Kentucky
Department for Surface Mining
Reclamation and Enforcement

Reclamation Advisory Memorandum

From: Carl Campbell, Commissioner C.C.

Date: March 10, 1997

Subject: Reforestation Initiative

RAM # 124

Introduction

In the spring of 1996, after conducting both field visits and public meetings, the Kentucky Environmental Quality Commission issued a resolution to Governor Paul E. Patton and the Natural Resources and Environmental Protection Cabinet (NREPC) concerning the establishment of trees and shrubs on mine sites. The specific concern was that certain regrading and reclamation techniques currently being used or promoted seemed to inhibit the proper growth and development of deep rooted woody species.

In response the NREPC, through the Department for Surface Mining Reclamation and Enforcement (DSMRE), established a very diverse working group of professionals from industry, environmental groups, the U.S. Office of Surface Mining, the University of Kentucky Extension Service, the Department of Fish and Wildlife Resources, the Department for Natural Resources and its Division of Forestry, DSMRE, and others. The purpose of the group was to review current reclamation policy and practices that impact tree survival and growth on mined lands, and develop reclamation advisory guidance that, when utilized, would promote woody species use and development on mined lands.

The working group approached this task in a most professional manner and with a cooperative, progressive spirit. On behalf of DSMRE, I want to express my sincere appreciation to the members of the working group for their hard work and for the excellent result. The individual members are identified at the end of this document.

The following information represents the suggestions conveyed by the working group, and is henceforth accepted by the DSMRE as appropriate reclamation practice for those mined areas reclaimed to a postmining land use which requires the establishment of deep rooted woody species.

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Rationale

Reclamation techniques and husbandry practices which are conducive to productive forest lands and wildlife areas are essential when successful achievement of the postmining land use demands good tree and/or shrub survivability and growth.

Current reclamation practices have created three prevalent problems which inhibit proper tree survivability and growth.

1) Excessive compaction of the rooting (growth) medium (soil or approved soil substitute).

2) Selection of an inappropriate rooting medium.

3) Excessive competition from the herbaceous ground cover species established to control erosion.

Research, both independent and generated by mining and reclamation professionals responsible for meeting current standards, indicates that the following conditions are necessary for proper tree growth and survivability on mined lands.

1) The final surface layer established on an area which will support a land use of forest or wildlife habitat must be composed of an acceptable rooting medium which is less intensively graded. Grading should be minimized on level and gently sloping areas that will support forest and wildlife land uses. Similarly, excessive grading of the rooting horizon on longer and steeper slopes should be minimized when backfill stability is not jeopardized. This should not be interpreted to mean that variance from the 1.3 static safety factor is being allowed.

2) During the mining and reclamation process, all highly alkaline materials with excessive soluble salt levels should be covered with four to six feet of acceptable rooting medium that will support trees, unless approved otherwise. All acid or toxic material should also be buried in a similar fashion.

3) Select herbaceous and woody species which provide long term erosion control, are compatible with one another, and are suited to site specific conditions (selection of certain species should be in accordance with 405 KAR 16:200 Section 6(1)(b) and 405 KAR 18:200 Section 6(1)(b)).

Forestry Reclamation Practices

These reclamation practices should be utilized when establishing a postmining land use which requires the planting and survival of woody species (trees and shrubs).

1) Selection of a growth medium

The best available growth medium on the permit area should be placed on the surface to a depth of at least four feet, thus accommodating the needs of deeply rooted trees. Growth media with low to moderate levels of soluble salts, an equilibrium pH of 5.0 to 7.0, low pyritic sulfur content, and a texture conducive to proper drainage are preferred. However, for those sites where the best available material varies from the above recommendation, an equilibrium pH as low as 4.5 or as high as 8.0 is acceptable, so long as species tolerant of those conditions are selected and utilized.

2) Grading

Minimizing any compaction during the application of the rooting medium and the final grading operation is extremely important. The compaction that can occur during establishment of the final surface layer can be minimized by dumping and leveling in separate operations. However, the operator is still responsible for assuring that AOC and backfill stability are achieved. Further, this technique should not be used on those areas which ultimately will support the final drainage conveyance systems (ditches and waterways).

A. Area/Mountaintop

When trucks are delivering the final layer of material, the rooting medium should be placed in tightly placed piles that abut one another across the entire area. Once the material is in place, a bulldozer can be used to grade the tops off the piles and gently level the area with one or two passes (see Diagram 1).

B. Dragline

For those mining operations that utilize draglines, the soil material can be cast and shaped in a manner that reduces the amount of final grading needed by tracked equipment. Here again, the final surface

layer of material should first be placed in tightly spaced piles or ridges that abut one another across the entire area and subsequently graded in a gentle fashion with one or two passes (see Diagram 2).

C. Steep slopes

On steeper sloped areas, the suitable growth medium should be dumped over the top of the outslope on the previously compacted backfill. Again, one or two passes with a bulldozer should be sufficient to minimally shape the slopes. Simultaneously, large boulders which could negatively affect ground cover assessments or postmining land use should be removed and disposed of properly (see Diagram 3). These techniques should be utilized only on areas with a slope of 2h:1v (≈ 27°) or flatter.

D. Final Surface

Regardless of whether the mined area is a mountaintop, dragline, or steep slope operation, minimizing tractor traffic minimizes compaction, which minimizes the negative effect on forest site quality. Natural forest sites and soils have a diverse microtopography with large amounts of organic matter and coarse woody debris. Many natural forest sites are also rocky, yet very productive. The combination of microtopography created by small depressions, hills, gullies, mounds, rocks, and coarse woody debris is more natural and creates a surface more amenable to recruitment, establishment, and survival of diverse, native forest species, both flora and fauna. Therefore, to the extent possible, final grading should be conducted to minimize compaction, create a surface microtopography, leave as much organic debris as possible, and leave occasional rocks, especially when their removal becomes counterproductive due to additional tractor traffic. Erosion rills and gullies should not be filled if the gullies are stable.

3) <u>Tree compatible ground cover</u>

Reforestation requires a carefully planned balance between ground cover and tree requirements for light, water and space. Ground cover should include grasses and legume species that are slow growing, are tolerant to a pH of 4.5 to 8, and can be established in a bare mineral spoil. Tree compatible ground covers are relatively sparse during the first year and become increasingly lush by the second and third years. This allows tree seedlings to emerge

above the ground cover and ensures their survival. Kentucky-31 fescue, Serecia Lespedeza, all vetches, clovers (except Ladino) and other aggressive or invasive species should be avoided. A herbaceous seed mixture for an area which is to be planted to trees and shrubs should have a balanced seed mixture of permanent grasses, legumes, temporary plants and small grains/ground cover species. A balanced seed mixture will allow for short-term and long-term erosion control, and not inhibit tree growth or survivability. Wherever possible, the operator should consider the use of native species. Please refer to Technical Reclamation Memorandum (TRM) #21, "Plant Species, Distribution Patterns, Seeding Rates, and Planting Arrangements for Revegetation of Mined Lands," (prepared jointly by the Division of Forestry, the Department of Fish and Wildlife Resources, and the Department for Surface Mining Reclamation and Enforcement) for examples of tree compatible species.

4) Fertilizer requirements

Fertilizer applications should be based on a current soil test. Make sure to inform the soil test laboratory that it will be making a recommendation for an area to be planted to trees. The fertilizer recommendation should have an adequate rate of phosphorus and potassium and a low rate of nitrogen. The lower rate of nitrogen reduces the height of the ground cover but not its density. By the third year, the inoculated legumes should be providing an adequate supply of nitrogen.

5) Tree species selection

Tree species, shrub species and nurse tree/shrub selections should be based on the approved postmining land use and site specific characteristics. If available, mychorrizae inoculated seedlings are recommended, but not required. Considerable thought and planning should go into the species selection process. Wherever possible, the operator should consider the use of native species. The species established must be capable of satisfying the requirements of a particular postmining land use whether it be a Non-commercial (unmanaged) Forest Land, Commercial (managed) Forest Land or a Fish and Wildlife land use. These requirements are listed in 405 KAR 16:200 and 18:200 Section 6.

6) Tree Planting

Trees can be properly established by utilizing hydroseeding, mechanical planters, hand planting, or a combination of these methods, depending upon

the species being established. Ideally, an experienced, reputable tree planter should be used. Proper planting techniques can be located in the following references. Copies of these documents can be obtained from Teri Welch at DSMRE, (502) 564-2377.

1. Kentucky Tree Planting Manual, Kentucky Natural Resources and Environmental Protection Cabinet, Department for Natural Resources, Division of Forestry, 1990, 104 pp.

2. Revegetation of Kentucky Surface Mined Lands, Kentucky Natural Resources and Environmental Protection Cabinet, Department for Surface Mining Reclamation and Enforcement, 1983, 105 pp.

3. A Guide for Revegetating Coal Minesoils in the Eastern United States, Vogel, Willis G., U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station, Berea, Ky, 1981, 190 pp.

If you have any questions or comments about this RAM, or need further information concerning the ongoing reforestation initiative, please contact Paul Rothman of my office, at (502) 564-6940.

If you have questions about the availability of tree species, planting techniques, or other matters related to forest productivity and management, please contact Jerry Zoochi or other personnel of the Kentucky Division of Forestry, 627 Comanche Trail, Frankfort, Kentucky, (502) 564-4496.

If you have questions about any aspect of mined land reforestation related to fish and wildlife, please contact Steve Beam or other personnel of the Environmental Section of the Kentucky Department of Fish and Wildlife Resources, Arnold L. Mitchell Building, #1 Game Farm Road, Frankfort, Kentucky, (502) 564-5448.

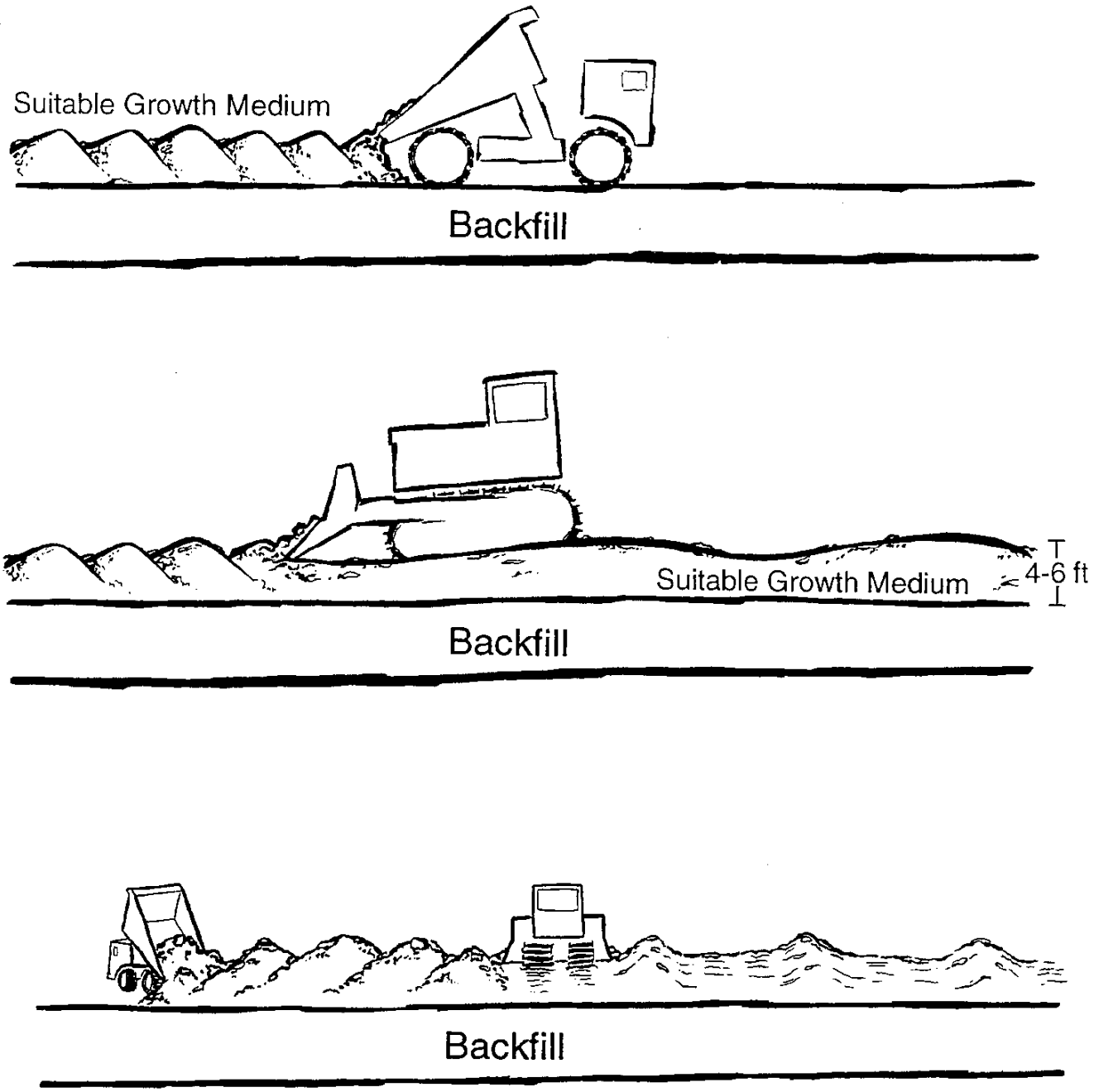


Diagram 1. Area Mining or Mountaintop Removal methods

illustrations not to scale

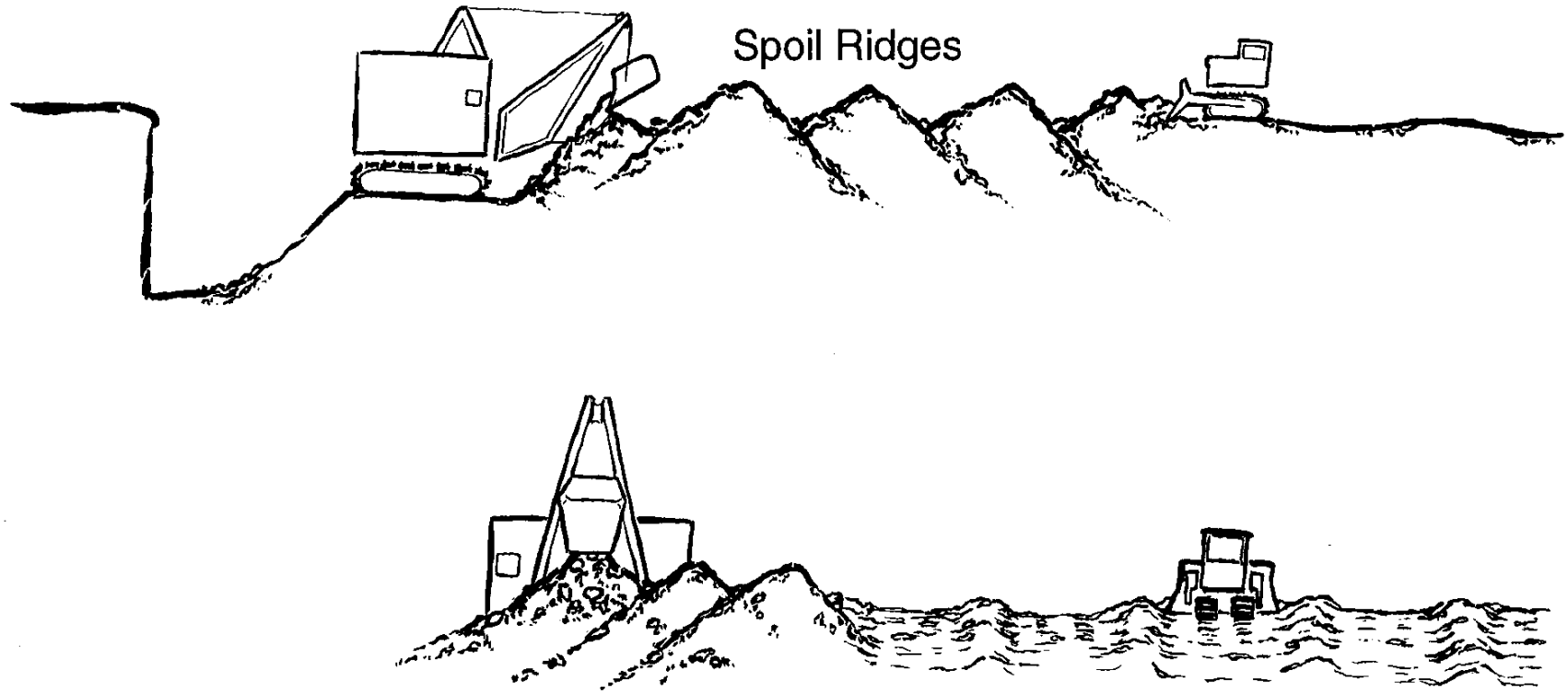
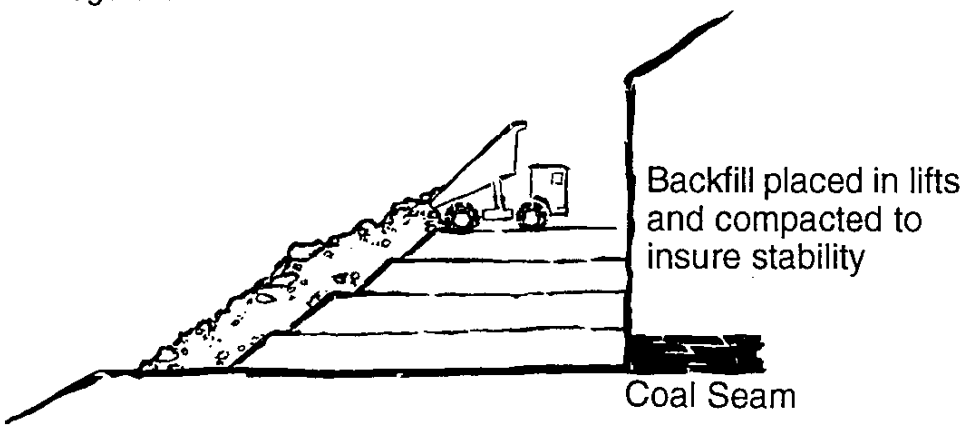
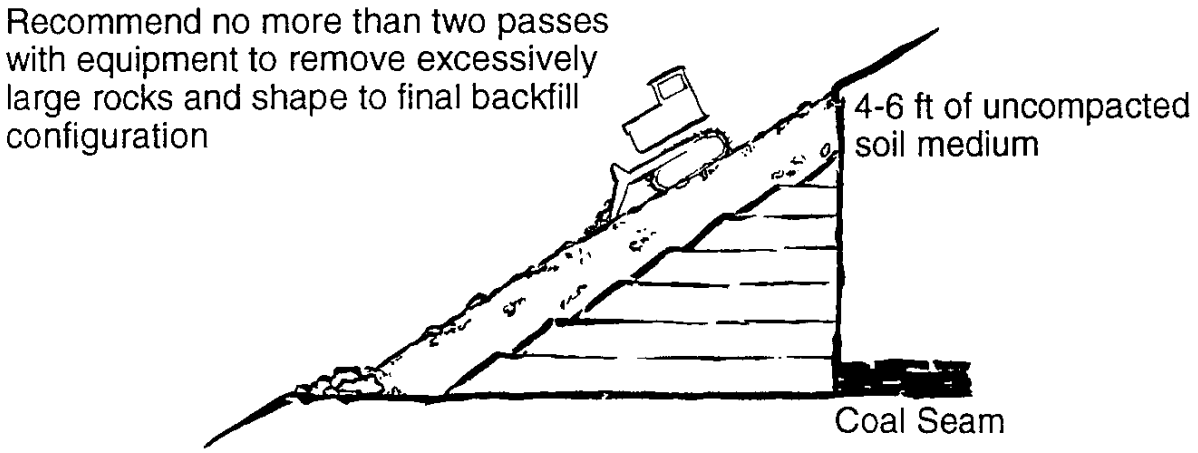


Diagram 2. Area Mining or Mountaintop Removal by Dragline method

illustrations not to scale





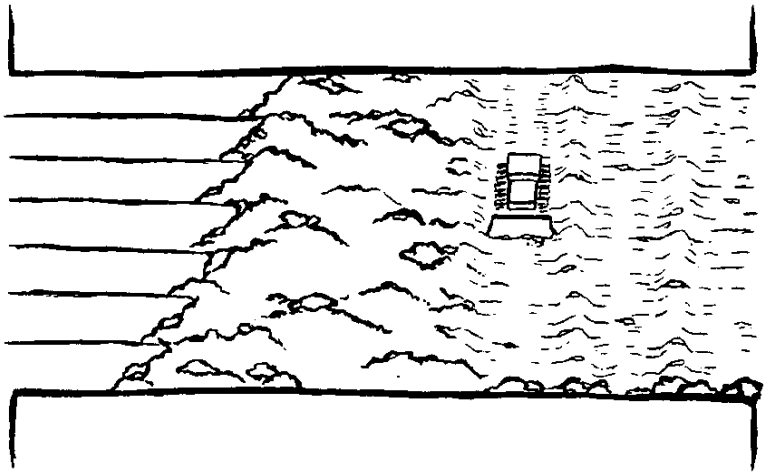


Diagram 3. Contour Mining or Other Sloped Areas

illustrations not to scale

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