RIGHT-OF-WAY RESTORATION[1]

by Richard H. Mider

ABSTRACT. Current public concerns for protection of soil and water resources have resulted in enactment of laws requiring soil erosion abatement and repair of damages resulting from construction of electric transmission lines. Utility personnel can reduce restoration costs by altering construction operations to minimize disturbance. The expertise of the USDA Soil Conservation Service should be tapped for assistance in adopting principles of soil conservation to right-of-way restoration. NYSE&G's methods of restoration including equipment and materials utilized are described.

Present day concerns for environmental protection have added a new operational phase to the establishment of electric transmission line rights-of-way. In the past, rights-of-way were cleared and lines were constructed. Now transmission line construction projects are not complete until a third phase, right-of-way restoration, is completed. The term restoration as used here is somewhat misleading. The objective is not to return the right-of-way to its original condition, but to repair construction damages, reestablish normal drainage patterns and stabilize disturbed soil to prevent erosion. Right-of-way restoration presents a new challenge to the utility arborist.

Years ago, rights-of-way were cleared, lines were built and the restoration contract was awarded to Mother Nature. In many cases she did a most commendable job. Lines constructed twenty-five or thirty years ago show very little evidence of construction damage. Those who deny the need to perform restoration work continually cite these vintage lines as examples of how a right-of-way "heals over" in time. In the past thirty years transmission line construction and construction equipment have changed drastically. Horses and small dozers have been replaced by D-8's and TD-20's. Hand labor and gin poles have been replaced by huge diggers and seventy-five ton cranes. This new equipment is being used to replace the fifty foot wood poles of the past with one hundred foot wood poles and one hundred fifty foot towers of the present.

Even the roughest terrain can be made accessible for construction with today's modern equipment. To do so, though, requires more severe cuts and fills and thus exposes more soil to potential erosion. The result is a severe scar on the landscape which, in many cases, will not heal with time. Today's public is more protective of soil and water resources and more critical of the environmental impacts of transmission line construction. Thus public pressure has demanded enactment of restoration laws and erosion and sedimentation control laws.

The key to effective and economical restoration is to minimize the surface area disturbed and thereby reduce the surface area to be restored. This can be accomplished only with coordination and cooperation between clearing and construction personnel and those charged with environmental protection. NYSE&G's clearing and construction specifications contain specific items to limit disturbance and make restoration a part of all phases of line construction.

Restoration begins during the clearing operation. Slash disposal methods are chosen on a site-by-site basis to limit soil disturbance on sensitive sites. Steep slopes and other areas where sensitive soils have been identified receive special attention. In these areas, equipment movement is limited to slash disposal techniques such as lop and scatter or hand piling are implemented. Even where selective clearing techniques are used the removal of mature forest cover, devoid of a desirable understory, usually results in bare soils that have the potential to erode. Since clearing occurs over the entire right-of-way surface, this operation exposes more soil to erosion than any other phase of line construction.

Immediate attention to this problem can quickly stabilize soils exposed by clearing operations. Clearing normally exposes only the surface layer of forest soils. The exposed soil is usually high in organic matter and nutrients which aid in the quick establishment of a vegetative cover. NYSE&G's

[1]Presented at the annual conference of the International Society of Arboriculture in Toronto, Ontario, Canada in August 1978.

clearing specifications require that soils disturbed by clearing be seeded within eight days of exposure regardless of the time of year. However, experience has shown that best results are obtained during the growing season if seed is applied before the first rainfall compacts the seed bed. During winter months best results are obtained by seeding immediately after slash disposal is completed. Seed sown at this time is less apt to be washed away during spring run-off because it becomes trapped within the roughened soil surface created by equipment movement.

This seed, referred to as temporary seeding, is applied through hand-held cyclone seeders. No soil amendments such as lime or fertilizer are added. Table I shows temporary seed formulations most commonly used by NYSE&G. These formulations have been adopted after experimenting with various mixtures recommended by the USDA Soil Conservation Service. The cereal grain, applied to well-drained sites, provides a rapid temporary cover. The Kentucky #31 Tall Fescue is well adapted to poor sites and provides a durable and quite permanent cover. In addition to protection against erosion, temporary seeding provides another important benefit. Although this is not documented, experience indicates that successful temporary seeding reduces invasion of undesirable tree species immediately after clearing. Temporary seeding costs range from $50 to $100 per acre.

The construction phase of transmission line establishment causes soil disturbance that is more concentrated than that caused by clearing and usually more severe. Construction forces must be adequately controlled to minimize disturbance and thus minimize restoration costs. To limit disturbance, access roads are located prior to construction and construction crews are required to restrict vehicular travel to these roads. Proper road planning includes avoidance of steep slopes when possible and elimination of access from two directions over sensitive sites. A construction area or structure fabrication area is designated around each structure. Construction activity is confined to this area. The size of the fabrication area is determined by the type of construction. Wire stringing set up areas are also confined to predetermined locations.

Table 1. Temporary Seed Formulations.

Well Drained Sites
Use from 4/1 to 9/1
20 lbs. Ky. #31 tall fescue
16 lbs. spring oats
36 lbs. per acre total

Use from 9/1 to 4/1
20 lbs. Ky. #31 tall fescue
30 lbs. winter wheat or cereal rye
50 lbs. per acre total

Poorly Drained Sites
Use from 4/1 to 9/1
10 lbs. reed canary grass
3 lbs. red top
13 lbs. per acre total

Use from 9/1 to 4/1
10 lbs. reed canary grass
3 lbs. red top
13 lbs. per acre total

During all grading operations attention is given to proper drainage of runoff from disturbed sites. Specifications require that fill slopes be graded to allow water to run off from the road surface and that where possible, cut banks be sloped to a grade that can be stabilized with vegetation. During access road construction, water bars are established and stream crossings are installed.

The same temporary seed formulations as used in conjunction with clearing is applied to all access roads within eight days of construction. In addition, all other disturbed areas where construction activity will be idle for thirty days or more are seeded, seasonal conditions permitting. As in the clearing operation, best results are obtained if seeding is performed before rain has an opportunity to compact soils. Mineral soils exposed by access road construction and grading are usually low in organic matter and nutrients. Consequently grass establishment is sparse and slow in development, but usually effective. Normally germination does not occur on the road surface itself due to traffic, but cut and fill slopes will be stabilized.

After completion of construction the final restoration program is implemented. Goals for final restoration vary according to land use. NYSE&G

does not maintain permanent access roads across agricultural lands. Therefore, roads that have been cut are returned as nearly as possible to original contours and then seeded. Where access roads cross agricultural land perpendicular to contours special problems arise. Water bars are normally constructed to divert water from disturbed areas. Farmers frequently object to the presence of water bars in fields and often will not allow their construction. This problem can sometimes be solved on less severe slopes by applying mulch at heavy rates. In other cases the farmer may agree to allow construction of water bars provided they are removed after a grass cover is established.

Another restoration problem encountered on agricultural land is soil compaction. Depending upon the severity of compaction thorough discing can sometimes remove it. In more severe instances the use of a sub-soiler or deep plow may be necessary. Fortunately in the northeast frost action will usually remove compaction in one or two years.

In non-agricultural areas a primary goal in restoration is to stabilize disturbed soil so that further attention to erosion problems will not be necessary unless further disturbance takes place. Access roads are left in a passable condition for use during future maintenance operations.

NYSE&G utilizes company personnel for construction and restoration of most transmission line facilities. When construction is contracted restoration is usually contracted separately from the construction. Regardless of who performs the restoration a detailed specification is developed for the job. During development of specifications it is helpful to consult with the U.S.D.A. Soil Conservation Service office local to the project. In addition, the SCS Plant Material Center at Big Flats, New York, can provide information on new developments in erosion control techniques and plant materials.

The SCS provides general recommendations for soil amendments in lieu of soil tests. In most cases it is impractical to run soil tests for pH and fertilizer requirements since rights-of-way by their nature usually cross many soil types. SCS will also provide seed formulation recommendations for specific project locations. Table II is an example of seed formulations provided by the SCS for a specific NYSE&G project.

Table 2. Seed Mixtures for Right of Way Restoration.

WELL DRAINED, DRY SITES		**POORLY DRAINED, WET SITES**	
Residential Lawn and Turf Areas			
Formula I		*Formula II*	
	lbs/A.		lbs/A.
Kentucky bluegrass	39	Poa triuialis	30
creeping red fescue	35	Kentucky bluegrass	22
Pennfine perennial ryegrass	13	creeping red fescue	22
TOTAL	87	perennial ryegrass	13
Seeding rate 2 lbs/ 1000 sq. ft.		TOTAL	87
		Seeding rate 2 lbs/ 1000 sq. ft.	
Hay Fields or Pasture			
Formula III[2]		*Formula V*[2]	
Hay			
Iroquois alfalfa	12	Reed canarygrass	10
smooth bromegrass (Southern Type)	8	timothy	3
TOTAL	20	Ladino clover	1
		TOTAL	14
Formula IV[2]			
Pasture			
Empire birdsfoot trefoil	10		
timothy	8		
TOTAL	18		
Non Agricultural Land, Slopes Less than 15%			
Formula VI[1,2]		*Formula VII*[1,2]	
Creeping red fescue	22		
Kentucky #31 tall fescue	10	Ky. #31 tall fescue	15
Birdsfoot trefoil	4	Redtop	3
Perennial ryegrass	10	Ladino Clover	2
TOTAL	46	Perennial ryegrass	10
		TOTAL	30
Non Agricultural Land, Cuts, Fills and Slopes over 15%.			
Formula VIII[1,2]			
Ky. #31 tall fescue	15		
Perennial ryegrass	15		
Penngift Crownvetch	12		
TOTAL	42		

1. In addition to the given formula the following is to be seeded per acre:
   a. From 4/1 through 9/1, add 1 bushel Spring Oats (seed quality)
   b. From 9/1 through 4/1, add 1 bushel Cereal Rye (seed quality) when not available, add 1 bushel Winter Wheat
2. Inoculant required.

Final restoration begins by grading disturbed areas to natural contours. During the grading operation ditches and water bars are reestablished. The importance of providing good drainage cannot be overemphasized. Even where seeding fails due to poor weather conditions, natural revegetation will eventually establish itself if good

drainage is provided. On the other hand, if water bars fail or are otherwise insufficient, seeding will not be effective and erosion may continue indefinitely. Water bars are constructed at a downhill angle to provide for self cleaning and should be deep enough to just barely permit access by four wheel drive vehicles. Where trespass by unauthorized four wheel drive vehicles is a problem, deeper water bars are constructed to act as barriers to access.

The second phase of restoration is the seeding operation which is begun by the application of soil amendments. This usually means the addition of both lime and fertilizer. Where lime is required it is usually applied at a maximum rate of two tons per acre. At this rate, NYSE&G has experienced good success even where SCS recommendations have been higher. Lime is relatively inexpensive, however, the cost of handling and application of higher rates is prohibitive. The SCS usually recommends fertilizer at a rate of 400-800 pounds per acre of 10-20-20 or equivalent. Lime and fertilizer can be mixed together and applied through a cyclone type seeder attached to a conventional 3 point hitch on a tractor. This type of spreader has the advantage of being able to throw lime and fertilizer on to cut and fill slopes that would not be accessible to a drop type spreader.

After lime and fertilizer is applied the seed bed is scarified or loosened and soil amendments are incorporated into the soil. Best results are obtained by using a heavy disc harrow towed by a small dozer. One or two passes will loosen heavily compacted soils to a depth of three to four inches. A disc such as this is also capable of removing ruts without any grading. York rakes require several passes to accomplish what a large disc can do in one pass.

Seed bed preparation is followed immediately by seed application. As in the temporary seed formulations a nurse or mulch crop consisting of oats, winter wheat or winter rye is sown in addition to the specified grass and legume mixture. The quickly germinating grain provides stabilization until the slower germinating grasses and legumes can become established. At times though, the mulch crop so quickly dominates the site that it appears to retard the development of the permanent grasses and legumes. Of course this competition only lasts until the mulch crop completes its life cycle or is killed off by frost.

To provide additional insurance against washout before germination and protection against droughty conditions, hay or straw mulch is applied at a rate of two tons per acre. Power mulchers are the only practical method for applying hay or straw mulch. Good results can be achieved without mulch during spring and early fall plantings if the weather cooperates. However, without mulching there is a chance of losing the investment in site preparation and materials. Mulching is good insurance. On steep slopes, especially during late fall plantings, some method of binding the mulch to the soil is necessary. There are various commercial products available that can be applied with the mulch or separately as an over spray. The SCS recommends "tracking" or running tracked equipment up and down slopes so that tracks overlap. The tracks push the mulch into the soil and hold it in place. Tracking of course cannot be done on some steep slopes. In these locations over spray materials must be relied upon.

Hydroseeding is an alternative to the conventional 3-step method of applying lime and fertilizer, seed and mulch. Hydroseeding simplifies seeding steep slopes that cannot be traversed with conventional equipment. The only requirement is that a road for access be located within the effective range of the seeder. Disadvantages to hydroseeding are its dependence upon a water source and the need for a large dozer to assist in going up and down steep slopes. Furthermore, the wood fiber mulch commonly used in hydroseeders is not as consistently effective as hay or straw mulch, although excellent results can be obtained.

NYSE&G has owned and operated its own hydroseeder for approximately five years. Most restoration that is done by company crews is done with the hydroseeder. Any one crew may have the opportunity to do extensive restoration work only once in several years. Therefore, restoration crews are almost always inexperienced. It is easier to train an inexperienced crew to operate a hydroseeder than it is to coordinate a restoration program using conventional equipment. Produc-

tion with the hydroseeder very seldom exceeds 2 to 2½ acres per day. An experienced crew using conventional equipment usually can double this production.

Once restoration is completed cooperation from the weatherman and from recreational vehicle operators is necessary for success. Lately it seems that cooperation from the former is easier to get than from the latter. It is discouraging to see how easily a few inconsiderate four wheel drive operators can cause many thousands of dollars of restoration work to be ineffective. NYSE&G now posts newly seeded areas with signs requesting that vehicles stay off until grasses are established. Property owners are reacting too by demanding that we erect barriers and gates at points of access to the right-of-way. It seems inevitable that eventually gates and barriers will be required at all road crossings.

Restoration utilizing the techniques described is expensive. Materials alone can cost in excess of $400 per acre. Site preparation and material application costs will vary tremendously dependent upon the terrain and degree of soil disturbance. Recent bid prices received by NYSE&G varied by a factor of three to four times between the low and high bid. This variation is probably caused by a lack of confidence due to inexperience. However, costs should become more competitive as more contractors enter the field and gain experience.

The restoration techniques described here are merely implementations of basic principles of soil conservation. NYSE&G has utilized these techniques on approximately 200 miles of transmission rights-of-way. The challenge of the future will be to keep abreast of new developments and strive to reduce costs without sacrificing effectiveness.

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ABSTRACTS

Dirr, M.A., E. Friedhoff, and T. Smith. 1978. **Plant hardiness evaluations.** Am. Nurseryman 148(5): 12, 38, 42, 44, 48, 50-51, 54-63, 66-69, 72.

The winters of 1976-77 and 1977-78 were two of the worst ever recorded in the midwestern states and provided ideal conditions for the evaluation of plant hardiness. Ours is a fairly broad-based evaluation and includes observations in Chicago and Champaign-Urbana, Illinois; Louisville and Clermont, Kentucky, and Cincinnati, Columbus, Mentor, Newark, and Wooster, Ohio. The treatment is alphabetical by scientific name. We are interested in hearing from others who may have maintained records, either mental or written. Please take the time to forward pertinent comments about plant injury in your particular part of the country. We can collate these and, we hope, provide valuable reference material.

Shank, Bruce. 1978. **Growth in tree fertilization linked to professional method.** Weeds, Trees, and Turf 17(8): 14-16.

The choices of fertilizing established trees have increased in number in the past five years. To determine the best, most professional method, each method must be examined for effectiveness, economy, and professional image. Comparative tests are needed which include all the methods. Two critical factors in the economy of a method are labor and equipment. The tree care industry needs its sign of professionalism for tree fertilization. It also needs to provide the service at an acceptable price. Professional image is difficult to earn when the person is doing essentially the same thing that a customer can do himself. The most unique method having the characteristics necessary for customer identification is the soil injection method.