

THE NEW WEST VIRGINIA MINE LAND REFORESTATION INITIATIVE

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Abstract. The West Virginia Department of Environmental Protection's Division of Mining and Reclamation has initiated a new effort to promote reforestation of mined lands in West Virginia. The goal of this initiative is to expedite the establishment of commercially valuable native timber stands. Forest productivity, species diversity, and natural invasion and succession will be emphasized. Traditional methods of reclamation have produced sites with decreased productivity compared with the pre-mining conditions. Compaction of the growth media, poor quality overburden materials used in the growth media, competition from ground covers, inferior species of trees planted, and poor tree planting techniques including timing, have all contributed to decreased productivity on many of our past reforestation efforts. The new reforestation technology encourages reforestation of mine sites through developing an optimal growth medium, loosely grading topsoil and topsoil substitutes, establishing less aggressive ground covers, planting commercially valuable crop trees, and using proper tree planting techniques. "The New West Virginia Mine Land Reforestation Initiative" includes regulatory changes, education, training and technology transfer.

Additional Key Words: forestland, commercial woodland, commercial forestry, growth medium, compaction, competition, experimental practices.

¹Paper was presented at the 2004 National Meeting of the American Society of Mining and Reclamation and The 25th West Virginia Surface Mine Drainage Task Force, April 18-24, 2004. Published by ASMR, 3134 Montavesta Rd., Lexington, KY 40502.

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Proceedings America Society of Mining and Reclamation, 2004
DOI: 10.21000/JASMR04010552

<https://doi.org/10.21000/JASMR04010552>

Introduction

The West Virginia Department of Environmental Protection's Division of Mining and Reclamation has initiated a new effort to promote reforestation of mined lands in West Virginia. According to 1996 Land Sat Imagery, West Virginia is currently about 84% forested with some of the southern counties as much as 94% forested. Many different interest groups, including but not limited to, large land holding companies, the timber industry, environmental groups, regulatory authorities, and the general public want mined sites returned to productive, aesthetically pleasing forestland. West Virginia recognizes the importance of a healthy environment and the importance of the timber industry to the State's economy. By using the new reforestation technology productivity can be restored, and in many instances productivity can actually be increased compared to pre-mining conditions (Burger, et al., 1998). The new reforestation technology encourages reforestation of mine sites through developing an optimal growth medium, loosely grading topsoil and topsoil substitutes, establishing less aggressive ground covers, planting commercially valuable crop trees, and using proper tree planting techniques, (OSM, 2003). The purpose of this paper is to provide an overview of the West Virginia Department of Environmental Protection's Division of Mining and Reclamation's (WV-DEP) reforestation efforts. Since WV-DEP is a regulatory agency, most of its reforestation efforts will be programmatic.

Recent Reforestation Regulatory History

Commercial Woodland Post Mine Land Use Policy

The recent regulatory changes in West Virginia's reforestation efforts began with the development and implementation of the Postmining Land Use on Mountaintop Removal and Steep Slope Mining with an AOC Variance policy approved May 20, 1999, (WV-DEP, 1999). This policy required the post mine land uses on AOC variance permits constitute an equal or better use compared with the premining land use. This policy limited postmining land uses on mountaintop removal AOC variance permits to industrial, commercial, woodland, agriculture, residential, or public (facility) use. At this time WV-DEP started receiving surface mine applications with innovative yet practical post mine land use plans. These included proposed

sites such as highways, racetracks, vineyards, nurseries, and other industrial sites. However, most of the AOC variant applications proposed commercial woodland as the postmine land use. Commercial woodland has been a post mine land use option long before the mountaintop removal policy referenced above. Woodlands as defined in the 1993 West Virginia Surface Mining Reclamation Regulations “means commercial woodlands where the postmining land use would result in the development of a commercial product where flat or gently rolling land is essential for the operation of mechanical harvesting equipment”. On June 4, 1998 an MOU between the West Virginia Division of Forestry and the West Virginia Division of Environmental Protection was signed, and significantly strengthened the commercial woodland post mine land use, (WV-DEP, 1998). These changes evolved while the mountain top mining/valley fill controversy was gaining momentum.

The 1998 commercial woodland post mine land use policy required the plans to be prepared by a registered professional forester, required a statement of intent from the landowner expressing his or her objectives, required a commercial species planting plan and a long-term management plan, and established a procedure for review incorporating the assistance of the West Virginia Division of Forestry. The commercial species planting plan had to include premining native soils information, a description of the proposed growth medium including topsoil and topsoil substitutes, seedbed preparation, lime and fertilizer rates, mulching specifications, ground cover specifications and a tree planting plan.

The commercial species planting plan required a six-foot growth medium comprised of native topsoil mixed with organic material and soil substitutes. The soil substitutes had to consist of brown, weathered, slightly acidic sandstone, from within 10 feet of the surface. The commercial species planting plan also required reduced levels of grading and compaction. The growth medium was to be dumped and spread over the spoil material, in a separate operation, minimizing the number of passes with a dozer. See Fig. 1. The surface was to be left rough with random depressions. The random depressions help catch and hold seed and other organic material. See Fig. 2. The random depressions also increase water infiltration and reduce runoff, (Warner and Agouridis, 2003). “Tracking in” of the growth medium was discouraged. The commercial species planting plan recommended reduced rates of lime and fertilizer and recommended a more tree compatible ground cover. Two types of trees were to be planted, crop trees and nurse trees. Species recommendations, favoring native oaks, ash, poplar and maple

were made for the crop trees or commercial trees, and species recommendations for the nurse trees or wildlife trees were also provided. Pines were to be planted in pure stands or monocultures on the poorer sites.

Approximately 30 permits covering about 25,000 acres, with a post mine land use of commercial woodland, have been issued. Most of these are in the southern and central part of the state. Many of these permits are approaching reclamation and the WV-DEP is working with the coal operators and the state and federal regulatory authorities on the new forestry reclamation approach.



Figure #1. Loosely placed commercial woodland growth medium in West Virginia.



Figure #2. Random depressions in end-dumped growth medium at the Starfire Project in KY. Photo courtesy of Jeff Skousen.

Commercial Forestry Post Mine Land Use Regulations

In an effort to improve reforestation success, and as a result of the Bragg vs. Robertson consent decree, the commercial forestry regulations (CSR38-2-7.4) replaced the commercial woodland policy for all AOC variant permits, with a forestry postmine land use, approved after August 18, 2000, (WV-DEP, 2000). The commercial forestry post mine land use regulations, compared to the commercial woodland post mine land use policy, are more specific about how the plans are prepared, who reviews the plans, the allowable growth medium including soil substitutes, soil placement and grading, the landscape criteria including the requirement to retain or construct ponds, the ground cover and tree planting plans, and the standards for bond release. The commercial forestry post mine land use standards were added to the West Virginia Surface Mining Reclamation Regulations in 2000. There have been no significant changes to the 2000

commercial forestry post mine land use regulations to date, and no changes are proposed in 2004.

As with the 1998 commercial woodland post mine land use policy, the commercial forestry post mine land use regulations require the planting plan and the long-term management plan be prepared by a registered professional forester. However, the commercial forestry regulations also require the planting plan, the long-term management plan, and the statements of intent be reviewed and approved by a registered professional forester employed by either the West Virginia Division of Forestry or the West Virginia Department of Environmental Protection. The commercial forestry post mine land use contains two main components: the commercial forestry component for the AOC variant areas, and the forestry component for the AOC compliant areas.

The commercial forestry regulations require a five-foot thick growth medium on all commercial forestry areas and a four-foot thick growth medium on all forestry areas. The regulations also require quantifying and qualifying all premining native soils, and saving all the soil volume, including topsoil, on all slopes 50% or less, to meet the depth requirements of the growth medium. If the depth requirements of the growth medium cannot be met by using the premining native soils recovered from slopes of 50% or less, substitute materials may be used. The first substitute option is the slightly acidic, brown, weathered sandstone from within ten feet of the surface. See Fig. 3. If this material, mixed with the premining native soil, is insufficient to meet the growth medium depth requirements, then the slightly acidic, brown, weathered sandstone from below ten feet of the surface can be added to the above mixture. If this mixture is still not adequate to meet the depth requirements, then up to $2/3$ of the growth medium can consist of the best available material or mixture of materials. For commercial forestry areas, the growth medium must consist of at least $1/3$ premining native soils and up to $2/3$ slightly acidic, brown, weathered sandstone. The forestry areas have no minimum requirement for using premining native soil. The commercial forestry regulations also require organic debris, such as forest litter, branches, small logs, roots and stumps, be incorporated into the growth medium. These regulations also set strict limits on the duration, and size, of the soil stockpiles. As with the commercial woodland policy, the commercial forestry regulations require the placement of the growth medium in a loose and non-compacted manor while still achieving post mining configuration and stability requirements. The regulations also prohibit tracking in and the use of

rubber-tired equipment over the growth medium. The regulations also require the growth medium be minimally graded with random depressions left on the surface.

The requirements of the landscape criteria section of the commercial forestry regulations are much stricter than the commercial woodland policy. Under the regulations the post mining landscape must be rolling and diverse, with slopes of 5 to 15%, with an average slope of 10 to 12.5 %. Elevation changes between the ridges and valleys must be varied and slope lengths must not exceed 500 feet. The minimum thickness of the backfill, including the growth medium, must be at least 10 feet. Bioengineering techniques, such as fascines, branch packings, live crib walls, etc., must be used for erosion control along watercourses to maximize diversity, when rip-rap is not required. When rip-rap is required it must originate from native stone. For the forestry areas, all sediment control structures, except for ponds constructed below valley fills, must be retained after final bond release. For the commercial forestry areas the requirements are the same, except at least three ponds, permanent impoundments, or wetlands, totaling at least three acres for every 200 acres of commercial forestry areas, must be constructed.

The commercial forestry regulations require a similar ground cover that the commercial woodland policy only recommends. Both are balanced seed mixtures that will help control erosion and will not inhibit tree growth or survival. The commercial forestry regulations also provide an alternative mixture to be used on south and west aspects and areas of high pH soils. Both the policy and the regulations prohibit the use of Kentucky 31-fescue, *Serecia lespedeza*, all vetches, clovers (except Ladino and white) and other aggressive and invasive species.

Again, the commercial forestry regulations require similar crop tree and nurse tree species be established that the commercial woodland policy only recommends. Both emphasize native species of crop trees. The commercial forestry regulations require at least six species of crop trees, at the rate of at least 500 seedlings per acre, for the commercial forestry areas, and at least four species of crop trees, at the rate of at least 450 seedlings per acre, for the forestry areas. The crop tree species must be selected from the following list: white and red oaks, other native oaks, white ash, yellow poplar, black walnut, sugar maple, black cherry, or native hickories. The regulations also require 5 to 10% of the trees planted be nurse trees or wildlife trees that improve the quality of the mine soil. At least three species of nurse trees must be chosen from the following list: black alder, black locust, bristly locust, redbud or bi-color lespedeza. On south and west aspects, and on areas of low pH, pines may be planted in pure stands providing the

acreage of these areas is less than 15% of the total permit area. Five to ten, 2-0 white pine seedlings per acre must also be planted on the commercial forestry areas for productivity checks for bond release.

The commercial forestry regulations go beyond the minimum requirements of tree and shrub survival and ground cover for bond release. For wildlife habitat, forestland, and commercial woodland post mine land uses, at least 450 trees per acre and 70% ground cover must be achieved for final bond release. For commercial forestry, specific levels of productivity must be achieved. This productivity is measured by an average annual growth increment of white pine indicator trees. The required productivity for final bond release for the indicator trees is an average of 1.5 feet of growth over a four-year period, to be achieved by the end of twelfth year after planting. Based on observations at the Starfire Mine in Kentucky, if the growth medium is properly placed, this level of productivity should be easy to achieve. See Fig. 4. If this productivity cannot be achieved, a commercial forestry mitigation plan must be developed. The mitigation plan would require twice the remaining bond amount being paid to the Special Reclamation Fund, or the same amount being used to establish forests on bond-forfeiture sites. To date twelve surface mine permits, covering approximately 11,500 acres, with a post mine land use of commercial forestry have been issued. Again, most of these are in the southern and central part of the state.



Figure #3. Soil and slightly acidic, brown, weathered sandstone from within 10 feet of the surface stockpiled, ready for distribution as the growth medium in West Virginia.



Figure #4. White pine growing in non-compacted growth medium at the Starfire Project in Kentucky. Annual growth increment of over 36 inches.

Forestland and Wildlife Habitat Post Mine Land Uses Regulation Changes

Forestland, and fish and wildlife habitat and recreation lands, are two long-standing post mining land use options for AOC compliant sites. Forestland requirements can be found at CSR38-2-9.2 and 9.3. Approximately 310 permits, covering about 59,000 acres, with a post mine land use of forestland have been issued in the last 10 years. Proposed changes to the forestland post mine land use regulations and the wildlife habitat post mine land use regulations have been recently approved by the State legislature. Most of the new reforestation technology has been incorporated into the proposed rule changes. The changes address the preparation and review of the planting plans, the growth medium requirements including soil placement and grading, lime and fertilizer requirements, ground cover and trees species planting plans, and bond release requirements.

The new forestland regulations require a West Virginia Registered Professional Forester prepares the planting plan and a forester employed by the WV-DEP reviews the planting plan. Premining native soils information must be part of the planting plan. Soil or soil substitutes must be redistributed in a uniform thickness of at least 4 feet across the mine area. Topsoil substitutes may be used providing the applicant demonstrates the premining native topsoil volume is insufficient to meet the depth requirements, the substitute material contains at least 75% sandstone, has a composite paste pH between 5.0 and 7.5, has a soluble salt level of less than 1.0 mmhos/cm, and complies with the existing topsoil substitutes regulations.

The existing topsoil substitute regulations (CSR38-2-14.3.c) require chemical and physical analyses of overburden and topsoil. The analyses must include depth, thickness, extent, pH, texture class, percent coarse fragments, and nutrient content. A qualified laboratory must provide a certification that: “the proposed substitute material is equally suitable for sustaining vegetation as the existing topsoil; the resulting soil medium is the best reasonably available in the permit area to support vegetation; and the analyses were conducted using standard testing procedures”.

The new forestland regulations require the growth medium be placed in a loose and non-compacted manner while still achieving stability. Final grading and tracking is prohibited on all slopes 30% or less. Organic debris, such as forest litter, tree tops, roots, and root balls may be left on and in the soil. A statement that rills and gullies will only be regraded when they lead to a watercourse or disrupt the approved post mining land use must be included in the planting plan.

In an effort to reduce competition on the tree seedlings from the ground cover, reduced rates of low growing, less aggressive grasses and legumes are recommended, and lime and fertilizer rates have been drastically reduced. Lime will only be required when the average soil pH is below 5.0. Fertilizer rates have been reduced from 600 lbs/acre of 10-20-10 to between 200 and 300 lbs/acre of 10-20-10. Ground cover recommendations are similar to the commercial woodland policy and the commercial forestry regulations. The new regulations also prohibit the use of Kentucky 31-fescue, *Serecia lespedeza*, all vetches, clovers (except Ladino and white) and other aggressive and invasive species.

The new forestland regulations require a stocking rate of 500 trees per acre. At least 350 trees per acre must be crop trees and at least 150 trees per acre must be nurse trees or wildlife trees. The crop trees must consist of at least 3 higher value, hardwood species (210 trees/acre) and two lower value hardwood or softwood species (140 trees/acre). The higher value hardwood species must be selected from the following list: northern red oak, black oak, white oak, chestnut oak, white ash, sugar maple, black cherry and yellow poplar. The lower value hardwood or softwood species must be selected from the following list: all hickories, red maple, basswood, cucumber magnolia, sycamore, white pine, Virginia pine and pitch x loblolly hybrid pine. The nurse trees or wildlife trees must be selected from the following list: black locust, bristly locust, dogwood, Eastern redbud, black alder, bigtooth aspen and bicolor lespedeza.

The standards for bond release have not changed. At least 450 trees per acre, including volunteer species, and 70% ground cover is needed for final bond release. The reduced ground cover and reduced compaction should encourage invasion from surrounding forested areas.

The wildlife habitat post mine land use changes are similar to the forestland post mine land use changes. A wildlife biologist employed by the West Virginia Division of Natural Resources must prepare the wildlife planting plans. Growth medium requirements are the same as the forestland changes. Slightly more fertilizer, and grass and legume seed is recommended for the establishment of ground cover for wildlife. The stocking density of woody plants is also 500 plants per acre. However, if a wildlife biologist proposes less than 450 trees per acre, than the requirement for ground cover goes up to 90%, instead of 70%. A minimum of four species of trees must be included in the planting plan with at least two hard mast producing species. The WV-DEP is currently working with the WV-DNR on the new requirements of the wildlife planting plans.

Education

Education of stakeholders is a huge component of the New West Virginia Mined Land Reforestation Initiative. The WV-DEP is in the process of identifying and educating stakeholders. The prominent stakeholders appear to be the landowners, the coal operators, the timber industry, and the environmental community. The WV-DEP has addressed the West Virginia Land and Minerals Owners Association with a presentation of the same title as this paper. Already landowners are requesting coal operators to reclaim mined land to some type of commercially viable forestland. The WV-DEP will continue to educate stakeholders about timber values, ecological assets associated with the forestry reclamation approach, and the relative ease of achieving these post mine land uses as compared with traditional post mine land use options. The reduced grading, reduced soil amendments, and the reduced ground cover will be less expensive and will require less maintenance than many of the stakeholders realize. Research has shown that by using the forestry reclamation approach, we can create forests that offer greater productivity and timber values than forests on unmined land in central Appalachia. The reduced grading and reduced ground cover will result in a rough looking surface that some regulators and environmentalists may find objectionable. However, if we can educate them about the long-term benefits, specifically forest productivity, of the reduced grading and reduced ground cover, they may be more tolerant of the short-term aesthetics.

Training

The WV-DEP has trained consulting foresters, permit writers, and coal operators about the forestry reclamation approach and the requirements of the commercial forestry post mine land use plans. The WV-DEP has conducted formal training sessions for its own permit reviewers and inspection and enforcement personnel on the forestry reclamation approach, commercial forestry post mine land use plans, the proposed forestland rule changes, and topsoil substitutes. The WV-DEP has encouraged operators to participate in experimental practices dealing with different types of overburden material used as a growth medium, different levels of grading intensities, and different types of ground covers. The WV-DEP would like to establish

experimental projects in each of its four major regions of the state. These experimental projects will be used to educate landowners, operators, regulators, environmentalists and the public.

Technology Transfer

It is crucial that information obtained be shared with those who have a similar need. West Virginia is not the only central Appalachian state who has had a less than desirable success in its past reforestation efforts. The Powell River Project in Virginia and the Starfire Project in Kentucky have provided a wealth of information on the forestry reclamation approach. Foresters with the West Virginia Department of Environmental Protection's Division of Mining and Reclamation have also attended numerous conferences on this topic including: OSM forum: Market Based Approaches to Mine Land Reclamation & Reforestation, May 2002; Arch Coal's North East Region – Best Management Practices Meeting, November 21, 2002; OSM's Soils and Revegetation Class, August 11-15, 2003, Starfire Reforestation Tour, August 28, 2003; and the Powell River Project Research Symposium, September 3, 2003.

Acknowledgements

The West Virginia Department of Environmental Protection's Division of Mining and Reclamation would like to thank the following organizations and individuals for their support and cooperation on implementing The New West Virginia Mine Land Reforestation Initiative:

Dr. James A. Burger, Professor, Forestry and Soil Science, College of Natural Resources,
Virginia Tech.

Dr. Jeff Skousen, Extension Specialist-Land Reclamation, Professor-Soil Science, West Virginia
University.

Dr. Paul F. Ziemkiewicz, Director West Virginia Water Research Institute, National Mine Land
Reclamation Center, West Virginia University.

Arch of West Virginia.

Rick Williams of Williams Forestry & Associates.

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