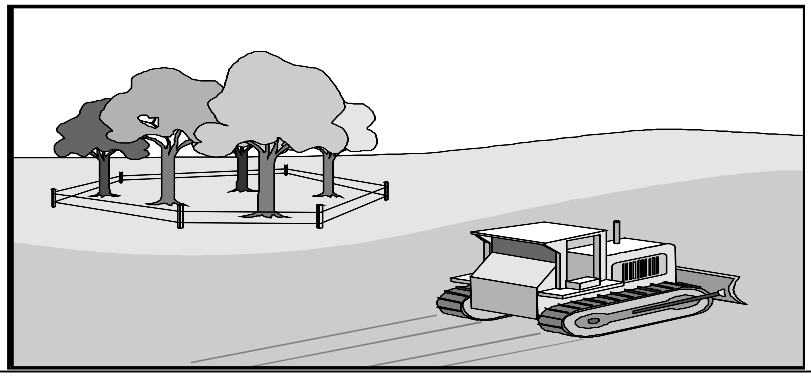
ACTIVITY: Mulching

TCP – 08



Targeted Constituents				
● Significant Benefit	◗ Partial Benefit	○ Low or Unknown Benefit		
● Sediment	○ Heavy Metals	○ Floatable Materials	○ Oxygen Demanding Substances	
◗ Nutrients	○ Toxic Materials	○ Oil & Grease	○ Bacteria & Viruses	○ Construction Wastes

Implementation Requirements				
● High	◗ Medium	○ Low		
◗ Capital Costs	◗ O & M Costs	◗ Maintenance	● Suitability for Slopes >5%	○ Training

Description

Mulching is used to temporarily and permanently stabilize cleared or freshly seeded areas. Types of mulches include organic materials, straw, wood chips, and bark or other wood fibers. This management practice is likely to create a significant reduction in sediment and a partial reduction in nutrients.

Suitable Applications

- Temporary stabilization of freshly seeded and planted areas.
- Temporary stabilization during periods unsuitable for growing vegetation.
- Temporary stabilization of areas that cannot be seeded or planted (e.g., insufficient rain, steep slope, non-growth season).
- Areas which have been permanently seeded to assist in retaining moisture, and to hold seedings.
- On poor or marginal soils to add organic matter and fertility as strategy to speed the establishment and increase the survival of temporary and/or permanent vegetative cover.
- As short term, non-vegetative ground cover on steepened slopes to reduce rainfall impact, decrease the velocity of sheet flow, and settle out sediment.
- As long term, non-vegetative ground cover around established plants, such as trees or shrubs, and on flat to minor slopes not otherwise protected.
- Apply to planting areas where slopes are 2:1 (H:V) or less steep. Tacking agents or devices may be necessary for steeper slopes.
- Areas where climatic conditions require a soil moisture retention aid to avoid cracking of the soil and associated compaction, and require soil temperature

modification.

- As an alternative to nets and mats as presented in TCP-09.

Approach

Mulch prevents erosion by protecting the soil surface from rain and runoff impact and fostering growth of new seedings that do not stabilize by themselves. Organic mulch materials, such as straw, wood chips, bark and wood fiber, have been found to be most effective where re-vegetation will be provided by reseeding. The choice of mulch should be based on the size of the area, site slopes, surface conditions such as hardness and moisture; weed growth and availability of mulch materials.

- May be used with netting to supplement soil stabilization.
- Binders may be required for steep areas, or if wind and runoff is a problem.
- Type of mulch, binders, and application rates should be recommended by manufacturer/contractor.

Mulch Selection

There are many types of mulches, and selection of the appropriate type should be based on the type of application and site conditions. The following criteria should be considered in selection of the appropriate mulch:

- Effectiveness
  - Reduction of erosion
  - Reduction of flow velocity
  - Reduction of runoff
- Vegetation Enhancement
  - Native plant compatibility
  - Germination rate
  - Growth rate
  - Moisture retention
  - Temperature modification
  - Open space/coverage
  - Nutrient uptake
- Operation and Maintenance
  - Maintenance frequency
  - Need for fertilization
  - Need for irrigation

Application Procedures

The construction-application procedures for mulches vary significantly depending upon the type of mulching method specified. Six (6) methods are highlighted here:

Vegetable Fibers (Hay or Straw): Loose hay and/or straw are the most common mulch materials used in conjunction with direct seeding of soil. Straw mulch is a good short-term protection most commonly used with seeding. The mulch should be from the

current season's crop. A letter of certification from the supplier should be required to show that the straw was baled less than 12 months from the delivery date. Wheat or oat straw is recommended.

- Mulching is generally the second part of a multi-step process which should be implemented as follows:

  - Apply seed and fertilizer to the bare soil.
  - Immediately apply loose hay or straw over the top of the seed/fertilizer at a rate of 4,500 kg/ha (2 tons/ac) either by machine or by hand distribution.
  - The mulch must be evenly distributed on the soil surface such that 80 to 90% of the ground is covered.
  - Anchor the mulch in place by using a tacking agent, netting, or "punch it" into the soil mechanically. On small areas and/or steepened slopes, straw or hay can also be held in place using plastic netting or jute. The netting should be held in place using 11 gauge wire staples, geotextile pins or wooden stakes (See Geotextiles TCP-10).
  - Where slopes are too steep to support construction equipment or areas of application too large to allow cost-effective use of nettings, straw or hay should be held in place using any number of tacking agents which act to glue the vegetable fibers together and to the soil surface. The tacking agents should be selected on the basis of their longevity and ability to hold the fibers in place until vegetation is established through the mulch.
  - Maximum fiber length shall be maintained and average fiber length should be greater than 6 in. (150 mm).

- "Green" Material: This type of mulch is produced by recycling of vegetation trimmings such as grass, shredded shrubs and trees. Methods of application are generally by hand, although pneumatic methods are currently being developed.

  - It can be used as a temporary ground cover with or without seeding.
  - The green material should be evenly distributed on site to a depth of not more than 4 in. (100 mm).
  - Anchoring green material in place with a tacking agent is necessary on steep slopes and in areas where overland sheet flow is anticipated.

- Wood/Bark Chips: Wood and bark chips are suitable for application in landscaped areas that will not be closely mowed. Wood chips do not require tacking, but do require nitrogen treatment (12 pounds/ton) to prevent nutrient deficiency. Bark chips do not require additional nitrogen fertilizer. When the wood source is near the project site, wood and bark chips can be very inexpensive. Caution must be used in areas of steep slopes, since both wood and bark chips tend to wash down slopes exceeding 6 percent. Suitable for areas that will not be mowed closely or for ground cover in ornamental or landscape plantings.

  - Soils must be tested before application to determine if nitrogen must be added to prevent nutrient deficiency in plants.
  - Wood/bark chips not suitable for steep slopes.
  - Should be distributed by hand (although pneumatic methods are currently being developed).
  - The mulch should be evenly distributed across the soil surface to a depth of 2

in. (50 mm) to 3 in. (75 mm).

- Hydraulic Mulches (made from recycled paper): This mulch is made from recycled newsprint, magazine, or other waste paper sources. This type of mulch is to be mixed in a hydraulic application machine (hydroseeder) and applied as a liquid slurry which contains the recommended rates of seed and fertilizer for the site. It can be specified with or without a tacking agent. The mulch should be mixed with seed and fertilizer as specified and applied at a rate recommended by the manufacturer in order to achieve uniform, effective coverage.

- Hydraulic Mulches (made from wood fiber): This type of mulch is manufactured from wood waste from lumber mills or from urban sources. This type of mulch is mixed in a hydraulic application machine (hydroseeder) and applied as a liquid slurry which contains the recommended rates of seed and fertilizer for the site.

- Wood fiber mulches consist of specially prepared wood fiber processed to contain no growth germination inhibiting factors. The mulch should be from virgin wood, and be manufactured and processed so the fibers will remain in uniform suspension in water under agitation to form a homogenous slurry. The fiber lengths should be as long as possible to increase the effectiveness for erosion control. Wood fiber mulching should not be used in areas of extremely hot summer and late fall seasons because of fire danger. When used as a tacking agent with straw mulch, wood fiber mulches are good for steep slopes and severe climates.

  A wood fiber mulch can be manufactured containing a tacking agent in each bag or specified without a tacking agent. A typical construction specification and application for wood fiber mulch is as follows:

  - 100 % wood fiber.
  - Moisture content (total weight basis) not to exceed 12% ± 3%.
  - Organic matter content (oven dry weight basis) = 99.3% minimum.
  - Inorganic matter (ash) content (oven dried basis) = 0.7% maximum.
  - pH = 4.9 ± 10% for a 3% water slurry.
  - Water holding capacity (oven dried basis) minimum 1.2 gal/lb. (10 liters/kg) of fiber.
  - The mulch shall be mixed with seed and fertilizer as specified and applied at a rate recommended by the manufacturer in order to achieve uniform, effective coverage and provide adequate distribution of seed.

- Hydraulic Matrices: This mulch category includes hydraulic slurries composed of wood fiber, paper fiber or a combination of the two held together by a binder system. A hydraulic matrix can be formulated using varying quantities of these components. A typical mixture applied on a per hectare basis (per acre) basis is as follows:

  - 500 lbs./ac. (550 kg/ha) wood fiber mulch.
  - 1,000 lbs./ac. (1,100 kg/ha) recycled paper mulch.
  - 55 gal./ac. (500 L/ha) acrylic copolymer w/ minimum 55% solids content.
  - Hydraulic matrix applied as aqueous slurry (with seed) using standard hydroseeding equipment to provide immediate dust control, temporary erosion control, and stabilization until permanent vegetation is reestablished.

Another category of hydraulic matrices is known as a Bonded Fiber Matrix (BFM). Rather than mix components from various manufacturers to create a hydraulic matrix, all fiber and binders are contained in one bag. Typical design guidance for a BFM is as follows:

- The BFM should be a hydraulic matrix which, when applied and upon drying, adheres to the soil to form a 100% cover which is biodegradable, promotes vegetation, and prevents soil erosion.
- The matrix should have no holes > 1 mm (4×10^{-3} in.) in size.
- The matrix should have no gaps between the product and the soil.
- The BFM should be comprised of long strand, thermally produced wood fibers passing a freeness test of 760 cc (MLS) level or below (>88% of total volume by weight) held together by organic tacking agents (10%) and mineral bonding agents (<2%) which upon drying becomes insoluble and non-dispersible.
- The material when mixed into a liquid slurry, should pass a free liquid quality control test.
- The binder should not dissolve or disperse upon watering.
- The matrix should have a minimum water holding capacity of 1.2 gal./lb. matrix (10 L/kg matrix).
- The matrix should have no germination or growth inhibiting factors and should not form a water insensitive crust.
- The matrix should be comprised of materials which are 100% biodegradable and 100% beneficial to plant growth.
- The BFM should be installed by an applicator trained in proper mixing and application of the product.
- The BFM should not be applied immediately before, during or immediately after rainfall so that the matrix will have an opportunity to dry for 24 hours after installation.

Maintenance

- Must be inspected weekly and after rain for damage or deterioration.
- Maintain an unbroken, temporary mulched ground cover throughout the period of construction that the soils are not being reworked. Inspect before expected rainstorms and repair any damaged ground cover and remulch exposed areas of bare soil.

Limitations

- Organic mulches are not permanent erosion control measures.
- Mulches tend to lower the soil surface temperature, and may delay germination of some seeds.
- Vegetable Fibers (Hay or Straw) - A machine and labor intensive practice that requires either proper crimping or use of tacking agents. Hay stays flexible longer than straw, but is more likely to contain weed and other unwanted seed.
- Recycled Paper Hydraulic Mulches - Can be applied rapidly on any large ground surface area. Short fiber length limits erosion control effectiveness unless applied with tackifier and in heavy layers.
- Wood Fiber Based Hydraulic Mulches - Can be applied rapidly on any large

ground surface area. Has longer fiber length than recycled paper-based products, but also has limits on erosion control effectiveness unless applied with tacking agents and in heavy layers.

- Hydraulic Matrices - Behave like erosion control blankets, but can be applied much more rapidly. Need 24 hours to dry before rainfall occurs to be effective.

Primary References

California Storm Water Best Management Practice Handbooks, CDM et.al. for the California SWQTF, 1993.

Caltrans Storm Water Quality Handbooks, CDM et.al. for the California Department of Transportation, 1997.

Subordinate References

Best Management Practices and Erosion Control Manual for Construction Sites, Flood Control District of Maricopa County, September 1992.

Controlling Erosion of Construction Sites, U.S. Department of Agriculture, Soil Conservation Service, Agriculture Information #347.

"Draft-Sedimentation and Erosion Control, An Inventory of Current Practices", U.S.E.P.A., April, 1990.

"Environmental Criteria Manual", City of Austin, Texas.

Guides for Erosion & Sediment Control in California, USDA Soils Conservation Service – January 1991.

Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, June 1981.

Proposed Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters, Work Group Working Paper, USEPA, April, 1992.

Soil Erosion by Water, U.S. Department of Agriculture, Soil Conservation District, Agriculture Information Bulletin #513.

Stormwater Management Water for the Puget Sound Basin, Washington State Department of Ecology, The Technical Manual – February 1992, Publication #91-75.

Tennessee Erosion and Sediment Control Handbook, Tennessee Department of Environment and Conservation, July 1992.

Water Quality Management Plan for the Lake Tahoe Region, Volume II, Handbook of Management Practices, Tahoe Regional Planning Agency – November 1988.