LAND RECLAMATION, CURRENTLY MINED LAND  
(Ac.)

CODE 544

DEFINITION
Reclamation of currently mined land to an acceptable form and planned use.

PURPOSE
• Prevent negative impacts to soil, water and air resources in and near mined areas
• Restore the quality of the soils to their pre-mining level
• Maintain or improve landscape visual and functional quality

CONDITIONS WHERE PRACTICE APPLIES
This practice applies to currently mined land. It includes the identification, removal, stockpiling and replacement of soil materials, and revegetation. This practice also applies to nearby non-mined areas adversely affected by the mining activities.

CRITERIA
General Criteria Applicable to All Purposes
Plans must comply with all applicable Federal, State and local laws and regulations relating to mining and mined land reclamation. Applicable laws and regulations include but are not limited to the following.
• Surface Mining Control and Reclamation Act of 1977 (SMCRA), 30 U.S.C. 1201 et seq. (regulates coal mining operations)
• Federal regulations 30 CFR 785.17, 816.22, and Part 823 (requirements and standards for surface coal mining and reclamation operations on prime farmland).
• Federal Register Vol. 64, No. 124, Tuesday, June 29, 1999/Notices, pages 34770-34778 (NRCS specifications for soil handling on relation to surface coal mining activities on prime farmland).
• 30CFR780.15 (Air pollution control plan)
• 30CFR701.5 (Definitions: Fugitive dust)
• The California Surface Mining and Reclamation Act of 1975 (SMARA)

Develop a reclamation plan that is consistent with the site capability, the planned land use and the landowner’s conservation objectives. Include the practices necessary to reclaim and stabilize the mined areas to prevent further degradation of soil, water, air, plant and animal resources.

Dust control
Control the generation of particulate matter and fugitive dust during removal and replacement of soil and other materials. Detail the practices and activities necessary for dust control in the plans and specifications.

Site preparation
Properly identify areas for preservation including those containing trees, vegetation, historic structures, stream corridors, natural springs or other important features.

Remove trees, logs, brush, rubbish and other debris from disturbed areas that will interfere with reconstruction and reclamation operations. Dispose of these undesirable materials so they will not create a resource problem or interfere with reclamation activities and the planned land use.
Land Shaping and Erosion and Sediment Control
Shape the land surface to provide adequate surface drainage and to blend into the surrounding topography. Use erosion control practices where estimated rates of sheet and rill erosion exceed acceptable levels.

Use sediment trapping practices such as filter strips, riparian forest buffers, contour buffer strips, sediment basins, or similar practices as appropriate, to trap sediment before it leaves the project site. Establish drainage ways with sufficient capacity and stability to carry concentrated runoff from the reclaimed area into receiving streams without causing excessive erosion.

Establishment of vegetation
Do site preparation, planting and seeding at a time and in a manner to ensure survival and growth of the selected species. In the plans and specifications, identify the criteria for successful establishment of vegetation such as minimum percent ground/canopy cover, percent survival or stand density.

Apply soil amendments and or plant nutrients as appropriate, according to the requirements of Conservation Practice Standard 590, Nutrient Management. If the recommended fertilizer rate exceeds the criteria in Conservation Practice Standard (590) Nutrient Management, use appropriate mitigating practices to reduce the risk of nutrient losses from the site.

Select plant materials suitable for the specified end land use according to local climate potential, site conditions and local NRCS criteria. Identify in the plans and specifications the species, rates of seeding or planting, minimum quality of planting stock, such as PLS or stem caliper, and method of establishment. Use only viable, high quality seed or planting stock.

Use local NRCS criteria for seedbed preparation, seeding rates, planting dates, depths and methods.

Additional Criteria to Restore the Quality of Soils to Their Pre-mining Level

Removal of soil material for reconstruction
Complete a detailed soil survey of the proposed mine area if suitable soils information is not available. Use the soil survey information to determine the extent and location of prime farmland soils.

If the area is prime farmland follow a reclamation plan prepared according to 30 CFR Part 823.

For soils that are not prime farmland, develop a reclamation plan prepared according to 30 CFR Parts 780 and 816.

Remove all upper soil horizons from the project area that are suitable for reconstruction before blasting, mining, or any surface disturbance other than removal of woody plants and debris.

Separate soils identified with high electrical conductivity, calcium carbonate, sodium, or other restrictive properties, and treat as appropriate and practicable.

Removal of overburden material for use as topsoil
Selected overburden materials can be substituted for or added to the A and B horizons, if field observations and/or chemical and physical laboratory analyses demonstrate that the material (or a mixture of overburden and original topsoil) is suited to restoring the capability and productivity of the original A and B horizon material. Analyze overburden materials for pH, sulfide content, organic matter, nitrogen, phosphorus, potassium, sodium absorption ratio, electrical conductivity, texture and available water holding capacity. If the overburden material is determined to be suitable for topsoil, remove and separate from other materials and replace according to the requirements for topsoil placement.

Storage of soil materials
Stockpile soil materials to be used as topsoil until they are needed for reclamation. Locate stockpiles to protect against wind and water erosion, dust generation, unnecessary compaction and contamination by noxious weeds, invasive species or other undesirable materials.
Replacement of soil material
When placing cover materials, treat graded areas to eliminate slippage surfaces and promote root penetration before spreading topsoil.

Spread topsoil so the position and thickness of each horizon is equivalent to the undisturbed soil without causing excess compaction.

The moist bulk density and soil strength of the reconstructed soil must support plant growth at a level equivalent to that of a similar layer in undisturbed soil.

Additional Criteria to Maintain or Improve Landscape Visual and Functional Quality
Reclaim the site to maintain or improve visual quality based on the scenic quality of the reclaimed site as well as the function of the site for the end land use. Plan the reclamation to be compatible with the topography and land cover of the adjacent landscape. Focus on areas of high public visibility, and those offering direct or indirect human and wildlife benefits.

Grade and shape spoil piles and borrow areas to blend with the adjacent landscape topography to the extent practicable.

Develop a planting plan that mimics the species, arrangement, spacing and density of plants growing on adjacent landscapes. Choose native species of erosion control vegetation and other plant materials where practical. Arrange plantings to screen views, delineate open space, act as windbreaks, serve as parkland, wildlife habitat or protect stream corridors.

CONSIDERATIONS
Prior to mining develop a conservation plan that can be used by the land owner as a guide for the development of a reclamation plan with the mining company.

Avoid locating soil stockpiles, access roads, impoundments, and other practices in locations where they could trigger excessive runoff, erosion, and/or sedimentation delivered streams and/or offsite.

Soil permeability is often a problem on reclaimed soils. Improve soil permeability after placing backfill material by using tillage or deep ripping to decrease compaction and promote infiltration and root development when. Do not plan practices that promote infiltration if seepage through cover materials has the potential to increase acid mine drainage or otherwise negatively impact groundwater quality, or where soil has been compacted to meet strength or stability criteria for engineered measures.

Overburden materials are often toxic to plants. To determine the best materials to plant, conduct field-site or greenhouse grow-outs to determine the feasibility of using overburden materials.

The reclamation of mined lands provides an opportunity to increase carbon sequestration. Choose species such as deep rooted perennial grasses and trees to increase the carbon sequestration potential of the reclaimed site.

Reclaimed mine areas can provide important wildlife habitat. Improve the potential for wildlife habitat by establishing diverse vegetation types, including water in the reclaimed landscape, increasing edge effect and diverse land forms.. Avoid monocultures of vegetation.

Reclaimed soils are often low in organic matter. The use of organic soil amendments such as manure, compost, mulch or sewage sludge can contribute to the success of vegetative establishment by increasing soil organic matter.

Unless an extensive program is undertaken to change the chemistry of a serpentine site, the site indigenous vegetative species are typically the best choice for rehabilitation of that site. These plants are adapted to the stressful soil environment, but tend to be very slow growing. Consider the need for additional erosion control measures in these situations (Newton and Claassen, 2003.)

Every effort should be made to utilize native, non-invasive vegetative species and control the spread of invasive undesirable species. Where appropriate, wash all equipment utilized in the project activities before leaving the site.

NRCS, CA
September 2007
Monitoring and maintenance activities will need to be done on a regular basis after the initial reclamation to ensure success. Include stabilized access roads to allow access to the site without causing erosion problems.

**Cultural Resources Considerations**

NRCS policy is to avoid any effect to cultural resources and protect them in their original location. Determine if installation of this practice or associated practices in the plan could have an effect on cultural resources. The National Historic Preservation Act may require consultation with the California State Historic Preservation Officer.

http://www.nrcs.usda.gov/technical/cultural.html is the primary website for cultural resources information. The California Environmental Handbook and the California Environmental Assessment Worksheet also provide guidance on how the NRCS must account for cultural resources. The e-Field Office Technical Guide, Section II contains general information, with Web sites for additional information.

Document any specific considerations for cultural resources in the design docket and the Practice Requirements worksheet.

**Endangered Species Considerations**

If during the Environmental Assessment NRCS determines that installation of this practice, along with any others proposed, will have an effect on any federal or state listed Rare, Threatened or Endangered species or their habitat, NRCS will advise the client of the requirements of the Endangered Species Act and recommend alternative conservation treatments that avoid the adverse effects. Further assistance will be provided only if the client selects one of the alternative conservation treatments for installation; or with concurrence of the client, NRCS initiates consultations concerning the listed species with the U.S. Fish and Wildlife Service, National Marine Fisheries Service and/or California Department of Fish and Game.

**PLANS AND SPECIFICATIONS**

Prepare plans and specifications for each treatment unit according to the Criteria, Considerations and Operation and Maintenance sections of this standard.

As a minimum include the following information in the plans and specification for the reclamation area:

- Location of the reclamation area
- Plans showing the final grading to take place on the reclamation area
- The location of topsoil stockpiles
- The location of erosion and sediment control practices
- Detail information for the installation of erosion and sediment control practices
- Detail information on the soil amendments to be applied to the site
- Detail information on the species and arrangement of plant materials to be planted on the site

**OPERATION AND MAINTENANCE**

Prepare an Operation and Maintenance plan that provides specific details concerning conservation practices identified in the reclamation plan. As a minimum include the following items in the operation and maintenance plan.

- Periodic checking of the site for areas where settlement may adversely affect drainage and land use.
- Periodic checking of the site for bare spots, eroded areas, areas of excessive settlement and other areas where initial attempts to establish vegetation were not successful.
- Periodic soil testing and checking of vegetation to determine if additional soil amendments are needed.
- Maintenance of access roads.
- Maintenance of drainage structures and channels.
• Periodic checking of the site for noxious
weeds and invasive species.
• Control of vehicular traffic to minimize
disturbance to reclaimed areas.

REFERENCES

Soil Survey Division Staff. 1993. Soil Survey
http://soils.usda.gov/technical/manual/

National Cultural Resources Procedures
Handbook 2003. USDA, Natural Resources
Conservation Service, Washington D.C.

National Agronomy Manual Part 501, Water
Erosion. 2002. USDA Natural Resources
Conservation Service, Washington D.C. and
Part 502, Wind Erosion. 2002. USDA Natural
Resources Conservation Service, Washington
D.C.,
http://policy.nrcs.usda.gov/media/pdf/M_190_NAM.pdf

Revised Universal Soil Loss Equation, Ver. 2
(Rusle 2). 2004. USDA Natural Resources
Conservation Service, Washington D.C.,
http://fargo.nserl.purdue.edu/rusle2_dataweb/
RUSLE2_Index.htm

Wind Erosion Equation (WEQ) Guidance
Document. 2003. USDA Natural Resources
Conservation Service, Washington D.C.,
http://www.nrcs.usda.gov/technical/ECS/agronomy/
WEQGuidance.doc

Landscape Design in Mined Land
Reclamation, LAN-1, 1983, National Technical
Information Service, USDA NRCS
Conservation Engineering Division,
Washington, D.C.

Procedures to Establish Priorities in
Landscape Architecture, TR-65 1978, National
Technical Information Service, USDA NRCS
Conservation Engineering Division,
Washington, D.C.,
http://www.info.usda.gov/CED/ftp/CED/tr65.pdf,

Surface Mining and Reclamation Act of 1975
and Associated Regulations. Revised January
2007. California Department of Conservation,
Office of Mine Reclamation, Sacramento, CA.
http://www.consrv.ca.gov/OMR/smara/

Rehabilitation of Disturbed Lands in California:
California Geological Survey Special
Publication 123 by G.A. Newton and V.P.
Claessen, Sacramento, CA.
http://www.consrv.ca.gov/OMR/qh_publications.htm

NRCS, CA
September 2007
Properly operated and maintained currently mined land project is an asset to your farm. This project was designed and installed to prevent negative impacts to soil, water, and air resources in and near mined areas, to restore the quality of the soils to their pre-mining level, and to maintain or improve the visual quality of the landscape.

The estimated life span of this installation is at least 10 years. The life of this installation can be assured and usually increased by developing and carrying out a good operation and maintenance program.

This practice will require you to perform periodic operation and maintenance to maintain satisfactory performance. Here are some recommendations to help you develop a good operation and maintenance program.

**GENERAL RECOMMENDATIONS**

- Maintain appropriate warning signs.
- All fences, railings, and/or warning signs shall be maintained to prevent unauthorized human, vehicle or livestock entry.
- Inspect project site yearly and fill areas where settlement is adversely affecting drainage and land use.
- Add soil amendments to soils that cannot support adequate vegetation or replace them with suitable soil material.
- Inspect haul roads and approaches to and from the project frequently to determine the need for stabilizing materials. Repair as needed.
- Inspect drainage structures and channels. Remove any obstructions to keep structures and channels clean and functional. Take corrective actions to address any erosion that occurs.
- Visually inspect grazed land. Take corrective actions to address any erosion that occurs. Seek the advice of the local NRCS for proper grazing practices to eliminate any future erosion.
• Inspect project area after heavy rains. Promptly repair any damage. Fill rills and gullies that occur and re-vegetate.

• Maintain vigorous growth of vegetative coverings. This includes reseeding, fertilization, and application of herbicides when necessary. Periodic mowing may also be needed to control height.

• Immediately repair any vandalism, vehicular, or livestock damage.

• Inspect for damage from rodents or burrowing animals. Repair any damage. Take appropriate corrective actions to alleviate further damage.

• Avoid excessive travel on any portion of the system that will harm or destroy the vegetative cover.

SPECIFIC RECOMMENDATIONS FOR YOUR PROJECT

CONTACT YOUR LOCAL NATURAL RESOURCES CONSERVATION SERVICE OFFICE FOR ANY ADDITIONAL TECHNICAL ASSISTANCE YOU MIGHT NEED FOR IMPLEMENTATION OF THIS OPERATION AND MAINTENANCE PLAN FOR YOUR CURRENTLY MINED LAND RECLAMATION PROJECT.

NRCS, CA
September 2007
These deliverables apply to this individual practice. For other planned practice deliverables refer to those specific Statements of Work.

**DESIGN**

**Deliverables:**

1. Design documents that demonstrate criteria in NRCS practice standard have been met and are compatible with planned and applied practices.
   a. Practice purpose(s) as identified in the conservation plan
   b. List of required permits to be obtained by the client
   c. List of facilitating practices
   d. Compliance with NRCS national and state utility safety policy (NEM part 503-Safety, Section 503.00 through 503.22)
   e. Practice standard criteria-related computations and analyses to develop plans and specifications including but not limited to:
      i. Site preparation requirements and areas to be preserved
      ii. Water disposal requirements
      iii. Additional provisions, as required, to restore productivity of soils, reduce erosion and sedimentation, and maintain or improve the visual quality of the landscape.
2. Written plans and specifications including sketches and drawings shall be provided to the client that adequately describes the requirements to install the practice and obtain necessary permits.
3. Operation and maintenance plan.
4. Certification that the design meets practice standard criteria and comply with applicable laws and regulations.
5. Design modifications during installation as required.

**INSTALLATION**

**Deliverables**

1. Pre-installation conference with client.
2. Verification that client has obtained required permits.
3. Staking and layout of measures according to plans and specifications including applicable layout notes.
4. Installation guidance as needed.
5. Facilitate and implement required design modifications with client and original designer.
6. Advise client/NRCS on compliance issues with all federal, state, tribal, and local laws, regulations and NRCS policies during installation.
7. Certification that the installation process and materials meet design and permit requirements.

**CHECK OUT**

**Deliverables**

1. Records of installation.
   a. Extent of practice units applied
   b. Actual measures and materials used and applied
   c. Drawings
   d. Final quantities
2. Certification that the application meets NRCS standards and specifications and is in compliance with permits.
3. Progress reporting.
REFERENCES

- NRCS Field Office Technical Guide (eFOTG), Section IV, Conservation Practice Standard – Land Reclamation, Currently Mined Land, 544
- NRCS National Environmental Compliance Handbook
- NRCS Cultural Resources Handbook
DEFINITION
Applying plant residues, by-products or other suitable materials produced off site, to the land surface.

PURPOSES
- Conserve soil moisture
- Moderate soil temperature
- Provide erosion control
- Suppress weed growth
- Establish vegetative cover
- Improve soil condition and increase soil fertility

CONDITIONS WHERE PRACTICE APPLIES
On soils subject to erosion; on areas where traffic may cause airborne emissions, where conserving soil moisture is desirable, on soils that may realize improved quality from a surface cover of organic materials, and where it is desirable to achieve weed control with little or no cultivation or herbicide use.

CRITERIA

General Criteria Applicable To All Purposes
The selection of mulching materials will depend primarily on site conditions and the material’s availability. Mulch materials shall consist of natural and/or artificial materials such as plant residue, wood bark or chips, by-products, gravel, plastic, fabric, animal manure, rice hulls, and materials from food processing plants or other equivalent materials of sufficient dimension (depth or thickness) and durability to achieve the intended purpose for the required time period. Mulching is generally performed after grading, soil surface preparation and seeding and plantings are complete. Soil surface shall be prepared in order to achieve the desired purpose.

The mulch material shall be evenly applied and anchored to the soil. Tackifiers, emulsions, pinning, netting, crimping or other acceptable methods of anchoring will be used if needed to hold the mulch in place for specified periods.

Manufactured mulches shall be applied according to the manufacturer’s specifications.

Mulching operations shall comply with federal, state and/or local laws and regulations during the installation, operation and maintenance of this practice.

Mulch material shall be relatively free of disease, noxious weed seeds, and other pests and pathogens.

All straw mulch materials will be acceptable to the County Agricultural Commissioner, per California Food and Agriculture Code Section 5101 and 5205.

When mulching with straw, use at least 2,000 pounds of cereal grain straw or grass hay per acre evenly distributed over the area to be treated and anchored sufficiently to hold it on the site.

When mulching with other wood products (chips, bark, shavings) or other material, they must be applied in an amount that will provide at least 80 percent ground cover.

When mulching with gravel or other inorganic material for permanent erosion control, they must be applied in sufficient amounts to provide 90 percent ground cover.

When using materials with potential to pollute surface waters (animal manures, sewage sludge, wastes from food processing, other similar materials) care will be taken to assure that runoff from the area will not enter streams, lakes, ponds,
or reservoirs and that nitrate leaching will be considered in the plan. Measures will also be taken to prevent mulch from washing away due to concentrated flows, rainfall, or irrigation.

**Additional Criteria To Conserve Soil Moisture**
Mulch materials applied to the soil surface shall provide at least 60 percent cover to reduce potential evaporation.

Mulch material shall be applied prior to moisture loss. Prior to mulching, ensure soil under shallow rooted crops is moist, as these crops require a constant supply of moisture.

**Additional Criteria To Moderate Soil Temperature**
Mulch materials shall be selected and applied to obtain 100 percent coverage over the area treated. The material shall be of a significant thickness to persist for the period required for the temperature modification.

**Additional Criteria To Provide Erosion Control**
When mulching with cereal grain straw or grass hay, apply in sufficient amounts to provide 70 percent ground cover. When mulching with wood products such as wood chips, bark, or shavings or other wood materials, apply to a 2-inch thickness if the soil is not well-drained, and to a 3- to 4-inch thickness if drainage is good. More finely textured mulches, which allow less oxygen penetration than coarser materials, should be no thicker than 1 or 2 inches. The mulch material shall provide no greater than 80 percent ground cover in order to ensure adequate air drainage.

Mulch rate shall be determined using current erosion prediction technology to reach the soil erosion objective, where appropriate. When mulching with straw, use at least 4,000 pounds of cereal grain straw or grass hay per acre evenly distributed over the area to be treated and anchored sufficiently to hold it on the site. When mulching with wood fiber, use at least 2,000 pounds of wood fiber mulch per acre.

Gravel or other inorganic material shall be applied approximately 2 inches thick and shall consist of pieces 0.75 to 2 inches in diameter. The mulch material shall provide no more than 90 percent ground cover in order to ensure adequate air drainage.

**Additional Criteria To Suppress Weed Growth**
The thickness of mulch will be determined by the size of the plant being mulched. Small plants must not be smothered. Mulches shall be kept clear of the stems of plants where disease is likely to occur. Mulches applied around growing plants or prior to weed seedling development shall have 100 percent ground cover. Thickness of the mulch shall be adequate to prevent emergence of targeted weeds. Plastic mulches may be used.

**Additional Criteria To Establish Vegetative Cover**
Mulch shall be applied at a rate that achieves 50 percent ground cover to provide protection from erosion and runoff and yet allow adequate light and air penetration to the seedbed to ensure proper germination, emergence, and disease suppression.

**Additional Criteria To Improve Soil Condition And Increase Soil Fertility**
To increase soil fertility, apply mulch materials with a carbon to nitrogen ratio (C:N) less than 30 to 1 such as animal manure, bio-solids, food processing wastes, or similar materials. Apply other practices such as contouring, filter strips or riparian forest buffers to assure that runoff from the mulched areas will not transport mulching materials to sensitive waterbodies. Do not apply mulch with C:N less than 20:1 to the area of designed flow in watercourses.

Credit nutrients applied with the mulch to the nutrient budget.

The Soil Conditioning Index may be used to assess soil quality impacts.

**CONSIDERATIONS**
Consider the effects of mulching on evaporation, infiltration and runoff. Mulch material may affect microbial activity in the soil surface, increase infiltration, and decrease runoff, erosion and evaporation. Increased infiltration may increase nutrient and chemical transport below the root

NRCS, CA
September 2007
zone. The temperature of the surface runoff may also be lowered.

Mulched soil retains moisture, requires less watering and reduces the chance of water stress on plant materials. Mulch also minimizes evaporation from the soil surface and hence reduces losses from bare soil areas.

Clear and infra-red transmissible (IRT) plastics have the greatest warming potential. They are transparent to incoming radiation and trap the longer wavelengths radiating from the soil. Black mulches are limited to warming soils by conduction only and are less effective.

Clear mulches allow profuse weed growth and may negate the benefits of soil warming. Black mulches provide effective weed control. Wavelength selective (IRT) blends the soil warming characteristics of clear mulch with the weed control ability of black mulch.

Consider potential toxic allopathic effects that mulch material may have on other organisms. Animal and plant pest species may be incompatible with the site.

Consider the potential for increased pathogenic activity within the applied mulch material.

Keep mulches 3 to 6 inches away from plant stems and crowns to prevent disease and pest problems.

Deep mulch provides nesting habitat for ground-burrowing rodents that can chew extensively on bark on tree trunk and/or tree roots. Light mulch applied after the first cold weather may prevent rodents from nesting.

Common mulch materials available include barley oats, rice, and wheat straw. Rice straw tends to persist longer. Most hay will decompose faster than barley or wheat.

Steep farm roads may be mulched with straw at the beginning of the rainy season. Restrict vehicle traffic until risk of runoff is low.

Disturbed construction sites often use mulches to comply with regulation. Regulations may require a storm water pollution prevention plan, erosion control plan, or compliance with a grading ordinance.

Barley and wheat straw usually contains 10 to 15 pounds/acre of seed. The resulting green growth does not interfere with most intended uses or future landscaping.

Use of wheat straw usually results in less volunteer grain when compared to barley straw.

Rollers and crimpers can be pulled on slopes up to 3:1. Where there is access, equipment can be winched up and down steeper slopes. Tackifiers can be utilized to anchor when equipment cannot be used on the site.

The effective range for straw blowing equipment is about 75 feet.

The effective range for hydoseeders is about 125 feet. When using a 100-foot hose the range can be extended up to 200 feet.

**Anchoring**

Anchoring of mulches can be accomplished by using the following methods:

Netting, tackifiers, matting: hand, roller, or crimper punching and disk-type straw punchers.

Netting to anchor mulches is made from plastics, paper, jute, and burlap. They are anchored with staples of various materials.

Several liquid “tackifiers” that can be mixed with water and sprayed on fiber mulches to bind them together are available. These “tackifiers” will be compatible with the mulch applied and in sufficient amount to adequately bind the materials together for the intended life of the practice.

**Endangered Species Considerations**

If during the Environmental Assessment, NRCS determines that installation of this practice, along with any others proposed, will have an effect on any federal or state listed Rare, Threatened or Endangered species or their habitat, NRCS will advise the client of the requirements of the Endangered Species Act and recommend alternative conservation treatments that avoid the adverse effects. Further assistance will be provided only if the client selects one of the alternative conservation treatments for installation; or with concurrence of the client, NRCS initiates...
consultations concerning the listed species with the U.S. Fish and Wildlife Service, National Marine Fisheries Service and/or California Department of Fish and Game.

**Cultural Resources Considerations**

NRCS policy is to avoid any effect to cultural resources and protect them in their original location. Determine if installation of this practice or associated practices in the plan could have an effect on cultural resources. The National Historic Preservation Act may require consultation with the California State Historic Preservation Officer.

http://www.nrcs.usda.gov/technical/cultural.html is the primary website for cultural resources information. The California Environmental Handbook and the California Environmental Assessment Worksheet also provide guidance on how the NRCS must account for cultural resources. The e-Field Office Technical Guide, Section II contains general information, with Web sites for additional information.

Document any specific considerations for cultural resources in the design docket and the Practice Requirements worksheet.

**PLANS AND SPECIFICATIONS**

Specifications shall be prepared for each site and purpose and recorded using approved specification sheets, job sheets, technical notes, and narrative statements in the conservation plan, or other acceptable documentation.

Documentation shall include:
- Type of mulch material used
- Percent cover and/or thickness of mulch material
- Timing of application
- Site preparation
- Listing of netting, tackifiers, or method of anchoring, and
- Operation and maintenance.

**OPERATION AND MAINTENANCE**

The owner or operator will be responsible for safe operation of equipment and maintenance of this practice.

Mulched areas will be periodically inspected, and mulch shall be reinstalled or repaired as needed to accomplish the intended purpose.

Removal, incorporation, bio- or photo-degradation of mulch and associated materials shall be consistent with the intended purpose and site conditions.

Operation of equipment near and on the site shall not compromise the intended purpose of the mulch.

Prevent or repair any fire damage to the mulch material.

Properly collect and dispose of artificial mulch material after intended use.

Monitor and control undesirable weeds in mulched areas.

**REFERENCES**


NRCS, CA
September 2007
DEFINITION
Managing the amount, source, placement, form and timing of the application of plant nutrients and soil amendments.

PURPOSE
- To budget and supply nutrients for plant production.
- To properly utilize manure or organic by-products as a plant nutrient source.
- To minimize agricultural nonpoint source pollution of surface and ground water resources.
- To protect air quality by reducing nitrogen emissions (ammonium and NO\textsubscript{x} compounds) and the formation of atmospheric particulates.
- To maintain or improve the physical, chemical and biological condition of soil.

CONDITIONS WHERE PRACTICE APPLIES
This practice applies to all lands where plant nutrients and soil amendments are applied.

CRITERIA
General Criteria Applicable to All Purposes
A nutrient budget for nitrogen, phosphorus, and potassium shall be developed that considers all potential sources of nutrients including, but not limited to animal manure and organic by-products, waste water, commercial fertilizer, crop residues, legume credits, and irrigation water. The nutrient budget shall use reasonable yields to set nutrient requirements based on currently accepted University of California guidance, or industry standards when acceptable to University of California.

Realistic yield goals shall be established based on soil productivity information, historical yield data, climatic conditions, level of management and/or local research on similar soil, cropping systems, and soil, tissue, and manure/organic by-products tests.

For new crops or varieties, industry yield recommendations may be used until documented yield information is available.

Plans for nutrient management shall specify the source, amount, timing and method of application of nutrients on each field to achieve realistic production goals, while minimizing movement of nutrients and other potential contaminants to surface and/or ground waters.

Areas contained within established minimum application setbacks (e.g., sinkholes, wells, gullies, ditches, surface inlets or rapidly permeable soil areas) shall not receive direct application of nutrients.

On irrigated lands, irrigation management shall be optimized based on Practice 449 "Irrigation Water Management". This applies whether or not nutrients are being applied with the irrigation water.

Nutrient loss to erosion, leaching, runoff, and subsurface drainage shall be addressed, as needed.

Soil, Manure, and Tissue Sampling and Laboratory Analyses (Testing) Nutrient planning shall be based on current soil, manure, and tissue test results developed in accordance with University of California guidance, or industry practice if recognized by...
the University of California. When used to assess P and K, current soil tests are no older than three years. Soil sampling used for managing N applications shall be timely, collected very near anticipated application times and considering previous and planned irrigation events or N applications.

Soil, manure, irrigation water, and tissue samples shall be collected and prepared according to University of California guidance or standard industry practice. Soil, water, manure, and tissue test analyses shall be performed by laboratories that are accepted in one or more of the following:

- Laboratories successfully meeting the requirements and performance standards of the North American Proficiency Testing Program (NAPT) under the auspices of the Soil Science Society of America http://www.naptprogram.org/about/participants/, or
- Environmental Laboratory Accreditation Program (ELAP) http://www.dhs.ca.gov/ps/ls/elap/default.htm
- For manure, laboratories successfully meeting the requirements and performance standards of the Manure Proficiency (MAP) Program http://ghex.colostate.edu/map/

Soil and tissue testing shall include analyses for any nutrients for which specific information is needed to develop the nutrient plan. Request analyses pertinent to monitoring or amending the annual nutrient budget, e.g. pH, electrical conductivity (EC), soil organic matter, texture, nitrogen, phosphorus and potassium.

**Nutrient Application Rates.** Soil amendments shall be applied as needed, to adjust soil properties, including soil pH, to adequately provide for crop nutrient availability and utilization.

Recommended nutrient application rates shall be based on current (updated, as appropriate) University of California recommendations, (and/or industry practice when recognized by the university) that consider current soil test results, tissue tests, realistic yield goals and management capabilities. If University of California does not provide state or regional recommendations, then UC guidance from County Farm Advisors on nutrient application rates, or industry practice when consistent with local UC guidance, is acceptable. The planned rates of nutrient application, as documented in the nutrient budget, shall be determined based on the following guidance:

- **Nitrogen Application** - Planned nitrogen application rates shall match the recommended rates as closely as possible, except when manure or organic by-products are a source of nutrients. When manure or organic by-products are a source of nutrients, see “Additional Criteria” below.
- **Phosphorus Application** - Planned phosphorus application rates shall match the recommended rates as closely as possible, except when manure or organic by-products are sources of nutrients. When manure or organic by-products are a source of nutrients, see “Additional Criteria” below.
- **Potassium Application** - When forage quality is impaired by excess soil potassium levels, application of potassium shall be reduced or suspended until desirable levels in the soil and forage are regained.
- **Other Plant Nutrients** - The planned rates of application of other nutrients shall be consistent with University of California guidance or industry practice if recognized by University of California.
- **Starter Fertilizers** - When starter fertilizers are used, they shall be included in the overall nutrient budget, and applied in accordance with University of California recommendations, or industry practice if recognized by University of California.

**Nutrient Application Timing.** Timing of nutrient application (particularly nitrogen) shall correspond as closely as possible with plant nutrient uptake characteristics, while considering cropping system limitations, weather and climatic conditions, risk assessment tools (e.g., leaching index, P index) and field accessibility.

NRCS, CA

September 2007
**Nutrient Application Methods.** Application methods to reduce the risk of nutrient transport to surface and ground water, or into the atmosphere shall be employed.

To minimize nutrient losses:

- Apply nutrient materials uniformly to application area(s) unless precision application technology indicates variable rates are appropriate. Precise placement with banding, use of drip irrigation, or other strategies to maximize root access to nutrients, is desirable.

- Nutrients shall not be applied to frozen, snow-covered or saturated soil if the potential risk for runoff exists.

- Nutrients shall be applied considering plant nutrient uptake patterns during the growing season, root growth patterns, irrigation practices, nutrient mobility, and other conditions so as to maximize availability to the plant and minimize the risk of runoff, leaching, and volatilization losses.

- Nutrient applications associated with irrigation systems shall be applied in a manner that prevents or minimizes leaching, runoff, or volatilization of nutrients.

- Incorporate or irrigate in any broadcast fertilizers within the shortest practicable timeframe. Apply nitrogen fertilizers as close to anticipated plant need as is possible.

**Conservation Management Unit (CMU) Risk Assessment.** In areas with identified or designated agricultural phosphorus related water quality impairment, a CMU specific risk assessment of the potential for phosphorus transport from the area shall be completed using the California P Index. In areas with identified or designated agricultural nitrogen related water quality impairment, a CMU specific risk assessment of the potential for nitrogen transport from the area to ground water or surface water shall be completed by evaluating the irrigation, soils, cropping, runoff management, nitrogen application strategies in use, and other factors pertinent to the site.

Note: California regulators may select an alternative method to the PI to manage P application. California NRCS is developing a tool for evaluating risk of N loss. This section will be revised in either case.

**Additional Criteria Applicable to Manure and Organic By-Products or Biosolids Applied as a Plant Nutrient Source**

When animal manures or organic by-products are applied, a risk assessment of the potential for nutrient transport from the CMU shall be completed using the California P Index to adjust the management of nutrient applications.

Nutrient values of manure and organic by-products shall be determined prior to land application. Samples will be taken and analyzed for nutrient concentration, moisture content, and Ec, as appropriate, with each hauling/emptying cycle for a storage/treatment facility. Manure sampling frequency may vary based on the operation’s manure handling strategy and spreading schedule. Dilute manure storage ponds shall be tested at least seasonally when drawdown occurs, with testing at each application recommended. If “stable” (maintaining a certain nutrient concentration with minimal variation) levels are found after three years or more of sampling average values from all sampling may be used for planning manure applications unless continued testing is desirable for other purposes or required by law. When changes occur in manure collection, treatment, storage, herd size, or any other factor capable of significantly altering manure nutrient characteristics renew sampling to establish new characteristics. Samples shall be collected and prepared according to University of California guidance or industry practice.

Manure exported from any facility shall be tested and measured as required by law.

In planning for new operations, acceptable “book values” recognized by the NRCS and/or University of California may be used (e.g., NRCS Agricultural Waste Management Field Handbook, UCCE publications, regulatory guidelines, ASABE standards, or unpublished data when appropriate).

NRCS, CA
September 2007
Biosolids (sewage sludge) shall be applied in accordance with USEPA regulations. (40 CFR Parts 403 (Pretreatment) and 503 (Biosolids) and other state and/or local regulations regarding the use of biosolids as a nutrient source.

**Manure and Organic By-Product Nutrient Application Rates.** Manure and organic by-product nutrient application rates shall be based on nutrient analyses procedures recommended by state regulation, or University of California. As indicated above, “book values” may be used in planning for new operations. At a minimum, manure analyses shall include appropriate nutrient and specific ion concentrations. Solid manure test results will include percent moisture. Salt concentration (Ec) shall be monitored so that manure applications do not cause plant damage or negatively impact soil or water quality.

When applying manure with sprinkler irrigation, the application rate (in/hr) of liquid materials applied shall not exceed the soil intake/infiltration rate. All applications with irrigation water shall be managed to minimize ponding, minimize leaching below the root zone, and avoid runoff. Applications with irrigation water shall conform to the principles found in NRCS Practice 449, Irrigation Water Management.

The planned rates of nitrogen and phosphorus application recorded in the plan shall be determined based on the following guidance:

**Nitrogen Application Rates**

- When manure or organic by-products are used, the nitrogen availability of the planned application rates shall match plant uptake characteristics as closely as possible, taking into consideration the timing of nutrient application(s) in order to minimize leaching and atmospheric losses.

- Management activities and technologies shall be used that effectively utilize mineralized nitrogen and that minimize nitrogen losses through denitrification, leaching, and ammonia volatilization.

- Manure or organic by-products may be applied on legumes at rates equal to the estimated removal of nitrogen in harvested plant biomass.

- When the nutrient management plan component is being implemented on a phosphorus basis, manure or organic by-products shall be applied at rates consistent with a phosphorus limited application rate. In such situations, an additional nitrogen application, from non-organic sources, may be required to supply, but not exceed, the recommended amounts of nitrogen in any given year.

**Phosphorus Application Rates**

- When manure or organic by-products are used, the planned rates of phosphorus application shall be consistent with state regulation or the Phosphorus Index (PI) Rating. **

  ** Acceptable phosphorus-based manure application rates shall be determined as a function of soil test recommendation or estimated phosphorus removal in harvested plant biomass.

- The application of phosphorus applied as manure may be made at a rate equal to the recommended phosphorus application or estimated phosphorus removal in harvested plant biomass for the crop rotation or multiple years in the crop sequence. When such applications are made, the application rate shall:

  ◊ Not exceed the recommended nitrogen application rate during the year of application, or

  ◊ Not exceed the estimated nitrogen removal in harvested plant biomass during the year of application when there is no recommended nitrogen application.

  ◊ Not be made on sites considered vulnerable to off-site phosphorus transport unless appropriate conservation practices, best

**NRCS, CA**

**September 2007**
management practices or management activities are used to reduce the vulnerability.

**Heavy Metal Monitoring.** When sewage sludge (biosolids) is applied, the accumulation of potential pollutants (including arsenic, cadmium, copper, lead, mercury, selenium, and zinc) in the soil shall be monitored in accordance with the US Code, Reference 40 CFR, Parts 403 and 503, and/or any applicable state and local laws or regulations.

**Additional Criteria to Protect Air Quality by Reducing Nitrogen and/or Particulate Emissions to the Atmosphere**

In areas with an identified or designated nutrient management related air quality concern, any component(s) of nutrient management (i.e., amount, source, placement, form, timing of application) identified by available risk assessment tools as a potential source of atmospheric pollutants shall be adjusted, as necessary, to minimize the loss(es).

Comply with any Federal, State, or Local air quality regulations governing the use of fertilizers or the application of manure or biosolids to land.

When tillage can be performed, surface applications of manure and fertilizer nitrogen formulations that are subject to volatilization on the soil surface (e.g., urea) shall be incorporated into the soil within 24 hours after application.

When manure or organic by-products are applied to grassland, hayland, pasture or minimum-till areas the rate, form and timing of application(s) shall be managed to minimize volatilization losses.

When liquid forms of manure are applied with irrigation equipment, operators will select weather conditions during application that will minimize volatilization losses.

Operators will handle and apply poultry litter or other dry types of animal manures when the potential for wind-driven loss is low and there is less potential for transport of particulates into the atmosphere.

Weather and climatic conditions during manure or organic by-product application(s) shall be recorded and maintained in accordance with the operation and maintenance section of this standard.

CAFO operations seeking permits under CARB or USEPA regulations (40 CFR Parts 122 and 412) should consult with their respective state or local permitting authority for additional criteria.

**Additional Criteria to Improve the Physical, Chemical and Biological Condition of the Soil**

Nutrients shall be applied and managed in a manner that maintains or improves the physical, chemical and biological condition of the soil.

Minimize the use of nutrient sources with high salt content unless provisions are made to leach salts below the crop root zone and water quality impacts to receiving waters are considered.

To the extent practicable nutrients shall not be applied when the potential for soil compaction and rutting is high.

**CONSIDERATIONS**

The use of management activities and technologies listed in this section may improve both the production and environmental performance of nutrient management systems.

The addition of these management activities, when applicable, increases the management intensity of the system and is recommended in a nutrient management system.

Action should be taken to protect National Register listed and other eligible cultural resources.

The nutrient budget should be reviewed annually to determine if any changes are needed for the next planned crop.

For some sites specific soil sampling techniques may be appropriate to better manage nitrogen. These include post-harvest deep soil profile sampling for nitrogen, Pre-Sidedress Nitrogen Test (PSNT), Pre-Plant

NRCS, CA
September 2007
Soil Nitrate Test (PPSN) or soil surface sampling for phosphorus accumulation or pH changes.

Additional practices to enhance the producer’s ability to manage manure effectively include modification of the animal’s diet to reduce the manure nutrient content, or utilizing manure amendments that stabilize or tie-up nutrients.

Soil test information should be no older than one year when developing new plans, particularly if animal manures are to be used as a nutrient source.

Excessive levels of some nutrients can cause induced deficiencies of other nutrients.

If increases in soil phosphorus levels are expected, consider a more frequent (annual) soil testing interval.

To manage the conversion of nitrogen in manure or fertilizer, use products or materials (e.g. nitrification inhibitors, urease inhibitors and slow or controlled release fertilizers) that more closely match nutrient release and availability for plant uptake. These materials may improve the nitrogen use efficiency (NUE) of the nutrient management system by reducing losses of nitrogen into water and/or air.

Sample the liquid manure/irrigation water mixture during each application to cropland.

Considerations to Minimize Agricultural Nonpoint Source Pollution of Surface and Ground Water

Erosion control and runoff reduction practices can improve soil nutrient and water storage, infiltration, aeration, tilth, diversity of soil organisms and protect or improve water and air quality (Consider installation of one or more NRCS FOTG, Section IV – Conservation Practice Standards).

Cover crops can effectively utilize and/or recycle residual nitrogen.

Application methods and timing that reduce the risk of nutrients being transported to ground and surface waters, or into the atmosphere include:

- Split applications of nitrogen to provide nutrients at the times of maximum crop utilization,
- Use corn stalk-test or other tissue tests to minimize risk of applying nitrogen in excess of crop needs.
- Where only summer crops are grown, avoid winter nutrient application for spring seeded crops,
- Band applications of phosphorus near the seed row,
- Incorporate surface applied manures or organic by-products as soon as possible after application to minimize nutrient losses,
- Delay field application of animal manures or organic by-products if precipitation capable of producing runoff and erosion is forecast within 24 hours of the time of the planned application.

Apply calcium or acidic soil amendments, as appropriate, to soils with infiltration rates reduced by low salt content in irrigation water or excessive sodium in the soil or irrigation water. This will improve crop health and help control runoff.

Use risk assessment tools for planning, such as the California P Index, where there is significant risk to water quality from nutrients even in areas without identified or designated nutrient related water quality impairment.

Considerations to Protect Air Quality by Reducing Nitrogen and/or Particulate Emissions to the Atmosphere

Odors associated with the land application of manures and organic by-products can be offensive to the occupants of nearby homes. Avoid applying these materials upwind of occupied structures when residents are likely to be home (evenings, weekends and holidays).

When applying manure with irrigation equipment, modifying the equipment can reduce the potential for volatilization of nitrogen from the time the manure leaves the application equipment until it reaches the surface of the soil (e.g., reduced pressure, drop down tubes for center pivots). N volatilization from manure in a surface

NRCS, CA

September 2007
irrigation system will be reduced when applied under a crop canopy.

When planning nutrient applications and tillage operations, encourage soil carbon buildup while discouraging greenhouse gas emissions (e.g., nitrous oxide \( \text{N}_2\text{O} \), carbon dioxide \( \text{CO}_2 \)).

Storage and application of ammonia based materials will be done considering methods that limit volatilization.

**Endangered Species Considerations**

If during the Environmental Assessment, NRCS determines that installation of this practice, along with any others proposed, will have an effect on any federal or state listed Rare, Threatened or Endangered species or their habitat, NRCS will advise the client of the requirements of the Endangered Species Act and recommend alternative conservation treatments that avoid the adverse effects. Further assistance will be provided only if the client selects one of the alternative conservation treatments for installation; or with concurrence of the client, NRCS initiates consultations concerning the listed species with the U.S. Fish and Wildlife Service, National Marine Fisheries Service and/or California Department of Fish and Game.

**Cultural Resources Considerations**

NRCS policy is to avoid any effect to cultural resources and protect them in their original location. Determine if installation of this practice or associated practices in the plan could have an effect on cultural resources. The National Historic Preservation Act may require consultation with the California State Historic Preservation Officer.

http://www.nrcs.usda.gov/technical/cultural.html is the primary website for cultural resources information. The California Environmental Handbook and the California Environmental Assessment Worksheet also provide guidance on how the NRCS must account for cultural resources. The e-Field Office Technical Guide, Section II contains general information, with Web sites for additional information.

Document any specific considerations for cultural resources in the design docket and the Practice Requirements worksheet.

**PLANS AND SPECIFICATIONS**

Plans and specifications for nutrient management shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purpose(s), using nutrients to achieve production goals and to prevent or minimize resource impairment.

Nutrient management plans shall include a statement that the plan was developed based on requirements of the current standard and any applicable Federal, state, or local regulations, policies, or programs, which may include the implementation of other practices and/or management activities. Changes in any of these requirements may necessitate a revision of the plan.

The following components shall be included in the nutrient management plan:

- aerial site photograph(s) or site map(s), and a soil survey map of the site,
- location of designated sensitive areas or resources and the associated, nutrient management restriction,
- current and/or planned plant production sequence or crop rotation,
- results of soil, water, manure and/or organic by-product sample analyses,
- results of plant tissue analyses, when used for nutrient management,
- realistic yield goals for the crops,
- complete nutrient budget for nitrogen, phosphorus, and potassium for the crop rotation or sequence,
- listing and quantification of all nutrient sources,
- CMU specific recommended nutrient application rates, timing, form, and method of application and incorporation, and
- guidance for implementation, operation, maintenance, and recordkeeping

If increases in soil phosphorus levels are expected, the nutrient management plan shall document:

- the potential for soil phosphorus drawdown from the production and harvesting of crops when phosphorus inputs are reduced, and
- management activities or techniques used to reduce the potential for phosphorus loss

**OPERATION AND MAINTENANCE**

The owner/client is responsible for safe operation and maintenance of this practice including all equipment. Operation and maintenance addresses the following:

- periodic plan review to determine if adjustments or modifications to the plan are needed. As a minimum, plans will be reviewed and revised with each soil test cycle.
- significant changes in animal numbers and/or feed management will necessitate additional manure sampling and analyses to establish a revised average nutrient content.
- protection of fertilizer and organic by-product storage facilities from weather and accidental leakage or spillage.
- calibration of application equipment to ensure uniform distribution of material at planned rates.
- documentation of the actual rate at which nutrients were applied. When the actual rates used differ from the recommended and planned rates, records will indicate the reasons for the differences.
- Maintaining records to document plan implementation. As applicable, records include:
  - Soil, plant tissue, water, manure, and organic by-product analyses resulting in recommendations for nutrient application,
  - quantities, analyses and sources of nutrients applied,
  - dates and method(s) of nutrient applications,
  - weather conditions and soil moisture at the time of application; lapsed time to manure incorporation, rainfall or irrigation event.
  - crops planted, planting and harvest dates, yields, and crop residues removed,
  - dates of plan review, name of reviewer, and recommended changes resulting from the review.

Records should be maintained for five years; or for a period longer than five years if required by other Federal, state or local ordinances, or program or contract requirements.

Workers should be protected from and avoid unnecessary contact with plant nutrient sources. Extra caution must be taken when handling ammoniacal nutrient sources, or when dealing with organic wastes stored in unventilated enclosures.

Material generated from cleaning nutrient application equipment should be utilized in an environmentally safe manner. Excess material should be collected and stored or field applied in an appropriate manner.

Nutrient containers should be recycled in compliance with state and local guidelines or regulations.

**REFERENCES**


NRCS, CA

September 2007
Western Fertilizer Handbook, 8th Edition or later, Western Plant Health Association

University of California publications such as crop production manuals, crop specific IPM manuals, and crop or research group websites.