CHAPTER 2: Agriculture

I. INTRODUCTION

I.1. Agriculture of Hawaii

In the past decade, the types and distribution of agricultural activities in Hawaii have changed significantly, shifting from sugarcane and pineapple plantation agriculture to a more diversified agriculture. A large amount of land that was under pineapple or sugarcane cultivation since 1985 is now experiencing a major transition to diversified crops. Other land has been converted to urban developments and still other land now lies fallow.

Pineapple: Since the mid-1980s, pineapple operations have been completely eliminated or reduced on Molokai, Lanai and Oahu. There are ongoing efforts to develop diversified agriculture to fill the void left by the demise of pineapple. These efforts have had limited success, and many former pineapple lands lie idle.

Sugarcane: Sugarcane operations have also been dramatically reduced in Hawaii in recent years. After many decades with a successful sugar industry, thousands of acres of sugarcane land on Kauai, Oahu, and Hawaii Island have been taken out of production. Some of this land has gone into other crops, such as coffee or macadamia nuts. Agroforestry is being considered for other former sugarcane land. Nonetheless, a majority of these lands are either in pasture or lay fallow.

crop	peak year	peak year	acreage for current yr	acreage for current yr
pineapple	1960 (earliest statistics available)	75,000	22,300	1994
sugarcane	1932	254,563	75,000	1995

Diversified Agriculture: Due to the ongoing transition in the type of agriculture in Hawaii, the crop and acreage composition will continue to shift in favor of diversified agriculture. Diversified agriculture in Hawaii includes flowers and nursery products, vegetables and melons, macadamia nuts, cattle, milk, fruits (excluding pineapples), poultry, forage, grain, forest products, hogs, coffee, taro, and other livestock. The current composition of agricultural uses is listed in Table III-1 below.

The transition in Hawaiian agriculture brings with it some inherent economic and environmental uncertainties. New crops will bring new cultivation practices and will use different quantities and types of fertilizers and pesticides. The effects of these changes on coastal water quality are uncertain. This transition, albeit economically wrenching, also provides a critical opportunity to examine the practices farming operations currently use, or are likely to use, while diversified agricultural operations are being expanded and practices and activities are being defined. This unique set of circumstances requires a cooperative and creative

process to incorporate agricultural, environmental, public, and agency concerns. This process must account for the inherent economic uncertainties of the changing face of agriculture in Hawaii, and have the ability to reward innovative and cooperative activities that protect coastal water quality. In addition, it must be able to weed out ineffective and destructive activities before they become codified into common practice.

Table III-1: 1993 Acreage for Major Agricultural Activities in Hawaii

Agricultural Activity	Acreage
Sugarcane	132,200
Pineapple	22,000
Coffee	7,000
Landscape/Recreation	12,000
Nurseries	2,495
Ranching/Pasture	1,092,000
Forestry (commercial, proposed)	10,000 to 60,000
Seed Industry	1,250
Vegetables	5,300
Fruits	6,900
Feed	1,126
Macadamia Nuts	20,500

Source: DOA 1994

Most of the nonpoint source pollution problems associated with agricultural activities are related to the intrinsic problems with the activity, including the systematic disturbance of the land and the use of fertilizers and pesticides. To this extent, agriculture in Hawaii is not inherently different from the U.S. mainland. However, there are some physical and economic characteristics that are singularly and in combination unique to Hawaii. These include year-round intensive agriculture, small watersheds, significant use of marginal lands, significant amount of leased land, and higher cost of land, goods and services.

Year-round intensive agriculture - Due to Hawaii's year-round sub-tropical temperatures, agriculture *can* be practiced year-round. This possibility together with the high cost of land leads to year-round cultivation to maximize production. Year-round cultivation means year-round land disturbance and year-round use of fertilizers and pesticides.

Small watersheds - Watersheds in Hawaii are typically small, and storms are high intensity. Physical controls such as retention/detention basins generally require a significant amount of land area. Since land prices in Hawaii are high and the amount of available land area is limited, operators may be more reluctant to use retention/ detention basins than on the U.S. mainland.

Significant use of marginal lands - Because land prices in Hawaii are high and the available land area is limited, agricultural production is often maximized by cultivating even marginal lands. These lands are often steep and may require additional best management practices (BMPs) to meet pollution prevention goals. Additional BMPs may not be economically achievable in many cases.

Significant amount of leased land - A significant amount of the land used by agricultural operations in Hawaii are leased from either the State or large private land owners. There are relatively few land *owners* and a large number of land *lessees*. This can lead to less incentive for lessees to install permanent structures and to take on other long-term stewardship responsibilities.

Higher cost of land, goods and services - Hawaii's average property values for agricultural lands are comparable to urban land in other states. Because of the islands' distance from mainland sources, a majority of goods must be shipped in, therefore adding significantly to their cost. Labor costs are also higher than comparable agriculture industries in other states.

I.2. Types of Polluted Runoff Associated with Agriculture

The primary agricultural nonpoint source pollutants are nutrients, sediment, animal wastes, salts, and pesticides. These pollutants are described in more detail under the relevant management measure. Agricultural activities also have the potential to directly impact the habitat of aquatic species through physical disturbances caused by livestock or equipment, or through the management of water.

I.3. Existing Programs Addressing Agricultural Sources of Polluted Runoff

A. State Department of Agriculture: The Hawaii Department of Agriculture (DOA) is made up of a number of divisions that take care of a specific regulatory or developmental area to help assure the quality of the State's agricultural products both for export and for local consumption. The Agricultural Loan Division promotes agricultural development by stimulating, facilitating, and granting loans to qualified farmers and aquaculturists. The Plant Industry Division's programs are designed to protect Hawaii's agricultural industries, natural resources, and the public from the entry and establishment of detrimental plants, animals, insects, weeds, and other pests; and to assure the safe and efficient use of pesticides in Hawaii. The Marketing Division inspects and grades commodities in wholesale and retail establishments, monitors current market conditions, collects and publishes agricultural statistics, promotes locally grown and manufactured products, and monitors the production, processing and selling of milk. The Agricultural Resource Management Division administers the development and management of the State's irrigation systems, and manages the State's agricultural parks. The Animal Industry Division safeguards Hawaii's livestock and poultry industries by controlling and preventing the entry and spread of pests and diseases.

B. State Department of Land and Natural Resources (DLNR), Soil and Water Conservation Districts (SWCDs): There are 16 local SWCDs in Hawaii. Their roles are to apply available technical, financial and educational resources to meet conservation needs of local land users. In this regard, the SWCDs initiate conservation projects; help implement the State's nonpoint source water pollution management plan (DOH); and approve conservation plans mandated by the federal Food Security Act, administered by the USDA Natural Resources Conservation Service (NRCS). Most importantly, agricultural activities are exempt from the county grading ordinances if a conservation plan is approved by the local SWCD. A list of approved plans are sent by each local SWCD to the respective county department of public works. These tasks are accomplished through the cooperation of the land users and the SWCDs, rather than through governmental regulations.

Chapter 180, HRS, administered by the Department of Land and Natural Resources (DLNR), provides the authority to establish SWCDs as governmental subdivisions of the State. To achieve their mission, Chapter 180 permits the SWCDs to aid land users with equipment and materials for conservation work; conduct surveys and investigations; initiate, construct, improve or maintain projects; sell, acquire or manage properties; effect agreements or litigation; develop or approve conservation programs and plans; establish fees for services; and as a condition to extend benefits, require or receive materials, services or funds.

Each SWCD is governed by five directors: three elected by agricultural land users or owners of respective districts and two appointed by the Board of Land and Natural Resources. All directors have three year terms. The directors are assisted by associate directors and directors emeritus. All directors and associates work as volunteers to provide agricultural land users with conservation assistance, including conservation plan reviews and approvals.

The SWCDs work with federal (NRCS, FSA) and State (DOH, the CZM Program, CES) agencies to help implement government programs. They, in turn, are assisted by these agencies with technical resources and funding. The counties' departments of public works engage the services of their respective districts to implement the grading ordinances in agricultural areas. Maui County districts are responsible for all areas, not just agricultural lands.

C. University of Hawaii Cooperative Extension Service (CES): The CES is the extension unit of the College of Tropical Agriculture and Human Resources at the University of Hawaii. Its mission is to enable people to improve their lives through an educational process that uses scientific knowledge to address issues and needs. This process involves transferring and expressing scientifically-based research knowledge in practical, usable educational programs, presentations, and services.

Hawaii CES is dedicated to supporting and fostering the efforts of agricultural practitioners and communities to transform Hawaii's agriculture into an appropriate, sustainable, diversified agriculture that contributes to Hawaii's

economy, is safe for consumers and the environment, and enhances Hawaii's appeal for tourism. CES provides a number of services at the local level, with offices and technical experts on all islands.

D. U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS): The NRCS administers programs designed to protect and improve land and water resources. The mission is carried out through two major activities: (1) conservation operations; and (2) watershed and flood prevention operations. Legislative authority allows NRCS to undertake the following activities in Hawaii: provide technical assistance to land users relating to soil and water resource concerns; develop plans for erosion control; work with communities to develop watershed plans; provide disaster assistance; map soils and publish soil surveys; and administer incentive programs such as the Wetland Reserve and Forestry Incentive Programs.

In Hawaii, NRCS works through the 16 SWCDs. The SWCDs cover approximately 98% of the State and are serviced through seven NRCS field offices located around the State in Lihue, Honolulu, Wailuku, Hoolehua, Hilo, Kamuela, and Kealakekua.

NRCS is a non-regulatory agency that primarily assists agriculture land users in developing plans to treat existing and potential resource (soil, water, plant, air, animal) problems, with emphasis on considering the entire watershed and the human element as part of the planning process. Although plans may be all-encompassing, the implementation of the plans is strictly voluntary for land users. NRCS partners with other agencies to find solutions to resource problems. NRCS has working agreements with the following agencies: CES, Department of Health (DOH), DOA, Department of Hawaiian Home Lands (DHHL), the CZM Program, DLNR, Rural Economic and Community Development, FSA, and U.S. Army.

NRCS will continue to provide planning assistance to agricultural operations based on its priorities. However, NRCS does not foresee an increase in resources or funding to work with *all* the agricultural operators in the State. Therefore, its participation in the Pollution Prevention Plan (PPP) Program described in this chapter will be on a limited basis. NRCS will continue to assist in developing PPPs and also continue to train others to prepare these plans based on funding, resources, and priorities.

E. U.S. Department of Agriculture, Farm Service Agency (FSA), Agricultural Conservation Program (ACP): The Agricultural Conservation Program is administered by FSA as a joint effort by agricultural producers, federal and State agencies, and other groups to restore and protect the nation's land and water resources, and preserve the environment. ACP provides cost-sharing with farmers and ranchers in carrying out conservation and environmental protection practices on agricultural lands that result in long-term public benefits. ACP is designed to help prevent soil erosion and water pollution, protect and improve productive farm and ranch land, conserve water used in agriculture, preserve and develop wildlife habitat, and encourage energy

conservation measures. Only those practices that significantly contribute to these objectives and that are not required as a condition of receiving assistance through other federal programs are eligible for cost-share assistance. ACP funds are authorized annually by Congress. The maximum cost-share limitation for ACP is $3,500 per person per fiscal year. (A person is defined as an individual, group, partnership, corporation, or other legal entity owning or operating a farm or ranch.)

II. MANAGEMENT MEASURES

The following management measures apply generally to agricultural lands around the State. Specific applicability is described under each management measure. During the implementation plan development process, the State will define a farm size below which the agricultural management measures will not apply. This definition will be based on pollution potential and recognized State and/or county definitions of "farm" and/or "agricultural operation."

A. Erosion and Sediment Control Management Measure

Apply [~~the erosion component of a Conservation Management System (CMS) as defined in the Field Office Technical Guide of the U.S. Department of Agriculture - Soil Conservation Service~~] any combination of conservation practices and management that achieves an acceptable level of treatment[(i)] to minimize the delivery of sediment from agricultural lands to surface waters, or

Design and install a combination of management and physical practices to settle the settleable solids[(ii)] and associated pollutants in runoff delivered from the contributing area for storms of up to and including a 10-year, 24-hour frequency.

II.A.1. Description

Sediment is the result of erosion. It is the solid material, both mineral and organic, that is in suspension, is being transported, or has been moved from its site of origin by air, water, or gravity. The types of erosion associated with agriculture that produce sediment are (1) sheet and rill erosion, and (2) gully erosion. Soil erosion can be characterized as the transport of particles that are detached by rainfall, flowing water, or wind. Eroded soil is either redeposited on the same field or transported from the field in runoff.

The fine soil and organic products comprising sediment can be held in suspension in water and deposited in a stream, estuary, embayment, or open coastal waters. In addition to smothering corals and other benthic species, sediments can create unsightly and odorous mud flats in enclosed bays.

Sediments also transport chemical substances (*e.g.*, pesticides, nitrate, and ammonium) bound to the eroded soils.

The problems associated with soil erosion are the movement of sediment and associated pollutants by runoff into a waterbody. Application of this management measure will reduce the mass load of sediment reaching a waterbody and improve water quality and the possible uses of the water resource. The measure can be implemented by using one of two different strategies or a combination of both. The first, and most desirable, strategy would be to implement practices on the field that would prevent erosion and the transport of sediment from the field. Practices that could be used to accomplish this are conservation tillage, field road stabilization, contour strip-cropping, terraces, and critical area planting.

The second strategy is to route runoff from fields through practices that remove sediment. Practices that could be used to accomplish this are filter strips, field borders, grade stabilization structures, sediment retention ponds, floculants, water and sediment control basins, and terraces. Site conditions will dictate the appropriate combination of practices for any given situation.

This management measure is an alternative management measure to the (g) measure contained in EPA's Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters.

***Justification for Alternative Management Measure**: The agriculture focus group proposed this alternative management measure because of biogeophysical and economic circumstances that are, either singularly or in combination, unique to Hawaii. It was the opinion of the agriculture focus group that these circumstances would render the (g) measure unimplementable in Hawaii for the following reasons.*

- *(i) Conservation Management System (CMS): The (g) measure refers to applying the erosion control component of an NRCS Conservation Management System (CMS). The CMS developed by NRCS was intended for use as part of a voluntary program of natural resources management. A CMS has two levels of treatment. The first is a Resource Management System (RMS). Currently, in order for a farmer to meet the criteria for a RMS, that farm must have an annual soil rill and sheet erosion rate that is less than "T" as determined by the Universal Soil Loss Equation (USLE) or the Revised Universal Soil Loss Equation (RUSLE). The USLE or RUSLE was never intended to provide absolute soil loss numbers and its reliability on steeper lands under high rainfall conditions is questionable. Rather, it was meant to be used as an erosion prediction tool that estimates soil erosion for planning purposes. A RMS, as part of a voluntary program, sets an erosion control goal for a land user to strive towards, rather than establishing an enforceable level of treatment. In Hawaii, many farms are unable to achieve a RMS level of treatment due to rainfall and slope conditions. Recognizing this, NRCS has established a second level of treatment called an Acceptable Management System (AMS) that may be implemented as it is needed. An AMS sets an erosion control goal for the*

specific resource use which is achievable in view of social, cultural, and economic constraints of the area. For NRCS planning purposes, the State Conservationist approves the AMS level for erosion control.

This alternative management measure provides the State the flexibility to apply the combination of conservation practices and management that achieves an acceptable level of treatment. This will enable Hawaii to determine the acceptable level of treatment, based not only on nonpoint source pollution control but also on economic, social, cultural and geographic criteria. Establishing the process for determining an acceptable level of treatment will be undertaken during FY 96-97, providing resources are available.

- *(ii) Settling the Settleable Solids: Rainstorms in Hawaii can be "flashy" and intense. Rainfall statistics for Hawaii show that it is not unusual for major agricultural areas to receive 10 to 14 inches of rainfall during 10-year, 24-hour storm events. The volumes of water that must be contained from such events and the limited land available for containment will likely lead to some physical and economic constraints in implementing the erosion and sediment control management measure. In addition, annual median rainfall in Hawaii ranges from about 7 to over 450 inches per year. Locations with large differences in annual rainfall can easily be within sight of one other, leading to extreme rainfall gradients. Annual rainfall in the agricultural region of central Maui, for instance, ranges from about 12 to over 75 inches per year within about 12 miles. A single large parcel of land may require significantly different management practices in different locations. Such extreme rainfall gradients may cause problems for operators in developing effective pollution prevention practices that would be applicable to all their lands.*

  Settleable solids is defined in EPA's Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters as: "Solids in a liquid that can be removed by stilling a liquid. Settling times of 1 hour or more are generally used." Hawaiian soils are generally finer-grained soils than those found on the U.S. mainland due to basaltic parent material and intense chemical weathering. Thus, physical control structures such as detention/retention basins may be less effective because only the coarsest fraction of the eroded sediment would settle out. Although detention/retention basins have been successfully used by agricultural operations in Hawaii, finer-grained soils combined with the limited size of Hawaiian watersheds would likely make this type of physical control less effective than on the U.S. mainland.

  These factors, in combination, may make it difficult to contain the volume of water generated by a 10-year, 24-hour storm event long enough to settle all the settleable solids, given the clayey nature of Hawaiian soils. Therefore, the percentage of settleable solids that must be removed in order to address this management measure will be determined by the State during FY96-97, provided resources are available.

II.A.2. Applicability

This management measure applies to activities that cause erosion on agricultural land and on land that is converted from other land uses to agriculture. Agricultural lands include:

- Cropland;
- Irrigated cropland;
- Range and pasture;
- Orchards;
- Permanent hayland;
- Managed forests;
- Specialty crop production; and
- Nursery crop production.

The intent of the management measure is to protect surface and ground water quality. Some waterbodies, such as farm ponds, have been created to water livestock. Protecting the water quality of these artificial water storage areas does not have the same priority as protecting natural streams and waterbodies.

II.A.3. Management Practices

The management practices listed below are representative of those currently in use. Numbers in parentheses indicate NRCS management practice numbers. These management practices are described in detail in the NRCS National Handbook of Conservation Practices or Field Office Technical Guide.

a. Conservation cover (327): Establishing and maintaining perennial vegetative cover to protect soil and water resources on land retired from agricultural production.
b. Conservation cropping sequence (328): An adapted sequence of crops designed to provide adequate organic residue for maintenance or improvement of soil tilth.
c. Conservation tillage (329): Any tillage or planting system that maintains at least 30 percent of the soil surface covered by residue after planting to reduce soil erosion by water; or, where soil erosion by wind is the primary concern, maintains at least 1,000 pounds of flat, small-grain residue equivalent on the surface during the critical erosion period.
d. 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.
e. Contour orchard and other fruit area (331): Planting orchards, vineyards, or small fruits so that all cultural operations are done on the contour.
f. Cover and green manure 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.
g. 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).
h. Crop residue use (344): Using plant residues to protect cultivated fields during critical erosion periods.

i. Delayed seed bed preparation (354): Any cropping system in which all of the crop residue and volunteer vegetation are maintained on the soil surface until approximately 3 weeks before the succeeding crop is planted, thus shortening the bare seedbed period on fields during critical erosion periods.
j. Diversion (362): A channel constructed across the slope with a supporting ridge on the lower side.
k. 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.
l. Filter strip (393): A strip or area of vegetation for removing sediment, organic matter, and other pollutants from runoff and wastewater.
m. Grade stabilization structure (410): A structure used to control the grade and head cutting in natural or artificial channels.
n. 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.
o. Sediment basins (350): Basins constructed to collect and store debris or sediment from runoff.
p. Contour stripcropping (585): Growing crops in a systematic arrangement of strips or bands on the contour to reduce water erosion.
q. Field strip-cropping (586): Growing crops in a systematic arrangement of strips or bands across the general slope (not on the contour) to reduce water erosion.
r. Terrace (600): An earthen embankment, a channel, or combination ridge and channel constructed across the slope.
s. 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.

II.A.4. Implementation of Management Measure

The erosion and sediment control management measure will be implemented as a part of a single non-regulatory Agricultural Pollution Prevention Plan (PPP) Program that encompasses all agricultural management measures. A description of the existing organizational structure and regulatory and non-regulatory mechanisms follows. See Section III "Recommended Implementation of Agriculture Management Measures" on page III-46 for a detailed description of the proposed PPP Program, its implementation measures and schedule, identified needs, and recommended actions.

(i) Existing Organizational Structure: The county departments of public works are the lead agencies for implementing this management measure because they administer the county grading ordinances. The Soil and Water Conservation Districts (SWCDs) are also major players because they approve conservation plans which allow agricultural operations to receive an exemption from the county grading ordinances. Other federal and State agencies involved in implementation include:

- USDA-NRCS, which provides information and technical assistance on management practices;

- USDA-FSA, which provides cost-share funds for implementing management practices;
- University of Hawaii, CES, which provides information and technical assistance on management practices;
- DOH, which funds demonstration projects to develop, test and implement best management practices tailored to Hawaii's environment.

(ii) Existing Regulatory and Non-Regulatory Mechanisms:

HRS	Chapter 180	Soil and Water Conservation Districts
HRS	Chapter 180C	Soil Erosion and Sediment Control
HRS	Chapter 342D	Water Pollution Control
HRS	Chapter 342E	Nonpoint Source Pollution
HAR	Chapter 11-54	Water Quality Standards
HCC	Chapter 10	Soil Erosion and Sediment Control (Hawaii County)
KCC	Chapter 22-7	Grading, Grubbing, and Stockpiling (Kauai County)
ROH	Chapter 14-13	General Provisions for Grading, Soil Erosion and Sediment Control (City and County of Honolulu)
MCC	Chapter 20.08	Soil Erosion and Sediment Control (Maui County)

The following programs encourage the implementation of appropriate management practices through education, technical assistance, cost-share assistance, demonstration programs, and coordinated watershed planning:

1. Cooperative Extension Service Education and Technical Assistance
2. EPA Environmental Education Grants
3. FSA Agricultural Conservation Program
4. FSA Emergency Conservation Program
5. Farmers Home Administration (FHA) Soil and Water Loans and Technical Assistance
6. FHA Resource Conservation and Development Loans
7. NRCS Conservation Operations Program
8. NRCS Small Watershed Protection Program
9. NRCS Emergency Watershed Protection Program
10. NRCS Resource Conservation and Development Program
11. NRCS Water Quality Initiative Projects
12. NRCS Conservation Reserve Program
13. NRCS Food Security Act Conservation Compliance Requirements
14. NRCS Wetland Reserve Program
15. DLNR Soil and Water Conservation Districts
16. DOH Nonpoint Source Pollution Control Program Demonstration Projects
17. State of Hawaii Agricultural Parks - Provisions in the State's agricultural park land leases require each land user to obtain an approved conservation plan with the local SWCDs.

18. Maui County Agricultural Parks - Agreements exist between the County of Maui and local SWCDs to approve conservation plans for the county's agricultural parks.
19. State DOA Farm Loan Program
20. DOH State Revolving Fund Low Interest Loan

Currently, all earthmoving activities, such as plowing, are regulated under the four county grading ordinances. Except for Oahu, these grading ordinances require land users to obtain a grading permit for any disturbances of lands greater than 1 acres. The City and County of Honolulu requires a grading permit if the disturbed area is 15,000 square feet or more. Under Chapter 180C, HRS, all county grading ordinances allow an exemption for agricultural grading conducted under an actively pursued conservation plan, which the local SWCDs approve. The NRCS and CES normally provide technical assistance to land users in developing their conservation plans, while the FSA provides cost-share funds to assist land users in installing best management practices (BMPs) as specified in their conservation plans. The non-regulatory Pollution Prevention Plan (PPP) Program envisioned by the agriculture focus group builds upon the existing non-regulatory structure of the SWCDs.

B[~~1~~]. Management Measure for Wastewater and Runoff from Confined Animal Facility [(~~Large Units~~)]

Limit the discharge from the confined animal facility to surface waters by:

(1) [~~Storing~~] Containing both the wastewater *and* the contaminated runoff from confined animal facilities that is caused by storms up to and including a 25-year, 24-hour frequency storm event. Storage structures should[:] be of adequate capacity to allow for proper wastewater utilization and constructed so they prevent seepage to groundwater;
[~~(a) Have an earthen lining or plastic membrane lining, or~~
~~(b) Be constructed with concrete, or~~
~~(c) Be a storage tank;~~]

and

(2) Managing stored contaminated runoff and accumulated solids from the facility through an appropriate waste utilization system.

[~~B2. Management Measure for Wastewater and Runoff from Confined Animal Facility (Small Units)~~

~~**Design and implement systems that collect solids, reduce contaminant concentrations, and reduce runoff to minimize the discharge of contaminants in both facility wastewater and in runoff that is caused by sotrms up to and including a 25-year, 24-hour frequency storm. Implement these systems to substantially reduce significant increases in pollutant loadings to groundwater.**~~

~~**Manage stored runoff and accumulated solids from the facility through an appropriate waste utilization system.]**~~

II.B.1. Description

Animal waste (manure) includes the fecal and urinary wastes of livestock and poultry; process water (such as from a milking parlor); and the feed, bedding, litter, and soil with which they become intermixed. Pollutants that may be contained in manure and associated bedding materials include oxygen-demanding substances; nitrogen, phosphorus, and minor nutrients; organic solids; salts; bacteria, viruses, and other microorganisms; and sediments.

The decomposition of organic materials can deplete dissolved oxygen supplies in water, resulting in anoxic or anaerobic conditions. Methane, amines, and sulfide are produced in anaerobic waters, causing the water to acquire an unpleasant odor, taste, and appearance. Such waters can cause fish kills and be unsuitable for drinking, fishing and other recreational uses.

The goal of this management measure is to minimize the discharge from confined animal facilities of contaminants in both wastewater and runoff that is caused by storms up to and including a 25-year, 24-hour frequency storm. This would be accomplished by using management practices that reduce runoff and protect groundwater.

The problems associated with animal facilities result from runoff, wastewater, and manure. Application of this management measure will greatly reduce the volume of runoff, manure, and wastewater reaching a waterbody, thereby improving water quality and the use of the water resource. The measure can be implemented by using practices that divert runoff water from upslope sites and roofs away from the facility, thereby minimizing the amount of water to be stored and managed. Runoff water and wastewater should be routed through a settling structure or debris basin to remove solids, and then stored in a pit, pond, or lagoon for application on agricultural land. If manure is managed as a liquid, all manure, runoff, and wastewater can be stored in the same structure and there is no need for a debris basin.

This management measure does *not* require manure storage structures or areas, nor does it specify required manure management practices. This management measure does, however, address the management of *runoff* from manure storage areas. Manure may be stacked in the confined lot or other appropriate area as

long as the storage and management of runoff from the confined lot are in accordance with this management measure. If manure is managed as a solid, any drainage from the storage area or structure area or structure should be routed to the runoff storage system.

It is possible that implementation of this measure may increase the potential for movement of water and soluble pollutants through the soil profile to the groundwater. However, it is not the intent of this measure to address a surface water problem at the expense of groundwater. Wastewater and runoff control systems for animal facilities can and should be designed to protect groundwater.

This management measure is an alternative management measure to the (g) measure contained in EPA's Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters. It also combines that management measures for large and small confined animal facility management.

***Justification for Alternative Management Measure**: The agriculture focus group proposed this alternative management measure for the following reasons.*

- *(i) Facility Size: The EPA guidance document proposes two management measures, one for "large" facilities and another for "small" facilities. The agriculture focus group recommends that only one management measure apply for all sizes, for the following reasons. First, State law does not differentiate between large and small facilities. Second, polluted runoff problems are cumulative in a watershed. Therefore, ALL facilities which may contribute to pollution problems share the responsibility for improving waste management.*

- *(ii) Facility Types: The list of storage facility types given in the (g) measure is too restrictive. Other alternatives may be viable to keep waste from leaving the confined animal facility. It is important that the storage facility be sized to provide flexibility in the operator's decision on when to apply waste to land.*

- *(iii) Containing and Managing Contaminated Runoff: The (g) measure implies that all runoff is to be contained, regardless of whether or not it is polluted. The intent of the management measure, however, is to contain and treat contaminated runoff. This alternative management measure clarifies this intent. By diverting runoff from upslope sites and roofs away from areas used to grow or house the animals, areas used for processing and storage of products, manure and runoff storage areas, and silage storage areas, the amount of runoff water to be stored and managed can be minimized.*

II.B.2. Applicability

This management measure applies to all new confined animal facilities regardless of size and to all existing confined animal facilities that contain the following number of head or more:

	Head	Animal Units[1]
Beef Feedlots	50	50
Stables (horses)	100	200
Dairies	20	28
Layers	5,000	50[2]
		165[3]
Broilers	5,000	50[4]
		165[5]
Turkeys	5,000	900
Swine	100	40

except those facilities that are required by Federal regulation 40 CFR 122.23 to apply for and receive discharge permits. That section applies to "concentrated animal feeding operations," which are defined in 40 CFR Part 122, Appendix B. In addition, 40 CFR 122.23(c) provides that the Director of a National Pollutant Discharge Elimination System (NPDES) discharge permit program may designate any animal feeding operation as a concentrated animal feeding operation upon determining that it is a significant contributor of water pollution. This has the effect of subjecting the operation to the NPDES permit program requirements. If a confined animal facility has a NPDES permit, then it is exempt from this management measure.

Facilities containing fewer than the number of head listed above are not subject to the requirements of this management measure.

A *confined animal facility* is a lot or facility (other than an aquatic animal production facility) where the following conditions are met:

- Animals (other than aquatic animals) have been, are, or will be stabled or confined and fed or maintained for a total of 45 days or more in any 12-month period, and
- Crops, vegetation forage growth, or post-harvest residues are not sustained in the normal growing season over any portion of the lot or facility.

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[1]Animal unit: A unit of measurement for any animal feeding operation calculated by adding the following numbers: the number of slaughter and feeder cattle multiplied by 1.0, plus the number of mature dairy cattle multiplied by 1.4, plus the number of swine weighing over 25 kilograms (approximately 55 pounds) multiplied by 0.4, plus the number of sheep multiplied by 0.1, plus the number of horses multiplied by 2.0 (40 CFR Part 122, Appendix B).

[2]If facility has a liquid manure system, as used in 40 CFR Section 122, Appendix B.

[3]If facility has continuous overflow watering, as used in 40 CFR Section 122, Appendix B.

Two or more animal facilities under common ownership are considered, for the purposes of these guidelines, to be a single animal facility if they adjoin each other or if they use a common area or system for the disposal of wastes.

Confined animal facilities, as defined above, include areas used to grow or house the animals, areas used for processing and storage of product, manure and runoff storage areas, and silage storage areas.

Wastewater and runoff from confined animal facilities are to be controlled under this management measure. Runoff includes any precipitation that comes into contact with any manure, litter, or bedding. Wastewater is water discharged in the operation of an animal facility as a result of any or all of the following: animal or poultry watering; washing, cleaning, or flushing pens, barns, manure pits, or other animal facilities; washing or spray cooling of animals; and dust control.

II.B.3. Management Practices

Most of the management practices listed below are described in more detail in DOH's *Draft Guidelines for Livestock Waste Management* (June 1995).

a. Buffer Zones for Operations: Livestock feeding operations, and its waste collection, transfer, treatment and storage facilities should provide a minimum buffer distance of 1000 feet from public drinking water resources, and 50 feet from surface water resources.
b. Buffer Zones for Waste Products: Livestock waste products should not be applied to land within 150 feet from public drinking water resources, and 50 feet from surface water resources.
c. State and County Land Use Codes: All activities must be consistent with appropriate State and County land use codes.
d. Critical Wastewater Disposal Areas: Livestock facilities and waste systems should be located, if at all possible, within designated Non-Critical Wastewater Disposal Areas ("Non-CWDA") and below the Underground Injection Control ("UIC") Line, "No Pass" Line, or Drinking Water Protection Line.
e. Waste and Runoff Containment: Animal feeding operations should be designed and operated to contain all process-generated waste plus the runoff from a 25 year, 24 hour rainfall event that comes in contact with the waste. The full 25 year, 24 hour storage provision should always be restored as soon as favorable weather and site conditions permit.
f. Waste Storage Structures: Waste storage structures designed to receive waste contaminated runoff, or designed to overflow during catastrophic or chronic rainfall precipitation events should be provided with an overflow spillway and flow contour so as to provide the best overflow discharge location, flow direction, and outfall area having the least public and environmental impact.
g. Rainfall Diversion: Rainfall diversion drainage and overflow discharge contours subject to scouring should be provided with soil erosion and sediment control measures.
h. Lined Soil Surfaces: Soil surfaces serving the confined feeding operation, or the waste system collection, transfer conduit, treatment, or storage foundation for process generated waste containing drainable liquids should be

of material "impervious" to liquid infiltration. Soil surfaces serving heavy use areas such as manure storage/composting area, or other waste system collection, transfer, treatment, or storage foundation for dry livestock waste residuals exposed to weather should be of material restrictive to liquid infiltration.

i. County Building Code: Proposed facilities must be consistent with appropriate County building code requirements.
j. Process Waste and Runoff Management: Management of all process generated waste and runoff, including dead animals or animal parts, should be provided on a reliable basis until its final disposal, reuse, or removal and transfer to a legitimate second party recipient.
k. Record Disposition of Wastes: Waste disposal, reuse, or transfer to second party recipients should be recorded.
l. Storage Structure Level Indicator: Storage structures receiving process generated waste and/or rainfall runoff should be provided with a level indicator which can readily determine the volume in storage, storage volume available, minimum storage volume, and critical 25 year, 24 hour storage volume.
m. Proper Equipment and Equipment Operators: Equipment, and equipment operators capable of performing waste system operation and management tasks without damage to pollution prevention plan measures should be readily available.
n. Soil Erosion and Sediment Control: Soil erosion and sediment control measures should be maintained on soil surfaces subject to scouring and runoff effects.
o. Waste Transport: Waste residues should be transported in spill proof vessels.
p. Reuse Land Application: Proper land application of wastes should be followed.
q. Facilities Operation and Maintenance: Holding ponds and treatment lagoons should be operated such that the design storm volume is available for storage of runoff. Facilities filled to or near capacity should be drawn down as soon as all site conditions permit the safe removal and appropriate use of stored materials. Solids should be removed from solids separation basins as soon as possible following storm events to ensure that needed solids storage volume is available for subsequent storms. Diversions will need periodic reshaping and should be free of trees and brush growth. Gutters and downspouts should be inspected annually and repaired when needed. Established grades for lot surfaces and conveyance channels are to be maintained at all times.
r. Facilities Abandonment: Upon abandoning, retiring or permanently discontinuing use of a commercial animal operation, the owner should render it safe and free of vectors; all waste residues should be removed and properly disposed/reused; excavated facilities such as waste conveying ditches should be dewatered, desludged and filled completely with soil, sand, gravel or similar non-organic matter; and appropriate vegetation should be established for erosion and sediment control purposes.
s. Streamside Buffer: Provide a 50-foot natural buffer on all undeveloped stream corridors.
t. Manure Storage: Store accumulated manure on high ground to prevent rainwater ponding.

II.B.4. Implementation of Management Measure

The management measure for facility wastewater and runoff from confined animal facilities will be implemented as a part of a single non-regulatory Agricultural PPP Program that encompasses all agricultural management measures. A description of the existing organizational structure and regulatory and non-regulatory mechanisms follows. See Section III "Recommended Implementation of Agriculture Management Measures" on page III-46 for a detailed description of the proposed PPP Program, its implementation measures and schedule, identified needs, and recommended actions.

(i) Existing Organizational Structure: DOH, Environmental Management Division, is the lead agency for implementing this management measure because it implements programs for wastewater management, water pollution control, safe drinking water, and solid waste management. Other federal and State agencies involved in implementation include:

- USDA-NRCS, which provides information and technical assistance on management practices;
- USDA-FSA, which provides cost-share funds for implementing management practices specified in land-user conservation plans;
- University of Hawaii, CES, which provides information and technical assistance on management practices; and
- SWCDs, which provide technical assistance on best management practices on agricultural lands.

(ii) Existing Regulatory and Non-Regulatory Mechanisms:

HRS	Chapter 180	Soil and Water Conservation Districts
HRS	Chapter 322	Nuisances; Sanitary Regulations
HRS	Chapter 340E	Safe Drinking Water
HRS	Chapter 342D	Water Pollution Control
HRS	Chapter 342E	Nonpoint Source Pollution
HAR	Chapter 11-11	Sanitation
HAR	Chapter 11-23	Underground Injection Control
HAR	Chapter 11-54	Water Quality Standards
HAR	Chapter 11-55	Water Pollution Control
HAR	Chapter 11-58.1	Solid Waste Management Control
HAR	Chapter 11-62	Wastewater Systems
DOH	Draft Guidelines for Livestock Waste Management (June 1995)	

The non-regulatory programs listed on page III-15 also encourage the implementation of appropriate management practices through education, technical assistance, cost-share assistance, demonstration programs, and coordinated watershed planning.

The DOH *Draft Guidelines for Livestock Waste Management* (June 1995) outline roles and responsibilities of the livestock industry, their assisting agencies/consultants and DOH in the concerted effort to reduce and prevent water

pollution. The guidelines also provide guidance to owners of livestock operations in obtaining approval from DOH to construct and operate livestock facilities and waste systems. The document is termed "guidelines" because it may be modified, as permitted by regulation, until a clear and workable program among the livestock industry, assisting agencies/ consultants, and DOH is established. This gives planners, resource managers, and the livestock industry flexibility and time to evaluate and modify the document. DOH may elect to develop administrative rules from these guidelines at a future date.

The approval to construct and operate a livestock feeding or processing operation and its waste system is obtained through a plan review and approval process conducted by DOH. The review and approval process is intended to provide DOH an opportunity to ensure that the application of demonstrated pollution control technology, processes, and operation and maintenance practices reflects the standards of performance required by rule. It also ensures that the owner of the facility is informed of and agrees to the pollution prevention plan measures under which they are allowed to operate.

The approval to construct a commercial livestock feeding or processing operation, and/or its waste system, requires a site plan, design plan, and pollution prevention plan. These plans are submitted to DOH, Environmental Management Division, and must be of sufficient scope and depth for determining the standard of performance of the planned measures. Prior to the introduction of livestock, DOH must conduct a site inspection of the completed construction and be satisfied that the facilities, waste systems, and pollution prevention measures are constructed in accordance with the approved plan specifications. The approval to operate is based on the condition that the livestock operation, its waste systems and pollution control measures will be operated and maintained in accordance with the approved plan measures.

In addition, Chapter 11-11, HAR, administered by DOH, requires that animal manure is disposed of in a sanitary manner and animal enclosures are kept clean and free from accumulation of excreta and other filth, and pests. Chapter 11-23, HAR, also administered by DOH, classifies exempted aquifers and underground sources of drinking water. Unless expressly exempted, all aquifers are considered underground sources of drinking water. Underground Injection Control (UIC) maps indicate the boundary line of exempted aquifers. No large municipal or community serving systems can use injection wells above the UIC line. Certain activities are also prohibited interior of the line.

C. Nutrient Management Measure

Develop, implement, and periodically update a nutrient management plan to: (1) apply nutrients at rates necessary to achieve realistic crop yields, (2) improve the timing of nutrient application, and (3) use agronomic crop production technology to

increase nutrient use efficiency. When the source of the nutrients is other than commercial fertilizer, determine the nutrient value [~~and the rate of availability of the nutrients~~]. Determine and credit the nitrogen contribution of any legume crop. Soil and/or plant tissue testing should be used [~~routinely~~] at a suitable interval. Nutrient management plans contain the following core components:

(1) Farm and field maps showing acreage, crops, soils, and waterbodies.

(2) Realistic yield expectations for the crop(s) to be grown, based [~~primarily on the producer's actual yield history, State Land Grant University yield expectation for the soil series, or NRCS Soils-5 information for the soil series~~] on achievable yields for the crop. Individual producer constraints and other producer's yields would be considered in determining achievable yields.

(3) A summary of the soil condition and nutrient resources available to the producer, which at a minimum would include:
- **[~~Soil test results for pH, phosphorus, nitrogen, and potassium~~] An appropriate mix of soil (pH, P, K) and/or plant tissue testing or historic yield response data for the particular crop;**
- **Nutrient analysis of manure, sludge, mortality compost (birds, pigs, etc.), or effluent (if applicable);**
- **Nitrogen contribution to the soil from legumes grown in the rotation (if applicable); and**
- **Other significant nutrient sources (e.g., irrigation water).**

(4) An evaluation of field limitations based on environmental hazards or concerns, such as:
- **[~~Sinkholes~~] Lava tubes, shallow soils over fractured bedrock, and soils with high leaching or runoff potential,**
- **[~~Lands near~~] Distance to surface water,**
- **Highly erodible soils, and**
- **Shallow aquifers.**

(5) [~~Use of the limiting nutrient concept to establish the mix of nutrient sources and requirements for the crop based on a realistic yield expectation~~] Best available information is used in developing recommendations for the appropriate mix of nutrient sources and requirements for the crops.

(6) Identification of timing and application methods for nutrients to: provide nutrients at rates necessary to achieve realistic crop yields; reduce losses to the environment; and avoid applications

as much as possible [~~to frozen soils and~~] during periods of leaching or runoff.

(7) Methods and practices used to prevent soil erosion or sediment loss.

[~~(7)~~] (8) Provisions for the proper calibration and operation of nutrient application equipment.

II.C.1. Description

Nitrogen and phosphorus are the two major nutrients from agricultural land that may degrade water quality. Nutrients are applied to agricultural land in several different forms and come from various sources, including commercial fertilizers, manure from animal production facilities, effluent and sludge from (domestic) wastewater treatment plants, legumes and crop residue, irrigation waters, and atmospheric deposition.

All plants require nutrients for growth. In aquatic environments, nutrient availability usually limits plant growth. Nitrogen and phosphorus generally are present at background or natural levels below 0.3 and 0.05 mg/L, respectively. When these nutrients are introduced into a stream, lake, or estuary at higher rates, aquatic plant productivity may increase dramatically. This process, referred to as cultural eutrophication, may adversely affect the suitability of the water for other uses.

The goal of this management measure is to minimize edge-of-field delivery of nutrients and minimize leaching of nutrients from the root zone. Nutrient management is pollution prevention achieved by developing a nutrient budget for the crop, applying nutrients at the proper time, applying only the types and amounts of nutrients necessary to produce a crop, and considering the environmental hazards of the site. Nitrogen is the major agricultural nutrient of concern with respect to nonpoint source pollution. Phosphorus as a nonpoint source pollutant can be minimized by controlling erosion in most areas.

This measure may result in some reduction in the amount of nutrients being applied to the land, thereby reducing the cost of production as well as protecting both groundwater and surface water quality. However, application of the measure may in some cases cause more nutrients to be applied where there has not been a balanced use of nutrients in the past. This will usually allow all the nutrients to be used more efficiently, thereby reducing the amount of nutrients that will be available for transport from the field during the non-growing season. While the use of nutrient management should reduce the amount of nutrients lost with surface runoff to some degree, the primary control for the transport of nutrients that are attached to soil particles will be accomplished through the implementation of erosion and sediment control practices.

Nutrient management plans should be reviewed and updated at least once every 3 years, or whenever a crop rotation or nutrient source is changed. Application equipment should be calibrated and inspected for wear and damage periodically, and repaired when necessary. Records of nutrient use and sources should be

maintained along with other management records for each field. This information will be useful when it is necessary to update or modify the management plan.

This management measure amends the (g) measure contained in EPA's Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters.

***Justification for Alternative Management Measure**: The agriculture focus group proposed this alternative management measure for the following reasons.*

- *(i) Rate of Availability of the Nutrients: There is currently limited use of organic nutrient sources and almost no data on nutrient availability from these sources under Hawaiian conditions.*

- *(ii) Soil testing: Nutrient applications for various crops in Hawaii are based on soil and/or plant tissue testing, depending on crop. Soil testing is not very useful in Hawaii to determine nitrogen availability. Nitrogen recommendations need to be based on realistic yield estimates and nitrogen uptake data. Soil testing, however, is essential to make recommendations for other nutrients, in order to assure that they do not limit nitrogen efficiency ("limiting nutrient concept").*

  In addition, much of the soil response data necessary to implement the (g) measure is currently not available for many crops in Hawaii. Most of the agricultural land in Hawaii has been farmed exclusively in pineapple and sugarcane for decades. Therefore, what soil testing data that does exist (such as nutrient availability and yield response) are for only those crops. Further, these data have been seen as proprietary and have not been generally available. Since agriculture in Hawaii is quickly shifting to diversified crops, much of the soil testing data necessary to implement the (g) measure for many crops is limited.

  Some crops, such as tree crops, do not rely on soil testing; rather, tissue analysis is used instead.

- *(iii) Testing Intervals: Suitable intervals for nutrient testing vary greatly for various crops and soils.*

- *(iv) Yield Expectations: Basing yield expectations on yield histories would limit potential yields. In addition, there are no Land Grant University or NRCS Interpretation Record data on potential yields in Hawaii.*

- *(v) Environmental Hazards: Sink holes do not exist in Hawaii. However, lava tubes can be considered an important environmental hazard.*

- *(vi) Nutrient Recommendations: Using the limiting nutrient concept is restrictive. Best available information for development recommendations for*

the appropriate mix of nutrient sources and requirements for the crop can include nutrient ratios and crop logging for various crops. This information can take into account more than a single limiting nutrient or other growth factor at a time.

- *(vii) Frozen Soils: No periodically frozen soils are farmed in Hawaii.*

- *(viii) Preventing Nutrient Losses Due to Soil Erosion: An additional component for nutrient management plans was added as (7). Using methods and practices to prevent soil erosion and sediment loss is important to prevent nutrient losses, since nutrients bind to soil particles and can become a nonpoint source pollution problem when sediment-laden runoff enters surface and coastal waters.*

II.C.2. Applicability

This management measure applies to activities associated with the application of nutrients, including both manures and commercial fertilizers, to agricultural lands.

II.C.3. Management Practices

The following general management practices should be adapted and refined to specific crops. The following crop categories may have different sets of BMPs or management strategies: leafy vegetables; other vegetables; root crops; flowers and other ornamentals; foliage; grain crops (non-legumes); legumes; forage crops; tree crops (including banana); and turf grass.

a. Soil sampling (should not be required for all crops until necessary calibration data is available);
b. Plant tissue testing (should not be required for all crops until necessary calibration data is available);
c. Timing of fertilizer applications to maximize plant utilization and minimize loss to environment;
d. Fertilizer placement;
e. Nutrient credits for previous crops and green manures;
f. Animal manure/compost management;
g. Base fertilizer applications on realistic yields;
h. Irrigation systems management;
i. Slow-release fertilizers;
j. Variable fertility management;
k. Improve soil properties;
l. Control soil erosion;
m. Identify environmentally-sensitive areas;
n. Buffer areas to protect environmentally-sensitive areas;
o. Provide a 50-foot natural buffer on all undeveloped stream corridors;
p. Consider the surface loss and leaching potential of soils.

II.C.4. Implementation of Management Measure

The nutrient management measure will be implemented as part of a single non-regulatory Agricultural PPP Program that encompasses all agricultural

management measures. A description of the existing organizational structure and regulatory and non-regulatory mechanisms follows. See Section III "Recommended Implementation of Agriculture Management Measures" on page III-46 for a detailed description of the proposed PPP Program, its implementation measures and schedule, identified needs, and recommended actions.

(i) Existing Organizational Structure: No one agency clearly has the lead in implementing this management measure at this time. Federal and State agencies involved in implementation include:

- DOH, Environmental Management Division, which implements programs for water pollution control and safe drinking water;
- USDA-NRCS, which provides information and technical assistance on management practices;
- USDA-FSA, which provides cost-share funds for implementing management practices;
- University of Hawaii, CES, which provides information and technical assistance on management practices;
- County departments of public works, which administer the county grading ordinances; and
- SWCDs, which approve conservation plans that allow agricultural operators to receive an exemption from the county grading ordinances.

(ii) Existing Regulatory and Non-Regulatory Mechanisms:

HRS	Chapter 180	Soil and Water Conservation Districts
HRS	Chapter 180C	Soil Erosion and Sediment Control
HRS	Chapter 342D	Water Pollution Control
HRS	Chapter 342E	Nonpoint Source Pollution
HAR	Chapter 11-54	Water Quality Standards
HCC	Chapter 10	Soil Erosion and Sediment Control (Hawaii County)
KCC	Chapter 22-7	Grading, Grubbing, and Stockpiling (Kauai County)
ROH	Chapter 14-13	General Provisions for Grading, Soil Erosion and Sediment Control (City and County of Honolulu)
MCC	Chapter 20.08	Soil Erosion and Sediment Control (Maui County)

The non-regulatory programs listed on page III-15 also encourage the implementation of appropriate management practices through education, technical assistance, cost-share assistance, demonstration programs, and coordinated watershed planning.

At present, there are no enforceable mechanisms that specifically address the management of agricultural nutrients. Nutrients are addressed generally under the State's water pollution control statutes. While Chapter 342E, HRS, addresses polluted runoff control, administrative rules have not yet been developed to implement it. These rules will be developed in conjunction with the further development and implementation of the coastal nonpoint pollution control program. Chapter 11-54, HAR - the administrative rules that implement much of

Chapter 342D, HRS - has no procedures in place to enforce the water quality standards it sets forth. Further, there is almost no monitoring in place that would be capable of enforcing any of these regulatory mechanisms.

Nutrient management on agricultural lands in Hawaii has been undertaken on a voluntary basis. Land users work with the NRCS and CES to develop appropriate nutrient management practices. As part of its resource conservation planning, NRCS now addresses nutrient and pesticide management, especially in relation to environmentally-sensitive areas. While NRCS does not make recommendations on types of fertilizers, rates or application methods, the CES does. A computerized system is being developed by CES to assist in making general fertilizer recommendations. The Hawaiian Sugar Planters Association makes fertilizer recommendations for sugarcane and the pineapple companies provide recommendations for pineapple crops.

Assessing the effectiveness of nutrient management plans may be challenging. Unlike soil conservation planning, for which the Universal Soil Loss Equation is used, there are no viable quantitative criteria known to the agriculture focus group for evaluating an appropriate mix of BMPs for nutrient management.

The following laboratories currently undertake soil and plant tissue analysis: the University of Hawaii's Agricultural Diagnostic Service Center (ADSC); Mainland facilities; HC&S Plantation (Maui); and Maui Land and Pine. HC&S and Maui Land and Pine have laboratories for analysis of company samples only. Because of limited local facilities, there are problems getting timely results from soil analyses in Hawaii. As a result, many growers send their samples outside of the State to get more timely results. However, the Mainland labs are not familiar with Hawaiian soils, and the soil extractants used for analysis in Mainland labs may be inappropriate for Hawaii soil samples. Manure and compost analysis is also not readily available in Hawaii.

Realistic yield expectation data are available primarily for plantation crops such as sugarcane, pineapple and, to a lesser extent, macadamia nuts and coffee. There are currently inadequate data to guide nutrient recommendations for most other crops. Likewise, soil analysis calibration data are most available for plantation crops and are limited or absent for other crops in Hawaii. Tissue sample data are available for most important tree crops, and data generated outside Hawaii can be used with care for other crops. However, the amount of nutrients to be applied to the soil for adequate plant levels may vary widely with soil type, particularly for phosphorus.

D. Pesticide Management Measure

[~~To reduce contamination of surface water and ground water from pesticides:~~

~~**(1) Evaluate the pest problems, previous pest control measures, and cropping history;**~~
~~**(2) Evaluate the soil and physical characteristics of the site including mixing, loading, and storage areas for potential leaching or runoff of pesticides. If leaching or runoff is found to occur, steps should be taken to prevent further contamination;**~~
~~**(3) Use integrated pest management (IPM) strategies that:**~~
~~**(a) Apply pesticides only when an economic benefit to the producer will be achieved (i.e., applications based on economic thresholds); and**~~
~~**(b) Apply pesticides efficiently and at times when runoff losses are unlikely;**~~
~~**(4) When pesticide applications are necessary and a choice of registered materials exists, consider the persistence, toxicity, runoff potential, and leaching potential of products in making a selection;**~~
~~**(5) Periodically calibrate pesticide spray equipment; and**~~
~~**(6) Use anti-backflow devices on hoses used for filling tank mixtures.**~~**]**

To eliminate the unnecessary release of pesticides into the environment and to reduce contamination of surface water and ground water from pesticides:

(1) Use integrated pest management strategies where available that minimize chemical uses for pest control.
(2) Manage pesticides efficiently by:
(a) calibrating equipment;
(b) using appropriate pesticides for given situation and environment;
(c) using alternative methods of pest control; and
(d) minimizing the movement of pest control agents from target area.
(3) Use anti-backflow devices on hoses used for filling tank mixtures.
(4) Enhance degradation or retention by increasing organic matter content in the soil or manipulating soil pH.

II.D.1. Description
The term *pesticide* includes any substance or mixture of substances used for preventing, destroying, repelling, or mitigating any pest or intended for use as a

plant regulator, defoliant, or desiccant. The principal pesticidal pollutants are the active and inert ingredients and any persistent degradation products. Both the degradation and adsorption characteristics of pesticides are highly variable.

The goal of this management measure is to reduce contamination of surface water and ground water from pesticides. The basic concept of the pesticide management measure is to foster effective and safe use of pesticides without causing degradation to the environment. The most effective approach to reducing pesticide pollution of waters is, first, to release fewer pesticides and/or less toxic pesticides into the environment and, second, to use practices that minimize the movement of pesticides to surface water and ground water. In addition, pesticides should be applied only when an economic benefit to the producer will be achieved. Such an approach emphasizes using pesticides only when, and to the extent, necessary to control the target pests. This usually results in some reduction in the amount of pesticides being applied to the land, plants, or animals, thereby enhancing the protection of water quality and possibly reducing production costs as well.

At a minimum, effective pest management requires evaluating past and current pest problems and cropping history; evaluating the physical characteristics of the site; applying pesticides only when an economic benefit to the producer will be achieved; applying pesticides efficiently and at times when runoff losses are unlikely; selecting pesticides (when a choice exists) that are the most environmentally benign; using anti-backflow devices on hoses used for filling tank mixtures; and providing suitable mixing, loading, and storage areas.

Pest management practices should be updated whenever the crop rotation is changed, pest problems change, or the type of pesticide used is changed. Application equipment should be calibrated and inspected for wear and damage each spray season, and repaired when necessary. Anti-backflow devices should also be inspected each spray season and repaired when necessary.

This management measure is an alternative management measure to the (g) measure contained in EPA's Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters.

> ***Justification for Alternative Management Measure**: The agriculture focus group proposed this alternative management measure because it felt that the (g) measure contained specific best management practices rather than providing overall goal statements. The alternative management measure provides general objectives for pesticide reduction and improved use-efficiency which can be implemented through various combinations of management practices.*

II.D.2. Applicability

This management measure applies to activities associated with the application of pesticides to agricultural lands.

II.D.3. Management Practices

a. Topography/hydrogeology. Determine the physical characteristics of the site:
- lava tubes, depth of soil, type of soil, slope;
- depth to groundwater;
- proximity to surface water, wetlands, or sensitive ecosystems;
- location of wells, well protection areas;
- prevailing wind direction and potential for erosion;
- water erosion potential;
- determine if the site is in a state pesticide management area either for groundwater or for endangered species; and
- review resource conservation plan.

b. Storage Area. Use already available printed material.

c. Keep storage area locked.
- Provide containment of spills.
- Provide ventilation.

d. Provide safety equipment.
- Provide shelf for Materials Safety Data Sheet (MSDS) information.
- Provide media for spill treatment.
- Post phone numbers for medical service.

e. Mixing, handling, clean-out, disposal of containers.

f. Follow recommendations of National Agricultural Chemicals Association.

g. Site History. Determine the vegetative cover and site history of the site:
- previous vegetative cover;
- current vegetative cover;
- soil information, such as soil series and slope range, pH, permeability, available water holding capacity, organic matter, etc., depending on historical plant growth and or proposed production;
- acres/area;
- rainfall distribution, amount; and
- method of irrigation.

h. Pest History. Determine the pest history of the site:
- pest problem(s) requiring action;
- previous pest control practices;
- describe practice if non-chemical;
- records of chemical control, including product name (EPA registration number), rate of application, amount, approximate date of application, location (annual summary);
- recommended pest control practice(s); and
- method of application.

i. Pest Management - Biological Control.
- Use integrated pest management techniques where practical.
- Eliminate routine preventive practices that may generate pollutants.
- Introduce and foster natural enemies.
- Use scouting to determine pest populations.
- Release sterilized male insects.
- Use biorational materials (*e.g.*, Bt).
- Use cover crop(s) to reduce surface run off, herbicide use, and leaching.
- Establish refuges (*i.e.*, ground cover, hedges) to harbor beneficial insects.
- Use trap crops to attract and contain pests.

- Use living sods to mask crops and provide barriers to pesticide movement.
- Provide ground covers to harbor beneficial insects (orchards).
- Rotate crops.
- Employ intensive crop rotations using broadcast planted ground covers to aid in breaking pest life cycles.
- Use field sanitation techniques to minimize harboring pests.

j. Pest Management - Cultural Control.

- Optimize crop vigor.
- Use resistant crop cultivars or varieties.
- Preserve predator habitats.
- Use vegetative filter strips.
- Use conservation tillage, such as no-till or ridge-tillage.
- Time crop production to coincide with lower insect population.

k. Pest Management - Chemical Control.

Pheromone Control:

- Aid in monitoring pest populations.
- Mass trapping.
- Disrupt mating or other behaviors of pests.
- Attract predators/parasites.

Pesticides:

- Apply the lowest effective rate as specified on the label or as determined and documented locally by testing.
- Minimize rates and/or runoff through appropriate timing of applications (*i.e.*, during optimum life cycle of pest for control, not before rainfall event, not in high winds).
- Determine economic threshold of pest population by field when scouting techniques are available and established for local pest/crop situation.
- Use efficient application methods and properly trained personnel.
- Consider the addition of drift-reducing agents.
- When choices of products exist, consider the following factors in making the final selection:
  - target efficacy;
  - toxicity of product to non-target organisms;
  - leaching and runoff potential;
  - persistence/bioaccumulation;
  - frequency of applications;
  - quantity required; and
  - previous detections off target within similar site circumstances.
- Use application equipment appropriate to the task.
- Calibrate application equipment frequently to assure correct application rates (replace worn or damaged nozzles, verify pump pressure and/or sprayer speed for proper application rate).
- Use alternate pesticide products when and where feasible to reduce the development of resistance and/or persistence in the environment.
- Use tested tank mixes to minimize number of applications and increase efficacy.
- Efficiently employ non-synthetic pesticides such as those used in organic farming.

l. Pest Management - Physical/Mechanical Control.

- rotary weed hoe;
- between-row cultivation;
- flaming with tractor mounted burners;
- weeder geese, shielded foraging (animal foraging restricted and/or controlled by physical means);
- organic mulch plastic film, solarization with clear plastic;
- woven plastic fabric.

II.D.4. Implementation of Management Measure

The pesticide management measure will be implemented as a part of a single non-regulatory Agricultural PPP Program that encompasses all agricultural management measures. A description of the existing organizational structure and regulatory and non-regulatory mechanisms follows. See Section III "Recommended Implementation of Agriculture Management Measures" on page III-46 for a detailed description of the proposed PPP Program, its implementation measures and schedule, identified needs, and recommended actions.

(i) Existing Organizational Structure: While most of the management practices of this management measure are implemented on a voluntary basis by land users, some regulatory controls exist over the use and distribution of pesticides. The Department of Agriculture (DOA), Pesticides Branch, is the lead agency for implementing those measures regulating pesticides. Other federal and State agencies involved in implementation include:

- SWCDs, which provide technical assistance on BMPs for agricultural lands;
- USDA-NRCS, which provides information and technical assistance on management practices;
- USDA-FSA, which provides cost-share funds for implementing management practices;
- University of Hawaii, CES, which provides information and technical assistance on management practices; and
- DOH, which funds demonstration projects to develop, test and implement management practices tailored to Hawaii's environment.

(ii) Existing Regulatory and Non-Regulatory Mechanisms:

HRS	Chapter 149A	Hawaii Pesticides Law
HRS	Chapter 180	Soil and Water Conservation Districts
HRS	Chapter 340E	Safe Drinking Water
HRS	Chapter 342D	Water Pollution Control
HRS	Chapter 342E	Nonpoint Source Pollution
HAR	Chapter 4-66	Pesticides
HAR	Chapter 11-21	Cross-Connection and Back-Flow Control
HAR	Chapter 11-54	Water Quality Standards

The non-regulatory programs listed on page III-15 also encourage the implementation of appropriate management practices through education,

technical assistance, cost-share assistance, demonstration programs, and coordinated watershed planning.

Chapter 149A, HRS, administered by DOA, states that "no person shall: (1) use any pesticide in a manner inconsistent with its label; (2) use, store, transport or discard any pesticide or pesticide container in any manner which would have unreasonable adverse effects on the environment; ....(6) fill with water, through a hose, pipe, or other similar transmission system, any tank, implement, apparatus, or equipment used to disperse pesticides, unless the tank, implement, apparatus, equipment, hose, pipe or other similar transmission system is equipped with an air gap or a reduced pressure principle backflow device meeting the requirements under section 340-2 [Safe Drinking Water Law] and the rules adopted thereunder" (§149A-31). Any person who violates Chapter 149A, HRS, or its rules may be issued civil penalties, including fines ranging from not more than $5,000 to not more than $1,000 (depending on whether the violator is a business or private entity) or criminal penalties, including misdemeanor charges and fines ranging from not more than $25,000 to not more than $1,000 (depending on whether the violator is a business or private entity).

Chapter 11-21, HAR, administered by DOH, requires that a reduced pressure principal back-flow preventer or air gap separation be installed as part of any piping network in which fertilizers, pesticides and other chemicals or toxic contaminants are injected or siphoned into the irrigation system [§11-21-7(a)(4), HAR]. Chapter 11-21, HAR, also requires that all back-flow prevention devices be approved by the University of Southern California Foundation for Cross-Connection Control and Hydraulic Research and are tested, periodically inspected, and properly maintained.

Chapter 4-66, HAR, administered by DOA, relates to the registration, licensing, certification, recordkeeping, usage, and other activities related to the safe and effective use of pesticides. It requires that those who apply or directly supervise others who apply restricted use pesticides be certified. This certification requires some understanding of the environmental concerns of using pesticides. This requirement is implemented under the CES/DOA Pesticide Applicator Program. Certification under Category 1 for agricultural applicators is required [§4-66-56(1), HAR]. Certification is not required for those using pesticides that are not classified as "restricted use."

E. Grazing Management Measure

Protect range, pasture and other grazing lands:

(1) By implementing one or more of the following to protect sensitive areas (such as streambanks, wetlands, estuaries, ponds, lake shores, <u>near coastal waters/ shorelines,</u> and riparian zones):

(a) Exclude livestock,
(b) Provide stream crossings or hardened watering access for drinking,
(c) Provide alternative drinking water locations,
(d) Locate salt and additional shade, if needed, away from sensitive areas, or
(e) Use improved grazing management (e.g., herding) to reduce the physical disturbance and reduce direct loading of animal waste and sediment caused by livestock; *and*

(2) By achieving either of the following on all range, pasture, and other grazing lands [~~not addressed under (1)~~]:
(a) Implement range and pasture [~~components of a Conservation Management System (CMS) as defined in the Field Office Technical Guide of the USDA-NRCS by applying the progressive planning approach of the USDA-NRCS~~] conservation and management practices that achieve an acceptable level of treatment to reduce erosion, or
(b) Maintain range, pasture, and other grazing lands in accordance with activity plans established by [~~either the Bureau of Land Management of the U.S. Department of the Interior or~~] the Division of Land Management of DLNR, [~~the Forest Service of USDA~~] federal agencies managing grazing land, or other designated land management agencies.

II.E.1. Description
The functioning condition of riparian-wetland areas is a result of interaction among geology, soil, water, and vegetation. Improper livestock grazing and equipment use may damage stream banks and shores, riparian vegetation, channels and the water column.

While the focus of the grazing management measure is on the riparian zone and shoreline areas, the control of erosion from range, pasture, and other grazing lands above these areas is also encouraged. Application of this management measure will reduce the physical disturbance to sensitive areas and reduce the discharge of sediment, animal waste, nutrients, and chemicals to surface waters.

For any grazing management system to work, it must be tailored to fit the needs of the vegetation, terrain, class or kind of livestock, and particular operation involved.

Special attention must be given to grazing management in riparian and wetland areas if management measure objectives are to be met. For purposes of this guidance, riparian areas are defined as:

> *vegetated ecosystems along a waterbody . Riparian areas characteristically have a high water table and are subject to periodic flooding and influence from the adjacent waterbody.*

The health of the riparian system, and thus the quality of water, is dependent on the use, management, and condition of the related uplands. Therefore, the proper management of riparian and wetland ecosystems will involve the correct management of livestock grazing and other land uses in the total watershed.

Most riparian areas in Hawaii are bordered by steep cliffs and are fenced primarily to keep animals from falling into gulches rather than to save the vegetation from the animals. All islands have some grazable flood plains, but Kauai, as the oldest island, has a higher percentage. Floods along these grazable areas are common and generally unpredictable. Frequent flooding often makes permanent fences parallel to streams uneconomical. Such fences are prone to being washed out and deposited downstream or along beaches. Instead, most of these areas have minimal "knockdown," easy to repair, fences running perpendicular to the stream. Streams are used both as a boundary fence and watering source.

This management measure amends the (g) measure contained in EPA's Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters.

Justification for Alternative Management Measure: *Changes were made to (2) of the (g) measure to make the management measure parallel the one for erosion and sediment control and to render it more applicable to Hawaii:*

- *(i) Conservation Management System (CMS): The (g) measure refers to applying the erosion control component of an NRCS Conservation Management System (CMS). The CMS developed by NRCS was intended for use as part of a voluntary program of natural resources management. A CMS has two levels of treatment. The first is a Resource Management System (RMS). Currently, in order for a farmer to meet the criteria for a RMS, that farm must have an annual soil rill and sheet erosion rate that is less than "T" as determined by the Universal Soil Loss Equation (USLE) or the Revised Universal Soil Loss Equation (RUSLE). The USLE or RUSLE was never intended to provide absolute soil loss numbers and its reliability on steeper lands under high rainfall conditions is questionable. Rather, it was meant to be used as an erosion prediction tool that estimates soil erosion for planning purposes. A RMS, as part of a voluntary program, sets an erosion control goal for a land user to strive towards, rather than establishing an enforceable level of treatment. In Hawaii, many farms are unable to achieve a RMS level of treatment due to rainfall and slope conditions. Recognizing this, NRCS has established a second level*

of treatment called an Acceptable Management System (AMS) that may be implemented as it is needed. An AMS sets an erosion control goal for the specific resource use which is achievable in view of social, cultural, and economic constraints of the area. For NRCS planning purposes, the State Conservationist approves the AMS level for erosion control.

This alternative management measure provides the State the flexibility to apply any combination of conservation practices and management that achieves an acceptable level of treatment. This will enable Hawaii to determine the acceptable level of treatment, based not only on nonpoint source pollution control but also on economic, social, cultural and geographic criteria. Establishing the process for determining an acceptable level of treatment will be undertaken during FY 96-97, provided resources are available.

- *(ii) Maintaining grazing lands in accordance with activity plans established by relevant agencies: The U.S. Department of Interior's Bureau of Land Management (BLM) does not have federal lands in Hawaii to lease for grazing. Therefore, BLM was eliminated from (2)(b) and replaced with Hawaii DLNR's Land Management Division, which does lease State lands for grazing. Similarly, USDA's Forest Service does not lease land, so this reference was deleted and replaced with "federal agencies managing grazing land." In addition, the clause "or other designated land management agencies" was added to (2)(b) to provide the State flexibility to designate other land management agencies, if appropriate.*

II.E.2. Applicability

The management measure applies to activities on range, irrigated and non-irrigated pasture, and other grazing lands used by domestic livestock. Range is those lands on which the native vegetation (climax or natural potential plant community) is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing use. Range includes natural grassland, savannas, many wetlands, some deserts, tundra, and certain forb and shrub communities. Pastures are those lands that are primarily used for the production of adapted, domesticated forage plants for livestock. Other grazing lands include woodlands, native pastures, and croplands producing forages.

The major differences between range and pasture are the kind of vegetation and level of management that each land area receives. In most cases, range supports native vegetation that is extensively managed through the control of livestock rather than by agronomy practices, such as fertilization, mowing, irrigation, etc. Range also includes areas that have been seeded with introduced species, but which are extensively managed like native range. Pastures are represented by those lands that have been seeded, usually with introduced species or in some cases with native plants, and which are intensively managed using agronomy practices and control of livestock.

The intent of the management measure is to protect surface and ground water quality. Some waterbodies, such as farm ponds, have been created to water

livestock. Protecting the water quality of these artificial water storage areas does not have the same priority as protecting natural streams and waterbodies.

II.E.3. Management Practices

The management practices listed below are representative of those currently in use. Numbers in parentheses indicate NRCS management practice numbers. These management practices are described in detail in the NRCS National Handbook of Conservation Practices or Field Office Technical Guide.

a. Planned Grazing System (556): A practice in which two or more grazing units are alternately rested and grazed in a planned sequence for a period of years, and rest periods may be throughout the year or during the growing season of key plants. This practice includes pasture management, leader/follower grazing, woodland grazing, and fire control grazing.
b. Deferred Grazing (352): Postponing grazing or resting a paddock for a prescribed period.
c. Proper Grazing Use (528): Grazing at an intensity that will maintain enough cover to protect the soil and maintain or improve the quantity of desirable vegetation.
d. Pasture and hayland management (510): Proper treatment and use of pasture or hayland.
e. Pipeline (516): Pipelines installed for conveying water for livestock or other purposes.
f. Ponds (378): A water impoundment made by constructing a dam or an embankment or by excavation of a pit or dugout.
g. Trough or Tank (614): A trough or tank, with needed devices for water control and wastewater disposal, installed to provide drinking water for livestock.
h. Spring Development (574): Improving springs and seeps by excavating, cleaning or providing collection and storage facilities.
i. Water-Harvesting/Catchment (636): Catchments are structures were rain water is trapped, channeled then collected, usually but not always, in a tank set below the catchment structure.
j. Fencing (382): Enclosing an area of land with a suitable fence that acts as a barrier to livestock, game or humans. Such fences may include barb wire, net wire, electric, rock, wood, or natural barriers such as *pali* (cliffs) or lava.
k. Livestock Exclusion (472): Excluding livestock from an area not intended for grazing.
l. Access Road (560): A fixed route of travel to move livestock, equipment and supplies. An access for proper operation, maintenance, and management of conservation enterprises.
m. Pasture Planting (512): Establishing long term stands of adapted species of forage plants. This includes reseeding eroded areas.
n. Critical Area Planting (342): Planting vegetation or seeds on highly erodible or critically eroding areas.
o. Brush and Weed Management (314): Managing and manipulating stands of brush and weeds on grasslands by mechanical, chemical, prescribed burning, or biological means. This includes grazing to control undesirable plants without significantly damaging desirable ones. This is primarily

accomplished with goats, often with sheep, occasionally with cattle and seldom with horses.

p. Prescribed Burning (338): Applying fire to predetermined areas under conditions which control the intensity and spread of fire.

q. Stock Trails and Walkways (575): Providing or improving access to forage and water to permit proper grazing use and planned grazing systems.

II.E.4. Implementation of Management Measure

The grazing management measure will be implemented as a part of a single non-regulatory Agricultural PPP Program that encompasses all agricultural management measures. A description of the existing organizational structure and regulatory and non-regulatory mechanisms follows. See Section III "Recommended Implementation of Agriculture Management Measures" on page III-46 for a detailed description of the proposed PPP Program, its implementation measures and schedule, identified needs, and recommended actions.

(i) Existing Organizational Structure: Currently, this management measure is implemented on a voluntary basis by land users, with technical assistance from a number of agencies, supplemented with more general State authorities with respect to water pollution control. Federal and State agencies involved in implementation include:

- SWCDs, which provide technical assistance on BMPs on agricultural lands;
- USDA-NRCS, which provides information and technical assistance on management practices;
- USDA-FSA, which provides cost-share funds for implementing management practices;
- University of Hawaii, CES, which provides information and technical assistance on management practices; and
- DOH, which funds demonstration projects to develop, test and implement BMPs tailored to Hawaii's environment.

(ii) Existing Regulatory and Non-Regulatory Mechanisms:

HRS	Chapter 180	Soil and Water Conservation Districts
HRS	Chapter 342D	Water Pollution Control
HRS	Chapter 342E	Nonpoint Source Pollution
HAR	Chapter 11-54	Water Quality Standards

The non-regulatory programs listed on page III-15 also encourage the implementation of appropriate management practices through education, technical assistance, cost-share assistance, demonstration programs, and coordinated watershed planning.

Nonpoint source pollution is generally addressed under the State's water pollution control statutes. See page III-28 for a brief discussion of Chapters 342D and 342E, HRS.

F. Irrigation Water Management Measure

To reduce nonpoint source pollution of surface waters caused by irrigation:

(1) Operate the irrigation system so that the timing and amount of irrigation water applied match crop water needs. This will require, as a minimum: (a) the [~~accurate~~] measurement of soil-water depletion volume and the volume of irrigation water applied; [~~and~~] (b) uniform application of water; and (c) application rate which does not exceed infiltration rate in the field.

(2) When chemigation is used, include backflow preventers for wells, minimize the harmful amounts of chemigated waters that discharge from the edge of the field, and control deep percolation. In cases where chemigation is performed with furrow irrigation systems, a tailwater management system may be needed.

The following limitations and special conditions apply:

(1) In some locations, irrigation return flows are subject to other water rights or are required to maintain stream flow. In these special cases, on-site reuse could be precluded and would not be considered part of the management measure for such locations.

(2) By increasing the water use efficiency, the discharge volume from the system will usually be reduced. While the total pollutant load may be reduced somewhat, there is the potential for an increase in the concentration of pollutants in the discharge. In these special cases, where living resources or human health may be adversely affected and where other management measures (nutrients and pesticides) do not reduce concentrations in the discharge, increasing water use efficiency would not be considered part of the management measure.

(3) [~~In some irrigation districts, t~~]The time interval between the order for and the delivery of irrigation water to the farm may limit the irrigator's ability to achieve the maximum on-farm application efficiencies that are otherwise possible.

(4) In some locations, leaching is necessary to control salt in the soil profile. Leaching for salt control should be limited to the leaching requirement for the root zone.

(5) Where leakage from delivery systems or return flows supports wetlands or wildlife refuges, it may be preferable to modify the system to achieve a high level of efficiency and then divert the "saved water" to the wetland or wildlife refuge. This will improve the quality of water delivered to wetlands or wildlife refuges by preventing the introduction of pollutants from irrigated lands to such diverted water.

(6) In some locations, sprinkler irrigation is used for [~~frost or freeze protection, or~~] crop cooling <u>or other benefits (*e.g.*, watercress)</u>. In these special cases, applications should be limited to the amount necessary for crop protection, and applied water should [~~remain on site~~] <u>not contribute to erosion or pollution</u>.

<u>II.F.1. Description</u>

The goal of this management measure is to reduce nonpoint source pollution of surface waters caused by irrigation. For the purposes of this management measure, "harmful amounts" are those amounts that pose a significant risk to aquatic plant or animal life, ecosystem health, human health, or agricultural or industrial uses of the water. A problem associated with irrigation is the movement of pollutants from the land into ground or surface water.

Return flows, pipe or hose leaks, runoff, and leachate from irrigated lands may transport the following types of pollutants: sediment and particulate organic solids; particulate-bound nutrients, chemicals, and metals, such as phosphorus, organic nitrogen, a portion of applied pesticides, and a portion of the metals applied with some organic wastes; soluble nutrients, such as nitrogen, soluble phosphorus, a portion of the applied pesticides, soluble metals, salts, and many other major and minor nutrients; and bacteria, viruses, and other microorganisms.

Since irrigation is a consumptive use of water, any pollutants in the source waters that are not consumed by the crop (*e.g.*, salts, pesticides, nutrients) can be concentrated in the soil, concentrated in the leachate or seepage, or concentrated in the runoff or return flow from the system. Salts that concentrate in the soil profile must be removed for sustained crop production.

Application of this management measure will reduce the waste of irrigation water, improve the water use efficiency, and reduce the total pollutant discharge from an irrigation system. It is not the intent of this management measure to require the replacement of major components of an irrigation system. Instead, the expectation is that components to manage the timing and amount of water applied will be provided where needed, and that special precautions (*i.e.*, backflow

preventers, prevent tailwater, and control deep percolation) will be taken when chemigation is used.

This management measure makes minor amendments to the (g) measure contained in EPA's Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters.

Justification for Changes to Management Measure: *These changes were made for the following reasons.*

- *(i) Application Rate: With few exceptions that application rate of irrigation water should not exceed the infiltration rate of the soil. Therefore, (1)(c) was added to the first part of this management measure.*

- *(ii) Irrigation Districts: Because Hawaii does not have irrigation districts, the reference to irrigation districts was deleted in (3) of the second part of the management measure.*

- *(iii) Frost or Freeze Protection: The reference to frost and freeze protection was deleted in (6) of the second part of the management measure because it is not applicable to Hawaii. Sprinkler irrigation does provide other benefits in Hawaii (such as insect control in watercress) so an additional phrase was added.*

- *(iv) Applied Water Remaining on Site: Item (6) of the second part of the management measure refers to applied irrigation water remaining on site. This was changed to indicate that applied water should not contribute to erosion or pollution. This change was made because crops such as watercress require continually flowing water through the production area. Also, in taro production, flowing water helps to control plant diseases by keeping water temperatures low.*

II.F.2. Applicability

This management measure applies to activities on irrigated lands, including agricultural crop and pasture land (except for isolated fields of less than 10 acres in size that are not contiguous to other irrigated lands); orchard land; specialty cropland; and nursery cropland. Those land users already practicing effective irrigation management in conformity with the irrigation water management measure may not need to purchase additional devices to measure soil-water depletion or the volume of irrigation water applied, and may not need to expend additional labor resources to manage the irrigation system.

II.F.3. Management Practices

a. Irrigation water management (449): Determining and controlling the rate, amount, and timing of irrigation water in a planned and efficient manner.
b. Water-measuring device: An irrigation water meter, flume, weir, or other water-measuring device installed in a pipeline or ditch.

c. 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.
d. Irrigation system, drip or trickle (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. The applicators can be placed on or below the surface of the ground.
e. Irrigation system, sprinkler (442): 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.
f. 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.
g. 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.
h. Irrigation land leveling (464): Reshaping the surface of land to be irrigated to planned grades.
i. Irrigation water conveyance, ditch and canal lining (428)
j. Irrigation water conveyance, pipeline (430)
k. Structure for water control (587)
l. Irrigation system, tailwater recovery (447): A facility to collect, store, and transport irrigation tailwater for reuse in the farm irrigation distribution system.
m. Filter strip (393): A strip or area of vegetation for removing sediment, organic matter, and other pollutants from runoff and waste water.
n. Surface drainage field ditch (607): A graded ditch for collecting excess water in a field.
o. Subsurface drain (606): A conduit, such as corrugated plastic tile, or pipe, installed beneath the ground surface to collect and/or convey drainage water.
p. 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.
q. Controlled drainage (335): Control of surface and subsurface water through use of drainage facilities and water control structures.
r. Backflow devices: The American Society of Agricultural Engineers recommends, in standard EP409, safety devices to prevent backflow when injecting liquid chemicals into irrigation systems (ASAE 1989).

II.F.4. Implementation of Management Measure

The irrigation management measure will be implemented as a part of a single non-regulatory Agricultural PPP Program that encompasses all agricultural management measures. A description of the existing organizational structure and regulatory and non-regulatory mechanisms follows. See Section III "Recommended Implementation of Agriculture Management Measures" on page

III-46 for a detailed description of the proposed PPP Program, its implementation measures and schedule, identified needs, and recommended actions.

(i) Existing Organizational Structure: DOH, Environmental Management Division, is the lead agency for implementing this management measure because it implements programs for water pollution control, safe drinking water and wastewater management. Other federal and State agencies involved in implementation include:

- SWCDs, which provide technical assistance on BMPs on agricultural lands;
- USDA-NRCS, which provides information and technical assistance on management practices;
- USDA-FSA, which provides cost-share funds for implementing management practices; and
- University of Hawaii, CES, which provides information and technical assistance on management practices.

(ii) Existing Regulatory and Non-Regulatory Mechanisms:

HRS	Chapter 180	Soil and Water Conservation Districts
HRS	Chapter 340E	Safe Drinking Water
HRS	Chapter 342D	Water Pollution Control
HRS	Chapter 342E	Nonpoint Source Pollution
HAR	Chapter 11-21	Cross-Connection and Back-Flow Control
HAR	Chapter 11-54	Water Quality Standards

The non-regulatory programs listed on page III-15 also encourage the implementation of appropriate management practices through education, technical assistance, cost-share assistance, demonstration programs, and coordinated watershed planning.

Chapter 11-21, HAR, administered by DOH, requires that a reduced pressure principal back-flow preventer or air gap separation be installed as part of any piping network in which fertilizers, pesticides and other chemicals or toxic contaminants are injected or siphoned into the irrigation system (§11-21-7(a)(4), HAR). Chapter 11-21, HAR, also requires that all back-flow prevention devices be approved by the University of Southern California Foundation for Cross-Connection Control and Hydraulic Research and are tested, periodically inspected, and properly maintained.

Nonpoint source pollution is generally addressed under the State's water pollution control statutes. See page III-28 for a brief discussion on Chapter 342D and 342E, HRS.

III. RECOMMENDED IMPLEMENTING ACTIONS

III.1. Proposed PPP Program Implementation

A. General Organizational Structure: A non-regulatory agricultural Pollution Prevention Plan (PPP) Program is being proposed for the implementation of the agriculture management measures (See Figure III-1). This new program would provide incentives to land users to develop (with assistance from NRCS, SWCDs, and CES) and implement pollution prevention plans covering erosion control, nutrient and pesticide management, runoff from confined animal facilities, grazing management and irrigation management, as applicable. These plans would specify the BMPs to be used to prevent or reduce nonpoint source pollution on the lands covered by each plan.

The agriculture focus group recommended addressing all agriculture management measures under one PPP Program, rather than developing individual mechanisms for erosion and sediment control, management of confined animal facilities, nutrient management, pesticide management, grazing management, and irrigation management. This holistic approach will be less cumbersome to both new and existing agricultural operations. It will facilitate coordination among existing programs and sharing of resources. In addition, it will maximize the technical assistance and monitoring and enforcement efforts provided by various agencies. A non-regulatory program emphasizing technical assistance to land users will build upon existing management structures and will likely lead to a greater level of cooperation and compliance.

Individual pollution prevention plans would be developed by operators with assistance from NRCS, SWCDs, CES and other persons with technical expertise. Model plans for various crop categories would be developed to assist land users and plan preparers. These PPPs would specify BMPs to be used to prevent or reduce nonpoint source pollution on the lands covered by each plan. Participating agricultural operations would only be required to have plan components for each management measure that applies to their operations (*e.g.*, operations without confined animal facilities would be exempted from requirements for that management measure).

PPPs would be submitted to the local SWCD for review and approval, limiting responsibilities and paperwork to a single local entity that already has substantial acceptance within each local agricultural community. This process would be similar to the existing process whereby land users develop agricultural soil conservation plans for approval by the local SWCDs in order to get exemptions from having to apply for grading permits every time they plow their fields. The PPP Program simply extends the planning process to include additional planning components for confined animal facilities, nutrient and pesticide applications, grazing management, and irrigation operations. It also provides additional incentives to participate in the program. The PPP Program will also strengthen the State's enforcement mechanisms with the development of a Bad Actor Law, described below.

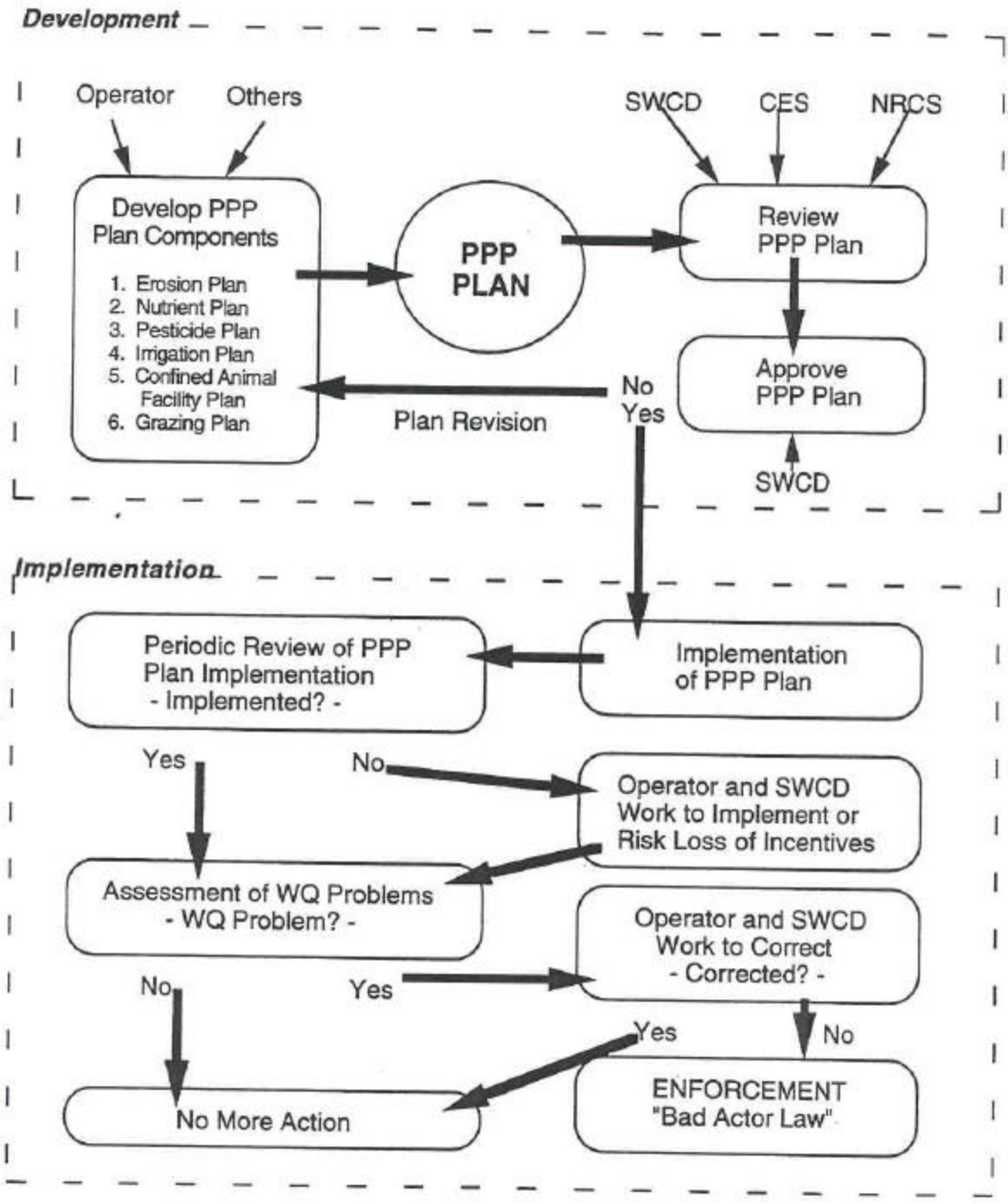
Review of plans would be undertaken through cooperative arrangements by a team consisting of SWCD directors, and staff from NRCS, CES, and DOH. Final approval of reviewed plans would be given by the SWCD to ensure that the plan meets conditions and criteria specific to the location. This local knowledge is particularly important for agricultural operations in Hawaii because of the extreme gradients in rainfall, the diversity of microclimates, and the variability of watershed conditions found across each island and the State as a whole.

Since each PPP would be developed for a fairly specific cropping pattern or type of animal operation, any new or revised agricultural operation would require the operator to prepare a new plan. Although the definition of what constitutes a "new or revised agricultural operation" should be defined by the coordinating agency, a new PPP would be required if the change required different amounts or types of chemical or nutrient inputs (*e.g.*, a change from vegetable crops to orchard; or from ornamental flowers to a fruit crop). In the absence of any changes such as these, operators would be required to revise and/or update existing plans every three to five years. This schedule would allow current information and improved BMPs to be incorporated into PPPs in a timely manner.

If an agricultural operator has an approved NRCS conservation plan with all the appropriate components in place addressing the agricultural management measures, then this plan would be acceptable as a Pollution Prevention Plan under the PPP Program.

As a non-regulatory program, the PPP Program will rely heavily on education, training, and technical assistance to ensure that land users understand its overall requirements. In this way, the land users will develop PPPs that comply with the requirements and intent of each agriculture management measure, and select management practices that adequately control nonpoint source pollution. It is recommended that the State offer training courses to land users and others who wish to prepare agriculture pollution prevention plans. These training sessions would offer the collective agricultural polluted runoff control expertise of federal and state agencies, and knowledgeable professionals in a single focused program. The coordinating agency would assemble knowledgeable personnel from agencies such as DOA, DOH, NRCS, CES, University of Hawaii, and the SWCDs.

Figure III-1: Agricultural PPP Plans - Operators Flowchart



Prepared by PER (1995)

B. Monitoring and Enforcement: The most realistic and cost-effective means to protect coastal water quality from nonpoint source pollution from agricultural activities is likely to be "compliance through tracking" rather than "enforcement through monitoring." This implementation methodology is complementary to the BMP concept itself, which is based on the principle that the best available technologies or management practices (defined as BMPs) are already known to be effective. Thus, if BMPs are adequately implemented or installed, water quality will improve. Thus, *tracking* the implementation of the BMPs as specified in approved PPPs will ultimately protect coastal water quality. The SWCD will monitor or track compliance by undertaking spot checks and periodic reviews of approved plans, and assessing reported problems.

If, despite installation of BMPs as specified in the operator's pollution prevention plan, there is still a polluted runoff problem, then the operator has an opportunity to work with the SWCD, along with NRCS and CES assistance, to correct the problem. A Bad Actor Law, implemented by DOH, would take effect against polluters who have not cooperated with the PPP Program and made a good faith effort to improve their operations.

Water quality monitoring would be used as a method to track the effectiveness of the overall PPP Program rather than as a method of enforcement. Thus, monitoring would be used as a tool to evaluate the effectiveness of the agricultural PPP Program. Monitoring results would then be used to revise BMPs and the intensity of their implementation, and to further enhance the PPP Program, as needed. Monitoring, however, would continue to be used in enforcement actions against those few operators who are in violation of the intent of the management measures and persistently resist requests to modify their management practices appropriately to protect coastal water quality.

In compliance with federal requirements, the State will evaluate the effectiveness of the non-regulatory PPP Program in implementing the agriculture management measures. If the voluntary program is not successfully implementing the management measures, then regulatory measures will be considered at that time.

C. Incentives for Participation in the PPP Program: A number of incentives have been proposed to encourage land users to participate in this non-regulatory PPP Program. The possible consequences of these proposals need to be explored more thoroughly and the process for their establishment outlined during the development of the coastal nonpoint pollution control program implementation plan.

Continued "Dedicated Agriculture" Status - Only agricultural operations that have an approved pollution prevention plan would continue to be eligible to have those lands in "dedicated agriculture" status and be able to receive substantial property tax benefits.

Ability to Lease State Lands - In order to be eligible to lease State lands for crop cultivation, confined animal facilities or grazing, operators would have to

factor the cost of developing a pollution prevention plan and of implementing best management practices into their bids. PPPs would be implemented and BMPs installed according to a schedule determined by the State upon approval of the bid. Failure to implement the PPP as specified would result in the termination of the lease agreement. This proposal would apply only to new leases awarded after the effective date of this program.

Continued FSA Participation - Agricultural operators who are actively applying their approved PPP would continue to be eligible to receive federal assistance for conservation and water quality practices, assistance from the commodity programs, federal crop insurance, and operational and land loans from federal agencies.

Avoid Financial Liability - Agricultural operators that have been and continue to be in compliance with an approved plan would be assumed to be in compliance with the intent of the management measures and would, therefore, be exempted from financial liability and other enforcement actions related to compliance with these management measures. However, to continue to be exempt, operators would be required to cooperate with the SWCD in revising their PPP, as needed, to meet the intent of the management measures.

D. Failure to Participate in the Non-Regulatory PPP Program: The success of this non-regulatory program depends on the voluntary cooperation of agricultural land users. If a voluntary program is not successful in encouraging the implementation of the agriculture management measures, then a regulatory program will likely be developed. Individual operators who do not participate may jeopardize the PPP Program's effectiveness and, thus, the very existence of the program for all operators. In addition, operators who choose not to participate in the non-regulatory pollution prevention plan program will endure greater scrutiny and immediate action from DOH if found contributing to water pollution.

Schedule for General Implementation:

July 1996	Initiate implementation of measures identified under III.2.
June 1997	Establish process for determining acceptable level of treatment for erosion and sediment control on agricultural lands, based not only on nonpoint source pollution control but also on economic and geographic criteria.
June 1997	Determine percentage of settleable solids that must be removed in order to address erosion and sediment control management measure.
July 1998	Land users begin submitting pollution prevention plans for review and approval.
July 1998	Begin compliance tracking and water quality monitoring.
December 2001	Evaluate effectiveness of non-regulatory program in terms of compliance and water quality protection.
2004	Complete program implementation of management measures.

III.2. Implementing Actions

The PPP Program would be designed to phase-in all components to allow for long-term agency planning and ensure the easiest possible transition for both operators and agencies. The implementation schedule should include provisions to phase in the costs of the program, interagency coordination and cooperative responsibilities, and operator responsibilities. Timing of implementation will depend, in part, on fiscal and personnel resources made available. The following recommendations will be explored in more detail in the coastal nonpoint pollution control program implementation plan.

A. Establish Organizational Structure and Adequate Program Funding

- Draft and implement statutory and regulatory amendments, as needed, to implement this organizational structure and provide program funding. Establish incentive mechanisms to encourage participation in the non-regulatory Pollution Prevention Plan Program and enact a Bad Actor Law as a regulatory backup. These amendments must be submitted for consideration by the legislature and relevant agencies.

- Appropriate sufficient funding to the SWCDs to support at least one full-time technical staff and part-time clerical support *per district*. The major burden of implementing the PPP Program will fall on the 16 regional SWCDs. Current DLNR funding for all 16 SWCDs, totaling roughly $60,000 for operating expenses, is wholly inadequate to account for the increased responsibilities to review, approve and oversee the PPP plans within each district. In addition, it is unrealistic to expect the volunteer SWCD directors to undertake the administration of this new PPP Program on a voluntary basis. Although the proposed increase in funding for the SWCDs is substantial relative to current funding, the expected results in polluted runoff control represent an extremely efficient use of resources to implement such a statewide program.

- Draft formal Memoranda of Understanding (MOUs) between agencies having technical and management expertise with respect to agricultural practices and polluted runoff control to ensure their commitment to implementing this program. A number of State, federal and county agencies will provide administrative and/or technical support for the implementation of the PPP Program, including DOH, NRCS, DLNR, DOA, SWCDs, CZM Program and CES. These agreements should specify the levels of financial, personnel and technical commitment to develop and implement the PPP Program.

  Schedule for Implementation:

December 1996	Draft MOU between participating agencies.
December 1997	Develop needed statutory or regulatory amendments and submit for consideration to legislature and agencies.
phase in	Increase funding for DLNR's SWCDs.

B. Develop Education and Training Materials

The non-regulatory PPP Program will rely heavily on education, training and technical assistance materials. Although many of these resource materials

already exist within various agencies and programs, they should be compiled and expanded to meet the needs of the PPP Program.

- Develop an operator handbook of PPP Program requirements, benefits, specification for plans and plan components for each management measure, and incentives.

- Create model PPP plans for various crop categories that can be used by operators or plan preparers as the framework for drafting individual plans.

- Develop a BMP manual for agricultural practices appropriate to Hawaii. This manual should be easy-to-read, flexible, and expandable, so that it can be revised as needed and as new information and more effective practices are developed.

- Develop easy-to-read educational materials in the major languages of Hawaii for wide distribution by extension agents, agricultural supplies stores, and others.

- Produce training materials for conducting trainings of operators and plan preparers, including local case studies, and island-specific soil and crop information. The trainers could also help develop appropriate training methodologies such as types of presentation materials, sites for trainings, field trips to demonstration farms, and could suggest procedures for evaluating the effectiveness of BMPs. This cooperative process would use the collective expertise of different entities to develop the best Hawaii-specific materials and methodologies to train operators in pollution prevention practices.

  Schedule for Implementation:

June 1997	Develop operator handbook.
June 1997	Develop model PPP plans for various crop categories.
June 1997	Develop BMP manual for agricultural practices.
June 1998	Develop training materials for conducting trainings of operators and plan preparers.
July 1998	Begin training operators and plan preparers.

C. Revise State Land Lease Requirements

To effectively carry out the agriculture management measures and help resolve some of the problems inherent to the high proportion of leased land in Hawaii, several revisions to the State's land lease requirements are recommended. These proposals would apply to new leases awarded after changes to implementing regulations.

- Include a requirement for development and implementation of Pollution Prevention Plans for all land leases for crop cultivation and grazing. All leases should have provisions for reasonable inspections of leased parcels to track compliance with PPP Program requirements. Failure to implement a PPP should result in termination of the associated lease.

- Classify State lands leased for grazing according to their carrying capacity and adjust lease rates for each parcel to reflect its stated carrying capacity. Lease requirements should stipulate the maximum number of animal units to be grazed on the parcel and make it clear that exceeding this limit would result in a substantial fine. A gross violation of the specified carrying capacity would result in the cancellation of the lease at the end of the current year.

- Establish natural resource criteria to be used to determine planning and treatment levels that meet acceptable parameters and/or conditions. The criteria should be stated in either qualitative or quantitative terms.

- Lengthen duration of leases to ensure that operators will realize the long-term economic benefits of installing costly improvements such as retention/detention basins, terraces, and replanting/construction of riparian buffer strips. If operators are confident they will recover the costs and receive the benefits of implementing Pollution Prevention Plans, they are more likely to act as good stewards of the leased land.

  Schedule for Implementation:
  December 1997 Develop needed statutory or regulatory changes and submit for consideration.

D. Develop Hawaii-Specific Soils Information

More Hawaii-specific soils research should be done to enhance publicly-available information and further develop Hawaii-specific BMPs for agriculture. Existing resources include the HENRIS geographic information system (GIS) and related data developed at the University of Hawaii, the Hawaii Pesticide Information and Retrieval System (HPIRS) pesticide database, and NRCS soils maps and attribute information. HPIRS, developed and maintained by the University of Hawaii Department of Environmental Biochemistry, is an index to the agricultural-use pesticide product labels licensed for sale in the State by DOA.

- Develop a database containing cross-referenced information for decision-making on suitable practices and products for a particular site. The database should include soil family chemical and physical properties, hydrologic and reactive properties, pesticide leachability characteristics, and site-specific physical geographic information such as rainfall and slope. The database should be made available both as a paper document and a searchable computerized database. A paper document would be most accessible and should contain information relating soils types and pesticides with their associated properties, characteristics, and risks, as well as maps delineating probable risks of erosion, and pesticide leaching and transport. Database materials linked with a GIS interface designed for the task would allow operators, SWCDs, CES personnel, and others to perform sophisticated planning and "what-if" scenarios using specific products and management activities and site-specific soil characteristics.

  Schedule for Implementation:
  June 1998 Develop soils database.

E. Establish Inverted Water Rate Structure

- Emphasize an inverted water rate structure on a per acre basis when setting water rates. Because water is the transport vehicle for pollutants, efficient irrigation should be of prime concern to ensure that runoff and leach water is kept to a minimum. If water is used efficiently, pollutants such as sediment, nutrients, and pesticides are kept on site and provide their intended benefits. Care should be taken not to penalize large agriculture operations that, by virtue of their large land holdings, would use large total amounts of water. Therefore, it is important that any inverted rate structure be on a "per acre" basis.

F. Integrate the PPP Planning Process into Watershed Planning

- Encourage agricultural operators to participate in a watershed planning process. The Pollution Prevention Plan Program should be viewed as one component in a broader watershed planning process. The wider perspective will benefit both agricultural operator and other land users in the watershed. A collaborative approach to solving polluted runoff problems will enable lessons learned in one land use sector to be shared with other land users. A watershed approach also facilitates targeting efforts to control major sources of polluted runoff in a cooperative manner. Finally, if community members are educated about the nonpoint source pollution control efforts made by agricultural operators, they may be less likely to blame agriculture for all polluted runoff problems in a watershed.

G. Change the Voting System for the Soil and Water Conservation Districts

- Change the voting structure of the SWCDs so that it is more equitable to the smaller farmers. Current assessments indicate that while 90% of the State's agricultural lands are covered by SWCD conservation plans, only 60% of agricultural operators are participating in their local SWCDs. Some of the smaller farmers may not be participating in their local district because the voting system is based on acreage (*i.e.*, one acre - one vote). In effect, one or two large land owners can control virtually all of the activities of the SWCD. Although a "one operator- one vote" structure may not be tenable, some kind of change may help bring these smaller operators into the SWCD system.