NATURAL RESOURCES CONSERVATION SERVICE
PACIFIC ISLANDS AREA

CONSERVATION PRACTICE SPECIFICATION

HERBACEOUS WEED CONTROL (315)

SCOPE

This document establishes the technical details, workmanship, and quality and extent of materials required to install the practice in accordance with the Conservation Practice Standard. The information shall be considered when preparing site-specific specifications for the practice.

All Herbaceous Weed Control plans and specifications for each field or treatment unit must be designed according to the criteria included in this specification. The PIA Plant Control, Clearing and Cutting Practices Jobsheet must be used when developing Herbaceous Weed Control plans, and shall be used to document the site-specific specifications for installing, operating, and maintaining the practice on a specific field or treatment unit. Other documents including transect data forms, worksheets, maps, drawings, and narrative statements in the conservation plan may be used in addition to the jobsheet to document site specifications or to plan, design or certify the practice.

GENERAL USE

Herbaceous weed control will be applied in a manner to achieve the desired control of the target species and protection of desirable non-target species. A detailed Herbaceous Weed Control plan that follows the guidance in this specification must be developed for each planned instance of Herbaceous Weed Control.

For planning and contracting purposes, a minimum reduction in target species density of 80% must be achieved in order for the control effort to be considered successful.

Revegetation may be necessary following Herbaceous Weed Control. Consult the Range Planting (550) or Forage and Biomass Planting (512) practice specifications for details concerning revegetation following Herbaceous Weed Control.

Field scouting, weed identification, evaluating economic thresholds, and choosing appropriate control methods are basic to general weed management activities.

Control measures may include using cultural, mechanical, chemical or biological methods either alone or in combination. An effective weed management program will usually include more than one control method, and more than one application “event”.

In the Pacific Islands Area, when managing for invasive woody species that are difficult to control and typically require more than one treatment application, Herbaceous Weed Control may be used in one of the following sequences of conservation practices:

- On RANGE and PASTURE: When treating difficult to control invasive species on range and pasture, Land Clearing (460) shall be used for the initial treatment, followed by Brush Management (314), followed by Herbaceous Weed Control (315).
- On FOREST: When treating difficult to control invasive species on forest land, Tree/Shrub Site Preparation (490) shall be used for the initial treatment, followed by Brush Management (314), followed by Herbaceous Weed Control (315).

NRCS will not develop biological or chemical treatment recommendations except for biological control utilizing grazing animals. A grazing plan that follows the Prescribed Grazing (528) practice standard and specification must be developed and followed to ensure desired results are achieved and maintained.

NRCS may provide clients with acceptable chemical control references. All chemical treatment references must be in accordance with the product label and follow the published recommendations from The University of

Hawai'i – College of Tropical Agriculture and Human Resources (CTAHR). If a recommendation published by CTAHR is not available, contact the PIA State Rangeland Management Specialist for guidance.

The NRCS office in Guam may provide clients with published chemical control references from the University of Guam's Cooperative Extension Service-Agriculture and Natural Resources (ANR) Unit and the NRCS office in Saipan may provide clients with published chemical control references from the Northern Marianas College-Cooperative Research Extension and Education Service, if available. If no published recommendations are available, follow the published UH-CTAHR recommendations or contact the PIA State Rangeland Management Specialist for assistance.

Livestock and human access will be controlled based on management methods applied and restrictions as listed on the chemical labels.

Consider using Integrated Pest Management (595) in support of herbaceous weed control. Consider soil erosion potential and difficulty of vegetation establishment when choosing a method of control that causes soil disturbance.

Consider the appropriate time period for treatment. Weed population suppression will be optimized when control measures are timed to susceptible life history stages of the weed species. Some herbaceous weed control activities can be effective when applied within a single year; others may require multiple years of treatment(s) to achieve desired objectives.

Consider impacts to wildlife species, especially threatened and endangered species, when designing an herbaceous weed control plan. Consider impacts to wildlife food supplies, space, and cover availability when planning the method and amount of herbaceous weed control.

State issued licenses may be required when using chemical pesticide treatments.

For air quality purposes, consider using chemical methods of herbaceous weed control that minimize chemical drift and excessive chemical usage and consider mechanical methods of herbaceous weed control that minimize the entrainment of particulate matter.

Adjacent land uses must be considered before chemicals are used.

Document revegetation needs on the Brush Management job sheet and consult the Range Planting (550) or Forage and Biomass Planting (512) practice specifications (as applicable) for details and procedures for developing a revegetation plan following Herbaceous Weed Control. Newly established forage plants shall not be grazed or harvested until the stand is well established and has reached the minimum recommended height and stage of growth for grazing to commence.

Herbaceous Weed Control is considered a facilitative practice in the PIA. When Herbaceous Weed Control is planned on grazing lands, at least one year of Prescribed Grazing (528) must also be planned as an accompanying management practice to ensure adequate recovery of forage species. The Prescribed Grazing plan must identify important management considerations including minimum height and stage of growth the stand much reach before grazing may commence, the recommended degree of grazing utilization and forage plant stubble height, the minimum height the forage plants must attain before grazing resumes, and estimated required deferment periods for adequate plant recovery. See the Prescribed Grazing (528) practice standard and specification for details.

NRCS Financial Assistance Programs: Whenever a cooperator enters into a contract with the NRCS, no less than one year and no greater than three years of Prescribed Grazing (528) must be planned. If revegetation is needed, Range Planting (550) or Forage and Biomass Planting (512) must also be planned. Consult the practice specifications (as applicable) for details and procedures for developing a revegetation plan following Herbaceous Weed Control. Refer to the Prescribed Grazing (528) practice specification for details on developing grazing plans following Herbaceous Weed Control and revegetation.

VARIANCES

Any requests for variances are to be submitted to the State Rangeland Management Specialist and must receive written approval prior to the implementation of the Herbaceous Weed Control Plan.

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HERBACEOUS WEED CONTROL PLAN:

All Herbaceous Weed Control plans and specifications for each field or treatment unit must be designed according to the criteria included in this specification. The PIA Plant Control, Clearing and Cutting Practices Jobsheet must be used when developing Herbaceous Weed Control plans.

At a minimum, an herbaceous weed control plan shall include:

1. The resource concern addressed by the plan.
2. Goals and objectives statement.
3. Plan map and soil map for the site, including drawings, and/or narratives detailing or identifying areas to be treated, pattern of treatment (if applicable), and areas that will not be disturbed. If these maps are already in the conservation plan folder, reference them but do not duplicate them for the purposes of the Herbaceous Weed Control plan.
4. Pre-treatment cover or density of the target plant(s) and the planned post-treatment cover or density and desired efficacy.
5. A monitoring plan that identifies what shall be measured (including timing and frequency) and the changes in the plant community (compare with objectives) that will be achieved.
6. T&E species and cultural resources documented in the CPA-52

In all cases, density measurements of target species must be quantified before and after treatment.

At the present time, use Forestry Technical Note 12 – "Transects and Fixed Radius Plots for Tree/Shrub Inventory" as the assessment tool for pasture, range, and forest lands to determine the density/size of vegetation requiring control and the corresponding Practice Payment Scenario (light, medium or heavy). Document the pre-treatment density of the target species on the PIA Plant Control, Clearing and Cutting Practices Jobsheet.

For Mechanical Treatment Methods. Plans and specifications will include items 1 through 6 above, plus the following:

- Type of equipment to use for management
- Techniques and procedures to be followed, including operating instructions (if applicable)
- Dates of treatment for effective management.

For Chemical Treatment Methods. Plans and specifications will include items 1 through 6, above, plus the following:

- Acceptable chemical treatment references for containment and management of target species. Refer to CTAHR's *Weeds of Hawaii's Pastures and Natural Areas; An Identification and Management Guide* and the *Practitioner's Guide for Effective Non-Restricted Herbicide Techniques to Control and Suppress Invasive Woody Species in Hawai'i* for approved herbicide recommendations. Document techniques to be used, planned dates and rates of application
- Evaluation and interpretation of herbicide risks associated with the selected treatment(s) using WIN-PST.
- Any special mitigation, timing considerations or other factors (such as soil texture and organic matter content) that must be considered to ensure the safest, most effective application of the herbicide.
- Reference to product label instructions. Material safety data sheets and pesticide labels may be accessed on the Internet at: http://www.greenbook.net/.

For Biological Treatment Methods. Must follow the Prescribed Grazing (528) standard and specification and document biological control grazing plan on the Prescribed Grazing Jobsheet. Plans and specifications will include items 1 through 6, above, plus the following:

- Acceptable biological treatment references for the selected biological agent (grazing/browsing animals only) used to contain and manage the target species
- Document release date, kind, and number of livestock
- Timing, frequency, duration and intensity of grazing or browsing

- Desired degree of grazing or browsing use for effective management of target species
- Maximum allowable degree of use on desirable non-target species
- Special mitigation, precautions, or requirements associated with the selected treatment(s)

SCOUTING FOR WEEDS

One of the most critical parts of an effective weed management plan is identifying weeds and the infestation levels at which to treat them.

Scouting is the most effective way to identify weeds and their levels of infestation. Weeds are easiest to identify when they are flowering and therefore critical scouting periods are typically during the rainy season.

Other critical scouting periods are prior to a management application including weed control, prescribed grazing, nutrient management, and irrigation management, and before and after construction activities or other disturbances.

WEED TREATMENT AND CONTROL METHODS

Cultural Treatment Methods

Cultural methods of pest control are designed to break the infestation cycle by making the environment less suitable for weed survival. This may accomplished by:

- reducing favorable habitat of weeds;
- altering planting and harvesting patterns to disrupt in time and space habitat resources required by the weed(s);
- preventing the import of weed propagules;
- Enhancing the vigor of desired plants so they can better compete with weeds;
- Revegetation with desired, competitive plants.

Examples of cultural controls include prescribed grazing, irrigation water management, nutrient management, and sanitation practices (cleaning equipment).

Mechanical Treatment Methods

These include mowing, tilling, hand pulling, prescribed burning, and screens placed in water conveyances (irrigation ditches, etc.) to reduce weed seed movement by water.

Chemical Treatment Methods

Chemical controls include various timing and application methods, including aerial, ground, and spot spraying.

When using herbicides in Hawaii, the recommendations of the University of Hawaii, College of Tropical Agriculture and Human Resources (CTAHR) AND the product label must be followed. Refer to CTAHR's *Weeds of Hawaii's Pastures and Natural Areas; An Identification and Management Guide* *and the* *Practitioner's Guide for Effective Non-Restricted Herbicide Techniques to Control and Suppress Invasive Woody Species in Hawai'i* for approved herbicide recommendations. If a recommendation published by CTAHR is not available, contact the PIA State Rangeland Management Specialist for guidance.

The NRCS office in Guam may provide clients with published chemical control references from the University of Guam's Cooperative Extension Service-Agriculture and Natural Resources (ANR) Unit and the NRCS office in Saipan may provide clients with published chemical control references from the Northern Marianas College-Cooperative Research Extension and Education Service, if available. If no published recommendations are available, follow the published UH-CTAHR recommendations or contact the PIA State Rangeland Management Specialist for assistance.

Read and follow label directions and maintain appropriate Material Safety Data Sheets (MSDS). Material safety data sheets and pesticide labels may be accessed on the Internet at: http://www.greenbook.net/.

When herbicides are identified as an alternative treatment, an environmental risk evaluation must be completed using Windows Pesticide Screening Tool (Win-PST).

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Herbicides shall not be applied to weeds if the application promotes other invasive plants ***unless*** an appropriate revegetation practice such as Range Planting (550) or Forage and Biomass Planting (512) is also applied.

Herbicide users should be cautioned as follows: If herbicides are handled or applied improperly, or if unused portions are not disposed of safely, they may injure humans, domestic animals, desirable plants, fish or other wildlife, and may contaminate water bodies, nearby crops or other vegetation. Follow the directions and heed all precautions on the container label. Landowners and applicators should be aware of and adhere to the provisions of state and federal laws and regulations concerning the use of agricultural chemicals.

Conformance with permits of all state and federal regulations for use of chemicals shall be the responsibility of the cooperator. Permits for use of chemicals will specify legally required setbacks from watercourses, ponds, residences, etc.

Biological Treatment Methods

Biological controls use living organisms (natural enemies) to suppress populations of weeds

NRCS will not develop biological treatment recommendations except for biological control utilizing grazing and browsing animals. A grazing plan that follows the Prescribed Grazing (528) practice standard and specification must be developed and followed to ensure desired results are achieved and maintained any time grazing or browsing animals are used for a biological control agent. Use the Prescribed Grazing jobsheet to document all grazing prescriptions used for biological control.

Livestock are best used for follow-up treatments after mechanical control. The use of livestock should never be planned as the primary brush treatment unless the brush is already in a state that is accessible for control by livestock.

MITIGATION PRACTICES

Where risk analysis tools identify intermediate to high potential hazards to humans or fish, mitigation practices that serve to minimize those risks are required to ensure the protection of water resources.

Minimizing groundwater contamination by leaching of an herbicide or associated metabolites are those practices that reduce or eliminate exposure or infiltration. Examples of these practices include reduced rates, foliar applications, spot applications, alternative herbicides, and alternative controls.

Mitigation practices for limiting surface water contamination by runoff of an herbicide or associated metabolite (including runoff of soil adsorbed herbicides) are those practices that minimize water runoff and soil erosion.

Examples of these practices are prescribed grazing, residue management, crop rotation, irrigation water management, and filter or buffer strips.

Table 1 – “Mitigation Effectiveness Guide − Reducing Pesticide Impacts on Water Quality” may be helpful in identifying methods that will help to ensure minimization of potential problems.

OTHER DESIGN CONSIDERATIONS

Consider the following IPM principles:

- Prevention, such as using weed-free seeds, transplants and hay, cleaning tillage and harvesting equipment between fields, irrigation screens, etc.
- Avoidance, such as using varieties competitive with weeds, crop rotation, prescribed grazing, etc.
- Monitoring, such as weed scouting, soil testing, weather forecasting, etc., to help target suppression strategies and avoid routine preventative weed control.
- Suppression, such as cultural, mechanical, biological and chemical controls, that can reduce a weed population or its impacts. Chemical controls should be used judiciously in order to minimize environmental risk and non-target plant injury.

Producers will use the minimum level of herbaceous weed control necessary to meet their objectives for forage quantity, quality and accessibility.

Control applications will maintain or facilitate a vegetative successional state to accommodate target wildlife species requirements, will accommodate wildlife reproductive and other life-cycle requirements, and will not adversely affect threatened or endangered species or their habitats.

Adequate plant nutrients and soil moisture, including favorable organic matter, pH and soil conditions, should be available to reduce plant stress, improve plant vigor and increase desirable plants overall ability to compete with weeds.

On irrigated land, irrigation water management should be designed to minimize weed management environmental risk.

Where tillage is use as a control application, the number, sequence, and timing shall be coordinated with other sediment-control tactics and practices in order to minimize sediment losses to nearby surface water bodies.

Critical scouting periods for Herbaceous Weed Control may be used as a guideline for scheduling on-site weed infestation investigations.

Producers should be aware of neighboring fields where organic production is practiced in an effort to minimize any potential adverse herbicide impacts on those crops and associated certification.

Open mixing of chemicals shall not occur in the application field within a minimum of 100 feet of a well or surface water body.

OPERATION AND MAINTENANCE

Operation

Operations shall be carried out in such a manner and sequence that erosion and air and water pollution are minimized and held within legal limits.

Success of the practice shall be determined by evaluating regrowth or reoccurrence of target species after sufficient time has passed to monitor the situation and gather reliable data. Length of evaluation periods will depend on the herbaceous weeds species being monitored, proximity of propagules (seeds, plant materials and roots) to the site, transport mode of seeds (wind or animals) and methods and materials used.

Herbaceous weed control practices shall be applied using approved materials and procedures. Operations will comply with all local, state, and federal laws and ordinances. Important operational procedures include:

- Read and follow label directions and maintain appropriate Material Safety Data Sheets (MSDS). MSDS and herbicide labels may be accessed on the Internet at: http://www.greenbook.net/
- Calibrate application equipment according to recommendations before each seasonal use and with each major chemical and site change.
- Replace worn nozzle tips, cracked hoses, and faulty gauges on spray equipment.
- Follow label requirements for mixing/loading setbacks from wells, intermittent streams and rivers, natural or impounded ponds and lakes, and reservoirs.
- Post signs, according to label directions and/or federal, state, tribal, and local laws, around fields that have been treated. Follow restricted entry intervals.
- Dispose of herbicide and herbicide containers in accordance with label directions and adhere to federal, state, tribal, and local regulations.
- Maintain records of plant management for at least two years. Herbicide application records shall be in accordance with USDA Agricultural Marketing Service's Pesticide Recordkeeping Program and state-specific requirements.

- The owner, operator, contractor or other persons will conduct all work and operations in accordance with proper safety codes for the type of construction being performed with due regards to the safety of all persons and property.

Maintenance

Following initial application, some regrowth, re-sprouting, or reoccurrence of herbaceous weeds should be expected. Spot treatment of individual plants or areas needing re-treatment should be completed as needed when weed vegetation is most vulnerable to desired treatment procedures.

Important maintenance procedures include:

- Reviewing and updating the plan periodically in order to:
  - incorporate new control strategies and technology
  - respond to grazing system and weed complex changes
  - avoid the development of weed resistance
- Maintain mitigation techniques identified in the plan in order to ensure continued effectiveness
- Re-treat areas as needed to ensure control

SAFETY

Landowners or operators, sponsoring organizations, and contractors shall be liable for damage to utilities and damage resulting from disruption of service caused by construction activities.

The Natural Resources Conservation Service makes no representation on the existence or non-existence of any utilities. Absence of utilities on the drawings is not assurance that no utilities are present at the site.

It is the responsibility of the landowner or operator to determine if there are buried or overhead utilities in the vicinity of the proposed work. They should take proper procedures to insure that the utilities shall not be jeopardized and that equipment operators and others will not be injured

during construction operations.

The operator will develop a safety plan for individuals exposed to chemicals, including telephone numbers and addresses of emergency treatment centers and the telephone number for the nearest poison control center.

- The National Pesticide Information Center (NPIC) telephone number in Corvallis, Oregon, may also be given for non-emergency information: **1-800-858-7384**
- The national Chemical Transportation Emergency Center (CHEMTRAC) telephone number is: **1-800-424-9300**

REFERENCES

Arnold, Harry L.1968. *Poisonous Plants of Hawaii*. Charles E Tuttle Co.

Hirano, Robert T. 1983. *Handbook of Hawaiian Weeds* edited by E.L. Haselwood and G.G.

Leary, J., Beachy, J., and Hardman, A. 2012. *Practitioner's Guide for Effective Non-Restricted Herbicide Techniques to Control and Suppress Invasive Woody Species in Hawai'i*. University of Hawai'I, College of Tropical Agriculture and Human Resources. Available at: http://www.ctahr.hawaii.edu/oc/freepubs/pdf/WC-10.pdf. (Accessed 25 November 2014).

Motter. Darold L. Lyon Arboretum, University of Hawaii.

Motooka, P., Castro, L., Nelson, D., Nagai, G., and Ching, L. 2003. *Weeds of Hawai`i's Pastures and Natural Areas: An Identification and Management Guide*. Univ. of Hawaii, College of Tropical Agriculture and Human Resources. Available at http://www.ctahr.hawaii.edu/invweed/weedsHi. (Accessed 25 November 2014).

Hawai'I Pacific Weed Risk Assessment: https://sites.google.com/site/weedriskassessment/

Weed Risk Assessments for Hawaii and Pacific Islands: http://www.botany.hawaii.edu/faculty/daehler/WRA and http://www.hear.org/pier/.

Table 1. Mitigation Effectiveness Guide – Reducing Herbicide Impacts on Water Quality

Note: This table identifies management techniques and conservation practices that have the potential to mitigate herbicide impacts on water quality. Not all techniques will be applicable to a given situation. Relative effectiveness ratings by herbicide loss pathway are "no effect" (blank); "slight effect" (+/-); "moderate effect" (++/--); and "significant effect" (+++/---). The table also identifies how the technique(s) functions. Effectiveness of any mitigation technique can be highly variable based on site conditions and design. Therefore, with guidance provided by the table, site- specific selection and design of mitigation technique(s) that are appropriate for identified resource concerns are left to the professional judgment of the conservation planner.

PEST MANAGEMENT MITIGATION TECHNIQUES	PESTICIDE LOSS PATHWAYS			FUNCTION
	LEACHING	SOLUTION RUNOFF	ADSORBED RUNOFF	
Application Timing	+++	+++	+++	Reduces exposure potential-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, also delaying application when wind speed is not in accordance with label requirements can reduce pesticide drift to surf ace water
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 rate
Partial Treatment	+++	+++	+++	Reduces exposure potential-spot treatment, banding and directed spraying reduce amount of pesticide applied
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 (IPM) Thresholds	+++	+++	+++	Reduces exposure potential-reduces the amount of pesticide applied
Set-backs	+	++	+	Reduces exposure potential-reduced application area reduces amount of pesticide applied, can also reduce inadvertent pesticide application and drift to surface water

Substitution – • Alternative pesticides • Cultural controls • Biological controls	+++	+++	+++	Reduces hazard potential-use alternative pesticides with low environmental risk, substituting cultural (including burning and mechanical controls) and biological controls can reduce the need for pesticides
PEST MANAGEMENT MITIGATION TECHNIQUES	**PESTICIDE LOSS PATHWAYS**			**FUNCTION**
	LEACHING	SOLUTION RUNOFF	ADSORBED RUNOFF	
Conservation Practices[3/]				
Brush Management (314)	+++	+++	+++	Using non-chemical brush control often reduces the need for pesticides, pesticide use requires environmental risk analysis and appropriate mitigation - see Integrated Pest Management (595)
Conservation Cover (327)	+++	+++	+++	Retiring land from annual crop production often reduces the need for pesticides, builds soil organic matter
Conservation Crop Rotation (328)	++	++	++	Reduces the need for pesticides by breaking pest lifecycles
Cover Crop (340)	+	+	++	Increases infiltration, reduces soil erosion, builds soil organic matter
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
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, 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

PEST MANAGEMENT MITIGATION TECHNIQUES	PESTICIDE LOSS PATHWAYS			FUNCTION
	LEACHING	SOLUTION RUNOFF	ADSORBED RUNOFF	
Conservation Practices[3/]				
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 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 (422)			*(+)*[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
Irrigation Land Leveling (464)	++	+	++	Reduces exposure potential-uniform surface reduces pesticide transport to around and surface water
Irrigation System, Microirrigation (441)	++	+++	+++	Reduces exposure potential-efficient and uniform irrigation reduces pesticide transport to ground and surface water
Sprinkler System (442)	++	++	++	Reduces exposure potential-efficient and uniform irrigation reduces pesticide transport to ground and surface water
Irrigation Water Management (449)	+++	+++	+++	Reduces exposure potential-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-unifom1 surface reduces pesticide transport to around and surface water

PEST MANAGEMENT MITIGATION TECHNIQUES	PESTICIDE LOSS PATHWAYS			FUNCTION
	LEACHING	SOLUTION RUNOFF	ADSORBED RUNOFF	
Conservation Practices[3/]				
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
Forage and Biomass Planting (512)	++	++	++	Retiring land from annual crop production often reduces the need for pesticides, builds soil organic matter
Prescribed Grazing (528)	++	++	++	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
Residue Management, No-till (329)	+	++	+++	Increases infiltration, reduces soil erosion, builds soil organic matter
Residue Management, Reduced-Till (345)	+	++	+++	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 and uptake of subsurface water, traps sediment builds soil organic matter
Sediment Basin (350)			++	Captures pesticide residues and facilitates their degradation
Stripcropping (585)		+	+	Increases infiltration, reduces soil erosion
Structure For Water Control (587)	-	++	+++	Captures pesticide residues and facilitates their degradation, increases infiltration and deep percolation
Surf ace Drainage, Field Ditch (607)	+	+	+	Increases infiltration and aerobic pesticide degradation in the root zone
Terrace (600)	-	++	+++	Increases infiltration and deep percolation, reduces soil erosion

PEST MANAGEMENT MITIGATION TECHNIQUES	PESTICIDE LOSS PATHWAYS			FUNCTION
	LEACHING	SOLUTION RUNOFF	ADSORBED RUNOFF	
Conservation Practices[3/]				
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
Waste Storage Facility (313)	+	++	++	Captures pesticide residues
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
Wetland Creation (Code 658)	+	+	+	Captures pesticide residues and facilitates their degradation
Wetland Enhancement (659)	+	+	+	Captures pesticide residues and facilitates their degradation
Wetland Restoration (657)	+	+	+	Captures pesticide residues and facilitates their degradation
Windbreak/ Shelterbelt Establishment (380)			*(++)*[4/]	Reduces wind erosion, reduces adsorbed pesticide establishment deposition in surface water, traps adsorbed pesticides, also can reduce pesticide drift
Windbreak/ Shelterbelt Renovation (650)			*(++)*[4/]	Reduces wind erosion, reduces adsorbed pesticide establishment deposition in surface water, traps adsorbed pesticides, also can reduce pesticide drift

1/ Additional infom1ation on weed management mitigation techniques can be obtained from extension weed management

publications, weed management consultants and herbicide labels.

2/ The herbicide label is the law-all herbicide label specifications must be carefully followed, including required mitigation. Additional mitigation may be needed to meet NRCS weed management requirements for identified resource concerns.

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

4/ Mitigation applies to adsorbed herbicide losses being carried to surface water by wind.