NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

PEST MANAGEMENT

(Acre)

CODE 595

Definition

Utilizing environmentally sensitive prevention, avoidance, monitoring and suppression strategies, to manage weeds, insects, diseases, animals and other organisms (including invasive and non-invasive species), that directly or indirectly cause damage or annoyance.

Purposes

This practice is applied as part of a Resource Management System (RMS) to support one or more of the following purposes:

- Enhance quantity and quality of commodities.
- Minimize negative impacts of pest control on soil, water, air, plant and animal resources and/or humans.

Conditions Where Practice Applies

Wherever pests will be managed.

CRITERIA

General Criteria Applicable to All Purposes

A pest management component of a conservation plan shall be developed wherever pests will be managed. The goals of the pest management plan are to: 1) adequately manage pests, 2) Reduce reliance on the use of pesticides and promote environmentally sound methods, 3) assess and address the risk of on site and off site impacts from pest management techniques.

The management plan shall emphasize, and include techniques to achieve these goals. The plan shall include an assessment of environmental risk associated with the existing and alternative pest management systems. Planning shall consider the principles of Integrated Pest Management (IPM) which will be included in the plan to the extent possible. Where comprehensive IPM programs are available they will be utilized. In other cases, IPM principles and techniques will be utilized as feasible. Where irrigation is used to meet all or part of crop water use, irrigation water management techniques conforming to NRCS practice 449 will be in place or planned.

The impacts of all pest management techniques shall be assessed regarding their impact on other resources. Where mitigation is needed for a particular practice it will be included in the plan.

Implementing IPM is a long term, multi-year task. A plan for achieving this should be prepared by the producer with the

assistance of IPM professionals. This plan will be part of, and consistent with, the overall conservation plan.

Where applied, IPM is an ecosystem-based strategy that focuses on long-term prevention of pests or their damage through a combination of techniques such as biological control, habitat manipulation, modification of cultural techniques, and use of resistant varieties. Pesticides are used only after monitoring indicates they are needed according to established guidelines, and treatments are made with the goal of removing only the target organism. Pest control materials are selected and applied in a manner that minimizes risks to human health, beneficial and nontarget organisms, and the environment. (UC Statewide IPM Program definition)

Pest monitoring, use of damage thresholds, prevention, avoidance, and suppression are IPM strategies that together can minimize economic risk, pest resistance, and potential harmful effects of pest control efforts on human health and environmental resources. IPM prevention strategies include the conservation of resident biological control agents, use of resistant varieties, sanitation, and other agronomic techniques. IPM suppression strategies include augmentative biological controls, cultural controls and the judicious use of chemical controls. Pest management strategies should emphasize prevention and avoidance, with chemical pesticides used only as a last resort. University of California IPM publications such as "IPM in Practice: Principles and Methods of Integrated Pest Management", "UC IPM Pest Management Guidelines" at www.ipm.ucdavis.edu, and crop specific manuals such as "IPM for Alfalfa Hay" or "IPM for Walnuts" should be consulted. The University of California publications can be ordered online at http://anrcatalog.ucdavis.edu or by contacting the University of California Division of Agriculture and Natural Resources (UC DANR). Other resources may be available at www.wripmc.org, the West Region IPM Center.

The decision to apply a pesticide should be made only after thorough sampling, after consideration of alternatives, and be based on an established treatment threshold value established by research (e.g. number of tomato fruit worm eggs per leaf), or local experience and consensus of private and public experts where research is lacking.

An appropriate set of prevention and/or mitigation techniques must be planned and implemented to reduce the environmental risks of pest management activities on non-target plants or animals, or other undesirable impacts, in accordance with quality criteria in the local Field Office Technical Guide (FOTG). Mitigation and prevention techniques include techniques like Filter Strip or Conservation Crop Rotation, and management techniques like application method, timing or use of reduced-risk pesticides. See Table 1 for a more comprehensive listing of mitigation and prevention techniques.

Clients shall be instructed to pay special attention to all environmental hazards (such as disposal of contaminated wash water or unused pesticide mixes), to site-specific application directions on pesticide labels, and to information contained in UC Guidelines, or provided by a licensed Pest Control Adviser.

In no circumstances will NRCS provide recommendations to either apply or not apply a particular pesticide. NRCS will not recommend any other particular action on a particular field to control a named pest unless it is written in a pest

management plan. Guidance for utilizing general or crop specific IPM practices conforming to UC guidelines, or risk assessment of a pesticide use that is current or being considered, can be provided by NRCS. The role of NRCS is to provide technical assistance to producers considering alternative pest management or pesticide risk reducing practices. The client will make decisions based on all available information in consultation with a licensed PCA. Technical Service Providers (TSP) working in relation to NRCS to prepare a pest management plan must be a licensed PCA.

All methods of pest management must comply with Federal, State, and local regulations, including management plans for invasive pest species, noxious weeds and disease vectors. Compliance with the Food Quality Protection Act (FQPA); Federal Insecticide, Fungicide and Rodenticide Act (FIFRA); Worker Protection Standard (WPS); the Interim Endangered Species Protection Program (H7506C), all label and supplemental label language, and California laws and regulations as required for chemical pest control.

Additional Criteria to Protect Quantity and Quality of Crops

Commodity specific guidelines should be consistent with general IPM principles and consider the need to reduce risk associated with pesticide use or other control measures. Consult UC published, crop specific IPM guidelines and the UC IPM website at www.ipm.ucdavis.edu

Additional Criteria to Protect Soil Resources

Clients shall be instructed to pay special attention to reducing potential pesticide residues in soil that may negatively impact human health or non-target plants and animals. Some pesticides, particularly soil fumigants, negatively affect soil structure by reducing beneficial soil organisms.

Avoid soil compaction by applying materials with the lightest equipment available and when soil moisture content is appropriate. If tillage is used to control weeds possible soil compaction, soil erosion, and sediment impacts shall be considered before the practice is planned.

Additional Criteria to Protect Water Resources

Risk to ground and surface water quality from pest management techniques and pesticides will be evaluated for all applicable Water Resource Concerns, as defined in FOTG Section III Quality Criteria - Water. When planning for land expected to affect water bodies designated as impaired from pesticides by the local Regional Water Quality Control Board, evaluate considering the basis for that designation, as appropriate. This evaluation will be performed using WIN-PST, or an approved alternative tool. www.wcc.nrcs.usda.gov/pestmgt/winpst.html contains more information on the proper use of WIN-PST.

Risk to water resources will be evaluated for each combination of pesticides used and management systems in place, planned, or considered as an alternative. When a chosen alternative has significant potential to negatively impact water resources, (e.g., when WIN-PST ratings are “Extra High”, “High” or “Intermediate” for human risk in the drainage area of a drinking water reservoir), a different alternative or an

appropriate set of mitigation or prevention techniques must be planned to reduce risk. The techniques planned will lower the risk rating to the desired level for the identified concern. The circumstances and severity of the problem will indicate the action required.

The Windows® Pesticide Screening Tool (WIN-PST) is approved for evaluating risk of pesticide runoff to surface water, leaching to groundwater, and associated impacts. This model does not evaluate other potential risks to human health and the environment.

Most pesticides are transported while dissolved in water or while adsorbed to particles suspended in water. Efficient water use will help prevent pesticide leaching to groundwater or runoff into surface water resources. Irrigation principles, as described in NRCS Practice 449, will be applied on irrigated cropland with a pest management plan. Irrigation induced erosion will be controlled adequately to assure that, in coordination with all conservation techniques, sediment discharge is minimized. As appropriate, tillage operations shall be managed in conjunction with other sediment control techniques to minimize sediment loading to nearby surface water bodies.

Techniques that can be used to mitigate or prevent potential pesticide loss are listed and evaluated in Table 1.

Clients shall follow label instructions for limiting pesticide residues in leachate and runoff that may negatively impact humans or non-target plants and animals.

Additional Criteria to Protect Air Resources

Clients shall be instructed to pay special attention to application standards, such as minimum wind speed, maximum wind speed, boom length on aircraft, nozzle specifications, boom pressure, shutoff valves, etc., to minimize pesticide drift that may negatively impact humans and non-target plants and animals.

When burning of crop residue is used to control disease the impacts on air quality will be considered.

Reducing the number of pesticide applications will reduce emissions of VOCs (Volatile Organic Compounds), particulates, and exhaust from application equipment. Certain pesticides and formulations have greater VOC emissions than others, particularly fumigants and emulsifiable concentrates. When practicable, clients shall use alternative techniques or products before using high VOC-containing pesticide products. Techniques that can be used to mitigate VOC emissions are listed in Table II.

Clients shall be encouraged to use techniques that reduce agricultural dust, including such tactics as reduced tillage and cover crops. Programs of various air regulatory agencies will be considered in the plan. For details on programs in the San Joaquin Valley see:

http://www.valleyair.org/Air_Quality_Plans/docs/pm10/PDF%202003%20PM10%20Plan%20adpt%20app/App%20H.pdf

Additional Criteria to Protect Plant Resources

Clients must follow all pesticide label instructions and in particular:

- Avoid pest control measures that negatively impact crop plants such as contaminated spray equipment, spray drift, or improper calibration.
- Identify appropriate climatic conditions, crop stage, soil moisture, pH, and soil organic matter to help protect plant health and increase pesticide efficacy (i.e., use less product to do the same job).
- Limit pesticide residues in soil that can persist and harm subsequent sensitive crops. Avoid carryover by following plant back requirements on pesticide labels.
- Limit impacts on crop plants from physical weed control such as poorly adjusted cultivators or flame burners.

Additional Criteria to Protect Animal Resources

Clients must follow all pesticide label instructions that minimize negative impacts to animals, especially bees.

Additional Criteria to Protect Humans

- Clients must follow all pesticide label instructions that minimize negative impacts to pesticide applicators, field workers, and the general public.

Fumigants such as methyl bromide, chloropicrin, metam-sodium (Vapam), and dichloropropene (Telone) are toxic, highly volatile, and applied at high rates. Off-gassing during application and for several days following application can lead to public and worker exposure problems. Modified application methods, rate or acreage limits, buffer zones, or other measures may be required to mitigate exposure. Clients must consult with the county agricultural commissioner about state and local regulatory requirements for fumigant applications. Techniques that can be used to mitigate VOC emissions are listed in Table II.

Additional Criteria to Protect Endangered Species

Determine if installation of this practice and others proposed will impact any federal or state listed Rare, Threatened or Endangered species or their habitat. The objective of NRCS is to benefit these species and others of concern, or not have an adverse effect on any listed species.

If the Environmental Evaluation indicates the action may adversely affect a listed species or result in adverse modification of critical habitat of a listed species, NRCS will advise the land user 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 landowner selects one of the alternative conservation treatments for installation; or at the request of the landowners, NRCS may initiate consultation with the Fish and Wildlife Service, National Marine Fisheries Service and/or California Department of Fish and Game.

If the Environmental Evaluation indicates the action will not affect a listed species or result in adverse modification of critical habitat, consultation generally will not apply and usually would not be initiated.

Some species are year-round residents in streams, such as freshwater shrimp. Other species, such as steelhead and salmon,

utilize streams during various seasons. Critical periods in the lifecycle of a species may preclude activities in the stream that affect stream habitat. For example during salmon spawning there should be no disturbance of stream gravel beds that may contain eggs. That could exclude any equipment in the stream, walking in the stream, or any work upstream that may result in sediment depositing in the gravel beds.

Document any special considerations for endangered species in the Practice Requirements Worksheet.

The following website contains useful information regarding Endangered Species and pesticide use, including the "PRESCRIBE" database.

http://www.cdpr.ca.gov/docs/es/index.htm

Considerations

- The University of California publishes commodity-specific IPM manuals and guidelines that should be consulted when evaluating or planning IPM actions. IPM principles described in the publication "IPM in Practice: Principles and Methods of Integrated Pest Management." (UC DANR publication 3418) should be considered when commodity specific manuals are not available. The website www.ipm.ucdavis.edu should be consulted for additional or current information.

The following IPM principles should be considered:

- Prevention, such as winter sanitation to remove over-wintering pests, using pest-free seeds and transplants, cleaning tillage and harvesting equipment between fields, irrigation scheduling to avoid situations conducive to disease development, etc. Excessive use of nutrients and water can promote pest populations and should be avoided.

- Avoidance, such as using pest resistant varieties, crop rotation, trap crops, etc.
- Monitoring, such as pest scouting, soil testing, weather forecasting, etc. to help target suppression strategies and avoid routine preventative pest control.
- Suppression, such as cultural, biological and least disruptive chemical controls, that can reduce a pest population or its impacts. Chemical controls should be based on monitoring and used as a last resort in order to minimize environmental risk, pest resistance, and to increase the plant's overall ability to tolerate pests.
- Consider alternate crops or planting dates, placing crops in certain spatial arrangements to avoid pest movement, or conserving natural enemies (with respect to insects)
- Treatment thresholds should be met prior to application of a pesticide.
- Records of past pest occurrences and control actions should be maintained and consulted when making pest management decisions.
- A systematic monitoring plan for each management unit is needed. Monitoring should be accomplished and recorded weekly. Dividing the management unit into subunits and recording information for each subunit is suggested.

- Mechanical weed control should be done under low wind conditions or when soil is at a desirable moisture level that limits compaction and dust emissions.
- The following website contains links useful for achieving the intent of this practice, including identification of lower toxicity alternative materials.

http://www.pesticideinfo.org/Index.html

PLANS AND SPECIFICATIONS

The pest management component of a conservation plan shall be prepared in accordance with the criteria of this standard and shall describe the requirements for applying the practice to achieve its intended purpose(s).

As a minimum, the pest management component of a conservation plan shall include:

- Plan map and soil map of managed site showing land units planned, pertinent infrastructure, the location of sensitive resources (such as adjacent water bodies), high risk areas (such as zones of very permeable soil), and setbacks, if applicable.
- Environmental risk analysis with approved tools and/or procedures, such as WIN-PST. Analysis will consider probable alternatives, including alternatives to pesticides.
- Where IPM is planned, a written IPM plan will be prepared stating how pest management decisions will be made, how pests will be monitored and what treatment thresholds will be used. Examples of monitoring forms should be included. The plan will also indicate how treatments will be chosen. The plan should follow the seasonal development of the crop from preplant to post harvest or harvest to harvest for perennial crops. Sample plans are at the UCIPM web site www.ipm.ucdavis.edu. Decisions that include actions that are field, date, and pest specific must be written and certified by a PCA.
- A description of how the plan will be evaluated. Generally IPM plans will be evaluated once a year after harvest. At a minimum evaluation will include a check-off list of activities with dates when procedures were carried out, filled out monitoring forms, written recommendations from PCA, and a list of all actions taken and treatment thresholds or guidelines used in decision-making. After considering evaluation results, plans will be revised as needed.
- Interpretation of the environmental risk analysis and identification of planned prevention and mitigation techniques.
- Standardized plan formats, such as those prepared to meet organic standards or other industry formats, *that meet all requirements of this standard*, may be substituted to avoid duplication of documents.
- Operation and maintenance requirements.

Operation and Maintenance

The pest management component of a conservation plan shall include appropriate operation and maintenance items for the client. These may include:

- Review and update the plan annually in order to incorporate new IPM technology, assure all needed actions

are planned and performed, respond to cropping system and pest complex changes, and avoid the development of pest resistance. Check current UC IPM guidelines and/or a UCCE Specialist to ensure consideration of the most appropriate IPM technology. Consult www.ipm.ucdavis.edu for current information. Contact the local Agricultural Commissioner to update knowledge of local pesticide use restrictions. Contact USEPA Food Quality Protection Act (FQPA) coordinator (415-947-4242) to identify pesticides targeted by FQPA.

- Maintain prevention and mitigation techniques identified in the plan in order to ensure continued effectiveness.
- Follow state and local requirements to protect individuals from exposure to chemicals. Provide telephone numbers and addresses of emergency treatment centers Provide telephone number of the nearest poison control center. The toll-free phone number for California Poison Control is:

1-800-876-4766
TDD 1-800-972-3323

Information on worker safety can be found at the following website:

http://www.cdpr.ca.gov/docs/whs/psisenglish

- The National Pesticide Information Center (NPIC) telephone number in Corvallis, Oregon for non-emergency information is:

1-800-858-7378

Monday - Friday
06:30 to 16:30 Pacific Time

The NPIC web address is:
http://npic.orst.edu

- For advice and assistance with emergency spills that involve agrichemicals, the local emergency telephone number should be provided. The national 24-hour CHEMTREC telephone number is:

1-800-424-9300

Contact the dealer or manufacturer for materials not covered by CHEMTREC.

- Follow label requirements for mixing/loading setbacks from wells, intermittent streams and rivers, natural or impounded ponds and lakes, or reservoirs. Install and utilize backflow prevention equipment. Check with your County Agricultural Commissioner for regulations that may be more restrictive.
- Post signs according to label directions and/or Federal, State, and local laws around sites that have been treated. Follow restricted entry intervals.
- Dispose of pesticides and pesticide containers in accordance with the most restrictive label directions. Federal regulations, local regulations and the California Code of Regulations Title 3, Division 6 may require varying disposal techniques.
- Read and follow label directions and maintain appropriate Material Safety Data Sheets (MSDS).
- Be aware of legal requirements for pesticide application. The following website contains DPR regulations.

http://www.cdpr.ca.gov/docs/inhouse/calcode/subchpte.htm#0302

- Calibrate application equipment according to Extension and/or manufacturer recommendations before each seasonal use and with each major chemical change.
- Replace worn nozzle tips, cracked hoses, and faulty gauges.
- Maintain records of all pest management actions for at least two years. Pesticide application records shall be in accordance with California Code of Regulations Title 3, Division 6. A list of federally registered Restricted Use Pesticides is available at http://entweb.clemson.edu/pesticid/document/fedrup.htm. California amendments are found at http://www.cdpr.ca.gov/docs/inhouse/calcode/020401.html#6400.0
- Maintain records of all pest monitoring for at least five years. There is no required format for these records.

TABLE I – Mitigation and Prevention Effectiveness Guide for Reducing Pesticide Impacts on Water Quality‡

Note: Tables I and II identify management techniques and conservation techniques that have the potential to mitigate or prevent pesticide impacts. Table I considers water quality impacts. Table II considers air quality impacts. Not all techniques will be applicable to a given situation. Relative effectiveness ratings by pesticide loss pathway are "no effect" (blank), "slight effect" (+/-), "moderate effect" (++/--), and "significant effect" (+++/---)‡. The tables also identify how the techniques function. Effectiveness of any technique can be highly variable based on site-specific conditions and how it is designed and installed. This is especially important with the widely variable soils, climate, and topography that are present in California. **Field Office employees should consult with appropriate local specialists for guidance as needed to evaluate the effectiveness of alternative mitigation and prevention techniques.** Note that techniques designed to protect one resource could have detrimental effects on another. For example, chiseling and subsoiling can reduce runoff (protection of surface water resources) but increase leaching (adversely affect groundwater resources). All resources should be taken into account when evaluating mitigation and prevention alternatives.

Pest Management Mitigation and Prevention Techniques	Pesticide Loss Pathways Addressed			Function
	Leaching	Solution Runoff	Adsorbed Runoff	
Management Techniques [1/]				
Application Placement	+++	+++	+++	Spot treatments, band treatments, alternate row treatments, border treatments, trunk treatments etc. limit the amount of pesticide used and can selectively place the pesticide where it will be most effective and/or least damaging to nontarget organisms.
Application Timing	+++	+++	+++	Reduces exposure potential and improves efficacy – applying chemical at the appropriate time in the pest lifecycle will achieve better control, delaying application when significant rainfall events are forecast can reduce pesticide transport to ground and surface water, application when conditions are optimal can reduce the amount of pesticide applied. Delaying application when wind speed is not in accordance with label requirements can reduce pesticide drift to surface water. Using computer models to time pesticide spraying can reduce the number of sprays required for adequate control. Only models considered to be adequately validated by the University of California – after review of available scientific research – should be considered acceptable

Pest Management Mitigation and Prevention Techniques	Pesticide Loss Pathways Addressed			Function
	Leaching	Solution Runoff	Adsorbed Runoff	
Behavioral Controls	+++	+++	+++	Use of semiochemicals (such as insect mating pheromones) to decrease reproductive success or feeding damage caused by pests. When properly managed, behavioral controls reduce the need to apply pesticides. Reduces hazard potential and improves long-term efficacy.
Biological Control	+++	+++	+++	Reduces hazard potential. The release, conservation, or enhancement of native or naturalized organisms for biocontrol of pests through disease, predation, or other means. These agents are usually not compatible with the use of broad-spectrum, high-toxicity pesticides.
Cultural Controls	+++	+++	+++	Reduces hazard potential. Includes modified planting dates, pruning techniques, field design, variety selection, and many other cultural techniques aimed at preventing or treating pest problems.
Formulations/Adjuvants	++	++	+	Reduces exposure potential – formulations and/or adjuvants that increase efficacy allow lower application rates
Lower Application Rates	+++	+++	+++	Reduces exposure potential - use lowest effective or legal rate
Mechanical/Physical Controls	+++	+++	+++	Reduces hazard potential by eliminating pesticide use. Examples include mulches, solarization, traps, cultivation, mowing, flaming and many other techniques. Each must be considered separately since they may have unintended impacts. For example, cultivation may lead to air emissions or increased loss of soil or residues.
Pesticide Label Environmental Hazard Warnings and BMPs	Required 2/	Required 2/	Required 2/	Reduces exposure potential - label guidance must be carefully followed for pesticide applications near water bodies and on soils that are intrinsically vulnerable to erosion, runoff, or leaching
Scouting and Integrated Pest Management Thresholds	+++	+++	+++	Reduces exposure and other risk potential - reduces the amount of pesticide applied and determines location of application.
Set-backs	+	++	+	Reduces exposure potential - reduced application area reduces amount of pesticide applied, can also reduce inadvertent pesticide application and drift to surface water
Soil Incorporation –	/---	+++	+++	Reduces exposure potential for surface losses, but may

Pest Management Mitigation and Prevention Techniques	Pesticide Loss Pathways Addressed			Function
	Leaching	Solution Runoff	Adsorbed Runoff	
Mechanical or Irrigation				increase exposure potential for leaching losses
Substitution – Alternative lower risk pesticides	+++	+++	+++	Reduces hazard potential. Use of pesticides such as biopesticides, or those deemed "minimum risk" by the U.S. EPA, or deemed "reduced-risk" by DPR, or EPA. http://www.pesticideinfo.org/Alternatives.html
Conservation Techniques [3/]				
Agrichemical Mixing Center (596)	+++	+++	+++	Reduces the potential for point source pesticide contamination
Alley Cropping (311)	+	+	++	Increases infiltration and uptake of subsurface water, reduces soil erosion, can provide habitat for beneficial insects which can reduce the need for pesticides, also can reduce pesticide drift to surface water
Anionic Polyacrylamide (PAM) Erosion Control (450)	/-	+	+++	Reduces irrigation induced soil erosion and may increase leaching losses if higher infiltration rates result from PAM use
Bedding (310)	+	+	+	Increases surface infiltration and aerobic pesticide degradation in the root zone
Brush Management (314)	+++	+++	+++	Using non-chemical brush control often reduces the need for pesticides, pesticide use requires environmental risk analysis and appropriate mitigation and prevention - see Pest Management (595)
Conservation Cover (327)	+++	+++	+++	Retiring land from annual crop production often reduces the need for pesticides, builds soil organic matter
Constructed Wetland (656)	+	+	++	Captures pesticide residues and facilitates their degradation
Conservation Crop Rotation (328)	++	++	++	Reduces the need for pesticides by breaking pest lifecycles
Contour Buffer Strips (332)		++	++	Increases infiltration, reduces soil erosion, creates local soil environment that accelerates pesticide degradation.
Contour Farming (330)	-	+	+	Increases infiltration and deep percolation, reduces soil erosion
Contour Orchard and Other Fruit Area (Ac.) (331)	-	+	+	Increases infiltration and deep percolation, reduces soil erosion
Contour Stripcropping (585)	-	++	++	Increases infiltration, reduces soil erosion
Cover Crop (340)	+	+	++	Increases infiltration, reduces soil erosion, builds soil organic matter, creates soil environment that

Pest Management Mitigation and Prevention Techniques	Pesticide Loss Pathways Addressed			Function
	Leaching	Solution Runoff	Adsorbed Runoff	
				accelerates pesticide degradation.
Cross Wind Ridges (589A)			(+) 4/	Reduces wind erosion and adsorbed pesticide deposition in surface water
Cross Wind Stripcropping (589B)			(++) 4/	Reduces wind erosion and adsorbed pesticide deposition in surface water, traps adsorbed pesticides
Cross Wind Trap Strips (589C)			(++) 4/	Reduces wind erosion and adsorbed pesticide deposition in surface water, traps adsorbed pesticides
Deep Tillage (324)	-	+	+	Increases infiltration and deep percolation, encourages root exploration and more rapid development in cotton (reduces impact of rook-knot nematode)
Dike (356)	++/--	++	++	Reduces exposure potential - excludes outside water (++ leaching) or captures pesticide residues and facilitates their degradation (-- leaching)
Diversion (362)	+	+	+	Reduces exposure potential - water is diverted
Drainage Water Management (554)	++/--	++	++	Seasonal saturation may reduce the need for pesticides, drainage reduces storm water runoff, drainage increases infiltration and aerobic pesticide degradation in the root zone during the growing season (++ leaching), seasonal saturation may bring the water table in contact with pesticide residues from the previous growing season (-- leaching)
Field Border (386)		+	++	Increases infiltration and traps adsorbed pesticides, often reduces application area resulting in less pesticide applied, can provide habitat for beneficial insects which reduces the need for pesticides, can provide habitat to congregate pests which can result in reduced pesticide application, also can reduce inadvertent pesticide application and drift to surface water
Filter Strip (393)		++	+++	Increases infiltration and traps adsorbed pesticides, creates local soil environment that accelerates pesticide degradation, can provide habitat for beneficial insects which reduces the need for pesticides, can provide habitat to congregate pests which can result in reduced pesticide application, also can reduce inadvertent pesticide application and drift to surface water
Floodwater Diversion (400)	+	+	+	Reduces exposure potential - floodwater is diverted
Forage Harvest	++	++	++	Reduces exposure potential - timely harvesting reduces

Pest Management Mitigation and Prevention Techniques	Pesticide Loss Pathways Addressed			Function
	Leaching	Solution Runoff	Adsorbed Runoff	
Management (511)				the need for pesticides
Forest Stand Improvement (666)	++	++	++	Reduces the potential for pest damage and the need for pesticides
Grade Stabilization Structure (410)			++	Traps adsorbed pesticides
Grassed Waterway (412)		+	++	Increases infiltration, creates local soil environment that accelerates pesticide degradation, and traps adsorbed pesticides (should be applied with Filter Strips at the outlet and on each side of the waterway)
Grazing Land Mechanical Treatment (548)	-	+	+	Increases infiltration and deep percolation
Hedgerow Planting (442)			(+) 4/	Reduces adsorbed pesticide deposition in surface water, also can reduce inadvertent pesticide application and drift to surface water
Herbaceous Wind Barriers (603)			(+) 4/	Reduces wind erosion, traps adsorbed pesticides, can provide habitat for beneficial insects which reduces the need for pesticides, can provide habitat to congregate pests which can result in reduced pesticide application, also can reduce pesticide drift to surface water
Hillside Ditch (423)	+	+	+	Reduces exposure potential - water is diverted
Irrigation Land Leveling (464)	++	+	++	Reduces exposure potential - uniform surface reduces pesticide transport to ground and surface water
Irrigation System, Microirrigation (441)	++	+++	+++	Reduces exposure potential - efficient and uniform irrigation reduces pesticide transport to ground and surface water
Irrigation System, Sprinkler (442)	++	++	++	Reduces exposure potential - efficient and uniform irrigation reduces pesticide transport to ground and surface water
Irrigation System, Surface and Subsurface (443)	+	+	+	Reduces exposure potential - efficient and uniform irrigation reduces pesticide transport to ground and surface water
Irrigation System Tail Water Recovery (447)		+++	+++	Captures pesticide residues and facilitates their degradation
Irrigation Water Management (449)	+++	+++	+++	Water is applied at rates that minimize pesticide transport to ground and surface water, promotes healthy plants which can better tolerate pests
Land Smoothing (466)	+	+	+	Reduces exposure potential - uniform surface reduces pesticide transport to ground and surface water
Mole Drain (482)	+	+	+	Increases infiltration and aerobic pesticide degradation

Pest Management Mitigation and Prevention Techniques	Pesticide Loss Pathways Addressed			Function
	Leaching	Solution Runoff	Adsorbed Runoff	
				in the root zone *Note – avoid direct outlets to surface water
Mulching (484)	+	+/-	+/-	Often reduces the need for pesticides, natural mulches increase infiltration and reduce soil erosion (+ solution and adsorbed runoff), artificial mulches may increase runoff and erosion (- solution and adsorbed runoff)
Nutrient Management (590)	++	++	++	Promotes healthy plants which can better tolerate pests
Pasture and Hay Planting (512)	++	++	++	Retiring land from annual crop production often reduces the need for pesticides, builds soil organic matter
Precision Land Forming (462)	++	+	++	Reduces exposure potential - uniform surface reduces pesticide transport to ground and surface water
Prescribed Burning (338)	++	++	++	Often reduces the need for pesticides
Prescribed Grazing (528A)	++	++	++	Improves plant health and reduces the need for pesticides
Range Planting (550)	++	++	++	Increases infiltration and uptake of subsurface water, reduces soil erosion, builds soil organic matter
Recreation Area Improvement (562)	++	++	++	Increases infiltration and uptake of subsurface water, reduces soil erosion, builds soil organic matter
Residue Management, No-till and Strip-Till (329A)	+	++	+++	Increases infiltration, reduces soil erosion, builds soil organic matter
Residue Management, Mulch-Till (329B)	+	++	+++	Increases infiltration, reduces soil erosion, builds soil organic matter
Residue Management, Ridge Till (329C)	+	++	+++	Increases infiltration, reduces soil erosion, builds soil organic matter
Residue Management, Seasonal (344)	+	+	+	Increases infiltration, reduces soil erosion, builds soil organic matter
Riparian Forest Buffer (391)	+	+++	+++	Increases infiltration and uptake of subsurface water, traps sediment, builds soil organic matter
Riparian Herbaceous Cover (390)	+	++	++	Increases infiltration, traps sediment, builds soil organic matter
Row Arrangement (557)	-	+	+	Increases infiltration and deep percolation, reduces soil erosion
Sediment Basin (350)			++	Captures and facilitates pesticide residue degradation
Stripcropping, Field (586)	-	+	+	Increases infiltration, reduces soil erosion
Structure For Water Control (587)	-	++	+++	Captures pesticide residues and facilitates their degradation, increases infiltration and deep percolation

Pest Management Mitigation and Prevention Techniques	Pesticide Loss Pathways Addressed			Function
	Leaching	Solution Runoff	Adsorbed Runoff	
Subsurface Drainage (606)	+	++	++	Increases infiltration and aerobic pesticide degradation in the root zone *Note – avoid direct outlets to surface water
Surface Drainage, Field Ditch (607)	+	+	+	Increases infiltration and aerobic pesticide degradation in the root zone
Surface Roughening (609)			(+) 4/	Reduces wind erosion and adsorbed pesticide deposition in surface water
Terrace (600)	--	++	+++	Increases infiltration and deep percolation, reduces soil erosion
Tree and Shrub Establishment (612)	+++	+++	+++	Retiring land from annual crop production often reduces the need for pesticides, increases infiltration and uptake of subsurface water, builds soil organic matter
Vegetative Barriers (601)			++	Reduces soil erosion, traps sediment, increases infiltration
Waste Storage Facility (313)	+	++	++	Captures pesticide residues
Waste Treatment Lagoon (359)		+++	+++	Captures pesticide residues and facilitates their degradation
Waste Utilization (633)	++	++	++	Increases soil organic matter
Water and Sediment Control Basin (638)	-	++	+++	Captures pesticide residues and facilitates their degradation, increases infiltration and deep percolation
Waterspreading (640)	-	+	+	Increases infiltration and deep percolation
Well Decommissioning (351)	+++			Eliminates point source contamination
Wetland Creation (Ac.) (658)	+	+	+	Captures pesticide residues and facilitates their degradation
Wetland Enhancement (Ac.) (659)	+	+	+	Captures pesticide residues and facilitates their degradation
Wetland Restoration (Ac.) (657)	+	+	+	Captures pesticide residues and facilitates their degradation
Windbreak/Shelterbelt Establishment (380)			(++) 4/	Reduces wind erosion, reduces adsorbed pesticide deposition in surface water, traps adsorbed pesticides, also can reduce pesticide drift
Windbreak/Shelterbelt Renovation (650)			(++) 4/	Reduces wind erosion, reduces adsorbed pesticide deposition in surface water, traps adsorbed pesticides, also can reduce pesticide drift

[1/] Additional information on pest management mitigation and prevention techniques can be obtained from Extension pest management publications, pest management consultants and pesticide labels.

[2/] The pesticide label is the law - all pesticide label specifications must be carefully followed, including required mitigation. Additional mitigation and prevention may be needed to meet NRCS pest management requirements for identified resource concerns.

[3/] Details regarding the effects of Conservation Techniques on ground and surface water contamination by pesticides are contained in the Conservation Practice Physical Effects matrix found in the National Handbook of Conservation Techniques.

[4/] Mitigation and prevention applies to adsorbed pesticide losses being carried to surface water by wind.

‡ *TABLE I Mitigation and prevention Effectiveness Guide - Reducing Pesticide Impacts on Water Quality* is based on available research, and the NWCC Pest Management Team's best professional judgment. It is prepared to assist with planning a response to risk identified using WIN-PST or other similar tool. The ratings are relative index values as opposed to absolute values, much like the Conservation Practice Physical Effects (CPPE) matrix. They are intended to help producers choose the best combination of techniques for their identified resource concerns. The *potential* for a technique to provide mitigation and prevention is rated. The technique has to be specifically designed, implemented and maintained for the mitigation and prevention potential to be realized. Varying site conditions impact mitigation and prevention effectiveness. . Our general rule of thumb is that +'s generally have the potential to reduces losses by 10 - 15%., ++'s have the potential to reduce losses by about 25% and +++'s have the potential to reduce losses by about 50%.

The original matrix was developed by the EPA-sanctioned Aquatic Dialogue Group and published by SETAC. The original reference is: *Aquatic Dialogue Group: Pesticide Risk Assessment and Mitigation, Baker JL, Barefoot AC, Beasley LE, Burns LA, Caulkins PP, Clark JE, Feulner RL, Giesy JP, Graney RL, Griggs RH, Jacoby HM, Laskowski DA, Maciorowski AF, Mihaich EM, Nelson Jr HP, Parrish PR, Siefert RE, Solomon KR, van der Schalie WH, editors. 1994. Society of Environmental Toxicology and Chemistry, Pensacola, FL., pages 99-111 and Table 4-2.* They provided ranges of effectiveness for various mitigation and prevention techniques. With their permission, we expanded their work for the NEDC *Nutrient and Pest Management Considerations in Conservation Planning* course materials. Richard Aycock from Louisiana was the first to put a mitigation matrix into an NRCS Pest Management (595) standard, based in large part on Table 6.2 (pages 67 - 68), and Table, 6.4 (pages 71 - 72) in *Module 6, Part C-Integrating Nutrient and Pest Management with Other Conservation Techniques* in our *Nutrient and Pest Management Considerations in Conservation Planning* course materials. Table 1 was built from the Louisiana matrix by adding additional management techniques and conservation techniques. If you have any questions, please contact the NWCC Pest Management Team.

TABLE II – Effectiveness Guide for Reducing Pesticide Impacts on Air Quality

Management Technique	Effectiveness	Function
Application Date Change	++	Poor air quality due to ozone occurs between May and October. Pesticide applications and resulting VOC emissions that can be shifted outside this time period will cause less ozone formation. This is practical only for certain pesticides, such as fumigants.
Formulations/Adjuvants	++	Many emulsifiable concentrates contain a high percentage of VOCs. Switching to a different type of liquid formulation will usually decrease VOC emissions. Switching to a solid formulation is even more effective.
Lower Application Rates	++	Application rates are usually proportional to the VOC emission rate. Decreasing the application rate will likely cause a proportional decrease in VOC emissions.
Alternative Controls	+++	Replace use of high VOC materials with alternative low VOC chemicals or non-chemical control techniques