

REFORESTATION AT THE CENTRALIA MINE:  
AN AWARD WINNING EFFORT<sup>1</sup>

by  
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Centralia Mining Company (CMC) is successfully meeting the challenges of reforesting disturbed mine lands as evidence by receiving OSM's 1990 Director's Award. Reforestation has been the predominant practice utilized to reclaim nearly 1,500 acres of the surface coal mine located in Centralia, Washington. Forestry land use has been successfully achieved through sound reclamation practices and developing a stable post-mining topography. Reclamation field activities are limited to a narrow period in the summer months when spoil moisture conditions are suitable for equipment traffic. Approximately 90-percent of the reclaimed mine land are reforested with Douglas-fir (*Pseudotsuga menziesii*) and Red alder (*Alnus rubra*) as the primary commercial tree species. Riparian and under story species are established along drainage channels and open space areas. These species are selected for their diversity, soil stabilization and promotion of wildlife habitat. After reforestation, special practices are required to control competitive grasses and infestation of rodents. Heavy grass cover competes with the trees for nutrients and moisture and provides an environment for large populations of voles. Voles feed on the bark at the base of the young trees which in most cases kills or damages the tree. Reforestation challenges at CMC are establishing sufficient ground cover to meet vegetation success standards and control competitors that preclude the survival of the young trees. Continual monitoring and sound working relationships with federal and state agencies and local universities is playing an important role in the success of CMC's reforestation program.

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Introduction

This paper describes the reforestation practices that were used by Centralia Mining Company (CMC) and which resulted in its receipt of the OSM 1990 Director's Award. CMC operates a surface coal mine located 7-miles east of

Centralia, Washington. The mine produces approximately 4.5 million tons of sub-bituminous coal annually and has been in operation since 1971. The mine is permitted to disturb approximately 14,500 acres (5,800 ha) and has currently disturbed 5,500 acres (2,200 ha) to-date due to mining activities. Approximately 1,500 acres (600 ha) have been reclaimed with 400 acres (160 ha) of those released from bond liability.

Centralia is located 50 miles (80.5 km) east of the Pacific Northwest coast. The area receives significant precipitation in the range of 30-56 inches (76.2-142.2cm) annually with 24-hour events ranging between a trace to 4.5 inches (11.4cm). Generally the wet season begins in October and continues intermittently through April. Temperatures range 0° F-95° F (-18° C-35° C).

The topography of the mine site is typical low elevation woodland. Approximately 90-percent of the mining disturbance is located on rounded hills that rise steeply from flat valley bottoms. Conifer and hardwood species dominate cover on the hills and the poorly drained valleys accommodate grasses and

various riparian species. Douglas-fir is the primary commercial tree species, while red alder is the most prevalent hardwood species. Hardwoods are found in pure stands and mixed throughout conifer stands. Disturbed mine lands will be returned to their original land use, tree farming on the uplands and pasture/riparian in the valley bottoms.

#### Reforestation Objectives

Forestry is the predominate land use in this region and provides significant income to the local economy. Reforestation also provides several beneficial environmental aspects. Wildlife depend on reforestation for protective cover and food source. Open space habitat and species diversity are incorporated on reclaimed areas to promote wildlife. Reforested slopes provide slope stability and erosion control in this high rainfall climate. The goal and objective of CMC's reforestation program is to reestablish this land use to equal or greater value. CMC continues to work with Regulatory authorities and colleagues in forest sciences to develop and monitor success of the forestry program.

## Reclamation and Soils Handling

Proper reclamation practices and spoil/topsoil handling play a very important role in successfully reestablishing forestry as a land use at CMC. Stable spoil slopes are constructed in 17-foot (5.16m) truck lifts to pre-mining elevation and graded to meet post-mining topography.

Four feet of suitable rooting medium is placed over the final graded slopes to ensure a productive site. When topsoil is available it will be placed over the suitable subsoil to comprise the 4-feet of rooting medium. Topsoil is hauled directly from the removal area and placed in a 6-18 inch (15.2-45.7cm) lift. Topsoil is a valuable resource at CMC and is always salvaged prior to mining disturbance. Cooperative studies on the mine site with Washington and Oregon State Universities have demonstrated that direct placement of the topsoil preserves the native seed and mycorrhiza to enhance volunteer ground cover. Stockpiling of topsoil will occur only when insufficient areas are available for placement. When sufficient topsoil is not available, 4-feet of suitable subsoil is distributed as top-dressing and amended with nutrients to support revegetation requirements. CMC

has developed two overburden suitability programs to ensure the quality of the rooting medium. The first program is a statistical suitability model which identifies suitable overburden in the advancing mine highwall. The second program is a Graded Spoil Sampling (GSS) Plan that verifies the spoil quality after handling and placement. All reclamation field operations are carried out during the drier months to minimize compaction and surface rutting, normally June through September. High moisture conditions prohibit any equipment traffic on reclaimed areas or topsoil handling during the remainder of the year.

The rooting medium is ripped on the contour with a D-9 Dozer to a depth of 3-feet (91.4cm) to promote infiltration and root penetration. Temporary terraces and permanent waterway structures are designed into the final topography to control and transfer surface runoff. Terraces are placed on the contour of the slope at a 1-percent gradient to intercept surface runoff and direct flow to waterways designed to carry the water down the slope. Drainage control is critical in providing for a stable slope and minimizing soil erosion in this high rainfall region.

## Reforestation Program

Reforestation is the final phase of reclamation and is the largest portion of CMC's post-mining land use. Reforestation experience at CMC has demonstrated that conditions of reclaimed slopes vary from non-disturbed sites in the region. However, plantings on reclaimed areas with topsoil have shown excellent survival and growth. Survival rates exceed 90-percent and growth of 4-year-old trees are averaging 6-feet 7-inches (2.0m) in height compared to 6-feet 11-inches (2.1m) for the same age trees growing on non-disturbed adjacent lands.

Conifer and hardwood species are planted with hand shovels at 400 and 435 trees per acre respectively. Typically Douglas-fir (Pseudotsuga menziesii) is planted on ridge tops and southerly and westerly slopes reclaimed with 6-18 inches (15.2-45.7cm) of topsoil. Red alder (Alnus rubra) is typically planted on northerly and easterly subsoil slopes without topsoil. As seen in its natural environment, Red alder is well suited for these slopes, along with its nitrogen fixing ability, it adapts well to subsoil sites. Willow (Salix) and cottonwood (Populus) are planted

along waterway channels for stabilization and to provide diverse habitat for wildlife. Small open spaces are left unplanted in pure stands of conifer and hardwoods to enhance species diversity and wildlife feeding areas. Wildlife enhancement is an important component the reforestation program and the goals of CMC.

## Challenges to Reforestation Success

One of the major challenges to reforesting reclaimed lands at CMC is controlling the rodent population which results from establishment of undesirable annual rye grass (Lolium multiflorum) after topsoil replacement. The Townsend Vole (Microtus townsendii) is the primary deterrent to the survival of young tree seedlings. The voles feed on the bark at the base of the young tree, which in most cases kills or at least severely damages the tree.

Infestation of the undesirable annual rye grass is found on reclaimed areas that have received several years of municipal sludge applications. The grass seed has invaded from adjoining properties. Sludge was used as a fertilizer amendment to topsoil, but

proved to be not necessary in the establishment of trees on topsoiled land. On selected suitable spoils, sludge or other amendments will continue to be used to enhance site productivity. Control of the grass and rodent populations are a major challenge in establishing a successful reforestation program at CMC.

Trees are most susceptible to rodent damage during the first 5-years after planting. In an attempt to protect seedlings, foil and netting have been placed around the base of young seedlings to prevent rodent damage during this period. In addition, selected herbicide prescriptions (Accord 1qt/ac and Attrazine 1gal/ac) are applied prior to tree planting to control the grass cover. Additional applications of herbicide (Oust 2oz/ac) are required after tree planting where grass problems persist. Where high rodent populations persist, a rodenticide (Field Mouse Plus 10lbs/ac) may be used to control the pests.

In addition to rodents and grass, high soil moisture conditions can also impact the survival of young tree seedlings. Unsuitable moisture conditions are prevalent where slope gradients are less than 5-percent. To minimize this excess moisture problem, CMC has built a

tool that creates a mound of soil upon which the tree seedling is planted. The tool is comprised of 2-shovel blades attached to a tool bar and placed on a 3-point hitch of a tractor. The tool bar is raised and lowered by hydraulic controls from the tractor at the desired spacing. The mound created by the tool is approximately 2-feet in diameter and provides 8-12-inches of relief on the surface. This allows the tree seedling to establish its roots in a suitable moisture regime during its initial growing years.

CMC monitors its reforestation lands annually to assure the requirements of OSM regulations are met and to identify any remedial work necessary. New practices are monitored very closely and assessed for their effectiveness. The goal of CMC is to achieve the revegetation requirements of bond release within the minimum period of 5-years, based on the high precipitation zone of the Pacific Northwest.

### Summary

Reclamation practices play an important role in achieving a stable and productive foundation

for all post-mining land uses. Reforestation practices have been developed to meet OSM success standards and the challenges of environmental conditions. A sound working relationship with local universities and Federal and State agencies has played an important role in the establishment and success of CMC's reforestation program. CMC has demonstrated an excellent reforestation program and a strong commitment to reestablish this land use by its receipt of OSM's 1990 Director's Award.

