Appendix

Appendix A: Best Management Practices — Definitions and Descriptions

Best management practices mentioned in this guidance are listed in alphabetical order below. This is not a complete list of all the management practices for agricultural nonpoint source pollution control; there are others that may be in use or are under development. The NRCS or other code number, if any, is given for each BMP, followed by a short definition. Additional explanatory text about selected BMPs is presented in italicized text below the practice, code, and definition.

Access Road (560): A travelway constructed as part of a conservation plan.

Animal Trails and Walkways (575): A livestock trail or walkway constructed to improve grazing distribution and access to forage and water.

Bedding (310): Plowing, blading, or otherwise elevating the surface of flat land into a series of broad, low ridges separated by shallow, parallel channels.

Brush Management (314): Removal, reduction, or manipulation of non-herbaceous plants.

Improved vegetation quality and the decrease in runoff from the practice will reduce the amount of erosion and sediment yield. Improved vegetative cover acts as a filter strip to trap the movement of dissolved and sediment attached substances, such as nutrients and chemicals from entering downstream water courses. Mechanical brush management may initially increase sediment yields because of soil disturbances and reduced vegetative cover. This is temporary until revegetation occurs.

Channel Vegetation (322): Establishing and maintaining adequate plants on channel banks, berms, spoil, and associated areas.

Chiseling and Subsoiling (324): Loosening the soil, without inverting and with a minimum of mixing of the surface soil, to shatter restrictive layers below normal plow depth that inhibit water movement or root development.

Composting Facility (317): A facility for the biological stabilization of waste organic material.

The purpose is to treat waste organic material biologically by producing a humus-like material that can be recycled as a soil amendment and fertilizer substitute or otherwise utilized in compliance with all laws, rules, and regulations.

Conservation Cover (327): Establishing and maintaining perennial vegetative cover to protect soil and water resources on land retired from agricultural production.

Agricultural chemicals are usually not applied to this cover in large quantities and surface and ground water quality may improve where these material are not used. Ground cover and crop residue will be increased with this practice. Erosion and yields of sediment and sediment related stream pollutants should decrease. Temperatures of the soil, surface runoff and receiving water may be reduced. Effects will vary during the establishment period and include increases in runoff, erosion and sediment yield. Due to the reduction of deep percolation, the leaching of soluble material will be reduced, as will be the potential for causing saline seeps. Long-term effects of the practice would reduce agricultural nonpoint sources of pollution to all water resources.

Conservation Crop Rotation (328): An adapted sequence of crops designed to provide adequate organic residue for maintenance or improvement of soil tilth.

This practice reduces erosion by increasing organic matter, resulting in a reduction of sediment and associated pollutants to surface waters. Crop rotations that improve soil tilth may also disrupt disease, insect and weed reproduction cycles, reducing the need for pesticides. This removes or reduces the availability of some pollutants in the watershed. Deep percolation may carry soluble nutrients and pesticides to the ground water. Underlying soil layers, rock and unconsolidated parent material may block, delay, or enhance the delivery of these pollutants to ground water. The fate of these pollutants will be site specific, depending on the crop management, the soil and geologic conditions.

Constructed Wetland (656): A wetland that has been constructed for the primary purpose of water quality improvement.

This practice is applied to treat waste waters from confined animal operations, sewage, surface runoff, milkhouse wastewater, silage leachate, and mine drainage by the biological, chemical and physical activities of a constructed wetland.

Contour Buffer Strips (332): Narrow strips of permanent, herbaceous vegetative cover established across the slope and alternated down the slope with parallel, wider cropped strips.

Contour Farming (330): Farming sloping land in such a way that preparing land, planting, and cultivating are done on the contour. This includes following established grades of terraces or diversions.

This practice reduces erosion and sediment production. Less sediment and related pollutants may be transported to the receiving waters.

Increased infiltration may increase the transportation potential for soluble substances to the ground water.

Contour Orchard and Other Fruit Area (331): Planting orchards, vineyards, or small fruits so that all cultural operations are done on the contour.

Contour orchards and fruit areas may reduce erosion, sediment yield, and pesticide concentration in the water lost. Where inward sloping benches are

used, the sediment and chemicals will be trapped against the slope. With annual events, the bench may provide 100 percent trap efficiency. Outward sloping benches may allow greater sediment and chemical loss.

The amount of retention depends on the slope of the bench and the amount of cover. In addition, outward sloping benches are subject to erosion from runoff from benches immediately above them. Contouring allows better access to rills, permitting maintenance that reduces additional erosion. Immediately after establishment, contour orchards may be subject to erosion and sedimentation in excess of the now contoured orchard. Contour orchards require more fertilization and pesticide application than did the native grasses that frequently covered the slopes before orchards were started. Sediment leaving the site may carry more adsorbed nutrients and pesticides than did the sediment before the benches were established from uncultivated slopes. If contoured orchards replace other crop or intensive land use, the increase or decrease in chemical transport from the site may be determined by examining the types and amounts of chemicals used on the prior land use as compared to the contour orchard condition.

Soluble pesticides and nutrients may be delivered to and possibly through the root zone in an amount proportional to the amount of soluble pesticides applied, the increase in infiltration, the chemistry of the pesticides, organic and clay content of the soil, and amounts of surface residues. Percolating water below the root zone may carry excess solutes or may dissolve potential pollutants as they move. In either case, these solutes could reach ground water supplies and/or surface downslope from the contour orchard area. The amount depends on soil type, surface water quality, and the availability of soluble material (natural or applied).

Contour Stripcropping (585): Growing crops in a systematic arrangement of strips or bands on the contour to reduce water erosion. The crops are arranged so that a strip of grass or close-growing crop is alternated with a strip of clean-tilled crop or fallow or a strip of grass is alternated with a close-growing crop.

This practice may reduce erosion and the amount of sediment and related substances delivered to the surface waters. The practice may increase the amount of water that infiltrates into the root zone, and, at the time there is an overabundance of soil water, this water may percolate and leach soluble substances into the ground water.

Controlled Drainage (335): Control of surface and subsurface water through use of drainage facilities and water control structures.

The purpose is to conserve water and maintain optimum soil moisture to (1) store and manage infiltrated rainfall for more efficient crop production; (2) improve surface water quality by increasing infiltration, thereby reducing runoff, which may carry sediment and undesirable chemicals; (3) reduce nitrates in the drainage water by enhancing conditions for denitrification; (4) reduce subsidence and wind erosion of organic soils; (5) hold water in channels in forest areas to act as ground fire breaks; and (6) provide water for wildlife and a resting and feeding place for waterfowl.

Cover Crop (340): A crop of close-growing grasses, legumes, or small grain grown primarily for seasonal protection and soil improvement. It usually is grown for 1 year or less, except where there is permanent cover as in orchards.

Erosion, sediment and adsorbed chemical yields could be decreased in conventional tillage systems because of the increased period of vegetal cover. Plants will take up available nitrogen and prevent its undesired movement. Organic nutrients may be added to the nutrient budget reducing the need to supply more soluble forms. Overall volume of chemical application may decrease because the vegetation will supply nutrients and there may be allelopathic effects of some of the types of cover vegetation on weeds. Temperatures of ground and surface waters could slightly decrease.

Critical Area Planting (342): Planting vegetation, such as trees, shrubs, vines, grasses, or legumes, on highly erodible or critically eroding areas. (Does not include tree planting mainly for wood products.)

This practice may reduce soil erosion and sediment delivery to surface waters. Plants may take up more of the nutrients in the soil, reducing the amount that can be washed into surface waters or leached into ground water.

During grading, seedbed preparation, seeding, and mulching, large quantities of sediment and associated chemicals may be washed into surface waters prior to plant establishment.

Cross Wind Ridges/StripCropping/Trap Strips (589): Ridges formed by tillage or planting, crops grown in strips, or herbaceous cover aligned perpendicular to the prevailing wind direction.

Dikes (356): An embankment constructed of earth or other suitable materials to protect land against overflow or to regulate water.

Where dikes are used to prevent water from flowing onto the floodplain, the pollution dispersion effect of the temporary wetlands and backwater are decreased. The sediment, sediment-attached, and soluble materials being transported by the water are carried farther downstream. The final fate of these materials must be investigated on site. Where dikes are used to retain runoff on the floodplain or in wetlands, the pollution dispersion effects of these areas may be enhanced. Sediment and related materials may be deposited, and the quality of the water flowing into the stream from this area will be improved.

Dikes are used to prevent wetlands and to form wetlands. The formed areas may be fresh, brackish, or saltwater wetlands. In tidal areas, dikes are used to stop saltwater intrusion, and to increase the hydraulic head of fresh water which will force intruded salt water out of the aquifer. During construction there is a potential of heavy sediment loadings to the surface waters. When pesticides are used to control the brush on the dikes and fertilizers are used for the establishment and maintenance of vegetation, there is the possibility for these materials to be washed into the surface waters.

Diversion (362): A channel constructed across the slope with a supporting ridge on the lower side.

This practice will assist in the stabilization of a watershed, resulting in the reduction of sheet and rill erosion by reducing the length of slope. Sediment may be reduced by the elimination of ephemeral and large gullies. This may reduce the amount of sediment and related pollutants delivered to the surface waters.

Fence (382): A constructed barrier to livestock, wildlife, or people.

Fencing is a facilitating practice to implement a prescribed grazing system which would improve vegetation and reduce erosion, sediment and nutrient delivery.

Fencing is a practice that can be on the contour or up and down slope. Often a fence line has grass and some shrubs in it. When a fence is built across the slope, the grasses and shrubs that may line the fence will slow down runoff and cause deposition of coarser grained materials, reducing the amount of sediment delivered downslope. Fencing may protect riparian areas which act as sediment traps and filters along water channels and impoundments.

Livestock have a tendency to walk along fences in search of forage when the grazing land is poorly managed or has inadequate forage. The paths become bare channels which concentrate and accelerate runoff causing a greater amount of erosion within the path and where the path/channel outlets into another channel. This can deliver more sediment and associated pollutants to surface waters. Fencing can have the effect of concentrating livestock in small areas, causing a concentration of manure which may wash off into the stream, thus causing surface water pollution.

Field Stripcropping (586): Growing crops in a systematic arrangement of strips or bands across the general slope (not on the contour) to reduce water erosion. The crops are arranged so that a strip of grass or a close-growing crop is alternated with a clean-tilled crop or fallow.

This practice may reduce erosion and the delivery of sediment and related substances to the surface waters. The practice may increase infiltration and, when there is sufficient water available, may increase the amount of leachable pollutants moved toward the ground water.

Since this practice is not on the contour there will be areas of concentrated flow, from which detached sediment, adsorbed chemicals and dissolved substances will be delivered more rapidly to the receiving waters. The sod strips will not be efficient filter areas in these areas of concentrated flow.

Field Border (386): A strip of perennial vegetation established at the edge of a field by planting or by converting it from trees to herbaceous vegetation or shrubs.

This practice reduces erosion by having perennial vegetation on an area of the field. Field borders serve as "anchoring points" for contour rows, terraces, diversions, and contour strip cropping. By elimination of the practice of tilling and planting the ends up and down slopes, erosion from concentrated flow in furrows and long rows may be reduced. This use may reduce the quantity of sediment and related pollutants transported to the surface waters.

Field windbreak (392): A strip or belt of trees or shrubs established in or adjacent to a field as a barrier to wind.

Filter Strip (393): A strip or area of vegetation for removing sediment, organic matter, and other pollutants from runoff and wastewater.

Filter strips for sediment and related pollutants meeting minimum requirements may trap the coarser grained sediment. They may not filter out soluble or suspended fine-grained materials. When a storm causes runoff in excess of the

design runoff, the filter may be flooded and may cause large loads of pollutants to be released to the surface water. This type of filter requires high maintenance and has a relative short service life and is effective only as long as the flow through the filter is shallow sheet flow.

Filter strips for runoff from concentrated livestock areas may trap organic material, solids, materials which become adsorbed to the vegetation or the soil within the filter. Often they will not filter out soluble materials. This type of filter is often wet and is difficult to maintain.

Filter strips for controlled overland flow treatment of liquid wastes may effectively filter out pollutants. The filter must be properly managed and maintained, including the proper resting time. Filter strips on forest land may trap coarse sediment, timbering debris, and other deleterious material being transported by runoff. This may improve the quality of surface water and has little effect on soluble material in runoff or on the quality of ground water.

All types of filters may reduce erosion in the area on which they are constructed. Filter strips trap solids from the runoff flowing in sheet flow through the filter. Coarse-grained and fibrous materials are filtered more efficiently than fine-grained and soluble substances. Filter strips work for design conditions, but when flooded or overloaded they may release a slug load of pollutants into the surface water.

Floodwater Diversion (400): A graded channel with a supporting embankment or dike on the lower side constructed on lowland subject to flood damage.

Forage Harvest Management (511): The timely cutting and removal of forages from the field as hay, greenchop, or ensillage.

Forest Land Erosion Control System (408): Application of one or more erosion control measures on forest land. Erosion control system includes the use of conservation plants, cultural practices, and erosion control structures on disturbed forest land for the control of sheet and rill erosion, gully formation, and mass soil movement.

Grade Stabilization Structure (410): A structure used to control the grade and head cutting in natural or artificial channels.

Where reduced stream velocities occur upstream and downstream from the structure, streambank and streambed erosion will be reduced. This will decrease the yield of sediment and sediment-attached substances. Structures that trap sediment will improve downstream water quality. The sediment yield change will be a function of the sediment yield to the structure, reservoir trap efficiency and of velocities of released water. Ground water recharge may affect aquifer quality depending on the quality of the recharging water. If the stored water contains only sediment and chemical with low water solubility, the ground water quality should not be affected.

Grassed Waterway (412): A natural or constructed channel that is shaped or graded to required dimensions and established in suitable vegetation for the stable conveyance of runoff.

This practice may reduce the erosion in a concentrated flow area, such as in a gully or in ephemeral gullies. This may result in the reduction of sediment and

substances delivered to receiving waters. Vegetation may act as a filter in removing some of the sediment delivered to the waterway, although this is not the primary function of a grassed waterway.

Any chemicals applied to the waterway in the course of treatment of the adjacent cropland may wash directly into the surface waters in the case where there is a runoff event shortly after spraying.

When used as a stable outlet for another practice, waterways may increase the likelihood of dissolved and suspended pollutants being transported to surface waters when these pollutants are delivered to the waterway.

Grazing Land Mechanical Treatment (548): Modifying physical soil and/or plant conditions with mechanical tools by treatments such as; pitting, contour furrowing, and ripping or subsoiling.

Heavy Use Area Protection (561): Protecting heavily used areas by establishing vegetative cover, by surfacing with suitable materials, or by installing needed structures.

Protection may result in a general improvement of surface water quality through the reduction of erosion and the resulting sedimentation. Some increase in erosion may occur during and immediately after construction until the disturbed areas are fully stabilized.

Some increase in chemicals in surface water may occur due to the introduction of fertilizers for vegetated areas and oils and chemicals associated with paved areas. Fertilizers and pesticides used during operation and maintenance may be a source of water pollution.

Paved areas installed for livestock use will increase organic, bacteria, and nutrient loading to surface waters. Changes in ground water quality will be minor. Nitrate nitrogen applied as fertilizer in excess of vegetation needs may move with infiltrating waters. The extent of the problem, if any, may depend on the actual amount of water percolating below the root zone.

Hedgerow Planting (422): Establishing a living fence of shrubs or trees in, across, or around a field.

Herbaceous Wind Bathers (422A): Herbaceous vegetation established in rows or narrow strips across the prevailing wind direction.

Hillside Ditch (423): A channel that has a supporting ridge on the lower side constructed across the slope at definite vertical intervals and gradient, with or without a vegetative barrier.

Irrigation Canal or Lateral (320): A permanent irrigation canal or lateral constructed to convey water from the source of supply to one or more farms.

Irrigation Field Ditch (388): A permanent irrigation ditch constructed to convey water from the source of supply to a field or fields in a farm distribution system.

The standard for this practice applies to open channels and elevated ditches of 25 ft^3/second or less capacity formed in and with earth materials.

Irrigation field ditches typically carry irrigation water from the source of supplying to a field or fields. Salinity changes may occur in both the soil and water. This will depend on the irrigation water quality, the level of water management, and the geologic materials of the area. The quality of ground and surface water may be altered depending on environmental conditions. Water lost from the irrigation system to downstream runoff may contain dissolved substances, sediment, and sediment-attached substances that may degrade water quality and increase water temperature. This practice may make water available for wildlife, but may not significantly increase habitat.

Irrigation Land Leveling (464): Reshaping the surface of land to be irrigated to planned grades.

The effects of this practice depend on the level of irrigation water management. If plant root zone soil water is properly managed, then quality decreases of surface and ground water may be avoided. Under poor management, ground and surface water quality may deteriorate. Deep percolation and recharge with poor quality water may lower aquifer quality. Land leveling may minimize erosion and when runoff occurs concurrent sediment yield reduction. Poor management may cause an increase in salinity of soil, ground and surface waters. High efficiency surface irrigation is more probable when earth moving elevations are laser controlled.

Irrigation Pit or Regulating Reservoir, Irrigation Pit (552A): A small storage reservoir constructed to regulate or store a supply of water for irrigation.

Irrigation Pit or Regulating Reservoir, Regulating Reservoir (552B): A small storage reservoir constructed to regulate or store a supply of water for irrigation.

Irrigation Storage Reservoir (436): An irrigation water storage structure made by constructing a dam.

Irrigation System, Microirrigation (441): A planned irrigation system in which all necessary facilities are installed for efficiently applying water directly to the root zone of plants by means of applicators (orifices, emitters, porous tubing, or perforated pipe) operated under low pressure (Figure 2-20). The applicators can be placed on or below the surface of the ground (Figure 2-21).

Surface water quality may not be significantly affected by transported substances because runoff is largely controlled by the system components (practices). Chemical applications may be applied through the system. Reduction of runoff will result in less sediment and chemical losses from the field during irrigation. If excessive, local, deep percolation should occur, a chemical hazard may exist to shallow ground water or to areas where geologic materials provide easy access to the aquifer.

Irrigation System, Sprinkler (422): A planned irrigation system in which all necessary facilities are installed for efficiently applying water by means of perforated pipes or nozzles operated under pressure.

Proper irrigation management controls runoff and prevents downstream surface water deterioration from sediment and sediment attached substances. Over irrigation through poor management can produce impaired water quality in runoff as well as ground water through increased percolation. Chemigation with

this system allows the operator the opportunity to mange nutrients, wastewater and pesticides. For example, nutrients applied in several incremental applications based on the plant needs may reduce ground water contamination considerably, compared to one application during planting. Poor management may cause pollution of surface and ground water. Pesticide drift from chemigation may also be hazardous to vegetation, animals, and surface water resources. Appropriate safety equipment, operation and maintenance of the system is needed with chemigation to prevent accidental environmental pollution or backflows to water sources.

Irrigation System, Surface and Subsurface (443): A planned irrigation system in which all necessary water control structures have been installed for efficient distribution of irrigation water by surface means, such as furrows, borders, contour levees, or contour ditches, or by subsurface means.

Operation and management of the irrigation system in a manner which allows little or no runoff may allow small yields of sediment or sediment-attached substances to downstream waters. Pollutants may increase if irrigation water management is not adequate. Ground water quality from mobile, dissolved chemicals may also be a hazard if irrigation water management does not prevent deep percolation. Subsurface irrigation that requires the drainage and removal of excess water from the field may discharge increased amounts of dissolved substances such as nutrients or other salts to surface water. Temperatures of downstream water courses that receive runoff waters may be increased. Temperatures of downstream waters might be decreased with subsurface systems when excess water is being pumped from the field to lower the water table. Downstream temperatures should not be affected by subsurface irrigation during summer months if lowering the water table is not required. Improved aquatic habitat may occur if runoff or seepage occurs from surface systems or from pumping to lower the water table in subsurface systems.

Irrigation System, Tailwater Recovery (447): A facility to collect, store, and transport irrigation tailwater for reuse in the farm irrigation distribution system.

The reservoir will trap sediment and sediment-attached substances from runoff waters. Sediment and chemicals will accumulate in the collection facility by entrapping which would decrease downstream yields of these substances.

Salts, soluble nutrients, and soluble pesticides will be collected with the runoff and will not be released to surface waters. Recovered irrigation water with high salt and/or metal content will ultimately have to be disposed of in an environmentally safe manner and location. Disposal of these waters should be part of the overall management plan. Although some ground water recharge may occur, little if any pollution hazard is usually expected.

Irrigation Water Conveyance, Ditch and Canal Lining, Flexible Membrane (428B): A fixed lining of impervious material installed in an existing or newly constructed irrigation field ditch or irrigation canal or lateral.

Irrigation Water Conveyance, Ditch and Canal Lining, Galvanized Steel (428C): A fixed lining of impervious material installed in an existing or newly constructed irrigation field ditch or irrigation canal or lateral.

Irrigation Water Conveyance, Ditch and Canal Lining, Nonreinforced Concrete (428A): A fixed lining of impervious material installed in an existing or newly constructed irrigation field ditch or irrigation canal or lateral.

Irrigation Water Conveyance, High-Pressure, Underground, Plastic (430DD): A pipeline and appurtenances installed in an irrigation system.

Irrigation Water Conveyance, Low-Pressure, Underground, Plastic (430EE): A pipeline and appurtenances installed in an irrigation system.

Irrigation Water Conveyance, Pipeline, Aluminum Tubing (430AA): A pipeline and appurtenances installed in an irrigation system.

Irrigation Water Conveyance, Pipeline, Asbestos-Cement (430BB): A pipeline and appurtenances installed in an irrigation system.

Irrigation Water Conveyance, Pipeline, Nonreinforced Concrete (430CC): A pipeline and appurtenances installed in an irrigation system.

Irrigation Water Conveyance, Pipeline, Reinforced Plastic Mortar (430GG): A pipeline and appurtenances installed in an irrigation system.

Irrigation Water Conveyance, Pipeline, Rigid Gated Pipeline (430HH): A rigid pipeline, with closely spaced gates, installed as part of a surface irrigation system.

Irrigation Water Conveyance, Pipeline, Steel (430FF): A pipeline and appurtenances installed in an irrigation system.

Irrigation Water Management (449): Determining and controlling the rate, amount, and timing of irrigation water in a planned and efficient manner.

Management of the irrigation system should provide the control needed to minimize losses of water, and yields of sediment and sediment-attached and dissolved substances, such as plant nutrients and herbicides, from the system. Poor management may allow the loss of dissolved substances from the irrigation system to surface or ground water. Good management may reduce saline percolation from geologic origins. Returns to the surface water system would increase downstream water temperature.

The purpose is to effectively use available irrigation water supply in managing and controlling the moisture environment of crops to promote the desired crop response, to minimize soil erosion and loss of plant nutrients, to control undesirable water loss, and to protect water quality.

To achieve this purpose the irrigator must have knowledge of (1) how to determine when irrigation water should be applied, based on the rate of water used by crops and on the stages of plant growth; (2) how to measure or estimate the amount of water required for each irrigation, including the leaching needs; (3) the normal time needed for the soil to absorb the required amount of water and how to detect changes in intake rate; (4) how to adjust water stream size, application rate, or irrigation time to compensate for changes in such factors as intake rate or the amount of irrigation runoff from an area; (5) how to recognize erosion caused by irrigation; (6) how to estimate the amount of irrigation runoff from an area; and (7) how to evaluate the uniformity of water application.

Land Reclamation Landslide Treatment (453): Treating inplace materials, mine spoil, mine waste, or overburden to reduce downslope movement.

Lined Waterway or Outlet (468): A waterway or outlet having an erosion-resistant lining of concrete, stone, or other permanent material.

The lined section extends up the side slopes to a designed depth. The earth above the permanent lining may be vegetated or otherwise protected.

This practice may reduce the erosion in concentrated flow areas resulting in the reduction of sediment and substances delivered to the receiving waters.

When used as a stable outlet for another practice, lined waterways may increase the likelihood of dissolved and suspended substances being transported to surface waters due to high flow velocities. A lined waterway may also prevent recharge of the water table as would occur with a natural water body.

Mole Drain (482): An underground conduit constructed by pulling a bullet-shaped cylinder through the soil.

Mulching (484): Applying plant residues or other suitable materials not produced on the site to the soil surface.

Nutrient Management (590): Managing the amount, source, placement, form and timing of applications of nutrients and soil amendments.

Pasture and Hay Planting (512): Establishing native or introduced forage species.

The long-term effect will be an increase in the quality of the surface water due to reduced erosion and sediment delivery. Increased infiltration and subsequent percolation may cause more soluble substances to be carried to ground water.

Pipeline (516): Pipeline installed for conveying water for livestock or for recreation

Pipelines may decrease sediment, nutrient, organic, and bacteria pollution from livestock. Pipelines may afford the opportunity for alternative water sources other than streams and lakes, possibly keeping the animals away from the stream or impoundment. This will prevent bank destruction with resulting sedimentation, and will reduce animal waste deposition directly in the water. The reduction of concentrated livestock areas will reduce manure solids, nutrients, and bacteria that accompany surface runoff.

Pond (378): A water impoundment made by constructing a dam or an embankment or by excavation of a pit or dugout.

Ponds may trap nutrients and sediment which wash into the basin. This removes these substances from downstream. Chemical concentrations in the pond may be higher during the summer months. By reducing the amount of water that flows in the channel downstream, the frequency of flushing of the stream is reduced and there is a collection of substances held temporarily within the channel. A pond may cause more leachable substances to be carried into the ground water.

Precision Land Forming (462): Reshaping the surface of land to planned grades.

Prescribed Burning (338): Applying controlled fire to predetermined areas.

When the area is burned in accordance with the specifications of this practice the nitrates with the burned vegetation will be released to the atmosphere. The ash will contain phosphorous and potassium which will be in a relatively highly soluble form. If a runoff event occurs soon after the burn there is a probability that these two materials may be transported into the ground water or into the surface water. When in a soluble state the phosphorous and potassium will be more difficult to trap and hold in place. When done on range grasses the growth of the grasses is increased and there will be an increased tie-up of plant nutrients as the grasses' growth is accelerated.

Prescribed Grazing (528A): The controlled harvest of vegetation with grazing or browsing animals, managed with the intent to achieve a specified objective.

Planned grazing systems normally reduce the system time livestock spend in each pasture. This increases quality and quantity of vegetation. As vegetation quality increases, fiber content in manure decreases which speeds manure decomposition and reduces pollution potential. Freeze-thaw, shrink-swell, and other natural soil mechanisms can reduce compacted layers during the absence of grazing animals. This increases infiltration, increases vegetative growth, slows runoff, and improves the nutrient and moisture filtering and trapping ability of the area.

Decreased runoff will reduce the rate of erosion and movement of sediment and dissolved and sediment-attached substances to downstream water courses. No increase in ground water pollution hazard would be anticipated from the use of this practice.

Increased vegetation slows runoff and acts as a sediment filter for sediments and sediment attached substances, uses more nutrients, and reduces raindrop splash. Adverse chemical effects should not be anticipated from the use of this practice.

Pumped Well Drain (532): A well sunk into an aquifer from which water is pumped to lower the prevailing water table.

Range Planting (Seeding) (550): Establishment of adapted perennial vegetation such as grasses, forbs, legumes, shrubs, and trees.

Increased erosion and sediment yield may occur during the establishment of this practice. This is a temporary situation and sediment yields decrease when reseeded area becomes established. If chemicals are used in the reestablishment process, chances of chemical runoff into downstream water courses are reduced if application is applied according to label instructions. After establishment of the grass cover, grass sod slows runoff, acts as a filter to trap sediment, sediment attached substances, increases infiltration, and decreases sediment yields.

Regulating Water in Drainage Systems (554): Controlling the removal of surface or subsurface runoff, primarily through the operation of water-control structures.

Residue Management (329) (NoTill): Any tillage and planting system in which at least 30 percent of the soil surface is covered by plant residue after planting to reduce soil erosion by water; or, where soil erosion by wind is the primary

concern, at least 1,000 pounds per acre of flat small grain residue-equivalent are on the surface during the critical erosion period.

This practice reduces soil erosion, detachment and sediment transport by providing soil cover during critical times in the cropping cycle. Surface residues reduce soil compaction from raindrops, preventing soil sealing and increasing infiltration. This action may increase the leaching of agricultural chemicals into the ground water.

In order to maintain the crop residue on the surface it is difficult to incorporate fertilizers and pesticides. This may increase the amount of these chemicals in the runoff and cause more surface water pollution.

The additional organic material on the surface may increase the bacterial action on and near the soil surface. This may tie-up and then breakdown many pesticides which are surface applied, resulting in less pesticide leaving the field. This practice is more effective in humid regions.

With a no-till operation, generally the only soil disturbance is from a leading coulter, followed by the disk openers. Fertilizer may be injected and applied in a separate operation, including side dressing. The surface applied fertilizers and chemicals are not incorporated and often are not in direct contact with the soil surface. This condition may result in a high surface runoff of pollutants (nutrient and pesticides). Macropores develop under a no-till system. They permit deep percolation and the transmittal of pollutants, both soluble and insoluble to be carried into the deeper soil horizons and into the ground water. If rainfall is relatively light and does not cause rapid runoff, surface applied nutrients and herbicides move into the soil and are no longer subject to surface runoff losses.

Reduced tillage systems disrupt or break down the macropores, incidentally incorporate some of the materials applied to the soil surface, and reduce the effects of wheeltrack compaction. The results are less runoff and less pollutants in the runoff.

Riparian Herbaceous Cover (390): Establishing an area of grasses and/or forbs adjacent to and up-gradient from water bodies.

Riparian Forest Buffer (391A): Establishing an area of trees and or shrubs adjacent to and up-gradient from water bodies.

Rock Barrier (555): A rock retaining wall constructed across the slope to form and support a bench terrace that will control the flow of water and check erosion on sloping land.

Roof Runoff Management (558): A facility for controlling and disposing of runoff water from roofs.

This practice may reduce erosion and the delivery of sediment and related substances to surface waters. It will reduce the volume of water polluted by animal wastes. Loadings of organic waste, nutrients, bacteria, and salts to surface water will be reduced as water is prevented from flowing across concentrated waste areas, barnyards, roads and alleys. Pollution and erosion will be reduced. Flooding may be prevented and drainage may improve.

Runoff Management System (570): A system for controlling excess runoff caused by construction operations at development sites, changes in land use, or other land disturbances.

Seasonal Residue Management (344): Using plant residues to protect cultivated fields during critical erosion periods.

When this practice is employed, raindrops are intercepted by the residue, reducing detachment, soil dispersion, and soil compaction. Erosion may be reduced and the delivery of sediment and associated pollutants to surface water may be reduced. Reduced soil sealing, crusting and compaction allows more water to infiltrate, resulting in an increased potential for leaching of dissolved pollutants into the ground water.

Crop residues on the surface increase the microbial and bacterial action on or near the surface. Nitrates and surface-applied pesticides may be tied-up and less available to be delivered to surface and ground water. Residues trap sediment and reduce the amount carried to surface water. Crop residues promote soil aggregation and improve soil tilth.

Sediment Basin (350): A basin constructed to collect and store debris or sediment.

Sediment basins will remove sediment, sediment-associated materials and other debris from the water which is passed on downstream. Due to the detention of the runoff in the basin, there is an increased opportunity for soluble materials to be leached toward the ground water.

Soil and Crop Water Use Data: From soils information the available water-holding capacity of the soil can be determined along with the amount of water that the plant can extract from the soil before additional irrigation is needed.

Water use information for various crops can be obtained from various USDA publications.

The purpose is to allow the water user to estimate the amount of available water remaining in the root zone at any time, thereby indicating when the next irrigation should be scheduled and the amount of water needed. Methods to measure or estimate the soil moisture should be employed, especially for high-value crops or where the water-holding capacity of the soil is low.

Spring Development (574): Improving springs and seeps by excavating, cleaning, capping, or providing collection and storage facilities.

There will be negligible long-term water quality impacts with spring developments. Erosion and sedimentation may occur from any disturbed areas during and immediately after construction, but should be short-lived. These sediments will have minor amounts of adsorbed nutrients from soil organic matter.

Stream Channel Stabilization (584): Stabilizing the channel of a stream with suitable structures.

Stream Corridor Improvement (interim): Restoration of a modified or damaged stream to a more natural state using bioengineering techniques to protect the banks and reestablish the riparian vegetation.

Stream Crossing (interim): A stabilized area to provide access across a stream for livestock and farm machinery.

The purpose is to provide a controlled crossing or watering access point for livestock along with access for farm equipment, in order to control bank and streambed erosion, reduce sediment and enhance water quality, and maintain or improve wildlife habitat.

Streambank and Shoreline Protection (580): Using vegetation or structures to stabilize and protect banks of streams, lakes, estuaries, or excavated channels against scour and erosion.

Stripcropping, Contour (585): Growing crops in a systematic arrangement of strips or bands on the contour to reduce water erosion. The crops are arranged so that a strip of grass or close-growing crop is alternated with a strip of clean-tilled crop or fallow or a strip of grass is alternated with a close-growing crop.

Structure for Water Control (587): A structure in an irrigation, drainage, or other water management systems that conveys water, controls the direction or rate of flow, or maintains a desired water surface elevation.

Subsurface Drain (606): A conduit, such as corrugated plastic tile, or pipe, installed beneath the ground surface to collect and/or convey drainage water.

Soil water outlet to surface water courses by this practice may be low in concentrations of sediment and sediment-adsorbed substances and that may improve stream water quality. Sometimes the drained soil water is high in the concentration of nitrates and other dissolved substances and drinking water standards may be exceeded. If drainage water that is high in dissolved substances is able to recharge ground water, the aquifer quality may become impaired. Stream water temperatures may be reduced by water drainage discharge. Aquatic habitat may be altered or enhanced with the increased cooler water temperatures.

Surface Drainage Field Ditch (607): A graded ditch for collecting excess water in a field.

From erosive fields, this practice may increase the yields of sediment and sediment-attached substances to downstream water courses because of an increase in runoff. In other fields, the location of the ditches may cause a reduction in sheet and rill erosion and ephemeral gully erosion. Drainage of high salinity areas may raise salinity levels temporarily in receiving waters. Areas of soils with high salinity that are drained by the ditches may increase receiving waters. Phosphorus loads resulting from this practice may increase eutrophication problems in ponded receiving waters. Water temperature changes will probably not be significant. Upland wildlife habitat may be improved or increased although the habitat formed by standing water and wet areas may be decreased.

Surface Drainage, Main or Lateral (608): An open drainage ditch constructed to a designed size and grade.

Surface Roughening (609): Roughening the soil surface by ridge or clod-forming tillage.

Terrace (600): An earthen embankment, a channel, or combination ridge and channel constructed across the slope.

This practice reduces the slope length and the amount of surface runoff which passes over the area downslope from an individual terrace. This may reduce the erosion rate and production of sediment within the terrace interval. Terraces trap sediment and reduce the sediment and associated pollutant content in the runoff water which enhance surface water quality. Terraces may intercept and conduct surface runoff at a nonerosive velocity to stable outlets, thus, reducing the occurrence of ephemeral and classic gullies and the resulting sediment. Increases in infiltration can cause a greater amount of soluble nutrients and pesticides to be leached into the soil. Underground outlets may collect highly soluble nutrient and pesticide leachates and convey runoff directly to an outlet. Terraces may increase the delivery of pollutants to surface waters. Terraces increase the opportunity to leach salts below the root zone in the soil. Terraces may have a detrimental effect on water quality if they concentrate and accelerate delivery of dissolved or suspended nutrient, salt, and pesticide pollutants to surface or ground waters.

Tree/Shrub Establishing (612): To establish woody plants by planting or seeding.

Trough or Tank (614): A trough or tank, with needed devices for water control and waste water disposal, installed to provide drinking water for livestock.

By the installation of a trough or tank, livestock may be better distributed over the pasture, grazing can be better controlled, and surface runoff reduced, thus reducing erosion. By itself this practice will have only a minor effect on water quality; however when coupled with other conservation practices, the beneficial effects of the combined practices may be large. Each site and application should be evaluated on its own merits.

Use Exclusion (472): Excluding livestock from an area not intended for grazing.

Livestock exclusion may improve water quality by preventing livestock from being in the water or walking down the banks, and by preventing manure deposition in the stream. The amount of sediment and manure may be reduced in the surface water. This practice prevents compaction of the soil by livestock and prevents losses of vegetation and undergrowth. This may maintain or increase evapotranspiration. Increased permeability may reduce erosion and lower sediment and substance transportation to the surface waters. Shading along streams and channels resulting from the application of this practice may reduce surface water temperature.

Waste Management System (312): A planned system in which all necessary components are installed for managing liquid and solid waste, including runoff from concentrated waste areas, in a manner that does not degrade air, soil, or water resources.

Waste Storage Facility (313): A waste storage impoundment made by constructing an embankment and/or excavating a pit or dugout, or by fabricating a structure.

This practice may reduce the nutrient, pathogen, and organic loading to surface waters. This is accomplished by intercepting and storing the polluted runoff from manure stacking areas, barnyards and feedlots.

Waste Treatment Lagoon (359): An impoundment made by excavation or earth fill for biological treatment of animal or other agricultural wastes.

This practice may reduce polluted surficial runoff and the loading of organics, pathogens, and nutrients into the surface waters. It decreases the nitrogen content of the surface runoff from feedlots by denitrification. Runoff is retained long enough that the solids and insoluble phosphorus settle and form a sludge in the bottom of the lagoon. There may be some seepage through the sidewalls and the bottom of the lagoon. Usually the long-term seepage rate is low enough, so that the concentration of substances transported into the ground water does not reach an unacceptable level.

Waste Utilization (633): Using agricultural wastes or other wastes on land in an environmentally acceptable manner while maintaining or improving soil and plant resources.

Waste utilization helps reduce the transport of sediment and related pollutants to the surface water. Proper site selection, timing of application and rate of application may reduce the potential for degradation of surface and ground water. This practice may increase microbial action in the surface layers of the soil, causing a reaction which assists in controlling pesticides and other pollutants by keeping them in place in the field.

Mortality and other compost, when applied to agricultural land, will be applied in accordance with the nutrient management measure. The composting facility may be subject to State regulations and will have a written operation and management plan if SCS practice 317 (composting facility) is used.

Water and Sediment Control Basin (638): An earthen embankment or a combination ridge and channel generally constructed across the slope and minor watercourses to form a sediment trap and water detention basin.

The practice traps and removes sediment and sediment-attached substances from runoff. Trap control efficiencies for sediment and total phosphorus that are transported by runoff may exceed 90 percent in silt loam soils. Dissolved substances, such as nitrates, may be removed from discharge to downstream areas because of the increased infiltration. Where geologic condition permit, the practice will lead to increased loadings of dissolved substances toward ground water. Water temperatures of surface runoff, released through underground outlets, may increase slightly because of longer exposure to warming during its impoundment.

Water Table Control (641): Water table control through proper use of subsurface drains, water control structures, and water conveyance facilities for the efficient removal of drainage water and distribution of irrigation water.

The water table control practice reduces runoff, therefore downstream sediment and sediment-attached substances yields will be reduced. When drainage is increased, the dissolved substances in the soil water will be discharged to receiving water and the quality of water reduced. Maintaining a high water

table, especially during the nongrowing season, will allow denitrification to occur and reduce the nitrate content of surface and ground water by as much as 75 percent. The use of this practice for salinity control can increase the dissolved substance loading of downstream waters while decreasing the salinity of the soil. Installation of this practice may create temporary erosion and sediment yield hazards but the completed practice will lower erosion and sedimentation levels. The effect of the water table control of this practice on downstream wildlife communities may vary with the purpose and management of the water in the system.

Waterspreading (640): Diverting or collecting runoff from natural channels, gullies, or streams with a system of dams, dikes, ditches, or other means, and spreading it over relatively flat areas.

Water Well (642): A well constructed or improved to provide water for irrigation, livestock, wildlife, or recreation.

The location of the well must consider the natural water quality and the hazards of its use in potentially contaminating the environment. Hazards exist during well development and its operation and maintenance. Care must be taken to prevent contamination of the aquifer from back flushing, accident, or flow down the annular spacing between the well casing and the bore hole.

Water-Measuring Device: An irrigation water meter, flume, weir, or other water-measuring device installed in a pipeline or ditch.

The measuring device must be installed between the point of diversion and water distribution system used on the field. The device should provide a means to measure the rate of flow. Total water volume used may then be calculated using rate of flow and time, or read directly, if a totalizing meter is used.

The purpose is to provide the irrigator the rate of flow and/or application of water, and the total amount of water applied to the field with each irrigation.

Wetland Wildlife Habitat Management (644): Creating, maintaining, or enhancing wetland habitat for desired wildlife species.

Wetland Restoration (657): A rehabilitation of a drained or degraded wetland where the soils, hydrology, vegetative community, and biological habitat are returned to the natural condition to the extent practicable.

Wildlife Upland Habitat Management (645): Creating, maintaining, or enhancing upland habitat for desired wildlife species.

Windbreak/Shelterbelt Establishment (380): Linear plantings of single or multiple rows of trees or shrubs established next to farmstead, feedlots, and rural residences as a barrier to wind.

Windbreak/Shelterbelt Renovation (650): Restoration or preservation of an existing windbreak, including widening, replanting, or replacing trees.

Appendix B: The NRCS Field Office Technical Guide (FOTG)

The NRCS Field Office Technical Guide (FOTG)

The Natural Resources Conservation Service (NRCS) Field Office Technical Guide (FOTG) (www.nrcs.usda.gov/technical/efotg/) is a compilation of resource information about soil, water, air, plant, animal, and socio-economic resources in each local field office area. It also contains other conservation planning aides, including standards and specifications for conservation practices that are applicable in the local area.

The driving concept behind the FOTG is that effective conservation must recognize the inherent variability of natural resources across the land. Each FOTG represents a continuing commitment of NRCS to provide its field office professionals with science and technologies that are tuned to resources they will encounter in their work. Because there are many factors to be considered through the NRCS conservation planning process, regardless of program or purpose, the FOTG provides the place to go for those considerations.

The FOTG is a key part of the materials needed to carry out NRCS' technical assistance. The National Planning Procedures Handbook, NRCS' technical handbooks and manuals, and the FOTG provide the basic framework for doing high quality conservation planning assistance.

FOTG is a work continually in progress. Because our professional needs change, our conservation programs change, our information technologies change, and our knowledge of resources grows, we know that the FOTG is dynamic.

The FOTG and Conservation Planning:

Conservation planning and the FOTG go hand in hand. Conservation planning is the vehicle we use to deliver technical information then allows clients to sustain the productive use of the natural resources they manage. At the same time, feedback from conservation planning, application, and evaluation efforts helps expand the quantity and improve the quality of the technical material found in the FOTG.

Conservation planning is the cornerstone of the technical work NRCS does with clients, groups, and conservation partners. It is an integrated, systematic way of utilizing technical information and knowledge to help people address resource problems and opportunities.

National Conservation Practice Standards Subcommittee:

The National Conservation Practice Standards Subcommittee (NCPSS) is a function of the National Technical Guide Committee. It exists to coordinate development and review of national level practice standards; and, it publishes those national standards in the NRCS National Handbook of Conservation Practices. NCPSS does not make selection of practice standards for inclusion in the FOTG. State Conservationists, through their state-level technical guide committees, direct which national practices are selected for inclusion in FOTGs in their respective states. Those state-level selections are made with needs of each field office in mind.

Selection of national practices for inclusion does not end the process. In most, if not all cases, national practice standards are too general for application through NRCS assistance. There are technical processes, procedures from handbooks and manuals, and other details to be added. State laws and local ordinances may impose performance criteria that must be addressed, too. NRCS state-level and other technical specialists (including NRCS field personnel) may be called upon to adapt the national practice standard and to develop the practice specifications.

Since 1996, state practices that are used with highly erodible land or in wetland programs are required to have public review prior to their placement in the FOTG. This is a requirement of the 1996 Farm Bill. This process is undergoing review along with other parts of NRCS' FOTG policy in order to make it more responsive to field needs.

After all these activities and reviews, the practice standard (and its specifications) are ready for inclusion in the field office FOTG. It is a process that ensures that the technical guidance each standard and specification provides is pertinent to field office conditions.

FOTG Contents:

Section I: General Resource References

Section I lists references and other information for use in understanding natural resources of the field office service area or in making decisions about resource use and management systems. The actual references listed are to be filed, to the extent possible, in the same location as the FOTG. Computer-based tools used in resource analysis and modeling will be listed in Section I. References kept in other locations will be cross-referenced. Examples include texts and publications dealing with databases found in Section II (below) as well as other resource issues.

Section II: Natural Resources Information

Section II contains natural resource data, databases, and procedures for interpretation. These may include Ecological Site Descriptions and Forage Suitability Group Descriptions. This section will have a statement indicating exactly what is used as the "official" copy of the Soil Survey. In some cases separate statements may be needed for maps, tables, and data.

Section III: Resource Management Systems and Quality Criteria

Resource Management Systems (RMS) will address all identified resource concerns at or above the level of sustainability, taking into account human-cultural, economic and social concerns relative to the Soil, Water,

Air, Plant, and Animal natural resources. Quality Criteria for treatment required to achieve a RMS will be established by NRCS and filed in this section of the FOTG. Criteria shall be stated in either qualitative or quantitative terms for each resource consideration. Where national criteria have not been established, the State Conservationist will establish criteria. Where State and/or local regulations establish more restrictive criteria, these must be used in developing the RMSs.

Section IV: Practice Standards, Specifications and Supplements

Section IV of the FOTG contains conservation practice standards applicable in that field office. Practice standards contain minimum quality criteria for each practice while the specifications describe requirements necessary to install the practice. Supplements add new information as it becomes available. It may also include specifications guide sheets developed for use with the standards.

Section V: Conservation Effects

Conservation effects provide indicators of the impacts conservation practices and systems have on the natural and cultural resources. They are based primarily on empirical data and field experience with practices and systems of practices. The effects are listed for each individual practice. States may provide hardcopy effects or refer the user to the Conservation Effects data. The effects of systems can be estimated by evaluating the combined effects of practices included in a specific system. When properly planned and applied, systems of conservation practices are generally complimentary and accumulative. When conservation practices are installed, the effects on all natural resources are considered.