ASSESSORS' HANDBOOK
SECTION 560

ASSESSMENT OF MINING PROPERTIES

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CALIFORNIA STATE BOARD OF EQUALIZATION

PREFACE

This edition of Assessors' Handbook Section 560, Assessment of Mining Properties, is a complete rewrite of the original manual (entitled Valuation of Mines of Quarries) written in 1973. The original manual was written under the direction of the Assessors' Mining Advisory Committee by eight authors, including two from the Board's Assessment Standards Division (ASD). The first draft was completed by a former ASD employee; subsequent revisions are primarily the work of Policy, Planning, and Standards Division authors writing at the direction of the Board.

The goal of this handbook is to give the appraiser an understanding of the components and complexities of mining property appraisals. For purposes of accuracy, the appraiser should consult with qualified experts regarding more technical aspects of geology or engineering.

As part of the process of producing this manual, meetings chaired by Board of Equalization Member Dean Andal (Second District) were held first with industry representatives and then with assessors of hard mineral–producing counties. Conflicts were identified and most were resolved. Those issues not resolved by meeting with industry and assessors were voted on by the Members of the Board of Equalization after hearing testimony from interested parties and Board staff. The results of the voting are reflected as Board positions on issues in this manual.

The valuation and assessment of mining properties for property tax purposes, especially under the mandates of Article XIII A of the California Constitution (Proposition 13), represents a complex and sometimes controversial challenge to county assessors. There is an ongoing need to enhance uniformity in the assessment of these properties wherever they are located in California. To that end, we submit this edition of Assessors' Handbook Section 560, which the Board adopted on March 19, 1997.

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March 1997

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Chapter 1 : GEOLOGY FUNDAMENTALS

INTRODUCTION

Minerals, as found in the earth today, are exceptional occurrences that constitute only a tiny fraction of the earth's crust; but are important economically far beyond their volume in nature. Minerals were not a part of the earth's original creation, but were formed over the millennia subsequent to creation.

Geology is the study of the earth. There are many branches of geology that provide information regarding minerals. To identify a few, there is petrology (study of rocks), mineralogy (study of minerals), economic geology (the science of locating and processing ores), paleontology (the study of fossils), structural geology (a study of the internal structure of the earth), stratigraphic geology (a study of the beds of rock laid down during geologic time), and historical geology (a study of the events in the earth's history). The study of mineral deposits falls under the branch categorized as economic geology.

The earth's surface is a thin crust about 62 miles in thickness, with an inner core consisting mostly of liquid iron. If it were compared to an egg, the yolk would be the core, the white would be the mantle, and the shell would be the crust that supports life. The iron core rotates against the mantle and induces the earth's magnetic field, giving the earth its magnetic poles, long used for navigation.

The occurrence and location of a mineral is subject to the natural forces of the earth and geologic time. With the exception of the aggregate minerals, a deposit is rarely homogeneous. This means that the important economic mineral usually occurs in varying concentrations distributed unevenly throughout the deposit and at varying depths.

As a result, a mining company faces a two–fold challenge: 1) the need to find a deposit, and 2) the decision that the deposit can be economically mined. The company must determine the distribution and grade of the mineral in three dimensions below the surface as well as the most economic pit design – assuming that the mineral can be open pit mined. This may involve the drilling of core sample holes in the earth in a spaced grid pattern and computer modeling to determine pit design. Pit design is critical because moving large volumes of waste and overburden can be very expensive. Minute shifts in the location of the pit can involve millions of dollars in future income and operating costs. Because of the high expense of underground mining, there is very little today involving the use of shafts and tunnels, although sometimes that is the only way a deposit can be economically mined.

BASIC MINERALS AND ROCKS

A ***mineral*** is defined as a substance occurring in nature with a characteristic chemical composition and usually possessing a definite crystalline structure, which is sometimes expressed in external geometrical forms or outlines. To be classified as a mineral a substance must be the product of nature and not the result of a laboratory process. For example, calcium sulfate, expressed by the chemical formula $CaSO_4$, is a naturally occurring mineral called gypsum. It can also be made in the lab, but it would not be called gypsum, but rather calcium sulfate.

In composition, most minerals are ***inorganic*** (not containing carbon), and are either chemical elements, or combinations of such elements, known as chemical compounds. There are, however, some important ***organic*** minerals (containing carbon), such as coal, amber, petroleum, lignite, and asphalt.

The minerals that are elements are simple in chemical composition, such as sulfur, silver, copper, and gold. There are about 3,000 varieties of minerals which may be classified as ***metallic***, ***nonmetallic,*** or ***organic***.

Many minerals exist naturally in the form known as ***crystals***. There is an entire field of study dealing solely with mineral crystals called crystallography, which relies heavily on the mathematical principles of solid geometry. Some crystals, such as quartz are commonly recognized. Being able to determine the kind of crystals a mineral exhibits can help to identify the mineral.

The exterior of the earth is made up of solids, liquids, and trapped gases. The solids are commonly called rocks. A ***rock*** is defined as any naturally formed aggregate or mass of mineral matter. Rocks are made up of consolidated or unconsolidated minerals. However, rock can be a single element, and an element can be a mineral. For instance, a large natural accumulation of sulfur is an example of a rock, a mineral, and an element. Generally, however, a rock consists of more than one component. If one examines a rock carefully, it visibly appears to consist of several components. For example, a specimen of the rock granite contains three main components: (1) a colorless, granular, and glassy material called quartz; (2) a pinkish, light colored substance with rather even surfaces, known as feldspar; and (3) a black, soft, and scaly material called biotite. Quartz, feldspar, and biotite are minerals, each of which consists of chemical compounds having unique physical characteristics.

PHYSICAL CHARACTERISTICS OF MINERALS

All minerals have distinctive physical characteristics that can be useful in identifying the mineral. Some of these characteristics are briefly described below.

HARDNESS

Many mineral textbooks list minerals by hardness. The resistance of a mineral to abrasion or, scratching is called hardness. ***Hardness*** is indicated in relative terms on Mohs' Scale, which consists of ten minerals arranged in order of increasing hardness.

Table 1–1 Mohs' Relative Hardness Scale

1. Talc	6. Orthoclase (Feldspar)
2. Gypsum	7. Quartz
3. Calcite	8. Topaz
4. Fluorite	9. Ruby (Corundum)
5. Apatite	10. Diamond

Mohs' Scale is not linear but simply indicates relative hardness. For example, in a Mohs' kit of minerals, it is possible to determine the approximate hardness of the specimen by examining its capacity to be scratched or to scratch another specimen. If the specimen was scratched by apatite, but not by fluorite, its hardness must be between 4 and 5. Along with other physical characteristics of the specimen, its relative hardness helps to identify the mineral.

Most minerals have a hardness of less than 6. Gemstones generally have hardnesses of greater than 6. Pure gold (24 karat) has a hardness of 2.5 to 3.0. For jewelry purposes copper and silver are alloyed with gold to increase its hardness. Fourteen karat gold is only fourteen–twenty-fourths pure gold, or 58 percent. Common levels of hardness for familiar objects are: fingernail 2.5, copper coin 3, knife blade 5.5, window glass 5.5, and a steel file 6–7.

CLEAVAGE

Cleavage is the property of splitting or readily separating along definite planes. It is frequently very conspicuous, especially in minerals that exist as crystals. Muscovite is a good example of a mineral with generally perfect cleavage. Thin sheets of it were once used in oven doors so a person could look in without opening the door. It is heat resistant and transparent.

OTHER PROPERTIES

There are some physical characteristics of minerals that are self explanatory, such as luster, color, tarnish, transparency, taste, odor, feel, and magnetic attraction. Others are less obvious, but equally important, including the following:

Play of colors	Exhibits different colors as it is rotated.
Opalescence	Milky or pearly reflections from the interior
Chatoyancy	Changeable, wavy, silky sheen
Iridescence	Play of colors on the surface
Asterism	Starlike effect when viewed in reflected light
Streak	The color left when scraping the mineral
Tenacity	Behavior when attempting to break, cut, hammer, crush, bend, or tear.
Specific gravity	Weight in air compared with the weight of an equal volume of water.
Fluorescence	Glow when ultraviolet light is applied
Electrical	Some minerals, such as quartz, possess electrical properties.
Structure	Some minerals exhibit unique structure, possibly fibrous, columnar, and cellular.
Refraction	Some minerals, such as calcite, exhibit double refraction.
Striations	A series of parallel lines on the surface of the mineral. Pyrite (fool's gold) is an example.

All of the above properties are important in identifying minerals, but they do not represent a complete list.

The weight of a mineral is also significant. Precious metals such as gold, silver, and platinum are weighed in the ***troy system***, not the ***avoirdupois*** system (based on 16 ounces to a pound). In the troy system there are 12 troy ounces to one troy pound and 20 pennyweights or 480 grains to one troy ounce. Thus, an avoirdupois ounce contains 28.35 grams, and a troy ounce contains 31.035 grams.

Another aspect of weight is the specific gravity of a mineral. Specific gravity is the ratio of the density of a substance to the density of another standard substance such as water. For example, gold has a specific gravity of 19.3, which means it is 19.3 times heavier than an equal volume of water. Thus, a cubic foot of water weighs 62.4 pounds, but a cubic foot of gold weighs 1,200 pounds. A cubic foot of lead would weigh 700 pounds. While gold is heavy, it is also extremely malleable. One ounce can be pounded into a sheet that will cover 160 square feet.

These properties of gold (or any other mineral) not only help to identify it, but are also indicative of its existence in elemental form in ancient placer deposits.

ROCKS

A rock can consist of a single mineral or more than one mineral. Rocks, generally classified according to their origin, fall into three classifications:

- Igneous
- Sedimentary
- Metamorphic

IGNEOUS

Igneous rocks resulted from the solidification of a molten or liquid mass, commonly called a magma. Igneous rocks are generally classified in the field on the basis of grain or texture and mineral composition, and can be further classified according to whether they are ***extrusive*** or ***intrusive***.

If the ***magma*** reached the surface, the resultant rock is called **extrusive** or volcanic. Rocks of this type are characterized by fragmented, glassy, cellular, or extremely fine–grained textures. Due to the rapid cooling of the surface, no mineral crystallization or only very fine crystals occur when such a rock cools. In rapid cooling, crystals do not have time to grow. Examples of an extrusive rock are pumice and obsidian. Obsidian is commonly black, hard, and glassy. Pumice is light colored, light weight, frothy, and abrasive. The Indians used obsidian for arrow points.

Magmas that have solidified at great depth yield ***plutonic*** or ***intrusive*** rocks which have cooled very slowly and therefore will yield large and well developed crystals. An example of an intrusive rock is granite.

It is important to recognize that not all rocks follow an orderly classification system regardless of their specificity or inclusive design. Rocks can and do vary widely in color, composition and texture, and gradation. For example, an examination of 10 different specimens of granite from different parts of the earth, would, of course, disclose some similarities, but it would also demonstrate significant differences. Differing amounts of individual mineral constituents and even differing colors of the constituents would appear in each. Given such differences, the table below represents the classification system used for categorizing the general properties of igneous rocks.

Table 1–2 Types of Igneous Rocks

Igneous Rocks (Solidified from a molten mass)		
Coarse–grained crystalline	Fine–grained crystalline (or crystals and glass)	Fragmental (crystalline or glassy)
Origin: deep intrusion, slowly cooled	Origin: quickly cooled volcanic or shallow intrusive	Origin: explosive volcanic fragments deposited as sediments
Granite Diorite Gabbro	Phyolite Andesite Basalt	Ash and pumice (volcanic dust and cinders) Tuff (consolidated ash)

Modified from Water and Power Resources Service, 1981

SEDIMENTARY

Sedimentary rocks are of secondary origin, having been derived from the disintegration of older rocks through the action of weathering. A sedimentary rock consists of the remnants and redeposition of a weathered igneous, ***metamorphic*** (see below) or sedimentary rock.

Sedimentary rocks are characterized by parallel or bedded structure, similar to a stack of books. The layers may vary in thickness and the individual grains of the materials making up the rock may show considerable variation in composition and size. When particles of sand varying in size from 0.02 to 2.0 mm diameter become consolidated, sandstone results. (25.4 mm equal one inch.)

Sedimentary rocks form widely extended deposits which are generally without great vertical dimensions, especially when compared with some of the massive igneous formations, although they can be many thousands of feet thick. Sedimentary rocks are classified in the field based on origin as follows:

- Mechanical sediments such as shale, sandstone, and conglomerate
- Chemical sediments such as gypsum, salt, and limestone
- Organic sediments such as coal or limestone
- Evaporite sediments such as salt and anhydrite.

Mechanically deposited sediments are those that are transported from one place to another by water, wind, or glaciers. Chemically deposited sediments are those that are precipitated from solution when certain chemical solutions come in contact with each other. Organic sediments are the remains of once living organisms. Limestone can be of either chemical or organic origin.

Sedimentary rocks are typically porous, while igneous and metamorphic rocks are not. The tiny pore spaces between the grains can store oil, gas, and water. If the pores are interconnected, these fluids can move through the rock. The ability of the pores to conduct fluids is called permeability. Porous, permeable rocks are the typical sources of aquifers and petroleum.

In order for the individual grains of a sedimentary rock to be held together, they are “cemented” by nature with various minerals that vary from one sedimentary rock to another. Typically, the cementing material is silica or calcium carbonate, although it may also consist of iron oxides, barite, anhydrite, zeolites, and clay minerals. The “cement” holds the grains in place, but leaves pore space and permeability available.

To visualize a sedimentary rock as a fluid reservoir, imagine a bucket filled with sand, and slowly add water. It is possible to add about a half a bucketful or more of water depending on the size and shape of the sand grains.

Many of the quarried aggregate rocks are sedimentary in origin. These rocks have enormous potential for use as building materials. Such rocks include sandstones and limestones. There are other sedimentary rocks that have economic use such as gypsum and salt. Gypsum has a variety of uses, but it is used chiefly for wallboard.

Organic sediments consist of the skeletal remains of once living organisms. Examples of these are fossiliferous limestone and diatomaceous earth. Diatomaceous earth consists of the microscopic remains of fossil diatoms, a microscopic plant having an outer skeleton of hydrated silica, and which inhabits both fresh and salt water. Diatomaceous earth has enormous economic use as filtering material for wines, fruit juices, and swimming pools.

Evaporite deposits, such as salt beds or potash beds, are usually mined from ancient lake beds where water has evaporated, leaving behind chemicals that were contained in solution. Searles Lake in San Bernardino County is an excellent example.

Table 1–3 Types of Sedimentary Rock

Sedimentary Rocks (Sediments transported by water, air, ice, gravity)	
Mechanically deposited	Chemically or biochemically deposited
Clastic:	Calcareous:
Shale (Consolidated clay) Siltstone (Consolidated silt) Sandstone (Consolidated Sand) Conglomerate (Consolidated rounded gravel or cobbles) Breccia (Angular fragments)	Limestone Dolomite
	Siliceous:
	Chert Flint Agate Chalcedony
	Others:
	Coal, phosphates, saline deposits

Modified from Water and Power Resources Service, 1981

METAMORPHIC

Metamorphic comes from the word *metamorphose* which means to *change in form.* A **metamorphic** rock is one that has undergone change by heat and pressure to form a new rock of different texture, composition, and internal structure. Any rock type can be metamorphosed. Sandstones that have been metamorphosed become quartzites, shales become slates, and limestones become marble. Quartzite is a very hard rock where the small grains have become "fused" together instead of merely cemented together as they are in sandstone. Metamorphosed rocks also have enormous value in the building industry.

Table 1–4 Types of Metamorphic Rock

Metamorphic Rocks (Any rock type changed by heat or pressure)	
Foliated:	Massive:
Slate Schist Gneiss	Marble Quartzite

Modified from Water and Power Resources Service, 1981

GEOLOGIC STRUCTURES

The following discussion represents a brief coverage of the basic aspects of structural geology.

Diastrophism is the term applied to all movements of the solid parts of the earth with respect to each other. These movements are generally slow and evolve over periods of thousands or millions of years. Some examples are the elevations of sea bottoms to form mountains or plateaus, or the subsidence of areas that are inundated with water and become covered by thousands of feet of sediment. The diastrophic processes may be classified as follows:

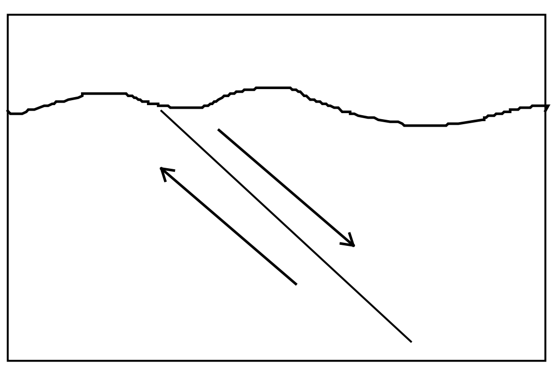
- Uplift – elevation of portions of the earth's crust
- Subsidence – depression of portions of the earth's crust
- Plate tectonics – crustal plates that move with respect to each other, both sideways and by slipping underneath each other.

Plate tectonics actually accounts for most of the faulting and volcanic action on the earth. The plate tectonic model is one in which the crust of the earth is made up of plates which can move separately with respect to each other. The San Andreas ***fault***, which runs the length of California, is the eastern boundary of the Pacific plate, where it meets the North American plate. While the San Andreas fault is the mother fault at the plate boundary, there are thousands of other faults, all associated with the San Andreas, that either meet it or are off-shoots of it. It is along this complex fault system that much of the seismic activity occurs.

A ***fault*** is a fracture in the earth along which there has been a displacement relative to the two sides. The displacement can be in any direction vertically or horizontally or both. The following constitutes some simple examples.

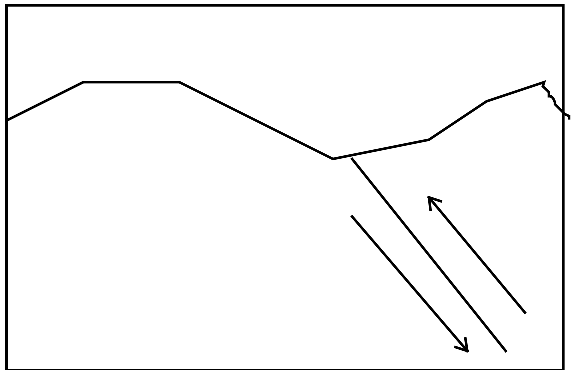
A ***normal fault*** is one in which the ***footwall*** moves upward in relation to the ***hanging wall***. Below is a view of such a fault in cross section. The terms footwall and hanging wall are used because the two faulted blocks are pulled apart laterally. A person could “walk” along one wall, but only “hang” from the other one.

Figure 1–1 A Cross Section of a Normal Fault



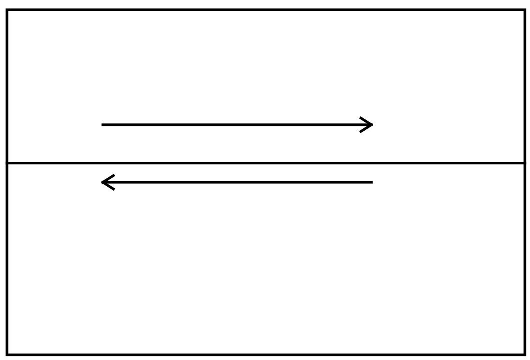
A ***thrust*** or ***reverse faul***t is one in which the hanging wall has moved upward in relation to the footwall.

Figure 1–2 Cross Section of the Earth Showing a Thrust Fault



A ***lateral fault*** is one in which the movement has occurred laterally of one side with respect to the other. Below is a plan view of a lateral fault similar to the San Andreas fault where the two sides move in opposite directions.

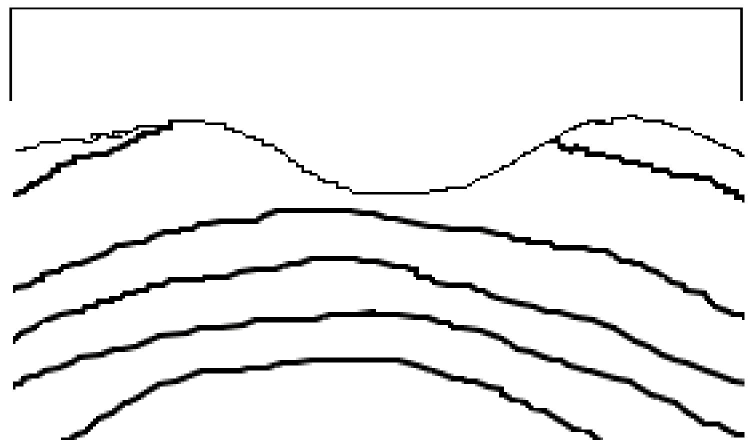
Figure 1–3 A Plan View of a Lateral Fault



Because most fault movement occurs slowly and is quickly overtaken by erosion, the effect of the movement is usually hidden to the casual observer. Nevertheless, the fault is still there and it could be quite active. Faults are important economically, since they are often filled with minerals derived from underlying magmas.

Fissures are small fractures in rock caused by rupturing that sometimes occurs during folding from lateral compressional forces or from pressures exerted from below the rock from upwelling magmas. These small fractures can be filled with minerals supplied by encroaching magmas. Folding of rocks is another very common phenomenon. There are folds called ***anticlines*** and ***synclines***. These patterns of folds in nature are constantly repeated in nature, they are not perfectly symmetrical and may even be faulted.

Figure 1–4 Beds of Sandstone Folded into an Anticline Beneath the Earth's Erosional Surface



The layers of sedimentary rock are separated by what geologists call ***bedding planes.*** These are the division planes that separate the individual layers. Bedding planes are found only in sedimentary rock types and represent changes in deposition over periods of time.

ORE DEPOSITS

An ***ore*** is usually a natural mineral compound of the elements, of which at least one is a metal. Often the metal is not recognizable as such because it is bound into a compound, as in the case of tungsten ore. Two important tungsten ores are wolframite and scheelite, both compounds in which the metal tungsten is combined with various other elements.

Many of the metallic ores have been emplaced in a host rock system after the initial formation of that host rock system. This is the result of the flow of molten rock (magma) deep within the earth. The magma, containing the ore minerals, slowly forces its way upward from deep within the earth. In the process it finds zones of weakness within the rock and will rise upward and finger into the overlying rock, then gradually cool as the upwelling pressure subsides. Alternatively, the upwelling magma itself will push into the overlying rock, and the heat and pressure from the magma will cause the host rock to metamorphose. This process is called ***contact metamorphism***.

Ore deposits are not orderly, layered regions of rich mineralization, but are typically discontinuous pockets that can be difficult and expensive to find. They may be near the surface or at some depth. They may even be partially eroded away and exposed at the surface. The economics of the deposit is highly dependent on a number of factors related to the character of the deposit and its chemistry. Chapter 4 covers ore deposits in more detail.

GEOLOGIC TIME

As previously noted with regard to geologic time, all the geologic processes have been at work throughout geologic history. Whether fault movement, uplift, subsidence, folding, or sedimentary deposition, the process occurs slowly and imperceptibly. Plate movement varies only about one-half inch to five inches per year at the most. A motion of just two inches a year adds up to 30 miles in one million years. Some plates have been in motion for 100 million years for a total movement of 3,000 miles.

Figure 1–5 is a geologic time chart showing geologic eras and periods.

Figure 1–5 Geologic Time Chart

Era	**Period**	**Epoch**	**Age (in Millions of Years)**
Cenozoic	Quaternary Tertiary	 Pliocene Miocene Oligocene Eocene Paleocene	Recent 1.6 66.4
Mesozoic	Cretaceous Jurassic Triassic		66.4 245
Paleozoic	Permian Carboniferous Devonian Silurian Ordovician Cambrian		245 540
Pre-Cambrian	Late Pre-Cambrian Early Pre-Cambrian		540 3960

Chapter 2 : THE MINING INDUSTRY

MINING AND QUARRYING IN CALIFORNIA

Minerals are the foundation of our modern civilization. The average American uses about 40,000 pounds of new minerals each year. Wherever we may be at the moment, we find ourselves surrounded by materials that came out of the earth—buildings, automobiles, roads, glass, plastics, fuels, cement, books, paint, batteries, light bulbs, medicines, jewelry, airplanes, trains, buses, tile, and rugs. Earth materials bear the energy to provide our movement on the planet, lighting, heating, and cooling. They also bear the raw materials to wage war and destruction.

Without those raw minerals that come out of the earth, modern civilization would not be possible. We have come to depend on them for the maintenance of our present quality of life.

It has been said that all true wealth flows from the agricultural and *mining* sectors of the economy. Given the importance of mineral commodities in the economy, such a statement does not come as a surprise. Even today's agricultural economy depends on mining.

California is a mineral–rich state. It is America's major producer of geothermal energy, rare earth minerals, boron, cement, sand and gravel, asbestos, calcined gypsum, and diatomite. It also produces gold, talc, sodium compounds, perlite, pumice, silver, iron, clays, limestone, dolomite, feldspar, lime, tungsten, titanium, stone, decorative rock, potash, and calcium chloride. In 1995, the value of California nonfuel mineral production was $2.68 billion. Over 80 percent of that was *industrial* mineral production.

At this writing there are about 1,100 active mines in California. Most are construction aggregate, followed by other industrial minerals and the metals. The mines are located in every county except San Francisco County.

Some of California's production has great historical significance in the state's population and development. The discovery of gold by John Marshall at Sutter's Mill near Coloma in 1848 spurred the rush westward by the hordes of "forty-niners," intent on making a fortune. Also legendary are the famous twenty–mule teams in Southern California that hauled borax out of Death Valley, pulling loads of 36½ tons, consisting of two wagons of ore and a water tank. Between 1883 and 1889, they hauled 20 million pounds of borax out of Death Valley to the train hub at Mojave.

During the 1980's, many of California's historic gold mining districts underwent rejuvenation as a result of advances in the technology of economically extracting gold from ore and the more favorable market price of gold. California in 1992 was the second largest producer of gold in the nation, with just over one million ounces.

As in any specialized filed of appraisal, a working knowledge of the scientific terminology and specific industry practices in the mining business is extremely beneficial. For this reason, the handbook includes a glossary of mining terms and a rather large section dealing with geology and minerals.

As an overview, today's mining business involves many facets which may affect an appraisal, including:

- Permitting
- Land negotiation and acquisition
- Royalty payments
- Mining law
- Economics
- Environmental law
- Regional geology
- Geologic exploration
- Sample analysis
- Ore crushing and grinding
- Ore chemistry and processing methods
- Reserve calculations and statistical analysis
- Mining engineering
- Specialized personnel training
- Mining equipment
- Mining finance
- Mineral and mineral product futures
- Politics
- International monetary values and futures
- Social awareness and good neighbor policies
- Economic outlooks

MINERAL USES

Since the beginning of civilization, mining has had a profound impact on society. Early man's first use of minerals was to make tools, pottery, weapons, paints, pigments, jewelry, ceremonial items, and fire from the metals, rocks, and stones found in the earth. There is archeological evidence that iron mines were worked 43,000 years ago in Africa, probably for pigments. Wars were and still are fought over minerals. Wars could not be fought without them! Even colonization of many areas of the world was brought about by the need for minerals by industrial countries. Today, politics and trade are shaped to a large degree by the locales of minerals.

Most of us go about our busy lives without an awareness of where material things originate. Occasionally, we are reminded, whenever there is a sudden scarcity, such as the gasoline lines in the early 1970's and the dramatic overnight oil price increases which resulted in sudden awareness of the Middle East as a major source of world oil supplies. The shortage affected both mobility and a sense of security. The demand for mineral materials has grown to an amazing level of usefulness and necessity.

CONSTRUCTION

Roads and highways, buildings, and foundations are often constructed of concrete which is a mixture of cement and aggregates. Cement is made from limestone, gypsum, iron oxide, clays, and sometimes pozzolan. Aggregates are sand and gravel or crushed stone, such as limestone, dolomite, granite, or volcanic rocks. Even blacktop contains aggregates, although the base material is asphaltic, i.e., derived from petroleum.

TRANSPORTATION

Trains, planes, cars, buses, and missiles are made from minerals. Glass and ceramics are made from silica sand, limestone, talc, lithium, borates, soda ash, and feldspar. Tires contain clay and calcium carbonate. Mag wheels contain dolomite, aluminum, and magnesium. Plastics are made from calcium carbonate, wollastonite, mica, talc, clays, and silica. Paints are made from titanium dioxide, kaolin clays, calcium carbonate, micas, talc, silica, wollastonite, and others. Engines are made from aluminum, iron, or an alloy. Spark plugs are made from ceramics, steel, copper, and tungsten.

The oil and gasoline used in vehicles came originally from a hole in the earth drilled with steel pipe and high carbon or tungsten steel drill bits. Some of these bits are faced with industrial diamonds called “bort.” The fluids used to drill the oil wells are composed of barite, bentonite, attapulgite, mica, and perlite.

COMMUNICATIONS AND COMPUTERS

Communications equipment is made from plastics, copper, steel, gold, silicon, glass, and a host of other minerals. Fiber optics, a newer growth industry, is founded on innovations made from glass. Television sets, stereos, and computers are filled with micro processors containing silica and gallenium, and are manufactured from carbon, copper, plastics, glass, steel, zinc, rare earths, iron oxide, and many other minerals. It requires 33 different minerals to make a computer. Some of the rarest of these are produced in California.

AGRICULTURE

As well as the obvious uses of minerals to make farming equipment, there are those used for the fertilizers, soil conditioners, and pesticides necessary to modern farming. These include potash, phosphates, nitrogen, sulfur, gypsum, and limestone, in addition to the organic chemicals that have their origins in natural gas and crude oil.

JEWELRY

Jewelry was one of the earliest uses of minerals by man. Such uses go back to the ancient Greeks, Egyptians, Africans, and Chinese. Silver, gold, platinum, garnet, lapis, opal, amethyst, topaz, malachite, turquoise and diamonds are just a few of the minerals used for human adornment.

OTHER

This is, of course, a large category which includes everything not previously classified, such as oil well drilling equipment, mining equipment, tools for military use (e.g., guns, ammunition, and ships of war), the space program, household items, surgical tools, and myriad other products that man uses in a modern civilization.

MINING ECONOMICS

INTRODUCTION

No major mining enterprise is undertaken without a careful and ongoing consideration of economics. In valuing mining properties, the appraiser should consider the risks appropriate to mining operations.

Mining properties differ greatly from other types of property – physically, economically, and politically for several reasons. First, the location is not subject to the choice of the miner. Mining properties are located anywhere that an economic deposit of the mineral may be found – in the hot deserts, high in the mountains, or in the middle of a city. As such, mining operations are subject to transportation, weather, political, environmental, and other logistical factors endemic to that particular location.

Second, because of the nature of the uncertainties and hazards involved in a mining operation, a proportionately larger profit margin as compared to other fabrication and manufacturing industries may be necessary to justify the risk of capital by the investors.

Third, minerals are depleting assets. Generally, once they are removed from the earth they are gone forever. In addition, as the miner goes deeper into the ground to extract the mineral, the cost of extraction increases. Although there is some limited recycling possible at present, e.g., aluminum and glass, it is has little effect on the depletion of most mineral resources.

Fourth, there are substantial physical risks connected with mining. These risks include the hazards presented by operating heavy equipment and handling explosives material. There is frequently dust and hazardous chemicals. Mining is labor intensive and requires advanced technology to economically locate, develop, and produce a deposit.

Fifth, prices for minerals are typically unstable and subject to great fluctuation. As one would expect with such commodities, many minerals are very sensitive to world market forces. Where a mining operation is successful because the price is high, the physical and economic hazards are offset by a high return on invested capital. However, a change in the demand can immediately trigger a decrease in the price and ultimately the return. For example, the slowdown in the construction industry related to the economic recession of the late 1980's and early 1990's affected the demand for construction aggregates. The peak year for cement production in the United States was 1987, but output declined each year for the next four years.

Finally, there is also the political factor. Volatile political situations can affect world prices. For example, import tariffs can change, environmental considerations can change, and governments sometimes stockpile minerals and/or dump them on the world market. “Dumping” is designed to depress prices and drive the competition out of business.

The following paragraphs discuss these important considerations in greater detail with regard to some of the specific effects on mining economics.

LOCATION OF MINERAL DEPOSITS

One of the major differences between mineral properties and other property types is that the location of mineral deposits is controlled by nature, not by man. Only the location of structures that man builds on mineral properties *are* within his control.

The specific location of the mineral property can and does affect costs of mining. Consider, for example, a mining property at 10,000 feet elevation in the Sierra Nevada. Because of adverse road and weather conditions in the winter months, mining may be done only seasonally. The mine's competitor may be operating at a much lower elevation with no winter shutdowns. This would certainly put the high–elevation mine at a competitive disadvantage. It is possible, however, that such a disadvantage may be offset by a richer ***ore grade*** (see glossary) or, perhaps, by other factors.

Consider mines that have regional markets such as aggregate properties. These can be more seriously impacted by their location than mines with world markets. The costs of transportation will be manifested in the mine’s cost of sales. For example, assume one property is 10 miles from town, and one is 30 miles from town. The town is the market for both properties. If both operators have hauling costs of $60 per hour, and a round trip from each quarry to the city takes one-half hour and one-and-a-half hours respectively, it requires triple the amount of time for the distant quarry to haul to the city. That quarry’s hauling costs are three times higher than its competitor. If both quarries use 25 ton trucks, the closer quarry has a $2.40 per ton advantage over the distant quarry. There are, of course, other factors involved, such as truck maintenance, driver costs, and the total number of trips that can be made in one day with a given number of trucks.

DEPLETION OF MINERAL DEPOSITS

Most mineral deposits are *exhaustible*, that is, the mineral *reserves* become depleted with production. Once depleted, a mine owner must explore for more minerals elsewhere. Reserve depletion is the reason these businesses constantly *explore* for new deposits. They employ staffs of geologists for that purpose. The exploration and development of mineral reserves is discussed in greater detail in Chapter 4, “Ore Reserves.”

This depletion of reserves affords an appraiser a useful tool for the valuation of mineral deposits. The total amount of projected future production by year cannot exceed the amount of reserves that are present.

It is important to recognize that not all mineral properties become exhausted. For example, neither the extraction of salt from sea water nor the recovery of aggregates from active rivers results in depletion. (River aggregates are usually replenished seasonally by river waters.)

COMPETITION AMONG MINERALS

Sometimes minerals compete with each other. One mineral may be substituted for another because of price or other advantages, thereby impacting the demand and ultimately the price for both. This is observable in the marketplace where one substance replaces another, such as aluminum or plastic for steel.

Aluminum was first introduced into the can manufacturing process in the 1960's when it replaced the tin–plated steel can tops in the three–piece can. In 1967, the first all–aluminum cans were introduced, displacing steel cans and some of the glass bottle market. Two years later, a new alloy of aluminum, H19, was developed, which gave it superior strength characteristics and made it even more popular. Aluminum containers are now commonplace.

The pipe market is one in which a material substitution process is still underway. The percentage of plastics in the pipe market has grown from zero in 1960 to 80 percent in 1993, and is continuing. It replaces clay, steel, concrete, and copper.

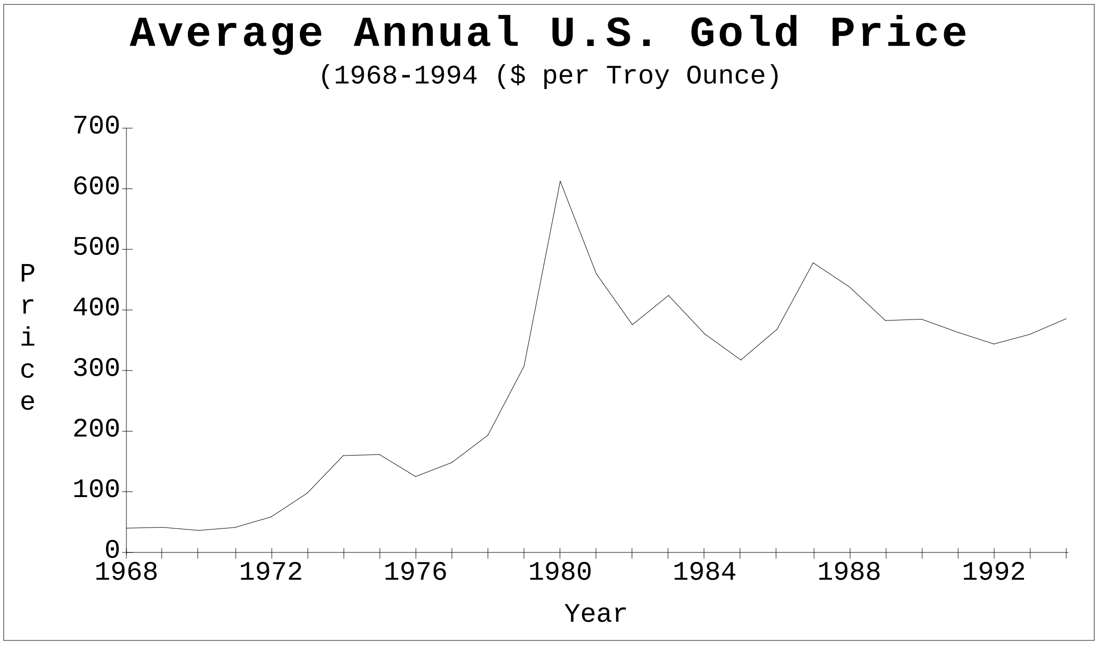
At one time milk only came in glass bottles Now it is generally limited to plastic or plastic–coated paper containers. Chrome–plated bumpers have been replaced by plastic except on light trucks. Asbestos building materials and mercury batteries have been almost totally replaced. The list is too lengthy to include here. Such major shifts in the uses of materials has had a major impact on the industries involved.

Another form of competition is where one mineral deposit replaces another of the same substance. A dramatic California example is that of the borate deposits at Ryan in Death Valley, home of the twenty–mule teams. The dominant boron mineral there, colemanite, is more expensive to process than the borax and kernite near Boron and the borate brines of Searles Lake. As a result, borate mining in Death Valley ceased many years ago, even though the colemanite deposits were far from depleted.

MINERALS AND MINERAL COMMODITIES PRICE STRUCTURE

Mineral price outlooks can be affected by the U.S. and world economies as they relate to the business cycle, politics, war, inflation, business competition, competition of other minerals, taxes, dumping by nations to drive out competitors, national stockpiling, new discoveries of competing deposits, environmental concerns, strategic uses, over or under production, deposit location, and reserves. Figure1–1 exhibits how the price of gold has fluctuated over the years.

Figure 2–1



The relationship between commodity prices and national and/or world events is a very common phenomenon and one that is especially important to appraisers. Events affecting the price of gold are too numerous to list here, but one is worthy of note. At one point on the chart there is a peak in the price of gold during 1980. The events leading up to that peak were worsening economic conditions, specifically high inflation and rising interest rates in the U.S. beginning in 1978. In addition, many people began buying gold as an inflation hedge, helping to push up the demand for the metal. Thus, political events in the U.S. and elsewhere propelled the gold price to a historic high of $850 an ounce on January 21, 1980.

The *Engineering and Mining Journal*, an industry periodical, is a good source of pricing data for gold and other metals. The March issue usually contains an outlook by mineral commodity and is written by experts in each field.

While the majority of minerals prices are affected by world competition, the most abundant minerals are affected most by local competition. These include minerals such as sand and gravel, limestone, common clays, and rock, which are commonly termed "***aggregates***."

Rock Products magazine is an excellent source of data for aggregate minerals. Their forecasts for the coming year, by regions of the United States, appears in the December issue.

POLLUTION, POLITICS, AND THE PUBLIC

Environmental concerns and regulations have an increasing impact on the industrial world. As environmental awareness heightens and protections and controls become institutionalized through law, both the costs and productivity of businesses are affected. This is especially true with the mining industry, where the extraction of minerals from the earth implicitly disturbs the environment. Restrictions on the mining industry, the lengthy permitting process, and stringent reclamation standards have affected jobs and prices.

For example, the United States was the second largest producer of gold in 1991, after the Republic of South Africa. Recent domestic exploration has leveled off. This is due partly to anticipated changes in the 1872 Mining Law, partly to environmental controls and costs, and partly to price fluctuations.

Government mandated pollution control devices are certainly costs of doing business and affect a property's net income in the mining industry. Newer technology for the recovery of gold uses a cyanide leaching process. Although cyanide is an unstable compound that cannot exist for more than a few weeks in the environment without breaking down chemically, the public perception is that cyanide is a dangerous pollutant. The U.S. Environmental Protection Agency is in the process of developing a minerals waste management regulatory program and has recently instituted a Stormwater Rule, which imposes strict water quality standards on all runoff from mineral and industrial properties. As a result of increased costs of compliance, many miners are redirecting their exploration and development elsewhere, often to Latin America.

Unprecedented changes in the world have occurred during the early 1990's. These changes include the Persian Gulf War, economic recessions in key industrial nations, upheaval in Eastern Europe, and the disintegration of the former USSR. These and similar changes will have a continuing effect on the entire world mining community.

Changes in local governments also have a critical impact on many mineral producing plants, particularly aggregates or those operating under the restrictions of local use permits. These permits may impose size, volume, time, or pollution constraints. The appraiser of mining properties should be familiar with the county planning department's mining applications and permit approvals.

MINERAL TAXATION IN CALIFORNIA

AD VALOREM TAXATION

Ad Valorem is a Latin phrase meaning *in proportion to value*. It generally refers to a tax on the value of property.

Article XI, Section 13 of the state’s first Constitution established the property tax in California in 1849. The Constitution and the Revenue and Taxation Code are the legal foundation for the property tax system. Those, taken together with the administrative regulations of the Board of Equalization and case law, provide the necessary legal guidelines for the assessment of property taxes.

With the passage of Proposition 13 (Article XIII A, California Constitution) in June 1978, the market value standard was replaced by an acquisition value standard for real property. (In California, all mines, minerals, and quarries in the land, and all associated rights and privileges are defined as real estate or real property.) Under Article XIII A, real property is assessed at the lower of (1) fair market value at the time of acquisition plus inflation of no more than 2 percent per year or (2) fair market value as of the lien date. This assessment system is discussed in detail in Chapter 9 “Article XIII A of the Constitution.”

OTHER TYPES OF MINERAL TAXES

California's taxation of hard minerals is limited to property taxes and income taxes. The collection of income tax is the responsibility of the Franchise Tax Board. Not all states use the property tax to tax minerals. Some states use a severance tax, others a net proceeds tax, and some use a combination of methods.

A severance tax is a tax on minerals at the time they are removed or "severed" from the earth, usually based on the value or the volume of the production. A net proceeds tax is a tax on the percentage of a certain part of the mine's income, since the ore in the ground is not taxed. Net proceeds are usually defined as total proceeds from sales for a specified period of time of all products from the mine minus certain statutory deductions that vary from state to state.

Correct identification or classification of taxes is very important for appraising mineral properties for property tax purposes. Under Property Tax Rule 8, which sets forth the income approach to value (the method generally used by mineral appraisers), property taxes, corporate net income taxes, and corporate franchise taxes measured by the net income are excluded from gross outgo (are not deducted as expenses). Most other taxes, such as business licenses, payroll taxes, uncapitalized sales taxes, etc. are allowed as expenses. See Chapter 5 and Chapter 6 for further information on the correct treatment of taxes for property tax appraisals.

Chapter 3 : MINERAL RIGHTS, MINING LEASES, MINING CLAIMS, AND OTHER INTERESTS

OWNERSHIP

Section 104(b) of the Revenue and Taxation Code defines real property in part as"…All mines, minerals, and quarries in the land,… and all rights and privileges appertaining thereto."[1] The term "land" is defined in Property Tax Rule 121 in relevant part as "the possession of, claim to, ownership of, or right to possession of land; mines, quarries, and unextracted mineral products…". All real property not exempt or immune from taxation is subject to property tax.

The terms "mineral rights" and "mining rights" as described in Section 607.5 include the right to enter in or upon the land for the exploration, development, and production of minerals including oil, gas, and other hydrocarbons.

For purposes of ownership, land may be divided horizontally as well as vertically. For example, the owner of the land may convey the minerals to another person and retain ownership of the land, or may convey the land with exception of the minerals, thus retaining the mineral ownership. The minerals can also be conveyed at different levels below the surface. Mineral rights carry an implied right of entry for the purpose of extracting the minerals. In order to eliminate the right of entry from the surface, the minerals may be conveyed below a designated depth from the surface, e.g., 500 feet. The lessee may then need to gain entry from an adjoining property owner to remove the minerals.

There are essentially two general types of property ownership: public and private. Public ownership includes federal, state, county, and city government. Private ownership includes an individual or a legal entity, each of which may be involved in one of the following circumstances connected with the right to mine minerals:

- May own the fee simple interest (or its equivalent, the fee simple absolute) in the property with no exceptions, which is ownership of all the property rights.
- May own both the mineral rights and the land in fee.
- May own the mineral rights exclusively and not the surface land.
- May lease the mineral rights from the fee owner of both the land and mineral rights.
- If the surface rights and mineral rights are under separate ownership, may lease the mineral rights from the owner of the

[1] All statutory references are to the California Revenue and Taxation Code unless otherwise indicated.

mineral rights. Reasonable compensation for damage must be provided for the surface owner. Generally the courts recognize that a mineral rights owner or lessee must be given reasonable access.

- May lease the mineral rights from a government entity through some bidding process or otherwise, in which case, the individual has a *taxable* ***possessory interest***.
- May have an unpatented mining claim, which means the individual or legal entity has a federal land mining claim granting the right of possession for the purpose of developing and extracting a discovered mineral deposit. An unpatented mining claim is also a taxable possessory interest.
- May have a patented mining claim, which means that title to the land and minerals has passed to the patent owner from the federal government.

LEASE AGREEMENTS AND ROYALTY INTERESTS

Whenever a mineral producer leases property for the extraction of minerals, the producer enters into a contract or lease agreement with the party controlling the mineral rights, either public or private. A lease agreement expresses the intent of the parties involved and each is unique. There are several things that an appraiser should particularly look for in such agreements:

- Time – Determines when the lease begins and ends, and renewal options.
- Restrictions – May obligate the mineral operator to restoration of the land, or mining only during certain hours, or to comply with certain noise restrictions, etc.
- Lease area – May include a boundary map or legal description, annual rental fees, payments to surface owner for right of trespass, etc.
- Royalty payment provisions – Establishes minimum royalty payments regardless of quantity mined and provides for future escalation of royalties either through consumer price index fluctuations, producer price index fluctuations, or some other method. Royalties may be renegotiable at some future time. They may be expressed as a percentage of the selling price(as the price escalates, so does the royalty income). Royalties may vary by type of mineral.

Originally a royalty was the tax or rent paid to the sovereign in England for the privilege of mining. In the United States, a ***royalty*** is a reservation to the lessor of a certain percentage of the minerals or their proceeds at no cost to the lessor.

The royalty is not a separately assessable mineral interest for property tax purposes. A holder of a mineral lease is considered to have the equivalent of a fee interest in the mineral rights. Under Section 104(b) and Rule 469, the right to enter upon land for the purposes of the exploration, development or production of a mineral is the taxable property interest being valued. The underlying reasoning is that the ***beneficial ownership interest*** is in the right to remove the minerals, and the exercise of such right is appraised and assessed separately from the owner's other land.

MINERALS ON STATE LANDS

California state lands are not subject to mining claims (patented or unpatented), as federal lands are, but may instead be prospected and leased for minerals other than oil and natural gas.

In order to explore on state property, a prospecting permit is needed. Such permits may be issued to prospect for minerals on lands not known to contain commercially valuable minerals when the permit is issued. They are valid for two years and can be extended for an additional two years. If a discovery is made, the prospector can acquire a preferential lease which is subject to the payment of royalties. Minerals on state lands may not be removed without such a lease.

On state lands already known to contain commercially valuable deposits of minerals, competitive bidding is necessary. The California State Lands Commission and its staff in the Mineral Resources Management Division (Long Beach) has jurisdiction over all mineral operations on state lands.

Leases of state lands create taxable possessory interests. To determine active mineral operations in any county, contact the Mineral Resources Management Division for copies of all active permits on state lands and the county planning commission for all use permits on private lands. Environmental impact reports are also excellent sources of data and are generally available before the permit is issued.

UNPATENTED AND PATENTED MINING CLAIMS ON FEDERAL LAND, AND FEDERAL MINING LAWS

INTRODUCTION

A mining claim, as previously noted, is that portion of the federal mineral lands which a person, for mining purposes, takes and holds (records) in accordance with the 1872 Mining Law, as amended. There are specific requirements which must be met in order to acquire and work such a claim. An "unpatented" mining claim is a claim in which title and deed has not been passed to the claim holder from the federal government. It is treated as a taxable possessory interest. Under a "patented" claim, title to the land and minerals has transferred to the claim holder.

The taxability of mining claims was established more than a century ago by the California Supreme Court, in the case of the *State of California v. Moore 12 Cal. 56 (1859)*, which stated in part:

> "The interest of the occupant of a mining claim is property, and, under the Constitution, it is in the power of the Legislature to tax such property."

There are three basic classifications of minerals on federal lands. Under the federal mining laws, minerals on federal lands are classified as either ***locatable***, ***leaseable,*** or ***salable***. Only minerals designated as "locatable" by the federal government can be claimed. These include metallic minerals such as gold, silver, and lead, and nonmetallic minerals such as fluorospar, asbestos, and mica.

“Leaseable” minerals are subject to lease by the federal government and include oil, natural gas, oil shale, geothermal resources, potash, sodium, native asphalt, bituminous rock, phosphate, coal and sulfur. In order to produce these minerals, an operator must an executed lease agreement with the federal government. In many cases, such leases are issued competitively.

“Salable” minerals may not be located but may be subject to extraction and sale on federal lands by permission of the Secretary of Interior under the authority of the Materials Disposal Act of 1947 (30 USCA Sec.601). These include common sand, gravel, stone, pumice, pumicite, cinders and clay. These materials may be purchased at fair market value, either at competitive or negotiated sales.

In practice, salable materials are usually purchased under contract for a specified volume at a specified price for a certain time period. This gives the purchaser a taxable possessory interest in the right to remove the material.

To file a claim with the federal government, the claimant must first know what the mineral is and then determine whether the mineral is locatable, salable, or leaseable. The above list of minerals categorized as locatable, salable or leaseable is not all–inclusive. If there is a question about permits, leases, or classification of minerals on federal lands, the U.S. Department of Interior, Bureau of Land Management (BLM), which administers mining laws on federal lands, should be consulted. The Department of Interior, BLM office headquarters for California is located in Sacramento, with smaller regional offices throughout California.

Not all federal lands are open to mining or mineral location. Among those that are not are the national parks, national monuments, military reservations, and scientific testing sites. However, some public land that is closed to mineral location may be open to recreational mining.

Many mining claims are staked in national forests. Usually, the local office of the United States Forest Service administering forestry regulations will have appointed a forester as a mining claim administrator. No claimant may disturb forestry land without first filing a mining plan which must be approved by the U.S. Forest Service. The forester appointed for administering the mining claims in his or her jurisdiction is an invaluable source of information.

STAKING A MINING CLAIM

Federal law specifies only that claim boundaries be distinctly and clearly marked so as to be readily identifiable. Individual states also have statutes detailing requirements for staking and recording mining claims. Generally, staking a claim includes erecting corner posts or monuments plus posting a notice of location on a post or monument in a conspicuous place. The claim is then recorded by filing an exact copy of the location notice in the same county as the claim within 90 days of locating the claim. State law regarding mining claims is generally found in Sections 3900 and following of the California Public Resources Code. The claim must also be recorded within the same 90–day period with the BLM office having jurisdiction over the area where the claim is located.

There are basically four types of mining claims:

- **Lode claim—**A lode is a fissure or vein in a rock, filled with a valuable mineral. A lode claim is that portion of a lode or vein, and the adjoining surface which has been staked and claimed under the federal mining laws. Lode claims are located by length and direction of each boundary line. They are limited to 1,500 feet in length and 300 feet on either side of the lode, that is, a total area of 900,000 square feet or 20.66 acres.

- **Placer claim—**A placer is an alluvial deposit (made by flowing water) containing a valuable mineral, typically gold. Such claims are usually found in stream beds, both active and ancient. A placer claim is that portion of a placer deposit staked and claimed under the federal mining laws. Placer claims are located by legal subdivision and are limited to 20 acres per claim per person, with a maximum of 160 acres for an 8–person associate claim.

- **Mill site—**A mill site is nonmineral public land suitable for the erection of a mill. Its purpose is to either support a lode or placer claim or to support itself independently of any particular claim. It cannot exceed five acres.

- **Tunnel site—**A tunnel site is located on a plot of land where a tunnel is constructed to develop or discover a vein or lode. It cannot be patented.

Frequently there are disputes between claimants, and the assessor may find that two claims overlap each other. It is the responsibility of the courts, not the assessor, to resolve any claim disputes. Since both claimants assert owning, claiming, possessing, or controlling such property on the lien date (per Section 405), an assessor should assess both claims until the dispute is resolved.

PATENTED MINING CLAIMS

A patented mining claim, as noted, is simply a claim in which title to the land and minerals has passed from the federal government to the claimant. The government actually delivers to the claimant a deed to the land and minerals.

Patenting a mining claim is an expensive and time–consuming process, as there are specific legal requirements which must be met. Most importantly, within the boundaries of each claim for which a patent is sought, there must be a discovery of a valuable mineral which can be mined and marketed at a profit. Detailed information on the patenting process is available from the Bureau of Land Management, U.S. Department of the Interior.

MINING CLAIM REGULATIONS OF THE FEDERAL GOVERNMENT

At the time of this writing, the regulations affecting unpatented mining claims are in a state of flux. While the Mining Law of 1872 (30 U.S.C. 22) still remains in effect, Congress modified the “assessment work requirements” for locating mining claims and the filing requirements under the Federal Land Policy and Management Act of 1976. Further changes in requirements were enacted by the 1993 Interior Department and Related Agencies Appropriation Act (43U.S.C. 1744(b). This legislation sets forth revised detailed procedures for patents, filing, applications, adverse claims, etc. It also requires that holders of unpatented mining claims and sites pay the government a rental fee of $100 per claim per year which fee may be adjusted to reflect changes in the Consumer Price Index every five years.(Federal Register, July 15, 1993). This fee replaces the previous requirement that a claimant perform the equivalent of $100 worth of annual assessment work in order to keep the claim active, and failure to pay the fee shall conclusively constitute a forfeiture of the unpatented mining claim, mill or tunnel site. These changes were initially two–year temporary modifications. However, Congress has now extended the law for an indefinite time and in 1995, the California Legislature amended the Public Resources Code, Section 3912, to provide that the fee, the amount of work done, improvements, etc. to hold possession of an unpatented mining claim shall be prescribed by the laws of the United States.

To summarize, federal regulation establishes the following in regard to unpatented claims: (1) procedures for paying and administering the required annual rental fee, (2) the mandatory payment deadlines and automatic abandonment provision for failure to timely pay the rental fee,(3) the recording and assessment work requirements, and (4) procedures for small miners (i.e., no more than 10 claims) to obtain an exemption. The exemption permits the small miner to do $100 worth of assessment work per claim instead of paying the per–claim rental of $100.

Also of interest to appraisers and concurrent with the foregoing are several provisions of the California Public Resources Code, and recording of an affidavit of mining claim assessment work ("proof of labor") with the county recorder. The county recorder may, upon resolution of the county board of supervisors, refuse to record a claim until the affidavit is filed in conformance with the applicable sections and proof of payment of property taxes on the claim is demonstrated.

Chapter 4 : ORE RESERVES

INTRODUCTION

Rule 469(b)(2) states “It is the right to explore, develop and produce that is being valued and not the physical quantity of resource present an the valuation date.” The value of these rights is best determined by estimating and valuing the quantity of reserves that can be economically recovered from the property.

The major asset of a mining property, ***reserves***, is often something that cannot be seen because it is hidden below the surface of the earth. In many cases the components that make up the reserve would not be visible anyway without the aid of a microscope or other sophisticated instrumentation. With many mining properties, the appraiser must rely on indirect evidence for the existence of reserves. With others, such as common aggregates, the reserves are much more obvious.

Reserves are finite and their physical or economic depletion signals the end of commercial exploitation. Therefore, ore reserve estimates are extremely important and generally form the basis for both the commencement and termination of operations.

Mining companies usually do not have just one set of ore reserve estimates. They can generate any number of reserve calculations using various cost and price scenarios. They do this because it is advantageous to management to look at future possibilities. While they can make informed projections, mining companies have no certain knowledge of what the future holds.

Reserve estimates change constantly, depending on the timing and the purpose of the estimate. Public reporting under Securities and Exchange Commission rules require the use of certain procedures to generate such estimates, but these may be considered by some to be overly conservative. The public reporting of reserves probably will not include those considered to be more risky, due to limited information concerning their presence.

In addition to reserves, which will be discussed in greater detail below, there are ***resources***. Webster's Dictionary defines a resource as something that lies ready for use or that can be drawn upon for aid or to take care of a need. Resource, as applied to minerals, is a mineral deposit that may or may not have a present economic value based on current needs. As such, a resource does not fit the definition of a proved reserve for property tax purposes, as discussed in Rule 469.

An example of a resource would be all of the undeveloped aggregates in California. It would even include rocks and minerals for which there is at present an inadequate market price to make development economic, as well as all of the minerals in the state in which there is no current economic interest.

GOVERNMENT AND INDUSTRY ORE RESERVE DEFINITIONS

To the miner, the term ***ore*** usually means that part of a rock body that contains a mineral or minerals in sufficient quantity and quality to be mineable at a profit. Many miners use the term solely to describe metallic ores, but that is not necessarily the only use of the term. The term “ore” may mean different things to different people.

Miners also speak of ***reserves***. There are measured, indicated, and inferred reserves, as well as proved, probable, and possible reserves. Many terms have evolved over the years to describe reserves in an attempt to delineate them with respect to quality, quantity, and economics.

A mineral appraiser must have a general familiarity with reserve definitions. The federal government (U.S. Bureau of Mines and U.S. Geological Survey) has long used the terms "measured", "indicated", and "inferred" for ore reserve definitions and classifications. Outside the federal government, they are rarely used. There is little reason to go into them further here other than to say they roughly equate to proved, probable, and possible reserves respectively.

Industry generally uses the terms proved, probable, and possible to describe reserves. One definition of “proved ore” is a body of ore where there is practically no risk of failure of continuity. It defines “probable ore” as a class of ore whose occurrence is reasonably assured but not absolutely certain. “Possible ore” is defined as a class of ore whose existence is a reasonable possibility, based primarily upon the strength and continuity of geologic–mineralogic relationships and upon ore bodies already developed.

It is important to remember that the definition of proved reserves found in Property Tax Rule 469 may not be equivalent to the same term used by miners or producers. It is, however, the only definition of importance to a property tax mineral appraiser.

ORE DEFINITIONS FOR PROPERTY TAX PURPOSES

PROVED RESERVES

In California property tax matters the only reserve definition paramount to the appraiser is found in Rule 469 (c)(2). It defines ***proved reserves*** as follows:

> ““Proved reserves” means those minerals measured by volume and weight which geological and engineering information indicate with reasonable certainty to be recoverable in the future, taking into account reasonably projected physical and economic operating conditions. Proved reserves include all minerals which satisfy the conditions of the preceding sentence without regard to how the term is used in the industry.”

If a reserve does not have a reasonable certainty of being recoverable in the future, “taking into account reasonably projected physical and economic operating conditions,” it may not be assessed. Property that does not exist cannot be assessed.

The projection of physical and economic operating conditions will affect the quantity of proved reserves. The key word is the term “economic.” A miner is always balancing cost against income. When the costs of extracting the ore become too high in relation to income and with no prospect of future profits, the miner cannot afford to continue operation of the mine. At that point the mine ceases to have a proved reserve, as defined in Rule 469, even if there are still recoverable minerals. On the other hand, if recovery costs increase, but the market price for the mineral also increases, then the proved reserves may remain economic and the miner may be able to continue operating. Among physical and economic conditions which the appraiser must consider are the existence or lack of operating permits and other governmental restrictions and the reasonable likelihood of the renewal of existing permits.

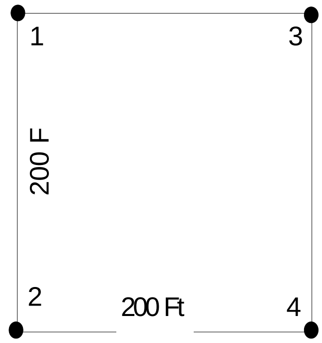
Proved reserves are also dictated by the physical quantities of ore present in a particular property. Proved reserves cannot exceed the physical quantity of the mineral in the earth, but can be and usually are, much less than the minerals deposited there.

Methods of estimating the physical quantity of reserves are typically based on observations made of outcroppings and from regularly spaced drill holes. Common methods of reserve estimation are the weighted volume estimates and isopach maps.

The weighted volume estimates, most easily used when the distance between drill holes is uniform, lays a grid pattern over the ore body. For uniform test holes a square pattern is laid out with the test holes establishing the corners of the grid. Each test hole is numbered and the depth, thickness, and grade of ore recorded. Once the data is recorded, simple calculations are made to determine the volume and average grade of material in each block defined by the grid lines.

Example 4–1 Reserve Estimation Square Test Hole Pattern

Test Hole	Depth to Ore	Thickness of ore	Average Assay of Ore	Thickness X Average Assay
1	21	70	2.01%	1.4070
2	15	90	1.45%	1.3050
3	16	85	2.90%	2.4650
4	20	75	2.37%	1.7775
Total				6.9545
Average	18	80	2.173%	



If the distance between bore holes is 200 feet, then the area of the grid is

200	200	40,000	Square Feet

The total volume of ore in the grid is

80	40,000	3,200,000	Cubic Feet

Assuming a specific gravity for the ore of 5.5. The tonnage factor is

2000	Divided by	5.5	Multiplied by	62.4
			Equals	5.827

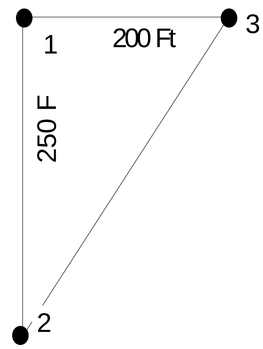
Tons of ore

3,200,000	5.827	549,168	Tons

When test holes have not been drilled in a regular pattern, the volume or tonnage and grade can be determined by establishing an system of either triangles or polygons. Using triangles, each test hole establishes an apex of the triangle. The test hole data is averaged in a manner similar to that for the evenly spaced holes.

Example 4–2 Reserve Estimation Triangle Test Hole Pattern

Test Hole	Depth to Ore	Thickness of ore	Average Assay of Ore	Thickness X Average Assay
1	21	70	2.01%	1.4070
2	15	90	1.45%	1.3050
3	16	85	2.90%	2.4650
Total				5.1770
Average	17.33333	81.66667	2.113%	



If the distance between bore holes is 200 feet, then the area of the grid is

200	250	25,000	Square Feet

The total volume of ore in the grid is

80	25,000	2,000,000	Cubic Feet

Assuming a specific gravity for the ore of 5.5. The tonnage factor is

2000	Divided by	5.5	Multiplied by	62.4
			Equals	5.827

Tons of ore

3,200,000	5.827	549,168	Tons

Polygonal block are constructed by connecting each adjacent test hole and drawing perpendicular bisectors on these lines. The test hole is located in the center of the polygon and the data is related to the area contained in the polygon.

Isopach maps are typically most useful for nonmetallic deposits. The upper and lower surfaces of the mineral body are mapped. Contours are drawn that connect points of equal thickness. Each contour establishes a horizontal plane whose area can be determined. The volume is determined by multiplying the area of the plane by the average thickness between two adjacent contours. The total volume is the sum of each layer's volume.

It is important to note from the preceding discussion that there are generally three categories of reserves recognized in the field. All of them are based on the relative certainty of the quantity, quality, and economics of the ore. The definition of proved reserves in Rule 469 was devised for application to all mineral properties. It is up to the appraiser, with the specific information on each property, to determine which reserves, if any, fit into the definition in Rule 469. It is important to note that "reasonably assured" and "reasonably certain" are not the same thing. The regulatory standard is "reasonably certain."

Most mining operators maintain continuing reserve studies. The calculated proved reserves undergo continual changes throughout the life of the property because mining economics are not static. Prices can fluctuate wildly, as previously indicated (Figures 4–3 and 4–4). While mining is in progress, new information is revealed that affects the quantity of proved reserves. Additional areas of the property are usually scrutinized and tested for possible future mining. Reserves fluctuate both *upward* and *downward* during the life of the property and it is important for the appraiser to keep abreast of changes. It is also important for the operator to annually notify the assessor of such changes.

DESCRIBING PROVED RESERVES

For a gold mine, an ore body consists of the host rock that encompasses the free gold. It is possible to describe the ore body in terms of weight, i.e., tons of ore body, or even volume, i.e., cubic yards of ore body. However, the ore body itself is not what is marketable. Most of the ore body is waste. It is the gold or other metal within the ore body that is produced and sold. Every ton or cubic yard of ore produced is likely to contain a different quantity of gold. The tonnage of ore produced is meaningless as a reserve value, although it does represent a cost. As such, it is taken into account both in the appraisal process and by the miner processing the ore.

Metallic ore bodies generally are quantified by ***grade***. For example, a gold mine has a resource of one million tons of grade 0.1, 50 million tons of grade 0.06, 40 million tons of grade 0.05, and 100 million tons of grade 0.03. The decimals simply represent the number of troy ounces of gold in place per ton of ore. (Troy weight units were discussed in Chapter 2.) The total amount of gold in place for this property is:

Example 4–3 Reserves Estimation

	Tons x 1000	Grade		Ounces x 1000
	1,000	0.1	=	100
	50,000	0.06	=	3,000
	40,000	0.05	=	2,000
	100,000	0.03	=	3,000
Totals	191,000			8,100

To determine the average grade of this deposit we would simply divide 8,100 by 191,000 to arrive at 0.0424 ounces per ton. This number is useful information but not very meaningful for appraisal purposes, because the deposit must be mined beginning at the top of the deposit according to the grades encountered in the mine plan.

Information gathered from the operator indicates the ***cutoff grade*** is 0.05 ore. A Any grade below 0.05 would not be cost effective to produce. Since the lowest grade which is economic has now been identified, the proved reserve can be determined. Obviously, if the 100 million tons of 0.03 grade ore is below the cutoff grade, it will not be produced under current economics and will not figure into the estimation of proved reserves. That reduces the total reserve by 3 million ounces to 5.1 million ounces.

The recovery or ***recovery factor*** is the amount of metal expressed as a percent which is obtained from the treatment of the ore. It is the amount of metal recoverable compared to the amount of metal in the produced ore. It is not possible to extract all of the metallic mineral from the ore. Some of the gold in the example will be lost along with the waste. Again, this has to do with economics. The more efficient the gold recovered, the greater the costs of recovery. Naturally, the miner has to decide what the most economic recovery method is going to be. No process is 100 percent efficient.

There are certain things that can be done to boost recovery that may be cost effective. New mines usually start out with a low percentage of recovery until the process is optimized. This usually takes time as the mine personnel learn by trial and error relative to that particular property. There are few places in the world where two ore chemistries are exactly alike. It is in the interest of the company to maximize the recovery to the greatest economic extent possible.

If a miner has 87 percent recovery, that means that only 87 percent of each ounce of gold can be recovered. The recovery efficiency is not necessarily static; it does vary over time. Part of the appraiser's job is to determine what the recovery efficiency is going to be from year to year. The best source of information is the mine supervisor or the mine technical staff.

Returning to the example, the reserve estimate is multiplied by the recovery factor to arrive at proved reserves.

Proved Reserves = Reserve Estimate x Recovery Factors **Equation 4–1**

= 5,100,000 x .87

= 4,437,000 Troy oz.

Normally, the recovery efficiency is expected to increase, because of the company's efforts to improve operations, but it can also decrease. The chemistry of the ore body can vary on the property. That alone can cause the recovery efficiency to vary and it is beyond the control of the miner.

Nature does not distribute minerals evenly in rocks, either laterally or vertically. When a mineral property operates as an open pit mine, there is not much latitude as to which grade of ore to mine first. An operator normally likes to mine the richest grade first, but it may be on the bottom of the pit.

An appraiser must also determine how the ore body will be mined in terms of which grade will be mined first, which is second, etc. This is largely a function of natural distribution and pit design. This information assists in the construction of the year-to-year cash flow. Without it, the value conclusion will be wrong. It is not possible to simply average the grade for the total reserve without producing a large error in the result.

In valuing mineral properties, an appraiser must project in the cash flow the actual operating characteristics of the property, using the prudent operator theory. This cannot be overemphasized!

AGGREGATE RESERVE ESTIMATION

Aggregates are derived from all three rock types: igneous, sedimentary, and metamorphic. Whether they are available for economic development depends upon the geographic area. Trap rock is a common name applied to all igneous classes of rock used for aggregate purposes. As compared to other aggregates, igneous rocks have superior physical properties. However, their superior attributes result in higher production costs, because of the presence of silica, which is very abrasive. Silica abrasives are hard on the equipment and can cause rapid wear. Igneous rocks are most common in the western United States.

Aggregates tend to be more homogeneous than many other minerals and reserves are often easily estimated. While there are no grade problems, the quality of the aggregates within a deposit may vary considerably. Also, the ***in situ*** or physical reserve quantity may not always be fixed, as in the case of a stream bed aggregate deposit where seasonal rains and storms may bring additional material onto the property or may even remove some material.

Aggregates are common in many areas. What makes them valuable as mineral reserves is their proximity to a local market. Transportation costs generally represent the largest component of expenses for aggregates. This can limit the effective market area for a deposit.

A large majority of aggregate rock production is of sedimentary origin. The mode of origin of a rock has a critical effect on reserves estimation because water–laid sediments typically are far more extensive and uniform in character and exhibit more easily defined boundaries than ore bodies do.

The approximate volume of a sedimentary rock deposit can often be determined by:

- Pacing or tape measuring its lateral dimensions.
- Observing or estimating its thickness by examining outcrops.
- Obtaining borehole information from the operator or on nearby water wells, if available.

Water well data generally shows the ***lithology*** of the rock penetrated while drilling the well. Well data may be available from the State Department of Water Resources or the county engineer's office.

Once the data is collected, the cubic yards or cubic feet of material in place can be determined. Of course, some of it may be waste which will also have to be estimated. For example, thin clay or silt beds may be present in the sand, or there may be no market for certain grades of sand. The thickness and volume of these can be estimated and deducted from the overall volume of material estimated. The job of estimating the overall volume of the material in place is to a large extent a geometry problem in which length, width, and depth are multiplied together.

The depth may need to be adjusted for the depth of the water table. If the operator attempts to produce below the water table, he will need to remove the water, adding additional costs that will affect the economics of the property.

The deeper the operator produces the deposit, the greater the cost. Therefore, the anticipated depth of production is a number the appraiser needs to know. Much of the information needed for such purposes is on the SBE form AH 560-A, Aggregate Production Report.

Aggregate materials may be sold either by weight (tons) or volume (cubic yards). To convert from weight to cubic yards or the reverse, the specific gravity of the material must be known.

Most high quality aggregate has a specific gravity of 2.65, the specific gravity of quartz. As such, it is 2.65 times heavier than water, which weighs 62.4 pounds per cubic foot. One cubic yard of high quality aggregate with no ***porosity*** (pore spaces in the rock) would weigh 2.65 times 62.4 times 27 (there are 27 cubic feet in a cubic yard) or 4,465 pounds (2.23 tons).

The same aggregate with 30 percent porosity would be

$$\frac{2..65 \times 62.4 \times 27 \times (1 - .3)}{2000} = 1.56 \text{ tons}.$$

From these calculations we can derive constants for tons per cubic yard, tons per cubic foot, or tons per acre foot. (There are 43,560 square feet in an acre and 43,560 cubic feet in an acre foot.)

Limestone, stone, clay, and diatomaceous earth must be calculated differently than sand, which is basically quartz. For example, limestone (calcium carbonate) has a slightly lower (2.60) specific gravity and is apt to have little or no porosity. Stone, clay, and diatomaceous earth can vary greatly in specific gravity and porosity. Many volcanic rocks are also lighter weight than sandstone, granite, or limestone because of much higher porosities due to gas bubbles in the parent lava.

RENEWABLE RESERVES

Many aggregate operations in California are conducted near active streams. Moving water has great power and can move materials both in suspension and by slowly pushing heavier materials along with the current. During the spring runoff, the streams flood and replenish the reserves. It is important to realize the difficulty in determining from year to year what has been brought in by storms, what has been removed, and what has been produced. In such areas, the proved reserves may be in a constant state of flux.

Since the reserves are renewed on a periodic basis, there is no net depletion. However, for property tax purposes the base year value of the reserves must still be adjusted to reflect the value of removed and added reserves.

THE MINE PLAN

As in other types of mining operations, aggregate producers generally have a plan of how the operation will proceed. Usually included in the plan will be details concerning the layout of the crushing and sorting equipment and access to and from the site.

A few words are necessary about distinction between aggregate reserves versus reserves of most other minerals. Aggregates are relatively plentiful throughout the state. However, they are not always plentiful near their ideal markets. Haulage costs for aggregates are typically such a large part of the cost that quarries can serve only a local market. On the other hand, they are relatively inexpensive to mine because they are almost always mined in surface deposits and there is little preparation for sale other than crushing, washing, and sorting. Some aggregate deposits contain little waste, in fact, the less waste, the better the deposit. Reserve estimation of aggregate deposits is vastly simpler than more complex mineral deposits because they are surface mined, and many times the deposit can be easily mapped from lease boundaries and ***outcroppings***.

ORE RESERVE ESTIMATION FOR COMPLEX MINERAL PROPERTIES

The art of reserve estimation for complex mineral properties is a difficult one. It requires specialized training and expertise. Typically, the ore is deposited in an uneven manner in discontinuous bodies.

The following table illustrates how mining engineers go about collecting the information they need to estimate the size of the ore body and the reserves.

Table 4–1 Steps for Determining Size of Ore Body and Reserves

- **Geologic Mapping—**Consists of recording on maps, photographs, aerial photographs, or satellite photographs, the contacts between different rock units, and their observable mineral content, all based on surface geology.
- **Sampling—**In itself is an art, consisting of obtaining a statistically unbiased collection of rock specimens from the ore body by means of core drilling or digging test pits.
- **Assaying—**Each sample is tested to determine its quality, i.e., percent of ore per ton of rock.
- **Analysis**
  - Weighting the quality of all samples and their relative locations to obtain an estimate of the quality of the ore body and the economics of mining it.
  - Making the three–dimensional computations necessary to estimate the ore that can be removed, with consideration for the amount that must be left behind because of optimum pit design, or in the case of underground mining, with regard for the location of pillars and safety of the mining process. Much of this work is now done with computer modeling and a methodology known as *kriging*.

Appraisers are advised to seek professional assistance in the interpretation of such sophisticated data. Many mining companies with complex ore deposits use specialized software written specifically for the mining industry's use in helping to resolve complex ore evaluation problems by means of a system of sophisticated mathematics called ***geostatistics*.**

Chapter 5 : MINING ACCOUNTING

INTRODUCTION

The purpose of this chapter is to familiarize the appraiser with accounting practices in the mining industry. Accounting practices of any business are the financial language of that business. Understanding the financial operations of that business requires understanding its language.

The success of any mining venture is measured by one thing: profit. Without profit there is no economic incentive to proceed with operations. Profit is measured by subtracting costs from revenues, and accounting methods are used to keep track of these cash inflows and outflows. When necessary, appraisers enlist the aid of auditor–appraisers to analyze the accounting records of a complex mining property.

Accounting is the practice of systematically recording, presenting, and interpreting the financial transactions relating to a specific person property or business. An ***audit*** is a report prepared by an accountant attesting to the accuracy and fairness of the data presented in company financial statements in accordance with generally accepted accounting principles (GAAP). Accounting is generally divided into two areas: financial accounting and cost accounting.

Financial accounting is for external use and consists of income statements and balance sheets for specific periods of time. The manner in which the numbers are reported are constrained by the Financial Accounting Standards Board, the Securities Exchange Commission, the Internal Revenue Service, and the American Institute of Certified Public Accountants. Cost accounting is for internal use by management. It is used to make decisions to help the organization achieve its goals. No external constraints are placed on how the data is generated and presented. As a result, no two operations may look at numbers in the same way. An appraiser's primary interest is in the cost accounting numbers.

While they are generally used interchangeably, there is a difference between a cost and an expense. Cost is the value of an asset given up to acquire another asset, while expense is the value of an asset given up to generate revenue. There are various types of costs/expenses that the mineral appraiser is interested in examining.

Costs can be described as either direct or indirect. Direct costs are easily traceable to a specific cost object—a function process, organizational unit, or physical item for which a separate measurement of cost is desired. Indirect costs are not easily traceable to a cost object and are generally charged to overhead. Appraisers are typically interested only in expenses that are directly related to the operation of the mine. Expenses not necessary to the operation of the mine are excluded from consideration. Care should be taken to neither blindly accept or reject overhead costs. Efforts should be made to get the company to explain the make up of overhead and see if some items can be traced to the operation of the mine.

Costs can further be characterized as fixed and variable. Fixed costs do not change with respect to short term changes in activity level, they remain constant. Typical fixed costs are rent and insurance. Variable costs change in direct relationship to activity level. Examples of variable costs are material and labor. A third characterization is a combination of fixed and variable. Utility costs are typical of the combination in that there is a fixed component to have service provided and an additional charge per unit of service provided, i.e., electricity and gas.

Because the income approach is used almost exclusively for the appraisal of mineral producing properties, the occasional assessor's audit of income and expenses is extremely important. Mineral properties, and mining properties in particular, are so different from other properties that audits often disclose new factors material to the appraisal, as well as operational data and details supporting the company's property tax statements.

Financial analysis of a mineral property should begin with the ***chart of accounts*** and the ***general ledger***. The appraiser, working with the auditor–appraiser, should determine what cost and revenue information is relevant to the appraisal.

Property taxes may be distributed throughout various accounts. Property taxes are not an allowed deduction, for property tax appraisals, and must be reinstated in the cash flow if deducted. Other non–allowed costs include statutory depletion, amortization, interest on loans, state and federal income tax and royalty payments. While all of these are non–deductible, they should be familiar to the appraiser. Royalty payments are not allowed as a cost. Royalty payments are made by the lessee to the lessor in exchange for the right to extract the mineral content of the land. These payments are attributable to the existence of the land and are therefore part of its value. The royalty method of appraisal is discussed in Chapter 6 of this handbook.

Corporate and administrative overhead expenses are allowable to the extent they contribute to and are reasonably necessary for the future operation of the property. That is, they are the types of expenses that a prudent operator would incur. For example, legal, tax, and accounting functions are often handled by corporate headquarters. These are expenses that would be incurred by any business operator, so a reasonable allocation of such expenses to the mining property should be allowed.

The appraiser should also distinguish between recurring expenses and non–recurring expenses, particularly when using historic expenses as a guide for future cash flows. Ordinarily, only recurring expenses are considered for future cash flows. Non–recurring expenses should be allowed in future cash flow estimates only to the extent a knowledgeable operator (or potential knowledgeable purchaser) would anticipate that such expenses are likely to occur.

Financial Accounting

As indicated above, financial accounting is done primarily for the benefit of those outside the business. Its purpose is to represent the financial well being of the company which otherwise might be distorted by the timing and the highs and lows of capital movement, both as income and outgo. It is therefore of very limited use in the evaluation and appraisal of a mining project. Financial accounting, however, is a valuable accounting method because it is employed primarily for stockholders and other public reporting purposes.

Typical of the financial accounting concepts are the company annual reports. These usually contain a report on reserves. Such a report is nowhere near the comprehensive reserve report that an appraiser needs for a professional evaluation of a mining property. Since reserves are, of course, the lifeblood of the mining enterprise, the appraiser should not use the annual report for the evaluation, because it was not designed for that purpose. The reserves reported with the financial statements are subject to SEC requirements regarding economic assumptions which may or may not be the same as the appraiser’s assumptions for a property tax appraisal. In addition, by the time the annual report is available, much of the information is obsolete. As noted, reserves are time, price, and cost sensitive, and are produceable only at various times for specific reasons. They are not static.

Finally, financial accounting is mandatory. Even companies that are not covered by the Securities and Exchange Commission requirements must meet certain financial accounting requirements. Although financial accounting practices are designed for purposes other than property appraisal, nevertheless such reports often yield important information that should be considered by the appraiser.

Managerial Accounting

As indicated previously, managerial accounting is an internal function of the company. It is used primarily for control, planning, organizing, directing, and decision making.

It is important to recognize too, that managerial accounting is not mandatory and is not governed by generally accepted accounting principles. A company is free to use whatever method works for it. As a result, company management is more inclined to put an emphasis on useful data.

Categorization of Costs

Federal income tax law makes it both desirable and necessary for costs to be classified in terms of the stage of mining at which they were incurred. A mining operator may have a choice for income tax purposes of capitalizing or expensing certain costs, or he may be required to do one at a given stage. The stages determined by both law and mining convention are:

- Prospecting
- Acquisition
- Exploration
- Development
- Production

Prospecting is an initial, preliminary search to discover the existence of valuable minerals. It occurs before acquisition of the property, and is not as detailed a search as would occur in the exploration stage. It merely helps the company to decide whether or not to acquire the mineral rights and do further detailed investigation. Prospecting is generally completed upon acquisition of the property or when the prospector decides to abandon the search. Typical prospecting costs are those for preliminary and generalized geological and geophysical work.

Acquisition is the process of purchasing, leasing or entering into an agreement (filing a claim) whereby certain mineral rights are acquired for further investigation. It is possible to acquire a property as either an operating property or a non–operating property. However, here the subject is typically a non–operating property, i.e., one that is not in production and without "proved reserves." Assuming the conditions of an arm's length sale are met, the acquisition cost is the best indicator of value for a recently sold property.

Exploration is the attempt to locate economic deposits and establish their nature, shape, extent, quantity, quality, and minability. It usually begins upon acquisition and ends upon the quitclaim or decision of the operator to begin development.

Development is the process of preparing minerals for production, including the removal of waste rock or overburden and the construction of basic improvements or improvements to land related to the production of minerals. The stage begins upon a business decision to begin development, because of the discovery of proved reserves. It ends with the commencement of production. However, even though proved reserves are discovered, a company may not begin development because other aspects of the project are not favorable enough to do so.

Production means the removal or processing of minerals.

Future development and production costs are the ones that bear most directly on the profitability of a mine. These are the costs that an appraiser is interested in when laying out the future year to year cash flow, attempting to reasonably project what these future costs might be.

MINING AND PROCESSING FUNCTIONS

The mine operator's chief concerns are "controllable" costs, those costs directly attributable to people, equipment, materials, and supplies employed in bringing the mineral commodity to its earliest salable or usable form. Such costs are best described and accounted for in terms of the various mining and processing functions discussed elsewhere in this manual.

Understanding the mine operations make it easier to identify the steps involved in severing the mineral from the land and preparing it for sale. Depending on the size of the mine and the mineral, most operations can be divided into extraction and processing. Extraction includes drilling, blasting, loading, and hauling. Processing includes crushing, screening, hauling, concentrating, and shipping.

A review of the mine's accounts will also reveal other charges that, while not involved with the actual extraction and processing of the minerals, can be directly attributed to the operation. These include on site engineering, on site accounting, direct mine management charges, assay costs, maintenance, clerical, and insurance.

It is also necessary to identify all sources of income from a mining operation. In some cases the principal product by itself is not profitable, and operations must be supplemented by the sale of byproducts. These additional revenues can be found by examining the books and talking to the mine manager. In reviewing the information provided, it is helpful to remember that the classification of mines is generally based on the value of the metal per ton. For example, an ore that produces one ounce of gold per ton, twenty pounds of copper and ten ounces of silver would still be classified as a gold mine because the gold is worth $380, the copper $30, and the silver $54.[2] Another example of a source of revenue is the fee charged by gravel pits to dump fill into the pit allowing restoration of the land.

[2] Economics of the Mineral Industry, Ed. Edward H. Robbie, p. 405. Example reflects prices of gold equal to $380 per ounce, copper: $1.50 per pound, and silver: $5.40 per ounce.

Chapter 6 : THE APPRAISAL PROCESS

INTRODUCTION

The properties that are the subject of this handbook are investment properties. They are bought and sold for the income they are capable of generating in the future. As such, they are appropriately valued by the income approach. Rule 469 provides that “while the assessor has full discretion to select the appropriate appraisal method, the income approach will generally be the most relevant appraisal method employed in establishing a value for the total property.”

Mining properties are often viewed as riskier investments than most other properties and therefore demand a higher return on investment. Some of the risks of mining were discussed in Chapter 1.

The appraiser should get to know the property by taking a tour and obtaining process diagrams. Talk to the mine manager and the staff, and especially the technical staff who know the property. Sometimes even the mine staff itself has unanswered questions.

RISK

Discussions about risk are typically related to determining the discount rate to be used for an income approach to value. However, risk also needs to be considered when evaluating comparables for the sales approach. The concept of risk involves the following:

Table 6–1 Definitions relating to risk.

Term	Definition
Outcome	One of the possible events that can take place.
Probability	The chance between 0% and 100% that a particular outcome will occur.
Certainty	Only one possible outcome. 100% probability of occurrence.
Uncertainty	Recognition that more than a single outcome is possible, with each outcome having a finite probability of occurrence.
Risk	Possibility of incurring economic loss or reduced economic value.

Adapted from "Economics of Worldwide Petroleum Production" by Allen & Seba

The first three terms are commonplace, and the probability of those actions can easily be determined or estimated as with weather. By analyzing weather patterns and through satellite imaging, meteorologists forecast outcomes in temperature, precipitation, and wind direction. The probability of the forecast actually occurring is based on the reliability of the input data and past history.

Uncertainty is not knowing the outcome of an event even though one may know the odds of a specific event occurring. Uncertainty can be further divided into objective uncertainty and subjective uncertainty. Objective uncertainty can be calculated before the event occurs with little disagreement about the probabilities. The outcome of a roll of a die has a specific probability of occurring that does not change and can be pre-calculated.

Subjective uncertainty represents most of the risk associated with mineral properties. The level of this uncertainty is likely to change as additional information is gathered. Often the quantification of subjective uncertainty requires a degree of personal or *appraisal* judgment.

"Risk" is the likelihood of not receiving the expected income. The less assurance there is of receipt of the income, the higher the rate at which the future expected income is discounted. Failure to achieve the anticipated income flow causes a loss in the value of the investment. Since not all investments are subject to the same degree of risk, not all investment income flows are discounted at the same rate. The following table lists several events associated with mineral properties that create uncertainty or risk.

Table 6–2 Types of Uncertainty in Mining Operations

Uncertainty	**Explanation**
Exploratory	Will commercial quantities of minerals be discovered on the property?
Product Price	Will prices be different than those projected in the appraisal?
Expense	Will expenses occur as projected?
Mechanical	Will one or more events occur causing equipment to perform other than expected?
Technical	Will the application of the recovery methods and the estimate of the reserves occur as predicted?
Political	Will political events occur that affect the operation of a property in a given area?

It is important to note that the possibility of political risk occurs even in areas of stable government. Local permitting requirements can make it uneconomic to proceed with a project. Political risk is also related to new taxes and/or changes in the tax code. A project that might be marginally economic under one series of tax laws may suddenly become uneconomic when the laws change.

There are several ways that risk can be accounted for in a cash flow analysis. Each method has advantages and drawbacks that the appraiser should consider. One method involves the adjustment of the discount rates beyond the minimum required rate of return. Another is to adjust the elements of the cash flow to reflect their downside potential. The most complex is a "***Monte Carlo***" simulation.

"Monte Carlo" simulation involves defining probability ranges for all the variables associated with a financial model. A computer then randomly selects numbers from within the distributions defined and runs calculations. This is repeated many times, sometimes as many as 10,000 repetitions.

The return that investors demand increases with risk. Development of the ***Modern Portfolio Theory*** and the ***Capital Asset Pricing Model*** indicated that investors were willing to accept risks only if they were properly compensated. The risk associated with an investment is the variability of the returns. If the variability is great, with a wide dispersion of potential returns, then the risk is assumed to be great. A narrow dispersion of potential returns lessens the variability and the risk is assumed to be lower.

The two methods available to investors to reduce risk are diversification and reduction of exposure. Diversification involves investing in many projects instead of putting all funds on one project. Reduced exposure involves taking a smaller participation in the project, i.e., a smaller working interest.

For further discussions of risk and uncertainty, see references listed in the bibliography.

THE SALES APPROACH TO VALUE

The discussion of the sales approach is divided into two parts – Sale of the Subject Property and Comparable Sales.

SALE OF THE SUBJECT PROPERTY

The appraisal of a property recently subject to an arm's length sale with neither party being in a position to take advantage of the exigencies of the other is simple, because all of the work has been done in calculating the fair market value. Finding such a sale, however, is easier said than done. Rather than merely accepting the sale price the appraiser needs to analyze it carefully.

If the sale is a recent one, the appraiser should be able to use the *adjusted* sale price. In all likelihood, the sale price will have been determined by discounting future income. The sale must meet the requirements of Property Tax Rule 2, i.e., an arm's length transaction.

Appraisers should scrutinize the sale in detail to make sure that the interest purchased is comparable with the interest being appraised. For example, many times just the lessee's interest is purchased, not the royalty interest. To arrive at the Fair Market Value for property tax purposes, the appraiser must adjust the cash flow that was used to establish the purchase price and discard the royalty expenses. Doing so includes the royalty interest in the overall property valuation.

Another example is the case where the purchase includes out of state property and there is no reliable allocation of the value. In such a case the appraiser may not be able to use the sale price at all because of the complexity of adjustments that need to be made.

COMPARABLE SALES

The comparable sales method is an important appraisal tool for appraisers. However, the unique nature of many mining properties makes it difficult to apply. Two mineral properties are seldom alike. Mines differ in ore, reserves, size, ore geology, mining depth, costs, ore beneficiation, location, salaries, geologic occurrence, waste, markets, local requirements of government agencies, access, etc. Mining properties change in value rapidly so that a sale would only be valid for comparison purposes very close to its actual sale date. Many mine sales are often part of a larger, more complex sale, so that it becomes difficult to extract data on a single property. Finally, it is rare to find sales of comparable mining properties. If appraisers are able to find two mining properties that are alike, they are encouraged to use the sales comparison approach. The units of comparison selected must be consistently applied to the subject property and all comparable sales properties in each analysis.

The comparable sales approach is based on the principle of substitution. Section 402.5 of the Revenue and Taxation Code speaks to the issue of comparability as does Rule 4. The purpose of the data gathering and analysis is to identify variations between the subject property and the comparable sale properties so that the value of these variations can be measured. If the value of these variations cannot be determined, then the comparable sales method is of limited use.

COST APPROACH

The value of a mining property often exceeds the costs incurred in bringing it to production. Occasionally, such costs may exceed the value of the property. For this reason, appraisers do not ordinarily use the cost approach to develop a mine's total property value. Further, if investors purchase mining properties for their income, it stands to reason that the cost approach would not measure the intentions of investors.

However, appraisers may use the cost approach to develop certain aspects of the value of a mine, and during certain stages of a mine's development prior to the evolution of income. Rule 6 provides the guidelines in this regard.

INCOME APPROACH

GENERAL

The income approach to value relies on the principle of anticipation to determine value. The future anticipated benefits of owning the property are discounted to reflect its present worth. The income approach sums the present worth of each future year's net income generated by the property. It is the appraisal method best suited for the total property valuation of mineral producing properties in the absence of a suitable arm's length sale.

When using the income approach to value, the question arises about the components of the property that are properly included in the value. The final value using the income approach *includes everything that contributes to income*. For example, it includes buffer zone land *necessary* to generate income on the property. Determining why the buffer zone land exists in the first place helps to establish whether it contributes to the income. Buffer zone land typically protects neighbors from the mining operations by providing an area where no activity takes place.

Construction work in progress that does not contribute to income or for which the appraiser made no allowance for its future contribution to income would have to be valued separately and added to the capitalized earning ability of the property. It is, of course, subject to taxation. Another item in this category is the reversionary value of the land, that is, the value of the reversionary interest after the mining has ceased. The present worth of the reversionary interest is part of the total property value and should be assessed to the owner of that interest.

The income approach is sensitive to the components used in it. It will always give an answer, even if incorrect data is used. The cash flow should reflect the operational characteristics of the property. For example, if in the third year of operation, a 20 percent increase in operating expenses is expected, the cash flow should show that. If in the fourth year, the ore grade is expected to deteriorate, the cash flow should show that too.

One aspect of mineral property ownership that seems to confuse many in the appraisal of mineral properties is the concept of lessee and lessor discussed in Chapter 3. A holder of a mineral lease is considered to have the equivalent of a fee interest in the mineral rights, which means the lessee's property right is valued as though he owned the mineral right in fee. There is no deduction of the royalty payment as an expense.

APPRAISAL UNIT

The appraisal unit is defined as that property which persons in the market place normally buy and sell as a unit or which is normally valued separately. Section 51 (d) of the Revenue and Taxation Code discusses appraisal units.

Producing mineral properties are usually appraised as a unit. The individual parts are not commonly appraised separately to arrive at a total property value, as in the cost approach. Often there is little purpose or discernible value to the various components of the mineral operation if they were to be valued as separate appraisal units. Just as it is rare that a home owner would sell the house and keep the garage, it is rare that components of the mineral property would be sold separately in the market place.

Example 6–1 Define the Appraisal Unit

Given: An operating property produces and concentrates ore but because of the environmental sensitivity of further processing the concentrated ore it is shipped to a company site in a neighboring state for further processing into a salable product. There is no intermediate market for the concentrated ore. What is the appraisal unit? What is taxable under California Property Tax Laws?

Solution: Since further processing of the ore is required before it can be sold it is unlikely that the mine would sell with the additional processing plant located in the other state. Since there is no intermediate market for the concentrated ore, the income level for the California operations alone is difficult to determine.

Therefore the property in the neighboring state contributes to the income of the California property and is part of the appraisal unit. To determine the proper assessment value of the California property an allocation for the processing plant needs to be made and subtracted from the total property value.

PRICE AND COST PROJECTIONS

The use of the income approach is an advanced appraisal methodology. It requires from the appraiser a great deal of thoughtfulness and initiative. Like the investors who make educated assumptions that are logical and reasonable, appraisers realize there are no crystal balls, no magic related to what the future holds. Even more so than investors, appraisers must carefully evaluate all relevant information when appraising properties.

This is accomplished through research. Each year the March issue of *Engineering and Mining Journal* has discussions by experts on short term future price scenarios. *Rock Products* magazine features articles on anticipated regional fluctuations, business factors, and expectations for the sand and gravel industry. These publications also make operating cost studies. This is a sampling of the information that is available. A search of the reader's guide to periodicals at the local library may also be of value. Appraisers of mineral properties should keep in touch with business news sources and become familiar with the applicable reference resources available at the public library. Of course the most important information is direct evidence from the market place. Appraisers should make every effort to collect sales data and discover what buyers and sellers are doing in a market where price forecasting is best demonstrated by prices paid for mineral properties.

Price fluctuations go up *and* down, and there is more than one component to future price fluctuations – a real component and an inflationary component. Sometimes price adjustments are due strictly to supply and demand – this is the real component. The inflationary component may or may not affect costs in the same way as prices for mineral commodities.

ECONOMIC LIFE AND FUTURE RATE OF PRODUCTION

The economic life of a property is determined by its proved reserves. These were discussed in Chapter 4. If the production of proved reserves on the property is the same each year, the appraiser can determine the economic life by dividing annual production into proved reserves.

$$\frac{\text{Proved Reserves}}{\text{Annual Production}} = \text{Economic Limit}$$

If the production is not the same each year, a more likely occurrence, the economic limit is the cumulative sum of the years of future anticipated production that will not exceed the proved reserves.

Example 6–2 Determining Economic Life

What is the remaining economic life of the property?

Given: The property has fluctuating production, detailed in the table below and reserves of 500 million units. Annual Production (Millions of Units)	Cumulative Production (Millions of Units)
50	50
60	110
75	185
85	270
125	395
105	500

The annual production continues for six years. At the end of six years, there are no reserves left. Therefore, we have a six–year economic limit.

The economic life of a mineral property is seldom constant because of the fluctuating economics. Fluctuating prices, costs, and the risks of mining may cause future changes in the economic life. If the price of the mineral were to suddenly increase, the life of the property could also be extended beyond what may have been considered a previous economic limit. The price increase allows the miner to produce a grade of ore previously considered uneconomic, thus increasing the quantity of proved reserves. Conversely, drops in product prices can increase the economic ore grade cut off.

UNPATENTED MINING CLAIM APPRAISAL

For an individual to hold an unpatented mining claim, he or she must have made a discovery of a valuable mineral. Such properties may be valued by any one of the existing approaches to value. However, use of the cost approach is not recommended for the reasons stated earlier The comparable sales approach is definitely applicable if there is a recent sale of the subject property; or if the properties are truly *comparable* and there are sufficient sales to establish the value patterns of the market.

Unpatented claims can be significantly different from neighboring claims. Some have mineral deposits at vastly different depths even though contiguous. An example is two contiguous mining claims, where the placer deposit in one is at an average depth of five feet and in the other is 25 feet. They may be different in other ways as well. One could be at the bend of a stream channel, and the other could be a part of a straight channel. Heavy minerals will tend to drop out of streams where the current slows, e.g., a change in direction. The value for these properties would not be comparable.

One valuation method the Board of Equalization's Staff has recommended over years is the capitalization of the recording fees and rental fees (or assessment work) required by the federal government. These represent income to the land and are an indication of the minimum value that the claimant perceives the property to be worth; otherwise it would not be retained. The rental fee or value of assessment work should be capitalized into perpetuity, since there is no time limit on how long a claim can be held.

In many cases, unpatented claims may be within the exemption of property having low value. Section 155.20 of the Revenue and Taxation Code provides a county board of supervisors the option to exempt property with a base year value (see Chapter 8) or full value so low that if not exempted, the total taxes, special assessments, and applicable subventions on the property would amount to less than the cost of assessing and collecting them. This authority to exempt does not apply to property with a base year value of more than $5,000. Many, if not most, unpatented claims will fall into this category.

WORKING CAPITAL

Accountants define working capital as the difference between current assets and current liabilities. For property tax purposes, working capital is the amount of cash needed to meet operating expenses and maintain minimum bank balances during the period expenditures have been made but revenues not yet received. Working cash is the amount of cash required on hand as a result of a lag in the collection of revenues with respect to the payment of expenses.

Rule 8(e) states that when income from operating a property is used to estimate value, sufficient income shall be excluded to provide for a return on working capital and other nontaxable operating assets. Typically, a working capital account is established at the start of a project and the working capital investment is “churned” throughout the life of the project. The working capital investment is then recaptured at the end of the project. The reason for allowing a return on working capital is to compensate investors for funds permanently committed to the property to pay operating expenses in advance of receiving offsetting revenues.

Working capital for mining operations is generally a function of the total operating costs. A formula for calculating the working capital requirement is:

$$W_C = TC \times {}^{Y}\!/_{12}$$ **Equation 6–1**

where:

W_c	= Working capital
TC	= Total Annual Operating Costs

Y	= Number of months in the pipeline
12	= Number of months in a year

"Number of months in the pipeline" refers to the time period beginning with the extraction of the ore and ending with the sale of the mineral product, the lag between expenses and revenues. This delay can be attributed to the extraction process for removing the mineral from the ore and converting it to a marketable form. The time frame will change depending upon the type of property and the mineral being extracted.

There is more than one way to allow for a return on working capital in a cash flow analysis. One method is to treat incremental changes in the working capital requirement as positive and negative cash flows to the working capital account. Example 6–3 shows how the working capital account changes as the operating cash requirements change. For a project with an economic life of seven years, the working capital requirements are detailed below. When the operations have ceased and the mine is closed, the value of the working capital account is zero.

An alternative method to allow for the return on working capital in a cash flow analysis is to estimate the return on working capital and treat it as an expense in the cash flow. The rate of return on working capital should be the same as the discount rate. In the example below, the return on working capital for the first year, at a discount rate of 15%, would be $15\% \times \$25000 = \$3750$. The results of the two methods are similar.

Example 6–3 Calculation of Working Capital and The Working Capital Incremental Change

Months in Pipeline (Y) = 2

Year	Total Operating Costs (TC)	Working Capital Account (TC x Y/12)	Working Capital Incremental Change
1	$ 150,000	$ 25,000	$ (25,000)
2	$ 281,000	$ 46,833	$ (21,833)
3	$ 400,000	$ 66,667	$ (19,833)
4	$ 455,000	$ 75,833	$ (9,167)
5	$ 458,000	$ 76,333	$ (500)
6	$ 375,000	$ 62,500	$ 13,833
7	$ 275,000	$ 45,833	$ 16,667
8	$ -	$ -	$ 45,833

Total operating costs are estimated for each year. The working capital investment for the first year is found by using Equation 6–1. In the first year of the project the working capital requirement is $25,000, arrived at by multiplying $150,000 in total operating costs by the lag in receiving revenues of two months out of a twelve month period. In the second year the working capital requirement is $46,833. Since $25,000 was invested in the prior year, only the additional $21,833 investment ($46833-$25000) is needed. In

Year 6 the working capital requirement is reduced from $76,333 to $62,500, an incremental change of -$13,833. This reduction is treated as a positive cash flow and added to the income for that year. At the beginning of Year 8 all of the working capital will be returned to the investors. For an example of how to address working capital in a cash flow analysis see the example at the end of Chapter 10.

RESIDUAL TECHNIQUE

The term residual technique simply means a technique of appraisal where the value of the mineral rights is ***residual*** to all other components of value. This technique has long been used by appraisers to determine the component values of a property. It is used by mineral appraisers to determine the value of the mineral rights. The technique assumes the other components of value are known or can be calculated. They are deducted from the total property value (usually derived by the income approach) to arrive at the value of the mineral rights.

Appraisers use the residual technique in the appraisal of mineral properties because there is often no practical way of appraising the mineral right directly. However, there are exceptional cases such as where the mineral right is sold separately or the limited use of the royalty method provides an estimate of the mineral right value.

ROYALTY APPRAISAL TECHNIQUE AND LIMITATIONS

The royalty appraisal technique is a commonly accepted appraisal procedure useful as an indicator for an operation of any size. The technique is a form of the income approach to value. It can be used to value the royalty interest, but it must be used with caution.

As discussed in Chapter 3, the lessee has the equivalent of a fee interest in the property for property tax purposes. The lessee is considered to own the entire interest, but when the interest sells, only the mineral interest, the lessee’s interest, is transferred. To arrive at the full value the appraiser must add the value of the royalty interest to the interest sold, even though the royalty interest itself never transferred ownership. If only the royalty interest sells, the property is not reappraised. However, information, such as product prices and discount rates, derived from the royalty interest sale may be used in estimating the fair market value of the total property.

The royalty technique can value the mineral rights directly, as opposed to using the residual technique. Historically, the royalty approach has been used to value the mineral rights directly for aggregate properties. It is used because it is simple, straightforward, and unencumbered by the necessity of collecting income and expense data. The remainder of the property is appraised using the cost approach or comparable sales approach. The use of the royalty approach assumes that sufficient data is available regarding current market royalty information. Previous cautions concerning the comparable sales approach apply here regarding the use of comparable property data. For property types that do not generally have a royalty, the method cannot be used.

To apply the royalty method, discount and sum the expected future economic royalty income. Since royalties are paid generally before expenses, there is no need to determine what expenses are for the property. The same discount rate that would generally be used for the income approach should be used for the royalty method. This will be a before–tax discount rate that reflects the risks of the property. The royalty technique is based on the premise that the royalties used are economic. Many royalties collected in the marketplace are not economic royalties because:

- Lessees are apt to be more knowledgeable than lessors at the time the royalty rate is negotiated.
- If a royalty rate is several years old and an escalation clause was not included in the lease/royalty agreement, inflation may have caught up with and passed the original royalty rate.

Example 6–4 Royalty Appraisal Example

The parameters used in this example are fictitious and should not be used in an actual appraisal. Royalty rates can vary widely geographically and are dependent upon quality, market availability, and other factors.

PURPOSE

The purpose of this appraisal is to value the royalty interest for the purpose of determining the value of the total property interest based on the sale of the leasehold interest.

LIFE

It is estimated that this property has an estimated life of 25 years based on remaining reserves. The lease agreement has a remaining term of 25 years with a 5–year renewal option.

LEASE AGREEMENT

The lease agreement provides for a subeconomic royalty; however, the escalator in the agreement appears to agree with the projected economic outlook. Therefore the escalators in the lease agreement will be used but the royalty will not.

GIVEN

The operator mined 785,000 tons of sand last year, the year before the sale. The operator sees a very slow improvement in future production and sales for about the next six years, but a substantial drop from last year, which was unusually high. The three prior years of production were, chronologically, 760,000, 750,000, and 785,000 tons. The current economic royalty rate for sand is $0.450 per ton. The escalators built into the lease agreement provide for royalty adjustments based on the U.S. consumer price index. The appraiser has projected CPI adjustments at a 2 percent escalator for 5 years, with a 3 percent escalator thereafter. The pre-tax discount rate based on an analysis of the sale was 14 percent. One additional percent was added for the property tax component. The 14 percent rate was judged reasonable based on the appraiser's experience in deriving mining discount rates. Sand reserves, as kept by the operator, are19,675,000 tons at the date of the sale.

North Canyon Sand Quarry
(Royalty Appraisal Example)

California State Board of Equalization — Assessment Standards Division

Year	Sand Mined (Tons)	Sand Sold (Tons)	Stock Piled Sand (Tons)	Economic Royalty ($/Ton)	Net Income ($)	Mid-Year Present Worth Factor at 0.15	Present Worth ($)
Pre-Prod.	785000						
1	760000	760000	0	0.4500	342000	0.93250	318917
2	780000	765000	15000	0.4590	358020	0.81087	290309
3	780000	770000	25000	0.4682	365180	0.70511	257491
4	790000	780000	35000	0.4775	377259	0.61314	231312
5	790000	780000	45000	0.4871	384805	0.53316	205163
6	790000	785000	50000	0.4968	392501	0.46362	181971
7	790000	785000	55000	0.5117	404276	0.40315	162983
8	790000	790000	55000	0.5271	416404	0.35056	145976
9	790000	810000	35000	0.5429	428896	0.30484	130744
10	790000	790000	35000	0.5592	441763	0.26508	117101
11	790000	770000	55000	0.5760	455016	0.23050	104882
12	790000	780000	65000	0.5932	468666	0.20044	93937
13	790000	790000	65000	0.6110	482726	0.17429	84135
14	790000	790000	65000	0.6294	497208	0.15156	75356
15	790000	790000	65000	0.6483	512124	0.13179	67493
16	790000	835000	20000	0.6677	527488	0.11460	60450
17	790000	805000	5000	0.6877	543313	0.09965	54142
18	790000	790000	5000	0.7084	559612	0.08665	48493
19	790000	780000	15000	0.7296	576401	0.07535	43432
20	790000	790000	15000	0.7515	593693	0.06552	38900
21	790000	790000	15000	0.7741	611503	0.05698	34841
22	790000	790000	15000	0.7973	629848	0.04954	31206
23	790000	790000	15000	0.8212	648744	0.04308	27949
24	780000	795000	0	0.8458	659748	0.03746	24716
25	775000	775000	0	0.8712	675184	0.03258	21995
Total	19675000	19675000			12352380		2853894

ASSESSEE REPORTING FORMS

The State Board of Equalization (SBE), over the years, has developed three assessee's reporting forms for mining properties:

- AH 560-A Aggregate Production Report
- AH 560-B Mining Production Report
- AH 560-C Mining Claim Production Report

These forms were reviewed by both assessors and industry for purposes of practicality and consistency. Appraisers should be certain that they are completed properly and in full by assessees because they provide most of the information needed for an appraisal. If the production report is not properly completed, it should be returned to the assessee with a letter stating the nature of the deficiencies. Be certain that the assessee understands the reason the form was returned.

Revenue and Taxation Code Sections 441 and following, and substantial case law, expressly state that the assessor has the right to any information that is germane to the appraisal. Information requests beyond the data provided for on the tax forms should be requested separately from the annual property statement and related forms. Penalties can accrue against the assessee for failure to properly file the annual reports by the specified dates. However, requests for information not provided for on the Board–prescribed forms are not subject to these penalties.

AH 560-A and AH 560-B request income and expense data for use with the income approach. Mining claims, on the other hand, that are being held for future mining, may not have income and expense data. However, this is not always the case. Some small miners work their claims actively. Because most claims do not fall into this category, income and expense data has not been requested on AH 560-C.

UNIQUE APPRAISAL SITUATIONS

No Reserves

There are occasional properties where the owner may operate a mine and justifiably not know what the reserves are. Property Tax Rule 469 (f) briefly mentions this situation. One property where this occurs is a situation in which the mining is against the face or wall of the underground vein deposit. The valuation of such a mine is not an easy because of the unknowns. For such a property, it is best to let history be the guide.

Stream–bed Aggregate Deposits

California has rivers that are active year round, especially in Northern California, and others that are active only seasonally, such as many of the rivers in Southern California. Moving water is a powerful force in the deposition of rocks and minerals. It is also a powerful force in removing them.

Some commercial aggregate deposits are located in or close to existing stream channels. As a result, there are no stable physical reserves. The movement of water may bring in or remove material with changing seasonal water levels. Keeping track of the reserves in such a situation is difficult not only for the operator, but for the appraiser as well. Instead, most operators of such properties know from experience that the reserves will ultimately be replenished, although there have certainly been cases of long years of drought where that has not been the case. Accordingly, it is the Board's position that such properties receive a base year value, in conformance with procedures established for other mining properties, with the following exceptions:

- No allowance shall be made for depletion
- No new reserves shall be added unless the property is expanded in size or some other mining method is utilized

Obviously, if new material is typically brought into the site naturally, the typical depletion does not occur. Therefore, no allowance for depletion should be made. By the same token, material is taken away from the site by nature. New reserves, in the typical sense usually do not occur.

WILLIAMSON ACT (OPEN SPACE) PROPERTIES

There has been much confusion over the years about the handling of mineral properties on Williamson Act lands created pursuant to the California Land Conservation Act of 1965.

Quoting Section 427 of the Revenue and Taxation Code:

> "427. **Consideration of minerals, etc**. Nothing in this article shall prevent the board or the assessor, in valuing open–space land for assessment purposes from taking into consideration the existence of any mines, minerals and quarries in or upon the land being valued, including, but not limited to oil, gas, and other hydrocarbon substances."

Minerals are not subject to Williamson Act value restrictions. They are valued and assessed the same way whether they are on Williamson Act Land or on other property. When using an income approach the income should be discounted at a rate that reflects the risk of the mineral operations and not the capitalization rate designated for the Land Conservation Act (LCA) valuation in Section 423(b). Section 51238.2 of the Government Code discusses compatible uses and mineral extraction. Additional information can also be found in Assessors' Handbook Section 521, Appraisal of Agricultural Property.

Chapter 7 : APPRAISAL OF LAND, FACILITIES, EQUIPMENT AND PERSONAL PROPERTY

INTRODUCTION

Mining properties vary greatly in size and function. They range in size from a one–person operation to large complexes consisting of many elaborate phases or steps of ore processing, both physical and chemical. Some operations are limited to surface or open pits, others consist of underground multilevel shafts, tunnels, and drifts. The facilities required to operate the mine will vary with the size and nature of the operation.

Most aggregate operations are surface or open pit. Those that tap active stream resources usually are worked with large hydraulic excavators and wheel loaders. Other types of aggregate properties may require drilling, blasting, crushing, and mucking.

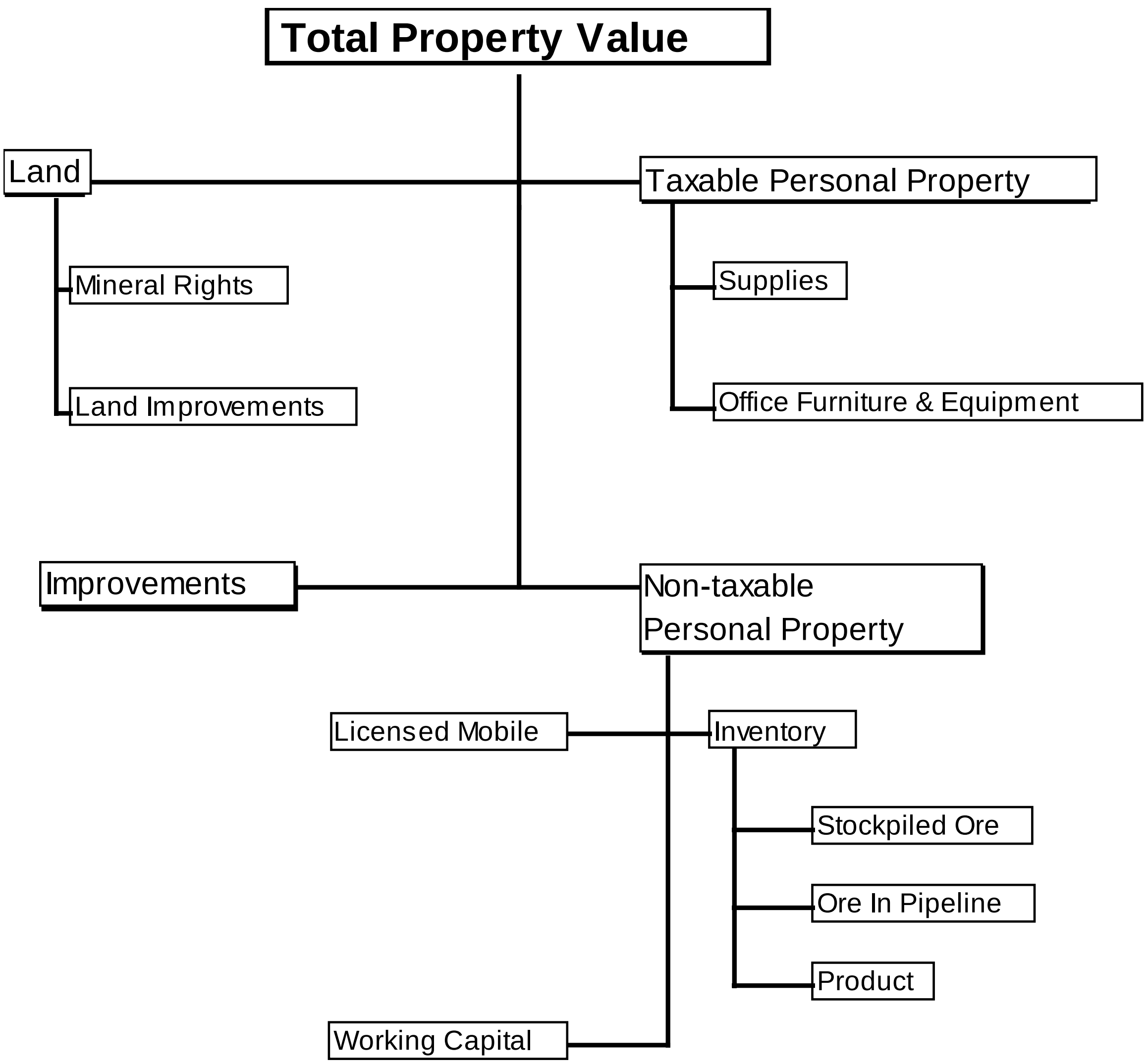
PROPERTY CLASSIFICATION

While property classification is not problematic in most appraisals, in the mineral domain problems sometimes arise. How to classify property that is unfamiliar or newly developed is a frequent challenge. Classification becomes particularly important when considering the effect of classification on property value under Article XIII A of the Constitution.

The primary issue is the mineral rights value. Figure 7–1 below shows that mineral rights are classified as land. Included in the classification of land are land improvements. The non-retrievable portions of a water well, for example, are considered land improvements. Some of the retrievable portions, such as the pump and tubing, are considered personal property. The permanent casing lining of the well is a land improvement, since it ordinarily cannot be retrieved. (“Non-retrievable” means items installed in the well that cannot be recovered.)

The diagram shows the components of value contained in the total property value. Inventory is not taxable and must be deducted from the total property value. A certain amount of inventory is necessary to the operation of a business, and a "normal" amount of inventory is included in the capitalized earnings of the property. Every property is different, and the application of appraisal judgment is necessary to determine what is normal. A few well–placed queries to the operator may be helpful in resolving the question.

Figure 7–1 Components of property value.



Stockpiled ore, ore being processed, and the product are classified as inventory. It is the appraiser's job to identify and separate the classifications, not only for purposes of enrollment, but also to identify them for treatment under Property Tax Rule 469 (d) and (e). That aspect is discussed in greater detail in Chapter 8.

Occasionally an appraiser may confront a situation where an operator will mine an old tailings dumpsite. Tailings that were disposed of by the previous mine operation are classified as land, because the tailings pile was considered too low grade to ever be profitable. The tailings site was viewed as the permanent resting place for the discarded material. Due to advances in mine technology and changes in economics, some old tailings piles can be profitable to produce. Their economic viability gives them the status of "new proved reserves" and they should be treated as such under Rule 469, since they are taxable in the same manner as any other new reserves. Property Tax Rules 121, 122, and 124 contain additional examples of property classification.

APPRAISAL CONSIDERATIONS

The income approach or total property approach will yield a value for the property that includes everything that contributes to income, as described in Chapter 6. The residual method, which deducts all components other than the mineral rights from the total property value, also described in Chapter 6, leads to a value of the mineral rights. Appraisers can use the cost and comparable sales approaches to determine the value of machinery and equipment, personal property (including inventory, supplies, and mobile equipment, both licensed and unlicensed), land improvements, improvements (including structures and buildings), and idle equipment. Idle equipment, in most cases, will not be included in the income approach, unless it is only temporarily idle or needed as a backup to prevent a shutdown of the entire operation.

A separate evaluation is necessary for leased equipment, which is fairly common in mining operations. Many times the property taxes on leased equipment are paid by the owner of the equipment. If so, the current value of the leased equipment should be deducted from the total property value, because it is not taxed twice. Equipment leases should be reviewed to determine the proper assessee.

BUFFER ZONE LAND

Buffer zone land was discussed briefly in Chapter 6 as an example of what is and is not included in the income approach. It may be owned or leased. Generally, it is there because the operator wishes to "buffer" the public from noise, dust, the possibility of damage due to blasting, and to prevent unauthorized trespass. If the buffer zone land is needed to operate the property safely, unhindered by outside forces, then its value is included in the total property value.

APPRAISAL PROCEDURES FOR FACILITIES AND EQUIPMENT

LAND IMPROVEMENTS

Land Improvements generally consist of on-site physical alterations and miscellaneous improvements to land. Mining properties may require extensive spur tracks for railroad access, roadways, walks, paving, ponds, and fences. All of these necessary items are incorporated in the appraisal. The appraiser should also be aware of water sources and fire protection systems, sewers and storm drains, fuel and power distribution facilities, and related utility services, many of which may be buried underground. The mine plan may be a reliable source for identifying these installations. In addition, the appraiser should ascertain whether they are included in the chart of accounts.

The factored historical cost method is especially useful in the valuation of land improvements, since in-place costs may be influenced by terrain, subsoil conditions, and other non-apparent subsurface conditions. Trending of historical costs to determine replacement cost should be based on an index that is reflective of mining industry costs. Note that land improvements and improvements to land may have little, if any, residual value once the mineral deposit is exhausted.

BUILDINGS AND OTHER STRUCTURES

Buildings and structures generally comprise a nominal portion of the overall mining facilities. The essential improvements may consist of an office, possibly a scale and scale house, parts warehouse, repair and shop buildings, laboratory, and washroom facilities. On larger facilities there may be additional buildings related to ore and mineral processing. The appraiser may identify each building separately by segregating the individual building accounts and factoring the historical costs individually, or may group all building costs based on the year of acquisition and factor the composite building investments.

The principle of ***substitution*** states that no one will pay more for a property than the amount required to obtain a property of equal desirability and utility, i.e., replacement cost less depreciation. Therefore caution must be exercised in adopting the factored cost approach. Factoring the original cost results in an indicated reproduction cost. This may or may not be proper, depending upon individual circumstances. The original structure and its method of construction may bear little relationship to the current or future use. The appraiser should analyze factored historical costs to ascertain their reliability. The utility of the structure should be examined and functional obsolescence determined. Note that buildings and other structures may have little, if any, residual value once the mineral deposit is exhausted.

FUNCTIONAL OBSOLESCENCE

Decreases in productivity, as a mine’s ore grade or quality of the mined material change, can result in functional obsolescence on portions of the equipment that were in full use when the facility was first put online. Failure to recognize the functional obsolescence of the mining facilities can lead to an improper allocation of the value and result in improper assessments. Functional obsolescence could be subcategorized as superadequacy.

An allowance for superadequacy should be considered when the current and projected use of the equipment is significantly below design capacity. Superadequacy only exists if the excess capacity will not be used in the future. If there are further development plans for the property that will increase production, the amount of the superadequacy is only the amount of the excess capacity above the expected peak production levels. Appraisal judgment must be exercised.

Determining the value of the superadequacy for a mine is sometimes impractical. It would require reengineering the facilities layout, determining the proper size of the equipment and whether satisfactory substitutions could be made, and analyzing the economic feasibility of correcting the superadequacy.

Instead, the following procedure is recommended, assuming information is available on the cost to correct the superadequacy and the correction is economically feasible. (1) Determine the reproduction cost of the current installation. (2) Calculate the depreciation charge. (3) Determine the cost to remove the excess capacity and install the properly–sized equipment. (4) Subtract the depreciation charge and the cost to cure the superadequacy. The remaining value represents the loss in value from depreciation and functional obsolescence.

It should be pointed out that since mining properties are valued as a whole, the primary reason for making an adjustment for superadequacy or other forms of obsolescence is for purposes of allocation. Where superadequacy exists, subtracting the normal fair market value of the equipment may leave little or no value for the mineral reserves. Since the reserves must have some value if production is expected to continue, it is necessary to recognize equipment obsolescence so the total value can be allocated reasonably.

FIXED MACHINERY AND EQUIPMENT

For assessment purposes, fixed machinery and equipment are classified as improvements. On site machinery and equipment will vary directly with the size and productive capacity of the operation and will usually constitute the bulk of the plant value.

The appraisal of machinery and equipment is initiated by making a field check of the operating plant. This way, the appraiser can classify the property into various categories and determine normal economic lives and applicable depreciation factors. Once the equipment is categorized by age–life, the operator may be requested to report original asset costs based on year of acquisition in the various life categories. Itemized equipment reports of additions and deletions made by the operator will be useful in subsequent years to maintain the proper classifications and fulfill the requirements explained in Chapters 8 and 9.

The factored historical cost method commonly offers a uniform and equitable approach to the valuation of fixed machinery and equipment for tax purposes. As in the appraisal of buildings, the basic cost information is gathered from the company's property ledger or depreciation schedules, and should include sales or use taxes and freight and installation charges. The cost data may be arranged by account or unit designation, and it is desirable that the data be grouped by year of acquisition. However, consideration also must be given to the fact that some fixed machinery and equipment may have only salvage value once the mineral deposit is exhausted.

Assessors' Handbook Section 581, contains lists of equipment index factors, along with industry classes, with mining in Group 2. The use of the factors is also illustrated in the handbook.

MOBILE EQUIPMENT

Heavy mobile earth–moving equipment is the predominant personal property found in mining operations. The types of mobile equipment include shovels, excavators, wheel and track loaders, dump trucks, and track and wheel dozers. Equipment that is steel–wheeled or track–laying; or over-weight, over-height, or over-width and requires a permit to be moved, is subject to the property tax.

Licensed vehicles have already been taxed and their value should not be included in the total appraisal value of the mineral property. For property values determined using the sales comparison or income approach, this may require that the value of the licensed vehicles be deducted from the total property value. For property values determined using the cost approach, the value of these vehicles should not be included in the summation.

Industrial mobile equipment may be appraised by using the factored historical cost approach described in Assessors' Handbook Section 581. Another source for the valuation of new and used construction equipment is the “Green Guide” published by Equipment Guide-Book Company. Information is compiled from reports of manufacturers, equipment dealers, auctioneers, and contractors throughout the nation. Revisions are made whenever major changes occur.

FURNITURE AND FIXTURES

Assessors' Handbook Section 581 has appropriate cost indices for factoring office equipment.

DEPRECIATION

Depreciation for property tax purposes means a loss in value from all causes, i.e., the difference between replacement cost new and present value. It can take the form of physical deterioration, functional obsolescence, economic obsolescence, or any combination of the three. Additional information about depreciation can be found in Assessors' Handbook Section 501.

The degree of physical deterioration is important in regard to mining and milling equipment. Such equipment is frequently used under highly abrasive conditions and may be operated around the clock. Unless a high level of maintenance is employed, depreciation from this source may greatly exceed that indicated simply by the age of the equipment.

Functional obsolescence may be less common than in manufacturing industries. Fixed mining machinery may often be custom built for a particular mine, or it may be standard equipment such as crushers, conveyor belts, etc., with designs that change very slowly over the years. However, functional obsolescence can occur as a result of changing technology, particularly when initiated by new environmental protection standards.

Economic (sometimes called external) obsolescence, on the other hand, is usually an incurable defect, caused by negative influences external to the mining site. An example of this is a zoning restriction affecting the property.

Depreciation used for income tax purposes has no bearing on the level of depreciation to be used for determining the taxable value of a piece of equipment. There are several methods used to determine depreciation. One is to determine the total number of units that the equipment can process in its life time and to estimate the level of depreciation based on the units processed. Another method is to estimate the useful life of the equipment based on the projected load factor, and each year deduct the proportionate amount from the replacement value. Other methods are available. The only restriction is that the method of depreciation must have some relationship to the expected life of the equipment and to no other criteria.

An appraiser can take several approaches to the estimation of depreciation from all causes:

- Observe the condition and utility of the facilities, make a judgment of the average age and remaining economic life, and then estimate the loss in value from all causes.
- Refer to published depreciation schedules such as those of Marshall and Swift and other appraisal reference services.
- For mobile equipment, heavy equipment dealers and /or equipment dealer publications (i.e., *Green Guide*, *My Little Salesman*, etc.) may be useful reference tools.
- Utilize Assessors' Handbook Section 581, which provides percent good tables based on the average economic life of an asset.

Although standard depreciation or percent good tables may be applied to the reproduction cost new (RCN), appraisers may use their judgment in determining "observed depreciation." Percent good tables are constructed to reflect "normal" depreciation based on analysis of statistical data on retirements of industrial plants and equipment. They are useful for speed and uniformity in a mass appraisal program. However, if depreciation is significantly greater or less than normal, the appraiser must estimate the amount and make the proper adjustment to reproduction cost less normal depreciation. Also, in a mine or quarry operation, the appraiser should recognize that the economic life of many of the units is tied to the remaining life of the ore deposit. Common sense and good judgment are prerequisites when adopting an economic life and depreciation schedule.

Mobile equipment may be relatively short lived because of hard usage on 24-hour-a-day– basis. Consequently, the industry measures economic life in operating hours rather than in years. Normal life is based on 10,000 hours with one overhaul. A one–shift operation would approximate 2,000 hours per year, resulting in a five–year average life. Some companies prefer not to overhaul equipment extensively and may replace it in a couple of years. Multiple shift operations may reduce the economic life to one year or less. Assessors' Handbook Section 581 carries recommended percent good factors and suggestions for adjustment based on condition.

VALUATION OF CONSTRUCTION WORK IN PROGRESS

Construction work in progress is taxable at the value of the completed work as of the lien date and should be added to the total value of the property. Rules 463 and 463.5 govern how new construction is classified and enrolled. New construction associated with mineral properties includes the removal of overburden and the addition of roads, processing equipment, and buildings.

Construction work in progress that does not contribute to income has to be valued separately and added to the capitalized earning ability of the property.

MATERIALS AND SUPPLIES

This classification of property includes a multitude of items from office supplies to blasting powder. This type of property is taxable as personalty.

IDLE EQUIPMENT

Many properties will frequently contain equipment that is idle for one reason or another. It may be awaiting replacement; it may have broken down; or it may be sitting idle until a decision is made about what to do with it. Such equipment could also be a spare, held in reserve in case another piece of equipment breaks down. Without holding such equipment in reserve, the cash flow could be interrupted. If it is backup equipment, then it is included in the CEA (capitalized earning ability) of the property. If it is idle and awaiting replacement, it must be added at its salvage value; the value is not included in the capitalized income stream.

Chapter 8 : ARTICLE XIII A OF THE CONSTITUTION (PROPOSITION 13)

INTRODUCTION

The passage of Proposition 13 (Article XIII A, California Constitution) in 1978 by California voters led to a number of far reaching and unprecedented changes in the way properties are valued. Section 1 establishes that the maximum amount of any ad valorem tax shall not exceed one percent (1%) of the full cash value of the property. Under Section 2, the full cash value means “the county assessor’s valuation of real property as shown on the 1975–76 tax bill under ‘full cash value’ or, thereafter, the appraised value of real property when newly constructed, or a change in ownership has occurred after the 1975 assessment.” The base year value may be adjusted for the effects of inflation up to a maximum of 2 percent per year based on the California Consumer Price Index or comparable data, or may be reduced to reflect substantial damage, destruction, or other factors causing a decline in value.

Proposition 13 left a number of unanswered questions in the appraisal of mineral properties in particular. To remedy the problem, the Board adopted Rule 469 which applies the provisions of Article XIII A to the valuation of mines in all phases of development. It is important to recognize that Rule 469 is a property–specific rule, and as such, takes precedence over any other rule which may be in conflict. *Phillips Petroleum Co. v. County of Lake*, 15 Cal.App.4th 180 (1993).

PHASES OF DEVELOPMENT OF A MINE PROPERTY

Rule 469(b) provides that the rights to enter upon land for the purpose of exploration, development, or production of mineral are “taxable real property interests to the extent they individually or collectively have ascertainable value.” Each subdivision of the rule thereafter specifically sets forth what to value and how a mine reaches the point of producing income.

In adopting Rule 469, the Board determined that

> “…due to the unique nature of mineral interests and the requirements of Article XIII A, …the assessor must select the one point in time when the mineral right will be valued by reference to proved reserves. Once the base year value is established, it cannot be increased except as permitted under Proposition 13.”

Disputes arose as to the appropriate point in time that the existence of proved reserves should be recognized, i.e., at the point of discovery or at the point of production. The Board’s position, incorporated into Rule 469, was that “the most realistic estimation of proved reserves cannot be made until about the time that production is ready to commence."[3] Commencement of production was held to be a much more readily identifiable event than other points during the transitional periods leading from exploration and development to production, and also the best for assessors and assessees from the standpoint of bringing uniformity to assessment procedures.

Recognizing that there may be a rather long continuum of points in time at which it might be possible to state that proved reserves were identified, the Board subdivided Rule 469 to cover three distinct phases or stages in the development of the proved reserves. The valuation of mineral property prior to production in the exploration phase is set forth in Rule 469(d)(1) and in the development phase in 469(d)(2).

EXPLORATION STAGE (UNDER A LEASE AGREEMENT)

Exploration as defined in Rule 469(c)(3) is the process of searching for and determining the location, quantity, nature, shape, and quality of mineral deposits. Searching for minerals is characteristic of the mineral industry. Without the search, there can be no assets to mine and no replenishment of reserves being depleted as the mine is producing. Exploration is an expensive process for mining companies and there is no assurance of a successful outcome.

Exploration expenses that are incurred and do not yield a successful outcome can be written off for tax purposes. Exploration expenses for a mine that eventually goes into production are assumed to be recaptured by the depletion allowance (discussed in Chapter 5), although this is not always the case.

The process of exploring is not just a matter of finding a valuable mineral, but the mineral must be produceable at a profit, i.e., economic. The mineral must not only be present in sufficient quantities, but it must be mineable without the need to remove too much overburden (waste) and must have a chemistry of occurrence that is favorable.

VALUATION IN THE EXPLORATION STAGE (UNDER A LEASE AGREEMENT)

When a company begins exploration in earnest, an agreement will be executed between the company and the owner of the mineral rights to establish the privileges and obligations of each (unless the company owns the mineral rights outright, discussed below). In Chapter 3, these lease agreements and the terms and conditions that an appraiser should particularly look for were discussed in detail. The lease terms are especially important, because the lease defines the expectations of the parties and as such is the key to the valuation of the property in the exploration stage.

Rule 469(b)(1) explains that the ***right to explore*** is a taxable property interest and in regard to valuation specifically states:

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[3] Regulation 469, FINAL STATEMENT OF REASONS, Board of Equalization, 1990.

> "The right to explore shall be valued by any appropriate method or methods as prescribed in Section 3 of Title 18 of this code taking into consideration appropriate risks; however, in no event shall the right be considered to be under construction."

In other words, the assessor may not place a base year value on the identifiable proved reserves during the exploration phase and then make regular changes in that value through the development phase and make the final determination of the base year value at the time of the commencement of production. Such continuing new construction approach to the valuation of mineral rights was rejected in the landmark case of *Lynch v. State Board of Equalization* (1984) 164 Cal.App.3d 94, cited by the Board as one of the important reasons for Rule 469.

The rule grants an assessor the right to use any appropriate method to value the property. As previously noted, the comparative sales approach is often quite difficult in mineral appraisal because of the need for true comparability of confirmed sales of similar properties. If there is an arm's length sale of the right to explore for a property under appraisal (constituting a change of ownership of a property right, the value conclusion is clearly determined by the sales price, unless there are complicating circumstances.

Generally, the use of the cost approach during the exploration stage is necessary. Rule 469 (d)(1) expressly states that the construction of structures or physical alterations to land (access roads, fencing, drainage, water systems, clearing, government approvals for such structures, etc.) during exploration constitutes assessable new construction and is subject to the provisions of Rule 463. However, the costs of obtaining government approval to operate, take ore samples, assay for mineral content, or test processing methods shall not be considered for purposes of valuing the right to explore. Operators may expend large sums of money exploring a particular property. Spending money does not equate to property value. The question is whether the cost has resulted in the construction of the above mentioned structures and physical alterations on the property being appraised.

It is important to recognize that Rule 469 does not permit proved reserves to be quantified and valued during the exploration phase, even though there may be discoveries in the exploration stage. Companies will not commit funds to actually develop a property until they are certain it will yield a reasonable return on the capital needed to develop it. Properties that remain in the exploration stage have not reached the critical point of management decision–making that is required to commit development funding. When such a commitment is made, the property then advances to the next phase – the development stage, discussed in the next section. Assessment of the right to explore, the right to develop, and improvements during the exploration and development phases should follow the procedures set forth in subdivision (d)(1) and (2) of the rule, recognizing that the proved reserves reasonably expected to be produced are assessed only as of the date production commences. (Rule 469(e).)

Typically, an excellent resource for valuing the mineral rights during the exploration stage is the agreement between lessee and lessor. As mentioned in Chapter 3, the following are of particular importance:

- Time
- Restrictions
- Lease Area
- Royalty Payments

The "term of the lease" or period of time covered by the agreement will usually determine the limit of time used in the cash flow. However, because of the uncertainty inherent in the exploration phase, the lease does not always extend to its full term and may be terminated early by the lessee.

Exploration is, by nature, a period of uncertainty, and the intended objectives are not always met. Even though an exploratory period of 10 years is written into the agreement, the company may quitclaim in a year or two, giving up the rights acquired in the agreement. Alternatively, the company may seek to extend the agreement for more than 10 years. Renewal options are typically written into the agreements.

Characteristically, the agreements are written so that the advance royalty payments escalate toward the end of the lease period. This looks attractive to the lessor and may be an incentive to sign, but the lessee knows that if nothing is found to develop, he will quitclaim before the payments come due.

Restrictions regarding the use of the land in the agreement probably would not affect valuation during the exploration phase, but will be important in later valuations if the property is developed. However, the lease area is an important item of information for any appraiser, as it outlines the geographic extent of the property covered by the lease.

The royalty payment provisions may allow payments to be credited against any production that occurs in the future. Coupled with these may be a number of other important monetary provisions covering, for example, surface rental for the right of trespass and bonus provisions that authorize a single payment upon initiation of the lease. Another example is a performance assurance provision that constitutes a commitment on the part of the company to spend certain sums of money each year for exploration on the property. Any amount not spent must be paid to the lessor. It is a form of a due diligence payment.

All of these provisions are capitalized into a value conclusion for the right to explore. Any actual improvements to the property, within the framework of Rule 469(d)(1), would be added to the value to derive a total property value. The value of the right to explore remains on the roll until the property is either quitclaimed, the ownership of the lease is transferred (ownership transfer), or the property goes into production.

For further information on this subject, refer to the Glossary for definitions of some of the more common lease agreement clauses.

DEVELOPMENT STAGE (UNDER A LEASE AGREEMENT)

Rule 469 also treats the development stage as a separate right or phase prior to the production of proved reserves. However, as stated in Rule 469(d)(2), "the value of the right to develop is virtually unascertainable separate from the right to produce." Therefore, the rule expressly provides that “no separate value shall be established for the right to develop unless there is an intervening change in ownership….” Any valuation of the right to develop is deemed to be included in the base year value of the mineral rights and proved reserves established in accordance with the valuation of mineral properties during production in subdivision (e) and the valuation of mineral producing properties without proved reserves in subdivision (f).

It is true that there are “proved reserves” in existence at the beginning of the development stage insofar as the mining business itself is concerned. However, these reserves are not necessarily “proved reserves” for property tax purposes. Rule 469(c)(2) states that,

> "'Proved reserves' means those minerals measured by volume or weight which geological and engineering information indicate with reasonable certainty to be recoverable in the future, taking into account reasonably projected physical and economic operating conditions. 'Proved reserves' include all minerals which satisfy the preceding sentence *without regard to how the term is used in industry*." (Emphasis added.)

The development stage is frequently long and drawn out because plans must be drawn up for the development of the property. This commonly involves a number of subcontractors. Also, there is the construction period involved in readying the property for mining, as well as the sometimes arduous permitting process involving numerous different agencies. Many things can happen during this process that may alter the economics of the property. What is economic one day may not be economic the next. For example, local politics is sometimes inhospitable to mining in certain areas and the permits may never become reality.

By adopting this framework in Rule 469, the Board of Equalization decided that while proved reserves can be discovered at almost any time, the valuation of such reserves prior to production is highly speculative due to many uncertainties. Therefore, the startup or commencement of production is the time when most of the speculation and uncertainties have been eliminated and the assessor’s determination of the quantity and value of the proved reserves can be reliably ascertained.

VALUATION IN THE DEVELOPMENT STAGE (UNDER A LEASE AGREEMENT)

No separate value determination for the right to develop should be made unless there is a change of ownership as previously discussed. In the absence of such a change of ownership, the value of the right to explore remains on the assessment roll, subject to the annual adjustment for the CPI not to exceed 2 percent. As in the exploration stage, the right to develop should never be considered as being under construction. Of course, any qualifying new construction during the development stage should be appraised by conventional appraisal techniques in conformance with Rule 463.

In the event of a change in ownership, the sale price may reflect a value for the right to develop, which is assessable.

PRODUCTION STAGE AND VALUATION (UNDER A LEASE AGREEMENT)

The commencement of production is the phase point at which the assessor establishes the base year value for the property. Rule 469(e) states that upon the commencement of production, the "…market value of such mineral rights is determined by valuing the estimated quantity of proved reserves that can reasonably expected to be produced during the time period these rights are exercisable." The standard in subdivision (e) requires that the valuation of the proved reserves shall be based on "…present and reasonably projected economic conditions (e.g., capitalization rates, product prices and operating expenses, etc.) normally considered by knowledgeable and informed people engaged in operating, buying, or selling of such properties or the marketing of the production therefrom." This standard necessitates a significant amount of detailed information.

An aerial photo or map of the property helps significantly to identify the property orientation and its development. A process flow diagram is also helpful, even on simpler properties. Discussing the property with the mine supervisor, the geologist, the financial officer, the environmental staff, and the mining engineers, and others who can furnish important information is a necessity in terms of discovering the "present and reasonably projected economic conditions" per Rule 469(e). The mine supervisor can generally make the staff available and provide the requisite data.

Similarly, determining what constitutes production for purposes of setting a base year value and when production actually starts often requires specific answers from the mine supervisor and/or management. The determination cannot always be made from physical observation, since a new mine frequently goes through a testing phase.

VALUATION OF A PROPERTY NOT UNDER A LEASE AGREEMENT

If a property is owner explored, developed, and produced, the value of the rights to explore and develop will be reflected in the purchase price of the mineral rights. The value can range from zero to millions of dollars. That value may have already been enrolled for years, depending upon when the change of ownership took place. It represents the base year value for the rights to explore and develop. At the beginning of production, the value of the right to explore and develop is replaced by the mineral right value determined by the property's cash flow.

It should be understood that on any particular property, ownership can be commingled, i.e., the operator owns part of the property and leases part. In this event the appraised value is a mix of the two, part of which may already have been enrolled.

BASE YEAR

All properties subject to Proposition 13 (Article XIII A, California Constitution), including mineral properties, have base year values which are defined as the full cash value determined on the lien date pursuant to Section 110.1(a). As previously noted, once the base year value is established and enrolled, it does not change unless the property undergoes a change in ownership under Section 60, et seq., or there is new construction, depletion, negative reserves, new reserves, removal of property, or the property is shut down for other than short temporary periods. Some of these occurrences are discussed below.

At the start of production, the market value of the total property is estimated, allocations for all the various components made, and base year values established. The allocations should consider the current conditions of the property and be based on the fair market value of each component part. Values carried as construction work in progress (CWIP) prior to the start of production are removed from the tax roll when the base year values are enrolled. The value for the exploration and development rights of the minerals must be reduced to zero when the value of the right to produce those same minerals is enrolled.

ADJUSTED BASE YEAR VALUE

As with other properties subject to Article XIII A, the base year values of mineral properties are subject to adjustment for inflation based on the California Consumer Price Index, not to exceed 2 percent each year. With regard to mining properties specifically, Rule 469(e) requires that reductions (depletion) in recoverable amounts of the minerals constitute reductions in the measure of the mineral rights and correspondingly reduce the value on the subsequent lien date. Accordingly, depletion is applied to the prior year's reserves before the adjustment is made for the California Consumer Price Index. It is necessary to apply the California Consumer Price Index adjustment only to the reserves carried over to the current year from the prior year.

DEPLETION (REMOVAL OF PROPERTY)

Used in this section, depletion refers to the process under Rule 469 of removing property, i.e., reducing the quantity of recoverable minerals, and not to statutory depletion referenced in the federal tax laws. Proved reserves constitute property that has been produced or physically severed from the land, and is no longer taxable. Since proved reserves usually decrease from year to year because of production, a corresponding adjustment must be made to the mineral right value.

The adjustment is made in the following manner:

$$\text{Unit Value for Depletion} = \frac{\text{Prior Year Value of Proved Reserves}}{\text{Prior Year Proved Reserves}} \quad \textbf{Equation 8–1}$$

$$\text{Value to be Depleted} = \text{Unit Value for Depletion} \times \text{Units Produced in Past Year} \quad \textbf{Equation 8–2}$$

Where:

Prior Year Proved Reserves	the reserves on last lien date or the date of change in ownership
Prior Year Value of Proved Reserves	the value of proved reserves (mineral rights) on last lien date or the date of change in ownership
Units Produced in Past Year	the volume or weight of proved reserves produced since the last lien date or date of change in ownership

NEW RESERVES

New reserves or increases in proved reserves that occur on the property from time to time are additions to the mineral right which must be added to the value of the property interest according to the requirements of Rule 469(e).

Increases in proved reserves following the commencement of production are dictated by physical quantities present, technological changes, and by economic conditions. Economics is no less important than the physical or technological changes. The proved reserves which may feasibly be recovered on the property will be altered with changing prices and costs, and any other factor that affects the property's economics. There can also be physical changes in reserves that result from new discoveries on the property. Proved reserves reported by the operator on the SBE mining report forms should be updated yearly.

Contact with mining operators from year to year provides awareness of operating changes on the property. Maintaining contact with the county planning and building department where operators must acquire approval for changes in use permits is also extremely helpful. There is a wealth of information available from these and related county agencies that can affect the property value.

Once the new or added reserves are identified, cash flows can be constructed for purposes of value calculation. New reserves are valued by building two cash flows as required by Rule 469(e)(1)(A)(v). When there are new reserves, the property must be appraised twice: once by determining the current market value of all of the proved reserves including the new proved reserves, based on the operations on the property in the future with the new proved reserves, and again without the new proved reserves less depletion. The quantity of new reserves is determined by subtracting the reserves in the two appraisals. The added mineral right value is determined by subtracting the mineral right values in the two appraisals.

REDUCTION IN RESERVES

Changes in physical and economic conditions can result in a reduction of proved reserves for a mineral property. Since they no longer exist, they must be credited back to the operator/assessee.

Knowledge of reserves reductions is derived from the operator's reporting forms and/or from the assessor’s market value appraisal which clearly exhibits less reserves than prior calculations indicated after bringing last year's reserves forward and accounting for production. These reserves are removed from the property value in the same way as produced or depleted proved reserves.

Chapter 9 : OTHER ADJUSTMENTS TO VALUE

INTRODUCTION

Once a value for the property has been estimated, there may be factors that affect the ***taxable*** value, in contrast to the ***market value*** of the property. Events such as new construction, new or reduced reserves, changes of ownership, changes in the consumer price index, or lien date adjusted base year values that are higher than market value all have an effect on the property's taxable value. As previously noted, mineral properties in particular often exhibit important differences as compared to other types of properties in the way they are treated for the purpose of property tax valuation.

Some of the differences have occurred as a result of legislation enacted since the passage of Proposition 13. Proposition 8, followed by the implementing legislation in Section 51, was adopted to allow for adjustments on the roll where property has declined in value. Of major importance regarding mineral appraisals was the fact that assessed values could now be reduced if the property values have declined because of damage or changes in economic conditions. Much legislation has attempted to clarify elements of the original initiative and to rectify inequities, such as the situation where the market value of a property is actually lower than the adjusted base year value.

This chapter is devoted primarily to changes and adjustments in taxable value brought about through initiatives and legislation in effect when this handbook was written. The intent is to familiarize the reader with special situations that are peculiar to mineral properties, not to cover every special case.

CHANGES IN VALUE

NEW CONSTRUCTION

Once the base year value is established, there may be additions to or the removal of property in terms of land or improvements since the last lien date, or there may be an alteration of the land or improvements. Both of these areas are covered in detail in Sections 70, et seq., and Rules 463 and 463.5. Mining properties do not differ from other properties in this regard. However, as discussed in Chapter 8, Rule 469 provides that additions to proved reserves are not physical construction and, therefore, cannot be treated as construction in progress. Added proved reserves are in effect “new property” that did not exist on the previous lien date and which enhances the value of the right to produce. The market value of added proved reserves for properties already in production should be added to the roll on the next succeeding lien date. Added proved reserves are not subject to supplemental assessment (discussed later in this chapter) on producing properties, in contrast to proved reserves for new properties which are subject to supplemental assessment when production begins.

New construction in progress, pursuant to Rule 463, must be appraised on the lien date at its full value and on each lien date thereafter, until the date of completion. Upon completion, the entire portion of the property newly constructed must be reappraised at its fair market value.

Removal of property is also classified as new construction. (See Sections 75.10 and 75.16 and Rule 463.5.) Rule 469 specifically provides that whether the construction of improvements or alteration to land during development qualify as new construction shall be determined by reference to Sections 70, 71, and 73 and Rules 463 and 463.5. Taxable values must be adjusted for the removal of property as specified in these provisions, on the lien date or through the supplemental assessment process, whichever is appropriate.

CHANGE IN OWNERSHIP

Changes in ownership occur when there is a "transfer of a present interest in real property, including the beneficial use thereof, which is substantially equal to the value of the fee interest." (Section 60, Rule 462.001) The result usually requires reappraisal of the entire property or a portion of it. It is important to recognize with regard to mineral property, however, exactly what property has changed ownership.

For mineral properties, transfers of either the lessee's or the lessor's interest is not subject to the lease term provision of 35 years or more found in Section 61(c) and Rule 462.100. Rather, Section 61(a) governs the transfer of mineral rights exclusively and states that the creation, renewal, sublease, assignment or other transfer of the right to produce or extract oil, gas, or other minerals, regardless of the period during which the right may be exercised, is a change of ownership. Even if the lease is for only one year (or even less), there is a change of ownership.

For example, assume on day 1, the owner of a mineral property is extracting/producing proved reserves. Assume that on day 2, the owner leases the right to remove minerals to a lessee. Assume on day 3 that the lessee transfers or surrenders the right to remove the minerals back to the owner. There is a change in ownership and reappraisal of the right to produce the minerals on day 2 and on day 3. Section 61(a) specifically states, however, that the balance of the property, other than the mineral rights, shall not be reappraised. The resulting sales price will recognize only the lessee's interest and not the value of the royalty interest. Since the lessee has the equivalent of a fee interest in the property (for property tax purposes), any time the lessee's interest transfers, the equivalent royalty interest must be reappraised at market value as well. If only a portion of the leased interest transfers, then only that equivalent portion would be reappraised. In the event of a royalty interest transfer, there is no subsequent reassessment of the property, since the mineral lessee is treated as holding the property in fee.

Ownership changes of mineral properties must be studied carefully and understood completely in order to analyze them for use in determining the percentage of the property interest transferred or conveyed, and to evaluate a sale for use as a value indicator. This can only be done with substantial information and full documentation from the buyer. If facts related to the sale are not fully understood, the appraiser should seek clarification, beginning with the buyer. Many mineral property ownership transactions are varied and complex and may contain features not found in other properties. It is important to have a complete understanding of exactly what interest(s) have transferred, as property values may be affected.

Changes in ownership, whether complete or partial, are subject to supplemental assessment. Revenue and Taxation Code Sections 60–66, and Rules 462.001–462.260, specifically address change in ownership questions and issues. Rule 462.260 discusses the appropriate date to use for the transaction.

ADJUSTMENTS TO BASE YEAR VALUES

As previously mentioned in Chapter 7, Section 51 provides generally that the taxable value of real property is the lesser of the base year value compounded by the inflation factor (not to exceed 2 percent), or its full cash value, or its adjusted value when damaged as stipulated under Sections 51 (c) and (d). It is always the *full value* of the appraisal unit that is compared for purposes of Section 51. In applying Section 51 to mineral property, Rule 469(e)(1)(C) specifically states that declines in the value of the mineral property shall be recognized when the market value of the appraisal unit (i.e., land, improvements including fixtures, and reserves) is less than the current adjusted base year value of that unit.

The appropriate inflation factor to use on each lien date for the purposes of fulfilling the requirement of Article XIII A of the Constitution is published annually by the Policy Planning and Standards Division, California State Board of Equalization in a letter to assessors.

SUPPLEMENTAL ASSESSMENT

Supplemental assessment applies whenever new construction resulting from actual physical new construction on the site is completed or changes of ownership occur, on or after July 1, 1983. The supplemental assessment statute was created by the legislature so that changes in ownership and completion of new construction could be assessed at the time they occur rather than waiting for the next lien date. Sections 75 through 75.40 cover all supplemental assessment provisions.

NEW CONSTRUCTION

Only completed new construction is supplementally assessed and only the value attributable to the new construction (less the value enrolled as construction in progress) is to be enrolled as a supplemental assessment. New construction in progress is assessed on the regular roll at its full value on lien date, until completed. In the case of a developing mineral property, construction is not completed until the mine enters the production phase, even though individual components of the property maybe ready for their intended use. The value is carried on the roll as construction work in progress until such time as the economic production of minerals begins and a base year value is established for the entire property. For supplemental assessment purposes, actual physical new construction includes the removal of a structure from land but does not include the discovery of hard mineral reserves. (Section 75.10.) Thus, there is no supplemental assessment with respect to the discovery of mineral reserves, since they are valued in accordance with the procedures set forth in Rule 469.

Commencement of production, as discussed in previous chapters, is the point at which the market value of the mineral rights is determined by valuing the proved reserves that can reasonably be expected to be produced. The factual question from an appraisal view is, “When does production start?” The question is not easily answered, because mineral properties go through a shakeout or testing near the production phase and may not really be commercially on line. They may constantly start up, take samples, make a limited number of sales, and shut down to reevaluate the total property, including economics, to determine whether to begin production. This activity should not be confused with intermittent production due to market demand. Activity based on demand for the product indicates the property has entered the production phase. The question is best answered by discussing the matter with the mine operator who is interested in beginning a flow of income as soon as possible.

Additions

Additions to the proved reserves are valued, under Rule 469(e)(1)(A), by determining the current market value of all of the proved reserves less the current market value of proved reserves existing prior to adding new proved reserves. The value of additional construction projects during the life of the operation is handled as new construction per the above discussion. The costs of construction are placed in the cash flow as well as the anticipated income from the construction.

Replacements

The substitution of an item which has become exhausted, worn out, or inadequate with one of fundamentally the same type or utility is a replacement. For property tax purposes, construction or reconstruction of an improvement or fixture performed for the purpose of normal maintenance and repair, (e.g. routine annual preparation of agricultural land, interior or exterior painting, roof covering replacement, the addition of aluminum siding to improvements, or the replacement of worn machine parts) constitutes replacement rather than “new construction.” (Rule 463(b)(4).) The effects of maintenance and repair may be reflected in the market value estimate of the property, but the property retains its original base year value without any addition for the costs of the maintenance and repair.

Replacements can be so extensive and extreme, however, as to make an improvement “like new.” Section 70(b) of the Revenue and Taxation Code provides that “new construction" includes: "Any rehabilitation, renovation, or modernization which converts an improvement or fixture **to the substantial equivalent of a new improvement or fixture** is a major rehabilitation of such improvement or fixture." (Emphasis added.) Also see Rule 463. If the fixture or improvement is reconstructed to the substantial equivalent of new, the item is to be appraised at fair market value as of the date of completion (see Rule 463(b)). The original base year value of the item is removed and a new base year value is enrolled. The difference in value between the newly reconstructed item and the current value on the roll is enrolled as a supplemental assessment.

Timely replacement of property damaged by misfortune or calamity does not fall under the definition of assessable new construction (Section 70(c) and Rule 463(f)). However, if the replacement property is not substantially equivalent to the property before the damage, a portion of the replacement will be taxable. See Rule 463(f).

Property tax relief for damage from a misfortune or calamity is only available if the county where the property is located has adopted a disaster relief ordinance. Since a timely replacement of a property damaged by misfortune or calamity is not new construction, it is not subject to supplemental assessment. Such a reconstructed improvement or fixture retains the base year and base year value of the original. However, if the property receives immediate relief in assessed value as a result of the calamity, the replacement is enrolled and taxed upon completion. Although technically there is no supplemental assessment in such a case, supplemental assessment procedures are used for enrolling and taxing the completed replacement. See Section 170, Revenue and Taxation Code.

Appraisal judgment, based on consideration of the relevant facts, must be exercised to determine whether the construction or rebuilding of an improvement or fixture is (1) taxable as new construction, (2) partially assessable as new construction, or (3) non reappraisable as restoration or replacement. It is obvious from the foregoing that it is not always clear whether construction or rebuilding of an improvement or fixture is new construction, is partially assessable as new construction, or is not new construction.

Removal of Property

Supplemental assessments can result in negative changes in value. This would be the case if property were "removed." A well that is capped—permanently abandoned—is considered to be removed, resulting in a negative supplemental assessment.

Section 75.10(b) provides in relevant part:

> "For purposes of this chapter, "actual physical new construction" includes the removal of a structure from land."

Property Tax Rule 463 requires that the new full cash value shall be computed as of the date of completion for only the newly constructed portion, and that the taxable value shall be determined by adding the full value of the new construction to the taxable value of the preexisting property, less an amount for the taxable value of property removed during construction.

Chapter 10 : MINERAL PROPERTIES APPRAISAL METHODS

FORECASTING PRODUCTION

Forecasts of production for mineral properties are generally constrained by two factors, capacity and market demand.

Capacity dictates the maximum amount that the operation can effectively produce. Increases in capacity usually require additional capital investment. Limitations to capacity can typically be traced to one point in the operation. Various pieces of equipment each have their own operating limits. By constructing a flow chart of the entire operation that shows the capacity of each piece in the process, the appraiser can determine the limiting factors of the operation and the likelihood that additional investment may be made to increase production in the event of increased market demand.

Market demand is an external factor limiting production from a property. Operators generally have little control over the market demand in a given area. Market demand is a function of the economy.

For aggregate properties, assuming that the rock is of a useful type, in areas with high growth and large amounts of new construction, operators can sell all that they produce. In areas of slow growth or well supplied markets, it may be more difficult for a particular property sell all of its production. The extent of a property's marketable area is also greatly influenced by transportation costs. As the distance to the point of sale increases, so do transportation costs. The widespread availability of common aggregates limits the effective range that an operator can transport the product and make a profit before some other entrepreneur will enter the market.

For other types of mineral properties the market demand may be regional, i.e., gypsum for wallboard, or global, i.e., gold and silver. In the case of some mineral for which there is a broad market, no one property will have a significant influence on pricing. However, prices of minerals for which there is little demand are easily influenced by new discoveries, improved recovery methods, or the development of cheaper substitute products.

CASH FLOW ANALYSIS

The following section covers most of the required information for a discounted cash flow analysis and the methods used to arrive at a value conclusion.

Components of a Cash Flow

Developing a cash flow model for a property analysis is easier when it is broken into component parts. For any income stream there will be revenues, expenses, and a value determination.

Revenues

It is important when valuing a mineral property using the income method that all potential revenue sources be identified. Additional revenue streams may exist on properties with cogeneration facilities, e.g., electricity and steam sales. Once the production forecast has been established, it is simply a matter of multiplying the forecast by the product price forecast and summing the revenue streams to arrive at total revenue.

Revenues from a quarry will depend on the variety of material being sold. It is common for an aggregate operation to sell several products, typically graded by size. Each product has specific uses and, depending upon the market, will command different price structures. The appraiser needs to verify all sources of potential income generation.

Property operators are required to file annual production reports with the assessor's office. Information contained in these reports covers the amount of mineral produced and sold (identifying the income sources) and the various operating costs associated with producing a property. This information provides a solid beginning for the appraisal of the property. However, additional information may be required.

Product Prices

Attempting to forecast prices into the future is a formidable task. Sources of information for mineral commodity prices were discussed in Chapter 2. The price of commodities, such as gold and silver, are related to supply and demand. Typically, if supply goes up and demand remains the same, prices drop until they reach an equilibrium level. The same occurs as supply goes down. Prices will increase until the demand levels off.

As previously discussed, the size of the market for a particular mineral needs to be identified in order to determine the supply and demand characteristics. As long as a sufficient surplus in production exists, producers will not have any control over the price they receive.

Aggregate prices are generally based on size and quality of the material. To determine the revenue for a property, multiply the annual production by the sale price for each product. Various publications will make annual forecasts of demand that will prove useful to an appraiser.

Revenue Summary

Total annual property revenue is determined by multiplying the component of the production stream times the product price for each product and adding the product revenues together. Production rates for components of the production stream may be scheduled or may be based on ratios. For example an aggregate property may produce 1000 pounds of gravel, 500 pounds of sand, and 500 pounds of waste material for every ton mined. The ratios for this property would be 50 percent gravel, 25 percent sand, and 25 percent waste. The property operator can supply these ratios, or they can be determined from the annual production report.

In some cases more material than can be used in the immediate future is produced. This may be due to the need for other quantities of material which are produced or the operational requirements of the property. Stockpiled product is not taxable on an ad valorem basis. The mineral has already been severed from the land. Because of this, production, instead of sales, should be used for determining the revenue from a mineral property. This prevents portions of the mineral rights from being exempted from property taxes based on the operation of the property.

EXPENSES

All expenses that are related to and necessary for the operation of the property should be included in the cash flow analysis. There are five general classifications of expenses that concern the mineral property appraiser. They are capital expenses, operating expenses, periodically reoccurring expenses, overhead expenses, and other non-reoccurring expenses. Expense data is reported by the operators in their annual property statements filed with county assessors. Expenses associated with other revenue sources from the property should be included.

Capital expenditures are future investments in equipment and improvements that will generate income for more than one period. Examples of capital investment expenses are funds spent to purchase conveyors, screen shakers, pumps, hoists, and crushers. Expenditures from previous years are sunk costs that are not considered in a current cash flow analysis. Sunk costs may have some relevance when valuing equipment using the sales comparison or cost approach.

Expenses that will only benefit one period, the one in which they are paid, are called operating expenses. Examples of operating expenses are direct labor for lease operations, maintenance expenses, water handling costs, and fuel.

Periodic reoccurring costs are those costs that will occur at regular intervals but not on an annual basis. An example of these types of costs are those associated with routine maintenance of larger equipment.

While all costs associated with the property should be included, they do not have to occur on the property. Overhead charges are included for certain expenses allocated from the division or corporate headquarters. Overhead includes salaries for management, engineering, and accounting that are necessary for the operation of the property. For the property tax appraiser, overhead costs are among the most difficult expenses to identify.

The appraiser needs to be certain that only those costs directly attributable to the property are included. Also, certain costs, while legitimately attributable to the property, cannot be considered for property tax valuations. These include property taxes, amortization, depreciation, depletion charges, and rents and royalties for use of the property. (See Rule 8(c) and Assessor's Handbook Section 501A.)

Other non-reoccurring expenses include reclamation costs and environmental cleanup costs and will be discussed further below.

Fixed and Variable Operating Expenses

Operating costs can be classified as either variable or fixed as previously stated in Chapter 5.

Variable costs change with respect to the level of output. Generally, variable costs change in relationship to the activity level on the property (AH501A). Examples of variable costs are hourly labor costs. An analysis of variable costs should be made to determine the controlling variable.

Fixed costs are those expenses that do not change over short periods of time regardless of the changes in production. Such costs are typically fixed only for a certain range of production. When the production rate changes substantially, the fixed cost structure will also change. Fixed costs include salaries, rents, insurance, and leased equipment payments. These are costs typically paid even if there is no production.

Some costs will exhibit characteristics of both fixed and variable costs. For example, electrical expenses for properties typically have a fixed component for capacity availability and a variable component for actual electrical usage.

When trying to determine whether an expense is fixed or variable, the following questions should be asked: What would happen to this expense if production changed by one unit of production per day? What would happen to this expense if the property did not exist? If the expense would not change with a change in production, then it is likely to be a fixed expense.

Reclamation Expenses

Reclamation expenses can occur throughout the life of a property and at the end of the productive life of a mine. They are the costs associated with returning the land to a safe environmental condition. All mineral properties will have reclamation expenses.

Accounting For Reclamation Expenses

It should not be assumed that funds will be available for reclamation costs from other sources. Reclamation costs are specific to each property and should be paid for out of each property's cash flow. The allocation should be enough so that the full cost of reclamation is available when the property has reached its economic limit. The appraiser should not make the assumption that reclamation costs will occur after the economic limit has been reached.

Reclamation expenses may be accounted for by establishing a sinking fund account. The purpose of this account is to set aside funds each year. These funds grow to a predetermined amount by the time they are needed to pay for the cost of reclaiming the property.

Environmental Expenses

Related to reclamation expenses are other environmental clean up costs associated with a property. Only those environmental costs related to the mineral extraction operations of the property should be considered. These may include the costs to remove and replace contaminated soil and monitoring of the environmental hazards. The effect of environmental cleanup costs resulting from other operations on or near the property should be accounted for in the surface value of the land. Environmental costs should be treated the same as reclamation costs in the cash flow. The expenses may be estimated, adjusted for inflation, and a sinking fund allocation established. See also *Firestone Tire & Rubber Co. v. County of Monterey*, 223 Cal.App.3d 382 (1990).

Royalty Deductions

Property Tax Rules 4(b) and 8(d) state that all real property is to be appraised as though it were unencumbered by a lease, mortgage, or other private agreement. In *Atlantic Oil Co. v. County of Los Angeles*, 69 Cal.App.2d 585 (1968), the court held that the deduction of the present value of the right to future royalty payments was prohibited in the valuation of mineral leases under the income approach.

Some government royalties are an allowable deduction from the cash flow when determining property values. Section 107.2 requires that the value of mineral interests created prior to the decision in *DeLuz Homes, Inc. v. County of San Diego* (1955) 45 Cal.2d 546 shall exclude the value of any royalties or other rights to share production by tax exempt entities. Section 107.2 does not apply if the interest is extended or renewed, unless the renewal was provided for in the lease and the lease does not allow a reduction in the royalty or production share due to an increase in the assessed valuation.

Expense Summary

After all of the allowable expenses have been calculated, the annual net operating income can be determined. Assuming that the property is operated to provide income to the operator, the economic life of the property is the point where the net operating income becomes negative without any potential to return to positive.

VALUE ESTIMATION

The final step in the cash flow analysis is the estimate of value. This is where the net operating income of the property is resolved into an expression of value. Expenses are subtracted from sales to determine net income to the property. Net income to the property is multiplied by the appropriate discount factor to calculate the present worth of the cash flow. The sum of the discounted net cash flow is the value of the income stream. Other adjustments to arrive at the total property value may be necessary. Using computerized spreadsheets, it is relatively easy to calculate the net present value of an income stream for several discount rates.

Discount Rates

In a cash flow analysis, the discount rate represents the required return investors need to accept a project. This is the combined rate that providers of capital, either debt or equity, require for putting their funds at risk, and the risk associated with the property.

The sum of the discounted cash flows typically represents the maximum value investors would pay for the projected income, given the risks associated with the income. At this maximum price the rate of return will equal the discount rate if the property performs and the cash flows occur as projected. When negotiating a purchase price, buyers will most likely seek a price below the present worth of their cash flow projections. The actual return experienced on the property may be greater than or less than the discount rate used to determine the purchase price. For information on the derivation of discount rates according to Rule 8, see Appendix C – Derivation and Estimation of Discount Rates Used in Discounted Cash Flow Analysis.

Some discounting for mineral properties is done using ***midyear factoring***. The assumption is that the annual income will be received at the middle of the year. The formula for midyear discounting is the same formula for end of year discounting with one small adjustment.[4]

$$\text{Discount Factor} = \frac{1}{(1+i)^{n-0.5}}$$

Equation 10–1

where
i = discount rate
n = the number of years until payment received

Rule 8 requires that a before–tax discount rate be used. Taxes are excluded as a deductible item from the income stream because they are based on the income that is being capitalized. A component for property taxes must be added to the rate since these are also excluded as a deduction from the income stream.

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[4] There are several formulas for discounting income in a cash flow. Most spreadsheet programs use end of period discounting. Other methods are beginning of period and continuous. The type of discounting used is dictated by the practice of the industry and the actual timing of the cash flow.

Measures of Success

After the discount rate has been selected and the adjustments for risk made, the appraiser discounts the net operating income of the property to reach a value conclusion.

Several methods are used by management to evaluate the fair market value using income information. The most common is to accept a project that provides a positive net present value at a specific discount rate. Other non-discounting methods are sometimes used, such as ***payout time***, ***profit to investment ratio***, and average annual rate of return. The criteria for payout time is the acceptance of projects that will return the original investment within a specific period of time. The profit to investment ratio measures the magnitude of the total profit over the life of the project against the investment required. These methods do not offer a means of valuing the property, but provide a check of the assumptions made to see that they are reasonable and yield results in an acceptable range.

Example 10–1 Cash Flow Analysis of an Aggregates Property

	Revenue					Expenses and Capital Investment						
Year	Gravel Production	Gravel Price	Sand Production	Sand Price	Sales	Mining Costs	Processing Costs	Marketing & Allowable Overhead Costs	Working Capital	Additional Capital Investment	Reclamation Costs	Total Expenses
1	100000	$ 5.75	250,000	$ 2.75	1,262,500	200,000	125,000	25,250	29,188		50,000	429,438
2	100000	$ 6.00	250,000	$ 2.80	1,300,000	212,000	128,750	26,000	1,375		50,000	418,125
3	100000	$ 6.00	250,000	$ 2.87	1,317,500	224,720	132,613	26,350	1,411		50,000	435,094
4	90000	$ 6.05	225,000	$ 2.94	1,206,000	238,203	136,591	24,120	1,269	500,000	50,000	950,183
5	100000	$ 6.25	250,000	$ 3.00	1,375,000	252,495	140,689	27,500	1,814		50,000	472,498
6	100000	$ 6.25	250,000	$ 3.00	1,375,000	267,645	144,909	27,500	1,614		50,000	491,669
7	90000	$ 6.25	225,000	$ 2.95	1,226,250	283,704	149,257	24,525	1,453	500,000	50,000	1,008,938
8	100000	$ 6.25	250,000	$ 3.00	1,375,000	300,726	153,734	27,500	2,040		50,000	534,000
9	100000	$ 6.25	250,000	$ 2.95	1,362,500	318,770	158,346	27,250	1,867		50,000	556,233
10	100000	$ 6.25	250,000	$ 3.05	1,387,500	337,896	163,097	27,750	(42,030)		50,000	536,712
	980000		2,450,000		Escalation Rate		3%					

Value Determination

Year	Net Sales	Discounted Net Cash Flow
1	833,063	$705,985
2	881,875	$633,349
3	882,406	$537,060
4	255,817	$131,947
5	902,502	$394,492
6	883,331	$327,214
7	217,312	$68,220
8	841,000	$223,738
9	806,267	$181,778
10	850,788	$162,555
Present Worth		$3,366,338

Discounted Using End of Year Factors

Present Worth Table

Discount Rate	
10%	4,556,643
12%	4,199,759
14%	3,886,654
15%	3,744,392
16%	3,610,677
17%	3,484,857
18%	3,366,338
20%	3,149,078
22%	2,955,097
24%	2,781,213

TAXABLE VALUE

As previously noted, for each year after initial enrollment, the taxable value is the lesser of the property's current market value or its factored base year value.[5] Since mineral properties are analyzed each year to determine the proper taxable value, Rule 469 provides the framework for determining the factored base year value of proved reserves. Figure 10–1 and Figure 10–2 (following) detail the steps required by Rule 469 to arrive at a taxable value for a mineral property.

CURRENT MARKET VALUE

The value determined by the cash flow analysis or other acceptable appraisal methods is an estimate of the current market value of the assessable property. This is the estimate of what 100 percent of the property would sell for in the open market on the lien date, meeting every condition of an arms length transaction. All of the risks associated with the property and a satisfactory return to the purchaser should be reflected in the current market value.

To determine the value of the mineral rights, the estimated value of the active improvements (facilities and equipment) is offset from the total cash flow value. Changes to reserves are quantified based on forecast economics. The value of idle equipment is added to the cash flow value to arrive at the total fair market value.

FACTORED BASE YEAR VALUE

Proposition 13 affects mineral properties similar to the way it affects most real estate in that once a base year value has been established, that value remains in effect unless certain events occur, such as a change in ownership or new construction. However, as previously discussed in regard to Rule 469, there are several factors unique to mineral properties which require consideration in making the annual calculations for adjusted base year values.

First, since mineral properties are a wasting asset, some of the reserves that were part of the initial base year value are removed from the ground each year and are no longer part of the mineral estate. The base year value of those reserves must be removed from the total.

Secondly, the quantity of reserves may increase or decrease from year to year depending on both economic conditions and on physical operating conditions. Reserves may increase as a result of increased product prices, reduced operating expenses, results of exploration, or other conditions. These new reserves are taxable and acquire a base year

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[5] For purposes of this chapter, "factored base year value" includes the compounded base year value of real property as described by subdivision (a) of Section 51 of the Revenue and Taxation Code plus the fair market value of property that is not subject to base year value procedures, such as personal property and real property under construction.

value as of the first lien date they are considered proved. Decreases in reserves as a result of economic conditions or engineering information are treated the same way as decreases due to depletion; they are no longer considered proved and their base year values must be removed.

Figure 10–1and Figure 10–2 demonstrate the steps that must be taken to determine the taxable value of a mineral property, including a detailed explanation of procedures required to calculate the adjusted base year value of the reserves, as demonstrated under "Base Year Value Adjustments." Also, see Rule 469, subdivision (e)(1)(A)(i) through (e)(1)(A)(vi).

The following paragraphs constitute an explanation of the terminology in Figure 10–1 and Figure 10–2.

Current Market Value and Estimated Reserves with New Reserves. This is the current total value of the property and the estimated reserves taking into account reasonably projected economic and physical operating conditions.

Current Value of Taxable Reserves. The allocated value of the land and improvements are subtracted from the total property value to determine the **Current Value of Taxable Reserves**.

Volume of New Reserves. The current reserve estimate is compared to the prior year's reserves estimate and prior year's production to determine the volume of new reserves.

Current Market Value and Estimated Reserves without New Reserves. The property is appraised without the addition of the new reserves and the allocation of values made.

Prior Year's Adjusted Base Year Value of Reserves. This is the amount of the adjusted base year value of the reserves on the previous lien date, but not necessarily the prior year's roll value. If the fair market value on the previous lien date was lower than the adjusted base year value, the fair market value would have been enrolled as the taxable value.

Prior Year's Adjusted Base Year Value of Produced Reserves. This is the volume of reserves removed for all reasons (depletion, economic conditions, and engineering information) multiplied by the weighted average adjusted base year value of the reserves as of the previous lien date. This number is subtracted from the previous year's value to yield the **Prior Year's Adjusted Base Year Value of Reserves Remaining**.

Value of New Reserves. This represents the quantity of all new mineral reserves. Rule 469 recognizes that during a year, a mineral property could have both reserves removed because of depletion, and new reserves added due to economic conditions and/or changed physical operating conditions. However, there would not be both removals and additions due to the same cause (such as changing economic conditions). There could be removals during one year, due to economic conditions (or engineering information), followed by additions the following year. The **Current Market Value of Reserves Existing before Adding New Reserves** is subtracted from the **Current Market Value of Reserves** to arrive at the **Value of New Reserves**.

The **Prior Year's Adjusted Base Year Value of Remaining Reserves** is adjusted by the California Consumer Price Index, not exceeding a 2 percent increase, to arrive at the **Current Adjusted Base Year Value of Remaining Reserves.** The value of the new reserves is added to arrive at the total **Current Adjusted Base Year Value for Reserves**.

The other calculations shown in Figure 10–1 and Figure 10–2 follow either fair market value principles or adjusted base year value calculations for conventional properties. The enrolled value is the lesser of the current market value or the adjusted base year value.

Figure 10–1 Current Market Value and Mineral Rights Value

Market Value Appraisal with New Reserve Additions

(e)(1)(A)(i)	Current Market Value and Estimated Reserves with New Reserves			
	Current Market Value — Total Property			$ 3,366,338
	Current Reserve Estimate			###########
(e)(1)(A)(ii)	Current Value of Taxable Reserves			
	Current Market Value — Total Property			$ 3,366,338
	Less Current Market Value — Non–Mineral Assets			$ 2,500,000
	Current Value of Taxable Reserves			$ 866,338
(e)(1)(A)(iii)	Volume of New reserves			
	Current Reserve Estimate		###########	
	Less: Prior Year's Reserves Base	###########		
	- Prior Year's Production	300,000 cuft	###########	
	New Reserves		530,000 cuft	
	Total Fair Market Value			$ 3,366,338

Market Value Appraisal without New Reserves [1]

(e)(1)(A)(v)	Current Market Value and Estimated Reserves with out New Reserves	
	Current Market Value — Total Property	$ 2,800,000
	Current Reserve Estimate	########### [2]
(e)(1)(A)(v)	Current Value of Taxable Reserves with out New Reserves	
	Current Market Value — Total Property	$ 2,800,000
	Less Current Market Value — Non–Mineral Assets	$ 2,200,000 [3]
	Current Value of Taxable Reserves with out New Reserves	$ 600,000

Figures 10-1 and 10-2 are provided to show the Rule 469 method for determining adjustments to base year values for the components of a mining property. The example does not include all items that may need to be considered in an appraisal. Other items that may need to be addressed include deductions for licensed vehicles.

Footnotes

[1] The appraisal of the property without new reserves most likely will be based upon the prior year's market value appraisal.

[2] **Current Reserve Estimate** should equal **Prior Year's Reserves less Prior Year's Production.**

[3] The current market value of the **Non-Mineral Assets** may or may not be different than the value with new reserves.

Figure 10–2 Determination of Taxable Value

	Base Year Value Adjustments		
(e)(1)(A)(iv)	Prior Year's Adjusted Base Year Value of Remaining Reserves		
	Prior Year's Adjusted Base Year Value of Reserves		$ 1,000,000 [4]
	Prior Year's Value of Produced Reserves		$ 93,750
	Prior Year's Adjusted Base Year Value of Remaining Reserves		$ 906,250
(e)(1)(A)(v)	Value of New Reserves		
	Quantity of New Reserves	530,000 cuft	
	Current Market Value of Reserves		$ 866,338
	Current Market Value of Reserves Existing before Adding New Reserves		$ 600,000
	Value of New Reserves		$ 266,338
(e)(1)(A)(vi)	Current Full Cash Value Base for Reserves		
	Prior Year's Adjusted Base Year Value of Remaining Reserves		$ 906,250
	SBE Inflation Factor		1.02
	Current Base Year Value of Remaining Reserves		$ 924,375
	Current Base Year Value of New Reserves		$ 266,338
	Current Full Cash Value Base for Reserves		$ 1,190,713
(e)(1)(A)(i)	Value of Land & Improvements		
	Prior Year's Adjusted Value of Non–Mineral Assets		$ 2,300,000 [5]
	Less: Value of Removed Improvements		$ -
	Less: Value of Continuing New Construction		0
	Prior Year's Revised Value of Non–Mineral Assets		$ 2,300,000
	SBE Inflation Factor		1.02
			$ 2,346,000
	Add: Value of New Construction		300,000 [6]
	Add: Value of Continuing New Construction (From Previous Years)		0
	Current Base Year Value of Non–Mineral Assets		$ 2,646,000
	Total Adjusted Base Year Value		$ 3,836,713
(e)(1)(C)	**Value to Enter on Role**		$ 3,366,338 [7]

[4] Value entered from prior year's appraisal records.
[5] Value entered from prior year's appraisal records.
[6] Current value of CWIP.
[7] Comparison made between Current Market Value (Figure 10-1) and Adjusted Base Year Value (Figure 10-2) with lower value entered on roll.

APPENDICES

APPENDIX A – RULE 469. MINING PROPERTIES

Reference: Article XIII, Section 1, California Constitution;
Article XIII A, Section 2, California Constitution;
Sections 51, 110.1, Revenue and Taxation Code.

(a) The provisions of this rule apply to the valuation of the rights to explore, develop and produce minerals, other than oil, gas and geothermal resources, and the real property associated with these rights.

(b) GENERAL.

(1) Rights to enter in or upon land for the purpose of exploration, development or production of minerals are taxable real property interests to the extent they individually or collectively have ascertainable value.

(2) It is the right to explore, develop and produce that is being valued and not the physical quantity of resources present on the valuation date.

(3) The unique nature of mineral property interests requires the application of specialized appraisal techniques designed to satisfy the requirements of Article XIII, Section 1, and Article XIII A, Section 2, of the California Constitution. To this end, mineral property interests and other real property associated therewith shall be valued pursuant to the principles and procedures set forth in this section.

(4) Notwithstanding any other provision in this section, any appropriate valuation method described in Section 3 of Title 18 of this code may be applied in the event of a transfer of an ownership interest in the right to explore, develop or produce a mineral property.

(c) DEFINITIONS. For the purposes of this section:

(1) “Minerals” means organic and inorganic earth material including rock but excluding oil, gas, and geothermal resources.

(2) “Proved reserves” means those minerals measured by volume or weight which geological and engineering information indicate with reasonable certainty to be recoverable in the future, taking into account reasonably projected physical and economic operating conditions. “Proved reserves” include all minerals which satisfy the conditions of the preceding sentence without regard to how the term is used in industry.

(3) “Exploration” means the searching for and determining the location, quantity, nature, shape, and quality of mineral deposits.

(4) “Development” means the preparation of minerals for production including the removal of waste rock or overburden, and the construction of improvements or improvements to land related to the production of minerals.

(5) “Production” means the removal or processing of minerals.

(d) VALUATION OF MINERAL PROPERTIES PRIOR TO PRODUCTION.

(1) Exploration. The right to explore for minerals is taxable to the extent it has value separate from the rights to develop and produce any discovered minerals. The right to explore shall be valued by any appropriate method or methods as prescribed in Section 3 of Title 18 of this code taking into consideration appropriate risks; however, in no event shall the right be considered to be under construction. While the construction of structures or the physical alterations to land, e.g., access roads, fencing, drainage or water systems, land clearing, etc., during exploration constitutes assessable new construction (subject to the provisions of Section 463 of Title 18 of this code), it does not add to or diminish the value of the right to explore. Costs associated with obtaining government approval related to new construction should be considered when valuing new construction. Costs of obtaining governmental approval to operate, taking ore samples, assaying for mineral content or testing processing methods, shall not be considered for purposes of valuing the right to explore. These latter elements of costs may appear in the value of the mineral rights when production starts. Once the base–year value of the right to explore is determined and enrolled, it shall not be changed except to reflect diminution in value from all causes as well as any increase in value resulting from the annual rate of inflation as prescribed by Section 460 of Title 18 of this code or to reflect a change in ownership, or as provided in subdivision (g) of this rule.

(2) Development. Although the right to develop and the right to produce minerals are separate rights, the value of the right to develop is virtually unascertainable separate from the right to produce. Therefore no separate value shall be established for the right to develop unless there is an intervening change in ownership at which time the right to develop may have an assessable value as reflected in the purchase price. Any value attributable thereto shall be deemed to be included in the base–year value of the mineral rights established in accordance with subsections (e) and (f) of this rule. In no event shall the right to develop or produce minerals be treated as being under construction.

Whether the construction of improvements or alteration to land during development qualify as new construction shall be determined by reference to Sections 463 and 463.5 of Title 18 of this code and Sections 70, 71, and 73 of the Revenue and Taxation Code.

(e) VALUATION OF MINERAL PROPERTIES DURING PRODUCTION. The base–year value of mineral rights associated with producing mineral properties shall be established as of March 1, 1975 or thereafter when such rights undergo a change in ownership or as of the date production commences. The market value of such mineral rights is determined by valuing the estimated quantity of proved reserves that can reasonably be expected to be produced during the time period these rights are exercisable. The valuation of the proved reserves shall be based on present and reasonably projected economic conditions (e.g., capitalization rates, product prices and operating expenses, etc.) normally considered by knowledgeable and informed people engaged in operating, buying, or selling of such properties or the marketing of the production therefrom. While the assessor has full discretion to select the appropriate appraisal method, the income approach will generally be the most relevant appraisal method employed in establishing a value for the total property.

Increases in proved reserves that occur following commencement of production and that are caused by changed physical, technological or economic conditions constitute additions to the mineral rights which have not been assessed and which shall be assessed on the regular roll as of the lien date following the date they become proved reserves. The increased quantity of proved reserves shall be used to establish the value of the addition to the property interest which value shall be added to the adjusted base–year value of the reserves remaining from prior years as the separate base–year value of the addition. Reductions in recoverable amounts of minerals caused by production or by changed physical, technological or economic conditions or a change in the expectation of future production capabilities constitute reductions in the measure of the mineral rights and shall correspondingly reduce value on the subsequent lien date.

(1) Value Calculation

(A) The base–year value or the adjusted base–year value of mineral rights as quantified by proved reserves for the current year's lien date shall be calculated as follows:

(i) Estimate the market value of the total property and estimate the physical quantity of proved reserves that may be reasonably expected to be produced during the time the right to produce is exercisable using current market data.

(ii) Estimate the current value of proved reserves by segregating the value of land (other than proved reserves), improvements to land constructed during the exploration, development and production stages (e.g., roads, ditches, trenches, excavations, pits, drifts, stopes, etc.), other improvements and personal property (including any resources severed from the land except for inventory already excluded from the market value of the unit) from the unit value by an allocation based on the current market value of the component parts.

(iii) Estimate the quantity of additions to proved reserves by subtracting the prior year's proved reserves, less depletion, from the estimated current proved reserves.

(iv) Estimate the value of the reserves removed (depletion) by multiplying the quantity of the reserves removed in the prior year by the weighted average value, for reserves only, per unit of minerals for all base years. The adjusted base–year value of the reserves remaining from prior years shall be found by subtracting the value of removed reserves from the prior year's adjusted base–year value.

(v) Value the added proved reserves by determining the current market value of all of the proved reserves less the current market value of proved reserves existing prior to adding new proved reserves.

(vi) The current adjusted base–year value for proved reserves only is the sum of the value of the prior year's proved reserves, less the depletion calculated in (iv) above, factored for inflation as prescribed by Section 460 of Title 18 of this code added to the value of the new reserves, as calculated in (v) above.

(B) The base–year value or adjusted base–year value of land (other than mineral right) and improvements for the current year's lien date shall be calculated as follows:

(i) Determine the adjusted base–year value of land, improvements to land constructed during the exploration, development and production stages (including roads, ditches, trenches, excavations, pits, drifts, stopes, etc.), and other improvements in accordance with Section 460.1 of Title 18 of this code and Sections 51 and 110.1 of the Revenue and Tax Code.

(ii) Add the current market value of any construction in progress on the lien date.

(C) Declines in the value of the mineral property shall be recognized when the market value of the appraisal unit, (i.e., land, improvements including fixtures and reserves), is less than the current adjusted base–year value of the same unit.

(f) VALUATION OF MINERAL PRODUCING PROPERTIES WITHOUT PROVED RESERVES. Where proved reserves cannot be estimated or are not usually estimated, the value of the mineral property shall be estimated in accordance with the provisions of Section 3 of Title 18 of this code.

(g) TAXABLE VALUE OF THE RIGHT TO PRODUCE MINERALS. The value of the right to produce minerals shall be established as of the date that the production of minerals commences and the value shall be placed on the roll as provided by law. When the value of the right to produce minerals is enrolled, the roll value of the exploration or development rights for the same reserves shall be reduced to zero.

History: Adopted June 29, 1978, effective July 3, 1978
Amended September 26, 1978, effective October 2, 1978
Amended June 1, 1990, effective August 26, 1990

APPENDIX B – TYPICAL UNIT WEIGHTS

Crushed Rock
(Typical Unit Weights)

Size (in inches)	Material	Pounds per Cubic Yard
1½ x ¾	Crushed	2633
1½ x 1½	Crushed	2484
1 x ½	Crushed	2522
¾ x ½	Crushed	2506
¾ x ¼	Crushed	2500
½ x ¼	Crushed	2360
2½ x 1½	Crushed	2614
4 x 2		2489
1½	Asphaltic Base Class 2	3051
¾	Asphaltic Base Class 2	2981
1½	Road Rock	3029
¾	Road Rock	2781
2½	Sub-base	3024
Bank Run		2754
4 x 12	Riprap	2800
6 x 18	Riprap	2700

Sand and Gravel
(Volume/Weight Equivalents)

1 Cubic Foot	0.06	Tons
1 Cubic Yard	1.60	Tons
1 Acre Foot	2500	Tons

APPENDIX C: DERIVATION AND ESTIMATION OF DISCOUNT RATES USED IN DISCOUNTED CASH FLOW ANALYSIS

DISCLAIMER: This appendix represents an introduction to the topic of determining discount rates with the Capital Asset Pricing Model. This appendix does not discuss all of the complexities of the model and the precautions that should be taken regarding its application.

Introduction

This appendix includes a very brief overview of discounted cash flow (DCF) analysis and discusses methods for deriving or estimating the discount rate to be used in the DCF format in the context of property tax valuation and assessment. Three methods of discount rate estimation are discussed: (1) rate derivation from market sales data; (2) surveys of market participants; and (3) use of the band of investment or weighted average cost of capital (WACC).

Present Value and Discounted Cash Flow Analysis

The Concept of Present Value

The concept of present value is one of the most important ideas in valuation. Because investors prefer immediate cash returns over future cash flows, they “discount” future flows, or reduce their value, when analyzing investments. Because of the pure time value of money, this is true even if no risk is involved. A rational investor would not pay $1,000 today for the certain right to receive $1,000 one year hence, because he or she could earn interest on $1,000 in hand, and the total value would accumulate (at the risk free rate of interest) to an amount greater than $1,000 at the end of one year. Thus, to the rational investor, a certain payment of $1,000 a year from today is worth something less than $1,000 today, with the amount of the discount being determined by the risk free rate of interest.

Theoretically, the risk free rate consists of a component for the cost of borrowing money plus a component for anticipated future inflation. It is virtually impossible to identify those components separately, but fortunately there is no need to do so, since the risk free rate can be established and is the least controversial component in discounted cash flow analysis.

Most investments also involve risk; the returns are variable, not certain. In addition to the pure time value of money (the risk free rate, which includes an inflation component), the discount rate for risky investments includes a premium for risk.

Discounted Cash Flow Analysis

Most investments produce a series of payments over future time periods; a typical pattern is periodic payments (monthly, quarterly, annually) and perhaps a reversionary payment at the end of the investment horizon or holding period. Discounted cash flow (DCF) analysis is a method by which investors explicitly value future cash flows—typically annual cash flows—over an anticipated holding period. In the DCF analysis, anticipated annual cash flows are discounted—typically with the aid of financial tables (for example, Assessors' Handbook Section 505) or computer software—to their present values. The present values are then summed to obtain an estimate of the market value of the property.

Risk is incorporated into DCF analysis through the discount rate, which includes components for the pure time value of money, inflation, and risk. The discount rate reflects the opportunity cost of the funds used in the investment, the return that could have been earned by investing the funds in an alternative investment opportunity of comparable risk. Accurate estimates of anticipated cash flows and the prudent selection of the discount rate are critical to DCF analysis, which is depicted in equation form below:

$$PV = \frac{CF_1}{1+r} + \frac{CF_2}{(1+r)^2} + \frac{CF_3}{(1+r)^3} + \cdots + \frac{CF_T}{(1+r)^T} = \sum_{t=1}^{T} \frac{CF_t}{(1+r)^t} \qquad \textbf{C–1}$$

where

PV	=	the present value, or estimated market value
CF_t	=	the cash flow at time t
r	=	the discount rate, reflecting the time value of money, inflation, and risk

In a real estate appraisal context, discounted cash flow analysis is a form of yield capitalization and has been defined as:

> "The procedure in which a discount rate is applied to a set of projected income streams and a reversion. The analyst specifies the quantity, variability, timing, and duration of the income streams as well as the quantity and timing of the reversion and discounts each to its present value at a specified yield rate. DCF analysis can be applied with any yield capitalization technique and may be performed on either a lease-by-lease or aggregate basis."
> (Appraisal Institute, 1993, p. 102)

Although Property Tax Rule 8 does not specifically mention the DCF method of valuation, it is entirely consistent with it. Subdivision (b), states, in relevant part:

> "Using the income approach, an appraiser values an income property by computing the present worth of a future income stream. This present worth depends upon the size, shape, and duration of the estimated stream and upon the capitalization rate at which future income is discounted to its present worth. Ideally, the income steam is divided into annual segments and the present worth of the total income stream is the algebraic sum (negative items subtracted from positive items) of the present worths of the several segments."

Terminology

The following concepts are used in this appendix and it is important to define them at the outset. Rates of return, in particular, have many pseudonyms.

Capitalization rate. “Any rate used to convert income into value.” (Appraisal Institute, 1993, p. 48)

Yield rate. “A rate of return on capital, usually expressed as compound annual percentage rate. A yield rate considers all expected property benefits, including the proceeds from sale at the termination of the investment. Yield rates include the interest rate, discount rate, internal rate of return (IRR), overall yield rate (Y_O), and equity yield rate (Y_E).)” (Appraisal Institute, 1993, p. 398) A yield rate can apply to the total property—that is both debt and equity—or to only the equity portion.

Discount rate. “A yield rate used to convert future payments or receipts into present value.” (Appraisal Institute, 1993, p.102)

Internal rate of return (IRR). The discount or yield rate which equates the present value of anticipated cash inflows to the present value of cash outflows or costs. It is the rate at which the present value of an investment’s cash inflows equals the cost or price of the investment. The yield to maturity of a bond is an example of an internal rate of return; it is the rate which equates the present value of the future payments on the bond to the current price on the bond.

Cost of capital. The expected return that is foregone by the firm when investing in a project rather than in comparable financial securities in the capital markets. (Brealey and Myers, Fourth Edition, pg. G8). From the firm’s perspective, it is the discount rate used to reduce anticipated cash flows to an estimate of present value. From the investor’s perspective, it is the expected or required rate of return from a debt or equity investment in the firm. The cost of capital reflects a return on the total property; that is, both debt and equity. The band of investment or weighted average cost of capital technique explicitly weights the costs of debt and equity components to arrive an average cost of total capital for a project or investment.

Cost of equity capital. The required return on the company’s common stock in capital markets. It is also called the equityholder’s required rate of return, because it is what equityholders can expect to obtain in the capital markets. It is a cost from the firm’s perspective. (Ross and Westerfield, 1988, p. 830)

Cost of debt capital. The required return on the company’s long–term, permanent debt; the debt holder’s required rate of return. It is a cost from the firm’s perspective.

Required rate of return. The minimum expected rate of return on investment that an investor will accept in order to select an investment.

Expected rate of return. The average of possible returns from an investment weighted by their respective probabilities; the return expected by the investor.

Risk. Uncertainty about the outcome of future events. Uncertainty about the future profitability of investments or projects. In finance, risk is quantified using statistical measures of variation. (Brigham and Gapenski, 1988, p. 36)

Deriving Discount Rates from Sales Data

Introduction

The market derived method, the preferred method under Rule 8, is the most direct method of estimating a discount or yield rate, as it extracts it from an actual sales transaction. This method requires detailed information from the buyer. For large properties, particularly those involving investment fiduciaries (for example, pension funds, insurance companies), or purchases involving natural resource properties (for example, oil, gas, or mining), detailed pro-forma data reflecting buyer/investor expectations is often available. For smaller transactions, the information may be more difficult to obtain.

To extract a discount rate from a sale, the analyst must: (1) determine that the sales price indicates fair market value, obtain the cash equivalent sales price, and the size of the interest sold; (2) obtain the anticipated income and expenses (the anticipated cash flows) of the buyer; that is, the economic basis on which the buyer purchased the property; (3) convert the buyer's anticipated income and expense data into a format consistent with Property Tax Rule 8, if necessary; and (4) compute the internal rate of return (IRR) or discount rate based on the sales price and the anticipated net operating income or cash flow.

Sales Data

The sales from which discount rates are derived must meet the requirements of market value and cash equivalency as set forth in Property Tax Rule 2, "The Value Concept." A determination should be made of whether the fee interest or a partial interest was sold.

Anticipated Income and Expenses and Cash Flow Projections

The analyst must obtain detailed income and expense projections for the sale being analyzed. These projections must be the buyer's expectations in order for the derived discount rate to have validity. In many cases, especially for large properties, the buyer's economic evaluation or pro forma will be available. The level of income from which the discount rate is derived must be carefully defined. Although this appendix does not deal with the valuation phase, the importance of applying the derived rate to the correct level of income when valuing a property is crucial.

Property Tax Rule 8, subdivision (c) refers to the proper income to be capitalized and not the income from which a rate is to be derived. Nevertheless, the requirements of Rule 8(c) are informative and useful for purposes of deriving a capitalization rate. Rule 8(c) reads:

> "The amount to be capitalized is the net return which a reasonably well informed owner and reasonably well informed buyers may anticipate on the valuation date…. Net return, in this context, is the difference between gross return and gross outgo. Gross return means any money or money's worth which the property will yield over and above vacancy and collection losses, including ordinary income, return of capital, and the total proceeds from sales of all or part of the property. Gross outgo means any outlay of money or money's worth, including current expenses and capital expenditures (or annual allowances therefor) required to develop and maintain the estimated income. Gross outgo does not include amortization, depreciation, or depletion charges, debt retirement, interest on funds invested in the property, or rents and royalties payable by the assessee for use of the property. Property taxes, corporation net income taxes, and corporation franchise taxes measured by net income are also excluded from gross outgo."

When deriving a rate for assessment purposes, the income is identical to that described above, with the exception of the treatment of anticipated property taxes, which are deducted from income when deriving a discount rate but remain in the income stream when capitalizing an income stream into an estimate of value. The income from which the discount rate is derived is the anticipated net income before investment recapture (NIBR), also known as the anticipated net operating income (NOI). It is the anticipated net operating cash flow that remains after all anticipated cash operating expenses, including anticipated property taxes, are deducted from anticipated cash revenue. Financing costs, accounting depreciation charges, and federal and state income taxes are not deducted from the income steam. There may also be a reversionary cash flow at the end of the holding period, which is a cash flow from the sale of the property or asset, less disposition costs at the end of the investment horizon. The income data provided by the buyer may have to be "reconstructed" to the above format, and for specialized property types this framework may not coincide with industry convention. In general, to derive a discount rate, the income data supplied by the buyer should be converted to an annual anticipated net operating income on a cash flow basis, including anticipated property taxes as an expense, but excluding any financing expenses, accounting depreciation charges, and, of course, federal and state income taxes.

Treatment of Inflation in Cash Flows

Most forecasts of anticipated income and expenses in DCF analysis build inflation estimates into each element in the income or cash flow statement; the forecasts reflect the impact of anticipated inflation. In economic terms, the forecasts are made on a "nominal" basis. For example, if revenues are expected to increase 5 percent a year over the holding period, reflecting inflation and supply and demand factors, the income estimates for each year in the DCF analysis reflect these anticipated changes.

The discount rates derived from such forecasts are also nominal ones; they contain an inflation component. Although it is possible to estimate both income and hence the discount rate net of inflation—on a real not nominal basis—it is not common practice and requires additional calculations.

In the mining industry, future anticipated changes in revenues and expenses are commonly referred to as “escalation.” In principle, there is or should be no difference between inflation and escalation, since each term represents the market’s perception of future changes in revenues and expenses. However, the word inflation implies that revenues and expenses are likely to change in accordance with cost-of-living indices or similar indices. The word escalation implies that a forecast of changes in revenues and expenses for a specific industry can be made, and those changes may be very different from the more general indices.

For example, assume that the annual rate of inflation will be 3 percent per year for the foreseeable future. However, the oil industry believes that there will be an oversupply of oil for the next two years resulting in a 20 percent decrease in price, a return to the current price for the following three years, and a severe shortage of oil three to five years thereafter, resulting in a 30 percent increase over the current price. Given no other data, buyers (and sellers) would assume that prices for oil (and therefore revenues) will literally decrease for the next two years, will return to the current level for the following three-to-five years, and will increase sharply thereafter. Costs will increase by 3 percent annually.

It should be noted that an escalation rate for oil may be the same as the escalation rate for natural gas, but if that happens, it is only a coincidence. In addition, individual buyers often use different escalation rates, some lenders use different escalation rates than others, and industrywide escalation rates sometimes change dramatically over short periods of time. Understanding escalation is absolutely critical both for deriving capitalization rates and for estimating the future cash flows of a property being appraised.

Computation of the IRR or Discount Rate

The final step is to calculate or compute the discount rate for the sale (with aid of a financial calculator or spreadsheet software). The rate derived is the total property yield rate, or IRR, the rate at which the present value of the forecast NIBR or NOI equals the sale price. It is a return on the total property, both debt and equity. The market–derived discount rate reflects the return expectations of market participants and can be used to discount income streams of comparable risk when valuing comparable properties.

Checking the Validity of Discount Rates Using Market Surveys

While the use of market surveys is not discussed in the California statutes or the Property Tax Rules, published and unpublished surveys of market participants and analysts can be used as sources of discount rate information. This approach might be called, “Ask someone who knows or should know.” Many studies and surveys are published across many property markets, which provide data regarding expected discount rates. They often present a range of rates. Sources include real estate investment fiduciaries, trade organizations, academic studies, and various industry groups. The appraiser should discover the sources of survey data relevant to the type of property he or she is valuing. The Society of Petroleum Evaluation Engineers publishes an annual survey with discount rates relating to petroleum properties.

When using this type of data, both the discount rate and the level of income on which it is based must be clearly defined and understood by the analyst. It is common to see an internal rate of return or total property yield rate based upon the property's NOI, as described the preceding section.

Deriving Discount Rates Using the Band of Investment or Weighted Average Cost of Capital

Band of Investment or Weighted Average Cost of Capital Defined

The band of investment has been described as "A technique in which the capitalization rates attributable to components of a capital investment are weighted and combined to derive a weighted–average rate attributable to the total investment." (Appraisal Institute, 1993, p.27) In the band of investment technique, a weighted average is taken of the debt and equity components of capital in order to derive a capitalization rate which can be applied to the total property—both debt and equity.

Property Tax Rule 8 (g) (2) refers to the band of investment, stating that a capitalization rate—that is, any rate used to convert income into value—may be estimated:

> "By deriving a weighted average of the capitalization rates for debt and for equity capital appropriate to the California money markets (the band of investment method) and adding increments for expenses that are excluded from outgo because they are based on the value that is being sought or the income that is being capitalized. The appraiser shall weight the rates for debt and equity capital by the respective amounts of such capital he deems most likely to be employed by prospective purchasers."

The band of investment method is analogous to the WACC technique. In the appraisal literature, the band of investment technique is used to derive an overall capitalization rate to be used with the direct capitalization method of valuation. However, it may be used to derive a yield rate to be used with the yield capitalization method of valuation. The WACC approach also derives a yield or discount rate which can be used in the DCF analysis.

The WACC technique is typically used by publicly–traded corporations to estimate the average cost of capital for the firm's proposed projects or investments. The WACC is the discount rate which a firm uses to value the cash flows of proposed projects or investments of average risk to the firm. This method uses financial data from the capital markets to estimate a discount rate that can be used in DCF analysis.

The WACC can be thought of as what the firm expects to pay out to debtholders and equityholders for every dollar of capital that it receives from them, or, conversely, what equity and debt investors require from the firm in order to fund or invest in it. The cost of capital is the average cost of the various types of capital the firm uses to fund its assets, with the average weighted by the current market values of the existing permanent financing components—most often long–term debt, preferred stock, and common stock.

The WACC is an opportunity cost. When evaluating projects or proposed investments, a firm asks the question: “Does this project or investment provide a rate of return at least equal to what could be obtained in the capital markets?” The firm’s WACC is the minimum rate of return that the firm must earn on an investment of average risk, an investment with risk comparable to the firm’s existing line of business.

Estimating Capital Structure Weights

The cost of capital is a weighted average based on the proportions of total capital—the funds required for the investment—financed by the debt and equity components. The weights should be based on current market values, not book values. The market value of equity is typically quite different from the book or accounting value, and the same is generally true for debt. In addition, only the permanent components of the financing mix—those used to finance long–term projects or investments—are included in the calculation of the average cost of capital. Typically, these are limited to long–term debt and equity.

Estimating the Cost of Debt

The current cost of debt for the project is estimated by using the current yield-to-maturity of long–term debt for the prospective purchasers; the objective is to estimate the current rate at which the prospective purchasers could borrow. This information can be obtained from various financial publications.

CAPM Overview

The CAPM is a financial/economic model which is used to estimate an equity rate of return on a given security or portfolio of securities. The CAPM postulates an explicit relationship between the risk of a security (as measured by its “systematic” risk, discussed below) and its expected return. The model concentrates on the estimate of security returns. To estimate the cost of equity using the CAPM, the analyst first estimates the risk of the asset or project being valued using the beta measurement (also discussed below), then converts this risk to the required return or cost of equity using the model. The CAPM estimates an after–tax cost of equity. Since we are estimating a before–tax WACC, we must convert the estimated cost of equity from the CAPM to a before–tax basis.

Portfolio theory is a major component of modern financial theories in general and of the CAPM in particular. Portfolio theory holds that risk can be reduced by combining individual risky assets (real or financial assets) into portfolios rather than holding them individually. ("Don't put all your eggs in one basket.") The same level of expected return can be obtained at lower risk by diversifying; in order to obtain the highest expected return for a given level of risk, rational investors should hold portfolios of assets and not individual assets in isolation.

The history of capital market returns indicates that risk has been rewarded. Assets of greater risk have produced higher average returns. For example, over the period 1926 to 1994, the average annual return (compound) on U.S. common stocks (large company) was 10.2 percent with a standard deviation of returns of 20.3 percent; for long–term U. S. government bonds the average annual return (compound) was 4.8 percent with a standard deviation of 8.8 percent. Stocks were riskier, on average, but also produced higher average returns (Ibbotson Associates, 1995, p., 33).

The CAPM estimates risk and return in a portfolio context. The model separates the total risk of an individual asset into two components: systematic (market) risk and unsystematic (unique) risk. Systematic risk is the tendency for returns on all assets to move up or down with shifts in the general economy. It is the risk that stems from general macroeconomic forces affecting all investments. Returns on almost all assets are positively correlated with general market movements, although the degree of correlation differs.

Unsystematic risk, by contrast, is the risk that affects a single asset or a small number of assets. A costly labor dispute is an example of unsystematic risk. It affects one company, or perhaps an industry group, but not the entire economy. Building on portfolio theory, the CAPM postulates that in a diversified portfolio, unsystematic risk is eliminated; the effects of unique events affecting individual stocks tend to cancel each other out when assets are held in a portfolio.

The systematic risk in a portfolio cannot be eliminated by diversification. Thus, in a portfolio context, the relevant risk is systematic risk, and expected returns should reflect only the systematic risk and not the total or stand–alone risk of an individual asset. Since rational investors will hold portfolios of assets and not individual assets, the relevant risk of an individual asset should be the risk it contributes to a diversified portfolio, not the asset's individual or stand–alone risk.

The relevant risk is systematic risk. Furthermore, assets should be valued based upon their systematic risk and the asset's risk premium—the additional return for making a risky investment rather than a safe or risk free one. The pure–play approach assumes that the systematic risk for a particular line of business is constant for all firms that compete in that line of business. This means that the beta of the pure–play firm or an average beta of several pure–play firms can be used to estimate the systematic risk of the project under review.

The beta of a security or project is the measure of systematic risk of a security or project. Beta measures the sensitivity of returns to general market movements. A beta of 1.0 indicates a risk level as risky as the market as a whole; an investment with a beta of 1.0 is expected to provide returns to investors equal to those of the market as a whole. A beta of 2.0 indicates a risk level twice that of the market as a whole ; a security with a beta of 2.0 should, on average, rise twice as much as the general market during periods of rising stock prices, and it should fall approximately twice as much as the market in periods of declining stock prices. A beta of 0.5 indicates a risk level one-half that of the market as a whole; a stock with a beta 0.5 should rise one-half as much as the general market during rising prices and fall one-half as much during declining prices.

What is the meaning of the "market as a whole," or the "general market" in the CAPM context? The CAPM conceptualizes the general market or the market as a whole as the "market portfolio." The market portfolio is a theoretical portfolio of all possible investments, including securities, real estate, plant and equipment, and even investments in human capital. In theory, systematic risk should be measured against a market portfolio containing all possible investments, but such a portfolio does not exist. In practice, for the purpose of measurement, the market portfolio is proxied by a large, diversified stock index.

The CAPM specifies that the size of the expected risk premium is a linear function of the risk of the asset, as measured by its beta. The expected return on equity or cost of equity of a security or asset is the sum of the risk free rate of return and the product of beta, the relative risk measure, and the market risk premium or compensation for bearing risk. This is represented by the following equation:

$$r_i = r_f + b_i (r_m - r_f) \qquad \textbf{C– 2}$$

where,

r_i = the expected after–tax equity return on security *i*; the after–tax cost equity
r_f = the risk free rate
b_i = beta, the volatility of security *i* relative to the market as a whole
$(r_m - r_f)$ = the market premium, the expected return on the market portfolio above the risk fee rate

A Few of the Difficulties in Applying CAPM

The concept is based on an economic theory with little if any information on how to apply the concept to deriving an equity yield rate for specific real property. The problems include but are not limited to: estimating the risk of an asset using the beta measurement; converting the estimated cost of equity to a before–tax basis; the concept is based on the securities market; deriving an equity risk premium from securities data; and adjusting the derived equity rate to be property specific. In addition to the lack of information on how to apply the concept, the literature on the subject is controversial.

Conclusion and Summary

Market–Derived Discount Rates

As previously noted, discount rates properly derived from actual sales transactions provide the most direct and supportable market indication of expected discount rates for properties of comparable risk. The market–derived method, preferred under Rule 8, however, requires detailed data regarding the anticipated income and expenses—(cash flows)—of the buyer over the anticipated holding period, and the data must be consistently processed by analysts in order to preserve comparability.

Market Surveys

A well-prepared and targeted market survey can be an authoritative source of discount rate information. In a good survey, the return measure is precisely defined for survey participants and is the one commonly used by market participants in their market evaluations. The best survey data is often collected by and from institutional investors and fiduciaries. Since these investors are almost exclusively interested in higher–tier properties, the survey method is most applicable to large, investment–grade properties (office buildings, hotels, shopping centers). Good survey data may not be available for property below this tier. Industry groups concerned with specialized property types (resource properties such as oil, gas, railroads, etc.,) may also be good sources of data regarding expected returns for such specialized properties. A strength of the survey approach is that survey data is truly *expectational*: it asks analysts and market participants what rate of return they *expect*, and is precisely the type of information that property analysts and appraisers are seeking. A weakness of the method is that it is obviously one step removed from actual market transactions and hence less authoritative than the market–derived method.

Band of Investment or Weighted Average Cost of Capital

The band of investment technique is a weighted average of the debt and equity components of capital and is used to derive a capitalization rate. The technique is one of the methods discussed in Property Tax Rule 8.

The WACC technique to derive a capitalization rate is different in name only. Typically the Band of Investment technique is used to derive a direct capitalization rate whereas the WACC technique is used to derive a discount rate.

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GLOSSARY

Accounting	The practice of systematically recording, presenting, and interpreting the financial transactions relating to a specific person, property, or business
Ad Valorem	Latin phrase meaning in proportion to the value. In California, the property tax is considered to be an ad valorem tax.
Adit	A near horizontal opening of a cross section driven from the surface, which gives access to the ore body
Agate	A kind of silica consisting mainly of chalcedony in variegated bands or other patterns occupying cavities in volcanic or other rock
Aggregate	Uncrushed or crushed gravel, crushed stone or rock, or sand, which form the major part of concrete
Alluvial	Associated with deposits made from flowing water
Amortization	The process of retiring a debt or recovering a capital investment through scheduled, systematic repayment of principal; a program of periodic contributions to a sinking fund or debt retirement fund
Andesite	A dark colored, fine–grained, extrusive rock
Anhydrite	Calcium sulfate; a source of cement, sulfuric acid, and plaster
Anticipation, Principle of	The principle that value is created by the expectation of benefits to be derived in the future
Anticline	A fold or arch of rock strata dipping in opposite directions from an axis
Apatite	A phosphate mineral having a hardness of 5
Appraisal Unit	That property which persons in the market place normally buy and sell as a unit or which is normally valued separately

Arbitrage Pricing Theory (APT)	A model of the expected return on a security available for estimating the cost of capital or discount rate. It may be viewed as an extended CAPM with multiple betas and risk premia. Arbitrage theory is based on the simple notion that security prices adjust as investors form portfolios in search of arbitrage profits. Arbitrage simply means finding two things that are essentially the same and buying the cheaper and selling, or selling short, the more expensive.
Ash	Fine material extruded from volcanoes
Assignability	May state that the lessor can sell the property subject to the lease. Usually the lessee may not assign the lease without the lessor's permission.
Band of Investment	A technique in which cash flow rates attributable to components of a capital investment are weighted and combined to derive a weighted average rate attributable to the total investment
Basalt	A dark colored fine grained extrusive rock
Bedding Planes	In sedimentary or stratified rocks, the division planes that separate the individual layers
Beta Coefficient	Measure of a stock's relative volatility. The beta is the covariance of a stock in relation to the rest of the stock market. The Standard and Poor's 500 Stock Index has a beta coefficient of 1. Any stock with a higher beta is more volatile than the market, and any with a lower beta can be expected to rise and fall more slowly than the market. A conservative investor whose main concern is preservation of capital should focus on stocks with low betas, whereas one willing to take high risks in an effort to earn high rewards should look for high beta stocks.
Buffer Zone Land	A zone of land surrounding all or part of a property to protect both it and surrounding landowners from disturbances
Calcareous	Consisting of or containing calcium carbonate
Calcite	A calcium carbonate mineral; the essential constituent of limestone, chalk, marble; a minor constituent of many other rocks

Capital Asset Pricing Model (CAPM)	Sophisticated model of the relationship between *expected risk* and *expected return*. The model is grounded in the theory that investors demand higher returns for higher risks. It says that the return on an asset or a security is equal to the risk free return—such as the return on a short term treasury security—plus a risk premium.
Chalcedony	A mixture of cryptocrystalline (crystals so fine they cannot be seen under a microscope)and hydrated (containing combined water) silica often with radiating fibrous or spherical structure
Chemical Compounds	A substance that can be decomposed into two or more substances
Chert	Cryptocrystalline silica (see chalcedony); very hard and glassy
Clastic	Consisting of fragments of rocks that have been moved individually from their places of origin
Consolidated	Earth materials that are firm and coherent rock
Contact Metamorphism	Metamorphism occurring along the boundary of the intrusion of a magma into another rock
Corundum	An aluminum oxide mineral with a hardness of 9; gem varieties are ruby and sapphire, the granular impure variety is known as emery, and used as an abrasive
Crystal	Formed by the solidification of a chemical element or a compound which has a regularly repeating geometrical arrangement of its atoms and often external plane faces.
Debt Cost of Capital	It is the expected return on debt. It is best approximated by the yield-to-maturity on the applicable debt, since that yield is a market observable measure of the cost of debt capital
Debt/Equity Ratio	The ratio between an enterprise's loan capital and its equity capital, i.e., the ratio between the amount owed to lenders and the capital account of shareholders or partners
Definitions	This clause sets forth the terms used within the lease about which a disagreement could arise. It is basically for the purpose of clarifying terminology.

Depletion (Property tax)	Under Section 469 of the Revenue and Taxation Code, a process by which an adjustment is made to existing taxable value for the removal of mineral property
Depletion (Statutory)	Relates to a practice in the federal and state income tax laws where a percentage, depending upon the mineral, is applied against the gross annual income for the property as a tax forgiveness because of the wasting asset nature of mineral properties
Development	The preparation of mineral for production including the removal of waste rock or overburden and the construction of improvements or improvements to land related to the production of minerals
Diamond	The hardest known natural substance, composed of carbon
Diastrophism	The process of deformation that produces in the earth's crust its continents and ocean basins, plateaus, mountains, folds, and faults
Diorite	A plutonic, crystalline, dark colored rock
Dolomite	A carbonate of magnesium and calcium
Economic Limit	a point in time when the property is no longer profitable to the operator
Economic Obsolescence	An element of accrued depreciation; a defect, usually incurable, caused by influences outside the site, sometimes called external obsolescence
Effective Tax Rate	The effective tax rate relates tax expense to before–tax income. A reduction in the effective tax rate from a one-time source (such as an investment tax credit from a major plant expansion) causes overstated earnings from the point of view of the investment analyst
Element	In chemistry, a substance that cannot be decomposed
Equity Cost of Capital	The equity cost of capital is equal to the expected rate of return, or forecast mean return, for the firm's equity
Equity Yield Rate	An annualized rate of return on equity capital, as distinguished from the rate of return on debt capital or interest; the equity investor's internal rate of return

Escalation Clause	A clause in an agreement that provides for the adjustment of a price or rent based on some event or index
Evaporite	One of the salts that results from the evaporation of ocean water or of saline lakes
Exploration	The searching for and determining the location, quantity, nature, shape, and quality of mineral deposits
Explore	See Exploration
Extrusive	Pertaining to igneous material pouring out onto the surface of the earth in a molten state, and to fragmented material erupted from volcanic vents
Fault	A fracture or fracture zone in the earth along which there has been displacement of the two sides relative to one another parallel to the fracture
Fee interest	an estate of inheritance in real property
Fee simple interest or fee simple absolute	Ownership of all the property rights attendant thereto without limitation, complete ownership, the highest type of interest
Feldspar	One of a group of rock forming minerals with a hardness of 6
Fissure	An extensive crack, break, or fracture in the rocks
Flint	A cryptocrystalline variety of quartz (see chalcedony)
Folding	The bending of strata usually the result of compressional forces resulting in the formation of geologic structures known as anticlines and synclines
Foliated	Thin parallel layers
Forecasting	Predicting a future happening or condition based on past trends and the perceptions of market participants, tempered with analytical judgment concerning the continuation of these trends, and the realization of these perceptions in the future

Functional Obsolescence	Curable: an element of accrued depreciation, a curable defect caused by a defect in the structure, materials or design. Incurable: an element of accrued depreciation, a defect caused by a deficiency or a superadequacy in the structure, materials, or design, which is not financially feasible or practical to correct
Gabbro	A dark colored, intrusive igneous rock, crystalline
Geo	a combining form meaning earth or of the earth
Geostat	A software program used in the mining industry
Geostatistics	The theory of regionalized variables to include the spatial interrelationship of ore samples. May help to reduce mining risk
Granite	A crystalline, quartz bearing igneous rock, commonly containing darker minerals
Granting Clause	Gives the time period or duration of the agreement, and information about the renewal periods. It also gives language about the exclusive rights of the lessee.
Gypsum	A hydrated calcium sulfate with a hardness of about 2, used for tile, plasters, plate glass, pottery, metallurgy, and paints
Hardness	Measurement of resistance to scratching, according to whether the mineral specimen under test scratches or is scratched by other minerals in a series ranging from talc to diamond
Host Rock	The rock receiving an injection of magma
Identification	This opening clause names the owner (lessor) and the operator (lessee), their addresses, and a legal description of the property.
Igneous	A rock formed by solidification from a molten state
Indemnity	Assures that the lessee assumes the risk for the mining operation. Indemnifies the lessor for damages.
Industrial Minerals	Those rocks and minerals not produced as a source of metals or mineral fuels

Inflationary Price Fluctuations	Price fluctuations due strictly to the increase in the volume of money and credit relative to available goods, resulting in the rise of the general price level
Inorganic	Applied to all substances that do not contain carbon as a constituent and to a few others in which carbon is present in an unimportant sense
Insitu	Occurring where originally formed or deposited
Inspection	May allow the lessor to come onto the property to inspect the operation and to audit the records
Intrusive	The penetration of a molten material into or between other rocks
Kriging	A geostatistical mathematical procedure for assigning linear weights to ore grade samples such that the calculated estimation error for the block grade is minimized
Leaseable	Under the federal mining laws, a term applied to minerals that are subject to a lease from the federal government, under certain conditions
Life of property	Refers to the period during which the property can be economically produced in keeping with the available amount of proved reserves
Limestone	A sedimentary rock containing calcium carbonate
Lithology	The character of a rock described in terms of its structure, color, mineral composition, grain size, and arrangement of its component parts
Locatable	Under federal mining laws, a term applied to minerals that are subject to claim
Lode	A fissure in a host rock filled with mineral
Magma	A term for the molten fluids generated within the earth
Massive	A homogeneous structure; descriptive of the structure of some rocks
Metallic	Of or belonging to metals, containing metals

Metamorphism	Any process by which consolidated rocks are altered in composition chiefly by heat and pressure
Midyear Factoring	A present worth factor that discounts the annualized income stream from the midpoint of the year in which it is generated
Mineral	A substance occurring in nature with a characteristic chemical composition and usually possessing a definite crystalline structure, which is sometimes expressed in external geometrical forms or outlines
Molten	Reduced to the fluid state by heat; melted
Mucking	Material removal, after blasting the rock to pulverize it
Nonmetallic	Not metallic, as in luster or other physical properties
Open pit mine	A mine working or excavation open to the surface
Ore	Mineral that can be extracted from the earth at a profit
Ore grade	In metallic mining, the amount of metal per unit volume in a given sample
Organic	Being, containing, or relating to carbon compounds
Outcropping	That part of a rock formation that appears at the surface of the ground
Plate Tectonics	A small number of large, broad, thick blocks of continental or oceanic crust of the earth, each of which floats on a viscous underlayer and moves independently of the others
Plutonic	Igneous rocks formed at great depths
Possessory Interest	(a) Possession of, claim to, or right to possession of land or improvements, that is independent, durable, and exclusive of rights held by others in the property except when coupled with the ownership of the land or improvements in the same person. (b) Taxable improvements on tax–exempt land.

Possible Reserves	A class of reserves whose existence is a reasonable possibility, as based primarily upon the strength and continuity of geologic–mineralogic relationships and upon ore bodies already developed
Pozzolan	Siliceous ash, tuff, or other material used in cement because when mixed with lime it hardens underwater
Probable Reserves	A class of reserves whose occurrence is reasonably assured but not absolutely certain
Producer Price Index	Measure of change in wholesale prices (formerly called the *wholesale price index*), as released monthly by the U.S. Bureau of Labor Statistics. The index is broken down into components by commodity, industry sector, and stage of processing. The consumer equivalent of this index is the *Consumer Price Index*.
Production	The removal or processing of minerals
Proved Reserves (Industry)	Mineral reserves for which reliable quantity and quality estimates have been made (varies from company to company)
Proved reserves (Property Tax)	Those minerals measured by volume or weight which geologic and engineering information indicate with reasonable certainty to be recoverable in the future, taking into account reasonably projected physical and economic operating conditions
Pumice	A light colored frothy, glassy rock which may float on water and is economically useful as an abrasive or light weight aggregate
Pyrophillite	A natural hydrous aluminum silicate found in metamorphic rocks; used in ceramics as a substitute for talc
Quartz	A crystallized silicon dioxide; amethyst is a variety of quartz; a very common mineral with a hardness of 7
Quitclaim	A release of a claim, a deed of release, a legal instrument
Real Price Fluctuation	Fluctuations in prices of a commodity caused by factors other than inflation

Reclamation	Describes the lessee's responsibility for the restoration or reclamation of the property
Recovery Factor	The amount of metal, expressed as a percent, which is obtained from the treatment of the ore
Reservations	Sets out excluded portions of the property or some specific conditions about its operation.
Reserves	A nonspecific term generally referring to a quantity of mineral
Residual Technique	An appraisal technique where the value of the mineral rights is found by identifying and eliminating all other contributing values of the property
Resources	A mineral deposit or deposits that have no present economic value because there is no current need for it
Reversionary Interest	In the case of mining, the remaining interest in the property at the completion of mining
Rhyolite	A light colored extrusive igneous rock, usually glassy to very fine grained
Riprap	Heavy irregular rock chunks used chiefly for river and harbor work, shore protection, and docks
Royalty	Indicates the royalty rate, how often it will be paid, whether there is an annual minimum, the dates it is to be paid, and how the records are to be kept. Also describes exceptions to the payments of royalties due to conditions beyond the control of the lessee such as natural disasters, strikes, etc.
Salable	Under the federal mining laws, a term applied to minerals that are subject to sale only
Sandstone	A sedimentary rock composed predominantly of quartz grains
Sedimentary	A descriptive term for rock formed of sediment, or rocks formed by precipitation from solution
Shale	A laminated sediment in which the constituents are predominantly clay minerals

Siliceous	Of, relating to, or derived from silica (see quartz)
Soapstone	A rock consisting mainly of talc with varying amounts of other minerals
Strata	Sedimentary rock layers
Successors	This clause indicates whether the agreement is binding on the heirs, transferees, successors, or assignees of the parties.
Syncline	A trough–shaped curve of strata, opposite of anticline
Taxes and Title	The lease should identify who is responsible for the property taxes, and other taxes that apply to the mining activity, and to certify property ownership
Termination	Both the lessor and lessee require language allowing them to terminate the lease under certain conditions. Describes the conditions under which one of the parties may terminate the lease (failure to make royalty payments, change in the ore grade, etc.).
Topaz	A mineral used as a gemstone with a hardness of 8
Trap Rock	A name applied to aggregates composed of igneous rock
Trona	The most important of the natural sodas (carbonates of sodium)
Tuff	Compacted volcanic ash
Unconsolidated	A sediment whose particles are not cemented together
Vein	A zone or belt of mineralized rock lying within boundaries clearly separating it from neighboring rock
Volcanic	Characteristic of, pertaining to, situated in or upon, formed in, or derived from volcanoes
Water Table	The upper limit of groundwater, often fluctuates
Working Capital	The readily converted capital that a business uses to conduct operations free from financial embarrassment; in *accounting*, current assets minus current liabilities as of a certain date

Yield Rate A measure of investment return that is applied to a series of incomes to obtain the present value of each; examples are the interest rate, the discount rate, the internal rate of return, and the equity yield rate

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