Past producing mines in the Atlin and Tagish Lake area were generally small, underground mines exploiting mineralized veins. The most significant operations were the Atlin Ruffner and Engineer mines, which have undergone several periods of development and hold potential for future mine production.

During the 1920s, the Tulsequah River area began to attract attention, and by 1930 there were 100 prospectors working in the region. Though both the Tulsequah Chief and Polaris Taku deposits were discovered in the 1920s, isolation and difficult access, coupled with a shortage of capital following the stock market collapse of 1929, constrained mine development. In 1934, economics changed dramatically when President Franklin D. Roosevelt raised the price of gold by almost 100 per cent to $35 per ounce.

The Polaris-Taku mine was the first to open. It began operations in 1938 and was in full production from 1939 to 1951, except for 1942 to 1946 when it was closed during the war. The Polaris-Taku mill continued to be used after 1951 to process ore from Tulsequah Chief and Big Bull mines on the opposite side of the Tulsequah River. Though the mines were far from depleted, low metal prices forced the closure of Big Bull and Tulsequah in 1956 and 1957, respectively.

The town of Tulsequah was established in the late 1930s to house mine workers and their families. There was no road connection between the mining town and either Juneau or Atlin, but reliable air transportation served the people there. In summer there was regular launch service to Juneau. In terms of facilities, the community lacked nothing. Residents even enjoyed a downhill skiing facility complete with night lighting and a challenging ski jump (Atlin News Miner, 28 Oct. 1938). Many Taku River Tlingit lived and worked at Tulsequah; elder Jackie Williams, who was born and raised there, became a prospector for Consolidated Mining and Smelting, and later its owner.

The Golden Bear mine, located approximately 140 km west of Dease Lake, is the last of the hardrock mines in the plan area to be shut down and is currently undergoing reclamation operations. The mine began operations mining refractory ore, but later converted to heap leach operations.

Golden Bear was discovered by Chevron Canada in 1981. Extensive surface and underground drilling was conducted from 1982 to 1987 to define the Bear Main deposit and in 1988 a 150-kilometre access road from Telegraph Creek was constructed. Underground mining of refractory
gold ore began in 1989 and continued with both underground and open pit mining until 1994. During this period, the mine operated on a year-round basis.

Wheaton River Minerals purchased the mine on July 2, 1993, when the mine was in shutdown mode with just six months’ reserves left to be mined and processed. Discovery of the Grizzly zone, approximately 400 metres below the mined out Bear Main zone, extended operations to September 1994, when the mine closed due to exhaustion of refractory ore reserves.

Work conducted by Wheaton River from 1994 to 1996 lead to the discovery of oxide gold deposits on the property. Though heap leach operations had never been conducted at latitudes this far north, the company successfully pursued this option. A feasibility study was completed in late 1996 and construction of the first heap leach pad was commissioned in late July 1997. Leaching began on Aug. 6 and the first gold bars were poured on Aug. 13. The official opening of the heap leach mine was on Sept. 17, 1997.

The heap leach mine has operated on a seasonal basis, closing operations during the winter months (generally November to April). Production from the mine has exceeded the output predicted in the feasibility study, with the 1997 gold recovery 19 per cent greater than predicted. A second heap leach pad and processing plant was put into production in the spring of 1998. Mining of the deposits was completed in 2000, however, production from stockpiles and residual leaching continued into 2002.

4.2.1.2 Current Producing Lode Mines

There are no currently producing lode mines, apart from Placer mines, in the plan area.

4.2.1.3 Exploration Activity

4.2.1.3.1 Regulatory Framework:

Mineral exploration is conducted in accordance with the Mineral Exploration Code and Mines Act of B.C. Prior to conducting any mechanical disturbance of the land, the work program must be approved by the Ministry of Energy and Mines and sufficient reclamation securities put in place to ensure that the site is reclaimed. Work programs are referred to affected agencies and First Nations for comment, which is then taken into consideration when approving (or disallowing) proposed mineral exploration.

Full approval of a work program may also require that permits from other ministries be obtained. For example, where timber will be cut as part of a program, a free use permit or licence to cut is required from the Ministry of Forests. Similarly, for road construction off mineral tenures, a special use permit must be obtained from the Ministry of Forests. Programs involving use of surface water must obtain a water use approval or water licence from the Ministry of Environment, Lands and Parks.

Most mineral exploration programs involve minimal disturbance of the land. However, where significant volumes of mineralized rock (i.e. greater than 1,000 tonnes) are to be blasted as part of a sampling program, testing for acid rock drainage potential is required. Similarly, though not
required by the Ministry of Forests, the Ministry of Energy and Mines will request acid rock
testing where road development requires blasting of mineralized rock.

4.2.1.3.2 Recent Mineral Exploration in the plan area:

Table 2 is a summary of major mineral exploration work conducted in the plan area between
2002 and 2007. Information in the table is compiled from exploration and mining summary
reports by the BCGS.

The past-producing Tulsequah, Big Bull and Polaris Taku mines in lower Tulsequah River valley
were evaluated for renewed mining by Redfern (now Redcorp) Resources Ltd. and Canarc
Resource Corporation, respectively. Tulsequah Chief and Big Bull are zinc-copper-lead-silver-
gold deposits and Polaris-Taku (now New Polaris) was a gold mine. Drilling programs, renewed
resource calculations (NI 43-101 compliant) and future mine planning/initial mine construction
were the major projects undertaken at these properties.

Several properties in the region changed ownership as exploration projects increased in size and
scope. Numerous placer gold claims in the Atlin area moved into recovery phase, most notably
the Yellow Jacket property in 2007.

Through 2006, drilling programs made up the bulk of exploration expenditures, but into 2007
more grassroots projects appeared, focusing on mapping and surficial exploration. In part, lack of
access to the unexplored areas of the region limits test drilling programs until basic prospecting
or other grassroots work indicates the high likelihood of finding ore, justifying the expense of
flying in drilling equipment.
Table 2: Summary of mineral exploration work. [Note: highlighted rows are those projects entering the mining phase.]

<table>
<thead>
<tr>
<th>Property</th>
<th>MINFILE #</th>
<th>Operator</th>
<th>Location</th>
<th>Commodities</th>
<th>Year</th>
<th>Work Conducted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tulsequah Chief</td>
<td>104K 002</td>
<td>Redfern Resources</td>
<td>Tulsequah River</td>
<td>Silver, Gold, Cadmium, Copper, Lead, Zinc</td>
<td>2002</td>
<td>Received Project Approval Certificate from MEMP and MSRM to develop 2250 tonne/day underground copper, lead, zinc, gold, and silver mine. Also, to construct 162-km access road from Atlin.</td>
</tr>
<tr>
<td>Thorn</td>
<td>104K 031</td>
<td>Rimfire Minerals Corp.</td>
<td>125km SE of Atlin</td>
<td>Gold, Silver</td>
<td>2002</td>
<td>Drilling</td>
</tr>
<tr>
<td>Adanac</td>
<td>104N 007</td>
<td>Stirrup Creek Gold Ltd.</td>
<td>Boulder Creek</td>
<td>Molybdenum, Gold</td>
<td>2002</td>
<td>Magnetic survey, rock and soil sampling</td>
</tr>
<tr>
<td>Beavis</td>
<td>104N 007</td>
<td>Gary Lee</td>
<td>Atlin</td>
<td>Gold</td>
<td>2002</td>
<td>Trenching</td>
</tr>
<tr>
<td>Yellow Jacket</td>
<td>104N 043</td>
<td>Lenard Diduck</td>
<td>Pine Creek</td>
<td>Gold</td>
<td>2002</td>
<td>Trenching</td>
</tr>
<tr>
<td>Golden Eagle</td>
<td>104M 071, 104M 074, 075</td>
<td>Marksmen Resources Ltd.</td>
<td>Tutshi Lake</td>
<td>Gold, Copper</td>
<td>2002</td>
<td>Surface and underground drill program; independent audit for 43-101 compliance; study to determine infill drill program to upgrade inferred resources.</td>
</tr>
<tr>
<td>Titan</td>
<td>104M 037, 073</td>
<td>Eagle Plains Resources Ltd.</td>
<td>40 km W of Atlin</td>
<td>Molybdenum</td>
<td>2003</td>
<td>Grab samples; IP surveying; drill planning.</td>
</tr>
<tr>
<td>Yellow Jacket</td>
<td>104N 043</td>
<td>Muskox Minerals Corp.</td>
<td>Pine Creek</td>
<td>Gold</td>
<td>2003</td>
<td>Drilling</td>
</tr>
<tr>
<td>Tulsequah Chief</td>
<td>104K 002</td>
<td>Redfern Resources</td>
<td>Tulsequah River</td>
<td>Silver, Gold, Cadmium, Copper, Lead, Zinc</td>
<td>2003</td>
<td>Drilling; resource study for 43-101 compliance; engineering studies of mining methods, underground access; type of processing plant, and transportation options; metallurgical testing.</td>
</tr>
<tr>
<td>New Polaris</td>
<td>104K 003</td>
<td>Canarc Resource Corp.</td>
<td>Tulsequah River</td>
<td>Gold</td>
<td>2003</td>
<td>Geological mapping; soil geochemistry; drilling</td>
</tr>
<tr>
<td>Yellow Jacket</td>
<td>104N 043</td>
<td>Muskox Minerals Corp.</td>
<td>Pine Creek</td>
<td>Gold</td>
<td>2003</td>
<td>Drilling (over 30,000 m); geologic modelling and calculation of new resource estimate; updated feasibility study; installation of pilot plant to treat acidic water from old mine; geotechnical study for mine tailings disposal.</td>
</tr>
<tr>
<td>New Polaris</td>
<td>104K 003</td>
<td>Canarc Resource Corp.</td>
<td>Tulsequah River</td>
<td>Gold</td>
<td>2004</td>
<td>Drilling</td>
</tr>
<tr>
<td>Thorn</td>
<td>104K 031</td>
<td>Rimfire Minerals Corp. / Cangold Limited</td>
<td>125km SE of Atlin</td>
<td>Gold, Silver</td>
<td>2004</td>
<td>Geophysics (IP survey); Drilling</td>
</tr>
<tr>
<td>Property</td>
<td>MINFILE #</td>
<td>Operator</td>
<td>Location</td>
<td>Commodities</td>
<td>Year</td>
<td>Work Conducted</td>
</tr>
<tr>
<td>---------------</td>
<td>-----------</td>
<td>-----------------------------------</td>
<td>------------------------------</td>
<td>-------------------------------</td>
<td>------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Joss’alun</td>
<td>104N 136</td>
<td>Copper Ridge Explorations Inc.</td>
<td>75 km SE of Atlin</td>
<td>Copper</td>
<td>2004</td>
<td>IP survey</td>
</tr>
<tr>
<td>Ruby Creek</td>
<td>104N 052</td>
<td>Adanac Moly Corp.</td>
<td>Ruby Creek</td>
<td>Molybdenum</td>
<td>2005</td>
<td>Drilling; environmental baseline studies; metallurgical study; tested rock quality of proposed pit wall; began feasibility study.</td>
</tr>
<tr>
<td></td>
<td>074, 085</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yellow Jacket</td>
<td>104N 043</td>
<td>Muskox Minerals Corp.</td>
<td>Pine Creek</td>
<td>Gold</td>
<td>2005</td>
<td>Magnetic survey; drilling</td>
</tr>
<tr>
<td>Tulsequah Chief</td>
<td>104K 002</td>
<td>Redfern Resources</td>
<td>Tulsequah River</td>
<td>Silver, Gold, Cadmium, Copper, Lead, Zinc</td>
<td>2005</td>
<td>Updated resource estimate; updated feasibility study (halted mid-year as project was deemed financially unattractive)</td>
</tr>
<tr>
<td>New Polaris</td>
<td>104K 003</td>
<td>Canarc Resource Corp.</td>
<td>Tulsequah River</td>
<td>Gold</td>
<td>2005</td>
<td>Drilling</td>
</tr>
<tr>
<td>Thorn</td>
<td>104K 031</td>
<td>Rimfire Minerals Corp. / Cangold Limited</td>
<td>125km SE of Atlin</td>
<td>Gold, Silver</td>
<td>2005</td>
<td>Geological mapping; geophysics; drilling</td>
</tr>
<tr>
<td>Kizmet</td>
<td>104K 074,</td>
<td>Barrick Gold Corp. / Rimfire Mining Corp.</td>
<td>Adjoining Thorn</td>
<td>Gold</td>
<td>2005</td>
<td>Geological mapping; prospecting; silt sampling</td>
</tr>
<tr>
<td></td>
<td>090</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ruby Creek</td>
<td>104N 052</td>
<td>Adanac Moly Corp.</td>
<td>Ruby Creek</td>
<td>Molybdenum</td>
<td>2006</td>
<td>Drilling; new project report submitted to EA office</td>
</tr>
<tr>
<td>Tulsequah Chief/Big Bull</td>
<td>104K 002</td>
<td>Redfern Resources</td>
<td>Tulsequah River</td>
<td>Silver, Gold, Cadmium, Copper, Lead, Zinc</td>
<td>2006</td>
<td>Drilling; feasibility study; new resource estimate; holds environmental approval</td>
</tr>
<tr>
<td>Golden Eagle</td>
<td>104M 057,</td>
<td>Signet Minerals Inc.</td>
<td>Tutshi Lake</td>
<td>Gold, Silver</td>
<td>2006</td>
<td>Drilling</td>
</tr>
<tr>
<td></td>
<td>074, 085</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yellow Jacket</td>
<td>104N 043</td>
<td>Muskox Minerals Corp.</td>
<td>Pine Creek</td>
<td>Gold</td>
<td>2006</td>
<td>Bulk sampling program; hydrologic and metallurgical investigations</td>
</tr>
<tr>
<td>Tag</td>
<td>104M 079</td>
<td>CZM Capital Corp.</td>
<td>Taku Arm of Tagish Lake</td>
<td>Gold, Silver</td>
<td>2006</td>
<td>Drilling</td>
</tr>
<tr>
<td>New Polaris</td>
<td>104K 003</td>
<td>Canarc Resource Corp.</td>
<td>Tulsequah River</td>
<td>Gold</td>
<td>2006</td>
<td>Drilling</td>
</tr>
<tr>
<td>Maple Leaf</td>
<td>104K 117</td>
<td>Saturn Minerals Inc.</td>
<td>20 km NW of Tulsequah Chief</td>
<td>Gold</td>
<td>2006</td>
<td>Drilling</td>
</tr>
<tr>
<td>Ruby Creek</td>
<td>104N 052</td>
<td>Adanac Moly Corp.</td>
<td>Ruby Creek</td>
<td>Molybdenum</td>
<td>2007</td>
<td>Received BC EA certificate; construction camp; road work; drilling</td>
</tr>
</tbody>
</table>

**Mineral Background Report**
<table>
<thead>
<tr>
<th>Property</th>
<th>MINFILE #</th>
<th>Operator</th>
<th>Location</th>
<th>Commodities</th>
<th>Year</th>
<th>Work Conducted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tulsequah Chief/Big</td>
<td>104K 002</td>
<td>Redfern Resources</td>
<td>Tulsequah River</td>
<td>Silver, Gold, Cadmium, Copper, Lead, Zinc</td>
<td>2007</td>
<td>New access via inflatable barge on Taku River; road construction; geotechnical assessment of plant side and tailings area; topographic survey; environmental programs; drilling</td>
</tr>
<tr>
<td>New Polaris</td>
<td>104K 003</td>
<td>Canarc Resource Corp.</td>
<td>Tulsequah River</td>
<td>Gold</td>
<td>2007</td>
<td>Preliminary assessment of underground program; pre-feasibility study; environmental baseline studies</td>
</tr>
<tr>
<td>Yellow Jacket</td>
<td>104N 043</td>
<td>Prize Mining Corp.</td>
<td>Pine Creek</td>
<td>Gold</td>
<td>2007</td>
<td>Bulk sampling; construction of gravity processing plant; channel sampling of test-mined blocks; sluicing of gravel from test pit to recover gold</td>
</tr>
<tr>
<td>Wheelbarrow</td>
<td>104N 122</td>
<td>Saturn Minerals Inc.</td>
<td>NE of Atlin</td>
<td>Silver, Lead, Zinc</td>
<td>2007</td>
<td>Geological mapping; trenching; drilling</td>
</tr>
<tr>
<td>Engineer</td>
<td>104M 014</td>
<td>BC Gold</td>
<td>Taku Arm of Tagish Lake</td>
<td>Gold</td>
<td>2007</td>
<td>Rehabilitated underground workings in preparation for major drilling program in 2008</td>
</tr>
<tr>
<td>Otter Creek</td>
<td></td>
<td>Blind Creek Resources</td>
<td>Atlin</td>
<td>Gold</td>
<td>2007</td>
<td>Drilling</td>
</tr>
<tr>
<td>Tag</td>
<td>104M 079</td>
<td>CZM Capital Corp.</td>
<td>Taku Arm of Tagish Lake</td>
<td>Gold, Silver</td>
<td>2007</td>
<td>Drilling; soil geochemistry; airborne magnetic surveys</td>
</tr>
</tbody>
</table>
4.2.1.3.3 Geophysical Survey
Geophysical surveys are useful to geologic study, assisting in delineating mapped rock units and structures, and in identifying alteration/enrichment/depletion zones associated with copper-gold mineralization.

Between September 2000 and March 2001, the Geological Survey of Canada commissioned a high-resolution aeromagnetic survey over the Atlin region. Data collected covered approximately 30,375 line kilometres of the Cache Creek Terrane.

The data set shows significant contrasts in magnetic properties among the rock types and is a valuable aid to bedrock mapping and mineral exploration.

A detailed map and initial reports are available at:
http://www.em.gov.bc.ca/Mining/Geolsurv/MapPlace/MoreDetails/AtlinGeophysics.htm

4.2.1.4 Potential Future Hardrock Mines

4.2.1.4.1 Regulatory Framework
With the exception of small operations of sand and gravel, rock quarry and placer, all mine development is subject to review under either the Mine Development Review Committee or the Environmental Assessment Act. Both processes are multi-agency reviews, often involving both provincial and federal agencies as well as First Nations and the public. Major mine projects are reviewed under the Environmental Assessment Act and require the approval of both the Ministry of Energy, Mines and Petroleum Resources (MEMPR) and the Ministry of Environment (MOE). Approval under the Mine Development Review Committee is for smaller operations and is signed off by the Minister of Energy, Mines and Petroleum Resources. For a more complete description of these processes and applicable mine thresholds, please refer to the following websites:

Ministry of Energy and Mines - Permit Application Requirements:
http://www.em.gov.bc.ca/subwebs/mining/Project_Approvals/permreq/default.htm

Environmental Assessment Office:
http://www.eao.gov.bc.ca

4.2.1.4.2 Potential Future Mines in the Plan Area:
Within the plan area, there are several hardrock mineral deposits with known reserves (Table 3). Even if only economic factors are considered (i.e. assuming a favourable land-use designation), it is impossible to predict which, if any, of the deposits listed will become mines.

Table 3: Hardrock and mineral deposits with known reserves
<table>
<thead>
<tr>
<th>Property</th>
<th>Location</th>
<th>Tonnage</th>
<th>Commodity</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Polaris</td>
<td>Tulsequah River</td>
<td>3,270,000 t</td>
<td>Gold</td>
<td>13.70 g/t</td>
</tr>
<tr>
<td>Tulsequah Chief</td>
<td>Tulsequah River</td>
<td>5,300,000 t</td>
<td>Silver</td>
<td>100.8 g/t</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Gold</td>
<td>2.73 g/t</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Copper</td>
<td>1.41%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Lead</td>
<td>1.32%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Zinc</td>
<td>6.73%</td>
</tr>
<tr>
<td>Atlin Ruffner</td>
<td>Atlin Area</td>
<td>113,638 t</td>
<td>Silver</td>
<td>600.00 g/t</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Lead</td>
<td>5.000%</td>
</tr>
<tr>
<td>Engineer Mine</td>
<td>Tagish Lake</td>
<td>20,000 t</td>
<td>Gold</td>
<td>34.00 g/t</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Lead</td>
<td>5.000%</td>
</tr>
<tr>
<td>Ericksen-Ashby</td>
<td>Taku River</td>
<td>907,000 t</td>
<td>Silver</td>
<td>214.90 g/t</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Lead</td>
<td>2.230%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Zinc</td>
<td>3.790%</td>
</tr>
<tr>
<td>Adanac</td>
<td>Atlin Area</td>
<td>152,000,000 t</td>
<td>Molybdenum</td>
<td>0.063%</td>
</tr>
<tr>
<td>Mt. Ogden</td>
<td>Headwaters of Inkin + Sheslay Rivers</td>
<td>217,704,000 t</td>
<td>Molybdenum</td>
<td>0.170%</td>
</tr>
<tr>
<td>Northern Dancer (Logtung)</td>
<td>Jennings River area</td>
<td>162,000,000 t</td>
<td>Molybdenum</td>
<td>0.30%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Tungsten</td>
<td>.100%</td>
</tr>
<tr>
<td>Spokane (Lawson)</td>
<td>Bighorn Creek (east of Tagish Lake)</td>
<td>77,216 t</td>
<td>Gold</td>
<td>5.83 g/t</td>
</tr>
<tr>
<td>Ruby Creek</td>
<td>Ruby Creek</td>
<td>212,907,000 t</td>
<td>Molybdenum</td>
<td>0.04%</td>
</tr>
</tbody>
</table>

Of the deposits in Table 3, the most likely candidates to become mines are Tulsequah Chief/Big Bull (mid to large-size underground mine), New Polaris (mid-size underground mine), and Ruby Creek (open pit). Of these, only New Polaris is not currently under development.

In 1994, Vancouver-based Redcorp (previously Redfern Industries) applied to re-open the Tulsequah Chief mine in the lower Taku River area. There were two access options included with the proposal:

1) barging equipment and products to and from Juneau, and
2) construction of a 160-kilometre road from the mine site on the Tulsequah River to Atlin.

At the time, barging was deemed financially and logistically not viable. One of the main concerns was servicing of the proposed 200-person camp at the mine, as barging would not be feasible year-round and the area is subject to dense cloud, often preventing the landing of aircraft at the mine site. Additionally, there were environmental concerns associated with the dredging and river traffic near Flannigan’s Slough.

The alternative proposal, to build a road into a remote and un-roaded area, was controversial within some circles in B.C. and internationally. Concerns included potential impacts on fish, wildlife and aboriginal rights.

Approval for the Tulsequah Chief project and associated road development was granted in August 1998. However, the approval was challenged by the Taku River Tlingit and overturned in a decision by the B.C. Supreme Court in June 2000. The court determined that Redcorp had met the requirements of the environmental assessment process, but that government had been remiss
in the latter stages of the review process in addressing aboriginal concerns. Road construction and mine development was put on hold while the project committee worked toward addressing issues of cultural sustainability brought forward by the Tlingit.

In 2002, MEMP and MSRM granted another Project Approval Certificate, allowing for the development of a 2,250 tonne/day underground copper, led, zinc, gold and silver mine, as well as the construction of a 162-kilometre access road from Atlin. Again, the proposed road access was challenged by the TRT; no Special Use Permit (SUP) was granted. Since then, a new plan for accessing the mine site has been proposed, based on using an air cushion barge towed by an amphibious tug on the Taku River, which will be able to operate year-round. Supplies and equipment, as well as concentrate, would be shipped through Juneau, Alaska.

Capital costs are estimated at $201.5 million for a 2,000-tonne-per-day underground mine. Construction of a 17-kilometre road from the barge site to the mill site was underway at the end of 2007, including the building of bridges and an airstrip.

The New Polaris gold deposit is the site of the former Polaris-Taku mine. Exploration drilling during the 1990s by Canarc Resources Corporation outlined a gold resource in excess of one million ounces below the old mine workings. Canarc pumped out the mine in 1997, renamed the property New Polaris and was about to begin close-spaced underground drilling in 1998. Financing for the project was being conducted during the Bre-Ex scandal and the company was unable to attract investment in the project. Delays in the approval of the Tulsequah Chief project (located proximal to New Polaris) also negatively impacted New Polaris. Little to no work was conducted on the site between 1998 and 2003 when Canarc initiated a new, limited drilling program. A NI 43-101 resource study was contracted, as well as engineering studies of mining methods, underground access, processing plant options and transportation possibilities. In-fill drilling to prove and expand the resource was conducted between 2004 and 2006, and extraction of an underground bulk sample is under consideration for 2008. A 2007 preliminary assessment of the property suggested a capital development cost of $90.5 million for a mine producing 80,000 ounces of gold per year.

The Ruby Creek molybdenum project, owned by Adanac Gold Corporation, received a B.C. Environmental Assessment Certificate on Sept. 11, 2007. Ruby Creek is a low-grade bulk deposit located at the headwaters of Ruby Creek, about 22 km northeast of Atlin. It is accessible by a 39-kilometre road, the first 19 kilometres of which are public and considered to be in reasonable condition. Once permits to proceed were granted, a construction camp was built to facilitate the upgrades to the remaining 20 kilometres of road.

Ruby Creek has been worked since the late 1800s, mainly as a placer gold region, but molybdenum exploration was not initiated until 1968. Numerous studies and drilling projects were conducted on the property through 1982, when the claims were allowed to lapse. In 2001, Adanac picked up the claims and exploration began anew.

Work is currently on hold for Ruby Creek as Adanac undergoes federal CEAA review for the open pit mine construction.
Other prospects in Table 3 are: Engineer, Atlin-Ruffner, Erickson-Ashby, Spokane and Mt. Ogden. These would be considered small underground mines (based on currently identified mineral resources). Logtung would be a mid-size to large open pit mine.

The deposits listed in Table 3 do not represent all future potential for mine development in the plan area. New discoveries, changes in exploration and mining technology, increased understanding of mineral deposits and/or changes in mineral prices can quite abruptly transform a mineral occurrence into a mine development. The inability to predict the location of future mine developments requires that flexibility be built into land use planning.

4.2.2 Placer Resources

Placer gold production has made a very important contribution to the development and sustainability of the town of Atlin for more than 100 years. The historic placer mining creeks of the Atlin area are located in a relatively small area between Atlin Lake on the west, the Gladys River on the east, the O’Donnell River to the south and Gladys Lake to the north. This is a geologically special part of the earth’s crust where suitable conditions for the creation and preservation of placer gold deposits has existed for perhaps more than one million years. The deposits were formed initially by the erosion of bedrock sources into steep sided canyons and have survived subsequent periods of intense continental glaciation and volcanic activity.

4.2.2.1 Regulatory Framework

Placer mining can take place only on placer claims or leases issued by the MEMPR under the Mineral Tenure Act. Production from a claim is limited to 2,000 cubic metres of paydirt per claim per year. If production exceeds 2,000 cubic metres, then the tenure must be changed to a placer lease.

All mechanized placer mining/testing requires a Mines Act Permit and a reclamation security deposit. Operations may also require Water Act approvals for short term water use or for works ‘in and about’ a stream, Forest Act Permits or licences to cut timber, Environmental Management Act discharge permits, and/or a special use permit under the Forest Practices Code of B.C. Act to construct or modify access to the placer tenures. Operations processing more than 500,000 cubic metres of paydirt may require a review under the Environmental Assessment Act.

In addition to government regulations, the Atlin Placer Miners Association uses peer pressure to affect a measure of self-regulation.

4.2.2.2 Placer Mining Operations

Placer mining activities in the Atlin area occur almost exclusively in the valleys of the historically mined creeks draining to Surprise, Atlin or Gladys Lakes. Most operations take place between the months of May and October, although it is possible to work through the winter. Projects range in size from hand panning and exploration test pits (less than 0.1 hectare) to larger
scale open-pit mining operations (up to five hectares) using large excavators, trucks, dozers, drills, front-end loaders and gold recovery plants capable of processing more than 100 cubic yards of gravel per hour (see photos). The water and fine tailings from the gold recovery plant are discharged to settling ponds.

### 4.2.2.3 State of the Industry

At present, the industry is enjoying a surge in exploration expenditures and potential mine development. This trend began in 2002 as global commodities prices began increasing, making viable the re-visititation of numerous prospects that had previously been deemed too low-grade or their reserves too small to develop. As well, increasing investment dollars were available to companies with NI 43-101 compliant projects as the Securities Commission demanded consistent methodologies for exploration and reporting of data in the hope of avoiding another Bre-Ex scandal.

Intensive Land Use Planning, communications with First Nations and other invested parties, and new, less environmentally detrimental technologies are encouraging exploration and investment in areas that were previously deemed “uncertain”; i.e. expenditures of a mining company to explore a region where it may end up losing its options/claims to a future park, treaty or reserve may not be worthwhile.

Thick glacial and glacifluvial overburden is the main factor limiting the location and development of new high-grade pre-glacial deposits. The extensive, lower grade post-glacial deposits have potential for large volume mining operations with the development of improved recovery technology for fine gold.

### 4.2.2.4 Operational Issues

Operational issues facing the industry and the regulatory agencies at this time include: discharge of water from settling ponds on “deregulated” creeks; riparian zone protection; construction of cabins by tenure owners for non-mining purposes; access to un-roaded areas; and steep highwalls on existing pits. These issues are addressed through regulation as described below.

On creeks named in the Placer Mining Waste Control Regulation (“deregulated” creeks), no Environmental Management Act Permit is required to discharge process water from a placer mining operation. These creeks have been mined historically and the material available for constructing settling pond berms has been washed several times and therefore is not suitable for compaction. Though the material available limits the effectiveness of settling ponds, Mines Act Permits still require settling ponds for all operations.

Although no code specific to placer mining exists, Mines Act Permit conditions specify a 10-metre riparian zone measured from the high water mark on each side of the creek. The purpose of the zone is to protect water quality, provide shade for the stream, provide fish food, and provide transportation corridors for large mammals. The riparian zone permit condition is not enforced on the historic “de-regulated” creeks of the Atlin area because they lack riparian values.
(i.e. vegetation) and are not fish-bearing.

Neither buildings nor access construction are allowed for hand operations. However, placer tenure holders are allowed trailers and other temporary buildings if required for their mining operations. The removal of these structures must be covered by a Mines Act Permit and reclamation security.

New access construction to placer properties is a particularly difficult issue, requiring a balance between the “right to mine” and a need to protect wildlife populations from increasing human encroachment. This issue is of particular interest to the Taku River Tlingit First Nation in their desire to protect their interests in traditional territory while negotiating a treaty settlement. Winter-only trails and/or total deactivation is now prescribed for wildlife and First Nation sensitive areas in order to deter ATV access.

Though many of the historic creeks have near-vertical highwalls that are unstable over the long term, these slopes are not subject to catastrophic failure. Most of these situations are legacies from the days of hydraulic mining, although some have been worked within the last five years using large equipment. Experience has shown that the pre-glacial gravels (red channel) and clay-boulder glacial tills will stand at steeper angles than post-glacial (grey channel) or glacial-fluvial gravels because they have been heavily compacted by thick continental ice. Failures in these types of material tend to be by slow raveling initiated by spring melting and don’t pose a significant threat due to massive failure. There is, however, a risk to persons snowmobiling near the unmarked crests of these pits.

4.2.3 Industrial Mineral Resources

Distance from markets and lack of infrastructure have severely limited the exploration for and development of industrial mineral deposits in the plan area. Many industrial minerals are low value commodities requiring proximity to cheap transportation or a local market, to be viable.

Within the plan area, jade, asbestos, nickel, chromite and magnesite are found in serpentine along the Nahlin fault. Magnesium leached by groundwater from the serpentine has produced deposits of hydromagnesite near Atlin. Limestone that occurs throughout Cache Creek terrane would be an important resource for manufacture of cement if it was closer to markets or tidewater. Bedded gypsum deposits, suitable for the production of wallboard, have been identified in the O’Connor River area. Additionally, the Surprise Lake batholith, near Atlin, is a potential source of building stone.

The Minfile database lists three industrial mineral prospects with identified reserves. All three deposits have been known for a considerable period of time (Atlin discovered in 1904, Ace in the early 1960s and O’Connor in 1958), however their development has been limited to a large extent by distance from markets.

Substantial drilling and surface work was conducted in the mid-1980s to define the gypsum deposit at O’Connor Creek. However, the establishment of the Tatshenshini-Alsek Park in 1992
negated any possibility of developing the property.

The hydromagnesite deposits at Atlin were mined in the early 1900s, however, high transportation costs made further development uneconomical. Recent interest in the property may yet create a viable mine. In 1999, Stralak Resources optioned the Crown-granted mineral tenures covering this deposit and conducted testing to determine its exact mineralogy. The material was found to be suitable for use in flame-retardant applications and thermoplastics. However, development of the property will hinge upon securing long-term contracts for the product.

4.2.4 Energy Resources

4.2.4.1 Oil and Gas Potential

The Atlin-Taku planning area is bisected by the Whitehorse Trough, a geological feature trending northwest-southeast through the southern Yukon and northwest B.C. The Whitehorse Trough holds significant potential for accumulations of natural gas. No exploration wells have been drilled, but the Geological Survey of Canada has undertaken a petroleum resource assessment of the Whitehorse Trough within B.C. Utilizing the GSC figures, the total in-place natural gas resource potential for the Atlin-Taku area is estimated at 2.65x10¹⁰ m³ (993 BCF).

The Takwahoni structural gas play (i.e. zone where gas is known to occur) is estimated to contain in-place resources of 2.18 x 10¹⁰ m³ (770 BCF) of natural gas within B.C. (the play extends north into the Yukon). The Atlin-Taku planning area is estimated to hold about half of B.C.’s share or 1.1x10¹⁰ m³ (385 BCF).

The Inklin structural gas play is estimated to contain in-place resources of 1.57 x 10¹⁰ m³ (557 BCF) of natural gas within B.C. (the play extends north into the Yukon). The Atlin-Taku planning area is estimated to hold about half of B.C.’s share or 7.85x10⁹ m³ (278 BCF).

The Lewes River structural gas play is estimated to contain in-place resources of 1.53 x 10¹⁰ m³ (540 BCF) of natural gas within B.C. (the play extends north into the Yukon). The Atlin-Taku planning area is estimated to hold about half of B.C.’s share or 7.65x10⁹ m³ (270 BCF).

4.2.4.2 Geothermal Potential

The northwest portion of the plan area holds some moderate potential of finding economically significant geothermal resources in the area surrounding the Surprise Lake Batholith. Although moderate potential does exist, the remoteness of the area makes it unlikely that this potential would be sufficient for direct conversion to electricity; however, it may be suitable for direct space heating or recreational activities.

4.3 Geographical Considerations for Mine Development and Mineral Infrastructure
4.3.1 Geographical Consideration for Mineral Development

The Atlin Taku area is geographically complex, extending from the Coast Mountains inland almost to Watson Lake. The more coastal areas are characterized by mountainous terrain with fast-moving high gradient streams, broad river floodplains and massive glacial fields. The climate is dictated by the topography and proximity to the coast, resulting in heavy precipitation and ocean- moderated temperatures. The mean monthly temperature at the lower Taku River ranges from 8°C in the winter to 15°C in the summer. Average annual precipitation is over 2,000mm (Rescan, 1997).

The interior part of the plan area is composed of a mixture of low mountains and large plateaus. The climate in the interior is continental and under an arctic influence. Winters are long and cold with limited snow accumulation. Summers are brief and warm. In Atlin, the mean temperature in January is -16°C and in July is 12.5°C. Annual precipitation is 338 mm (Rescan, 1997).

Almost half of the area (43 per cent) is in Alpine Tundra. Major rivers include the Taku, Tatshenshini and Alsek Rivers. There is a complex of large lakes (Atlin, Tagish and Teslin Lakes) that feed the Yukon River watershed. Fed by the Llewellyn Glacier, Atlin Lake is the largest natural lake in B.C. and forms the headwaters of the Yukon River drainage.

The mountainous nature of the region is attractive for underground mining as it is far easier to tunnel into a mountainside below a deposit, and mine upward using gravity to assist in the transportation of ore, than it is to dig a deep shaft and have to haul the ore up to surface. This being said, Tulsequah, Big Bull and New Polaris deposits are all below river level, so a shaft or decline are required to access the deposit.

The relatively isolated nature of much of the area is less of a problem for mine development than one might expect. Although road access is important for large and medium-sized metal mines and access to valley bottoms (by road or river) as likely transportation routes are always an anticipated option, it is not essential for a mine or quarry to be connected to the provincial road system. Major mining companies build and operate mines in remote areas that are run as self-contained operations. Though some modern mines in remote areas have town sites, government policy and socio-economic costs deter future developments of this sort. Most modern mines provide accommodation on site and operate on a rotational basis, cycling the staff through by plane or boat. And, as evidenced by the Tulsequah Chief project, innovative transportation methods can be found.

Where it is not feasible for a mine operation to connect to the provincial power grid, there are alternate sources of energy. Diesel generators are a common choice (even the community of Atlin runs on generator power), but with alternative energies becoming more affordable/feasible, there may be other options for the future, particularly with the high number of rivers/high-gradient streams in the area (hydroelectric).

---

3 Section 3.3.1 is by Wojdak, from Horn and Tamblyn, 2002.
4.3.2 Mineral Infrastructure in Atlin-Taku Communities

Mining has continued to be one of the primary economic mainstays of the Atlin-Taku area through the years. Many of the creeks around Atlin have past or existing placer operations on them, with placer mines ranging in size from single person outfits to large operations using heavy equipment and employing several people. The Atlin area has yielded over $23 million in gold in the last 100 years, second only to the Cariboo for placer gold production in B.C. (BC Tour Online, 2000). There have been a number of mining operations on the Taku River since the 1800s. Mines have operated at three deposits along the Tulsequah River (Tulsequah Chief, Big Bull and Polaris Taku) at various times between 1923 and 1957. In 1929, the small settlement of Tulsequah was established as a service center for three operating mines, all of which ceased production at the outbreak of World War II.

World War II hit the mining and tourism industries in the Atlin area hard. Jobs disappeared and the population of Atlin dwindled. The Atlin Road was built in 1949-50 linking Atlin to the Alaska Highway. Despite the land-based link to Whitehorse and beyond, the size of the town was slow to recover. In 1963, the non-aboriginal population of Atlin was only 75 (Rescan, 1997). In the 1960s, the overall population of the town slowly began to rise again as people began moving into the area as part of a lifestyle choice. The current population of Atlin is approximately 450 permanent residents and 100 to 200 seasonal residents (Atlin Community Website, 2008).

With such limited road access, no power grid, no railway (barring the White Pass Rail tourist attraction) and only the small community of Atlin servicing the region, infrastructure is almost negligible. Access to Atlin is limited. The Atlin Road provides the only ground access to the town. The nearest major center, Whitehorse in the Yukon, is approximately 200 kilometres (two hours drive) away. A local bus and van service provides public transportation between Atlin and Whitehorse. Fixed-wing planes, floatplanes and helicopters provide year-round flights to the town. Juneau, Alaska is 45 minutes from Atlin by air. Skagway, Alaska is also accessible by a short plane ride. Atlin can be accessed by boat from the town of Tagish along Tagish Lake in the Yukon. In the winter months, when the lakes have frozen, travel to the area can also occur by snowmobile and dog sled.

The Yellow Jacket property hosts a gravity processing plant and the Tulsequah Chief mine plans to have a mill up and running in the near future. As well, the Ruby Creek mine plans to have infrastructure in place. The more properties that have access, power and mills, the more feasible it will be for smaller, nearby properties to be developed.

4.4 Strategic Planning Considerations Related to Mineral and Energy Resources

Completion of a strategic plan for the Atlin-Taku region would help provide certainty to the mining sector regarding lands available for mineral exploration and development, particularly when investors are hesitant to fund projects in areas of the province where treaty negotiations are on-going.
Identification of key resource values are important to the environmental assessment processes, and integration of mining exploration with other resource uses (wildlife corridors, tourism, cultural areas) in the region will encourage growth and balance acceptable to all those involved.

4.5 Economic Perspective on Mineral Development

Mining (the process of extracting metallic and non-metallic mineral deposits from the earth) refers to a variety of industrial activities that take place over a range of scales. Mines may be very large, or very small. Either way, they are point-focused and time-limited operations that only function as long as the commodity they produce can be extracted at a profit. Ultimately, all mines are depleted and, these days, their sites are reclaimed. Mining is a temporary usage of the land. Mines range from small shafts and adits driven to extract high-grade material to recover gold (or other metals) to larger open-pit operation developed to extract many millions of tonnes of low-grade ore. They all have their own economic significance, based on size and scale of production, richness and need for infrastructure.

The higher-grade styles of mineralization (veins and bedded sulphide lenses) found in the region may be amenable to open-pit and/or underground development but the lower-grade (vein stockwork and industrial mineral) styles are commonly only amenable to open-pit development. The approach taken in mining a deposit will depend on its grade, size, shape and location with respect to the land surface. Miners almost invariably have to remove waste rock to get at ore; however, they try to remove as little as possible, as it costs just as much to remove waste as it does ore. In the case of a small high-grade deposit exposed at surface, the miner may try to create a small open pit centered on the ore zone. However, in the case of a deeper deposit, this will rarely be an option. These require underground tunnels to provide access (e.g. Tulsequah Chief). Lower-grade deposits can usually only be mined by surface pitting. With these deposits (i.e. vein stockwork-type), miners commonly process large volumes of ore per day and rely on economies of scale to ensure that the operation remains profitable (e.g. Ruby Creek). Industrial minerals, which are usually low unit value products, are also commonly quarried at surface (e.g. Ace). In each case, the value of the ore has to be able to carry the cost of production.

A mineral deposit goes through several stages before it becomes a mine. Those stages include (1) initial discovery, (2) identification of economically mineable mineralization, (3) engineering to establish technical and economic feasibility, (4) environmental assessment and mine certification, (5) mine financing and (6) mine construction. Although very few deposits make it through all six stages, all of them start along the same path and many get stalled at some point, only to proceed later. Each stage involves considerable investments in time, talent and money and, even if mining does not proceed, the exploration process makes a significant contribution to an area’s economy.

Early-stage and mid-stage exploration provides employment for prospectors and income for service providers in remote communities. As Atlin is the only community in the region, as well as the only major road access, suppliers and support would likely originate from there, particularly for the Ruby Creek mine and placer operations. It commonly takes several years of exploration drilling and analytical work to establish the outline of a mineral deposit and it may
require underground development before it is defined well enough to proceed to feasibility. Local communities benefit directly through providing goods and services supporting the exploration program(s). Once it has been found and delineated, it takes a considerable amount of time and engineering to establish the most appropriate way to mine a deposit, and to determine whether it is economically feasible to do so. This type of engineering work is usually carried out in larger communities and benefits contractors based in the Lower Mainland and elsewhere. Environmental concerns are important, and it takes a considerable amount of time and money to meet the needs of the permitting authorities. Mine financing is, itself, a major hurdle and generates economic activity in the main financial centers. Typically, mining companies can expect to spend $10 to $20 million to bring a major deposit through the feasibility process.

Mine or quarry development hinges on economic feasibility. If the size and grade of a deposit is too small, or the profit from mining and processing is too low to carry the cost of building the mine, the development will not proceed and the resource will remain in the ground. However, economic conditions change, commodity prices rise and fall, currencies fluctuate and mine technology and infrastructure improve. Thus, deposits that are not economic under current conditions may become so in the future. Only a small percentage of the showings in the Atlin-Taku plan area have been drilled, and few of the deposits can be considered completely delineated. Additional work should find more mines.

There is no “average” mine, but it is possible to profile the economic impacts to be expected with the development of different types and sizes of mines. Large metal mines process more than 5,000 tonnes of ore per day. They are commonly open-pit operations, however a few may be underground mines. They need a considerable amount of infrastructure and they are exceedingly expensive to construct. Capital costs, incurred before any ore is processed, commonly exceed $100 million and this figure can easily escalate to $500 million if the operator has to build roads and load-out facilities and/or bring electricity into the mine site. Given the up-front investment required, companies commonly look for sufficient reserves to ensure a minimum 10 to 20 years of operation before they will put such a deposit into production. Large mines commonly take two to five years to build and, once built, provide direct employment for between 125 and 400 people and indirect employment for another 250 to 800. Examples include Kemess, in the Toodoggone area, and Highland Valley Copper, near Kamloops.

Medium-sized metal mines process approximately 500 to 5,000 tonnes of ore a day. Some are open-pit operations but many more are underground developments. They also require a considerable amount of site preparation and infrastructure. They take two to five years to build but commonly at a lower capital cost, in the range of $50 to $250 million. A medium-sized mine employs between 50 and 250 people and provides indirect employment for twice as many. Examples include Myra Falls, near Campbell River, and Eskay Creek, north of Stewart.

Small metal mines are commonly underground operations that process less than 500 tonnes a day. They have smaller reserves at the outset and they commonly have less complicated processing plants. Some build their own facilities but others ship their ore off-site for custom processing. Small mines take one to two years to build. They have a capital cost of between $10 million and $75 million and employ between 25 and 150 people. They also provide indirect
employment for an additional 50 to 300 people. One example is Golden Bear, southwest of Cassiar.

Industrial mineral operations, such as limestone quarries, may produce a considerable tonnage of product, but they tend to have relatively simple processing facilities. They resemble small mines in terms of their cost and staff requirement. Examples include the Texada Island limestone deposits, which collectively ship approximately five million tonnes of rock a year.

In short, all mines and their employees pay taxes and contribute to the economic wellbeing of the province.

4.6 Global Significance of Mineral Resources

Canada is a major producer and supplier of metals and coal. In 2003, it was the fourth largest supplier of zinc in the world, the eighth largest supplier of copper, the seventh largest supplier of silver and eighth of gold, the sixth largest supplier of lead and the fourth of molybdenum. A large proportion of this comes from British Columbia. The province was the nation’s largest producer of silver, copper and molybdenum, the third largest producer of gold and lead, and the fifth largest producer of zinc.

In 2006, British Columbia’s nine metal mines and 11 coalmines, along with other sectors of its minerals industry, employed approximately 10,800 people and generated export sales worth $6 billion (http://www.em.gov.bc.ca/Mining/MiningStats). Most of the minerals produced in the province are shipped to Japan, Korea and other countries in Asia. Although they are few in number, the mines and quarries provide considerable benefit to their local communities and to the province at large.

Metal markets are hard to predict, but the long term outlook for metal and mineral demand is encouraging, as relatively underdeveloped countries need resources to build the infrastructure required for a modern lifestyle. Future demand for metals and minerals is likely to increase in China, India, Thailand, Indonesia and elsewhere, which will put additional pressure on existing mines and mineral resources. In the short term, commodity prices should continue to mirror fluctuations in global economic growth and rise and fall in response to temporary imbalances in supply and demand. In the long-term, however, new mines will be needed to replace those that are depleted in order to maintain global supply. British Columbia has many world-class deposits (Sullivan, Highland Valley) and is well placed to contribute to the global metal and mineral economy. The province has highly prospective geology and a long tradition of mining. It has excellent infrastructure and globally respected expertise in exploration geology, mine engineering and development, and mining. It has, and should continue to have, cost-competitive mines.

5 Administration and Regulation of Mineral Resources
The Ministry of Energy, Mines and Petroleum regulates mineral exploration and mine development/mining in British Columbia. The principle legislation governing mining includes the Mineral Tenure Act, the Mines Act, the Mining Rights Amendment Act, the Mining Right of Way Act, the Mineral Exploration Code, and the Health, Safety and Reclamation Code for Mines in B.C. Many other laws and regulations also apply, some of which are administered by the Ministry of Agriculture and Lands, the Ministry of Forests, or the federal Ministry of Fisheries and Oceans Canada.

Mineral tenure is acquired via the Mineral Titles Online website as of 2005 (www.mtonline.gov.bc.ca).

Tenure holders must do work (or pay cash in lieu) in order to maintain their claims in good standing. Before a tenure holder may undertake activities that will mechanically disturb the ground surface, a Mines Act permit is required. All work proposals are subject to review by regulatory agencies. Depending on the scale of the proposal, this may entail referral to government resource agencies, review by the regional Mine Development Review Committee, or a full-scale environmental impact assessment coordinated by the Environmental Assessment Office. A reclamation bond is required to ensure that the government has sufficient funds to reclaim disturbances in case the operator defaults.

Mineral tenure, regulation of mineral exploration and development, and access management are discussed in more detail in the following sections.

5.1 Mines Act Permitting

Two types of applications can be made to obtain a Mines Act Permit:

- **Exploration and Small Mines** - A notice of work (NOW) is filed with the Mining Operations Branch district manager for coal or mineral exploration programs and for approvals of placer mining, or sand and gravel pits and quarries in accordance with parts 6.1.1, 6.1.2 and 10.1.1 of the code.

- **Major Mines** - A detailed Mine Plan and Reclamation Program must be submitted to the Mining Operations Branch Regional Manager for proposed coal or hardrock mineral mines, major expansions or modifications of producing coal and hardrock mineral mines, and large pilot projects, bulk samples, trial cargoes or test shipments. Information requirements for these applications are summarized in Parts 6.1.2, 6.1.3, 6.1.4, 6.1.5, 9.1, 9.2 and 10.1.2 of the code, in various geotechnical guidelines, and described in detail in Appendix I of this document. Mines Act Permit applications are required whether or not proposed developments fall under the EAA.

Permit applications for projects under the EAA may be submitted concurrently with the project report; however, a Project Approval Certificate must be obtained prior to Mines Act Permit issuance. No work is permitted on a mine site without a valid Mines Act Permit.
5.2 Mineral Exploration Permitting

Mineral exploration is conducted in accordance with the Mineral Exploration Code and Mines Act of B.C. Prior to conducting any mechanical disturbance of the land, the Ministry of Energy and Mines must approve the work program and sufficient reclamation securities must be set in place to ensure that the site is reclaimed. Work programs are referred to affected agencies (i.e. guide outfitters, tourism operators, etc.) and First Nations for comments, which are then taken into consideration when approving (or disallowing) proposed mineral exploration.

Full approval of a work program may also require that permits from other ministries be obtained. For example, where timber will be cut as part of a program, a free-use permit or licence to cut is required from the Ministry of Forests. Similarly, for road construction off mineral tenures, a special use permit must be obtained from the Ministry of Forests. Programs involving use of surface water must obtain a water use approval or water licence from the Ministry of Agriculture and Lands.

Most mineral exploration programs involve minimal disturbance of the land. However, where significant volumes of mineralized rock (i.e. greater than 1,000 tonnes) are to be blasted as part of a sampling program, testing for acid rock drainage potential is required. Similarly, though not required by the Ministry of Forests, the Ministry of Energy and Mines will request testing for acid rock drainage where road development requires blasting of mineralized rock.

5.3 Mine Development Permitting

With the exception of small operations of sand and gravel, rock quarry and placer, all mine development is subject to review under either the Mining Development Review Committee or the Environmental Assessment Act. Both processes are multi-agency reviews, often involving both provincial and federal agencies as well as First Nations and the public. Major mine projects are reviewed under the Environmental Assessment Act and require the approval of both the Ministry of Energy and Mines and the Ministry of Agriculture and Lands. Approval under the Mine Development Review Committee is for smaller operations and is signed off by the Minister of Energy and Mines. For a more complete description of these processes and applicable mine thresholds, please refer to the following websites:

Ministry of Energy and Mines Permit Application Requirements:
http://www.em.gov.bc.ca/subwebs/mining/Project_Approvals/permreq/default.htm

Environmental Assessment Office:
http://www.eao.gov.bc.ca

Tenure for aggregate mining operations is administered by Ministry of Agriculture and Lands while the Ministry of Energy and Mines is responsible for regulating mining of aggregate resources (both private sector and government). The only exception to this is the development of pits and quarries for forestry purposes, which are regulated by the Ministry of Forests.
5.4 Access Management

5.4.1 Mineral Resource Access

The Mineral Tenure Act, the Mining Right of Way Act and the Mining Rights Amendment Act define legal rights of access to mineral and placer claims. The Mineral Tenure Act establishes the right of entry, occupation and use of Crown land for mineral development, subject to conditions. The Mines Act and the Mineral Exploration Code regulate mechanized access on mineral tenure. A Mines Act Permit, issued by the Ministry of Energy and Mines, specifies conditions for operation, maintenance and reclamation of on-tenure access. Mechanized access (including trail and road construction) to a mineral tenure is regulated by the Mining Right of Way Act, the Mining Rights Amendment Act and the Forest Practices Code of British Columbia Act. A special use permit is issued by the Ministry of Forests for the construction, operation, maintenance and reclamation of the access off tenure. Access development under either permit requires the operator to post a security to ensure compliance with permit conditions.

Current management practices ensure that the right to develop exploration and mine access is balanced by the responsibility to predict, minimize and mitigate impacts on other known values. Prediction and mitigation of impacts to other values are achieved through referrals and consultation with other ministries, First Nation groups, non-governmental organizations, the public during the permitting process, and through inspections during the operation of the mine. For example, exploration access to a remote area with sensitive wildlife issues could be restricted to unbladed trails during the winter months.

Road development has both positive and negative consequences that must be assessed prior to proceeding with construction. With appropriate planning and management (either through direction regarding road development and use, or by introducing controls on public access), many of the negative consequences can be reduced and occasionally eliminated.

Negative consequences may include:
- increased pressures on wildlife through habitat loss, changes in habitat utilization, increased mortality (from vehicle collisions, hunting and poaching) and wildlife habituation;
- impacts on previously remote lakes, including reduction in water quality and fish populations through recreational over use, and possible negative impacts on aesthetic quality of a previously remote recreational experience;
- damage to alpine habitats;
- poor road placement impacting on visual quality;
- temporary access roads into sensitive environments may become permanent access roads; and
- Development of natural resources which were not part of the original proposal for the road (i.e. construction of a road to a mine site may make previously uneconomic timber viable for harvesting).
Positive consequences may include:

- development of natural resources leading to a more economically diversified community;
- potential for development of more than one resource (i.e. construction of a road to a mine site may make previously uneconomic timber viable for harvesting or may foster the development of a tourist operation); and
- increased public access to Crown lands for recreation.

### 5.4.1.1 Current Major Mine Roads

Within the plan area, there is one existing major mine road to the Golden Bear mine.

In 1988, a 155-kilometre road was constructed from the Telegraph Road to the Golden Bear mine site at Bearskin Lake. Approximately 90 kilometres of this road lies within the Atlin-Taku plan area. As most of the road is located off mineral tenure, the Ministry of Forests holds permitting and reclamation securities under a Special Use permit. Mining at Golden Bear was completed in 2000; however, gold extraction by heap leaching continued through 2002. The 155-kilometre-long access road was scheduled for reclamation in 2004, which is on-going.

There is a historical legacy of existing (non-status) roads and 4x4 trails in the Atlin area that are used by outdoor recreationalists and mining operators. Most non-status roads around Atlin were constructed in the 1960s or earlier to access mining properties. Some of the roads were originally packhorse trails, which have been upgraded over time to accommodate vehicular traffic. Others are more recent and were constructed for movement of heavy equipment. Many of the roads have been upgraded and maintained by private users over the years.

Due to the dry climatic conditions and the abundance of gravel and other fairly non-erodible soils in the Atlin area, water control on these roads and trails is generally not a problem. There are few culverts, bridges or ditches requiring maintenance and most streams are crossed by fords. As such, un-maintained non-status roads remain traversable for decades, with little environmental impact resulting from erosion.

### 5.4.1.2 Mineral Resource Use of Non-Status Roads

The Forests Practice Code of British Columbia Act regulates use by mining operators of existing access (including non-status roads) off mineral tenure. A special use permit exemption is issued to the operator by the Ministry of Forests for the following: exploration, bulk sampling and small mining projects involving occasional use of the access by heavy equipment with no maintenance work outside the access prism. No security is required. For projects involving more than occasional use of the access by heavy equipment or maintenance work outside the access prism, a special use permit including a maintenance/deactivation plan and security deposit are required by the Ministry of Forests.

Use of existing access by mining operators on mineral tenures is regulated by the Mines Act.
Permit conditions including the security deposit are used to ensure proper maintenance and deactivation of the access.

In current practice, special use permits and Mines Act permits do not generally prescribe total deactivation of existing access since they don’t represent a significant environmental liability and they are an important resource for continued mineral exploration and recreational use. Deactivation is generally limited to controlling water in a self-maintaining fashion.

6 Issues Facing the Mineral Sector

Geological resource development presents unique challenges. Mineral resources are mostly hidden, non-quantifiable (except at enormous cost) and fixed in place. If they are to be developed at all they must be mined where they are found. Finding new mines requires time, patience, knowledge and money. International markets drive the search for commodities, pushing prices up to make the exploration viable or driving them down, resulting in the lapsing of work. Large areas of land and many mineral occurrences need to be evaluated through repeated and expensive exploration campaigns, over a span of years or decades, before a commercially viable mineral deposit is delineated.

In order to sustain the exploration and development process, the mineral sector needs security of tenure, security of access for exploration and development, and certainty with respect to other resource values and land uses that must be addressed in permit approval processes.

Another concern is that overlapping, or competing, land-use designations, objectives, and strategies for non-mining values can result in the inadvertent fragmentation of mineral lands and the perception of land-use uncertainty. This can cause decreased opportunities for sustained, long-term mineral exploration and development programs, along with loss of investment in mineral exploration and development.

7 Summary

Economic activity in the Atlin-Taku area is constrained by its limited infrastructure and long distance to markets. The main economic drivers, mining and tourism, are cyclical in nature which has lead to significant fluctuations in the local economy.

The town of Atlin was built on placer mining and it remains a key employer in the community. Hardrock mining has been a lesser contributor to the local economy, as past producing mines adjacent to the community have been small with short periods of operation. However, hardrock mineral exploration continues to contribute to the local economy, through seasonal employment and purchase of local goods and services.

In the broader plan area, there are several significant past producing mines and mineral exploration sites that, as a result of topography and infrastructure, have benefited northern
residents outside of the Atlin-Taku plan area. Examples include historic mining and current development of the Tulsequah and Polaris-Taku deposits in the Taku River area, and recent construction on the Ruby Creek deposit.

Mining has continued to be one of the primary economic mainstays of the Atlin-Taku area through the years. Many of the creeks around Atlin have past or existing placer operations on them, with placer mines ranging in size from single person outfits to large operations using heavy equipment and employing several people. The Atlin area has yielded over $23 million in gold in the last 100 years, second only to the Cariboo for placer gold production in B.C. (BC Tour Online, 2000). There have been a number of mining operations on the Taku River since the 1800s. Mines have operated at three deposits along the Tulsequah River (Tulsequah Chief, Big Bull, and Polaris Taku) at various times between 1923 and 1957. In 1929, the small settlement of Tulsequah was established as a service center for three operating mines, all of which ceased production at the outbreak of World War II. The Tulsequah Chief mine re-opened after the war and closed again in 1957. Redfern Resources Ltd. began an application to resume operations at the Tulsequah Chief mine in 1994 and is currently developing the mine site.

World War II hit the mining and tourism industries in Atlin and area hard. Jobs disappeared and the population of Atlin dwindled. The Atlin Road was built in 1949-50 linking Atlin to the Alaska Highway. Despite the land-based link to Whitehorse and beyond, the size of the town was slow to recover. In 1963, the non-aboriginal population of Atlin was only 75 (Rescan, 1997). In the 1960s the overall population of the town slowly began to rise again as people began moving into the area as part of a lifestyle choice. The current population of Atlin is approximately 450 permanent residents and 100 to 200 seasonal residents (Atlin Community Website, 2006).

Though many of the streams have been panned for gold, placer gold production has been concentrated in two relatively small portions of the plan area. Placer gold production from streams in the St. Elias Mountains ended prior to 1993, when establishment of the Tatshenshini-Alsek Park absorbed active placer areas. The remaining placer gold production area is located proximal to the community of Atlin.

Many of the creeks lying to the east and south of Atlin, contain placer gold and are actively mined. Placer mining largely occurs outside of the winter months, though in some years, a few operations continue year round. Winter is also used to mobilize equipment to remote placer sites, to minimize environmental impacts. Placer mining is considered the most important contributor to the local economy, generating approximately $5 million in 1994 (Rescan, 1997). In 1996, placer mines employed approximately 150 people a year on a seasonal basis (approximately one-quarter of the summer population) (Rescan, 1997). The overall income dependency on mining in Atlin, based on the above figures, is estimated at 60 per cent (Rescan, 1997). The economy of the town is tied closely to gold prices and the economic health of the town tends to fluctuate as markets change (Atlin Community Website, 2006).

The Atlin-Taku plan area has good potential for the discovery of economic mineral deposits. The area encompasses three developing mines, several past producing metallic mines, and numerous
developed prospects. Several of the known developed prospects are polymetallic, containing several potentially economic metals. Reflective of the prospective geology in the plan area is the large number of mineral tenures and extensive mineral exploration conducted. Exploration spending in the Atlin area alone is estimated at $500,000 to $1 million per year (Rescan, 1997).

Mining activity has contributed to the development of tourism in the Atlin area both historically and at the present. In the early 1900s, small communities were established around the Ben-My-Chree and Engineer mines on Tagish Lake. At Ben-My-Chree, the wife of the mine owner developed beautiful gardens and ran a small tourist operation serving tea for travellers arriving on the paddle wheeler. Both sites continue to be points of interest for travelers. In the community of Atlin, historic placer activity is a draw for tourism. Efforts have been made to establish a mining museum and develop placer tourism opportunities.

Although it is impossible to predict what sort of deposits will be found in the area, or when or where they will be located, past discoveries provide some idea as to what we can expect. The most prospective areas for these deposits are indicated in a general way on the Mineral Potential Map.

The need for industrial minerals (limestone, garnet, clay, dimension-stone etc.) increases as populations grow and is a growth area within the provincial economy. There is always going to be a need for high quality, low cost industrial mineral deposits to replace product shipped in from elsewhere.

New mines will be discovered through exploration, which is an expensive, high-risk process. Future prospectors will benefit from the collective increase in knowledge gained from work carried out by both government and industry and through access to improved technologies, such as remote sensing (LANDSAT, etc.), more sophisticated airborne surveys and more effective ground-based geophysical surveys. Historically, B.C.’s prospectors have always found new mines to replace those that are depleted and have thus sustained the mining industry. Given access to the land, they should continue to do so.

Although it is impossible to predict the location and value of a hidden resource, it is reasonable to expect numerous new mineral showings to be discovered and several deposits to be delineated over the next 10 to 20 years. Some may be economically viable. The types of deposits found and the scope of the developments that will result are unknown but, based on past experience, they may include medium-sized underground operations. It is quite possible that some of the proposals discussed in this report may become economically viable. The environmental impact of a typical mine/mill complex would typically be limited to a few hundred hectares within a single valley, a road/transportation route to the coast or Atlin, and a load out facility. Any such development would be regulated and would benefit the nearest main community, and the province as a whole.

8 Glossary
**Acid Rock Drainage**: Acidic seepage from rocks containing sulphides that have been exposed to the combination of air and water.

**Adit**: A nearly horizontal passage by which a mine is entered from the surface.

**ARIS**: Assessment Report Information System of the B.C. Ministry of Energy and Mines. The system tracks reports that outline data gathered by industry on mineral exploration and development projects.

**Bedded Sulfide Deposit**: Layers of sulphide minerals parallel to rock masses (beds) occurring in large horizontal planes.

**Coast Plutonic Complex**: An intrusive, mainly granitic, mountain chain extending the length of coastal British Columbia, formed as a result of the heating and melting of an oceanic plate that was forced under the continental plate.

**Concentrate**: A product containing the valuable metal from which most of the waste material has been eliminated.

**Dike**: A long and relatively thin body of igneous rock that, while in the molten state, has intruded a fissure in older rocks and then solidified.

**Igneous**: Rocks formed by the solidification of molten material that originated within the earth.

**Intrusion**: A body of igneous rock formed by the consolidation of magma intruded into other rocks, in contrast to lavas, which are extruded upon the surface.

**MapPlace**: An interactive website produced by the B.C. Ministry of Energy, Mines and Petroleum Resources, which facilitates easy access to maps and databases.

**Mineral**: A naturally occurring homogeneous substance having definite physical properties and chemical composition and, if formed under favourable conditions, a definite crystal form.

**Industrial Mineral**: A broad range of minerals such as gemstones, dimension or building stone, plus minerals which are used in industry and manufacturing processes in their natural state, e.g. asbestos, salt, talc.

**Metallic Mineral**: A mineral that is typically fusible, opaque, a good conductor, and shows a metallic luster, such as gold, lead, zinc and silver.

**Mineral Tract**: An area of similar geology that is used for the projection of mineral potential by the B.C. Ministry of Energy and Mines, Mineral Potential Assessment Project.

**Mineralized Vein Deposits**: An occurrence of ore in a fissure, fault or crack in a rock filled by minerals that has travelled from some other source.
MINFILE: A database developed and maintained by the Ministry of Energy and Mines that documents known mineral occurrences in B.C., supplying information on the location, commodities, geology, known extent and level of development of each occurrence. Occurrences are largely compiled from government and industry sources (i.e. geological survey crews, regional geologists and industry assessment reports). The database is based on reported occurrences and is continually updated.

Ore: A mixture of ore minerals and gangue (waste) from which metals can be extracted at a profit.

Ore shoots: The portion, or length, of the vein or other ore structure that carries sufficient valuable minerals to be profitable to mine.

Placer: An alluvial deposit of sand and gravel containing valuable minerals such as gold, platinum or tin.

Schist: A foliated metamorphic rock whose grains have a roughly parallel arrangement and is generally developed by shearing.

Tailings: Material rejected from a mill after the recoverable valuable minerals have been extracted.

Waste Rock: Barren rock in a mine or material too low in grade to be of economic value.

9 References


Websites:

www.infomine.com
10 MAPS

Map 1: Atlin Taku planning area.