
CHAPTER 6: Hydromodifications - Channelization, Channel Modification, Dams, Streambank and Shoreline Erosion

I. INTRODUCTION

According to the Environmental Protection Agency's (EPA) *Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters*, **hydromodification** means "alteration of the hydrologic characteristics of coastal and noncoastal waters, which in turn could cause degradation of water resources" (p 6-90). In other words, any alteration to a stream or coastal waters, whether a diversion, channel, dam, or levee, is considered a hydromodification.

The hydromodification management measures will affect all land use activities, especially those associated with agriculture, forestry and urban development. Therefore, these management measures should be considered in conjunction with the management measures for agriculture, forestry, urban areas and, to a lesser extent, marinas. In addition, the management measures for other land use categories are also relevant to the protection of streams and riparian areas. These management measures include:

- Forestry - II.B. - Streamside Management Zones
- Forestry - II.J. - Wetland Forests
- Wetlands - II.A. - Protection of Wetlands and Riparian Areas
- Wetlands - II.B. - Restoration of Wetlands and Riparian Areas
- Wetlands - II.C. - Vegetated Treatment Systems

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

- A **stream** is any natural water course in which water usually flows in a defined bed or channel. The flow can be constant, uniform, or uninterrupted, regardless of whether the stream has been altered or channelized.
- A **perennial stream** carries water at all times.
- An **intermittent stream** carries water most of the time but periodically ceases to flow when evaporation or seepage into the stream's 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.
- A **channel** is a natural or constructed waterway that continuously or periodically passes water.
- A **streambank** is the side slopes of a channel between which the streamflow is normally confined.

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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 management measure for Streamside Management Zones (SMZs) 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.1. Hydromodifications in Hawaii

Hawaii has 376 perennial streams, distributed among the islands as shown below:

Island	Perennial Streams
Kauai	61
Oahu	57
Molokai	36
Maui	90
Lanai	0
Hawaii	132
TOTAL	376

Hawaii generally has small watersheds with a limited amount of usable land area. Given this limited land area and various development pressures, land prices are very high. These factors have contributed to the development of closely-spaced housing and other intensive land uses neighboring streams.

Because of Hawaii's sub-tropical climate, "flashy" storm events consisting of high peak discharges and large volumes of runoff are common. County drainage standards were first developed in the 1960s to safely handle these runoff volumes, in order to protect life and property located close to streams. Consequently, many streams, especially in urban areas, have been channelized in the form of concrete box culverts that drastically alter the physical, chemical, hydrological, and ecological characteristics of streams. The Hawaii Stream Assessment (DLNR 1990) concluded that "over 19% of Hawaii's 376 perennial streams have been channelized to some degree, including most of those on Oahu. Approximately 34 have been lined with concrete or other material: one on Kauai, 26 on Oahu, four on Maui, and three on Hawaii (p 98)."

Hawaii has 129 structures that fit the size criteria for dams specified in EPA's *Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters*. Of these, 54 are considered unsafe (DLNR 1994).

I.2. Effects of Channelization and Channel Modification Activities

Channel modification activities have deprived wetlands and estuarine shorelines of enriching sediments, changed the ability of natural systems to both absorb hydraulic energy and filter pollutants from surface waters, and caused interruptions in the different life stages of aquatic organisms. Channel modification activities can also alter instream water temperature and sediment characteristics, as well as the rates and paths of sediment erosion, transport, and deposition. A frequent result of channelization and channel modification activities is a diminished suitability of instream and riparian habitat for fish and wildlife. Hardening of banks along waterways has eliminated instream and riparian habitat, decreased the quantity of organic matter entering aquatic systems, and increased the movement of nonpoint source pollutants from the upper reaches of watersheds into coastal waters.

I.3. Existing Mechanisms that Relate to the Control of Hydromodification Impacts

A number of State and county mechanisms generally address hydromodification activities and the mitigation of their impacts. These are described here and will be referenced in the management measure sections.

(a.) Section 401, Clean Water Act (CWA), administered by DOH: The Section 401, CWA, water quality certification is administered by DOH. Section 401 permits are required for proposed projects which must obtain the following permits: (1) federal permit to construct or operate a facility that may discharge polluted waters into navigable waters; (2) Section 404, CWA, dredge and fill permits administered by the U.S. Army Corps of Engineers (USACOE); (3) Section 10, Harbors and Rivers Act, permits; (4) U.S. Coast Guard (USCG) bridge permit; and Section 402, CWA, permits NOT issued or administered by the State. (All State-issued Section 402 permits do not require a Section 401 permit.)

(b) Hawaii Water Code, administered by DLNR: 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.

(c) State Environmental Impact Statement Law: Chapter 343, HRS, and Chapter 11-200, HAR, both relating to the Environmental Impact Statement law, require the preparation of an environmental assessment (EA) and/or environmental impact statement (EIS) for proposed activities that trigger the environmental review process. The trigger conditions are as follows: (1) use of State or county lands or funds; (2) use within the conservation district; (3) use within a shoreline setback area; (4) use within the Waikiki special district; (5) use within an historic site; (6) reclassification of conservation lands; (7) amendment to a county general plan; and (8) construction of helicopter facilities. If a project may significantly affect the environment, an agency or applicant must prepare a full EIS. Otherwise, only an environmental assessment is required.

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(d) Coastal Zone Management Law: Chapter 205A, HRS and Chapter 1-2, HAR, delegate responsibility for implementing permit applications and reviewing and approving projects within the State's SMAs and shoreline setback areas to the counties. The goals are to preserve, protect, and where possible, restore the natural resources of the coastal zone of Hawaii, recognizing that special development controls within the shoreline area are necessary to avoid permanent loss of access and use. The Maui Planning Department adds restrictions for retention basins for many SMA permit applications and actively applies the EA significant criteria (Chapter 11-200, HAR) to the review of all zoning and SMA permit applications. Maui County also has set drainage requirements and other stream impact criteria for some zoning districts under Title 19, MCC.

(e) Kauai Constraint Districts: Kauai County has implemented "Constraint Districts" to mitigate the impact of developments in six specific districts: drainage, flood, shore, slope, soil, and tsunami. These constraint districts are designed to (a) identify areas where particular biological, physical, and ecological characteristics of the land, water, and atmosphere indicate that standard requirements for development, modification, or use may be inadequate to ensure general health or maintenance of established physical, geologic, and ecological forms and systems; (b) to ensure development, modification, or use will not create substantial threats to health or maintenance of established physical, geologic, and ecological forms and systems; and (c) to permit development, modification, or use when it can be shown that ecological interrelationships will be improved or not significantly depreciated.

(f) State Water Pollution Control Statutes: 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.

(g) Stream Water Quality Standards: DOH establishes and enforces the State water quality standards (Chapter 11-54, HRS). The inland waters - streams, lakes, and wetlands - are separated into three classifications:

Class 1: [are to] remain in their natural state as nearly as possible with an absolute minimum of pollution from any human-caused source. To the extent possible, the wilderness character of these areas shall be protected. Waste discharged into these waters is prohibited. Any conduct which results in a demonstrable increase in levels of point or nonpoint source contamination in class 1 waters is prohibited.

Class 1(a): [Uses protected in class 1.a. waters] are scientific and educational, protection of breeding stock... compatible recreation, aesthetic enjoyment, and other nondegrading uses....

Class 1(b): [Uses protected in class 1.b. waters in addition to the uses protected in class 1.a. waters] are domestic water supplies....

Class 2: [Class 2 waters are to be protected] for recreational purposes... agricultural and industrial water supplies....

The existing Class I waters in the State are specifically described in Section 11-54-05.1, HAR.

DOH, Environmental Planning Office, is currently preparing proposed amendments to the stream water quality standards.

II. CHANNELIZATION AND CHANNEL MODIFICATION MANAGEMENT MEASURES

One form of hydromodification is *channelization* or *channel modification*. These terms (used interchangeably) describe river and stream channel engineering systems that facilitate flood control, navigation, drainage improvement, and reduction of channel migration potential. Activities such as straightening, widening, deepening, or relocating existing stream channels and clearing or snagging operations fall into this category. These forms of hydromodification typically result in more uniform channel cross-sections, steeper stream gradients, and reduced average pool depths.

The terms *channelization* and *channel modification* are also used in this chapter to refer to the excavation of borrow pits, canals, underwater mining, or other practices that change the depth, width, or location of waterways or embayments in coastal areas. Excavation of marina basins is addressed separately under the marina and recreational boating management measures in Chapter 5.

A. Management Measure for Physical and Chemical Characteristics of Surface Waters

- (1) Evaluate the potential effects of proposed channelization and channel modification on the physical and chemical characteristics of surface waters in coastal areas;**
- (2) Plan and design channelization and channel modification to reduce undesirable impacts; and**
- (3) Develop an operation and maintenance program for existing modified channels that includes identification and implementation of opportunities to improve physical and chemical characteristics of surface waters in those channels.**

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II.A.1. Description

The physical and chemical characteristics of surface waters that may be influenced by channelization and channel modification include sediment, turbidity, salinity, temperature, nutrients, dissolved oxygen, oxygen demand, and contaminants.

Implementation of this management measure is intended to occur concurrently with the implementation of Management Measure B (Instream and Riparian Habitat Restoration) of this chapter. The purpose of this management measure is to ensure that the planning process for new hydromodification projects addresses changes to physical and chemical characteristics of surface waters that may occur as a result of the proposed work. The programs to maintain existing channels should make use of any opportunities to improve the physical and chemical characteristics of the surface waters.

II.A.2. Applicability

This management measure applies to public and private channelization and channel modification activities to prevent the degradation of physical and chemical characteristics of surface waters from such activities. This management measure applies to any proposed channelization or channel modification projects, including levees, as well as existing modified channels.

II.A.3. Management Practices

- a. Use models/methodologies as one means to evaluate the effects of proposed channelization and channel modification projects on the physical and chemical characteristics of surface waters. Evaluate these effects as part of watershed, land use, and new development plans.

II.A.4. Implementation of Management Measure

A list of the existing programs, statutes, rules or ordinances that currently address aspects of this management measure follows. See Section V “Recommended Implementing Actions” on page III-226 for a description of the changes in governmental policies that are recommended to facilitate effective implementation of the hydromodification management measures.

(i) Existing Organizational Structure: The Department of Health (DOH), Environmental Management Division, is the lead agency for implementation of this management measure because of its responsibilities for water pollution control. Water quality assessments are required under the Section 401, Clean Water Act (CWA), a water quality certification process administered by DOH. Other federal, State, and local agencies involved in implementation include:

- Commission on Water Resource Management (CWRM), which administers the Stream Channel Alteration Permit (SCAP);
- Department of Land and Natural Resources (DLNR), which administers the Conservation District Use (CDUA) permit, and reviews for modification of stream channels;
- Hawaii Coastal Zone Management (CZM) Program, which reviews for consistency with CZM objectives and policies; and

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- County departments of planning, which administer the Shoreline Management Area (SMA) permit and shoreline setback provisions, if a stream channel project is planned in the SMA.

(ii) Existing Regulatory and Non-Regulatory Mechanisms:

HRS	Chapter 183	Conservation District
HRS	Chapter 205A	Coastal Zone Management
HRS	Chapter 342D	Water Pollution Control
HRS	Chapter 342E	Nonpoint Source Pollution
HRS	Chapter 343	Environmental Impact Statements
HAR	Chapter 1-2	Special Management Areas/Shoreline Areas
HAR	Chapter 11-54	Water Quality Standards
HAR	Chapter 11-200	Environmental Impact Statements
HAR	Chapter 13-2	Conservation Districts
HAR	Chapter 13-104	Forest Reserves
HAR	Chapter 13-169	Protection of Instream Uses of Water
ROH	Chapter 23	Shoreline Setbacks
ROH	Chapter 25	Shoreline Management
MCC	Chapter 19	Zoning

The Section 401, CWA, Water Quality Certification process; Hawaii Water Code; the State's Environmental Impact Statement (EIS) law; the Coastal Zone Management law; the Kauai County Constraint Districts; and the State's water pollution control statutes and administrative rules are all relevant to this management measure. These mechanisms are described briefly on pages III-207 - III-209.

The counties (Section 46-11.5, HRS) are responsible for the maintenance of channels, streams, streambanks, and drainageways which may remove sources of nonpoint pollution. For lands comprising the channels, streams, streambanks, and drainageways that are privately owned or owned by the State, the respective owner is responsible for maintenance. Hawaii and Kauai counties use Chapter 46-11.5, HRS, to implement stream maintenance responsibilities. Hawaii County conducts stream cleaning operations upon request or in response to a complaint. Kauai County cleans streams in response to complaints and as needed based on the results of inspections every two years.

Maui County and the City and County of Honolulu use county requirements to enforce and complement Chapter 46-11.5, HRS. Maui County (Chapter 12.12, MCC, and Chapter 46-11.5, HRS) conducts stream cleaning operations by request, in response to a complaint, or on an 'as needed' basis. City and County of Honolulu (Section 41-26.3, ROH, and Chapter 46-11.5, HRS) currently requires land owners to maintain streams and remove silt, vegetation, debris, and other items that may interfere with the natural flow of the water. Stream channel mouths are cleaned at a minimum of once every five years (flood prevention related maintenance only). The City and County of Honolulu maintains that streambank cleanup is the responsibility of property owners. The County enforces

clean-ups by giving 30-day notice, by cleaning the stream itself and billing the owner, and/or by contracting the cleanup and billing the owner.

Chapter 13-104, HAR, administered by DLNR, addresses all activities in forest reserves, including general pollution concerns. Within a forest reserve, it is prohibited to drain, dump, or leave any material which pollutes or is likely to cause pollution in the forest reserve, its streams, and other water sources. This includes any litter, animal waste, or animal remains.

B. Instream and Riparian Habitat Restoration Management Measure

- (1) Evaluate the potential effects of proposed channelization and channel modification on instream and riparian habitat in coastal areas;**
- (2) Plan and design channelization and channel modification to reduce undesirable impacts; and**
- (3) Develop an operation and maintenance program with specific timetables for existing modified channels that includes identification of opportunities to restore instream and riparian habitat in those channels.**

II.B.1. Description

The impacts of channelization and channel modification projects can and have had detrimental effects on instream and riparian habitats. Fortunately there are management measures that can prevent or correct the impact of channelization. Levees can be constructed to allow for overbank flooding which provides surface water contact to streamside areas (including wetlands and riparian areas). Compound-channel designs, consisting of an incised, narrow channel to carry surface water during low (base)-flow periods, a staged overbank area into which the flow can expand during design flow events, and an extended overbank area, sometimes with meanders, for high-flow events can lessen the impact on instream and riparian habitats.

II.B.2. Applicability

This management measure applies to any proposed channelization or channel modification project to determine changes in instream and riparian habitats and to existing modified channels to evaluate possible improvements to these environments.

II.B.3. Management Practices

- a. Use models/methodologies to evaluate the effects of proposed channelization and channel modification projects on instream and riparian habitats and to determine the effects after such projects are implemented.
- b. Identify and evaluate appropriate best management practices (BMPs) for use in the design of proposed channelization or channel modification projects or

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in the operation and maintenance program of existing projects. Identify and evaluate positive and negative impacts of selected BMPs and include costs.

II.B.4. Implementation of Management Measure

A list of the existing programs, statutes, rules or ordinances that currently address aspects of this management measure follows. See Section V “Recommended Implementing Actions” on page III-226 for a description of the changes in governmental policies that are recommended to facilitate effective implementation of the hydromodification management measures.

(i) Existing Organization Structure: Various agencies are involved in evaluating the effects of channelization and planning channelization projects to minimize their impacts. Federal, State and local agencies involved in implementation include:

- DOH, Environmental Management Division, which administers the water quality certification process under Section 401, CWA;
- Hawaii CZM Program, which reviews for consistency with CZM objectives and policies;
- CWRM, which administers the SCAP;
- DLNR, which administers the CDUA permit and reviews for modification of stream channels; and
- County planning departments, which administer the SMA permit and shoreline setback provisions, when channelization projects are planned within the SMA.

(ii) Existing Regulatory and Non-Regulatory Mechanisms:

HRS	Chapter 46-11	Maintenance of Channels, Streambeds, Streambanks, and Drainageways
HRS	Chapter 174C	Hawaii Water Code
HRS	Chapter 205A	Coastal Zone Management
HRS	Chapter 343	Environmental Impact Statements
HRS	Chapter 342D	Water Pollution Control
HRS	Chapter 342E	Nonpoint Source Pollution
HAR	Chapter 1-2	Special Management Areas/Shoreline Areas
HAR	Chapter 11-54	Water Quality Standards
HAR	Chapter 11-200	Environmental Impact Statements
HAR	Chapter 13-104	Forest Reserves
HAR	Chapter 13-169	Stream Channel Alteration
ROH	Chapter 41-26	Regulated Activities Within the City
ROH	Chapter 2	Shoreline Setbacks
ROH	Chapter 25	Shoreline Management
MCC	Chapter 12.12	Street and Highway Excavations
MCC	Chapter 19	Zoning

The Section 401, CWA, Water Quality Certification process; the Hawaii Water Code; the State’s Environmental Impact Statement (EIS) law; the Coastal Zone

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Management law; the Kauai County Constraint Districts; and the State's water pollution control statutes and administrative rules are all relevant to this management measure. These mechanisms are described briefly on pages III-207 - III-209.

The only existing State or county mechanisms that directly address instream and habitat restoration *per se* is the State Water Code. Section 174C-71, HRS, of the Hawaii Water Code mandates that an instream flow program be established to protect, enhance, and re-establish, where practicable, beneficial instream uses of water. However, to date, no such program has been implemented.

The counties (Section 46-11.5, HRS) are responsible for the maintenance of channels streams, streambanks, and drainageways which may remove sources of nonpoint pollutants. See page III-211 for a description of county, State and private responsibilities.

III. DAMS MANAGEMENT MEASURES

Dams are defined in EPA's *Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters* as constructed impoundments that are either: (1) 25 feet or more in height *and* greater than 15 acre-feet in capacity; or (2) 6 feet or more in height *and* greater than 50 acre-feet in capacity.¹ This definition of a dam would apparently also include large retention/detention/ siltation basins if any of these structures meet the specified size criteria in the applicability statements.

A. Management Measure for Erosion and Sediment Control

- (1) Reduce erosion and, to the extent practicable, retain sediment onsite during and after construction, and**
- (2) Prior to land disturbance, prepare and implement an approved erosion and sediment control plan or similar administrative document that contains erosion and sediment control provisions.**

III.A.1. Description

The purpose of this management measure is to prevent sediment from entering surface waters during construction or maintenance of dams. This measure should be incorporated into existing State erosion and sediment control programs at the local level. Erosion and sediment control is intended to be part of a comprehensive land use or watershed management program. Refer to the

¹This definition is consistent with the federal definition at 33 CFR 222.8(h)(1) (1991).

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Watershed and Site Development Management Measures in Chapter 4, which cover urban areas.

III.A.2. Applicability

This management measure applies to the construction and maintenance of dams. Dams are defined as constructed impoundments which are either:

- (a) 25 feet or more in height *and* greater than 15 acre-feet in capacity, or
- (b) six feet or more in height *and* greater than 50 acre-feet in capacity.

Hawaii has 129 structures that fit the size criteria for the management measures for dams.

III.A.3. Management Practices

- a. Preserve trees and other vegetation that already exist near the dam construction site.
- b. Control runoff from the construction site and construction-related areas.
- c. Control soil and surface water runoff during construction

III.A.4. Implementation of Management Measure

A list of the existing programs, statutes, rules or ordinances that currently address aspects of this management measure follows. See Section V “Recommended Implementing Actions” on page III-226 for a description of the changes in governmental policies that are recommended to facilitate effective implementation of the hydromodification management measures.

(i) Existing Organization Structure: Responsibility for implementing this management measure is shared among the following county, State and federal agencies:

- County departments of public works, which administer the grading ordinances;
- CWRM, which administers the SCAP;
- DOH, Environmental Management Division, which implements programs for water pollution control;
- USACOE, which administers the Section 404, CWA, permit process;
- DLNR, which administers the CDUA permit, and reviews for modification of stream channels;
- Hawaii CZM Program, which reviews for consistency with CZM objectives and policies; and
- County departments of planning, which administer the SMA permit and shoreline setback provisions, for projects planned within the SMA.

(ii) Existing Regulatory and Non-Regulatory Mechanisms:

HRS	Chapter 174C	Hawaii Water Code
HRS	Chapter 205A	Coastal Zone Management
HRS	Chapter 342D	Water Pollution Control
HRS	Chapter 342E	Nonpoint Source Pollution
HRS	Chapter 343	Environmental Impact Statements

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HAR	Chapter 1-2	Special Management Areas/Shoreline Areas
HAR	Chapter 11-54	Water Quality Standards
HAR	Chapter 11-55	Water Pollution Control
HAR	Chapter 11-200	Environmental Impact Statements
HAR	Chapter 13-104	Forest Reserves
HAR	Chapter 13-169	Stream Channel Alteration
HAR	Chapter 13-190	Dams and Reservoirs
HCC	Chapter 10	Soil Erosion and Sediment Control
KCC	Chapter 22-7	Grading, Grubbing and Stockpiling
ROH	Chapter 14	Public Works Infrastructure Requirements
ROH	Chapter 14-13	Provisions for Grading, Soil Erosion & Sediment Control
MCC	Chapter 20.08	Soil Erosion and Sediment Control

Chapter 180C, HRS, administered by DOH, mandated that counties enact ordinances to control soil erosion from land disturbing activities. Each county has adopted grading ordinances, administered by the departments of public works, which require land users to obtain grading permits for any grading, grubbing, or stockpiling. Chapter 180C, HRS, was repealed once counties promulgated their grading ordinances.

Chapter 10, HCC, prohibits grading, grubbing, or stockpiling without a permit. The maximum area of land that may be cleared for grading and grubbing is 20 acres at one time (§10-20) and all permits must conform to erosion and sediment control standards as well as guidelines established by the County of Hawaii Department of Public Works (§10-26). Whenever feasible, natural vegetation should be retained on-site [§10-22(b)].

Chapter 22-7, KCC, requires a grading permit for grading, stockpiling, and grubbing. There are additional requirements for areas of one acre or more, or where slopes equal or exceed 20%.

Chapter 20.08, MCC, provides minimum standards to regulate and control grading and grubbing. Permit application must be accompanied by plans and specifications, including a plot plan describing soil, details, and locations of proposed land drainage patterns, drainage structures, drainage pipes, and retaining walls. If an area is more than one acre, a drainage and erosion control plan must be prepared by an engineer, showing the scheme for controlling erosion and disposal of runoff water. All drainage and erosion control plans must be submitted to the applicable soil and water conservation district (SWCD) for review and approval (§20.08.080).

Chapter 14-14, ROH, prohibits grading, grubbing, or stockpiling without a permit. If the area involved is 15,000 square feet or more, a grading plan and specifications are required. If the area involved is one acre or more, an additional drainage and erosion control plan is required (§14-14.2). If the proposed grading is on land with slopes exceeding 15%, or if any fill is to be placed over a swamp, pond, gully or lake, an engineer's soils report must be submitted [§14-14.2(a)(9)].

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While State and federal dam projects are not required to follow the county grading and drainage requirements, they usually follow the county standards because they lack their own standards. Further, if State and federal projects do not follow county grading and drainage standards, they risk refusal to tie into county services. Maui County, for example, will not allow any project to tie into its storm drain system or any other facility unless Maui County permits are issued and County standards are followed.

The Section 401, CWA, Water Quality Certification process; the Hawaii Water Code; the State's Environmental Impact Statement (EIS) law; the Coastal Zone Management law; the Kauai County Constraint Districts; and the State's water pollution control statutes and administrative rules are relevant to this management measure. These mechanisms are described briefly on pages III-207 - III-209.

DLNR inspects dams every five years, but this applies only to safety concerns. It is believed, however, that implementing these provisions would also help control erosion.

B. Management Measure for Chemical and Pollutant Control

- (1) Limit application, generation, and migration of toxic substances;**
- (2) Ensure the proper storage and disposal of toxic materials; and,**
- (3) Apply nutrients at rates necessary to establish and maintain vegetation without causing significant nutrient runoff to surface waters.**

III.B.1. Description

The purpose of this management measure is to prevent downstream contamination from pollutants associated with dam construction activities.

Although suspended sediment is the major pollutant generated at a construction site (EPA 1973), other pollutants include:

- Pesticides - insecticides, fungicides, herbicides, rodenticides;
- Petrochemicals - oil, gasoline, lubricants, asphalt;
- Solid wastes - paper, wood, metal, rubber, plastic, roofing materials;
- Construction chemicals - acids, soil additives, concrete-curing compounds;
- Wastewater - aggregate wash water, herbicide wash water, concrete-curing water, core-drilling wastewater, or clean-up water from concrete mixers;
- Garbage;
- Cement;
- Lime;
- Sanitary wastes; and
- Fertilizers.

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III.B.2. Applicability

This management measure applies to construction and maintenance activities. Dams are defined as constructed impoundments which are either:

- (a) 25 feet or more in height *and* greater than 15 acre-feet in capacity, or
- (b) 6 feet or more in height *and* greater than 50 acre-feet in capacity.

This management measure addresses fuel and chemical spills associated with dam construction, as well as concrete washout and related construction activities. Hawaii has 129 structures that fit the size criteria of the management measures for dams.

III.B.3. Management Practices

- a. Develop and implement a spill prevention and control plan. Agencies, contractors, and other commercial entities associated with the dam construction project that store, handle, or transport fuel, oil, or hazardous materials should have a spill response plan, especially if large quantities of oil or other pollution liquid materials are used.
- b. Maintain and wash equipment and machinery in confined areas specifically designed to control runoff.
- c. Locate fuel and vehicle maintenance staging areas away from surface waters and all drainages leading to surface waters, and design these areas to control runoff.
- d. Store, cover, and isolate construction materials, refuse, garbage, sewage, debris, oil, and other petroleum products, mineral salts, industrial chemicals, and topsoil to prevent runoff of pollutants and contamination of ground water.

III.B.4. Implementation of Management Measure

A list of the existing programs, statutes, rules, or ordinances that currently address aspects of this management measure follows. See Section V “Recommended Implementing Actions” on page III-226 for a description of the changes in governmental policies that are recommended to facilitate effective implementation of the hydromodification management measures.

(i) Existing Organizational Structures: The Department of Agriculture (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 nutrients. Other State and local agencies involved in implementation include:

- DOH, which implements programs for water pollution control and safe drinking water;
- Hawaii CZM Program, which reviews for consistency with CZM objectives and policies;
- CWRM, which administers the SCAP;
- DLNR, which administers the CDUA permit, and reviews for modification of stream channels; and

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- Counties, which administer the SMA permit and shoreline setback provisions, and zoning ordinances.

(ii) Existing Regulatory and Non-Regulatory Mechanisms:

HRS	Chapter 128D	Hawaii Environmental Response Law
HRS	Chapter 149A	Pesticides Law
HRS	Chapter 174C	Hawaii Water Code
HRS	Chapter 205A	Coastal Zone Management
HRS	Chapter 342D	Water Pollution Control
HRS	Chapter 342E	Nonpoint Source Pollution
HRS	Chapter 343	Environmental Impact Statements
HRS	Chapter 460J	Pest Control Operators
HAR	Chapter 1-2	Special Management Areas/Shoreline Areas
HAR	Chapter 4-66	Pesticides
HAR	Chapter 11-54	Water Quality Standards
HAR	Chapter 11-200	Environmental Impact Statements
HAR	Chapter 11-451	State Contingency Plan
HAR	Chapter 13-169	Stream Channel Alteration
HAR	Chapter 13-190	Dams and Reservoirs

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, HRS, or its rules may be issued civil penalties, including fines ranging from not more than \$5,000 to not more than \$1,000 (depending on whether the violator is a business or private entity) or criminal penalties, including misdemeanor charges and fines ranging from not more than \$25,000 to not more than \$1,000 (depending on whether the violator is a business or private entity).

Chapter 4-66, HAR, administered by DOA, relates to the registration, licensing, certification, recordkeeping, usage, and other activities concerning the safe and effective use of pesticides. It requires that those who apply or directly supervise others who apply restricted use pesticides be certified. This certification requires some understanding of the environmental concerns of using pesticides. This requirement is implemented under the University of Hawaii Cooperative Extension Service (CES)/DOA Pesticide Applicator Program. Certification under Category 7 is required for industrial, institutional, and structural pest control (§4-66-56(7), HAR). Certification is not required for those using pesticides that are not classified as “restricted use.”

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

Chapter 128D, HRS, the Hawaii Environmental Response Law, is administered by DOH. It requires DOH to adopt rules establishing the quantity of a hazardous substance, pollutant, or contaminant that must be reported should it be released, as well as establishing the time periods during which the release must be reported. Chapter 128D, HRS, also requires DOH to adopt a Hawaii state contingency plan that includes methods and criteria for evaluating the degree of hazard present at a site with regard to hazardous substance, pollutant, or contaminant releases. In addition, it should be determined whether the site poses an imminent or substantial hazard, whether it is a priority site, and whether response actions are feasible and effective (§128D-7). In September 1995, DOH promulgated administrative rules (Chapter 11-451, HAR) to implement Chapter 128D, HRS.

The Section 401, CWA, Water Quality Certification process; the Hawaii Water Code; the State's Environmental Impact Statement (EIS) law; the Coastal Zone Management law; the Kauai County Constraint Districts; and the State's water pollution control statutes and administrative rules are also relevant to this management measure. These mechanisms are described briefly on pages III-207 - III-209.

C. Management Measure for Protection of Surface Water Quality and Instream and Riparian Habitat

Develop and implement a program to manage the operation of dams in coastal areas that includes an assessment of:

- (1) Surface water quality and instream and riparian habitat and potential for improvement and**
- (2) Significant nonpoint source pollution problems that result from excessive surface water withdrawals.**

III.C.1. Description

The purpose of this management measure is to protect the quality of surface waters and aquatic habitat in reservoirs and in the downstream portions of rivers and streams that are influenced by the releases (tailwaters) from reservoir impoundments. Impacts from the operation of dams to surface water quality and aquatic and riparian habitats should be assessed and the potential for improvement evaluated. Additionally, new upstream and downstream impacts to surface water quality and aquatic and riparian habitat caused by the implementation of practices should also be considered. The overall program approach is to produce a set of practices that can be applied individually or in combination to protect and improve surface water quality and aquatic habitat.

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Implementation of the most cost-effective operations should then be done where economically feasible.

A variety of approaches, described below, have been developed and tested for their effectiveness at improving or maintaining acceptable levels of dissolved oxygen, temperature, phosphorus, and other constituents in reservoirs and tailwaters.

III.C.2. Applicability

This management measure applies to dam operations that result in the loss of desirable surface water quality, and of desirable instream and riparian habitat. Dams are defined as constructed impoundments which are either:

- (a) 25 feet or more in height *and* greater than 15 acre-feet in capacity, or
- (b) 6 feet or more in height *and* greater than 50 acre-feet in capacity.

Hawaii has 129 structures that fit the size criteria for the management measures for dams.

NOTE: This measure does not apply to projects that fall under NPDES jurisdiction.

III.C.3. Management Practices

Aeration of Reservoir Waters and Releases:

- a. Pumping and Injection Practices
- b. Turbine Venting

Improving Oxygen Levels in Tailwaters:

- c. Grated Conduits
- d. Spillways
- e. Spillway Modifications
- f. Reregulation Weir
- g. Labyrinth Weir

Adjustments in the Operational Procedures of Dams for Improvement of Water Quality:

- h. Selective Withdrawal
- i. Turbine Operation

Watershed Protection:

- j. Land Use Planning
- k. Nonpoint Source Screening and Identification
- l. Soil Erosion Control
- m. Groundwater Protection
- n. Quarry Reclamation
- o. Animal Waste Control
- p. Failing Septic Systems

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Restore or Maintain Aquatic and Riparian Habitat:

- q. Flow Augmentation
- r. Riparian Improvements
- s. Aquatic Plant Management

Maintain Fish Passage:

- t. Behavioral Barriers
- u. Physical Barriers
- v. Fish Collection Systems
- w. Fish Diversion Systems
- x. Spill and Water Budgets
- y. Fish Ladders

III.C.4. Implementation of Management Measure

A list of the existing programs, statutes, rules or ordinances that currently address aspects of this management measure follows. See Section V “Recommended Implementing Actions” on page III-226 for a description of the changes in governmental policies that are recommended to facilitate effective implementation of the hydromodification management measures.

(i) Existing Organizational Structure: DOH, Environmental Management Division, is the lead agency for implementing this management measure. Other agencies involved in implementation include:

- CWRM, which administers the SCAP;
- DLNR, which administers the CDUA permit, and reviews for modification of stream channels;
- Hawaii CZM Program, which reviews for consistency with CZM objectives and policies; and
- Counties, which administer the SMA permit and shoreline setback provisions, and zoning ordinances.

(ii) Existing Regulatory and Non-Regulatory Mechanisms:

HRS	Chapter 174C	Hawaii Water Code
HRS	Chapter 205A	Coastal Zone Management
HRS	Chapter 342D	Water Pollution Control
HRS	Chapter 342E	Nonpoint Source Pollution
HRS	Chapter 343	Environmental Impact Statements

HAR	Chapter 1-2	Special Management Areas/Shoreline Areas
HAR	Chapter 11-54	Water Quality Standards
HAR	Chapter 11-200	Environmental Impact Statements
HAR	Chapter 13-169	Stream Channel Alteration
HAR	Chapter 13-190	Dams and Reservoirs

The Section 401, CWA, Water Quality Certification process; the Hawaii Water Code; the State’s Environmental Impact Statement (EIS) law; the Coastal Zone Management law; the Kauai County Constraint Districts; and the State’s water pollution control statutes and administrative rules are all relevant to this

management measure. These mechanisms are described briefly on pages III-207 - III-209.

IV. STREAMBANK AND SHORELINE EROSION MANAGEMENT MEASURE

Streambank erosion is used in this report to refer to the loss of fastland along nontidal streams and rivers. *Shoreline erosion* is used in this report to refer to the loss of beach or fastland in tidal portions of coastal bays or estuaries. Erosion of ocean coastlines is not regarded as a substantial contributor of nonpoint source pollution in coastal waterbodies and will not be considered in this report.

A. Management Measure for Eroding Streambanks and Shorelines

- (1) Where streambank or shoreline erosion is a serious nonpoint source pollution problem, streambanks and shorelines may need to [should] be stabilized. Vegetative methods are strongly preferred. Structural methods may be necessary where vegetative methods cannot work and where they do not interfere with natural beach processes or harm other sensitive ecological areas. [unless structural methods are more cost-effective, considering the severity of wave and wind erosion, offshore bathymetry, and the potential adverse impact on other streambanks, shorelines, and offshore areas.]**
- (2) Protect streambank and shoreline features with the potential to reduce nonpoint source pollution.**
- (3) Protect streambanks and shorelines from erosion due to uses of either the shorelands or adjacent surface waters.**
- (4) Where artificial fill is eroding into adjacent streams or coastal waters, it should be removed.**

IV.A.1. Description

Several streambank and shoreline stabilization techniques will be effective in controlling coastal erosion wherever it is a source of nonpoint pollution. Techniques involving marsh creation and vegetative bank stabilization (“soil bioengineering”) will usually be effective at sites with limited exposure to strong currents or wind-generated waves. In other cases, the use of engineering approaches, including beach nourishment or coastal structures, may need to be considered. In addition to controlling those sources of sediment input to surface waters which are causing nonpoint source pollution, these techniques can halt the destruction of wetlands and riparian areas located along the shorelines of surface waters. Once these features are protected, they can serve as a filter for

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surface water runoff from upland areas, or as a sink for nutrients, contaminants, or sediment already present as nonpoint source pollution in surface waters.

Stabilization practices involving vegetation or coastal engineering should be properly designed and installed. These techniques should be applied only when there will be no adverse effects to aquatic or riparian river habitats, or to the stability of adjacent shorelines, from stabilizing a shoreline sediment source. In addition, it is the intent of this measure to promote institutional measures that establish minimum set-back requirements or that allow a buffer zone to reduce concentrated flows and to promote infiltration of surface water runoff in areas adjacent to the shoreline.

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: Hawaii's environment has suffered as a result of the proliferation of hardening projects. Structural methods have resulted in channelized streams and hardened shorelines which have degraded environmental quality and increased nonpoint source pollution problems. This alternative measure will improve the protection of water quality and sensitive ecosystems.

IV.A.2. Applicability

This management measure applies to eroding shorelines in coastal bays and to eroding streambanks in coastal streams. The measure does not imply that all shoreline and streambank erosion must be controlled. Some amount of natural erosion is necessary to provide the sediment for beaches in estuaries and coastal bays, for point bars and channel deposits in rivers, and for substrate in tidal flats and wetlands. The measure, however, applies to eroding shorelines and streambanks that constitute a nonpoint source pollution problem in surface waters. It is not intended to hamper the efforts of any States or localities to retreat rather than to harden the shoreline.

IV.A.3. Management Practices

- a. Use soil bioengineering and other vegetative techniques to restore damaged habitats along shorelines and streambanks wherever conditions allow.
- b. Use properly designed and constructed engineering practices for shore erosion control in areas where practices involving marsh creation and soil bioengineering are ineffective.
- c. In areas where existing protection methods are being flanked or are failing, implement properly designed and constructed shore erosion control methods such as returns or return walls, toe protection, and proper maintenance or total replacement.
- d. Plan and design all streambank, shoreline, and navigation structures so that they do not transfer erosion energy or otherwise cause visible loss of surrounding streambanks or shorelines.
- e. Establish and enforce no-wake zones to reduce erosion potential from boat wakes.

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- f. Establish setbacks to minimize disturbance of land adjacent to streambanks and shorelines to reduce other impacts. Upland drainage from development should be directed away from bluffs and banks so as to avoid accelerating slope erosion.

IV.A.4. Implementation of Management Measure

A list of the existing programs, statutes, rules, or ordinances that currently address aspects of this management measure follows. See Section V “Recommended Implementing Actions” on page III-226 for a description of the changes in governmental policies that are recommended to facilitate effective implementation of the hydromodification management measures.

(i) Existing Organizational Structure: The CZM Program has been discouraging the hardening of natural shorelines in Hawaii due to its negative effects on adjacent and down-current areas. Because erosion can affect lands under both State and county jurisdictions, implementation of this management measure is shared between DLNR and the counties. Other agencies involved in implementation include:

- CWRM, which administers the SCAP;
- Hawaii CZM Program, which reviews for consistency with CZM objectives and policies; and
- DOH, which administers the State’s water pollution control programs.

(ii) Existing Regulatory and Non-Regulatory Mechanisms:

HRS	Chapter 174C	Hawaii Water Code
HRS	Chapter 200	Ocean Recreation and Coastal Areas
HRS	Chapter 205A	Coastal Zone Management
HRS	Chapter 342D	Water Pollution Control
HRS	Chapter 342E	Nonpoint Source Pollution
HRS	Chapter 343	Environmental Impact Statements
HAR	Chapter 1-2	Special Management Areas/Shoreline Areas
HAR	Chapter 11-54	Water Quality Standards
HAR	Chapter 11-200	Environmental Impact Statements
HAR	Chapter 13-169	Stream Channel Alteration
HAR	Chapter 13-190	Dams and Reservoirs

Chapter 200-3, HRS, requires DLNR to “assist in controlling shoreline erosion.” Repairing coastal protective structures and seawalls under the jurisdiction of the State are also the responsibility of DLNR.

The Section 401, CWA, Water Quality Certification process; the Hawaii Water Code; the State’s Environmental Impact Statement (EIS) law; the Coastal Zone Management law; the Kauai County Constraint Districts; and the State’s water pollution control statutes and administrative rules are also relevant to this management measure. These mechanisms are described briefly on pages III-207 - III-209.

V. RECOMMENDED IMPLEMENTING ACTIONS

As stated earlier, because Hawaii has a limited amount of usable land area, there is a tendency to intensively use as much of the available land as possible for any given project. This has often led to the development of closely-spaced housing and other intensive land uses neighboring streams. Because of Hawaii's sub-tropical climate, "flashy" storm events generate large volumes of runoff in short periods of time. County drainage standards have been developed to safely handle these runoff volumes in order to protect life and property located with close proximity to streams. The confluence of these interests has led to the inevitable channelization of many streams, often in the form of concrete box culverts that drastically alter the physical, chemical, hydrological, and ecological characteristics of streams. The recommendations below are meant to address these concerns by eliminating the need for further channelization through protection of the stream resources, effective land use planning, modification of engineering techniques to control runoff, and improved coordination of permit review.

A. Establish new development planning and drainage criteria to reduce runoff volumes. The drainage standards implemented by all counties are based primarily on flood control and safety criteria, not environmental criteria. Existing drainage criteria address structural requirements for runoff volumes, but only after runoff reaches the existing or proposed drainage system. Limiting or controlling the effects of channelization is linked to limiting the need for channelization itself. To reduce the need for channelization and to protect the natural drainage systems and riparian and aquatic habitats, the following changes to the county drainage standards should be considered:

- Revise and implement criteria for new urban development and drainage/flood control to facilitate onsite retention of surface drainage using a series of management practices designed to increase infiltration, reduce peak runoff, and limit discharged runoff to pre-development levels. (See management practices under II.A. New Development Management Measure in Chapter 4, "Urban Areas.")
- Drainage standards should address the incremental impacts on surface waters of siting new developments. Perennial streams flowing into those wetlands that serve as critical habitat for endangered waterbirds, as determined by USFWS or DLNR-DOFAW, should be given special consideration based on long-term watershed planning. These watersheds should be assessed for potential cumulative impacts of development under "build-out" scenarios.

B. Define streamside management zones (SMZs) that would come under more intense management. A useful management tool for watershed planning is the establishment of streamside management zones (SMZs) or "buffer areas" around all perennial streams in the State. 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

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mitigate the adverse effects. The SMZ is not an area of exclusion, but an area of closely managed activity.

- Consider alternative management policies and implementation options for SMZs. 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. There are several possible mechanisms for implementing SMZs around streams or stream segments that will be developed and examined in more detail during the CZM Program's ongoing study:
 - Rezone stream buffer areas to the State conservation district, as suggested in the most recent State Land Use District Boundary Review undertaken by OSP;
 - Include stream buffers within the county SMAs; or
 - Create overlay districts for SMZs.

There are several obvious consequences of these choices. A rezoning to the conservation district would provide a higher level of stream protection than the SMA alternative. Although the conservation district alternative would require an extensive process of delineation and rezoning, the precedent and processes for that rezoning are already in place. Once rezoned, activities in the SMZs would require a CDUA permit, which redirects the approval and control of land use activities from county to State authority. This alternative would be less desirable for watershed areas that are already urbanized.

The inclusion of SMZs within county SMAs would result in a zoning overlay that would bring activities near streams under far more scrutiny than at present, but would likely result in less stream protection than the conservation district alternative. Chapter 205A, HRS, may have to be revised to specifically allow for the designation of SMZs within county SMAs in order to protect coastal water quality. Approval authority for SMA applications would remain at the county level.

The third option would require creating new overlay districts around streams to protect their water quality.

One of the above alternatives may be more applicable to a particular stream or stream segment than the others. In fact, the most realistic solution may be a combination of alternatives, each applied where it is most applicable.

C. Adopt and Implement Proposed Rules for a Stream Protection and Management System

- DLNR should support the adoption of the proposed changes to Chapter 13-169, HAR, to facilitate a coordinated and statewide approach to the management of streams and their ecosystems.

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Section 174C-31(c)(4), HRS, states that the Commission on Water Resources Management (CWRM) shall “identify rivers or streams, or portions of a river or stream, which appropriately may be placed within a wild and scenic river system, to be preserved and protected as part of the public trust.” CWRM defined “wild and scenic rivers” as “rivers or streams, or portions of the [same], of high natural quality or possess significant scenic value, including, but not limited to, rivers and streams which are within the natural area reserves system.”

In response, CWRM appointed and convened the Stream Protection and Management (SPAM) task force comprising eight members representing diverse interests. In 1994, after information gathering, field trips, and statewide meetings, the task force published its recommendations and suggestions. CWRM staff produced additional recommendations.

The proposed changes to Chapter 13-169, HAR, create a Stream Protection and Management System that establishes categories of “heritage streams” and “valuable stream segments.” Criteria for nominating and adopting streams for such status, and management provision are outlined in the proposed changes. Another proposed amendment addresses polluted runoff control: “Recognition shall be given to the direct effect of activities within a watershed on the quality of stream water and the health of the stream ecosystem. Accordingly, where practicable, the protection of riparian lands as buffers shall be supported in order to reduce the amount of non-point source pollution entering a stream.” The proposed amendments further state that: “Channelization is discouraged in areas that are not yet urbanized. Accordingly, in an area that is not yet urbanized, a permit should not be granted unless it is deemed necessary to protect existing life or property and effective mitigation measures are proposed to reduce undesirable impacts.”

At this time, the draft rules for the SPAM System have been adopted for public review by CWRM and the Governor.

- Consider incorporating a long-range watershed planning and assessment approach into the SPAM Plan for protecting perennial streams flowing into wetlands that serve as critical habitats for endangered waterbirds, as determined by USFWS and DLNR-DOFAW. The potential cumulative effects of development should be assessed using “build-out” scenarios guided by county general plans, development plans, current zoning, or other useful long-range planning tools. In these build-out scenarios, the cumulative effects of runoff, sediment loads, and loads of different pollutants could be assessed according to existing land use designations and zoning. If these effects are unacceptable, mitigative action can be implemented *before* specific developments are proposed. Such long-range assessments are essential to setting appropriate development policy for these watersheds and to address potential problems prior to development.

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D. Create a coordinated agency review process for development plans

- Designate a coordinating agency to “shepherd” permit applications through the agency review and comment process. The intent of a coordinating agency is to: (a) ensure that a variety of agencies have the opportunity to comment in their fields of technical expertise as part of a review continuum; and (b) provide checks and balances to increase the chances of catching and resolving potential problem issues early in the permit application process.
- Cooperatively develop a consistent and standardized routing process for review of permit applications between the relevant federal, State, and county agencies. This can ensure adequate opportunity for review and comment by agencies knowledgeable in assessing specific types of impacts.

E. Expand Operation and Maintenance Program for Existing Hydromodifications

- Include in the operation and maintenance program for existing modified channels provisions for the identification and implementation of opportunities to improve physical and chemical characteristics of surface waters in those channels, and to restore instream and riparian habitats. Some mechanism, possibly as an amendment to the Hawaii Water Code (Chapter 174C, HRS), should be developed to include specific language for such provisions.
- Dam operation and maintenance programs should include provisions for the assessment of surface water quality and instream and riparian habitats as well as the assessment of potential for improvement of significant nonpoint source pollution problems that result from excessive surface water withdrawals. Chapter 13-190, HAR, should be revised to incorporate these specifications or another mechanism developed.

F. Develop Instream Flow Standards

- CWRM should set instream flow standards or implement the instream flow program required under Chapters 174C-71(1) and 174C-71(4), HRS, respectively.

G. Ensure Consistency with County Erosion Control and Drainage Standards for State Dam Construction Projects

- Hawaii should ensure that the State dam construction projects follow appropriate erosion control and drainage standards. The State could articulate a consistent policy to follow grading and drainage standards for dam construction in each county, or develop State grading and drainage standards that are in keeping with the most stringent county standards. Memoranda of agreement between the State and counties could be used to ensure adherence to proper standards.
- DLNR should revise Chapter 13-190, HAR, or develop another mechanism to provide erosion and sediment control guidelines for dams. The chapter’s

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provision for inspection of dams every five years should also be revised to include nonpoint source pollution-related erosion and sediment control criteria.

H. Implement Mechanisms to Ensure Proper Use, Handling, Storage, Transportation, and Disposal of Construction Chemicals and Provide Adequate Spill Prevention and Response Planning

- Refer to recommendations under III.B. Construction Site Chemical Control Management Measure in Chapter 4, “Urban Areas.” on p. III-124 - III-126.

I. Consider Alternative Streambank Vegetation Control Methods

- The counties should consider alternative methods to control streambank vegetation. Streambank erosion and stream water pollutant loadings could be reduced by replacing the use of herbicides for vegetation management with weed-whacking or other mechanical method.