

Section II:

BMP'S FOR SEEDING & REVEGETATION

Contents and Applicability

Best Management Practices (BMP's):

- II.1 Topsoiling.** Placement of topsoil over a prepared subsoil for the purpose of enhancing revegetation conditions.
- II.2 Seedbed Preparation.** Preparation of the soil surface to provide better plant growth conditions prior to seeding.
- II.3 General Planting and Seeding Specifications.** Information applicable to revegetating disturbed lands.
- II.4 Broadcast Seeding.** Planting seed by scattering seed over the surface of the soil. This seeding method is most useful on small sites, for repairing damage, or for very large, low angle rock areas.
- II.5 Drill Seeding.** Planting seed with an agricultural drill. This seeding method is most useful on large, low angle sites with loose, non-rocky soil.
- II.6 Vegetative Planting.** The method for planting living plants and trees.
- II.7 Willow Cutting Establishment.** The method for selecting and planting willow cuttings.
- II.8 Fertilizer Use.** General guidelines for use of fertilizer. Specific techniques for fertilizer use with revegetation methods using seed or live plants.
- II.9 Maintenance of Revegetated Areas.** Protective measures, irrigation, fencing, fertilization and repair measures for areas being revegetated.

BMP'S FOR SEEDING AND REVEGETATION

II.1 Topsoiling

Topsoiling is the placement of topsoil or other suitable plant growth material over a prepared subsoil.

Purpose: To provide a suitable soil medium for vegetative growth.

Specifications:

The practice is recommended on slopes 2:1 or flatter where the native soil is unsuitable for vegetative growth. Topsoiling may only consist of replacing topsoils that were stripped and stockpiled during initial development activities. Topsoil should be a loam consisting of varying proportions of organic matter, clay, silt, and sand. It should be free of stones, weeds, and inorganic debris. In most mining operations, the top six (6) to twelve (12) inches of soil is stockpiled as topsoil.

Care must be taken when applying topsoil so it is not laid on top of a subsoil of contrasting texture. This could cause the topsoil to slough if water flows between the topsoil and the subsoil.

The following guidelines should be considered when replacing topsoil. However, site specific conditions will have an impact on topsoil availability and application rates.

1. The existing grade of the subsoil should be maintained.
2. Lime may need to be applied to acidic soil to adjust the pH to a more neutral pH of around 7.
3. Topsoil should be uniformly distributed at a minimum compaction depth of two (2) inches (6 to 12 inches is preferred) on slopes graded 3:1 or steeper. It should reach a depth of four (4) inches on slopes flatter than 3:1.
4. Topsoil should not be applied when the subsoil is frozen or extremely wet.
5. The operator should plan on a reduction in soil volume between salvage, stockpiling, and replacement activities. This volume loss could be as much as thirty percent.

BMP'S FOR SEEDING AND REVEGETATION

II.2 Seedbed Preparation

Seedbed preparation entails preparing the soil by ripping, discing, scarifying, and adding soil amendments to make the soil more productive and enhance revegetation efforts.

Purpose: To promote successful revegetation efforts by preparing the soil for planting and creating proper seedbed conditions.

Specifications:

Seed bed preparation is applicable for all sites to be revegetated by seeding. Seed germination and seedling establishment are enhanced by loosening the surface of the soil by hand or machine raking prior to planting and then covering the seeds by raking or scarifying the soil to a depth of 1/4 to 1/2 inch. Good seed germination and establishment is also obtained by seeding on one (1) to six (6) inches of snow.

Seedbed preparation including weed control and soil tillage are essential for successful sowing and the establishment of seedlings. Weeds must be controlled by mechanical means or by spraying.

Good seedbed preparation may be difficult to achieve. Areas to be seeded should be ripped or scarified, to a minimum depth of three (3) inches. The soil should be worked to establish suitable conditions in which the seeding equipment can be operated. Areas to be seeded by broadcasting should be tilled immediately before seeding to a depth of two (2) inches, except on benches where no additional preparation is necessary or possible.

Seeding areas can be separated into the following types:

1. Rocky areas which are untillable.
2. Benched areas need no preparation as sloughing of soil from the bench above will tend to cover seeds.
3. Very steep areas (steeper than 2:1, a 50% slope, a 27° slope) are extremely difficult to seed. Hydro seeding or broadcast seeding should be used at these sites. Dragging a cleated cat track across slope will do a satisfactory job in loosening the soil.
4. Steep areas (between 2:1 and 3:1, between a 50% and a 33% slope, or between a 27° and a 18° slope) can be cat-walked up and down in most soils. This leaves a good seedbed by firming the loose soils and loosening the hard soils. This work should be completed immediately prior to seed application. Note: Rough, loose seedbeds on all steep slopes is important to help retain water, nutrients, and promote infiltration. Roughened seedbeds also help enhance hydroseeding efforts.

BMP'S FOR SEEDING AND REVEGETATION

- 5. Sloped areas (3:1 or flatter, less than a 33% slope, less than a 18° slope) can be prepared with conventional equipment such as discs, harrows, or rippers and a grader. Slopes that exceed 10° should be prepared with cleated equipment such as a sheep foot roller. Fill slopes, flatter than 3:1 may not need to be prepared before seeding, however, they should be checked for satisfactory seedbed conditions.**

BMP'S FOR SEEDING AND REVEGETATION

II.3 General Planting and Seeding Specifications

These are general guidelines that apply to all planting and seeding operations. They are designed to enhance the success of revegetation efforts. These guidelines are applicable to most revegetation and landscaping work.

The Soil Conservation Service (SCS) is a good source of information on seed and planting specifications in addition to Appendix D.

Seeding and Planting Guidelines:

1. Annual grasses and legumes are recommended for quick cover, rapid temporary soil protection, or as a nurse crop combined with slower growing perennials. Perennial grasses and legumes, shrubs and trees are for continual soil protection.
2. All grasses, legumes, shrubs, and trees used in revegetation should be certified as viable and be effective for erosion control and soil stabilization.
3. Most legumes should be inoculated with appropriate bacteria before seeding since many varieties will not germinate without being inoculated.
4. Trees and shrubs can be used to provide lasting vegetative stabilization and should protect the soil surface after the grasses and legumes decline. Trees and shrubs, however, may not survive in all climates, and species selection for reclamation should be based on site specific conditions. See appendix D.
5. Trees, shrubs, and grasses, used in revegetation, should be of a similar species to that existing prior to mining. This will assist in maintaining the biological integrity of the area being reclaimed.

Site Evaluation and Modification of Revegetation Methods:

1. Existing soil survey reports should be consulted for each revegetation site or area. All sites should be inspected and/or tested by a soil scientist for texture, organic matter content, drainage, slope, and aspect. Testing for potentially toxic elements, water holding capacity, and nutrient levels should be done by a soils lab.
2. When the pH of the soil is less than 5.5 (acidic soil), seedling establishment may be limited. Lime can be added to increase the soil pH to a more neutral pH of 7. Lime should be applied at a rate determined by soil testing and it should be tilled into the top four (4) to six (6) inches of soil. Powdered lime or waste treatment lime can be used.

BMP'S FOR SEEDING AND REVEGETATION

- 3. When the frost heave potential of the site is determined to be high to moderate, the following precautions should be taken:**
 - a. Planting and seeding should be conducted from May 1 to August 1. Supplemental irrigation will be required in this case for germination and seedling establishment.**
 - b. Mulch rates should be increased 50 percent over those specified in chapter 1, to 3 tons of straw per acre.**
 - c. Areas damaged by frost heaving (after the initial seeding season) should be repaired to original specifications, if possible. The mulch rate on the repaired area should be 50 percent greater than the original application rate.**
 - d. Follow-up application of fertilizer should be made each spring for the first two (2) years following the initial seeding to help plants establish and maintain vigorous growth and develop extensive root systems which will help to stabilize the soil.**

Some seeds require pretreatment prior to planting. Check with seed suppliers to ascertain the need for and/or acquire treated seed. Shrubs and trees may be seeded or planted from bare root or potted stock. Cuttings from some species can also be taken from native stock adjacent to the area and planted in moist ground. Bare root shrubs and trees should be kept bundled and in cold storage prior to receipt and before planting. Potted trees and shrubs should be stored in the shade, outdoors, and should be sprinkled periodically with water to keep the soil moist.

Season of Seeding:

Selection of the proper season for seeding is vital in ensure successful revegetation. Even if all other conditions are satisfactory, if the timing of the seeding is poor, the seedlings are likely to die. Seeding in the fall is preferable. Early spring seeding is also acceptable.

Fall seeding is most successful in Idaho. Field experience has shown that seeding on one (1) to six (6) inches of snow over freshly scarified soil produces excellent germination. Spring seeding is most successful on northern facing exposures. Generally, the greatest potential for seeding failure is from freezing of the young plants prior to establishment.

When seeding in the spring, moisture conditions may not be adequate for establishment. In this case, the seedlings may not survive dry summer weather.

BMP'S FOR SEEDING AND REVEGETATION

II.4 Broadcast Seeding

Broadcast seeding is the process of uniformly casting seeds and fertilizer on the soil by hand or mechanical means.

Purpose: Broadcast seeding is employed when seeding grasses, shrubs, forbes, or trees on flat surfaces and slopes where other seeding methods are not appropriate. Broadcast seeding is well suited for use on steep slopes, rocky areas, abandoned roadways, sites with limited access, and where hand labor is used.

Specifications:

The following procedures are recommended for the most successful application and growth. These procedures should be followed only after the seedbed has been prepared:

1. Apply fertilizer and work it into the soil. Fertilizer can also be applied either at the same time or after the seeds have been broadcast. Check the soil analysis for fertilizer application rate.
2. Apply seed by either wet (hydroseeding) or dry broadcasting. Seeds placed in a hydroseeder should be used within 30 minutes of having been put in water. In general, broadcast seeding rates must be twice the drill seeding rate.
3. Where applicable and if mulch is not going to be applied, lightly rake over the broadcast seed. The soil cover will help protect the seed and facilitate germination. Seeds covered with 1/4 to 1/2 inch of soil will have a better germination rate than those left on the surface of the ground.
4. Apply mulch, when necessary, either by hand or with a mechanical mulcher.
5. On steep slopes that are inaccessible, and where other methods are impractical, seeding should be done with a hydromulcher or by broadcasting.

BMP'S FOR SEEDING AND REVEGETATION

II.5 Drill Seeding

Drill seeding is the process of planting seed and fertilizer using an agricultural or rangeland drill seeder.

Purpose: This method is most effective on flat, non-rocky surfaces. Drill seeding provides the maximum possibility for successful germination and growth, with a minimum investment in fertilizer, seed, and labor because seeds are not damaged or carried away by wind, water, animals, or birds.

Specifications:

The following procedures are recommended for the most successful application and growth rate:

1. The soil must be loose enough to allow penetration of the drill disc to a depth of approximately two (2) inches. This will help ensure that seeds are not planted too deep or left on the surface of the ground.
2. Fertilizer should be applied at specified rates after soil analysis at an appropriate soil laboratory.
3. On steep slopes where drilling equipment cannot be used, broadcast seeding methods should be utilized.

BMP'S FOR SEEDING AND REVEGETATION

II.6 Vegetative Planting

Vegetative planting means the establishment of vegetation by planting trees and shrubs from nursery stock or transplants.

Purpose: Planting vegetation is an effective means of promoting soil stability and controlling erosion; however, until establishment is complete the site is vulnerable to erosion. Trees and shrubs should be planted in conjunction with grasses and legumes to enhance the overall effectiveness of soil stabilization efforts and erosion control measures.

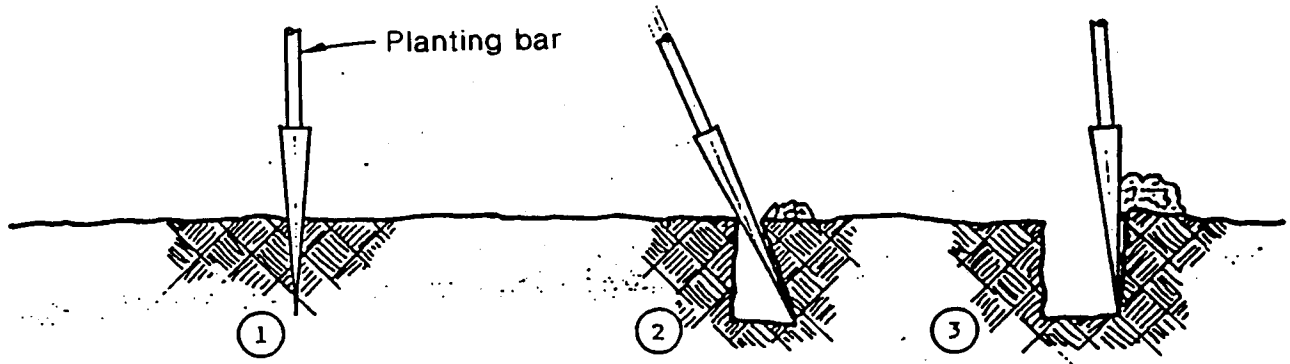
Specifications: (See Figure II-6)

The following procedures are recommended for the most successful establishment of vegetation:

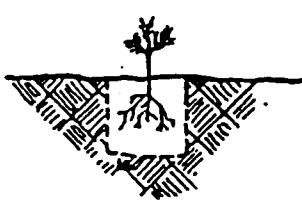
1. Choose plant species native to the area and that match specific habitats. The type of vegetation planted may be dependent on the intended use of the site following reclamation. In this case, native vegetation might not be the preferred alternative.
2. Planting holes should be prepared as shown in Figure II-6. Seedlings should be placed in the hole so the crown of the plant is at the surface of the soil. The roots should not be folded and there should be no air space around the roots.
3. Planting should be supervised by someone skilled in revegetative techniques.
4. Fertilizer should be applied as specified by the manufacturer or in accordance with soil testing results.
5. The survival rate of vegetation will be increased if plants are irrigated regularly during the first two (2) years after planting.

Maintenance: Adequate maintenance following planting is absolutely essential for maximum success of the revegetative efforts. Fencing may be required to protect planted areas where there is livestock grazing or wildlife use.

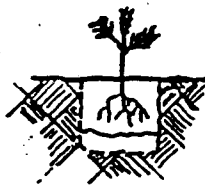
BMP'S FOR SEEDING AND REVEGETATION



PREPARATION OF PLANTING HOLE USING PLANTING BAR



CORRECTLY PLANTED



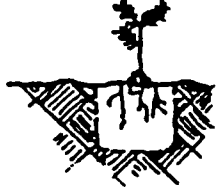
Air space



Roots folded



Too deep



Too shallow

INCORRECTLY PLANTED

11.7 Willow Cutting Establishment

Willow cutting establishment is the process of selecting and planting willow cuttings to help stabilize streambanks. Planting willow can also enhance fish and wildlife habitat.

Purpose: To stabilize streambanks and other reclaimed areas adjacent to water.

Specifications:

Planting of willow cuttings is recommended when completing streambank stabilization efforts or in areas adjacent to water where there is enough moisture for cuttings to take hold and grow.

The guidelines listed below should be followed when selecting and planting willow cuttings:

1. Select varieties that are indigenous to the area in which you wish to re-establish willows. Select varieties compatible with your objective and the stream size, i.e. shrubby types for outside curves, tree types for shade areas, small varieties for small streams.
2. Cuttings should have smooth bark and should come from willow stock two years or older.
3. Make cuttings at joint or at ground level so the natural appearance of the parent plant is preserved. Trim back root end to a diagonal cut, approximately one-half inch below a leaf node.
4. Cover top of cutting with pruning seal or latex paint immediately after cutting. This will help prevent damaging the cuttings and ensure they are oriented correctly when planted. Remove all leaves and side branches and keep at least the bottom one-third of the cutting emersed in water. If cuttings must be stored for more than a week, wrap bundled cuttings with burlap and store in a cool place. Soak stored cuttings in water for 24 hours before planting.
5. Cuttings must be planted in soil that will remain moist during the growing season. Cuttings need to be anchored or protected against erosion until established. Do not leave air pockets around cuttings.
6. Cuttings should be long enough so one or two bud nodes are in permanent contact with moisture. Three to four bud nodes should be above ground.

BMP'S FOR SEEDING AND REVEGETATION

- 7. Plant shrubby type willows one - three feet apart. Plant in a random pattern. Avoid planting in rows. Cuttings can be planted in shallow trenches along stream banks. They can also be anchored in holes excavated below the scour line (scour - to clear, dig or remove by a powerful current of water) in the channel bottom adjacent to the bank.**

For more detailed information on willow planting, contact the Aberdeen Plant Material Center, Aberdeen, Idaho, or the Idaho Department of Water Resources.

II.8 Fertilizer Use

The following guidelines can be used to select fertilizer types. The guidelines will help prevent improper or excessive use of fertilizer that may result in water quality impacts or damage vegetation. The techniques are applicable to all revegetation efforts.

Purpose: Fertilizer(s) should only be used when soils are deficient in nutrients which retard or impair vegetative growth. The use of fertilizer will promote revegetation efforts if the proper type and amounts are applied.

Specifications:

The following guidelines pertain to types of fertilizer:

1. **Slow release fertilizer.** This type of fertilizer is one of the most reliable methods of providing nutrients for plants. It is best adapted to application during seeding, vegetative planting and maintenance of established vegetation. Recommended application rates are usually specified on the fertilizer container.
2. **Fast release fertilizer.** This type of fertilizer releases nutrients rapidly, making them available for immediate use by plants, which makes it most adaptable to maintenance operations after vegetation has been established. When fast release fertilizer is applied at the same time as seeds, nutrients can be leached out of the ground before the seeds germinate. Application rates are usually specified on the fertilizer container. If fast release fertilizer is needed, choose a type that contains nitrogen, phosphorus, and sulfur. Nitrogen maintains plant growth and phosphorus aids in root establishment and initial plant growth. Sulfur should be included in the fertilizer as some soils are deficient in this nutrient.
3. **If fertilizer is applied at the recommended rate and fails to promote or increase vegetative growth over that which would occur naturally, do not apply more fertilizer. Instead, have the soil tested and follow the recommendations of the test report.**
4. **Excessive or incorrect use of fertilizer can cause more harm than good. For example, excessive nitrogen can kill seedlings, particularly in dry areas. Fertilizer should be applied, by broadcast methods, after seeding has been completed. Operations which apply fertilizer, usually apply between four hundred (400) and one thousand (1000) pounds per acre. Note: Fertilizer type and application rate should be based on soil tests.**

BMP'S FOR SEEDING AND REVEGETATION

II.9 Maintenance of Revegetated Areas

Maintenance can include, but is not limited to, irrigating, fencing, fertilizing, and repairing revegetated areas to help ensure the success of revegetation efforts. These measures should be applied to sites revegetated within the past one (1) to five (5) years.

1. **Irrigation:** Provisions for irrigation, especially on dry lands, should be included in the initial reclamation plan. On areas that will require irrigation to ensure that the plants or seeds do not die, the following measures should be taken:
 - a) **Keep the soil moist from planting time until the seeds germinate.**
 - b) **Water frequently during the growing season so that the soil retains enough moisture to ensure plant growth. Try to coordinate irrigation with natural precipitation so the site is not over-watered.**
 - c) **During the second growing season, after plants are established, the frequency of watering can be reduced. This will help plants become accustomed to natural conditions but it will provide sufficient water for growth during the season.**
2. **Fencing:** All revegetated areas that are potentially subject to heavy use by either livestock or wildlife before the plants have become established, should be fenced to ensure adequate regeneration.
3. **Fertilizing:** In some instances it is beneficial to apply fertilizer after the first growing season to help ensure and enhance revegetative efforts. Site specific conditions and soil testing should dictate whether fertilizer should be applied and at what application rates.
4. **Repairs:** Repairs could include reseeding, repairing damage caused by wind and water erosion or damages caused by animals and man. All damage should be repaired as soon as possible after it occurs. Site specific conditions will dictate what repairs are necessary.