CHAPTER 3: Forestry

I. INTRODUCTION

Forestry, or silviculture, is defined in the Forestry Handbook, Second Edition, as:

> *...the science and art of cultivating forestry crops..., the theory and practice of controlling the establishment, composition ... and growth of forests." Silviculture as applied to forest ecology - a means of protecting and enhancing range, wildlife, water, and soil resources, as well as timber crops. It is the manipulation of forest vegetation for human purposes. Silvicultural treatments are increasingly designed to meet several forest uses simultaneously. Silvicultural knowledge and techniques are applied to forest land through prescriptions. The prescription is a record of the examination, diagnosis, and treatment regimes recommended for forest lands.*

I.1. Forestry in Hawaii

At this time, commercial forestry operations in Hawaii are limited in scope and area. The acres of fallowed land left by the downsizing of Hawaii's sugar industry, however, have created the potential for a growing commercial forestry industry. Many of the same attributes that made plantation sugar a viable industry are also conducive to commercial forestry.

Most of the forestry operations envisioned for Hawaii are plantation-style forestry rather than logging of undisturbed, native forests. There are four broad commercial forest management scenarios being considered by the Department of Land and Natural Resources' (DLNR) Division of Forestry and Wildlife (DOFAW): (1) short-rotation (6-12 years) sustainable forest plantations of large-yielding wood fiber; (2) long-rotation (25-50 years) sustainable forest plantations of high quality wood; (3) afforestation of *mauka* pasture lands and enhancement of degraded native forests; and (4) agroforestry[1]. A strategic mix of a short rotation crop to recoup initial investments and help carry a longer rotation crop of higher value hardwoods will probably be needed on former sugar lands to attract needed outside investment.

Because forestry is a promising replacement for agriculture, there is a potential for improved water quality and lessened nonpoint source pollution owing to that land use change. Where conversion from agriculture to forestry has been studied, water quality has improved when compared to the previous agricultural practices. Related research in Hawaii has compared soil properties of natural forest areas and areas under pineapple and sugarcane cultivation (Wood 1977). This research indicated that forest-covered soils accepted and stored appreciably more water than the same soils planted in sugarcane or pineapple. Wood (1977) concluded that the likelihood of surface water runoff will be less on a given soil

[1]Agroforestry is defined, in the case of Hawaii, as grazing cattle under either long-rotation trees or afforested *mauka* pasture lands.

under forest cover than on land cultivated in sugarcane, pineapple, or pasture, and that erosion rates would also be less for soils under forest cover.

In addition, because of the difference in the amount and intensity of mechanized harvesting, the conversion of land from sugarcane cultivation to forestry may yield significant water quality improvements. Mechanized, clear-cut harvesting of sugarcane requires travel over 100% of the planted area every 2-3 years. Mechanized, clear-cut harvesting of trees, on the other hand, requires travel over 10-20% of the land area every 6-8 years for fiber production and every 20-50 years for high quality logs.

There are currently no commercial forestry operations on State lands. However, the State is in the process of negotiating a lease to a commercial forestry operation on several thousand acres of former sugar land. In addition, special projects have taken place on State lands, such as chipping wood and salvaging trees along roadsides being cleared as firebreaks, and cutting koa killed by Hurricane Iniki and stimulating regeneration of koa in stands now dominated by non-native weeds.

Private operations are almost exclusively salvage operations, and the vast majority of this is harvesting of dead and senescent *Acacia koa*, a high-value native specialty hardwood. Because these operations are small and scattered, the acreage directly affected by planting and harvesting operations each year is not known. Estimates range between 200 to 500 acres annually [DLNR-DOFAW and the Hawaii Forest Industry Association (HFIA)].

Because of the type of forestry undertaken in Hawaii, acreage may not be the best indicator of the extent of forestry operations. Instead, a better indicator may be total harvested volumes. HFIA estimates annual production for the past decade to be:

Time period	**Annual Production (million board feet)**
Mid 1980's	1.20 - 1.50
About 1990	0.75
Presently	0.50 - 0.60

There are approximately 52,000 acres of planted forests on commercial forest land in Hawaii. The islands of Hawaii and Maui have 62% of the planted forests. Approximately 39,000 acres of these plantations are commercial forest types. The remaining 13,000 are non-commercial forest types. Approximately 60% of the area of planted commercial forests is made up of eucalypts. About 26% of the planted commercial forests are other hardwood species, including Australian toon, nepal alder, and albizzia. Conifer species make up the remaining 14% of planted commercial forests.

The major private owner engaged in forestry is Kamehameha Schools Bishop Estate. According to their forester, 10,500 acres in Honaunau in South Kona have been selectively logged for a period of years. There has also been a forest project in

existence at Keauhou Ranch near Volcano since 1977. (Peter Simmons, Forester, Kamehameha Schools Bishop Estate, pers.comm., Oct. 1993)

Forestry in Hawaii has been viewed primarily as a diversified agricultural industry. The Hawaii Constitution, the State land use law [Chapter 205, Hawaii Revised Statutes (HRS)], and the State conservation district regulations all consider forestry an agricultural activity. While forestry operations in the State conservation district, like many other activities, require a Conservation District Use permit, most private operations take place in the State agricultural district. Tree planting and harvesting, in this case, are treated like other agricultural activities and could be exempted from the county grading ordinances, provided land users have conservation plans approved by the local Soil and Water Conservation Districts (SWCDs).

I.2. Types of Polluted Runoff Associated with Forestry

Without adequate controls, forestry operations may degrade several water quality characteristics in waterbodies receiving drainage from forest lands. Sediment concentrations can increase due to accelerated erosion; water temperatures can increase due to removal of overstory riparian shade; slash and other organic debris can accumulate in waterbodies, depleting dissolved oxygen; and organic and inorganic chemical concentrations can increase due to harvesting, and fertilizer and pesticide applications. These potential increases in water quality contaminants are usually proportional to the severity of site disturbance. Silvicultural impacts on water quality depend on site characteristics, climatic conditions, and the management practices employed.

Sediment: Sediment is often the primary pollutant associated with forestry activities. Sediments consist of fine soil products 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 nutrients and other chemical substances, such as pesticides, bound to the eroded soils.

Nutrients: Nitrogen and phosphorus are the two major nutrients from forest lands that may degrade water quality. Sudden removal of large quantities of vegetation through harvesting can increase leaching of nutrients from the soil system into surface and ground waters by disrupting the nitrogen cycle. Excessive amounts of nutrients may cause enrichment of waterbodies, stimulating algal blooms.

Forest Chemicals: Herbicides, insecticides, and fungicides used to control forest pests and undesirable plant species can be toxic to aquatic organisms. Pesticides that are applied to foliage or soils, or are applied by aerial means, are most readily transported to surface and ground waters. Other chemicals that may be released during forestry operations include fuel, oil, and coolants used in equipment for harvesting and road-building operations.

Organic Debris: Organic debris includes residual logs, slash, litter, and soil organic matter generated by forestry activities. Organic debris can result in decreased dissolved oxygen levels in watercourses, and logs and slash can form dams and alter streamflows.

Temperature: Increased temperatures in streams and waterbodies can result from vegetation removal in the riparian zone by either harvesting or herbicide use. These temperature increases can adversely affect aquatic species and habitats and decrease the dissolved oxygen holding capacity of a waterbody.

Stream Flow: Increased stream flow caused by vegetation removal can scour channels, erode streambanks, increase sedimentation, and increase peak flows.

I.3. Existing Programs Addressing Forestry

A. DLNR: Chapter 186, HRS, authorizes the Board of Land and Natural Resources to classify private lands as tree farms, if they are suited for the sustained production of forest products in quantities sufficient to establish a business. DNLR-DOFAW administers this Tree Farm Program. The "Right to Harvest" condition under the Tree Farm Program assures landowners that they can harvest commercially grown timber in a manner consistent with conservation concerns. Eligible lands must be within the State Agricultural District, or on degraded forest and pasture lands within the permitted State Conservation District subzone designated for forest use. The "Right to Harvest" covers new trees grown according to a management plan that has been approved by DLNR.

In addition, once land users have completed an approved tree farm management plan with DLNR, they will be able to petition the county to qualify for a property tax assessment established for tree farms. DLNR is currently working with the County of Hawaii to establish this tax incentive.

DLNR-DOFAW also administers several federal- and State-funded assistance programs for private land users who have an interest in managing their forest lands and native ecosystems. The Forest Stewardship Program is one such program. This program, established under Chapter 195F, HRS, enables DLNR-DOFAW to provide cost-share funding of up to 50% for implementation of approved forest stewardship management practices and activities. To qualify, landowners must be a private individual, group, or association; or a private corporation whose business is not exclusively the production of forest products. Landowners prepare stewardship management plans for approval by DLNR. The Forest Stewardship Program receives dedicated State funding through a portion of the conveyance tax, as well as U.S. Forest Service funding.

B. U.S. Forest Service: The Institute of Pacific Islands Forestry, U.S. Department of Agriculture's (USDA) Forest Service (USFS), provides research and extension services to its constituents in Hawaii and several island groups in the Western Pacific. Locally, USFS research is conducted on State land in collaboration with DLNR-DOFAW. USFS does not own land or have land management responsibilities in Hawaii.

The Institute's Forest Management Services unit provides a broad range of extension services that include technology transfer to reduce nonpoint source pollution. Staff are available for consultation, advice, and participation on committees such as the forestry focus group. The unit provides technical advice on forest management practices and offers grants through DLNR-DOFAW for reforestation on State and private lands. The unit can also help secure mainland USFS technical assistance in farm and forest road engineering to reduce erosion.

C. DLNR, SWCDs: There are 16 local SWCDs in Hawaii. Their roles are to take available technical, financial and educational resources and focus them to meet the conservation needs of the local land users. For more information, please refer to the description of the SWCDs on page III-8 under Chapter 1: Agriculture.

D. University of Hawaii Cooperative Extension Service (CES): The CES is the organized extension unit of the College of Tropical Agriculture and Human Resources at the University of Hawaii. For more information on the role of CES, please refer to the description on page III-8 under Chapter 1: Agriculture.

E. USDA, 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. For more information on NRCS's services, please refer to the description on page III-8 under Chapter 1: Agriculture.

II. MANAGEMENT MEASURES

Due to the small base of operations, forestry in Hawaii is not a significant contributor to polluted runoff at this time. However, the management measures for forestry are still relevant to Hawaii because there is potential for significant growth in the forest products industry in the near future.

Since commercial forestry is not being undertaken on a large scale in Hawaii at this time, there are few mechanisms currently in place that specifically address forestry activities and their impacts on water quality. In anticipation of forestry becoming a more viable industry in the State, such mechanisms will likely be further developed in the near-future. Other mechanisms do exist that will affect forestry operations in certain areas.

A. Preharvest Planning Management Measure

Perform advance planning for forest harvesting that includes the following elements, where appropriate:

(1) Identify the area to be harvested including location of waterbodies and sensitive areas such as wetlands, threatened

or endangered aquatic species habitats, or high erosion-hazard areas (landslide-prone areas) within the harvest unit.

(2) Time the activity for the season or moisture conditions when the least impact occurs.

(3) Consider potential water quality impacts and erosion and sedimentation control in the selection of silvicultural and regeneration systems, especially for harvesting and site preparation.

(4) Reduce the risk of occurrence of landslides and severe erosion by identifying high erosion-hazard areas and avoiding harvesting in such areas, to the extent practicable.

(5) Consider additional contributions from harvesting or roads to any known existing water quality impairments or problems in watersheds of concern.

Perform advance planning for forest road systems that includes the following elements, where appropriate:

(1) Locate and design road systems to minimize, to the extent practicable, potential sediment generation and delivery to surface waters. Key components are:
- **locate roads, landings, and skid trails to avoid, to the extent practicable, steep grades and steep hillslope areas, and to decrease the number of stream crossings;**
- **avoid, to the extent practicable, locating new roads and landings in Streamside Management Zones (SMZs); and**
- **determine road usage and select the appropriate road standard.**

(2) Locate and design temporary and permanent stream crossings to prevent failure and control impacts from the road system. Key components are:
- **size and site crossing structures to prevent failure;**
- **for fish-bearing streams, design crossings to facilitate fish passage.**

(3) Ensure that the design of road prism and the road surface drainage are appropriate to the terrain and that road surface design is consistent with the road drainage structures.

(4) Use suitable materials to surface roads planned for all-weather use to support truck traffic.

(5) Design road systems to avoid high erosion or landslide hazard areas. Identify these areas and consult a qualified specialist for design of any roads that must be constructed through these areas.

Each State should develop a process (or utilize an existing process) that ensures that the management measures in this chapter are implemented. Such a process should include appropriate notification, compliance audits, or other mechanisms for forestry activities with the potential for significant adverse nonpoint source effects based on the type and size of operation and the presence of stream crossings or SMZs.

II.A.1. Description

The objective of this management measure is to ensure that silvicultural activities, including timber harvesting, site preparation, and associated road construction, are conducted without significant nonpoint source pollutant delivery to streams and coastal areas. Road system planning is an essential part of this management measure, since roads have consistently been shown to be the largest cause of sedimentation resulting from forestry activities. Good road location and design can greatly reduce the sources and transport of sediment. Road systems should generally be designed to minimize the number of road miles/acres, the size and number of landings, the number of skid trail miles, and the number of watercourse crossings, especially in sensitive watersheds. Timing operations to take advantage of favorable seasons or conditions, avoiding wet seasons prone to severe erosion or spawning periods for fish, is effective in reducing impacts to water quality and aquatic organisms.

Preharvest planning is the collection of information about the area to be harvested and the synthesis of that information into an effective preharvest plan. This plan will consider the silvicultural prescription for the species and site, the best estimate of the time and method of harvest, and any post-harvest site preparation and reforestation activities.

An effective preharvest plan will take into consideration all aspects of a timber harvest that may lead to water quality degradation and plan for the implementation of best management practices (BMPs) which will minimize or void the adverse effects of the operation. The objective of preharvest planning is to determine which BMPs are necessary to protect water quality and how those BMPs will be implemented.

II.A.2. Applicability

This management measure pertains to lands where silvicultural or forestry operations are planned or conducted. The planning process components of this management measure apply to commercial harvesting on areas greater than 5 acres and any associated road system construction or reconstruction conducted as

part of normal silvicultural activities. The component for ensuring implementation of this management measure applies to harvesting and road construction activities that are determined to be of a sufficient size to potentially impact the receiving water or that involve SMZs or stream crossings. This measure does not apply to harvesting conducted for precommercial thinning or noncommercial firewood cutting.

II.A.3. Management Practices

The following BMPs are described in more detail in the DLNR-DOFAW draft BMP Manual (February 1995).

a. Develop a written pre-harvest plan that includes the following information about the physical and administrative details of the site, and management activities to be used:
   - property and administrative boundaries;
   - topography;
   - location of streams and drainages;
   - location of SMZs and buffer strips;
   - location of all roads, skid trails, and landings prior to harvest;
   - forest types;
   - soil types;
   - environmental concerns (botanical, archaeological, biological, visual quality);
   - road and landing design;
   - construction techniques;
   - felling and bucking techniques;
   - yarding systems and layout;
   - planned stream crossings;
   - disposal of waste materials (machine lubricants);
   - post-harvest site preparation; and
   - reforestation activities.

b. Use topographic maps, road maps, aerial photos, forest type maps, and soil surveys in combination with field reconnaissance to determine the site conditions and plan operations. Field reconnaissance with an individual who is knowledgeable about the area being harvested is recommended.

c. Identify, at a minimum, known sites of threatened and endangered aquatic species habitats.

d. Preliminary planning should consider the maintenance of existing drainage patterns and the location of environmentally-sensitive areas such as streams, wetlands, and high erosion-hazard areas.

e. The location and design of roads, skid trails, and landings should be integrated to minimize their impact.

f. The grade of logging roads and skid trails should be less than 10% when possible, with 3-5% being the most desirable. Avoid long, straight grades and occasionally break the grade to provide surface drainage.

g. Preharvest planning should include full consideration of silvicultural prescriptions, site preparation, and reforestation activities.

II.A.4. Implementation of Management Measure

The preharvest planning management measure for forestry will be implemented as part of a voluntary incentive program, administered by DLNR under the Tree Farm Program, that will encompass all forestry management measures. A description of the existing programs, statutes, rules or ordinances that currently address aspects of this management measure follows. See Section III "Recommendations for Implementation" on page III-96 for a description of the changes in governmental policies that must be made before this program can be successfully implemented.

(i) Existing Organizational Structure: DLNR-DOFAW is the lead agency for implementation of this management measure. Other federal, State, and local agencies involved in implementation include:

- DOH, Environmental Management Division, which implements programs for water pollution control;
- USFS, which provides funding for the Forest Stewardship Program and Stewardship Incentives Program through grants to DLNR-DOFAW, and research and extension services; and
- County departments of planning, which administer the Shoreline Management Area (SMA) permit and shoreline setback provisions, if a forestry operation is planned in the SMA.

(ii) Existing Regulatory and Non-Regulatory Mechanisms:

HRS	Chapter 171	Management and Disposition of Public Lands
HRS	Chapter 183	Conservation District
HRS	Chapter 186	Tree Farm Program
HRS	Chapter 195F	Forest Stewardship
HRS	Chapter 342D	Water Pollution
HRS	Chapter 342E	Nonpoint Source Pollution Control
HRS	Chapter 343	Environmental Impact Statements
HAR	Chapter 13-2	Conservation Districts
HAR	Chapter 11-54	Water Quality Standards

Chapter 186, HRS, authorizes the Board of Land and Natural Resources to classify private lands as tree farms, if they are suited for the sustained production of forest products in quantities sufficient to establish a business. DNLR-DOFAW administers this Tree Farm Program. In order to receive tree farm classification, land users must develop management plans that specify BMPs to be installed during all phases of the forestry operation. The requirements of this management plan would appear to address those of a preharvest plan, as specified in this management measure.

The "Right to Harvest" condition under the Tree Farm Program assures landowners that they can harvest commercially grown timber in a manner consistent with conservation concerns. Eligible lands must be within the State Agricultural District, or on degraded forest and pasture lands within the permitted State Conservation District subzone designated for forest use. The

"Right to Harvest" covers new trees grown according to a management plan that has been approved by DLNR.

In addition, only after a forestry operation has completed an approved management plan can the land user petition the county to qualify for the property tax rate for tree farms. The County of Hawaii is interested in promoting forestry activities, and is in the process of establishing a property tax rate for tree farms. Once this lower, more favorable rate is established, it will provide a tremendous incentive for land users to prepare and implement forestry management plans in order to qualify for the tax savings.

At present, a Conservation District Use Application (CDUA) permit under Chapter 183, HRS, and Chapter 13-2, HAR, administered by DLNR, appears to be the only regulatory mechanism that deals directly with preharvest planning in some situations. A CDUA permit would be required before forestry operations were conducted in the State conservation district. Such an application would require some kind of preharvest plan, though CDUA requirements are not currently designed to meet the requirements of this preharvest planning management measure. However, since most potential forestry operations are likely to be started on agricultural lands, a CDUA permit would not be required. In addition, lands under the administration of the State Department of Hawaiian Home Lands (DHHL) may be exempt from the CDUA and other State and county permit requirements.

Under Chapter 171-54, HRS, the Board of Land and Natural Resources may issue land licenses for use of public lands, including harvesting of forest lands. While such licenses have not been issued for some time, they may be issued in the future. Conditions could be placed on these licenses requiring land users to implement BMPs, as specified by DLNR-DOFAW.

Water quality is generally addressed under the State's water pollution control statutes. While Chapter 342E, HRS, addresses nonpoint source pollution 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 capable of enforcing any of these regulatory mechanisms.

B. Streamside Management Zones (SMZs)

Establish and maintain a streamside management zone along surface waters, which is sufficiently wide and which includes a sufficient number of canopy species to buffer against detrimental changes in the temperature regime of the waterbody, to provide bank stability, and to withstand wind damage. Manage the SMZ in

such a way as to protect against soil disturbance in the SMZ and delivery to the stream of sediments and nutrients generated by forestry activities, including harvesting. Manage the SMZ canopy species to provide a sustainable source of large woody debris needed for instream channel structure and aquatic species habitat.

II.B.1. Description

A SMZ is a designated area that consists of the stream itself and an adjacent area of varying width where management activities that might affect water quality, fish, or other aquatic resources are modified to mitigate the adverse effects. The SMZ is not an area of exclusion, but an area of closely managed activity.

The SMZ is also commonly referred to as a streamside management area or riparian management area or zone. SMZs are widely recognized to be highly beneficial to water quality and aquatic habitat. Vegetation in SMZs reduces runoff and traps sediments generated from upslope activities, and reduces nutrients in runoff before they reach surface waters. Canopy species provide shading to surface waters, which moderates water temperature and provides the detritus that serves as an energy source for stream ecosystems. Trees in the SMZ also provide a source of large woody debris to surface waters. SMZs provide important habitat for aquatic organisms (and terrestrial species), while preventing excessive logging-generated slash and debris from reaching waterbodies.

II.B.2. Applicability

This management measure pertains to lands where silvicultural or forestry operations are planned or conducted. It applies to surface waters bordering or within the area of operation. SMZs should be established for perennial waterbodies as well as for intermittent streams that are flowing during the time of operation.

For the purposes of this management measure, the following definitions will be used.

- ***Perennial waterbodies*** include lakes, ponds, springs, wetlands, and perennial streams listed in the Hawaii Stream Assessment.
- A ***stream*** is any natural water course in which water usually flows in a defined bed or channel, whether or not the flow is constant, uniform, or uninterrupted, and regardless of whether the stream has been altered or channelized. In distinguishing between a stream and other water features such as gullies, the most significant feature of a stream is the existence of a streambed that has graded or sorted deposits consisting primarily of sand, gravel, and boulders.
- A ***perennial stream*** carries water all the time.
- An ***intermittent stream*** carries water most of the time but ceases to flow occasionally because evaporation or seepage into its bed and banks exceed the available streamflow. For the purposes of this management measure, intermittent streams will also include:
    - ***ephemeral streams*** that carry water only after rains; and

- ***interrupted streams*** that carry water generally through their length but may have sections with dry streambeds.

Manmade structures that may function as streams and other natural waterbodies, such as livestock ponds, swales, and water distribution systems (i.e., irrigation), are not considered perennial waterbodies or streams, as defined above.

II.B.3. Management Practices

The following BMPs are described in more detail in the DLNR-DOFAW draft BMP Manual (February 1995).

a. The width of SMZs may vary, depending on the following conditions: slope of land adjacent to stream, soil erodibility, precipitation, knowledge of particular area, sensitivity of stream, etc. These factors can be obtained from soil maps, on-the-ground evaluation and measurements, weather data, etc.
b. SMZs should be designed on a case-by-case basis. Most important is that SMZs be consistent with stream characteristics and wide enough to protect water quality.
c. Partial harvesting is acceptable in SMZs. A minimum of 50% of the original crown cover or 50 square feet of basal area per acre, evenly distributed, should be retained in the SMZ. This may be adjusted to meet on-site conditions.
d. Clearcutting is always prohibited within the SMZ.
e. Designate SMZs to provide stream shading, soil stabilization, sediment and water filtering effects, and wildlife habitat. Trees on the south and west banks provide the most critical shading of water.
f. Within the SMZ, the immediate vicinity of the stream shall be more protected, with trees rarely harvested and understory disturbances kept to a minimum. The "immediate vicinity" shall include unstable slopes and areas annually flooded.
g. Access roads should cross perennial or intermittent streams at or near a right angle.
h. Drainage structures such as ditches, cross drain culverts, water bars, rolling dips, and broad-based dips should be used on all roads prior to their entrance into an SMZ to intercept and properly discharge runoff waters.

II.B.4. Implementation of Management Measure

At this time, the State does not have a general, statewide policy on SMZs. However, the CZM Program is currently exploring alternatives for such a policy, in cooperation with DLNR and other State, federal, and county agencies. An ongoing riparian area management study will recommend specific riparian area BMPs that would significantly reduce the potential for polluted runoff into the State's surface waters, and a phased strategy for implementing the recommended BMPs in Hawaii's political, social, and economic context. While EPA's SMZ management measure applies only to lands where forestry operations are planned or conducted, the CZM Program hopes to expand the coverage to include areas where other land use activities are conducted. Therefore, the SMZ management measure for forestry may evolve into a more general recommendation for the establishment of SMZs throughout the State, regardless

of land use activity, where they can effectively mitigate the effects of polluted runoff on surface water quality.

(i) Existing Organizational Structure: DLNR is the lead agency for implementing this management measure because it administers the Stream Channel Alteration Permit (SCAP) under the Commission on Water Resources Management (CWRM), and the Forest Stewardship and Tree Farm programs under DOFAW. Other federal and State agencies involved in implementation include:

- DOH, Environmental Management Division, which implements programs for water pollution control; and
- USFS, which provides funding for the Forest Stewardship Program and Stewardship Incentives Program through grants to DLNR-DOFAW, reviews Forest Stewardship Program plans, and provides other research and extension services.

(ii) Existing Regulatory and Non-Regulatory Mechanisms:

HRS	Chapter 174C	Hawaii Water Code
HRS	Chapter 183	Conservation District
HRS	Chapter 186	Tree Farm Program
HRS	Chapter 195F	Forest Stewardship
HRS	Chapter 342D	Water Pollution
HRS	Chapter 342E	Nonpoint Source Pollution Control
HRS	Chapter 343	Environmental Impact Statements
HAR	Chapter 13-2	Conservation Districts
HAR	Chapter 11-54	Water Quality Standards
HAR	Chapter 13-169	Protection of Instream Uses of Water

Chapter 13-169, HAR, administered by DLNR, states that no stream channel shall be altered without first obtaining a SCAP from CWRM. Section 174C-3 of the Hawaii Water Code provides a definition for "stream." Generally speaking, the definition of stream includes perennial and intermittent streams, but streams must be natural watercourses which contain sufficient water to support instream uses as defined in the Code.

Chapter 186, HRS, authorizes the Board of Land and Natural Resources to classify private lands as tree farms, if they are suited for the sustained production of forest products in quantities sufficient to establish a business. For more information on the Tree Farm Program, please refer to the relevant description on page III-63. A management plan prepared under this program could specify BMPs for streamside management zones.

A CDUA permit under Chapter 183, HRS, and Chapter 13-2, HAR, administered by DLNR, would be required before forestry operations were conducted in the State conservation district, and a requirement to establish and maintain a SMZ could be included as a permit condition.

C. Road Construction/Reconstruction Management Measure

(1) Follow preharvest planning (as described under Management Measure A) when constructing or reconstructing the roadway.
(2) Follow designs planned under Management Measure A for road surfacing and shaping.
(3) Install road drainage structures according to designs planned under Management Measure A and regional storm return period and installation specifications. Match these drainage structures with terrain features and with road surface and prism designs.
(4) Guard against the production of sediment when installing stream crossings.
(5) Protect surface waters from slash and debris material from roadway clearing.
(6) Use straw bales, silt fences, mulching, or other favorable practices on disturbed soils on unstable cuts, fills, etc.
(7) Avoid constructing new roads in SMZs, to the extent practicable.

II.C.1. Description

The goal of this management measure is to minimize delivery of sediment to surface waters during road construction/reconstruction projects as part of forestry operations. Disturbance of soil and rock during road construction/reconstruction creates a significant potential for erosion and sedimentation of nearby streams and coastal waters. Some roads are temporary or seasonal-use roads, and their construction does not involve the high level of disturbance generated by permanent, high-standard roads. However, temporary or low-standard roads still need to be constructed in such a way as to prevent disturbance and sedimentation.

Although there are many commonly practiced techniques to minimize erosion during the construction process, the most meaningful are related to how well the work is planned, scheduled, and controlled by the road builder and those responsible for determining that work satisfies design requirements and land management resource objectives.

II.C.2. Applicability

This management measure pertains to lands where silvicultural or forestry operations are planned or conducted. It applies to road construction/ reconstruction operations for silvicultural purposes, including:

- *Clearing phase* - clearing to remove trees and woody vegetation from road right-of-way;

- *Pioneering phase* - excavating and filling the slope to establish road centerline and approximate grade;
- *Construction phase* - final grade and road prism construction and bridge, culvert, and road drainage installation; and
- *Surfacing phase* - placement and compaction of roadbed, road fill compaction, and surface placement and compaction (if applicable).

II.C.3. Management Practices

The following BMPs are described in more detail in the DLNR-DOFAW draft BMP Manual (February 1995).

Planning, Design, and Location:

a. Use a design to minimize damage to soil and water quality.
b. Roads should be designed no wider than necessary to accommodate the immediate anticipated use.
c. Design cut and fill slopes to minimize massive soil movement.
d. Provide culverts, dips, water bars, and cross drainages to minimize road bed erosion.
e. Design bridge and culvert installations using stream flow data, with a margin of safety proportional to the importance of the road and the protected resources.
f. Provide drainage where surface and groundwater cause slope instability.
g. Avoid diverting water from natural drainage ways. Dips, water bars, and cross drainage culverts should be placed above stream crossings so that water can be filtered through vegetative buffers before entering streams.
h. Locate roads to fit the topography, and minimize alterations to the natural features.
i. Avoid marshes and wetlands.
j. Minimize the number of stream crossings.
k. Cross streams at right angles to the stream channel.
l. Roads should not be located in SMZs, except where access is needed to a water crossing, or where there is no feasible alternative. Roads in any SMZs must be designed and located to minimize adverse effects on fish habitat and water quality.

Construction:

m. A final pre-harvest site review should be conducted so that road alignments and other considerations can be visually checked prior to road construction. The reconnaissance plan should be modified, as necessary, to make desirable adjustments based on the final site review.
n. Construct roads when moisture and soil conditions are not likely to result in excessive erosion or soil movement. Avoid construction during wet periods, when possible, to minimize unnecessary soil disturbance and compaction.
o. The boundaries of all SMZs should be defined on the ground prior to the beginning of any earth-moving activity.
p. Construct roads sufficient to carry the anticipated traffic load with reasonable safety and minimum environmental impact.
q. When using existing roads, reconstruct only to the extent necessary to provide adequate drainage and safety.

r. Road grades should be kept at less than 10%, except where terrain requires short, steep grades.
s. Minimize the number of stream crossings. Except at crossings, construct roads as far as practicable from streams.
t. Stream crossing construction should minimize disturbance of the area in which the crossing is being constructed.
u. As slope increases, additional diversion ditches should be constructed to reduce the damages caused by soil erosion; ditches, adequate culverts, cross drains, etc., should be installed concurrent with construction.
v. To control erosion, cut and fill slopes should conform to a conservative design appropriate for the particular soil type and topography.
w. Stumps, logs, and slash should be disposed outside of the road prism; in no case should they be covered with fill material and incorporated into road beds.
x. Stabilize the side banks of a road during construction to aid in the control of erosion and road deterioration; this may require mesh or other stabilizing material in addition to planting and/or seeding and other structural measures.
y. Water bars should be located to take advantage of existing wing ditches and cross drainage. Water bars should be constructed at an angle of 30 to 45 degrees to the road. Water bars should be periodically inspected, and damage or breeches should be promptly corrected. Install water bars at recommended intervals to provide drainage.
z. Bridges and overflow culverts should be constructed to minimize changes in natural stream beds during high water.
zz. Culverts on perennial streams should be installed low enough to allow passage of aquatic life during low water.

II.C.4. Implementation of Management Measure:

The road construction/reconstruction management measure for forestry will be implemented as part of a voluntary incentive program, administered by DLNR under the Tree Farm Program, that will encompass all forestry management measures. A description of the existing programs, statutes, rules, or ordinances that currently address aspects of this management measure follows. See Section III "Recommendations for Implementation" on page III-96 for a description of the changes in governmental policies that must be made before this program can be successfully implemented.

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

- County departments of public works, which administer the grading ordinances, requiring land users to obtain a grading permit for any disturbances of land greater than a specified area;
- DLNR, which implements the CDUA permit process, the voluntary Stewardship Incentive and Tree Farm programs, and the Hawaii Water Code;
- SWCDs, which help implement the county grading ordinances on agricultural lands;

- DOH, Environmental Management Division, which implements programs for water pollution control;
- USFS, which provides funding for the Forest Stewardship Program and Stewardship Incentives Program through grants to DLNR-DOFAW, reviews Forest Stewardship Program plans, and provides other research and extension services; and
- County departments of planning, which administer the SMA permit and shoreline setback provisions, if a forestry operation is planned in the SMA.

(ii) Existing Regulatory and Non-Regulatory Mechanisms:

HRS	Chapter 171	Management and Disposition of Public Lands
HRS	Chapter 174C	Hawaii Water Code
HRS	Chapter 180	Soil and Water Conservation Districts
HRS	Chapter 180C	Erosion and Sediment Control
HRS	Chapter 183	Conservation District
HRS	Chapter 186	Tree Farm Program
HRS	Chapter 195F	Forest Stewardship
HRS	Chapter 342D	Water Pollution
HRS	Chapter 342E	Nonpoint Source Pollution Control
HRS	Chapter 343	Environmental Impact Statements
HAR	Chapter 13-2	Conservation Districts
HAR	Chapter 11-54	Water Quality Standards
HAR	Chapter 13-169	Protection of Instream Uses of Water
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 & County of Honolulu)
MCC	Chapter 20.08	Soil Erosion and Sediment Control (Maui County)

Chapter 186, HRS, authorizes the Board of Land and Natural Resources to classify private lands as tree farms, if they are suited for the sustained production of forest products in quantities sufficient to establish a business. For more information on the Tree Farm Program, please refer to the relevant description on page III-63. A management plan prepared under this program could specify BMPs for road construction/ reconstruction.

A CDUA permit under Chapter 183, HRS, and Chapter 13-2, HAR, administered by DLNR, would be required before forestry operations were conducted in the State conservation district, and a requirement to establish and maintain a SMZ could be included as a permit condition.

While all earthmoving activities, such as road-building, greater than a specified area[2] are regulated under the four county grading ordinances, the SWCDs may

[2] In Kauai County, this specified amount is 100 cu.yds. In Maui County, the threshold is 4 acres or a vertical cut of 50ft. or greater. A grubbing permit is required if grubbing over 1 acre. In Hawaii County, a permit is required if a project alters a drainage pattern, disturbs more than 100 cu.yds., or entails a cut and fill over 5-ft. In the City and County of Honolulu, a permit is required if a project alters a drainage pattern, requires more than 50 cu.yds. of excavation or 50 cu.yds. of fill, or involves grubbing an area in excess of 15,000 sq.ft.

approve conservation plans which allow agricultural operations to receive an exemption from the grading ordinances (Chapter 180C, HRS). If forestry is considered an agricultural operation, then forestry activities, such as road construction/reconstruction could be exempted from the county grading ordinances *provided* the land users have conservation plans approved by the local SWCDs.

Descriptions of Chapter 13-169, HAR, and Chapter 171-54, HRS, both relevant under this management measure are found on pages III-67 and III-64, respectively.

D. Road Management

(1) Avoid using roads, where possible, for timber hauling or heavy traffic during wet periods on roads not designed and constructed for these conditions.

(2) Evaluate the future need for a road and close roads that will not be needed. Leave closed roads and drainage channels in a stable condition to withstand storms.

(3) Remove drainage crossings and culverts if there is a reasonable risk of plugging or failure from lack of maintenance.

(4) Following completion of harvesting, close and stabilize temporary spur roads and seasonal roads to control and direct water away from the roadway. Remove all temporary stream crossings.

(5) Inspect roads to determine the need for structural maintenance. Conduct maintenance practices, when conditions warrant, including cleaning and replacement of deteriorated structures and erosion controls, grading or seeding of road surfaces, and, in extreme cases, slope stabilization or removal of road fills, where necessary to maintain structural integrity.

(6) Conduct maintenance activities, such as dust abatement, so that chemical contaminants or pollutants are not introduced into surface waters, to the extent practicable.

(7) Properly maintain permanent stream crossings and associated fills and approaches to reduce the likelihood that (a) stream

overflow will divert onto roads, and (b) fill erosion will occur if the drainage structures become obstructed.

II.D.1. Description

The objective of this management measure is to manage existing roads to maintain stability and utility and to minimize sedimentation and pollution from runoff-transported materials. Roads that are actively eroding and providing significant sediment to waterbodies, whether in use or not, must be managed. If roads are no longer in use or needed in the foreseeable future, an effective treatment is to remove drainage crossings and culverts if there is a risk of plugging or failure from lack of maintenance. In other cases (*e.g.*, roads in use), it may be more economically viable to periodically maintain crossing and drainage structures.

Sound planning, design, and construction measures often reduce the future levels of necessary road maintenance. Roads constructed with a minimum width in stable terrain and with frequent grade reversals or dips require minimum maintenance. However, older roads remain one of the greatest sources of sediment from forest land management. In some locations, problems associated with altered surface drainage and diversion of water from natural channels can result in serious gully erosion or landslides. Smaller erosion features, such as gullies and deep ruts, are far more common than landslides and very often are related to road drainage.

Drainage of the road prism, road fills in stream channels, and road fills on steep slopes are the elements of greatest concern in road management.

II.D.2. Applicability

This management measure pertains to lands where silvicultural or forestry operations are planned or conducted. It applies to active and inactive roads constructed or used for silvicultural activities.

II.D.3. Management Practices

The following BMPs are described in more detail in the DLNR-DOFAW draft BMP Manual (February 1995).

Maintenance:

a. Maintain erosion control features through periodic inspection and maintenance, including cleaning dips and crossdrains, repairing ditches, marking culvert inlets to aid in location, and clearing debris from culverts.
b. Keep culverts, flumes, and ditches functional before and during the rainy season to diminish danger of clogging and the possibility of washouts. Provide for practical and scheduled preventive maintenance programs for high risk sites that will address the problems associated with high intensity rainfall events.
c. Conduct road surface maintenance, as necessary, to minimize erosion of the surface an subgrade.

d. During operations, keep the road surface crowned or outsloped, and keep the downhill side of the road free from berms, except those intentionally constructed for protection of fill.
e. Avoid using roads during wet periods if such use will likely damage road drainage features.
f. Water bars should be inspected after major rainstorms, and damage or breeches should be promptly corrected.

Harvesting - Temporary Access Roads and Landings:
g. The location of temporary access roads (logging roads) should be planned before operations begin.
h. Road construction should be kept to a minimum.
i. Landings should be located to minimize the adverse impacts of skidding on natural drainage patterns.
j. Logging roads and landings should be located on firm ground.
k. Landings should be kept as small an area as possible.
l. When operations are completed, provisions should be made to divert water runoff from roads and landings.

II.D.4. Implementation of Management Measure

The road management measure for forestry will be implemented as part of a voluntary incentive program, administered by DLNR under the Tree Farm Program, that will encompass all forestry management measures. A description of the existing programs, statutes, rules, or ordinances that currently address aspects of this management measure follows. See Section III "Recommendations for Implementation" on page III-96 for a description of the changes in governmental policies that must be made before this program can be successfully implemented.

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

- DLNR, which implements the CDUA permit process, the voluntary Stewardship Incentive and Tree Farm Programs, and the Hawaii Water Code;
- SWCDs, which provide technical assistance on best management practices on agricultural lands;
- DOH, Environmental Management Division, which implements programs for water pollution control;
- County departments of planning, which administer the SMA permit and shoreline setback provisions, if a forestry operation is planned in the SMA; and
- USFS, which provides funding for the Forest Stewardship Program and Stewardship Incentives Program through grants to DLNR-DOFAW, reviews Forest Stewardship Program plans, and provides other research and extension services.

(ii) Existing Regulatory and Non-Regulatory Mechanisms:

HRS	Chapter 174C	Hawaii Water Code
HRS	Chapter 183	Conservation District
HRS	Chapter 186	Tree Farm Program
HRS	Chapter 195F	Forest Stewardship
HRS	Chapter 342D	Water Pollution
HRS	Chapter 342E	Nonpoint Source Pollution Control
HRS	Chapter 343	Environmental Impact Statements
HAR	Chapter 13-2	Conservation Districts
HAR	Chapter 11-54	Water Quality Standards
HAR	Chapter 13-169	Protection of Instream Uses of Water

Chapter 186, HRS, authorizes the Board of Land and Natural Resources to classify private lands as tree farms, if they are suited for the sustained production of forest products in quantities sufficient to establish a business. For more information on the Tree Farm Program, please refer to the relevant description on page III-63. A management plan prepared under this program could specify BMPs for road management.

At present, there are no enforceable mechanisms that specifically address the road management measure for forestry. Water quality is generally addressed under the State's water pollution control statutes. Please refer to page III-64 for more information on Chapters 342D and 342E, HRS.

E. Timber Harvesting

The timber harvesting management measure consists of implementing the following:

(1) Timber harvesting operations with skid trails or cable yarding follow layouts determined under Management Measure A.

(2) Install landing drainage structures to avoid sedimentation, to the extent practicable. Disperse landing drainage over sideslopes.

(3) Construct landings away from steep slopes and reduce the likelihood of fill slope failures. Protect landing surfaces used during wet periods. Locate landings outside of SMZs. <u>Minimize size of landing areas.</u>

(4) Protect stream channels and significant ephemeral drainages from logging debris and slash material.

(5) Use appropriate areas for petroleum storage, draining, dispensing. Establish procedures to contain and treat spills.

Recycle or properly dispose of all waste materials in accordance with State law.

For cable yarding:

(1) Limit yarding corridor gouge or soil plowing by properly locating cable yarding landings.
(2) Locate corridors for SMZs following Management Measure B.
(3) Cable yarding should not be done across perennial or intermittent streams, except at improved stream crossings.

For groundskidding:

(1) Within SMZs, operate groundskidding equipment only at stream crossings, to the extent practicable. In SMZs, fell and endline trees to avoid sedimentation.
(2) Use improved stream crossings for skid trails which cross flowing drainages. Construct skid trails to disperse runoff and with adequate drainage structures.
(3) On steep slopes, use cable systems rather than groundskidding where groundskidding may cause excessive sedimentation.
(4) Groundskidding should not be done across perennial or intermittent streams, except at improved stream crossings.

II.E.1. Description

The goal of this management measure is to minimize sedimentation resulting from the siting and operation of timber harvesting, and to manage petroleum products properly. Locating landings for both groundskidding and cable yarding harvesting systems according to preharvest planning minimizes erosion and sediment delivery to surface waters.

Also, any chemicals or petroleum products spilled in harvest areas can be highly mobile, adversely affecting the water quality of nearby surface waters. Correct spill prevention and containment procedures are therefore necessary to prevent petroleum products from entering surface waters.

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**: The forestry focus group proposed these changes for the following reasons.*

- *(i) Minimize Size of Landing Areas: Not only is it important to construct landings away from steep slopes, reduce the likelihood of fill slope failures,*

protect landing surfaces used during wet periods, and locate landings outside SMZs, but it is also important to minimize the size of the landing areas in order to reduce the amount of land disturbance. This sentence was added to (3) under the first paragraph.

- *(ii) Dispose of Wastes According to State Law: It is important to recycle and properly dispose of all waste materials, in accordance with State law. This phrase was added to (5) under the first paragraph.*
- *(iii) Cable Yarding and Groundskidding Across Streams: Cable yarding and groundskidding should not be done across perennial or intermittent streams, except at improved stream crossings. This sentence was added as (3) under cable yarding and (4) under groundskidding.*

II.E.2. Applicability

This management measure pertains to lands where silvicultural or forestry operations are planned or conducted. It applies to all harvesting, yarding, and hauling conducted as part of normal silvicultural activities on harvest units larger than 5 acres. This measure does not apply to harvesting conducted for precommercial thinnings or noncommercial firewood cutting.

II.E.3. Management Practices

The following BMPs are described in more detail in the DLNR-DOFAW draft BMP Manual (February 1995).

a. Careful felling can minimize the impact of subsequent phases of logging operations.
b. Trees should not be felled into streams, except where no safe alternative exists. In the latter case, such trees should be removed promptly.
c. Skidding should be done so as to avoid disrupting natural drainage and to prevent excessive soil displacement.
d. Stream channels and road ditches should not be used as skid trails.
e. Skid trails on steep slopes should have occasional water bars.
f. Servicing of equipment involving fuel, lubricants, or coolants should be performed in places where these materials cannot enter streams. Spent oil should be collected for proper disposal and never poured on the ground.
g. Upon completion of logging, erosion-prone areas should be mulched or seeded.
h. Logging debris in streams should be removed immediately.
i. Debris from landings should not be pushed into drains, streams, or SMZs.
j. All trash associated with logging operations should be promptly removed (not buried) and hauled to a legal disposal site.

II.E.4. Implementation of Management Measure

The timber harvesting management measure for forestry will be implemented as part of a voluntary incentive program, administered by DLNR under the Tree Farm Program, that will encompass all forestry management measures. A description of the existing programs, statutes, rules or ordinances that currently address aspects of this management measure follows. See Section III "Recommendations for Implementation" on page III-96 for a description of the

changes in governmental policies that must be made before this program can be successfully implemented.

(i) Existing Organizational Structure: No one agency clearly has a regulatory lead in implementing this management measure. DLNR implements the Forest Stewardship and Tree Farm Programs, CDUA permit process, and Hawaii Water Code. Other federal, State, and local agencies involved in implementation include:

- SWCDs, which provide technical assistance on best management practices on agricultural lands;
- DOH, Environmental Management Division, which implements programs for water pollution control, solid and hazardous waste management, and used oil disposal;
- USFS, which provides funding for the Forest Stewardship Program and Stewardship Incentives Program through grants to DLNR-DOFAW, reviews Forest Stewardship Program plans, and provides other research and extension services; and
- County departments of planning, which administer the SMA permit and shoreline setback provisions, if a forestry operation is conducted in the SMA.

(ii) Existing Regulatory and Non-Regulatory Mechanisms:

HRS	Chapter 171	Management and Disposition of Public Lands
HRS	Chapter 174C	Hawaii Water Code
HRS	Chapter 180	Soil and Water Conservation Districts
HRS	Chapter 183	Conservation District
HRS	Chapter 186	Tree Farm Program
HRS	Chapter 195F	Forest Stewardship Program
HRS	Chapter 342D	Water Pollution
HRS	Chapter 342E	Nonpoint Source Pollution Control
HRS	Chapter 342H	Solid Waste Pollution
HRS	Chapter 342I	Lead Acid Battery Recycling
HRS	Chapter 342L	Underground Storage Tank
HRS	Chapter 342N	Used Oil
HRS	Chapter 343	Environmental Impact Statements
HAR	Chapter 13-2	Conservation Districts
HAR	Chapter 11-54	Water Quality Standards
HAR	Chapter 13-169	Protection of Instream Uses of Water

Chapter 186, HRS, authorizes the Board of Land and Natural Resources to classify private lands as tree farms, if they are suited for the sustained production of forest products in quantities sufficient to establish a business. For more information on the Tree Farm Program, please refer to the relevant description on page III-63. A management plan prepared under this program could specify BMPs for timber harvesting.

A CDUA permit under Chapter 183, HRS, and Chapter 13-2, HAR, administered by DLNR, would be required before forestry operations were conducted in the State conservation district, and conditions pertaining to timber harvesting could be attached to the permit.

Descriptions of Chapter 13-169, HAR, and Chapter 171-54, HRS, which may be relevant under this management measure, are found on pages III-67 and III-64, respectively.

Chapter 342L, HRS, administered by DOH, discusses petroleum storage. Chapter 342N, HRS, also administered by DOH, prohibits the discharge of new, used, or recycled oil into sewers, drainage systems, surface or groundwaters, watercourses, marine waters, or onto the ground. Chapter 342I, HRS, also administered by DOH, describes the procedures and prohibitions for disposing and recycling of lead acid batteries.

F. Site Preparation and Forest Regeneration Management Measure

Confine on-site potential nonpoint source pollution and erosion resulting from site preparation and the regeneration of forest stands. The components of the management measure for site preparation and regeneration are:

(1) Select a method of site preparation and regeneration suitable for the site conditions.
(2) Conduct mechanical tree planting and ground-disturbing site preparation activities on the contour of [~~sloping~~] <u>erodible</u> terrain.
(3) Do not conduct mechanical site preparation and mechanical tree planting in SMZs.
(4) Protect surface waters from logging debris and slash material.
(5) Suspend operations during wet periods if equipment used begins to cause excessive soil disturbance that will increase erosion.
(6) Locate windrows at a safe distance from drainages and SMZs to control movement of the material during high runoff conditions.
(7) Conduct bedding operations in high water-table areas during dry periods of the year. Conduct bedding in [~~sloping~~] <u>erodible</u> areas on the contour.

(8) Protect small ephemeral drainages when conducting mechanical tree planting.

II.F.1. Description

Regeneration of harvested forest lands not only is important in terms of restocking a valuable resource, but also is important to provide water quality protection from disturbed soils. Tree roots stabilize disturbed soils by holding the soil in place and aiding soil aggregation, decreasing slope failure potential. The presence of vegetation on disturbed soils also slows runoff, which, in turn, decreases erosion.

Leaving the forest floor litter layer intact during site preparation operations for regeneration minimizes mineral soil disturbance and detachment, thereby minimizing erosion and sedimentation. Maintenance of an unbroken litter layer prevents raindrop detachment, maintains infiltration, and slows runoff. Mechanical site preparation can potentially impact water quality in areas that have steep slopes and erodible soils, and where the prepared site is located near a waterbody. Natural regeneration, hand planting, and direct seeding minimize soil disturbance, especially on steep slopes with erodible soils.

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**: Though erosion is normally a problem associated with sloping lands, there are soils in Hawaii that are highly resistant to erosion despite their sloping characteristics. In order to more accurately reflect this point, the word "sloping" was changed to "erodible" in Items (2) and (7) of this management measure.*

II.F.2. Applicability

This management measure pertains to lands where silvicultural or forestry operations are planned or conducted. It applies to all site preparation and regeneration activities conducted as part of normal silvicultural activities on harvested units larger than 5 acres.

II.F.3. Management Practices

The following BMPs are described in more detail in the DLNR-DOFAW draft BMP Manual (February 1995).

Mechanical Site Preparation:

a. Avoid excessive soil compaction.
b. Minimize erosion and the movement of sediment into waters.
c. Prevent accumulation of debris in ponds, streams, or rivers.
d. Windrows, disking, bedding, and planting with "furrow" type mechanical planters should follow contours.
e. Avoid complete disking of steep slopes with extremely erodible soil.
f. Plant trees on contour.

II.F.4. Implementation of Management Measure

The site preparation and forest regeneration management measure for forestry will be implemented as part of a voluntary incentive program, administered by DLNR under the Tree Farm Program, that will encompass all forestry management measures. A description of the existing programs, statutes, rules, or ordinances that currently address aspects of this management measure follows. See Section III "Recommendations for Implementation" on page III-96 for a description of the changes in governmental policies that must be made before this program can be successfully implemented.

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

- DLNR, which implements the CDUA permit process, the voluntary Forest Stewardship Program, Tree Farm Program, and Hawaii Water Code;
- SWCDs, which help implement the county grading ordinances on agricultural lands;
- DOH, Environmental Management Division, which implements programs for water pollution control;
- USFS, which provides funding for the Forest Stewardship Program and Stewardship Incentives Program through grants to DLNR-DOFAW, reviews Forest Stewardship Program plans, and provides other research and extension services;
- County departments of planning, which administer the SMA permit and shoreline setback provisions, if a forestry operation is planned in the SMA; and
- County departments of public works, which administer the grading ordinances, requiring land users to obtain grading permits for any disturbances of land greater than a specified area.

(ii) Existing Regulatory and Non-Regulatory Mechanisms:

HRS	Chapter 171	Management and Disposition of Public Lands
HRS	Chapter 174C	Hawaii Water Code
HRS	Chapter 180	Soil and Water Conservation Districts
HRS	Chapter 180C	Erosion and Sediment Control
HRS	Chapter 183	Conservation District
HRS	Chapter 186	Tree Farm Program
HRS	Chapter 195F	Forest Stewardship Program
HRS	Chapter 342D	Water Pollution
HRS	Chapter 342E	Nonpoint Source Pollution Control
HRS	Chapter 343	Environmental Impact Statements
HAR	Chapter 13-2	Conservation Districts
HAR	Chapter 11-54	Water Quality Standards
HAR	Chapter 13-169	Protection of Instream Uses of Water
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 & County of Honolulu)
MCC	Chapter 20.08	Soil Erosion and Sediment Control (Maui County)

Chapter 186, HRS, authorizes the Board of Land and Natural Resources to classify private lands as tree farms, if they are suited for the sustained production of forest products in quantities sufficient to establish a business. For more information on the Tree Farm Program, please refer to the relevant description on page III-63. A management plan prepared under this program could specify BMPs for site preparation and forest regeneration.

A CDUA permit under Chapter 183, HRS, and Chapter 13-2, HAR, administered by DLNR, would be required before forestry operations were conducted in the State conservation district, and conditions pertaining to site preparation and forest regeneration could be attached to the permit.

While earthmoving activities greater than a specified area are regulated under the four county grading ordinances, the SWCDs are allowed to exempt agricultural operations from the grading ordinance if the operations have approved conservation plans (Chapter 180C, HRS). If forestry is considered an agricultural operation, then forestry activities that involve grading, grubbing, or other earthmoving could be exempted from the county grading ordinances *provided* land users have conservation plans approved by the local SWCDs.

Descriptions of Chapter 13-169, HAR, and Chapter 171-54, HRS, which may be relevant under this management measure, are found on pages III-67 and III-64, respectively.

G. Fire Management

Prescribe fire [~~for site preparation and control~~] or suppress wildfire in a manner which reduces potential nonpoint source pollution of surface waters:

(1) [~~Intense p~~]Prescribed fire should not cause excessive sedimentation due to the combined effect of removal of canopy species and the loss of soil-binding ability of subcanopy and herbaceous vegetation roots, especially in SMZs, in streamside vegetation for small ephemeral drainages, or on very steep slopes.

(2) Prescriptions for [~~prescribed~~] fire should protect against excessive erosion or sedimentation, to the extent practicable.

(3) All bladed firelines, for prescribed fire and wildfire, should be plowed on contour or stabilized with water bars and/or other

appropriate techniques if needed to control excessive sedimentation or erosion of the fireline.

(4) Wildfire suppression and rehabilitation should consider possible nonpoint source pollution of watercourses, while recognizing the safety and operational priorities of fighting wildfires.

II.G.1. Description

The goal of this management measure is to minimize potential nonpoint source pollution and erosion resulting from prescribed fire and from the methods used for presuppression and suppression activities.

Prescribed burning is aimed at reducing fuel loading and competition for nutrients among seedlings and protecting against wildfire. Slash burning destroys vegetation that reduces nitrogen-nitrate loadings. If uncontrolled, the burn may impact SMZs or highly erodible soils, causing increased sedimentation and erosion. Prescribed burning causes changes in the chemical cycling of elements by influencing biological and microclimatic changes, volatilization, and mineralization processes.

The intensity and severity of burning and the proportion of the watershed burned are the major factors affecting the influence of prescribed burning on stream flow and water quality.

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**: The forestry focus group proposed these changes for the following reasons.*

- *(i) Fire for Site Preparation: Fire is not used for site preparation for forestry operations in Hawaii. Therefore, that clause has been eliminated from the management measure.*
- *(ii) Intense Prescribed Fire: No prescribed fire should cause sedimentation, whether or not it is "intense." Therefore, the word "intense" has been removed from (1).*
- *(iii) Redundancy: It is redundant to state "prescriptions for prescribed fire." Therefore, the word "prescribed" has been removed from (2).*

II.G.2. Applicability

This management measure pertains to lands where silvicultural or forestry operations are planned or conducted. It applies to all prescribed burning conducted as part of normal activities on all management units for wildfire suppression and rehabilitation on forest, brush, and watershed lands.

II.G.3. Management Practices

The first and foremost concern in wildfire control is to prevent harm or damage to people and property. Fireline best management practices should incorporate

minimum impact strategies, which meet land and resource management objectives. The following BMPs are described in more detail in the DLNR-DOFAW draft BMP Manual (February 1995).

Wildfire Control and Reclamation:

a. Areas with bare mineral soils should be revegetated and areas where vegetative cover has been killed or severely degraded should be regenerated with plant species appropriate for the soil conditions.
b. First priority for revegetation/reforestation should be given to banks of surface waterbodies so that SMZs are reestablished.
c. Firelines should be stabilized and, if necessary, revegetated. Erodible areas altered by suppression equipment activities should be repaired and revegetated, as necessary.
d. Access road surfaces should be repaired and stabilized, as necessary.
e. Whenever possible, avoid using fire suppression chemicals over watercourses, and prevent their runoff into watercourses. Do not clean application equipment in watercourses or locations that drain into watercourses.
f. Provide advance planning and training for firefighters that considers water quality impacts when fighting wildfires. This can include increasing awareness so direct application of fire suppression chemicals to waterbodies is avoided and firelines are appropriately placed.
g. Include rehabilitative practices as part of suppression and post-suppression tactics and strategies to mitigate nonpoint source pollution.

Fireline Construction and Maintenance:

h. Firelines should be constructed on the perimeter of the burn area and along the boundaries of SMZs. The purpose of protecting SMZs from fire is to safeguard the filtering effects of tree litter and organic matter.
i. Firelines should follow the guidelines established for logging trails and skid trails, with respect to waterbars and wing ditches, and should be only as wide and as deep as needed to permit safe prescribed burns or fire suppression.
j. Firelines which would cross a drainage should be turned parallel to the stream or have a wing ditch or other structure allowing runoff in the line to be dispersed rather than channeled directly into the stream.
k. All firelines should be assessed after the fire is controlled for appropriate stabilization, and, if necessary, proper rehabilitation should be done while equipment and people are in place.

Prescribed Burn:

l. Intense prescribed fire for site preparation shall be conducted only if it achieves desired results with minimum impacts to water quality.
m. Burning on steep slopes or highly erodible soils should be conducted only when it is absolutely necessary and should follow carefully planned prescriptions.
n. Carefully plan burning to adhere to time of year, weather, topography, and fuel conditions that will help achieve the desired results and minimize impacts on water quality. With proper planning, prescribed fires should not cause excessive sedimentation due to the combined effect of removal of canopy

species and the loss of soil-binding ability of the subcanopy and herbaceous vegetation roots, especially in SMZs, in streamside vegetation for small ephemeral drainages, or on very steep slopes.

II.G.4. Implementation of Management Measure

The fire management measure for forestry will be implemented as part of a voluntary incentive program, administered by DLNR under the Tree Farm Program, that will encompass all forestry management measures. A description of the existing programs, statutes, rules, or ordinances that currently address aspects of this management measure follows. See Section III "Recommendations for Implementation" on page III-96 for a description of the changes in governmental policies that must be made before this program can be successfully implemented.

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

- DLNR, which implements the CDUA permit process, Forest Stewardship Program, and Tree Farm Program;
- SWCDs, which provide technical assistance on best management practices on agricultural lands;
- DOH, Environmental Management Division, which implements programs for water pollution control and air quality standards; and
- County departments of planning, which administer the SMA permit and shoreline setback provisions, if the forestry operation is planned in the SMA.

(ii) Existing Regulatory and Non-Regulatory Mechanisms:

HRS	Chapter 180	Soil and Water Conservation Districts
HRS	Chapter 180C	Erosion and Sediment Control
HRS	Chapter 183	Conservation District
HRS	Chapter 185	Land Fire Protection Law
HRS	Chapter 186	Tree Farm Program
HRS	Chapter 195F	Forest Stewardship
HRS	Chapter 342D	Water Pollution
HRS	Chapter 342E	Nonpoint Source Pollution Control
HRS	Chapter 343	Environmental Impact Statements
HAR	Chapter 13-2	Conservation Districts
HAR	Chapter 11-54	Water Quality Standards
HAR	Chapter 11-60	Air Pollution Control
HAR	Chapter 13-169	Protection of Instream Uses of Water
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 & County of Honolulu)
MCC	Chapter 20.08	Soil Erosion and Sediment Control (Maui County)

Chapter 185, HRS, administered by DLNR, has provisions to protect wildlands from the destructive impacts of uncontrolled fire. The law provides for an organized approach to the prevention, presuppression, and suppression of fires which threaten forest, grass, brush, and watershed lands. The threat of wildfire is minimized by a permitting system established under Chapter 185-7, HRS. It also has provisions for those who willfully, maliciously, or negligently set fires.

Department of Health administers an Agricultural Burning Permit, required under Chapter 11-60, HAR. DOH issues permits for prescribed fire in support of fuel reduction in the interest of public safety. While this permit is designed primarily to meet air quality standards, the permit system also allows control of burning activities other than agricultural activities statewide.

Chapter 186, HRS, authorizes the Board of Land and Natural Resources to classify private lands as tree farms, if they are suited for the sustained production of forest products in quantities sufficient to establish a business. For more information on the Tree Farm Program, please refer to the relevant description on page III-63. A management plan prepared under this program could specify BMPs for fire management.

Chapter 183, HRS, and Chapter 13-2, HAR, administered by DLNR, regulate land use within the State's conservation districts. According to conditions normally imposed during the CDUA permit process, applicants are required to exercise care and identify a means to prevent and suppress wildfires.

Please refer to page III-71 for a brief description of Chapter 180C, HRS, related to erosion and sediment, which may be relevant under this management measure.

H. Revegetation of Disturbed Areas

Reduce erosion and sedimentation by rapid revegetation of areas disturbed by harvesting operations or road construction:

(1) Revegetate disturbed areas (using seeding or planting) promptly after completion of the earth-disturbing activity. Local growing conditions will dictate the timing for establishment of vegetative cover.
(2) Use mixes of species and treatments developed and tailored for successful vegetation establishment for the region or area.
(3) Concentrate revegetation efforts initially on priority areas such as disturbed areas in SMZs or the steepest areas of disturbance near drainages.

II.H.1. Description

Revegetation of areas of disturbed soil can successfully prevent sediment and pollutants associated with the sediment (such as phosphorus and nitrogen) from entering nearby surface waters. The vegetation controls soil erosion by dissipating the erosive forces of raindrops, reducing the velocity of surface runoff, stabilizing soil particles with roots, and contributing organic matter to the soil, which increases soil infiltration rates.

Vegetation can trap and prevent dry ravel from moving further downslope, and it produces organic matter that is incorporated into the soil, increasing infiltration rates. Nutrient and soil losses to streams and lakes also can be reduced by revegetating burned, cut over, or otherwise disturbed areas. In some cases, double plantings are used: an early planting to establish erosion protection quickly and a later planting to provide more permanent protection.

II.H.2. Applicability

This management measure pertains to lands where silvicultural or forestry operations are planned or conducted. It applies to all disturbed areas resulting from harvesting, road building, and site preparation conducted as part of normal silvicultural activities. Disturbed areas are those localized areas within harvest units or road systems where mineral soil is exposed or agitated (*e.g.*, road cuts, fill slopes, landing surfaces, cable corridors, or skid trail ruts).

II.H.3. Management Measures

There are currently no BMPs described by DLNR-DOFAW that pertain directly to revegetation of disturbed areas.

II.H.4. Implementation of Management Measure

The management measure for revegetation of disturbed forestry areas will be implemented as part of a voluntary incentive program, administered by DLNR under the Tree Farm Program, that will encompass all forestry management measures. A description of the existing programs, statutes, rules or ordinances that currently address aspects of this management measure follows. See Section III "Recommendations for Implementation" on page III-96 for a description of the changes in governmental policies that must be made before this program can be successfully implemented.

(i) Existing Organizational Structure: There are currently no regulatory and non-regulatory mechanisms that directly pertain to this management measure. Federal, State, and local agencies indirectly involved in its implementation include:

- DLNR, which implements the CDUA permit process and the voluntary Forest Stewardship and Tree Farm Programs;
- SWCDs, which provide technical assistance on best management practices and help implement the county grading ordinances on agricultural lands;
- DOH, Environmental Management Division, which implements programs for water pollution control;

- County departments of public works, which administer the grading ordinances, requiring land users to obtain grading permits for any disturbances of land greater than a specified area;
- USFS, which provides funding for the Forest Stewardship Program and Stewardship Incentives Program through grants to DLNR-DOFAW, reviews Forest Stewardship Program plans, and provides other research and extension services; and
- County departments of planning, which administer the SMA permit and shoreline setback provisions, if a forestry operation is planned in the SMA.

(ii) Existing Regulatory and Non-Regulatory Mechanisms:

HRS	Chapter 171	Management and Disposition of Public Lands
HRS	Chapter 180C	Erosion and Sediment Control
HRS	Chapter 183	Conservation District
HRS	Chapter 186	Tree Farm Program
HRS	Chapter 195F	Forest Stewardship
HRS	Chapter 342D	Water Pollution
HRS	Chapter 342E	Nonpoint Source Pollution Control
HRS	Chapter 343	Environmental Impact Statements
HAR	Chapter 13-2	Conservation Districts
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 & County of Honolulu)
MCC	Chapter 20.08	Soil Erosion and Sediment Control (Maui County)

Chapter 186, HRS, authorizes the Board of Land and Natural Resources to classify private lands as tree farms, if they are suited for the sustained production of forest products in quantities sufficient to establish a business. For more information on the Tree Farm Program, please refer to the relevant description on page III-63. A management plan prepared under this program could specify BMPs for revegetation of disturbed areas.

A CDUA permit under Chapter 183, HRS, and Chapter 13-2, HAR, administered by DLNR, would be required before forestry operations were conducted in the State conservation district, and conditions pertaining to revegetation of disturbed areas could be attached to the permit.

Please refer to page III-71 for a brief description of Chapter 180C, HRS, related to erosion and sediment, which may be relevant under this management measure.

I. Forest Chemical Management

Use chemicals when necessary for forest management in accordance with the following to reduce nonpoint source pollution impacts due to the movement of forest chemicals off-site during and after application:

(1) Conduct applications by skilled and, where required, licensed applicators according to the registered use, with special consideration given to impacts to nearby surface and ground waters.

(2) Carefully prescribe the type and amount of pesticides appropriate for the insect, fungus, or herbaceous species.

[(4)] (3) Establish and identify buffer areas for surface waters. (This is especially important for aerial applications.)

[(3)] (4) Prior to applications of pesticides and fertilizers, inspect the mixing and loading process and the calibration of equipment, and identify the appropriate weather conditions, the spray area, and buffer areas for surface waters.

(5) Immediately report accidental spills of pesticides or fertilizers into surface waters to the appropriate State agency. Develop an effective spill contingency plan to contain spills.

II.I.1. Description

Chemicals used in forest management are generally pesticides (insecticides, herbicides, and fungicides) and fertilizers. Since pesticides may be toxic, they must be mixed, transported, loaded, and applied properly and their containers disposed of properly in order to prevent potential nonpoint source pollution. Since fertilizers may also be toxic or may shift the ecosystem energy dynamics, depending on the exposure and concentration, they must also be properly handled and applied.

Although pesticides and fertilizers are used infrequently in forest operations, they can still pose a risk to the aquatic environment, depending on the application technique used. Most adverse water quality effects related to the application of pesticides and fertilizers result from direct application of chemicals to surface waters or from chemical spills. Researchers also found that providing buffer areas around streams and other waterbodies effectively eliminated adverse water quality effects from forestry chemicals.

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**: The forestry focus group proposed these changes for the following reasons.*

- *(i) Adding Groundwater: It is important to protect groundwater, as well as surface water, from impacts due to forestry chemical applications. Therefore, groundwater was added to (1) of this management measure.*
- *(ii) Reordering (3) and (4): The order of (3) and (4) was switched, since it is important to establish buffer areas before applying pesticides and fertilizers.*

II.I.2. Applicability

This management measure pertains to lands where silvicultural or forestry operations are planned or conducted. It applies to all fertilizer and pesticide applications (including biological agents) conducted as part of normal silvicultural activities.

II.I.3. Management Practices

The following BMPs are described in more detail in the DLNR-DOFAW draft BMP Manual (February 1995).

Pesticide Selection:

a. When the decision is made to use pesticides, choose products suitable for use on the target species and registered for the intended uses. Use only pesticides registered by EPA. Prior to using any pesticide, carefully read and follow all label directions.
b. When selecting pesticide options, more than effectiveness and cost should be evaluated. Consideration should also be given to site factors, application conditions and techniques and products that can influence impacts to water quality.
c. Three main characteristics can greatly affect a pesticide's potential to contaminate surface or ground water. They are solubility, absorption and breakdown rate. In a given situation, pesticides with the highest water solubilities, greatest persistence, lowest affinities for absorption to organic matter, and highest application rates have the greatest potential for movement in surface or ground water. An alternative means of minimizing the potential movement of a pesticide is to select a non-broadcast application technique for the same pesticide that reduces the amount of the chemical applied directly to the soil.

Procedures for Pesticide Use:

d. Transportation
    - Use common sense and care when transporting pesticides;
    - Inspect all containers prior to loading and ensure all caps, plugs, and bungs are tightened;
    - Handle containers carefully when loading onto vehicles;
    - Secure containers properly to prevent shifting during transport;
    - Check containers periodically en route;
    - Limit access to containers during transport to prevent tampering;
    - Consider potential impacts on water quality when selecting transportation routes;

- Educate and inform the driver of the proper transportation precautions; and
- Never transport pesticides unless arrangements have been made to receive and store them properly.

e. Storage

- Chemicals should be used and stored in accordance with all applicable federal, state, and local regulations;
- All containers should be labeled in accordance with applicable federal, state, and local regulations;
- Store pesticides in their original containers with labels intact;
- Do not store pesticides for extended periods in buildings that will not contain a complete spill from the largest container being stored;
- Check containers prior to storage and periodically during storage to ensure that they are properly sealed;
- Locate pesticide storage facilities at sites that minimize the possibility of impacts on water quality in case accidents or fires occur;
- Use storage buildings that have floors constructed of concrete or other impermeable materials so that spills are easy to clean up;
- Ensure that storage facilities can be secured under lock and key; and
- Post a list of chemicals and quantities stored at storage areas and notify the fire department about storage.

f. Mixing/Loading

- Review label before opening the container to ensure familiarity with current use directions;
- Exercise care and caution during mixing and loading;
- Replace pour caps and close bags or other containers immediately after use; and
- Mix chemicals and clean equipment only where possible spills would not enter streams, lakes, or ponds.

g. Application

- Chemicals should not be applied where stream pollution is likely to occur through aerial drift;
- Use a spray device capable of immediate shutoff;
- Refer to label directions before making a pesticide application;
- Check all application equipment carefully, particularly for leaking hoses and connections and plugged or worn nozzles. Calibrate spray equipment periodically to achieve uniform distribution and rate;
- Apply pesticides under favorable weather conditions. Never apply a pesticide when there is a likelihood of significant drift; and
- Always use pesticides in accordance with label instruction, and adhere to all federal and State policies and regulations governing pesticide use.

h. Cleanup and Disposal

- Before disposal, containers should be rinsed as described in equipment cleanup;

- Cleanup should be in a location where chemicals will not enter any stream, pond, or where stream pollution might occur;
- Rinse empty pesticide containers and mixing apparatus three times. This flushing should be applied in spray form to the treated area, NOT into the ground; and
- Dispose of pesticide wastes and containers according to federal and State laws. Some pesticide wastes are specifically identified as hazardous wastes by law and must be handled and disposed of in accordance with hazardous waste regulations.

Other chemicals:
Improper storage and handling of oil products and fuel can be a water quality hazard. Improper disposal of oil or fuel can contaminate ground water and seep into streams.

i. Locate storage and disposal facilities away from streams, and be prepared to clean up spills.
j. Know and comply with regulations governing the storage, handling, application (including licensing of applicators), and disposal of hazardous substances.
k. Do not transport, handle, store, load, apply, or dispose of any hazardous substance or fertilizer in such a manner as to pollute water supplies or cause damage or injury to humans, desirable plants and animals.
l. Do not store, mix, or rinse hazardous substances or fertilizers within SMZs or where they might enter streams or waterways.
m. Develop a contingency plan for hazardous substance spills, including cleanup procedures.
n. Report all spills to DOH.

II.I.4. Implementation of Management Measure:
The forest chemical management measure will be implemented as part of a voluntary incentive program, administered by DLNR under the Tree Farm Program, that will encompass all forestry management measures. A description of the existing programs, statutes, rules, or ordinances that currently address aspects of this management measure follows. See Section III "Recommendations for Implementation" on page III-96 for a description of the changes in governmental policies that must be made before this program can be successfully implemented.

(i) Existing Organizational Structure: DOA, Pesticides Branch, is the lead agency for implementing those measures that relate to regulating pesticides. At present, there are no enforceable mechanisms that specifically address the application of forestry fertilizers. Therefore, no one agency clearly has the lead in implementing that component of the management measure. Other agencies involved in implementation include:

- DLNR-DOFAW, which implements the Forest Stewardship and Tree Farm Programs; and

- DOH, Environmental Management Division, which implements programs for water pollution control and safe drinking water.

(ii) Existing Regulatory and Non-Regulatory Mechanisms:

HRS	Chapter 149A	Hawaii Pesticides Law
HRS	Chapter 186	Tree Farm Program
HRS	Chapter 195F	Forest Stewardship
HRS	Chapter 340E	Safe Drinking Water
HRS	Chapter 342D	Water Pollution
HRS	Chapter 342E	Nonpoint Source Pollution Control
HAR	Chapter 4-66	Pesticides
HAR	Chapter 11-54	Water Quality Standards

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...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 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 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. 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 2 for commercial applicators is required for forest pest control [§4-66-56(2), HAR]. Certification is not required for those using pesticides that are not classified as "restricted use."

Chapter 186, HRS, authorizes the Board of Land and Natural Resources to classify private lands as tree farms, if they are suited for the sustained production of forest products in quantities sufficient to establish a business. For more information on the Tree Farm Program, please refer to the relevant description on page III-63. A management plan prepared under this program could specify BMPs for forest chemical management.

Forestry pesticides and nutrients are addressed generally under the State's water pollution control statutes. While Chapter 342E, HRS, addresses nonpoint source pollution 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 capable of enforcing any of these regulatory mechanisms.

Finally, the Hawaii Occupational Safety and Health (HIOSH) regulations require that all commercial pesticide applications either be done by or be directly supervised by a certified pesticide applicator.

J. Wetlands Forest Management

Plan, operate, and manage normal, ongoing forestry activities (including harvesting, road design and construction, site preparation and regeneration, and chemical management) to adequately protect the aquatic functions of forested wetlands.

II.J.1. Description

Forested (palustrine) wetlands provide many beneficial functions that need to be protected. Among these are floodflow alteration, sediment trapping, nutrient retention and removal, habitat for fish and wildlife, and provision of timber products.

The primary difference between forestry activities on wetland sites and activities on upland sites is the flooding that occurs in most wetlands during some or most of the year. Potential impacts of forestry operations in wetlands include: sediment production as a result of road construction and use and equipment operation; drainage alteration as a result of improper road construction; stream obstruction caused by failure to remove logging debris; soil compaction caused by operation of logging vehicles during flooding periods or wet weather; contamination from improper application and/or use of pesticides; habitat degradation; and damage to existing timber stands.

In an effort to prevent these adverse effects, Section 404 of the Federal Water Pollution Control Act requires use of appropriate BMPs for road construction and maintenance in wetlands so that flow and circulation patterns, and chemical and biological characteristics are not impaired. Additional Section 404(f) BMPs specific to forestry can be found at 40 CFR 232.3.

II.J.2. Applicability

This management measure is intended for forested wetlands where silvicultural or forestry operations are planned or conducted. It applies specifically to forest management activities in forested wetlands and to supplement the previous management measures by addressing the operational circumstances and management practices appropriate for forested wetlands.

This management measure applies specifically to forest management activities in forested wetlands, including those currently undertaken under the exemptions of Section 404(f) of the Federal Water Pollution Control Act (40 CFR, Part 232). Many normal, ongoing forestry activities are exempt under Section 404(f)(1) unless recaptured under the provisions of Section 404(f)(2). This management measure is not intended to prohibit these silvicultural activities but to reduce incidental or indirect effects on aquatic functions as a result of these activities.

II.J.3. Management Practices

If the wetland is located along a stream, pond, perennial flowing natural spring, or a spring or reservoir serving as a domestic water supply, then the BMPs for SMZs would apply (see Streamside Management Zone Management Measure above). Otherwise, there are currently no BMPs described by DOFAW that pertain directly to wetland forest areas.

II.J.4. Implementation of Management Measure

Some of the major forested wetland areas in Hawaii (Alakai, Waikamoi, Hanawi, Kipahulu) are in various forms of protected area status. In addition, Waimanu on the Big Island is a National Estuarine Research Reserve. Because these forested wetlands are within protected areas, it is unlikely that forestry or silvicultural operations will be conducted on a commercial basis. However, salvage operations (*e.g.*, as a result of hurricanes) or other maintenance kinds of activities are sometimes conducted in these areas.

(i) Existing Organizational Structure: DNLR is the lead agency for implementing this management measure. Other agencies involved in implementation include:

- USACOE, which administers the Section 404, CWA, dredge and fill permit process; and
- USFWS, which is consulted on any federal action, including permit decisions, with respect to Section 7 of the Endangered Species Act.

(ii) Existing Regulatory and Non-Regulatory Mechanisms:

HRS	Chapter 171	Management and Disposition of Public Lands
HRS	Chapter 173A	Acquisition of Resource Value Lands
HRS	Chapter 183	Conservation District
HRS	Chapter 186	Tree Farm Program
HRS	Chapter 195	Natural Area Reserve
HRS	Chapter 195D	Conservation of Aquatic Life, Wildlife and Land Plants
HRS	Chapter 195F	Forest Stewardship
HRS	Chapter 198	Conservation Easements
HRS	Chapter 342D	Water Pollution
HRS	Chapter 342E	Nonpoint Source Pollution Control
HRS	Chapter 343	Environmental Impact Statements
HAR	Chapter 13-2	Conservation Districts
HAR	Chapter 11-54	Water Quality Standards

Chapter 173A, HRS, enables DLNR to acquire lands and waters having environmental value for public use. Chapter 198, HRS, authorizes DLNR to acquire conservation easements to preserve natural lands and waters.

DLNR is authorized under Chapter 183, HRS, "to manage and regulate all lands which may be set apart as forest reserves and to devise ways and means of protecting, extending, increasing, and utilizing the forests and forest reserves, more particularly for protecting and developing the springs, streams, and sources of water supply to increase and make the water supply available for use." A CDUA permit under Chapter 183, HRS, and Chapter 13-2, HAR, would be required before forestry operations were conducted in the State Conservation District. Chapter 183D, HRS, authorizes DLNR to "manage and administer the wildlife and wildlife resources of the State."

Under Chapter 195, HRS, DLNR is responsible for the management of NARS, which should "preserve in perpetuity specific land and water areas which support communities, as relatively unmodified as possible, of the natural flora and fauna, as well as geological sites, of Hawaii." It also empowers DLNR to establish NARS for areas with unique wetland values and native species.

The conservation of aquatic life, wildlife, and land plants pursuant to Chapter 195D, HRS, is also the responsibility of DLNR. This chapter authorizes DLNR to acquire habitat for endangered species restoration.

Under Chapter 171-54, HRS, the Board of Land and Natural Resources may issue land licenses for use of public lands, including harvesting of forest lands. While such licenses have not been issued for some time, they may be issued in the future. Conditions could be placed on these licenses requiring land users to implement best management practices, as specified by DLNR-DOFAW.

The Nature Conservancy of Hawaii (TNC) currently co-manages with several other organizations and agencies approximately 30,000 acres of wetlands, upland bogs, riparian stream corridors, and streams. TNCs conservation efforts have largely entailed acquisition programs, and the promotion of incentive programs for landowners to manage their resources for the long-term. TNC has also engaged in management and research, has lobbied Congress for acquisition funding for Hawaii, and worked to educate the public and lawmakers about the importance of acquiring and managing State Natural Area Reserves. TNC plans to increase its incentive programs for private landowners, and to promote additional partnership ventures, in order to leverage critically-needed resources for the future.

III. RECOMMENDATIONS for IMPLEMENTATION

III.1. Proposed Program Implementation

A. General Organizational Structure: At this time, forestry operations in Hawaii are occurring on an extremely small scale. A number of agencies and

officials at the State and county levels, however, would like to see the forestry industry expand and provide a viable alternative to the dying sugar industry. Plantation forestry is viewed as a practical alternative, particularly for the Hamakua coast of Hawaii. When the transition from plantation agriculture to forestry does occur, the scale and nature of these new operations will require attention to improved safeguards against potential nonpoint source pollution. At the same time, it must be recognized that forestry, as a land use, is likely to produce less pollution than most other current and potential land uses. While agencies and officials want to ensure that forestry does not contribute to water pollution, many also want to provide an organizational regime that will encourage investment in tree planting.

Therefore, the forestry focus group recommended that the implementation of the forestry management measures build upon existing regulatory and non-regulatory mechanisms, with an emphasis on encouraging participation in voluntary, incentive-driven programs. BMPs implementing the forestry management measures can be incorporated into CDUA permits, timber land licenses, and management plans developed and implemented under the Forest Stewardship and Tree Farm programs. It is also recommended that existing laws, regulations, and incentive programs be reviewed and amended to improve agency coordination and to optimize their effectiveness for forestry activities. As forestry activities increase and BMPs for forestry are further developed, other implementation mechanisms may be considered that more directly address forestry's contribution to polluted runoff.

Assuming that the majority of forestry operations will be undertaken on agricultural lands, DLNR's Forestry Stewardship and Tree Farm Programs appears to be the most logical mechanisms through which to implement the management measures initially. These programs provide incentives for land users to develop and implement management plans that could specify BMPs to reduce forestry's potential adverse effects on the environment. BMPs for nonpoint source pollution control can be encouraged as part of individual plans.

Because of the close relationship between forestry and agriculture in Hawaii, the agencies and organizations that support both of these industries will have expertise to assist forestry operators in developing and implementing management plans. While DLNR-DOFAW, USFS, and HFIA can contribute their expertise in forest management, NRCS, local SWCDs, DOA, and CES can contribute complementary expertise in erosion and sediment control, and nutrient and pesticide management. Coordination among these programs will maximize their technical assistance resources. A voluntary 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.

B. Monitoring and Enforcement: The most realistic and cost-effective means to protect coastal water quality from nonpoint source pollution from forestry 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 specified in approved management plans to assure that the BMPs are being implemented as specified will ultimately protect coastal water quality. DLNR-DOFAW 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 management plan, a polluted runoff problem develops, then the operator has an opportunity to work with DLNR-DOFAW and others to correct the problem. A Bad Actor Law, implemented by DOH, would take affect against polluters who are not cooperative and have not made a good faith effort to improve their operations.

Water quality monitoring would be used as a method to track the effectiveness of the BMPs implemented, rather than as a method of enforcement. Monitoring results would then be used to revise BMPs and the intensity of their implementation, and to further enhance forest management, 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 appropriately modify their management practices to protect coastal water quality.

In compliance with federal requirements, the State will evaluate the effectiveness of voluntary programs in implementing the forestry management measures. If voluntary programs are not successfully implementing the management measures, then regulatory measures will be considered. Individual operators who do not participate in a voluntary program may jeopardize its effectiveness and, thus, the very existence of the programs for all operators. In addition, operators who choose not to participate in a voluntary program will endure greater scrutiny and immediate action from DOH if found generating water pollution.

The schedule for implementing the forestry management measures depends primarily on the evolution of the forestry industry in Hawaii and will be developed when the need arises. The implementation schedule will include provisions to phase in the costs of the program, and to outline the interagency coordination and responsibilities of the operators. In addition, timing of implementation will depend, in part, on fiscal and personnel resources made available.

III.2. Implementing Actions

In order for the forestry management measures to be successfully implemented under existing programs such as DLNR's voluntary Forest Stewardship and Tree Farm Programs, a number of changes in governmental policies must be considered. The following recommendations will be explored in more detail in the coastal nonpoint pollution control program implementation plan.

A. Develop tree farm property tax classification

- Work with the counties to develop a county tree farm property tax classification for land dedicated to sound forest management based on approved plans. This will provide a powerful incentive for land users to participate in the Tree Farm Program. While the County of Hawaii has already initiated this process, it needs to be completed. In addition, the value of existing or growing forest trees should be exempted from assessed value for property taxes, eliminating a tax incentive for premature harvest and recognizing the longer rotation ages needed for forest management.

B. Provide adequate financial support for research and development activities, education and technical assistance

The forestry focus group recognized that the BMPs developed by DLNR-DOFAW do not fully address the management measures set forth by EPA. Similarly, existing regulatory and non-regulatory mechanisms are not comprehensive. It is the focus group's opinion that further development of BMPs and implementation mechanisms should be supported by sound science and practical experience in Hawaii and developed in tandem with supporting extension systems.

- Support continued BMP development by forestry professionals. In this development process, it must be recognized that there is limited local experience with large-scale forestry operations and limited local forestry research capacity. Additional assistance for BMP development should be provided through consultation with other states experienced in the implementation of BMPs. Local forestry staff should work on a cross-reference system for stream and soil classification. Additional applied research in other key areas will also be needed.

- As BMPs are researched and trials are conducted to provide a sound basis for BMPs in Hawaii, develop a manual describing forestry BMPs. 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.

  Schedule for Implementation:
  As BMPs are research Develop BMP manual for forestry practices.

- Seek FY97 funding of the Tropical Forestry Plan, produced by the U.S. Department of Agriculture as required by the federal Hawaii Tropical Forestry Act. This Plan would provide funding to the USFS, much of which would, in turn, be made available to DLNR-DOFAW in grants. It would be beneficial to have increased funding for service forester positions for DLNR-DOFAW to provide technical forestry support to private landowners and to monitor commercial forestry operations.

- Consider developing a forestry extension system through University of Hawaii's CES to provide specialized assistance, training and research.

Schedule for Implementation:

as resources are available	Increase funding for DLNR and other relevant agencies.

C. Support coordination among agencies

- Draft formal MOUs between agencies having technical and management expertise with respect to forestry practices and polluted runoff control. A number of State and federal agencies, and industry organizations will provide administrative and/or technical support for the implementation of the forestry management measures, including DLNR, DOH, DOA, USFS, NRCS, SWCDs, CES, and HFIA. The MOUs should specify levels of financial, personnel and technical commitment to developing and implementing the program.

- Draft statutory or regulatory amendments, as needed, to implement the organizational structure, provide program funding, enact a Bad Actor Law, and establish incentive mechanisms.

Schedule for Implementation:

December 1996	Draft MOU between participating agencies.
As Needed	Develop statutory or regulatory changes, as needed, and submit for consideration.

D. Facilitate the direct lease of State lands

- Facilitate the direct lease of State lands most suited to forestry in order to encourage responsible forest management. A direct lease recognizes the high up-front costs and long-term return on investment inherent to forestry operations which normally work to a disadvantage during a bid process. In order to secure a direct lease on State lands, however, a land user should be required to develop and implement a management plan specifying BMPs for nonpoint source pollution control. These plans should be implemented and BMPs installed according to a schedule determined by the State upon approval of the lease. Failure to implement the plan as specified should result in the termination of the lease agreement.

Schedule for Implementation:

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