



## POWELL RIVER PROJECT

# Mine Permitting to Establish Productive Forests as Post-Mining Land Uses

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## Introduction

Due to advances in reclamation science, Virginia coal mining operations can establish high-value, productive hardwood forests on reclaimed mine sites during reclamation. The forest sites produced by this process will be of superior productivity when compared to native forests on steep mountain soils and forested areas produced by conventional reclamation practices.

Mine reclamation practices capable of re-establishing productive forests are described in other Powell River Project publications, including:

- *How to Restore Forests on Surface-Mined Land*, Virginia Cooperative Extension publication 460-123,
- *Establishing Ground Cover for Forested Post-Mining Land Uses*, VCE publication 460-124, and
- *Restoring the Value of Forests on Reclaimed Mined Land*, VCE publication 460-138.

This publication suggests language that may be used by Virginia mine operators in mine permit applications when it is their intention to use the Forestry Reclamation Approach to produce native hardwood forests of superior productivity during reclamation. The procedures may be applied if the post-mining land use is designated in the permit as either commercial or unmanaged forest. These procedures are consistent with Powell River Project reforestation guidelines and Virginia Division of Mined Land Reclamation (DMLR) regulations.

## Important Considerations

The language in this publication was developed in consultation with Virginia DMLR in 2002 and was updated in 2009. It can be used in mine permits only if appropriate to site conditions and only if it accurately describes intended reclamation procedures. Permit writers are encouraged to modify the language as needed to represent site conditions and reclamation intentions clearly.

This publication deals only with those sections of the mine permit that describe reclamation techniques necessary to produce a highly productive forest site with native hardwood vegetation.

## Permit Section IX: Soils and Revegetation

### Soil Salvage and Redistribution Plan

In addition to providing other required information, the following language may be used where appropriate to site conditions:

“Where available at reasonable cost, soiling material – which includes both native soils and overburden suitable for trees – will be redistributed over the overburden at a thickness of 18 inches or more. Brown sandstone (weathered overburden) will be used for the soiling material and for

the near-surface overburden. Where weathered brown sandstone overburden can be removed in association with surface soils at reasonable cost, such materials will be mixed with surface soils during excavation and transport and used as a soiling material. Surface grading will be minimized, creating a rough, uncompacted surface in areas where surface compaction is not necessary to achieve slope stability. The uncompacted soiling material and weathered overburden will create a post-mining soil which will equal or exceed the depth characteristics of the adjacent undisturbed soil.

“Further soil tests will be taken, as necessary, during and after redistribution to determine specific soil amendment requirements. The results of the analyses will be used as an aid in recommending use of soil additives, such as lime or fertilizer. If such soil test results fail to identify adverse soil conditions, amendments will be applied at the following elemental rates:

50-75 lb/acre Nitrogen (N)

80-100 lb/acre Phosphorus as P (180-230 lb/acre as P<sub>2</sub>O<sub>5</sub>)

50-75 lb/acre Potassium (K)

“To achieve these N, P, and K rates, 200 pounds per acre concentrated superphosphate will be blended with 300 pounds per acre of 19-19-19 fertilizer or its equivalent.”

## Revegetation Plan

The following text may be used in permits for either managed or unmanaged forest post-mining land use, but the correct land use should be designated.

“Permit areas intended for [unmanaged or managed] forest post-mining land use are identified in Section 7.7 of this application. This land use will produce commercially valuable timber and will provide a diversity of habitat for wildlife and ground cover to control erosion. The post-mining land use will be achieved by following the revegetation plan.

“Disturbed areas will be seeded within 30 days after final grading during normal planting periods. Backfilled areas prepared for seeding during

adverse climatic conditions will be seeded with an appropriate temporary cover until permanent cover can be established.

“Optimum seeding dates are from Feb. 15 to May 15, and – after a good rain – from Aug. 1 to Oct. 15. The described seeding mixture will also be used to protect any stockpiled soiling material.

“Permit areas intended for [unmanaged or managed] forest post-mining land use are identified in Section 7.7 of this application. At least five of the following timber species will be used within any given area, with the species used within each area and their placement determined by site characteristics: red oak, white oak, post oak, black oak, chestnut oak, scarlet oak, sugar maple, white pine, green ash, white ash, pignut or mockernut hickory, tulip poplar, black cherry, sycamore. Species will be selected and mixed to accommodate soil and site characteristics and to achieve a silviculturally sound timber stand and wildlife habitat. About 550 timber trees and 50 nurse trees/shrubs will be planted per acre at spacing of about 8 feet by 10 feet to allow for future management and harvesting. Nurse trees/shrubs will be interplanted with the timber species. Nurse trees/shrubs will be comprised of eastern redbud, bristly locust, black alder, and indigobush. For wildlife habitat, sawtooth oak, gray or silky dogwood, and crab apple will be planted at a combined rate of 50 trees per acre on average for the permit area. Wildlife trees and shrubs will be planted in small, scattered areas (about 0.25 acre) and along drains in narrow strips to create wildlife corridors and sources of food and shelter. A total of about 650 trees and shrubs will be planted per acre.

“Colonization of the mined site by native-forest tree species compatible with the post-mining land use will be encouraged through use of fresh soil, where available, in the soiling material and through use of the tree-compatible ground cover mix listed below. It is intended that unplanted ‘volunteer’ seedlings of suitable native species, which colonize the mine site via natural processes, will be encouraged by the revegetation plan, and those volunteers that attain adequate size prior to the bond release inspection will contribute to the reclaimed site’s post-mining land use. Trees and nurse trees/shrubs will be planted during the first spring following seeding (see table 1).”

**Table 1. Revegetation species and materials, with planting and application rates**

Type	Species	Rate/acre
Perennial grasses	List perennial grasses and seeding rates per acre to be used. <sup>a</sup>	
Legumes	List legumes and seeding rates per acre to be used. <sup>a</sup>	
Annuals	List annual grass or grasses and seeding rates per acre to be used. <sup>a</sup>	
Timber trees	Red oak, white oak, post oak, black oak, chestnut oak, scarlet oak, sugar maple, white pine, green ash, white ash, pignut or mockernut hickory, tulip poplar, black cherry, sycamore*	Approximately 110** each of 5 species, or approximately equal numbers totaling 550 if more than 5 species are used within a given area.
Wildlife trees	Sawtooth oak, crabapple, silky dogwood	50 total**
Nurse trees/shrubs	Eastern redbud, indigobush, bristly locust, black alder	50 total**
Fiber, mulch	Cellulose or wood fiber	1,500 lbs.

\*Planted trees shall be selected from among these groupings. If any of these species are unavailable from conventional sources or priced at excessive levels at the time of planting, that species may be eliminated from the revegetation plan.

\*\*These figures are cumulative averages for the entire permit area. Species composition of areas will vary throughout the site in response to factors such as soil properties, slope, and aspect orientation. Thus, the specified planting rate for each tree type can vary from acre to acre as long as these averages are attained. The combination of timber trees, wildlife trees, and nurse trees/shrub planted stems shall total 650 per acre, but per-acre species distributions shall vary across the job site.

<sup>a</sup>Note: Permit writers are encouraged to reference VCE publications 460-123 and 460-124, and Virginia DLR Guidance Memorandum 22-08 for guidance in species selection.

### **Post-Mining Land-Use Management – Unmanaged Forest**

Beyond normal husbandry practices, no special management practices are necessary to achieve the proposed unmanaged forestland use.

### **Post-Mining Land-Use Management – Commercial Forest**

If a managed forest post-mining land-use designation is requested in the permit, a forest management plan must be submitted with the permit application. If the post-mining forest is to be managed by the landowner in association with other holdings, a management plan prepared by the landowner to describe such procedures may be submitted to meet this requirement. Advice and assistance with forest management plans can also be obtained from the authors of this publication.

## **Permit Section XIII: Backfilling/Regrading**

### **Backfilling and Grading**

In addition to other language used to describe specific practices, language similar to the following may be used:

“Backfilled soils shall be handled and placed in a manner necessary to achieve a long-term static safety factor of 1.3 and to ensure against settlement-induced highwall exposure.” [Permit should describe specific practices.]

“Soiling materials shall be obtained as described in Section 9.3 and applied over backfilled soils. On areas where engineering calculations or onsite observations indicate that surface compaction of soiling materials is necessary to achieve slope stability or to assure that eventual settlement does not expose highwalls, such materials shall be graded and compacted as necessary to achieve

stability. On areas being reclaimed to [managed or unmanaged] forests that do not require compaction, soiling materials shall be graded loosely, in most cases with a single pass of the dozer, so as to assure a soil medium capable of supporting a productive timber stand. Rocks or woody debris that may be present on such surfaces after such grading will be left in place, unless such debris will hinder forest management activities described in this permit or eventual forest harvest. On such areas, 'tracking in' or 'walking in' of slopes shall not be practiced.

"Where compaction of overburden materials is not required to achieve a long-term static safety factor of 1.3 and/or to ensure against settlement-induced highwall exposure, and – where soiling materials are to be applied at less than 4 feet of thickness – the overburden surface beneath the soiling medium shall be left in an uncompacted condition so as to achieve at least a 4-foot depth of loose rooting medium."

Note that the Appalachian Regional Reforestation Initiative (ARRI) publication, *Low Compaction Grading to Enhance Reforestation Success on Coal Surface Mines*, describes grading practices that are recommended for use in reforestation. This publication was prepared with direct involvement of U.S. Office of Surface Mining personnel and with consent and approval by Virginia Department of Mines, Minerals and Energy; Division of Mined Land Reclamation.

## Conclusions

This publication contains language describing reclamation practices that may be used in preparing mine permits for submission in Virginia. The language was developed in cooperation with Virginia DMLR with the expectation that permit writers will revise and modify as needed, based on reclamation intentions and site conditions. It is not intended to describe a "one-size-fits-all" approach to reclamation.

Mine reforestation with hardwoods – using procedures designed to achieve superior site productivity – will be an appropriate reclamation procedure on some mining sites, including sites where such reclamation is requested by the landowner in the permit and site conditions are favorable. Such procedures are described in Virginia Cooperative Extension publications 460-123 and 460-124, and by the Appalachian Regional

Reforestation Initiative publication, *The Forestry Reclamation Approach*. On Virginia mining sites that are not being converted to a forested post-mining land use that will utilize native hardwoods, conventional reclamation/reforestation procedures are likely to remain in use and – assuming all legal standards are met – are likely to be acceptable to Virginia DMLR.

## References

**Powell River Project/Virginia Cooperative Extension publications:** Available from Powell River Project ([www.cses.vt.edu/PRP/](http://www.cses.vt.edu/PRP/)) and Virginia Cooperative Extension ([www.ext.vt.edu](http://www.ext.vt.edu)).

Burger, J. A., and C. E. Zipper. Updated 2009. *How to Restore Forests on Surface-Mined Land*, Virginia Cooperative Extension publication 460-123; [www.pubs.ext.vt.edu/460/460-123/460-123.html](http://www.pubs.ext.vt.edu/460/460-123/460-123.html).

Burger, J. A., C. E. Zipper, and J. Skousen. Updated 2009. *Establishing Ground Cover for Forested Post-Mining Land Uses*, Virginia Cooperative Extension publication 460-124; [www.pubs.ext.vt.edu/460/460-124/460-124.html](http://www.pubs.ext.vt.edu/460/460-124/460-124.html).

Burger, J. A., C. E. Zipper, and J. Skousen. Updated 2009. *Restoring the Value of Forests on Reclaimed Mine Land*, Virginia Cooperative Extension publication 460-138; [www.pubs.ext.vt.edu/460/460-138/460-138.html](http://www.pubs.ext.vt.edu/460/460-138/460-138.html).

**Appalachian Regional Reforestation Initiative publications:** Available from <http://arri.osmre.gov/FRA.htm>.

Forest Reclamation Advisory No. 1: The Appalachian Regional Reforestation Initiative.

Forest Reclamation Advisory No. 2: The Forestry Reclamation Approach.

Forest Reclamation Advisory No. 3: Low Compaction Grading to Enhance Reforestation Success on Coal Surface Mines.

Forest Reclamation Advisory No. 4: Loosening Compacted Soils on Mined Sites.

Forest Reclamation Advisory No. 5: Mine Reclamation Practices to Enhance Forest Development Through Natural Succession.

**Virginia Department of Mines, Minerals and Energy**

Virginia Division of Mined Land Reclamation. 2008. *Forestry Reclamation Approach*. Guidance Memorandum 22-08. (Available at: [www.dmme.virginia.gov/DMLR/Adobe/22-08.pdf](http://www.dmme.virginia.gov/DMLR/Adobe/22-08.pdf))