



AG IN THE CLASSROOM—HELPING THE NEXT GENERATION UNDERSTAND ITS CONNECTION TO AGRICULTURE

What is Coal?

Coal is a black rock that's made primarily of carbon. It is different from most rocks because it is organic also called a fossil fuel. That means it was formed from the remains of trees, ferns and other plants that were alive and died during ancient times.

How was it formed? Large coal deposited formed as early as 350 million years ago to about 50 million years ago. Plants grew in swampy areas. As these plants lived

and died, they absorbed and stored energy from the sun. The dead plants created "peat" deposits (a spongy brown material made up of decomposing plants). These deposits built up over time and were buried by layers of sand and silt. After millions of years of pressure and heat under the earth's surface, coal formed from the compressed peat. The greater the heat and pressure, the harder the coal.

Coal is unique because it can be burned and used for fuel. Coal has been mined for over a thousand years, but only on a large-scale since the 1700s.

U. S. COAL TIMELINE

1000 A.D.	1673-1674	1701	1748	1800	1816	1839	1866	1875	1896	1961	1973-1974	1975-1980	1977	1990
Hopi Indians use coal to bake pottery made from clay.	Coal is discovered along the Illinois River.	Coal is found on the James River, near Richmond, Virginia.	First commercial U.S. coal production from mines near Richmond, Virginia.	Locomotives that use coal are manufactured.	Baltimore, Maryland, becomes first city to light streets with gas made from coal.	The steam shovel is invented and begins helping in process of surface mining.	Surface mining begins near Danville, Illinois. Horse-drawn plows and scrapers, wheelbarrows and carts were used.	Distilled coal replaces charcoal as main fuel for iron blast furnaces.	Steel beams are used instead of wooden beams for the first time at shaft mine openings.	Coal becomes the major fuel used by electric utilities to generate electricity.	Increased demand for U.S. coal because of the energy crisis.	National Coal reclamation laws passed.	Coal reclamation laws passed.	U.S. coal production tops one billion tons in a single year for the first time.

Types of Coal

There are four types of coal, classified by hardness. The harder the coal – the less moisture it contains and the more efficient it is as fuel.

Lignite contains a large amount of moisture, is brownish-black in color and crumbles easily. Lignite is primarily used at electricity generating plants.

Sub-bituminous coal contains less moisture than lignite and is mostly used to produce steam for electricity generation.

Bituminous coal is

medium-hard and has high heat value. It is used to generate electricity and to make coke which is used in the steel industry.

Anthracite is the hardest type of coal and has very high heat value making it a very good home heating fuel.

The more that carbon coal has, the more stored energy it has. Lignite has the least, anthracite has the most. Colorado's coal is mainly of the sub-bituminous and bituminous variety and is used for generating electricity.

Satellites are used for coal exploration.

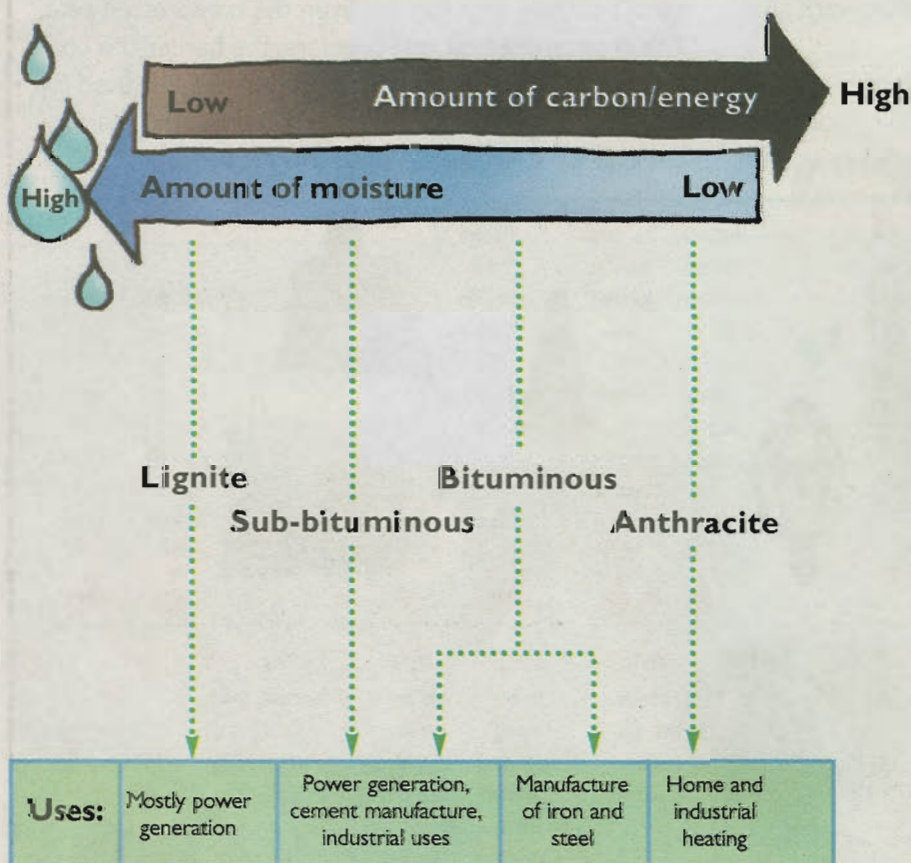


Coal Mining in Colorado

Coal mining in Colorado began soon after the first settlers and miners arrived in the Front Range. The area around Boulder and Weld counties once had more than 100 producing coal mines.

In the late 1800s, coal deposits were discovered in the hills and mountains near Trinidad in Las Animas County and Walsenburg in Huerfano County. By 1900, Colorado Fuel and Iron Company had a number of mines in operation. At this time most of the work was accomplished with a pick and shovel. A gradual decline in coal mining operations in Las Animas County began in the 1930s and continued into the 1950s and 1960s when only one mine was in operation. Now, most of the mines are abandoned. Remember abandoned mines are dangerous. Stay out and stay alive.

Today, coal is still produced in Colorado, primarily from open pit and underground mines in the western part of the state.

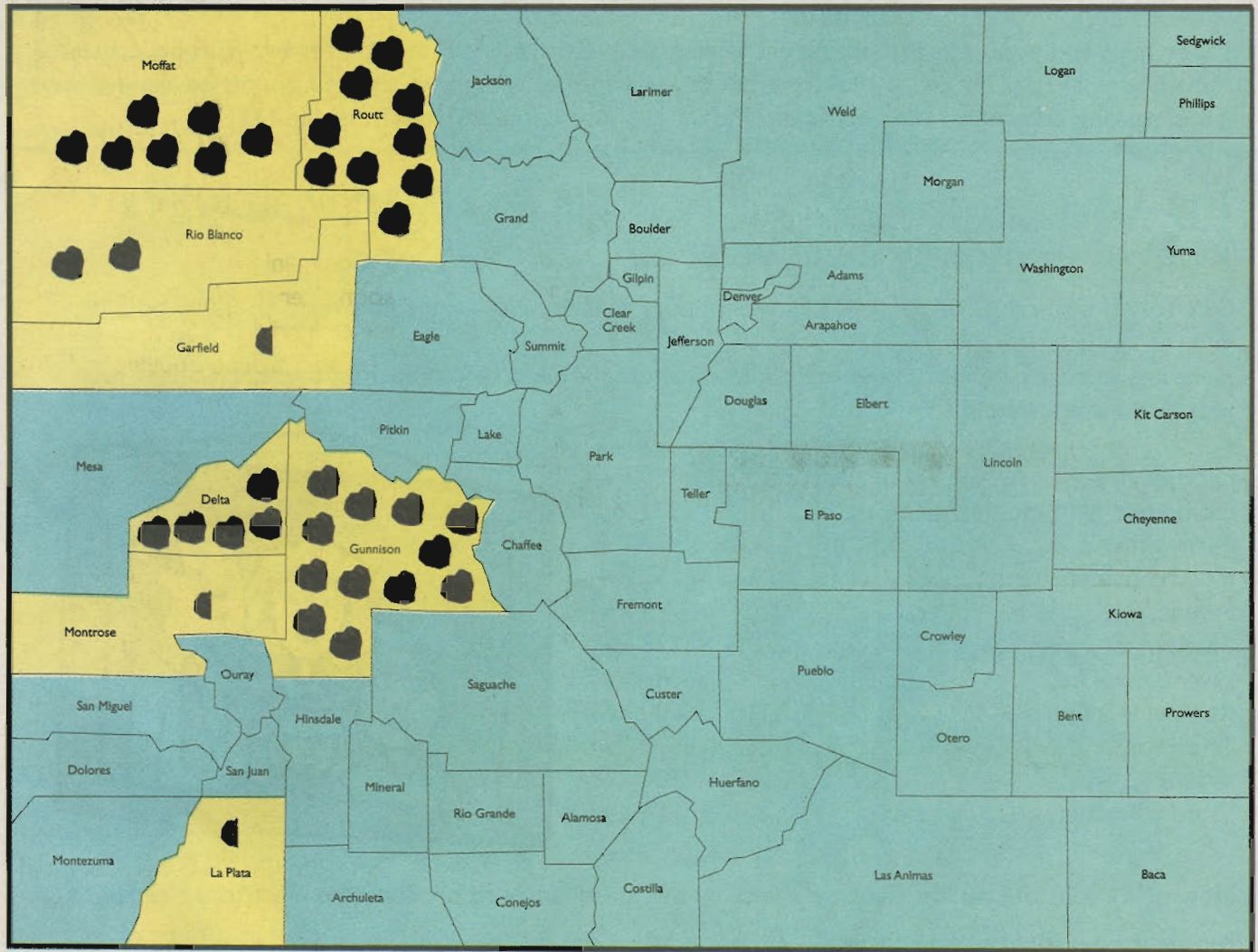


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Coal in Colorado

Coal is currently being mined in eight Colorado counties. In 2004, Colorado ranked seventh in the nation in coal production with 40.9 million tons produced. In that year, there were 12 producing mines in Colorado. Five of these mines are surface mines, and seven are underground. Colorado coals are among the highest quality, cleanest fuels found anywhere in the world. Most Colorado coals are clean enough to burn without washing or further preparation. Coal workers are the highest paid industrial workers in Colorado, earning \$80,659 in average pay and benefits per employee each year. Colorado coal mines are very efficient, producing the most coal per worker in the country.



COLORADO COAL PRODUCTION IN 2004 ● = approximately 1,000,000 tons ● = approximately 500,000 tons

Which Colorado county produced the most coal in 2004? _____

How many tons of coal were produced in that county during 2004? _____

Which three Colorado coal producing counties produced the least coal in 2004? _____

How many tons of coal were produced in each of those three counties during 2004? _____

Which area of the state produces coal? _____ northern _____ eastern _____ southern _____ western

Using Coal to generate electricity

How cool is coal? It's so cool—it's hot. It's one way we get electricity. More than 50% of the electricity used in the U.S. comes from coal burned at electric utility companies. In Colorado, we use even more – 82% of our electricity is generated by burning coal.

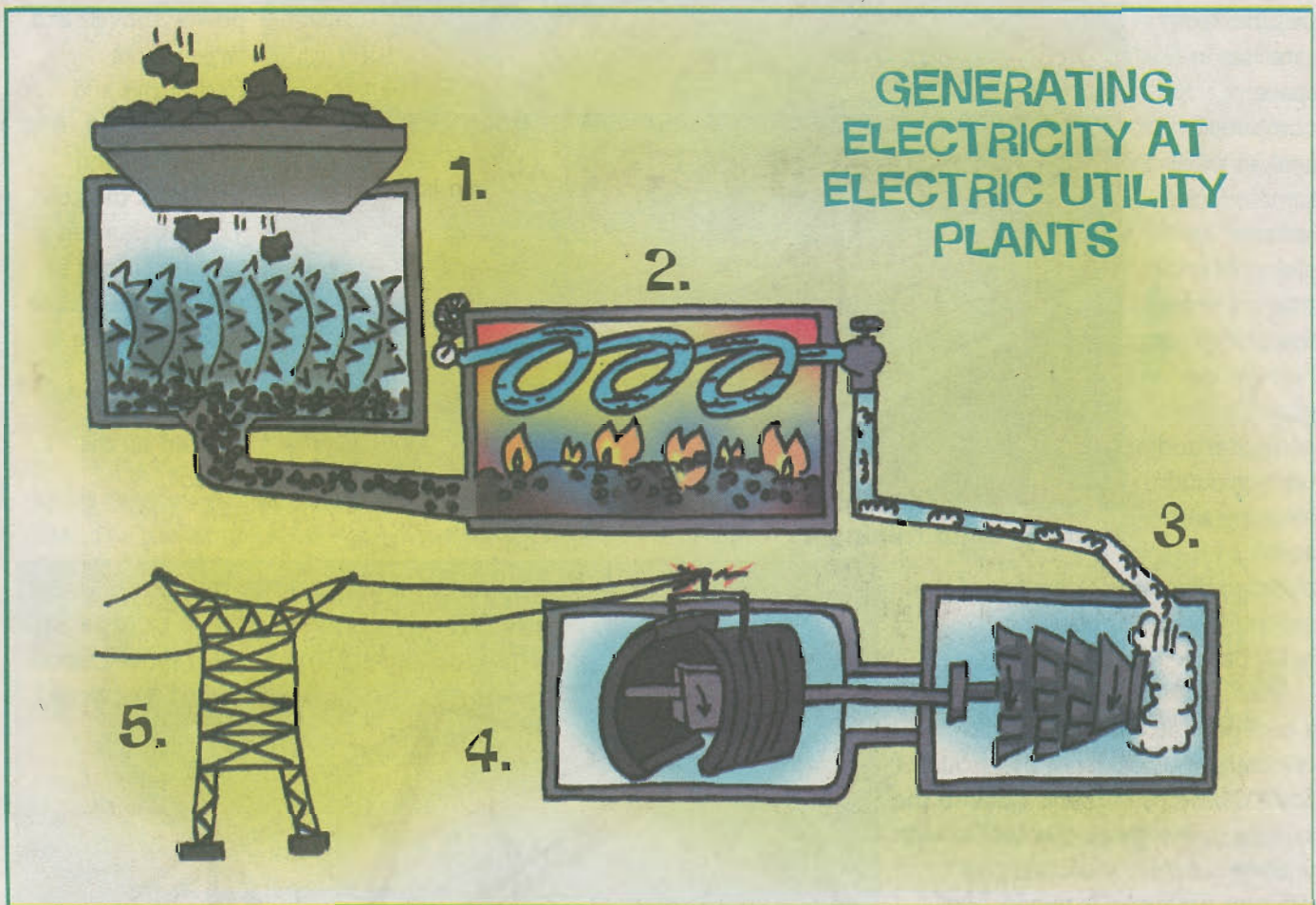
Why do we use coal to generate electricity? In the

United States, coal is fairly abundant. The U.S. produces 1/4 of the world's supply of coal. This is more than any other country in the world. If we used all the coal we have, at the same rate we're using it today, there will be enough coal to last 200-300 years!

The U.S. has about 250 billion tons of recoverable coal. This

amount of coal can provide more energy than all the world's oil reserves. Coal comprises more than 90% of all of our fossil fuels in the U.S. (Fossil fuels include petroleum, coal, and natural gas.)

Over the long term, coal usually costs less than oil, natural gas or nuclear power. It's also cheaper and easier to find than oil or natural gas.



The steps used in generating electricity from coal:

1. The coal is pulverized or crushed.
2. Coal is burned, which heats a boiler and water inside the boiler turns to steam, creating pressure.
3. The pressure from the steam turns a turbine. A turbine is an engine that spins around, causing the heat energy of the burning coal to become mechanical energy.
4. A generator creates electricity from the spinning turbine.
5. The electricity is transmitted to our homes, schools, businesses and factories over powerlines.
6. The steam is cooled and changes back to water, and the cycle begins all over again.

Getting Coal Out of the Ground

Before coal can be removed from the ground, a mining company needs to find it. This is called exploration. In addition to using traditional mapping and sampling, mining companies use many modern exploration technologies. Some of

these new technologies include: satellite imaging (taking pictures from satellites in space), computer analysis of core sample (core samples are pieces of rock that are drilled from deep test holes in the ground), computerized underground mapping and aerial

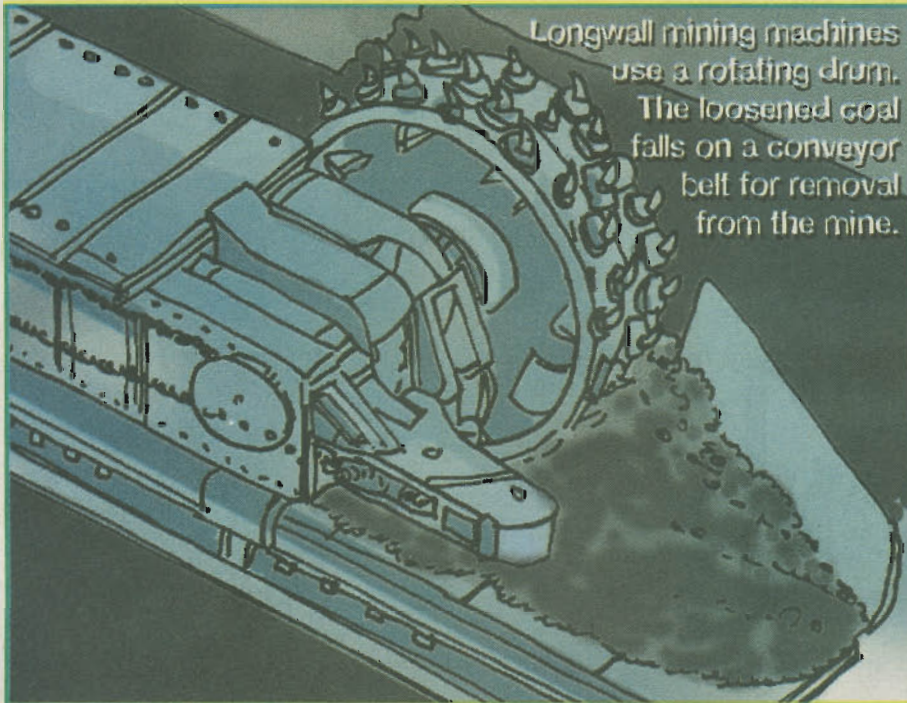
photography (taking pictures of the ground from an airplane or helicopter).

After a mining company discovers a coal deposit, the next step is removing the coal from the ground. Sometimes coal is found close to the surface. Other times the coal is deep underground. So there are two different ways coal is mined. Two-thirds of Colorado's coal production comes from underground mining.

Underground mining

Workers enter portals or a shaft that takes them down deep into the earth. The coal is removed by breaking or ripping it from a "seam" or wall of coal with "shearers." The

coal is removed with conveyor belts or shuttle cars. Robots, lasers and computers, special sensors, and plasma blasting are some of the newer technologies used to improve mining safety and protect the health of miners.



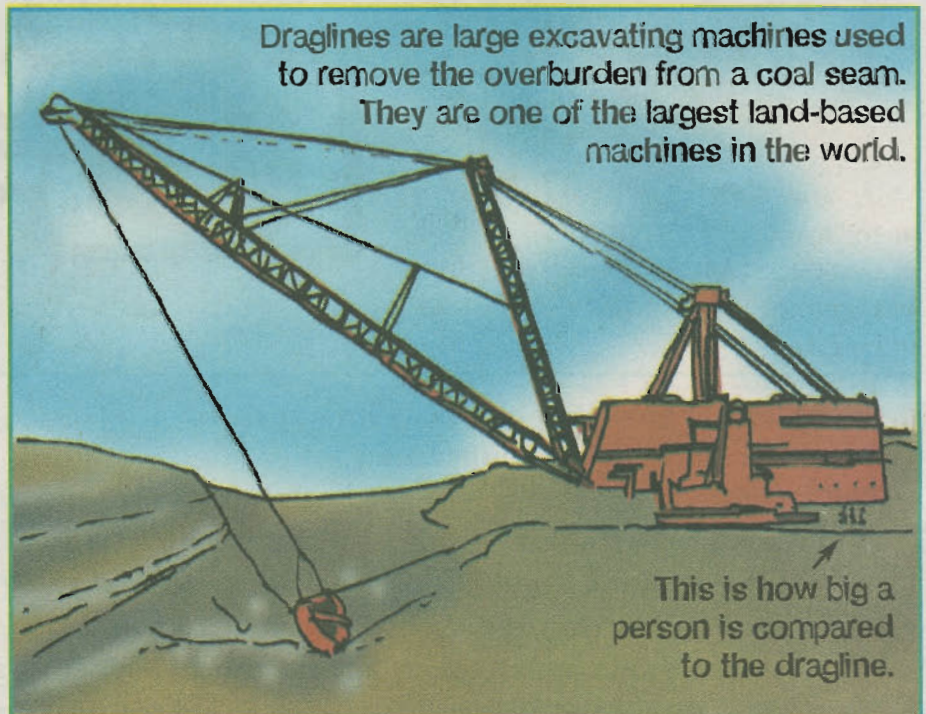
Longwall mining machines use a rotating drum. The loosened coal falls on a conveyor belt for removal from the mine.

Underground mining

Surface Mining

Surface or strip mining is safer and cheaper than underground mining. The dirt and rock that covers a coal deposit is called overburden. The fertile portion is called topsoil. It is removed with draglines that are

huge earth-moving machines. The coal is broken and removed with heavy equipment such as power shovels and large trucks. Excavators and conveyors are used to remove and transport the coal. The overburden is saved so it can be put back into place when the mine is reclaimed. Vegetation is planted on the topsoil.



Draglines are large excavating machines used to remove the overburden from a coal seam. They are one of the largest land-based machines in the world.

This is how big a person is compared to the dragline.

Surface Mining

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Biologists work closely with other scientists to make sure the environment will again support wildlife and plants. The mining site is also examined for artifacts from past cultures. If any are found, they are removed and preserved.

Next, the timeline for mining and reclamation is set. The mining company works with government agencies and local officials to make sure all regulations are being followed. The mining company may not wait until the mining operation is completed to begin reclaiming the land. With the information obtained from the plan, improvements can be made such as adding ponds for livestock or wildlife, improving drainage patterns or growing vegetation where little has grown before.

Mining Phase

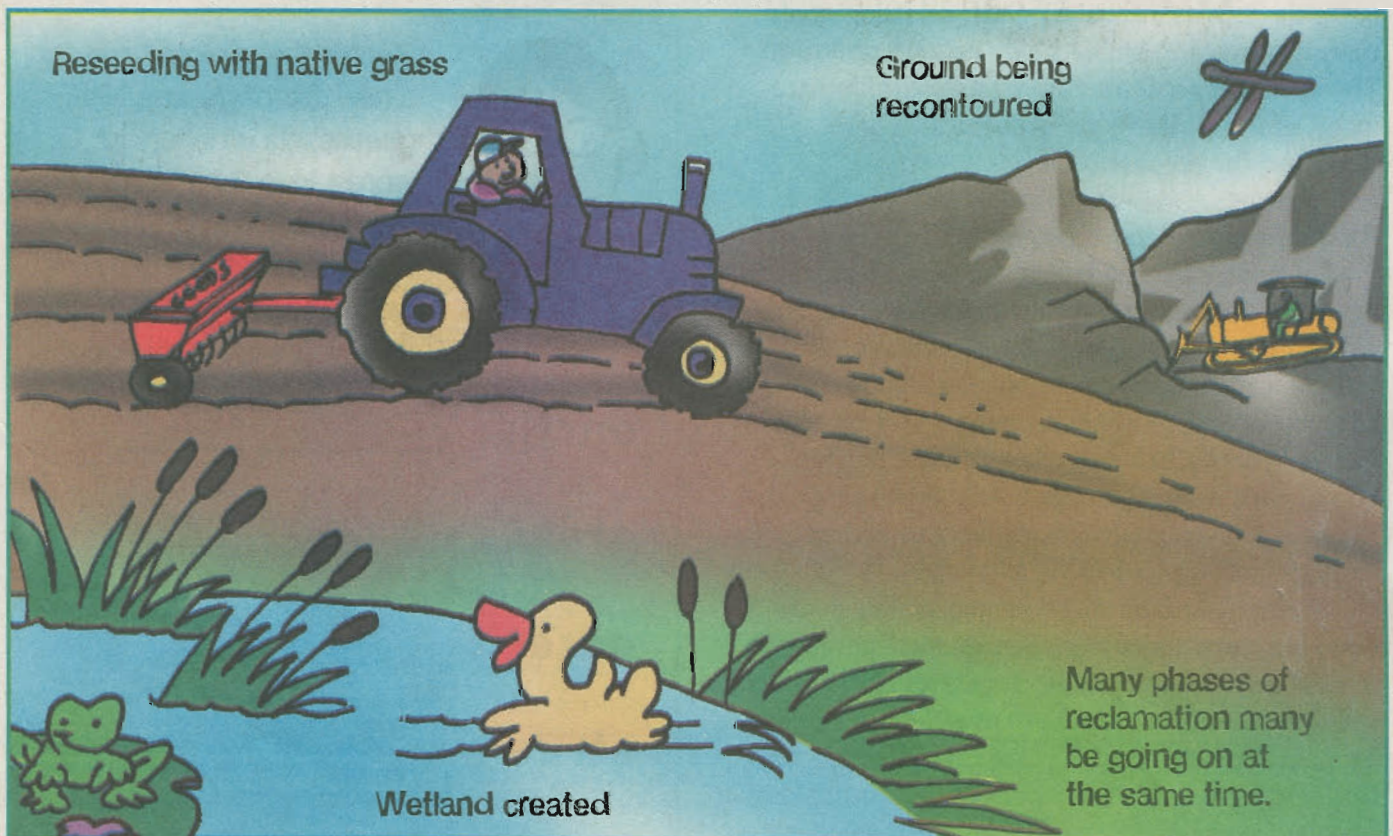
Now mining can begin. The topsoil, subsoil, earth and rock are removed and set aside, and the coal is mined. During the mining process, water is tested to ensure that it is not polluted. If water is found to be contaminated, it is treated before it leaves the mine area. Waste rock is separated so that it does not cause acid drainage. Special care is taken to ensure good water and air quality. Depending on the site and

the plan, as mining is completed in one area reclamation work may begin in that area, while mining moves on to another area.

Post-Mining Phase

Finally, when all the mining has ended, reclamation is completed. This can include: removing, relocating or tearing down buildings; closing pits and shafts; treating waste rock and waste water; stabilizing underground workings, soil and slopes; and removing roads. The area is refilled with the overburden, (earth and rock that were removed). Subsoil and topsoil are shaped to blend with the surrounding land. Then grasses, plants, shrubs and trees are seeded, planted and irrigated if needed. The area is restored to as close to its original condition as possible. This can take many years to complete. The land is returned to "beneficial use" and monitored to demonstrate success.

Not all mined lands can be returned to their original state. Some surface or deep pit mines cannot be recontoured to the site's original shape. Sometimes areas can be used for wetland development, green space, farming or ranching, recreation sites or as landfills. The goal is to create an area that is safe and usable for other purposes.



Many phases of reclamation may be going on at the same time.