

APPENDIX E

COMMENTS RECEIVED ON DRAFT ENVIRONMENTAL ASSESSMENT

COPY

LINDA LINGLE
GOVERNOR OF HAWAII

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SEP 03 2004



PETER T. YOUNG
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

DAN DAVIDSON
DEPUTY DIRECTOR - LAND

YVONNE Y. IZU
DEPUTY DIRECTOR - WATER



EKNA SERVICES, INC.

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
BUREAU OF CONVEYANCES
COMMISSION ON WATER RESOURCE MANAGEMENT
CONSERVATION AND COASTAL LANDS
CONSERVATION AND RESOURCES ENFORCEMENT
ENGINEERING
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

September 1, 2004

LD-NAV

KAHULUIHARBORDOT.RCM

Mr. Brian Ishii
Edward K. Noda and Associates, Inc.
615 Piikoi Street, #300
Honolulu, Hawaii 96814

Dear Mr. Ishii:

SUBJECT: Draft Environmental Assessment (Job H.C. 3334)
Project: Kahului Commercial Harbor Improvements
Applicant: State Department of Transportation
Location: District of Wailuku, County of Maui, Hawaii

Thank you for the opportunity to review and comment on the subject matter. A copy of the Draft Environmental Assessment covering the subject matter was transmitted to the following Department of Land and Natural Resources' Division for their review and comment:

- Division of Forestry and Wildlife
- Commission on Water Resource Management
- Engineering Division
- Division of Aquatic Resources
- Office of Conservation and Coastal Lands
- Division of State Parks
- Land Division Maui District Land Office
- Land-Planning and Development

Enclosed please find a copy of the Division of Forestry & Wildlife, Engineering Division and Division of Aquatic Resources comment. Based on the attached responses, the Department of Land and Natural Resources has no other comment to offer on the subject matter. Should you have any questions, please feel free to contact Nicholas A. Vaccaro of the Land Division Support Services Branch at (808) 587-0384.

Very truly yours,

DIERDRE S. MAMIYA
Administrator

C: MDLO

LINDA LINGLE
GOVERNOR OF HAWAII



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RECEIVED
LAND DIVISION

PETER T. YOUNG
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

DAN DAVIDSON
DEPUTY DIRECTOR - LAND

YVONNE Y. IZU
DEPUTY DIRECTOR - WATER

2004 AUG 17 A 10:23



04 AUG 13 A 8:02

COMMISSION ON WATER
RESOURCE MANAGEMENT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

AQUATIC RESOURCES
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KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

August 10, 2004

LD/NAV
KAHULUIHARBORDOT.CMT

Suspense Date: 8/18/04

MEMORANDUM:

- TO: *XXX Division of Forestry & Wildlife
 XXX Engineering Division
 XXX Division of Aquatic Resources
 *XXX Division of State Parks
 *XXX Commission on Water Resource Management
 XXX Office of Conservation and Coastal Lands
 XXX Land-Maui District Land Office (DD)
 *XXX Land-Planning and Development

FR

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TO

FROM: Dierdre S. Mamiya, Administrator
Land Division

SUBJECT: Draft Environmental Assessment (JOB H.C. 3334)
 Project: Kahului Commercial Harbor Improvements
 Applicant: State Department of Transportation
 Consultant: Edward K. Noda and Associates, Inc
 Location: District of Wailuku, County of Maui

Please review the DEA dated June 2004 pertaining to the subject matter and submit your comments (if any) on Division letterhead signed and dated by the suspense date.

***Note: One copy of the DEA is available for your review in the Land Division Office, Room 220.**

Should you need more time to review the subject matter, please contact Nicholas A. Vaccaro at ext.: 7-0384.

If this office does not receive your comments by the suspense date, we will assume there are no comments.

We have no comments.

Comments attached.

Date: 8/13/04

Signed: David Higazi

Name: DAVID HIGAZI

RECEIVED
LAND DIVISION

Division of Forestry & Wildlife

2004 AUG 15 11:17 AM Punchbowl Street, Rm. 325 • Honolulu, HI 96813 • (808) 587-0166 • Fax: (808) 587-0160

August 16, 2004

MEMORANDUM

TO: Nick Vaccaro, Land Agent
Land Division

THRU: Dierdre S. Mamiya, Administrator
Land Division

FROM: Paul J. Conry, Administrator
Division of Forestry and Wildlife



SUBJECT: **Draft Environmental Assessment (JOB H.C. 3334) Kahului Commercial Harbor Improvements by State Department of Transportation.**

DOFAW has reviewed this subject document and we provide the following comments for your consideration. In short, we recommend that the Department of Transportation strengthen its working plan for alien species detection through Hawaii's harbors and airports on all islands. The plan should be the product of an integrated intra-inter agency program emphasizing the prevention and control of alien species (plant and animal) movement through Hawaii's primary shipping ports and airports. In 1995, the Department of Transportation committed to being involved with a multi-agency partnership called (CGAPS - the Coordinating Group on Alien Pest Species) involving 14 state, federal, and private organizations to protect Hawaii's resources from harmful alien pests. The Department will need to continue its participation in CGAPS. The Statewide Transportation Plan must address the alien species issues and their potential devastating impacts to Hawaii's economy, environment, health and quality of life. A ten-point action plan was developed and information are available through Conservation Hawaii's web-page (<http://www.conservationhawaii.org/silent/action/>).

The improvements to Kahului harbor will expand commerce to the island of Maui, and we are concerned that this will bring new or existing alien pest species to the island. Similarly to Kahului Airport which has begun planning for a cargo inspection facility for alien pest prevention, we recommend that Department of Transportation, Harbors Division institute a similar cargo inspection facility, procedures and protocol for Kahului harbor. Maui's native resources have been compromised with invasive species i.e. coqui frog, miconia etc. The Statewide Transportation Plan should include mitigation of alien species introduction to Maui through Kahului harbor. Thank you for the opportunity to comment on this draft EA.

C: DOFAW, Maui Branch
Mindy Wilkinson, DOFAW Administration

RS ✓
FO ✓

Suspense Date: 10/18/04

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
Division of Aquatic Resources
Honolulu, Hawaii

MEMORANDUM

To: William Devick, Administrator
Division of Aquatic Resources

From: Jo-Anne N. Kushima, Aquatic Biologist

Subject: Draft Environmental Assessment (JOB H.C. 3334)
Kahului Commercial Harbor Improvements

Comments Requested By: Dierdre S. Mamiya, Administrator
Land Division

Date of Request: 08/10/04

Date Received: 08/18/04

Summary of Project

Title: Draft Environmental Assessment
Kahului Commercial Harbor Improvements
JOB H.C. 3334

Proj. By: State Department of Transportation)

Location: District of Wailuku, County of Maui

Brief Description:

This Environmental Assessment was prepared by the applicant for the proposed short-term improvements listed below, for the Kahului Commercial Harbor. The applicant is the Department of Transportation, Harbors Division (DOT-HAR) and the accepting authority is the Department of Transportation.

DOT-HAR recently completed the Kahului Harbor 2025 Master Plan. The 2025 Master Plan serves as a guide for development, maintenance and enhancement of the harbor. The recommendations in the 2025 Master Plan are to ensure the efficient, safe, accessible and economical operations of Kahului Commercial Harbor. To begin the process, DOT-HAR proposes to proceed with improvements identified in the 2025 Master Plan that need to be implemented within the next ten (10) years. These projects are located on the harbor's east side and include the:

- 1) Pier 1 extension (Pier 1D);
- 2) Pier 1 comfort stations, waterline and sewer line;
- 3) Pier 3 expansion;
- 4) New Pier 4;
- 5) New Pier 2C, including a passenger terminal, roadway and bridge; and
- 6) Structural pavement, access bridge and utilities at "Puunene Yard."

Additionally, as presented in this Environmental Assessment, it appears that DOT-HAR plans to incorporate the Pier 1C Mooring Dolphin improvement project, which is covered under a separate Environmental Assessment, dated March 2004, with the proposed harbor improvements listed above.

Concern Not Previously Identified:

A concern not previously identified by the Division of Aquatic Resources (DAR), during the Pre-Assessment Consultation process is listed under 4.10 BIOTIC COMMUNITIES, 4.10.1.4 ALIEN PEST SPECIES in the DEA. In this section, DOT-HAR acknowledges the problems associated with overseas arrivals of barges and cruise ships serving as vectors for the introduction of alien pest species, HOWEVER the discussion is limited to the terrestrial realm; the harmful effects of introductions of terrestrial organisms; plants, predators and insects which they identify, can damage native flora and fauna; carry diseases that can affect native species; affect agricultural crops and humans; and interrupt shipment of local produce.

The agencies primarily responsible for the prevention of terrestrial alien pest species introductions are identified as the State Department of Agriculture; U.S. Department of Homeland Security (formerly the U.S. Customs and U.S. Department of Agriculture); and the State Department of Health. These agencies monitor, inspect, quarantine and certify cargo from foreign ports and inter-state/intra-state cargo.

With regards to alien aquatic organism introductions, however, the Department of Land and Natural Resources (DLNR), DAR is designated the lead state agency for preventing the introduction and for carrying out the destruction of alien aquatic organisms through the regulation of ballast water discharges and hull fouling organisms through Act 134 Session Laws 2000. DAR is currently in the second funding period for its efforts to develop a ballast water management plan for the State of Hawaii. Working closely with the re-established Alien Aquatic Organism Task Force (AAOTF) to develop a ballast water management plan for Hawaii, DAR and the AAOTF have identified that a greater concern for Hawaii are the introductions of alien aquatic organisms through hull fouling. Previous studies have identified hull fouling as the primary vector for alien aquatic introductions in Hawaii with solid ballast and ballast water following.

Comments:

During the Pre-Assessment Consultation Process for the Kahului Harbor 2025 Master Plan, DAR suggested that DOT-HAR discuss in detail, any/all potential short term impacts, and to propose specific measures for averting or minimizing adverse effects as well as to provide possible mitigation measures for unavoidable damage to natural resource values. Additionally, DAR requested DOT-HAR describe potential hazards to the public from any structures during the construction period and to propose

mitigation measures, to protect fishermen, boaters and other recreational users who normally frequent and share the area of the proposed improvements.

DAR also recommends that DOT-HAR contact the Maui Ocean Center (MOC), if they have not already been contacted for comments. Portions of Kahului Harbor serve as the primary collection site for their displays. Additionally, MOC has identified some of the marine resources they collect to be unique to Kahului Harbor.

Our concerns regarding the necessary improvements DOT-HAR is proposing to undertake within the next 10 years will be done in already highly modified areas of Kahului Harbor. Because of this, they are not likely to diminish existing aquatic resource values in the immediate areas of the proposed improvements. As a precautionary measure, however, during the improvements we recommend that any/all fabrication and/or treatment of the materials to be used for the improvements, be done on fast land so that any paint, antifoulant or similar bioactive materials used for the improvements will have adequate drying or detoxifying time before being installed near the water.

As always, the applicant should take precautions during the improvement activity to prevent disturbed soil, debris, trash, petroleum products and other contaminants or toxic substances from entering the aquatic environment.

Thank you for providing us the opportunity to review and comment on the above proposed project.

LINDA LINGLE
GOVERNOR OF HAWAII



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LAND DIVISION



2004 AUG 19 A 10:39

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

August 10, 2004

PETER T. YOUNG
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

DAN DAVIDSON
DEPUTY DIRECTOR - LAND

YVONNE Y. IZU
DEPUTY DIRECTOR - WATER

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
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CONSERVATION AND COASTAL LANDS
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HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

LD/NAV
KAHULUIHARBORDOT.CMT

Suspense Date: 8/18/04

MEMORANDUM:

TO: *XXX Division of Forestry & Wildlife
XXX Engineering Division
XXX Division of Aquatic Resources
*XXX Division of State Parks
*XXX Commission on Water Resource Management
XXX Office of Conservation and Coastal Lands
XXX Land-Maui District Land Office (DD)
*XXX Land-Planning and Development

FROM: Dierdre S. Mamiya, Administrator *Dierdre Mamiya*
Land Division

SUBJECT: Draft Environmental Assessment (JOB H.C. 3334)
Project: Kahului Commercial Harbor Improvements
Applicant: State Department of Transportation
Consultant: Edward K. Noda and Associates, Inc
Location: District of Wailuku, County of Maui

Please review the DEA dated June 2004 pertaining to the subject matter and submit your comments (if any) on Division letterhead signed and dated by the suspense date.

***Note: One copy of the DEA is available for your review in the Land Division Office, Room 220.**

Should you need more time to review the subject matter, please contact Nicholas A. Vaccaro at ext.: 7-0384.

If this office does not receive your comments by the suspense date, we will assume there are no comments.

() We have no comments.

(X) Comments attached.

Date: 8/17/04

Signed: *Eric T. Hirono*

Name: ERIC T. HIRONO, CHIEF ENGINEER

DEPARTMENT OF LAND AND NATURAL RESOURCES
ENGINEERING DIVISION

LA/NAV

Ref.: KAHULUIHARBORDOT.CMT

COMMENTS

- (X) We confirm that the project site, according to the Flood Insurance Rate Maps (FIRM), is located in Flood Zone V23.
- () Please take note that the project site, according to the Flood Insurance Rate Map (FIRM), is located in Zones ____.
- () Please note that the correct Flood Zone Designation for the project site according to the Flood Insurance Rate Map (FIRM) is ____.
- (X) Please note that project site located in Zone V23 must comply with the rules and regulations of the National Flood Insurance Program (NFIP) presented in Title 44 of the Code of Federal Regulations (44CFR), whenever development within a Special Flood Hazard Area is undertaken. If there are any questions, please contact the State NFIP Coordinator, Ms. Carol Tyau-Beam, of the Department of Land and Natural Resources, Engineering Division at (808) 587-0267.

Please be advised that 44CFR indicates the minimum standards set forth by the NFIP. Your Community's local flood ordinance may prove to be more restrictive and thus take precedence over the minimum NFIP standards. If there are questions regarding the local flood ordinances, please contact the applicable County NFIP Coordinators below:

- () Mr. Robert Sumimoto at (808) 523-4254 or Mr. Mario Siu Li at (808) 523-4247 of the City and County of Honolulu, Department of Planning and Permitting.
- () Mr. Kelly Gomes at (808) 961-8327 (Hilo) or Mr. Kiran Emler at (808) 327-3530 (Kona) of the County of Hawaii, Department of Public Works.
- () Mr. Francis Cerizo at (808) 270-7771 of the County of Maui, Department of Planning.
- () Mr. Mario Antonio at (808) 241-6620 of the County of Kauai, Department of Public Works.

- () The applicant should include project water demands and infrastructure required to meet water demands. Please note that the implementation of any State-sponsored projects requiring water service from the Honolulu Board of Water Supply system must first obtain water allocation credits from the Engineering Division before it can receive a building permit and/or water meter.
- (X) The applicant should provide the water demands and calculations to the Engineering Division so it can be included in the State Water Projects Plan Update.

- () Additional Comments: _____

- () Other: _____

Should you have any questions, please call Mr. Andrew Monden of the Planning Branch at 587-0229.

Signed: 
ERIC T. HIRANO, CHIEF ENGINEER

Date: 8/17/04

LINDA LINGLE
GOVERNOR OF HAWAII



STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

August 10, 2004

PETER T. YOUNG
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

DAN DAVIDSON
DEPUTY DIRECTOR - LAND

YVONNE Y. IZU
DEPUTY DIRECTOR - WATER

AQUATIC RESOURCES
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HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

LD/NAV
KAHULUIHARBORDOT.CMT

Suspense Date: 8/18/04

MEMORANDUM:

TO: *XXX Division of Forestry & Wildlife
XXX Engineering Division
XXX Division of Aquatic Resources
*XXX Division of State Parks
*XXX Commission on Water Resource Management
XXX Office of Conservation and Coastal Lands
XXX Land-Maui District Land Office (DD)
*XXX Land-Planning and Development

FROM: Dierdre S. Mamiya, Administrator *[Signature]*
Land Division

SUBJECT: Draft Environmental Assessment (JOB H.C. 3334)
Project: Kahului Commercial Harbor Improvements
Applicant: State Department of Transportation
Consultant: Edward K. Noda and Associates, Inc
Location: District of Wailuku, County of Maui

Please review the DEA dated June 2004 pertaining to the subject matter and submit your comments (if any) on Division letterhead signed and dated by the suspense date.

***Note: One copy of the DEA is available for your review in the Land Division Office, Room 220.**

Should you need more time to review the subject matter, please contact Nicholas A. Vaccaro at ext.: 7-0384.

If this office does not receive your comments by the suspense date, we will assume there are no comments.

We have no comments.

Comments attached.

Date: 8-17-04

Signed: *Jason K. Koga*
Name: Jason K. Koga

LINDA LINGLE
GOVERNOR OF HAWAII

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LAND DIVISION



AUG 13 RECD

PETER T. YOUNG
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

DAN DAVIDSON
DEPUTY DIRECTOR - LAND

YVONNE Y. IZU
DEPUTY DIRECTOR - WATER



2004 AUG 17 A 10:01

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

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HONOLULU, HAWAII 96809

AQUATIC RESOURCES
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LAND
STATE PARKS

August 10, 2004

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KAHULUIHARBORDOT.CMT

Suspense Date: 8/18/04

MEMORANDUM:

TO: *XXX Division of Forestry & Wildlife
XXX Engineering Division
XXX Division of Aquatic Resources
*XXX Division of State Parks
*XXX Commission on Water Resource Management
XXX Office of Conservation and Coastal Lands
XXX Land-Maui District Land Office (DD)
*XXX Land-Planning and Development

FROM: Dierdre S. Mamiya, Administrator *[Signature]*
Land Division

SUBJECT: Draft Environmental Assessment (JOB H.C. 3334)
Project: Kahului Commercial Harbor Improvements
Applicant: State Department of Transportation
Consultant: Edward K. Noda and Associates, Inc
Location: District of Wailuku, County of Maui

- ___ ADMINISTRATOR
- ___ ASST ADMIN
- ___ DEV BR
- ___ PLAN BR
- ___ RES MGT BR
- ___ CLERICAL
- ___ ADMIN ASST
- ___ INTERP BR
- ___
- ___ CIRC/POST/STAFF RM
- ___ COMMENTS REC
- ___ DRAFT REVIEW
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- ___ FOLLOW UP
- ___ INFO
- ___ RUN COPIES
- ___ RUSH DEL
- ___ SEE ME
- ___ FAX/SEND COPY TO

Please review the DEA dated June 2004 pertaining to the subject matter and submit your comments (if any) on Division letterhead signed and dated by the suspense date.

***Note: One copy of the DEA is available for your review in the Land Division Office, Room 220.**

Should you need more time to review the subject matter, please contact Nicholas A. Vaccaro at ext.: 7-0384.

If this office does not receive your comments by the suspense date, we will assume there are no comments.

() We have no comments.

() Comments attached.

Date: 8/16/04

Signed: *[Signature]*

Name: Daniel S. Limu

LINDA LINGLE
GOVERNOR



STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
869 PUNCHBOWL STREET
HONOLULU, HAWAII 96813-5097

RODNEY K. HARAGA
DIRECTOR

Deputy Directors
BRUCE Y. MATSUI
BARRY FUKUNAGA
BRENNON T. MORIOKA
BRIAN H. SEKIGUCHI

IN REPLY REFER TO:

HAR-EP
7810.06

November 10, 2005

TO: RUSSELL TSUJI, ADMINISTRATOR
LAND DIVISION
DEPARTMENT OF LAND AND NATURAL RESOURCES

FROM: RODNEY K. HARAGA
DIRECTOR OF TRANSPORTATION

SUBJECT: RESPONSE TO COMMENTS, KAHULUI COMMERCIAL HARBOR 2025
MASTER PLAN ENVIRONMENTAL ASSESSMENT – JOB H. C. 3334

Thank you for your comments on the subject document dated September 1, 2004. We offer the following responses.

DIVISION OF FORESTRY & WILDLIFE:

1. Regarding your comment recommending that the Department of Transportation (DOT) strengthen its working plan for alien species detection through Hawaii's harbors and airports on all islands. The alien species issue is addressed in the *Kahului Commercial Harbor 2025 Master Plan Environmental Assessment* (EA) Section 4.10.1.4. While the DOT has no jurisdictional authority over the interdiction of alien species through its ports, the DOT is committed to assisting the responsible agencies, and is a member of the Coordinating Group on Alien Pest Species as well as other State working groups that are focused on the alien species issue. The DOT is committed to its continuing participation in these groups.
2. Regarding your concern that this will bring new or existing alien pest species to the island. The measures for the control of alien species introduction are discussed in the EA Section 4.10.1.4. As stated in the Draft EA, the Hawaii Department of Agriculture (HDOA), Hawaii Department of Health (HDOH) and other agencies have the responsibility for and jurisdiction over the prevention and mitigation of the introduction of alien species. In addition, the Hawaii Department of Land and Natural Resources (HDLNR), Division of Aquatic Resources (DAR) has jurisdiction over aquatic alien species. The role of DAR will be described in the Final EA.

In addition, the following information will also be added to the Final EA.

Alien species can be introduced purposefully or incidentally, such as by hitchhiking on cargo or as stowaways in the containers. Therefore, many of the alien pest species hitchhike on commodities imported by businesses and residents of Maui County. This is shown in the results from the Kahului Airport Risk Assessment, which indicates that the passengers are typically a low risk pathway for the importation of alien species. The high-risk commodities for the importation of alien pest species include plants and propagative plant parts. Other high-risk commodities include organic produce, leafy greens (such as lettuce, cabbage and kale), cut flowers, strawberries, and peppers. Other high-risk commodities, which enter through the Harbor, include Christmas trees and other plant material.

Once an alien species is established on one island it is highly likely to spread to other islands, especially seeds and flying insects. The inter-island dispersal pathways include, but are not limited to, seeds carried by birds, migration of birds, dispersal by wind and dispersal by ocean currents.

The HDOA has designated Kahului as a limited port-of-entry for overseas agricultural commodities; therefore only plants and plant products such as produce and cut flowers are allowed entry. Live animals (except live seafood for consumption) and microorganisms from foreign and domestic origins are not allowed entry through Kahului unless inspected by HDOA in Honolulu prior to the transport to Kahului.

Therefore, pursuant to the HRS, Section 150A-5 any person transporting any agricultural commodity to Hawaii shall notify the HDOA and hold the commodity on the dock, pier, wharf, airport, air terminal where they are first received or discharged until inspection can be made by the Plant Quarantine Inspector. However, because there has always been a shortage of space at the piers, transportation companies have been requesting more inspections to be done at sites other than the dock or at the dock but before or after regular work time to allow for the containers to be moved from the docks. For the maritime operations, the shippers will reimburse the State for the inspector's cost to inspect the containers during overtime hours.

Although HDOA manpower is limited at other ports, the addition of DOT funded agricultural inspectors at Kahului Airport allows the non-Airport inspectors to work more hours at the Harbor to perform the necessary inspections. In addition,

there are more inspectors to work overtime hours to inspect the incoming maritime commodities, if necessary.

Similarly, propagative agricultural commodities cannot move between islands without HDOA inspection. If this cargo is not inspected by HDOA, Young Brothers will not allow the cargo to be boarded onto the vessel. Non-propagative plant parts, such as cut flowers, fruits, vegetables and produce, need not be inspected provided that they are subject to random inspection by HDOA. Similarly, Hawaii Superferry is currently working on the HDOA requirements for their operations with HDOA and has included the following measures in their Tariff No. 1.

- *“Domestic cats and dogs **ONLY** may travel on Carrier’s [“Superferry”] vessels. No other animals are permitted except livestock and poultry from Hawaii Department of Agriculture (HDOA) licensed agricultural producers. Carrier does not permit the carriage of reptiles, snakes, birds (except HDOA registered poultry transported by registered growers), rodents or exotic species of animals of any kind.*
 - *Only plants, flowers and crops that have either been inspected and passed at the HDOA Plant Quarantine Office or via the Nursery Self Certification Program may be transported on Carrier’s [“Superferry”] vessel. In all cases, a “Passed” sticker must be shown before plants will be allowed on the ferry. No other plants will be permitted on the ferry and must be left for destruction by Carrier’s [“Superferry”] personnel.”*
3. Regarding your recommendation that the Harbors Division develop a cargo inspection facility. The Harbors Division’s budget is bereft of the benefit of State General Funds. The Harbors Division, however, is willing to support aliens species prevention measures within its limited capabilities and resources. Please be advised that Harbors Division has no jurisdictional authority over the interdiction, inspection, and quarantine of incoming passengers, cargo, pests and organisms. These responsibilities are with other state and federal agencies such as HDOA, HDOH, HDLNR and the U.S. Department of Agriculture. The Harbors Division may be able to designate space within Kahului Harbor for a cargo inspection facility. Please be advised, however, that maritime requirements for space with the commercial harbor are a pressing issue.

ENGINEERING DIVISION:

1. Regarding your comment about compliance with the rules and regulations of the National Flood Insurance Program (NFIP) presented in Title 44 of the Code of Federal Regulations (44 CFR), whenever development within a Special Flood Hazard Area is undertaken. The Harbors Division will comply with regulations of the National Flood Insurance Program as applicable.
2. Regarding your comment that the applicant should provide the water demands and calculations to the Engineering Division so it can be included in the *State Water Projects Plan Update*. The water demand, which is projected as 0.04 MGD for the year 2010, will be included in the Final Environmental Assessment. The Harbors Division has submitted this projected demand to the HDLNR.

DIVISION OF AQUATIC RESOURCES:

1. Regarding your comment identifying the DAR as the lead state agency for preventing the introduction and for carrying out the destruction of alien aquatic organisms through the regulation of ballast water discharges and hull fouling organisms. We will include HDLNR-DAR's role in the discussion on alien species.
2. Regarding your recommendation that any/all fabrication and/or treatment of the materials to be used for the improvements be done on fast land so that any paint, antifoulant or similar bioactive materials used for the improvements will have adequate drying or detoxifying time before being installed in/near the water. As stated in the EA, the Harbors Division will use mitigation measures such as Best Management Practices and silt curtains to prevent/minimize pollutants from entering into the water. The Final EA will recommend to the extent practical, that all fabrication will be performed on fast land to minimize impacts to the marine environment.

We appreciate your interest in the environmental review process. If you have any questions, please contact Glenn Soma of my Planning Staff at 587-2503.

LINDA LINGLE
GOVERNOR OF HAWAII



RS
C:BI
GENEVIEVE SALMONSON
DIRECTOR

STATE OF HAWAII
OFFICE OF ENVIRONMENTAL QUALITY CONTROL

235 SOUTH DERETANIA STREET
SUITE 702
HONOLULU, HAWAII 96813
TELEPHONE (808) 586-4185
FACSIMILE (808) 586-4186
E-mail: oeqc@health.state.hi.us

RECEIVED
SEP 08 2004

September 7, 2004

EKNA SERVICES, INC.

Ms. Iris Ishida
Department of Transportation – Harbors Division
State of Hawai'i
79 South Nimitz Highway
Honolulu, Hawai'i 96813

Mr. Brian Ishii
Edward K. Noda and Associates, Inc.
615 Pi'ikoi Street, Suite 300
Honolulu, Hawai'i 96814

Dear Ms. Ishida and Mr. Ishii:

The Office of Environmental Quality Control (OEQC) has reviewed the draft environmental assessment for the Kahului Commercial Harbor Improvements, Tax Map Key 3-7 (various), in the judicial district of Wailuku, and offers the following comment for your consideration.

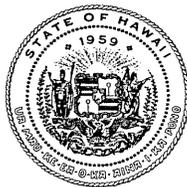
1. FUNDING: Please discuss the funding mechanism for the project.
2. GLASSPHALT: Please consider using glassphalt for paving the project.
3. SUSTAINABLE BUILDING AND NATIVE LANDSCAPING: Please refer to our Internet website and consider implementing the sustainable building guidelines developed by the Environmental Council as well as landscaping with xerophagic native plants.

Thank you for the opportunity to comment. If there are any questions, please call Mr. Leslie Segundo, Environmental Health Specialist, at (808) 586-4185.

Sincerely,

A handwritten signature in cursive script that reads "Genevieve Salmonson".
GENEVIEVE SALMONSON
Director

LINDA LINGLE
GOVERNOR



RODNEY K. HARAGA
DIRECTOR

Deputy Directors
BRUCE Y. MATSUI
BARRY FUKUNAGA
BRENNON T. MORIOKA
BRIAN H. SEKIGUCHI

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
869 PUNCHBOWL STREET
HONOLULU, HAWAII 96813-5097

IN REPLY REFER TO:

HAR-EP 7811.05

November 14, 2005

TO: GENEVIEVE K.Y. SALMONSON, DIRECTOR
OFFICE OF ENVIRONMENTAL QUALITY CONTROL
DEPARTMENT OF HEALTH

FROM: RODNEY K. HARAGA
DIRECTOR OF TRANSPORTATION

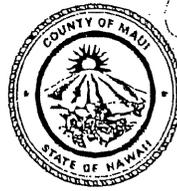
SUBJECT: RESPONSE TO COMMENTS, KAHULUI COMMERCIAL HARBOR 2025
MASTER PLAN ENVIRONMENTAL ASSESSMENT – H.C. 3334

Thank you for your comments on the subject document dated September 7, 2004. We offer the following response.

1. Regarding your comment about including the funding mechanism for master plan recommended improvements. The funding of the projects will be from state funds, either using Harbors Special Funds or the General fund. This will be included in *the Kahului Commercial Harbor 2025 Master Plan Final Environmental Assessment* (Final EA).
2. Regarding your recommendation about using Glassphalt for paving projects. The Harbors Division will use Glassphalt, if available, as stated in Environmental Assessment Sections 1.3 and 3.4.
3. Regarding your suggestion about using sustainable building guidelines developed by the Environmental Council, as well as landscaping with xerophagic native plants. The use of sustainable building guidelines, including the use of xerophagic native plants, will be included in the Final EA Section 1.3.

We appreciate your interest in the environmental review process. If you have any questions, please call Mr. Glenn Soma of my Harbors planning staff at 587-2503.

ALAN M. ARAKAWA
Mayor



COPY

GLENN T. CORREA
Director

JOHN L. BUCK III
Deputy Director

(808) 270-7230
Fax (808) 270-7934

C:BI

DEPARTMENT OF PARKS & RECREATION

700 Hali'a Nakoa Street, Unit 2, Wailuku, Hawaii 96793

RECEIVED

AUG 25 2004

August 13, 2004

EKNA SERVICES, INC.

Mr. Brian Ishii
Edward K. Noda and Associates, Inc.
615 Piikoi Street, Suite 300
Honolulu, Hawaii 96814

Dear Mr. Ishii:

SUBJECT: KAHULUI COMMERCIAL HARBOR IMPROVEMENTS

Thank you for the opportunity to review the Draft Environmental Assessment for the subject project. We have no comments to submit at this time.

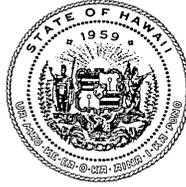
Please contact me or Mr. Patrick Matsui, Chief of Parks Planning and Development, at (808)270-7387 if there are any questions.

Sincerely,

GLENN T. CORREA
Director

c: Patrick Matsui, Chief of Planning and Development
Office of Environmental Quality Control

LINDA LINGLE
GOVERNOR



RODNEY K. HARAGA
DIRECTOR

Deputy Directors
BRUCE Y. MATSUI
BARRY FUKUNAGA
BRENNON T. MORIOKA
BRIAN H. SEKIGUCHI

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
869 PUNCHBOWL STREET
HONOLULU, HAWAII 96813-5097

IN REPLY REFER TO:

HAR-EP 7812.05

November 14, 2005

Mr. Glenn T. Correa
Director
Department of Parks & Recreation
700 Hali'a Nakoia Street, Unit 2
Wailuku, Hawaii 96793

Dear Mr. Correa:

Subject: Response to Comments, Kahului Commercial Harbor 2025 Master Plan
Environmental Assessment – H.C. 3334

Thank you for reviewing the subject document and your letter of no comment dated August 13, 2004.

We appreciate your interest in the environmental review process. If you have any questions, please contact Mr. Glenn Soma of my Harbor's planning staff at 587-2503.

Very truly yours,


RODNEY K. HARAGA
Director of Transportation

K8
e:BI

ALAN M. ARAKAWA
Mayor
MICHAEL W. FOLEY
Director
WAYNE A. BOTEILHO
Deputy Director



RECEIVED
SEP 09 2004

COUNTY OF MAUI
DEPARTMENT OF PLANNING EKNA SERVICES, INC.

September 7, 2004

Mr. Brian Ishii
Edward K. Noda and Associates, Inc.
615 Piikoi Street, Suite 300
Honolulu, Hawaii 96814

Dear Mr. Ishii:

RE: Draft Environmental Assessment Prepared for the Kahului Commercial Harbor Improvements located at TMK: 3-7-001: 021 & 022; 3-7-010: 2, 3, 6, 13, 15, 21, 22, 24, 27, 27, 28, 39, 32 & 34; and 3-7-008: 2, 3, 4, and 6 (LTR 2004/2937)

The Maui Planning Department (Department) is in receipt of your request for comments on the Draft Environmental Assessment (DEA) prepared for the above referenced project and provides the following comments:

1. The DEA should include any plans/drawings for the proposed facilities, if available.
2. The proposed improvements will increase the capacity and use of the harbor facilities for both domestic and foreign services. As such, a Traffic Impact Analysis should be prepared to assess these uses and any impacts to the surface transportation system.
3. A water quality sampling program should be implemented during construction related activities to ensure no net increase in pollutant loads.
4. The Department recommends transmitting the DEA to the County of Maui, Department of Transportation, Fire Department, and Police Department for consultation. In addition, since the proposed improvements will impact the canoe clubs, the Department recommends transmitting a copy of the DEA for their review and comment.

Mr. Brian Ishii
September 7, 2004
Page 2

5. The Department requests additional information regarding the proposed alignments of the sewer and water lines in order to determine whether the improvements should require review in accordance with the Special Management Area (SMA) Rules of the Maui Planning Commission and Chapter 205A, HRS.
6. Copies of the letters prepared in response to pre-consultation comments should have been included in the DEA.

Thank you for the opportunity to comment. Should you require additional clarification, please contact Ms. Kivette A. Caigoy, Environmental Planner, at 270-7735.

Sincerely,



Foley MICHAEL W. FOLEY
Planning Director

MWF:KAC:lar

c: Wayne A. Boteilho, Deputy Planning Director
Clayton I. Yoshida, AICP, Planning Program Administrator
Kivette A. Caigoy, Environmental Planner
State DOT
TMK File
OEQC
General File
K:\WP_DOCS\PLANNING\EA\DEAComments\2004\2937_KahuluiHarborImprvmts.wpd



STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
869 PUNCHBOWL STREET
HONOLULU, HAWAII 96813-5097

IN REPLY REFER TO:

HAR-EP 7813.05

November 14, 2005

Mr. Michael W. Foley
Director
Department of Planning
County of Maui
250 South High Street
Wailuku, Hawaii 96793

Dear Mr. Foley:

Subject: Response to Comments, Kahului Commercial Harbor 2025 Master Plan
Environmental Assessment – H.C. 3334

Thank you for your comments on the subject document dated September 7, 2004. We offer the following responses.

1. Regarding your comment that the DEA should include any plans/drawings for the proposed facilities, if available. The available drawings were presented in the *Kahului Commercial Harbor 2025 Master Plan Environmental Assessment (EA)*.
2. Regarding your comment that the proposed improvements will increase the capacity and use of the harbor facilities for both domestic and foreign services and as such, a Traffic Impact Analysis should be prepared to assess these uses and any impacts to the surface transportation system. The proposed improvements are not expected to impact the maritime demand at Kahului Commercial Harbor and therefore, a formal Traffic Impact Analysis is not required. In addition, there is no requirement in HRS 343 for a formal Traffic Impact Analysis.
3. Regarding your comment that a water quality sampling program should be implemented during construction related activities to ensure no net increase in pollutant loads. A water quality sampling program will be implemented if required by the State Department of Health or the U.S. Army Corps of Engineers. As stated in the Draft EA the construction will incorporate mitigative measures such as BMPs to minimize pollutant loads into the Harbor.
4. Regarding your comment recommending the transmittal of the Draft EA to the County of Maui, Department of Transportation, Fire Department, and Police Department, as well as to the canoe clubs for comment. The Draft EA was transmitted to the required County of Maui agencies and to representatives of the canoe clubs. In addition, the Draft EA is available at the Kahului Public Library.

Mr. Michael W. Foley
Page 2
November 14, 2005

HAR-EP 7813.05

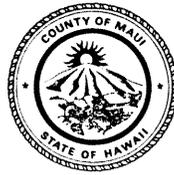
5. Regarding the Department's request for additional information regarding the proposed alignments of the sewer and water lines in order to determine whether the improvements should require review in accordance with the Special Management Area (SMA) Rules of the Maui Planning Commission and Chapter 205A, HRS. The provisions of Hawaii Revised Statutes Chapter 266-2 state that the Harbors Division is exempt from all county approvals.
6. Regarding the request that copies of the letters prepared in response to pre-consultation comments should have been included in the Draft EA. No substantive response letters were generated for the pre-consultation comments.

We appreciate your interest in the environmental review process. If you have any questions, please contact Mr. Glenn Soma of my Harbors planning staff at (808) 587-2503.

Very truly yours,


RODNEY K. HARAGA
Director of Transportation

ALAN M. ARAKAWA
Mayor



GEORGE Y. TENGAN
Director

JEFFREY T. PEARSON, P.E.
Deputy Director

C:BI
Mattac

**DEPARTMENT OF WATER SUPPLY
COUNTY OF MAUI**

200 South High Street
WAILUKU, MAUI, HAWAII 96793-2155
Telephone (808) 270-7816 • Fax (808) 270-7833
www.mauewater.org

RECEIVED

SEP 13 2004

September 9, 2004

Mr. Brian T. Ishii
Edward K. Noda and Associates, Inc.
615 Piikoi Street, Suite 300
Honolulu, Hawaii 96814

EKNA SERVICES, INC.

Subject: Draft Environmental Assessment for Kahului Commercial Harbor Improvements,
TMK: 3-7-01:021 & 022; 3-7-10:002, 003, 006, 013, 015, 021, 022, 024, 026, 027, 028, 030, 032
& 034; and 3-7-08:002, 003, 004 & 006

Dear Mr. Ishii:

Thank you for the opportunity to provide comments on this Draft Environmental Assessment (EA). Please find attached the Department comments to the Pier 1C Mooring Dolphin Draft EA of February 25, 2004. We have the following additional comments:

Source Availability and Consumption

The project area is served by the Central Maui System. The main sources of water for this system are the Iao and Waihee aquifers, the Iao tunnel and the Iao-Waikapu Ditch. As of July 21, 2003, the Commission on Water Resource Management (CWRM) has designated Iao aquifer as Groundwater Management Area. The sustainable yield of this aquifer is 20 MGD. DWS will not issue reservations for future meters until new sources are brought on-line. DWS is developing new sources outside of Iao aquifer, including the Waihee aquifer and surface water sources. Water for this project may not be available until new sources are on-line.

The EA should include estimated water demand for the proposed improvements, including increased use due to the forecast increase in passengers and vessels utilizing the harbor.

System Infrastructure

Please find attached a section of the Department fire protection map serving the harbor area. Water system improvement requirements will be determined in the building permit process. The applicant should contact our engineering division at (808) 270-7835 to discuss system improvements.

Pollution Prevention

The project overlies the Kahului aquifer. The Department of Water Supply strives to protect the integrity of surface and groundwater resources by encouraging the applicant to adopt best management practices (BMPs) designed to minimize infiltration and runoff from all construction and vehicle operations. We have attached sample BMPs for principle operations for reference. Additional information can be obtained from the State Department of Health.

We recommend that the following water conservation measures be included in the EA and implemented in project design and construction:

Eliminate Single-Pass Cooling: Single-pass, water-cooled system should be eliminated per Maui County Code

2004
SEP 13
10:00 AM
2004

ALAN M. ARAKAWA
Mayor

GEORGE Y. TENGAN
Director

JEFFREY T. PEARSON, P.E
Deputy Director

Subsection 14.21.20. Although prohibited by code, single-pass water cooling is still manufactured into some models of air-conditioners, freezers, and commercial refrigerators.

Utilize Low-Flow Fixtures and Devices: Maui County Code Subsection 16.20A.680 requires the use of low-flow water fixtures and devices in faucets, showerheads, urinals, water closets and hose bibs. Water conserving washing machines, ice-makers and other units are also available.

Maintain Fixtures to Prevent Leaks: A simple, regular program of repair and maintenance can prevent the loss of hundreds or even thousands of gallons a day. Refer to the attached handout, "The Costly Drip". The applicant should establish a regular maintenance program.

Use Climate-adapted Plants: The project is located in the "Maui County Planting Plan" - Plant Zone 5. Native plants adapted to the area conserve water and protect the watershed from degradation due to invasive alien species. Please refer to the attached brochure: "Saving Water In The Yard - What and How to Plant In Your Area".

Prevent Over-Watering By Automated Systems: Provide rain-sensors on all automated irrigation controllers in common areas. Check and reset controllers at least once a month to reflect the monthly changes in evapo-transpiration rates at the site. As an alternative, provide the more automated, soil-moisture sensors on controllers.

Should you have any questions, please contact our Water Resources and Planning Division at 270-7199.

Sincerely,



George Y. Tengan
Director
emb

c: engineering division

Office of Environmental Quality Control

attachments (with original only):

DWS letter of 2/25/04

Section of fire protection map (not to scale)

Maui County Planting Plan-Plant Zone 5-Saving Water in the Yard-What and How to Plant in your Area

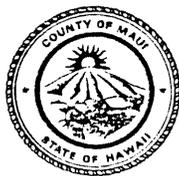
Ordinance No. 2108 - A Bill for an Ordinance Amending Chapter 16.20 of the Maui County Code, Pertaining to the Plumbing Code

A Checklist of Water Conservation Ideas For Commercial Buildings

Selected BMP's from "Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters"-EPA

C:\WPdocs\EAs EISs\Kahului Commercial Harbor Improve DEA.wpd

By Water All Things Find Life



DEPARTMENT OF WATER SUPPLY
COUNTY OF MAUI
200 South High Street
WAILUKU, MAUI, HAWAII 96793-2155
Telephone (808) 270-7816 • Fax (808) 270-7833

February 25, 2004

Ms. Gail W. Atwater, AICP
R.M. Towill Corporation
420 Waikamilo Road, Suite 411
Honolulu, HI 96817-4941
19829-OP

Subject: Request for Review
Draft Environmental Assessment
Kahului Commercial Harbor Pier 1C Mooring Dolphin
Kahului, District of Wailuku, Maui
TMK: 3-7-01"022

Dear Ms. Atwater:

Thank you for the opportunity to comment on this Draft Environmental Assessment (DEA). We provide the following information:

The Kahului Harbor is serviced by the Central Maui System. Any effect on potable water usage would be incidental to increased use of harbor facilities.

The Department of Water Supply strives to protect the integrity of watersheds and water resources. As stated in the DEA, additional berthing sites for overseas ships provided by the proposed Pier 1C mooring dolphin would increase the potential of further alien species introduction to Maui. Alien species can out-compete native species, leaving large areas unprotected against erosion and other watershed damage. While the DEA describes current measures to prevent alien pest species introduction to the State, it should also specify what specific mitigation measures will be taken to address the increased threat from the added berthing sites.

Should you have any questions, please contact our Water Resources and Planning Division at (808) 270-7199.

Sincerely,

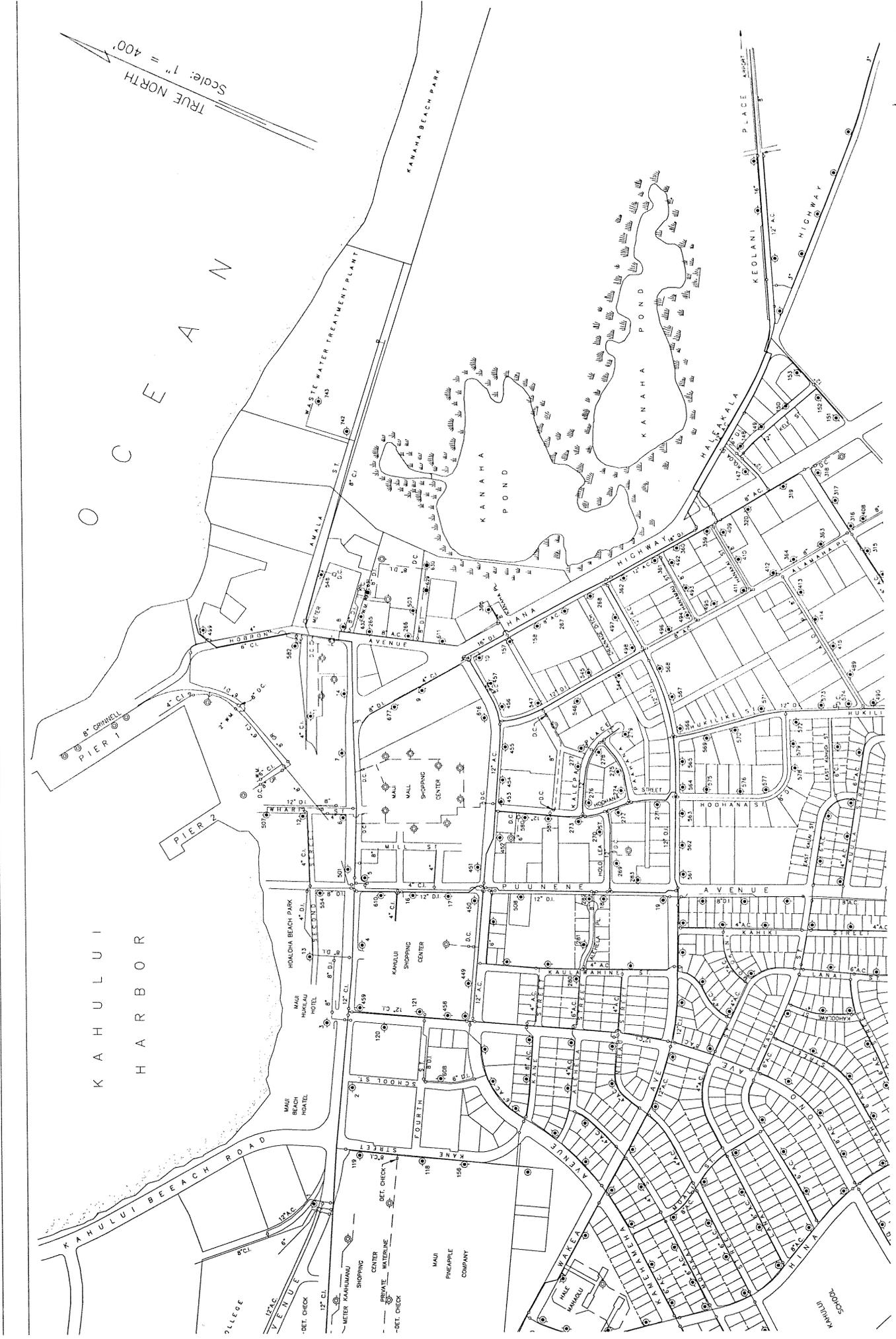


George Y. Tengam
Director
emb

c: engineering division

By Water All Things Find Life

Scale: 1" = 400'
TRUE NORTH

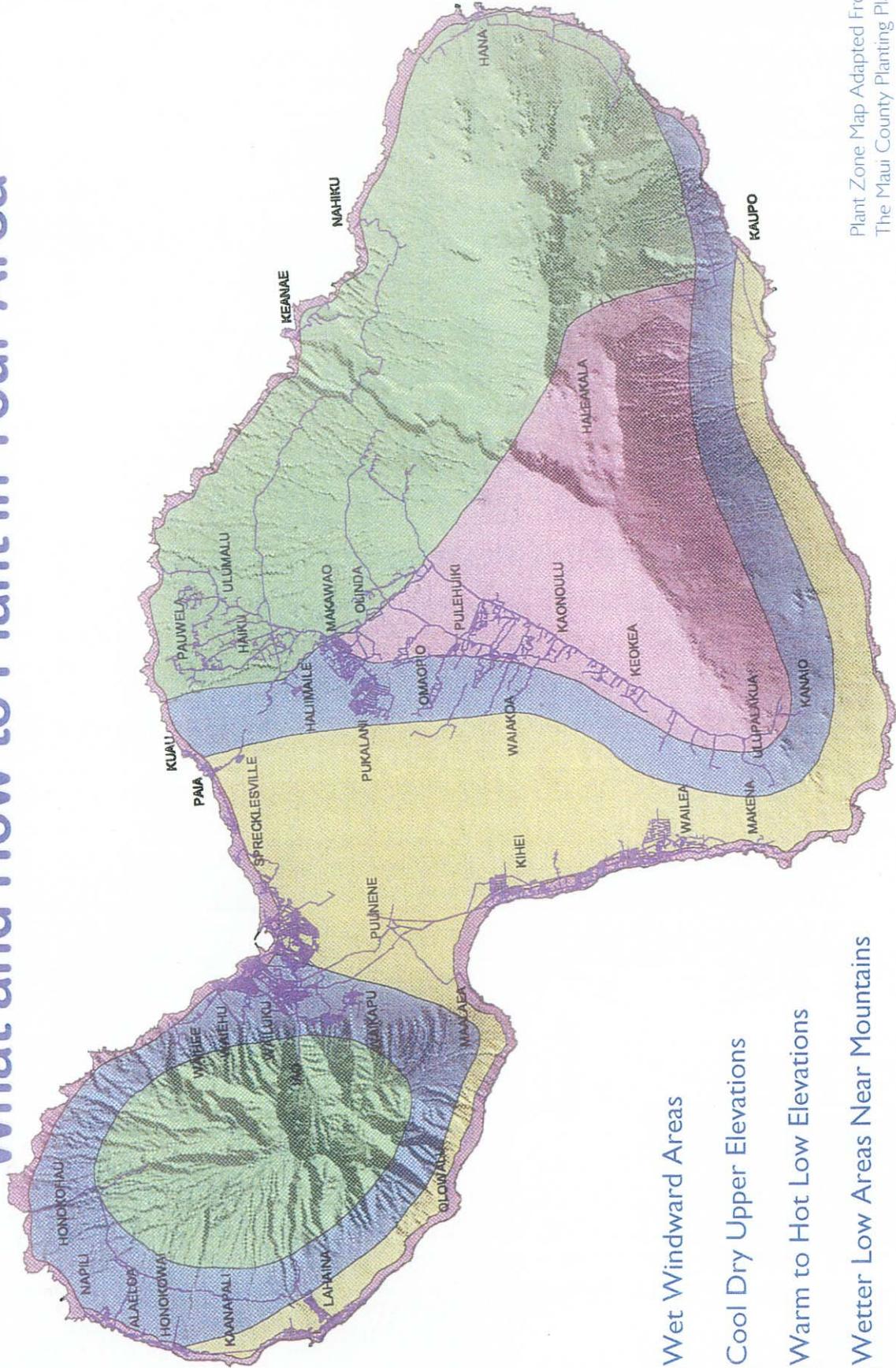


KAHULUI HARBOR

10-11-10

Saving Water in The Yard

What and How to Plant in Your Area



- 1 Wet Windward Areas
- 2 Cool Dry Upper Elevations
- 3 Warm to Hot Low Elevations
- 4 Wetter Low Areas Near Mountains
- 5 Windward Coastal Salt Spray Zones

Tips From The Maui County Department of Water Supply
By Water All Things Find Life

Plant Zone Map Adapted From
 The Maui County Planting Plan

Zone-specific Native and Polynesian plants for Maui County

Zone 1

Type	Scientific Name	Common Name	Height	Spread	Elevation	Water req.
F	<i>Psilotum nudum</i>	moa, moa kula	1'	1'	sea to 3,000'	Dry to Wet
F	<i>Sadleria cyatheoides</i>	'ama'u, ama'uma'u				
Gr - Sh	<i>Lipochaeta succulenta</i>	nehe	2'	5'	sea to 1,000'	Dry to Wet
P	<i>Cocos nucifera</i>	coconut, niu	100'	30'	sea to 1,000'	Dry to Wet
P	<i>Pritchardia arecina</i>	lo'ulu, hawane	40'	10'	1,000' to 3,000'	Dry to Wet
P	<i>Pritchardia forbesiana</i>	lo'ulu	15'			
P	<i>Pritchardia hillebrandii</i>	lo'ulu, fan palm	25'	15'	sea to 1,000'	Dry to Wet
S	<i>Mariscus javanicus</i>	marsh cypress, 'ahu'awa	0.5'	0.5'	sea to 1,000'	Dry to Medium
Sh	<i>Bidens hillebrandiana</i> ssp. <i>hillebrandiana</i>	ko'oko'olau	1'	2'	sea to 1,000'	Dry to Wet
Sh	<i>Cordyline fruticosa</i>	ti, ki	6'			
Sh	<i>Hedyotis</i> spp.	au, pilo	3'	2'	1,000' to 3,000'	Dry to Wet
Sh - Tr	<i>Broussonetia papyrifera</i>	wauke, paper mulberry	8'	6'	sea to 1,000'	Dry to Medium
Tr	<i>Acacia koa</i>	koa	50' - 100'	40' - 80'	1,500' to 4,000'	Dry to Medium
Tr	<i>Aleurites moluccana</i>	candlenut, kukui	50'	50'	sea to 3,000'	Medium to Wet
Tr	<i>Calophyllum inophyllum</i>	kamani, alexandrian laurel	60'	40'	sea to 3,000'	Medium to Wet
Tr	<i>Charpentiera obovata</i>		15'			
Tr	<i>Cordia subcordata</i>	kou	30'	25'	sea to 1,000'	Dry to Wet
Tr	<i>Hibiscus furcellatus</i>	'akiohala, hau-hele	8'			
Tr	<i>Metrosideros polymorpha</i> var. <i>macrophylla</i>	ohi'a lehua	25'	25'	sea to 1,000'	Dry to Wet
Tr	<i>Morinda citrifolia</i>	indian mulberry, noni	20'	15'	sea to 1,000'	Dry to Wet
Tr	<i>Pandanus tectorius</i>	hala, puhala (HALELIST)	35'	25'	sea to 1,000'	Dry to Wet
V	<i>Alyxia oliviformis</i>	malle	Vine		sea to 6,000'	Medium to Wet

TYPE: F Fern G Grass Gr Ground Cover Sh Shrub S Sedge Tr Tree V Vine

Zone 2

Zone-specific Native and Polynesian plants for Maui County

TYPE: F Fern G Grass Gr Ground Cover Sh Shrub S Sedge Tr Tree V Vine

Type	Scientific Name	Common Name	Height	Spread	Elevation	Water req.
F	<i>Psilotum nudum</i>	moa, moa kula	1'	1'	sea to 3,000'	Dry to Wet
F	<i>Sadleria cyatheoides</i>	'ama'u, ama'uma'u				
G	<i>Eragrostis monticola</i>	kalamalo	1'	2'	sea to 3,000'	Dry to Medium
Gr	<i>Ipomoea tuboides</i>	Hawaiian moon flower, 'uaia	1'	10'	sea to 3,000'	Dry to Medium
Gr	<i>Peperomia leptostachya</i>	'ala'ala-wai-nui	1'	1'	sea to 3,000'	Dry to Medium
Gr	<i>Plumbago zeylanica</i>	'ilie'e	1'			
Gr - Sh	<i>Hibiscus calyphyllus</i>	ma'o hau hele, Rock's hibiscus	3'	2'	sea to 3,000'	Dry to Medium
Gr - Sh	<i>Lipochaeta rockii</i>	nehe	2'	2'	sea to 3,000'	Dry to Medium
Sh	<i>Argemone glauca</i> var. <i>deciplens</i>	pua kala	3'	2'	sea to 3,000'	Dry to Medium
Sh	<i>Artemisia mauiensis</i> var. <i>diffusa</i>	Maui wormwood, 'ahinahina	2'	3'	1,000' to higher	Dry to Medium
Sh	<i>Chenopodium oahuense</i>	'aheahea, 'aweoweo	6'		sea to higher	Dry to Medium
Sh	<i>Dianella sandwicensis</i>	'uki	2'	2'	1,000' to higher	Dry to Medium
Sh	<i>Lipochaeta lavarum</i>	nehe	3'	3'	sea to 3,000'	Dry to Medium
Sh	<i>Osteomeles anthyllifolia</i>	'ulei, eluehe	4'	6'	sea to 3,000'	Dry to Medium
Sh	<i>Senna gaudichaudii</i>	kolomana	5'	5'	sea to 3,000'	Dry to Medium
Sh	<i>Styphelia tameiameia</i>	pukiawe	6'	6'	1,000' to higher	Dry to Medium
Sh	<i>Vitex rotundifolia</i>	pohinahina	3'	4'	sea to 1,000'	Dry to Medium
Sh - Tr	<i>Myoporum sandwicense</i>	naio, false sandalwood	10'	10'	sea to higher	Dry to Medium
Sh - Tr	<i>Nototrichum sandwicense</i>	kulu'i	8'	8'	sea to 3,000'	Dry to Medium
Sh - Tr	<i>Dodonaea viscosa</i>	'a'ali'i	6'	8'	sea to higher	Dry to Medium
Tr	<i>Acacia koa</i>	koa	50' - 100'	40' - 80'	1,500' to 4,000'	Dry to Medium
Tr	<i>Charpentiera obovata</i>		15'			
Tr	<i>Erythrina sandwicensis</i>	williwili	20'	20'	sea to 1,000'	Dry
Tr	<i>Metrosideros polymorpha</i> var. <i>macrophylla</i>	ohi'a lehua	25'	25'	sea to 1,000'	Dry to Wet

Zone-specific Native and Polynesian plants for Maui County

Zone 2

Type	Scientific Name	Common Name	Height	Spread	Elevation	Water req.
Tr	<i>Nestegis sandwicensis</i>	olopua	15'	15'	1,000' to 3,000'	Dry to Medium
Tr	<i>Pleomele auwahiensis</i>	halapepe	20'			
Tr	<i>Rauvolfia sandwicensis</i>	hao	20'	15'	sea to 3,000'	Dry to Medium
Tr	<i>Santalum ellipticum</i>	coastal sandalwood, 'Ili-ahi	8'	8'	sea to 3,000'	Dry to Medium
Tr	<i>Sophora chrysohylla</i>	mamane	15'	15'	1,000' to 3,000'	Medium
V	<i>Alyxia oliviformis</i>	maile	Vine		sea to 6,000'	Medium to Wet

Zone-specific Native and Polynesian plants for Maui County

Zone 3

TYPE:

F Fern

G Grass

Gr Ground Cover

Sh Shrub

P Palm

S Sedge

Tr Tree

V Vine

Type	Scientific Name	Common Name	Height	Spread	Elevation	Water req.
F	<i>Psilotum nudum</i>	moa, moa kula	1'	1'	sea to 3,000'	Dry to Wet
G	<i>Colubrina asiatica</i>	'anapanapa	3'	10'	sea to 1,000'	Dry to Wet
G	<i>Eragrostis monticola</i>	kalamalo	1'	2'	sea to 3,000'	Dry to Medium
G	<i>Eragrostis variabilis</i>	'emo-loa	1'	2'	sea to 3,000'	Dry to Medium
G	<i>Fimbristylis cymosa</i> ssp. <i>spathacea</i>	mau'u'aki'aki fimbriatylis	0.5'	1'	sea to 1,000'	Dry to Medium
Gr	<i>Boerhavia repens</i>	alena	0.5'	4'	sea to 1,000'	Dry to Medium
Gr	<i>Chamaesyce celastroides</i> var. <i>laehiensis</i>	'akoko	2'	3'	sea to 1,000'	Dry to Medium
Gr	<i>Cressa truxillensis</i>	cressa	0.5'	1'	sea to 1,000'	Dry to Medium
Gr	<i>Heliotropium anomalum</i> var. <i>argenteum</i>	hinahina ku kahakai	1'	2'	sea to 1,000'	Dry to Medium
Gr	<i>Ipomoea tuboides</i>	Hawaiian moon flower, uala	1'	10'	sea to 3,000'	Dry to Medium
Gr	<i>Jacquemontia ovalifolia</i> ssp. <i>sandwicensis</i>	pa'u o hi'iaka	0.5'	6'	sea to 1,000'	Dry to Medium
Gr	<i>Lipochaeta integrifolia</i>	nehe	1'	5'	sea to 1,00'	Dry to Medium
Gr	<i>Peperomia leptostachya</i>	'ala'ala-wai-nui	1'	1'	sea to 3,000'	Dry to Medium
Gr	<i>Plumbago zeylanica</i>	'iile'e	1'			
Gr	<i>Sesuvium portulacastrum</i>	'akulikuli, sea-purslane	0.5'	2'	sea to 1,000'	Dry to Wet
Gr	<i>Sida fallax</i>	'ilima	0.5'	3'	sea to 1,000'	Dry to Medium
Gr	<i>Tephrosia purpurea</i> var. <i>purpurea</i>	'auhuhu	2'	2'	sea to 1,000'	Dry to Medium
Gr - Sh	<i>Hibiscus calyphyllus</i>	ma'o hau hele, Rock's hibiscus	3'	2'	sea to 3,000'	Dry to Medium
Gr - Sh	<i>Lipochaeta rockii</i>	nehe	2'	2'	sea to 3,000'	Dry to Medium
Gr - Sh	<i>Lipochaeta succulenta</i>	nehe	2'	5'	sea to 1,000'	Dry to Wet
Gr - Sh	<i>Lycium sandwicense</i>	'ohelo-kai, 'ae'ae	2'	2'	sea to 1,000'	Dry to Medium
P	<i>Cocos nucifera</i>	coconut, niu	100'	30'	sea to 1,000'	Dry to Wet
P	<i>Pritchardia hillebrandii</i>	lo'lulu, fan palm	25'	15'	sea to 1,000'	Dry to Wet
S	<i>Mariscus javanicus</i>	marsh cypress, 'ahu'awa	0.5'	0.5'	sea to 1,000'	Dry to Medium

Zone 3

Zone-specific Native and Polynesian plants for Maui County

Type	Scientific Name	Common Name	Height	Spread	Elevation	Water req.
Sh	<i>Argemone glauca</i> var. <i>decipiens</i>	pua kala	3'	2'	sea to 3,000'	Dry to Medium
Sh	<i>Bidens mauiensis</i>	ko'oko'olau	1'	3'	sea to 1,000'	Dry to Medium
Sh	<i>Bidens menziesii</i> ssp. <i>menziesii</i>	ko'oko'olau	1'	3'		
Sh	<i>Bidens micrantha</i> ssp. <i>micrantha</i>	ko'oko'olau	1'	3'		
Sh	<i>Chenopodium oahuense</i>	'aheahea, 'aweoweo	6'		sea to higher	Dry to Medium
Sh	<i>Dianella sandwicensis</i>	'uki	2'	2'	1,000' to higher	Dry to Medium
Sh	<i>Gossypium tomentosum</i>	mao, Hawaiian cotton	5'	8'	sea to 1,000'	Dry to Medium
Sh	<i>Hedyotis</i> spp.	au, pilo	3'	2'	1,000' to 3,000'	Dry to Wet
Sh	<i>Lipochaeta lavarum</i>	nehe	3'	3'	sea to 3,000'	Dry to Medium
Sh	<i>Osteomeles anthyllifolia</i>	'ulei, eluehe	4'	6'	sea to 3,000'	Dry to Medium
Sh	<i>Scaevola sericea</i>	naupaka, naupaka-kahakai	6'	8'	sea to 1,000'	Dry to Medium
Sh	<i>Senna gaudichaudii</i>	kolomana	5'	5'	sea to 3,000'	Dry to Medium
Sh	<i>Solanum nelsonii</i>	'akia, beach solanum	3'	3'	sea to 1,00'	Dry to Medium
Sh	<i>Styphelia tameiameia</i>	pukiawe	6'	6'	1,000' to higher	Dry to Medium
Sh	<i>Vitex rotundifolia</i>	pohinahina	3'	4'	sea to 1,000'	Dry to Medium
Sh	<i>Wikstroemia uva-ursi</i> <i>kauaiensis</i> <i>kauaiensis</i>	'akia, Molokai osmanthus				
Sh - Tr	<i>Broussonetia papyrifera</i>	wauke, paper mulberry	8'	6'	sea to 1,000'	Dry to Medium
Sh - Tr	<i>Myoporium sandwicense</i>	naio, false sandalwood	10'	10'	sea to higher	Dry to Medium
Sh - Tr	<i>Nototrichium sandwicense</i>	kulu'i	8'	8'	sea to 3,000'	Dry to Medium
Sh-Tr	<i>Dodonaea viscosa</i>	'a'ai'i	6'	8'	sea to higher	Dry to Medium
Tr	<i>Aleurites moluccana</i>	candlenut, kukui	50'	50'	sea to 3,000'	Medium to Wet
Tr	<i>Calophyllum inophyllum</i>	kamani, alexandrian laurel	60'	40'	sea to 3,000'	Medium to Wet
Tr	<i>Canthium odoratum</i>	Alahe'e, 'ohe'e, walahe'e	12'	8'	sea to 3,000'	Dry to Medium
Tr	<i>Cordia subcordata</i>	kou	30'	25'	sea to 1,000'	Dry to Wet
Tr	<i>Diospyros sandwicensis</i>	lama	12'	15'	sea to 3,000'	Dry to Medium
Tr	<i>Erythrina sandwicensis</i>	wiliwili	20'	20'	sea to 1,000'	Dry
Tr	<i>Metrosideros polymorpha</i> var. <i>macrophylla</i>	ohi'a lehua	25'	25'	sea to 1,000'	Dry to Wet

Zone 3

Zone-specific Native and Polynesian plants for Maui County

Type	Scientific Name	Common Name	Height	Spread	Elevation	Water req.
Tr	<i>Morinda citrifolia</i>	Indian mulberry, noni	20'	15'	sea to 1,000'	Dry to Wet
Tr	<i>Nesoluma polynesianum</i>	keahi	15'	15'	sea to 3,000'	Dry
Tr	<i>Nestegis sandwicensis</i>	olopua	15'	15'	1,000' to 3,000'	Dry to Medium
Tr	<i>Pandanus tectorius</i>	hala, puhala (HALELIS)	35'	25'	sea to 1,000'	Dry to Wet
Tr	<i>Pleomele auwahiensis</i>	halapepe	20'			
Tr	<i>Rauwolfia sandwicensis</i>	hao	20'	15'	sea to 3,000'	Dry to Medium
Tr	<i>Reynoldsia sandwicensis</i>	'ohe makai	20'	20'	1,000' to 3,000'	Dry
Tr	<i>Santalum ellipticum</i>	coastal sandalwood, 'ili-ahi	8'	8'	sea to 3,000'	Dry to Medium
Tr	<i>Thespesia populnea</i>	milo	30'	30'	sea to 3,000'	Dry to Wet

Zone 4

Zone-specific Native and Polynesian plants for Maui County

TYPE: F Fern G Grass Gr Ground Cover Sh Shrub P Palm S Sedge Tr Tree V Vine

Type	Scientific Name	Common Name	Height	Spread	Elevation	Water req.
F	<i>Psilotum nudum</i>	moa, moa kula	1'	1'	sea to 3,000'	Dry to Wet
F	<i>Sadleria cyatheoides</i>	'ama'u, ama'uma'u				
G	<i>Colubrina asiatica</i>	'anapanapa	3'	10'	sea to 1,000'	Dry to Wet
G	<i>Eragrostis monticola</i>	kalamalo	1'	2'	sea to 3,000'	Dry to Medium
G	<i>Eragrostis variabilis</i>	'emo-loa	1'	2'	sea to 3,000'	Dry to Medium
G	<i>Fimbristylis cymosa</i> ssp. <i>spathacea</i>	mau'u'aki'aki fimbriatylis	0.5'	1'	sea to 1,000'	Dry to Medium
Gr	<i>Chamaesyce celastroides</i> var. <i>laehiensis</i>	'akoko	2'	3'	sea to 1,000'	Dry to Medium
Gr	<i>Ipomoea tuboides</i>	Hawaiian moon flower, 'uala	1'	10'	sea to 3,000'	Dry to Medium
Gr	<i>Jacquemontia ovalifolia</i> ssp. <i>sandwicensis</i>	pa'u o hi'iaka	0.5'	6'	sea to 1,000'	Dry to Medium
Gr	<i>Lipochaeta integrifolia</i>	nehe	1'	5'	sea to 1,00'	Dry to Medium
Gr	<i>Peperomia leptostachya</i>	'ala'ala-wai-nui	1'	1'	sea to 3,000'	Dry to Medium
Gr	<i>Plumbago zeylanica</i>	'iile e	1'			
Gr	<i>Sida fallax</i>	'ilima	0.5'	3'	sea to 1,000'	Dry to Medium
Gr	<i>Tephrosia purpurea</i> var. <i>purpurea</i>	'auhuhu	2'	2'	sea to 1,000'	Dry to Medium
Gr - Sh	<i>Hibiscus calyphyllus</i>	ma'o hau hele, Rock's hibiscus	3'	2'	sea to 3,000'	Dry to Medium
Gr - Sh	<i>Lipochaeta rockii</i>	nehe	2'	2'	sea to 3,000'	Dry to Medium
Gr - Sh	<i>Lipochaeta succulenta</i>	nehe	2'	5'	sea to 1,000'	Dry to Wet
P	<i>Cocos nucifera</i>	coconut, niu	100'	30'	sea to 1,000'	Dry to Wet
P	<i>Pritchardia arecina</i>	io'ulu, hawane	40'	10'	1,000' to 3,000'	Dry to Wet
P	<i>Pritchardia forbesiana</i>	io'ulu	15'			
P	<i>Pritchardia hillebrandii</i>	io'ulu, fan palm	25'	15'	sea to 1,000'	Dry to Wet
S	<i>Mariscus javanicus</i>	marsh cypress, 'ahu'awa	0.5'	0.5'	sea to 1,000'	Dry to Medium
Sh	<i>Argemone glauca</i> var. <i>decipiens</i>	pua kala	3'	2'	sea to 3,000'	Dry to Medium
Sh	<i>Artemisia australis</i>	'ahinahina	2'	3'	sea to 3,000'	Dry to Medium

Zone 4

Zone-specific Native and Polynesian plants for Maui County

Type	Scientific Name	Common Name	Height	Spread	Elevation	Water req.
Sh	<i>Artemisia mauiensis</i> var. <i>diffusa</i>	Maui wormwood, 'ahinahina	2'	3'	1,000' to higher	Dry to Medium
Sh	<i>Bidens hillebrandiana</i> ssp. <i>hillebrandiana</i>	ko'oko'olau	1'	2'	sea to 1,000'	Dry to Wet
Sh	<i>Bidens menziesii</i> ssp. <i>menziesii</i>	ko'oko'olau	1'	3'		
Sh	<i>Bidens micrantha</i> ssp. <i>micrantha</i>	ko'oko'olau	1'	3'		
Sh	<i>Cordylone fruticosa</i>	ti, ki	6			
Sh	<i>Dianella sandwicensis</i>	'uki	2'	2'	1,000' to higher	Dry to Medium
Sh	<i>Lipochaeta lavarum</i>	nehe	3'	3'	sea to 3,000'	Dry to Medium
Sh	<i>Osteomeles anthyllifolia</i>	'ulei, eluehe	4'	6'	sea to 3,000'	Dry to Medium
Sh	<i>Scaevola sericea</i>	naupaka, naupaka-kahakai	6'	8'	sea to 1,000'	Dry to Medium
Sh	<i>Solanum nelsonii</i>	'akia, beach solanum	3'	3'	sea to 1,00'	Dry to Medium
Sh	<i>Styphelia tameiameia</i>	pukiawe	6'	6'	1,000' to higher	Dry to Medium
Sh	<i>Vitex rotundifolia</i>	pohinahina	3'	4'	sea to 1,000'	Dry to Medium
Sh	<i>Wikstroemia uva-ursi</i> <i>kauaiensis</i> <i>kauaiensis</i>	'akia, Molokai osmanthus				
Sh - Tr	<i>Broussonetia papyrifera</i>	wauke, paper mulberry	8'	6'	sea to 1,000'	Dry to Medium
Sh - Tr	<i>Myoporum sandwicense</i>	naio, false sandalwood	10'	10'	sea to higher	Dry to Medium
Sh - Tr	<i>Notochrym sandwicense</i>	kulu'i	8'	8'	sea to 3,000'	Dry to Medium
Sh-Tr	<i>Dodonaea viscosa</i>	'a'ali'i	6'	8'	sea to higher	Dry to Medium
Tr	<i>Acacia koa</i>	koa	50' - 100'	40' - 80'	1,500' to 4,000'	Dry to Medium
Tr	<i>Aleurites moluccana</i>	candlenut, kukui	50'	50'	sea to 3,000'	Medium to Wet
Tr	<i>Calophyllum inophyllum</i>	kamani, alexandrian laurel	60'	40'	sea to 3,000'	Medium to Wet
Tr	<i>Canthium odoratum</i>	Alahe'e, 'one'e, walahe'e	12'	8'	sea to 3,000'	Dry to Medium
Tr	<i>Charpentiera obovata</i>		15'			
Tr	<i>Cordia subcordata</i>	kou	30'	25'	sea to 1,000'	Dry to Wet
Tr	<i>Diospyros sandwicensis</i>	lama	12'	15'	sea to 3,000'	Dry to Medium
Tr	<i>Hibiscus furcellatus</i>	'akiohala, hau-hele	8'			
Tr	<i>Metrosideros polymorpha</i> var. <i>macrophylla</i>	ohi'a lehua	25'	25'	sea to 1,000'	Dry to Wet
Tr	<i>Morinda citrifolia</i>	indian mulberry, noni	20'	15'	sea to 1,000'	Dry to Wet

Zone-specific Native and Polynesian plants for Maui County

Zone 4

Type	Scientific Name	Common Name	Height	Spread	Elevation	Water req.
Tr	<i>Nestegis sandwicensis</i>	olopua	15'	15'	1,000' to 3,000'	Dry to Medium
Tr	<i>Pandanus tectorius</i>	hala, puhala (HALELIST)	35'	25'	sea to 1,000'	Dry to Wet
Tr	<i>Pleomele auwahiensis</i>	halapepe	20'			
Tr	<i>Rauvolfia sandwicensis</i>	hao	20'	15'	sea to 3,000'	Dry to Medium
Tr	<i>Santalum ellipticum</i>	coastal sandalwood, 'ili-ahi	8'	8'	sea to 3,000'	Dry to Medium
Tr	<i>Sophora chrysophylla</i>	mamane	15'	15'	1,000' to 3,000'	Medium
Tr	<i>Thespesia populnea</i>	milo	30'	30'	sea to 3,000'	Dry to Wet
V	<i>Alyxia oliviformis</i>	maile	Vine		sea to 6,000'	Medium to Wet

Zone 5

Zone-specific Native and Polynesian plants for Maui County

Type	F Fern	G Grass	Gr Ground Cover	Sh Shrub	P Palm	S Sedge	Tr Tree	V Vine
Type	Scientific Name	Common Name	Height	Spread	Elevation	Water req.		
G	<i>Colubrina asiatica</i>	'anapanapa	3'	10'	sea to 1,000'	Dry to Wet		
G	<i>Eragrostis variabilis</i>	'emo-iaa	1'	2'	sea to 3,000'	Dry to Medium		
G	<i>Fimbristylis cymosa</i> ssp. <i>spathacea</i>	mau'u'aki'aki fimbriatylis	0.5'	1'	sea to 1,000'	Dry to Medium		
Gr	<i>Boerhavia repens</i>	alena	0.5'	4'	sea to 1,000'	Dry to Medium		
Gr	<i>Chamaesyce celastroides</i> var. <i>laehiensis</i>	'akoko	2'	3'	sea to 1,000'	Dry to Medium		
Gr	<i>Cressa truxillensis</i>	cressa	0.5'	1'	sea to 1,000'	Dry to Medium		
Gr	<i>Heliotropium anomalum</i> var. <i>argenteum</i>	hinahina ku kahakai	1'	2'	sea to 1,000'	Dry to Medium		
Gr	<i>Jacquemonia ovalifolia</i> ssp. <i>sandwicensis</i>	pa'u o hii'aka	0.5'	6'	sea to 1,000'	Dry to Medium		
Gr	<i>Lipochaeta integrifolia</i>	nehe	1'	5'	sea to 1,00'	Dry to Medium		
Gr	<i>Sesuvium portulacastrum</i>	'akulikuli, sea-purslane	0.5'	2'	sea to 1,000'	Dry to Wet		
Gr	<i>Sida fallax</i>	'ilima	0.5'	3'	sea to 1,000'	Dry to Medium		
Gr	<i>Tephrosia purpurea</i> var. <i>purpurea</i>	'auhuhu	2'	2'	sea to 1,000'	Dry to Medium		
Gr - Sh	<i>Hibiscus calyphyllus</i>	ma'o hau hele, Rock's hibiscus	3'	2'	sea to 3,000'	Dry to Medium		
Gr - Sh	<i>Lycium sandwicense</i>	'ohelo-kai, 'ae'ae	2'	2'	sea to 1,000'	Dry to Medium		
P	<i>Cocos nucifera</i>	coconut, niu	100'	30'	sea to 1,000'	Dry to Wet		
P	<i>Pritchardia hillebrandii</i>	lo'ulu, fan palm	25'	15'	sea to 1,000'	Dry to Wet		
S	<i>Mariscus javanicus</i>	marsh cypress, 'ahu'awa	0.5'	0.5'	sea to 1,000'	Dry to Medium		
Sh	<i>Argemone glauca</i> var. <i>decipiens</i>	pua kala	3'	2'	sea to 3,000'	Dry to Medium		
Sh	<i>Artemisia australis</i>	'ahinahina	2'	3'	sea to 3,000'	Dry to Medium		
Sh	<i>Bidens hillebrandiana</i> ssp. <i>hillebrandiana</i>	ko'oko'olau	1'	2'	sea to 1,000'	Dry to Wet		
Sh	<i>Bidens mauiensis</i>	ko'oko'olau	1'	3'	sea to 1,000'	Dry to Medium		
Sh	<i>Chenopodium oahuense</i>	'aheahea, 'aweoweo	6'		sea to higher	Dry to Medium		
Sh	<i>Dianella sandwicensis</i>	'uki	2'	2'	1,000' to higher	Dry to Medium		
Sh	<i>Gossypium tomentosum</i>	mao, Hawaiian cotton	5'	8'	sea to 1,000'	Dry to Medium		

Zone 5

Zone-specific Native and Polynesian plants for Maui County

Type	Scientific Name	Common Name	Height	Spread	Elevation	Water req.
Sh	Hedyotis spp.	au, pilo	3'	2'	1,000' to 3,000'	Dry to Wet
Sh	Lipochaeta lavarum	nehe	3'	3'	sea to 3,000'	Dry to Medium
Sh	Osteomeles anthyllifolia	'ulei, eluehe	4'	6'	sea to 3,000'	Dry to Medium
Sh	Scaevola sericea	naupaka, naupaka-kahakai	6'	8'	sea to 1,000'	Dry to Medium
Sh	Senna gaudichaudii	kolomana	5'	5'	sea to 3,000'	Dry to Medium
Sh	Solanum nelsonii	'akia, beach solanum	3'	3'	sea to 1,00'	Dry to Medium
Sh	Vitex rotundifolia	pohinahina	3'	4'	sea to 1,000'	Dry to Medium
Sh	Wikstroemia uva-ursi kauaiensis kauaiensis	'akia, Molokai osmanthus				
Sh - Tr	Myoporium sandwicense	nalo, false sandalwood	10'	10'	sea to higher	Dry to Medium
Sh-Tr	Dodonaea viscosa	'a'ali'i	6'	8'	sea to higher	Dry to Medium
Tr	Aleurites moluccana	candlenut, kukui	50'	50'	sea to 3,000'	Medium to Wet
Tr	Calophyllum inophyllum	kamani, alexandrian laurel	60'	40'	sea to 3,000'	Medium to Wet
Tr	Cordia subcordata	kou	30'	25'	sea to 1,000'	Dry to Wet
Tr	Hibiscus furcellatus	'akiohala, hau-hele	8'			
Tr	Morinda citrifolia	indian mulberry, noni	20'	15'	sea to 1,000'	Dry to Wet
Tr	Pandanus tectorius	hala, puhala (HALELIST)	35'	25'	sea to 1,000'	Dry to Wet
Tr	Thespesia populnea	imilo	30'	30'	sea to 3,000'	Dry to Wet
V	Ipomoea pes-caprae	beach morning glory, pohuehue	1			

DO NOT PLANT THESE PLANTS !!!

Common name	Scientific name	Plant family
black wattle	Acacia mearnsii	Mimosaceae
blackberry	Rubus argutus	Rosaceae
blue gum	Eucalyptus globulus	Myrtaceae
bocconia	Bocconia frutescens	Papaveraceae
broad-leaved cordia	Cordia alliodora	Boraginaceae
broomsedge, yellow bluestem	Andropogon virginicus	Poaceae
buffelgrass	Cenchrus ciliaris	Poaceae
butterfly bush, smoke bush	Buddleja madagascariensis	Buddlejaceae
cats claw, Mysore thorn, wait-a-bit	Caesalpinia decapetala	Caesalpinaceae
common ironwood	Casuarina equisetifolia	Casuarinaceae
common velvet grass, Yorkshire fog	Holcus lanatus	Poaceae
fiddlewood	Citharexylum spinosum	Verbenaceae
fire tree, faya tree	Myrica faya	Myricaceae
glorybower	Clerodendrum laponicum	Verbenaceae
hairy cat's ear, gosmore	Hypochoeris radicata	Asteraceae
haole koa	Leucaena leucocephala	Fabaceae
ivy gourd, scarlet-fruited gourd	Coccinia grandis	Cucurbitaceae
juniper berry	Citharexylum caudatum	Verbenaceae
kahili flower	Grevillea banksii	Proteaceae
klu, popinac	Acacia farnesiana	Mimosaceae
logwood, bloodwood tree	Haematoxylum campechianum	Caesalpinaceae
loquat	Eriobotrya japonica	Rosaceae
meadow ricegrass	Ehrharta stipoides	Poaceae
melaleuca	Melaleuca quinquenervia	Myrtaceae
miconia, velvet leaf	Miconia calvensens	Melastomataceae
narrow-leaved carpetgrass	Axonopus fissifolius	Poaceae
oleaster	Elaeagnus umbellata	Elaeagnaceae
oriental mangrove	Bruguiera gymnorhiza	Rhizophoraceae
padang cassia	Cinnamomum burmannii	Lauraceae
palmgrass	Setaria palmifolia	Poaceae
pearl flower	Heterocentron subtripplinervium	Melastomataceae
quinine tree	Cinchona pubescens	Rubiaceae
satin leaf, caimitillo	Chrysophyllum oliviforme	Sapotaceae
silkwood, Queensland maple	Flindersia brayleyana	Rutaceae
silky oak, silver oak	Grevillea robusta	Proteaceae
strawberry guava	Psidium cattleianum	Myrtaceae
swamp oak, saltmarsh, longleaf ironwood	Casuarina glauca	Casuarinaceae
sweet vernalgrass	Anthoxanthum odoratum	Poaceae
tree of heaven	Allianthus altissima	Simaroubaceae
trumpet tree, quarumo	Cecropia obtusifolia	Cecropiaceae
white ginger	Hedychium coronarium	Zingiberaceae
white moho	Heliocarpus popayanensis	Tiliaceae
yellow ginger	Hedychium flavescens	Zingiberaceae

DO NOT PLANT THESE PLANTS !!!

Common name	Scientific name	Plant family
	<i>Jasminum fluminense</i>	Oleaceae
	<i>Arthrostem ciliatum</i>	Melastomataceae
	<i>Dissotis rotundifolia</i>	Melastomataceae
	<i>Erigeron karvinskianus</i>	Asteraceae
	<i>Eucalyptus robusta</i>	Myrtaceae
	<i>Hedychium gardnerianum</i>	Zingiberaceae
	<i>Juncus planifolius</i>	Juncaceae
	<i>Lophostemon confertus</i>	Myrtaceae
	<i>Medinilla cumingii</i>	Melastomataceae
	<i>Medinilla magnifica</i>	Melastomataceae
	<i>Medinilla venosa</i>	Melastomataceae
	<i>Melastoma candidum</i>	Melastomataceae
	<i>Melinis minutiflora</i>	Poaceae
	<i>Olea europaea</i>	Melastomataceae
	<i>Oxyspora paniculata</i>	Poaceae
	<i>Panicum maximum</i>	Poaceae
	<i>Paspalum urvillei</i>	Poaceae
	<i>Passiflora edulis</i>	Passifloraceae
	<i>Phormium tenax</i>	Agavaceae
	<i>Pinus taeda</i>	Pinaceae
	<i>Prosopis pallida</i>	Fabaceae
	<i>Pterolepis glomerata</i>	Melastomataceae
	<i>Rhodomyrtus tomentosa</i>	Myrtaceae
	<i>Schefflera actinophylla</i>	Araliaceae
	<i>Syzygium jambos</i>	Myrtaceae
	<i>Acacia melanoxylon</i>	Mimosaceae
	<i>Cyathea cooperi</i>	Cyatheaceae
	<i>Sphaeropteris cooperi</i>	Cyatheaceae
	<i>Bidens pilosa</i>	Asteraceae
	<i>Brachiaria mutica</i>	Poaceae
	<i>Ficus microcarpa</i>	Moraceae
	<i>Asystasia gangetica</i>	Acanthaceae
	<i>Schinus terebinthifolius</i>	Anacardiaceae
	<i>Acacia confusa</i>	Mimosaceae
	<i>Senecio mikanioides</i>	Asteraceae
	<i>Lonicera japonica</i>	Caprifoliaceae
	<i>Clidemia hirta</i>	Melastomataceae
	<i>Lantana camara</i>	Verbenaceae
	<i>Furcraea foetida</i>	Agavaceae
	<i>Fraxinus uhdei</i>	Oleaceae
	<i>Hunnemannia fumarifolia</i>	Papaveraceae
	<i>Angiopteris evecta</i>	Marattiaceae
	<i>Corynocarpus laevigatus</i>	Corynocarpaceae
	<i>Lepospermum scoparium</i>	Myrtaceae
	<i>Cortaderia jubata</i>	Poaceae
	<i>Castilleja elastica</i>	Moraceae
	<i>Ardisia elliptica</i>	Myrsinaceae
	<i>Passiflora mollissima</i>	Passifloraceae
Australian blackwood		
Australian tree fern		
Australian tree fern		
Beggar's tick, Spanish needle		
California grass		
Chinese banyon, Maylayan banyon		
Chinese violet		
Christmasberry, Brazilian pepper		
Formosan koa		
German ivy		
Japanese honeysuckle		
Koster's curse		
Lantana		
Mauritius hemp		
Mexican ash, tropical ash		
Mexican tulip poppy		
Mules foot, Madagascar tree fern		
New Zealand laurel, karakaranut		
New Zealand tea		
Pampas grass		
Panama rubber tree, Mexican rubber tree		
Shoebuuton ardisia		
banana poka		

Selection

As a general rule, it is best to select the largest and healthiest specimens. However, be sure to note that they are not pot-bound. Smaller, younger plants may result in a low rate of plant survival.¹ When selecting native species, consider the site they are to be planted in, and the space that you have to plant. For example: Mountain species such as koa and maile will not grow well in hot coastal areas exposed to strong ocean breezes. Lowland and coastal species such as wiliwili and Kou require abundant sunshine and porous soil. They will not grow well with frequent cloud cover, high rainfall and heavy soil.

Consider too, the size that the species will grow to be. It is not wise to plant trees that will grow too large.² Overplanting tends to be a big problem in the landscape due to the underestimation of a species' height, width or spread.

A large, dense canopied tree such as the kukui is a good shade tree for a lawn. However, its canopy size and density of shade will limit what can be planted in the surrounding area. Shade cast by a koa and ohia lehua is relatively light and will not inhibit growth beneath it.

Keep seasons in mind when you are selecting your plants. Not all plants look good year round, some plants such as ilima will look scraggly after they have flowered and formed seeds. Avoid planting large areas with only one native plant. Mixing plants which naturally grow together will ensure the garden will look good all year round.³ Looking at natural habitats helps to show how plants grow naturally in the landscape.

When planting an area with a mixed-ecosystem, keep in mind the size and ecological requirements of each plant. Start with the hardiest and most easily grown species, but allow space for fragile ones in subsequent plantings.

Acquiring natives

Plants in their wild habitat must be protected and maintained. It is best and easiest to get your plants from nurseries (see list), or friend's gardens. Obtain proper permits from landowners and make sure you follow a few common sense rules:

- ▶ collect sparingly from each plant or area.
- ▶ some plants are on the state or Federal Endangered Species list. Make sure you get permits (see app. A,B)

¹ K. Nagata, P.6

² K. Nagata, P.9

³ Nagata, P.9

Soil

Once you have selected your site and the plants you wish to establish there, you must look at the soil conditions on the site. Proper soil is necessary for the successful growth of most native plants, which perform poorly in hard pan, clay or adobe soils. If natives are to be planted in these types of soil, it would be wise to dig planting holes several times the size of the rootball and backfill with 50-75% compost.⁴ A large planting hole ensures the development of a strong root system. The plant will have a headstart before the roots penetrate the surrounding poor soil.⁵

It is recommended that native plants not be planted in ground that is more dense than potting soil. If there is no alternative, dig a hole in a mound of soil mixed with volcanic cinder which encourages maximum root development. Fill the hole with water, if the water tends to puddle or drain too slowly, dig a deeper hole until the water does not puddle longer than 1 or 2 minutes.⁶ Well-drained soil is one of the most important things when planting natives as you will see in the next section.

Irrigation

Most natives do very poorly in waterlogged conditions. Do not water if the soil is damp. Water when the soil is dry and the plants are wilting. Once established, a good soaking twice a week should suffice. Deep soaking encourages the development of stronger, and deeper root systems. This is better than frequent and shallow watering which encourage weaker, more shallow root systems.

The following is a watering schedule from Kenneth Nagata's Booklet, *How To Plant A Native Hawaiian Garden*:

WATER REQUIREMENT

Heavy
Moderate
Light

WATERING FREQUENCY

3x / week
2x / week
1x / week

Red clay soils hold more water for a longer period of time than sandy soils do. If your area is very sunny or near a beach, things will dry out faster. Even in the area of one garden, there are parts that will need more or less water. Soils can vary and amount of shade and wind differ. After plants are established (a month or two for most plants, up to a year for some trees), you can back off watering.

⁴ Nagata, p. 6

⁵ Nagata, p. 8

⁶ Nagata, p. 8

Automatic sprinkler systems are expensive to install and must be checked and adjusted regularly. Above-ground systems allow you to monitor how much water is being put out, but you lose a lot due to malfunctioning of sprinkler heads and wind. The most efficient way to save water and make sure your plants get enough water, is to hand-water. This way you are getting our precious water to the right places in the right amounts.⁷

Fertilizer

An all-purpose fertilizer 10-10-10 is adequate for most species. They should be applied at planting time, 3 months later, and 6 months thereafter. Use half the dosage recommended for ornamentals and pay special attention to native ferns which are sensitive to strong fertilizers. Use of organic composts and aged animal manures is suggested instead of chemical fertilizers. In addition, use of cinders for providing trace minerals is strongly recommended.⁸

Natives are plants which were here hundreds of years before the polynesians inhabited the Hawaiian Islands. They were brought here by birds, or survived the harsh ocean conditions to float here. They are well-adapted to Hawaii's varying soil and environmental conditions. This is why they make prime specimens for a xeriscape garden. However, natives will not thrive on their own, especially under harsh conditions. On the other hand, like any other plant, if you over-water and over-fertilize them, they will die. Follow the instructions given to you by the nursery you buy the plant from, or from this booklet. Better yet, buy a book (suggested readings can be found in the bibliography in the back of this pamphlet), read it, and learn more about native plants. I guarantee that you will be pleased with the results.

⁷ Bornhorst, p. 19-20

⁸ Nagata, p. 6

Propagation

There are many ways to propagate and plant-out native Hawaiian species. One of the most thorough and helpful book is Heidi Bornhorst's book, *Growing Native Hawaiian Plants*. The easiest, and best way to obtain natives for the novice gardener is to get them from a reputable nursery (see appendix c). That way all you will have to do is know how to transplant (if necessary) and plant-out when you are ready. These are the two methods I have listed here.

Transplanting

1. Use pots that are one size bigger than the potted plant is in
2. Get your potting medium ready

Good potting medium is a ½, ½ mixture of peat moss and perlite. If the plant is from a dry or coastal area, add chunks of cinder or extra perlite. If it is a wet forest species, add more peat moss or compost. Be aware that peat moss is very acidic and certain plants react severely to acidity.

If the plant is to eventually be planted into the ground, make a mix of equal parts peat moss, perlite, and soil from the area in which the plant is to be planted. Slow-release fertilizer can be mixed into the potting medium.

3. Once pots, potting medium, fertilizer and water are ready, you can begin re-potting. Keep the plant stem at the same depth it was in the original pot. Avoid putting the plant in too large a pot, as the plant may not be able to soak up all the water in the soil and the roots may drown and rot.

Mix potting medium and add slow-release fertilizer at this time. Pre-wet the medium to keep dust down and lessen shock to the plant. Put medium in bottom of pot. Measure for the correct depth in the new pot. Make sure there is from ½ to 2 inches from the top of the pot so the plant can get adequate water. Try to stand the plant upright and center the stem in the middle of the pot.

Water the plant thoroughly after transplanting. A vitamin B-1 transplanting solution can help to lessen the transplant shock. Keep the plant in the same type of environment as it was before, sun or shade. If roots were broken, trim off some of the leaves to compensate for the loss.⁹

Planting out

1. Plant most native Hawaiian plants in a sunny location in soil that is well-drained.
2. Make the planting hole twice as wide as the root ball or present pot, and just as deep. If the soil is clay-like, and drains slowly, mix in some coarse red or bland cinder, coarse perlite or

⁹ Bornhorst, p.20-21

coarse compost. Place some slow-release fertilizer at the bottom of the hole.

3. Carefully remove the plant from the container and place it in the hole.

The top of the soil should be at the same level as the top of the hole, if it is too high or too low, adjust the soil level so that the plant is at the right depth.

4. Water thoroughly after you transplant.

Mulch

Most natives cannot compete with weeds, and therefore must be weeded around constantly in order to thrive. Mulch is a practical alternative, which discourages and prevents weeds from growing.

Hawaii's hot, humid climate leads to the breaking down of organic mulches. Thick organic mulches such as wood chips and leaves, may also be hiding places for pests.

Stone mulches are attractive, permanent and can help to improve soil quality. Red or black cinder, blue rock chips, smooth river rocks and coral chips are some natural choices.¹⁰ Macadamia nut hulls are also easy to find and can make a nice mulch.¹¹

Never pile up mulch right next to the stem or trunk of a plant, keep it a few inches away.

¹⁰ Bornhorst, p. 24

¹¹ Nagata, p. 7

PLACES TO SEE NATIVES ON:

The following places propagate native Hawaiian plants from seeds and/or cuttings. Their purpose is to protect and preserve these native plants. Please contact them before going to view the sites, they can provide valuable information and referral to other sources.

Maui:

1. Hoolawa Farms, P.O. Box 731, Haiku, Hawaii, 96708 572-4835
2. The Hawaiian Collection, 1127 Manu St., Kula, Hawaii, 96790 878-1701
3. Kula Botanical Gardens, RR 4, Box 228, Kula, Hawaii, 96790 878-1715
4. Maui Botanical Gardens, Kanaloa Avenue across from stadium 243-7337
5. Kula Forest Reserve, access road at the end of Waipouli Rd.
Call the Maui District Forester 984-8100
6. Wailea Point, Private Condominium residence, 4000 Wailea Alanui,
public access points at Four Seasons Resort or Polo Beach 875-9557
7. Kahanu Gardens, National Tropical Botanical Garden,
Alau Pt, Hana, Hawaii, 96713 248-8912
9. Kahului Library Courtyard, 20 School Street, Kahului, Hawaii 873-3097

ZONES

The Maui County Planting Plan has compiled a system of 5 zones of plant growth for Maui County. The descriptions of zones and maps for these zones are as follows:

Zone 1:

Wet areas on the windward side of the island. More than 40 inches of rain per year. Higher than 3,000 feet.

Zone 2:

Cool, dry areas in higher elevations (above 1,000 feet). 20 to 40 inches of rain per year.

Zone 3:

Low, drier areas, warm to hot. Less than 20 inches of rain per year. Sea level to 1,000 feet.

Zone 4:

Lower elevations which are wetter due to proximity of mountains. 1,000 to 3,000 feet.

Zone 5:

Salt spray zones in coastal areas on the windward side.

These zones are to be used as a general guide to planting for Maui County. In addition to looking at the maps, read the descriptions of the zones and decide which zone best fits your area. Plants can be listed in more than one zone and can be planted in a variety of conditions. For best results, take notes on the rainfall, wind, sun and salt conditions of your site. Use the zones as a general guide for selection and read about the plants to decide which best fits your needs as far as care and or function.

PLACES TO BUY NATIVES ON:

Maui:

1. **Hoolawa Farms** **575-5099**
P O Box 731
Haiku HI 96708
The largest and best collection of natives
in the state. They will deliver, but it's
worth the drive to go and see!
Will propagate upon request

2. **Kula True Value Nursery** **878-2551**
Many natives in stock
Get most of their plants from Hoolawa Farms
They take special requests

3. **Kihei Garden and Landscape** **244-3804**

4. **Kihana Nursery, Kihei** **879-1165**

5. **The Hawaiian Collection** **878-1701**
Specialize in Sandalwood propagation
Will propagate special requests

A Checklist of Water Conservation Ideas For

Commercial Buildings

This checklist provides water conservation tips successfully implemented by industrial and commercial users. This list has been revised from the original copy first published and distributed by the Los Angeles Department of Water and Power.

General suggestions

- Increase employee awareness of water conservation.
- Install signs encouraging water conservation in employee and customer restrooms.
- When cleaning with water is necessary, use budgeted amounts.
- Determine the quantity and purpose of water being used.
- Read water meter weekly to monitor success of water conservation efforts.
- Assign an employee to monitor water use and waste.
- Seek employee suggestions on water conservation; put suggestion boxes in prominent areas.
- Determine other methods of water conservation.

Building maintenance

- Check water supply for leaks.
- Turn off any unnecessary flows.
- Repair dripping faucets and showers and continuously running or leaking toilets.

Install faucet aerators where possible.

Reduce toilet water use by adjusting flush valves or installing dams and flapper mechanisms.

As appliances or fixtures wear out, replace them with water-saving models.

Shut off water supply to equipment rooms not in use.

Minimize the water used in cooling equipment in accordance with manufacturers recommendations. Shut off cooling units when not needed.

Cafeteria area

Turn off continuous flow used to clean the drain trays.

Turn off dishwasher when not in use. Wash full loads only.

Use water from steam tables to wash down cooking area.

Do not use running water to melt ice or frozen foods.

Use water-conserving ice makers.

ORDINANCE NO. 2108

BILL NO. 6 (1992)

Draft 1

A BILL FOR AN ORDINANCE AMENDING
CHAPTER 16.20 OF THE MAUI COUNTY
CODE, PERTAINING TO THE PLUMBING CODE

BE IT ORDAINED BY THE PEOPLE OF THE COUNTY OF MAUI:

SECTION 1. Title 16 of the Maui County Code is amended by adding a new section to Chapter 10 of the Uniform Plumbing Code to be designated and to read as follows:

"16.20.675 Section 1050 added. Chapter 10 of the Uniform Plumbing Code is amended by adding a new section, pertaining to low-flow water fixtures and devices, to be designated and to read as follows:

Sec. 1050 Low-flow water fixtures and devices. (a) This section establishes maximum rates of water flow or discharge for plumbing fixtures and devices in order to promote water conservation.

(b) For the plumbing fixtures and devices covered in this section, manufacturers or their local distributors shall provide proof of compliance with the performance requirements established by the American National Standards Institute (ANSI) and such other proof as may be required by the director of public works. There shall be no charge for this registration process.

(c) Effective December 31, 1992, only plumbing fixtures and devices specified in this section shall be offered for sale or installed in the County of Maui, unless otherwise indicated in this section. All plumbing fixtures and devices which were installed before December 31, 1992, shall be allowed to be used, repaired or replaced after December 31, 1992.

(1) Faucets (kitchen): All kitchen and bar sink faucets shall be designed, manufactured, installed or equipped with a flow control device or aerator which will prevent a water flow rate in excess of two and two-tenths gallons per minute at sixty pounds per square inch of water pressure.

(2) Faucets (lavatory): All lavatory faucets shall be designed, manufactured, installed or equipped with a flow control device or aerator which will prevent a water flow rate in excess of two and two tenths gallons per minute at sixty pounds per square inch of water

pressure.

(3) Faucets (public rest rooms): In addition to the lavatory requirements set forth in paragraph (2), lavatory faucets located in rest rooms intended for use by the general public shall be of the metering or self-closing types.

(4) Hose bibbs: Water supply faucets or valves shall be provided with approved flow control devices which limit flow to a maximum three gallons per minute.

EXCEPTIONS: (A) Hose bibbs or valves not used for fixtures or equipment designated by the director of public works.

(B) Hose bibbs, faucets, or valves serving fixed demand, timing, or water level control appliances, and equipment or holding structures such as water closets, pools, automatic washers, and other similar equipment.

(5) Showerheads: Showerheads, except where provided for safety or emergency reasons, shall be designed, manufactured, or installed with a flow limitation device which will prevent a water flow rate in excess of two and one-half gallons per minute at eighty pounds per square inch of water pressure. The flow limitation device must be a permanent and integral part of the showerhead and must not be removable to allow flow rates in excess of two and one-half gallons per minute or must be mechanically retained requiring force in excess of eight pounds to remove.

(6) Urinals: Urinals shall be designed, manufactured, or installed so that the maximum flush will not exceed one gallon of water. Adjustable type flushometer valves may be used provided they are adjusted so the maximum flush will not exceed one and six tenths gallons of water.

(7) Water closets (toilets): Water closets shall be designed, manufactured, or installed so that the maximum flush will not exceed one and six tenths gallons of water.

(d) Beginning December 31, 1992, it is unlawful to sell or install any plumbing fixtures or devices not specified in this section, except as permitted under this section.

(e) The director of public works may exempt the use of low-flow water fixtures and devices if there is a finding that the use of such fixtures and devices would not be consistent with accepted engineering practices and would be detrimental to the public health, safety and welfare.

(f) Any person violating this section shall be fined \$250 for each violation and shall correct all instances of non-compliance for which a citation is issued. Violation of this section shall constitute a violation as defined in section 701-107 Hawaii Revised Statutes and shall be enforceable by employees of the department of public works. The foregoing fine may also be imposed in a civil, administrative proceeding pursuant to Rules and Regulations adopted by the department of public works in accordance with chapter 91 Hawaii Revised Statutes."

SECTION 2. New material is underscored. In printing this bill, the County Clerk need not include the underscoring.

SECTION 3. This ordinance shall take effect upon its approval.

APPROVED AS TO FORM
AND LEGALITY:



HOWARD M. FUKUSHIMA
Deputy Corporation Counsel
County of Maui
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WE HEREBY CERTIFY that the foregoing BILL NO. 6 (19 92), Draft 1

1. Passed FINAL READING at the meeting of the Council of the County of Maui, State of Hawaii, held on the 1st day of May, 1992, by the following votes:

Howard S. KIHUNE Chair	Patrick S. KAWANO Vice-Chair	Vince G. BAGOYO, Jr.	Goro HOKAMA	Alice L. LEE	Ricardo MEDINA	Wayne K. NISHIKI	Joe S. TANAKA	Leinaala TERUYA DRUMMOND
Aye	Aye	Excused	Excused	Aye	Aye	Aye	Aye	Aye

2. Was transmitted to the Mayor of the County of Maui, State of Hawaii, on the 1st day of May, 1992.

DATED AT WAILUKU, MAUI, HAWAII, this 1st day of May, 1992.

HOWARD S. KIHUNE, CHAIR
Council of the County of Maui

DARYL T. YAMAMOTO, COUNTY CLERK
County of Maui

THE FOREGOING BILL IS HEREBY APPROVED THIS 5th DAY OF MAY, 1992.

LINDA CROCKETT LINGLE, MAYOR
County of Maui

I HEREBY CERTIFY that upon approval of the foregoing BILL by the Mayor of the County of Maui, the said BILL was designated as ORDINANCE NO. 2108 of the County of Maui, State of Hawaii.

DARYL T. YAMAMOTO, COUNTY CLERK
County of Maui

Passed First Reading on January 17, 1992.
Effective date of Ordinance May 5, 1992.

I HEREBY CERTIFY that the foregoing is a true and correct copy of Ordinance No. 2108, the original of which is on file in the Office of the County Clerk, County of Maui, State of Hawaii.

Dated at Wailuku, Hawaii, on

County Clerk, County of Maui



Guidance Specifying Management Measures For Sources Of Nonpoint Pollution In Coastal Waters

Issued Under the Authority of
Section 6217(g) of the Coastal Zone Act
Reauthorization Amendments of 1990

III. CONSTRUCTION ACTIVITIES

A. Construction Site Erosion and Sediment Control Management Measure

- (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.

1. Applicability

This management measure is intended to be applied by States to all construction activities on sites less than 5 acres in areas that do not have an NPDES permit³ in order to control erosion and sediment loss from those sites. This management measure does not apply to: (1) construction of a detached single family home on a site of 1/2 acre or more or (2) construction that does not disturb over 5,000 square feet of land on a site. (NOTE: All construction activities, including clearing, grading, and excavation, that result in the disturbance of areas greater than or equal to 5 acres or are a part of a larger development plan are covered by the NPDES regulations and are thus excluded from these requirements.) Under the Coastal Zone Act Reauthorization Amendments of 1990, States are subject to a number of requirements as they develop coastal NPS programs in conformity with this management measure and will have flexibility in doing so. The application of management measures by States is described more fully in *Coastal Nonpoint Pollution Control Program: Program Development and Approval Guidance*, published jointly by the U.S. Environmental Protection Agency (EPA) and the National Oceanic and Atmospheric Administration (NOAA) of the U.S. Department of Commerce.

2. Description

The goal of this management measure is to reduce the sediment loadings from construction sites in coastal areas that enter surface waterbodies. This measure requires that coastal States establish new or enhance existing State erosion and sediment control (ESC) programs and/or require ESC programs at the local level. It is intended to be part of a comprehensive land use or watershed management program, as previously detailed in the Watershed and Site Development Management Measures. It is expected that State and local programs will establish criteria determined by local conditions (e.g., soil types, climate, meteorology) that reduce erosion and sediment transport from construction sites.

Runoff from construction sites is by far the largest source of sediment in urban areas under development (York County Soil and Water Conservation District, 1990). Soil erosion removes over 90 percent of sediment by tonnage in urbanizing areas where most construction activities occur (Canning, 1988). Table 4-14 illustrates some of the

³ On May 27, 1992, the United States Court of Appeals for the Ninth Circuit invalidated EPA's exemption of construction sites smaller than 5 acres from the storm water permit program in *Natural Resources Defense Council v. EPA*, 965 F.2d 759 (9th Cir. 1992). EPA is conducting further rulemaking proceedings on this issue and will not require permit applications for construction activities under 5 acres until further rulemaking has been completed.

measured sediment loading rates associated with construction activities found across the United States. As seen in Table 4-14, erosion rates from natural areas such as undisturbed forested lands are typically less than one ton/acre/year, while erosion from construction sites ranges from 7.2 to over 1,000 tons/acre/year.

Table 4-14. Erosion and Sediment Problems Associated With Construction

Location	Problem	Reference
United States	Sediment loading rates vary from 36.5 to 1,000 ton/ac/yr. These are 5 to 500 times greater than those from undeveloped land. Approximately 600 million tons of soil erodes from developed sites each year. Construction site sediment in runoff can be 10 to 20 times greater than that from agricultural lands.	York County Soil and Water Conservation District, 1990
Franklin County, FL	Sediment yield (ton/ac/yr): forest < 0.5 rangeland < 0.5 tilled 1.4 construction site 30 established urban < 0.5	Franklin County, FL
Wisconsin	Erosion rates range from 30 to 200 ton/ac/yr (10 to 20 times those of cropland).	Wisconsin Legislative Council, 1991
Washington, DC	Erosion rates range from 35 to 45 ton/ac/yr (10 to 100 times greater than agriculture and stabilized urban land uses).	MWCOG, 1987
Anacostia River Basin, VA, MD, DC	Sediment yields from portions of the Anacostia Basin have been estimated at 75,000 to 132,000 ton/yr.	U.S. Army Corps of Engineers, 1990
Washington	Erosion rates range from 50 to 500 ton/ac/yr. Natural erosion rates from forests or well-sodded prairies are 0.01 to 1.0 ton/ac/yr.	Washington Department of Ecology, 1989
Anacostia River Basin, VA, MD, DC	Erosion rates range from 7.2 to 100.8 ton/ac/yr.	USGS, 1978
Alabama	1.4 million tons eroded per year.	Woodward-Clyde, 1991
North Carolina	6.7 million tons eroded per year.	
Louisiana	5.1 million tons eroded per year.	
Oklahoma	4.2 million tons eroded per year.	
Georgia	3.8 million tons eroded per year.	
Texas	3.5 million tons eroded per year.	
Tennessee	3.3 million tons eroded per year.	
Pennsylvania	3.1 million tons eroded per year.	
Ohio	3.0 million tons eroded per year.	
Kentucky	3.0 million tons eroded per year.	

Eroded sediment from construction sites creates many problems in coastal areas including adverse impacts on water quality, critical habitats, submerged aquatic vegetation (SAV) beds, recreational activities, and navigation (APWA, 1991). For example, the Miami River in Florida has been severely affected by pollution associated with upland erosion. This watershed has undergone extensive urbanization, which has included the construction of many commercial and residential buildings over the past 50 years. Sediment deposited in the Miami River channel contributes to the severe water quality and navigation problems of this once-thriving waterway, as well as Biscayne Bay (SFWMD, 1988).

ESC plans are important for controlling the adverse impacts of construction and land development and have been required by many State and local governments, as shown in Table 4-13 (in the Site Development section of this chapter). An ESC plan is a document that explains and illustrates the measures to be taken to control erosion and sediment problems on construction sites (Connecticut Council on Soil and Water Conservation, 1988). It is intended that existing State and local erosion and sediment control plans may be used to fulfill the requirements of this management measure. Where existing ESC plans do not meet the management measure criteria, inadequate plans may be enhanced to meet the management measure guidelines.

Typically, an ESC plan is part of a larger site plan and includes the following elements:

- Description of predominant soil types;
- Details of site grading including existing and proposed contours;
- Design details and locations for structural controls;
- Provisions to preserve topsoil and limit disturbance;
- Details of temporary and permanent stabilization measures; and
- Description of the sequence of construction.

ESC plans ensure that provisions for control measures are incorporated into the site planning stage of development and provide for the reduction of erosion and sediment problems and accountability if a problem occurs (York County Soil and Water Conservation District, 1990). An effective plan for urban runoff management on construction sites will control erosion, retain sediments on site, to the extent practicable, and reduce the adverse effects of runoff. Climate, topography, soils, drainage patterns, and vegetation will affect how erosion and sediment should be controlled on a site (Washington State Department of Ecology, 1989). An effective ESC plan includes both structural and nonstructural controls. Nonstructural controls address erosion control by decreasing erosion potential, whereas structural controls are both preventive and mitigative because they control both erosion and sediment movement.

Typical nonstructural erosion controls include (APWA, 1991; York County Soil and Water Conservation District, 1990):

- Planning and designing the development within the natural constraints of the site;
- Minimizing the area of bare soil exposed at one time (phased grading);
- Providing for stream crossing areas for natural and man-made areas; and
- Stabilizing cut-and-fill slopes caused by construction activities.

Structural controls include:

- Perimeter controls;
- Mulching and seeding exposed areas;
- Sediment basins and traps; and
- Filter fabric, or silt fences.

Some erosion and soil loss are unavoidable during land-disturbing activities. While proper siting and design will help prevent areas prone to erosion from being developed, construction activities will invariably produce conditions where erosion may occur. To reduce the adverse impacts associated with construction, the construction management measure suggests a system of nonstructural and structural erosion and sediment controls for incorporation into an

ESC plan. Erosion controls have distinct advantages over sediment controls. Erosion controls reduce the amount of sediment transported off-site, thereby reducing the need for sediment controls. When erosion controls are used in conjunction with sediment controls, the size of the sediment control structures and associated maintenance may be reduced, decreasing the overall treatment costs (SWRPC, 1991).

3. Management Measure Selection

This management measure was selected to minimize sediment being transported outside the perimeter of a construction site through two broad performance goals: (1) **reduce erosion** and (2) **retain sediment onsite**, to the extent practicable. These performance goals were chosen to allow States and local governments flexibility in specifying practices appropriate for local conditions.

While several commentors responding to the draft (May 1991) guidance expressed the need to define "more measurable, enforceable ways" to control sediment loadings, other commentors stressed the need to draft management measures that do not conflict with existing State programs and allow States and local governments to determine appropriate practices and design standards for their communities. These management measures were selected because virtually all coastal States control construction activities to prevent erosion and sediment loss.

The measures were specifically written for the following reasons:

- (1) Predevelopment loadings may vary greatly, and some sediment loss is usually inevitable;
- (2) Current practice is built on the use of systems of practices selected based on site-specific conditions; and
- (3) The combined effectiveness of erosion and sediment controls in systems is not easily quantified.

4. Erosion Control Practices

As discussed more fully at the beginning of this chapter and in Chapter 1, the following practices are described for illustrative purposes only. State programs need not require implementation of these practices. However, as a practical matter, EPA anticipates that the management measure set forth above generally will be implemented by applying one or more management practices appropriate to the source, location, and climate. The practices set forth below have been found by EPA to be representative of the types of practices that can be applied successfully to achieve the management measure described above.

Erosion controls are used to reduce the amount of sediment that is detached during construction and to prevent sediment from entering runoff. Erosion control is based on two main concepts: (1) disturb the smallest area of land possible for the shortest period of time, and (2) stabilize disturbed soils to prevent erosion from occurring.

■ a. *Schedule projects so clearing and grading are done during the time of minimum erosion potential.*

Often a project can be scheduled during the time of year that the erosion potential of the site is relatively low. In many parts of the country, there is a certain period of the year when erosion potential is relatively low and construction scheduling could be very effective. For example, in the Pacific region if construction can be completed during the 6-month dry season (May 1 - October 31), temporary erosion and sediment controls may not be needed. In addition, in some parts of the country erosion potential is very high during certain parts of the year such as the spring thaw in northern areas. During this time of year, melting snowfall generates a constant runoff that can erode soil. In addition, construction vehicles can easily turn the soft, wet ground into mud, which is more easily washed offsite. Therefore, in the north, limitations should be placed on grading during the spring thaw (Goldman et al., 1986).

b. Stage construction.

Avoid areawide clearance of construction sites. Plan and stage land disturbance activities so that only the area currently under construction is exposed. As soon as the grading and construction in an area are complete, the area should be stabilized.

By clearing only those areas immediately essential for completing site construction, buffer zones are preserved and soil remains undisturbed until construction begins. Physical markers, such as tape, signs, or barriers, indicating the limits of land disturbance, can ensure that equipment operators know the proposed limits of clearing. The area of the watershed that is exposed to construction is important for determining the net amount of erosion. Reducing the extent of the disturbed area will ultimately reduce sediment loads to surface waters. Existing or newly planted vegetation that has been planted to stabilize disturbed areas should be protected by routing construction traffic around and protecting natural vegetation with fencing, tree armoring, retaining walls, or tree wells.

c. Clear only areas essential for construction.

Often areas of a construction site are unnecessarily cleared. Only those areas essential for completing construction activities should be cleared, and other areas should remain undisturbed. Additionally, the proposed limits of land disturbance should be physically marked off to ensure that only the required land area is cleared. Avoid disturbing vegetation on steep slopes or other critical areas.

d. Locate potential nonpoint pollutant sources away from steep slopes, waterbodies, and critical areas.

Material stockpiles, borrow areas, access roads, and other land-disturbing activities can often be located away from critical areas such as steep slopes, highly erodible soils, and areas that drain directly into sensitive waterbodies.

e. Route construction traffic to avoid existing or newly planted vegetation.

Where possible, construction traffic should travel over areas that must be disturbed for other construction activity. This practice will reduce the area that is cleared and susceptible to erosion.

f. Protect natural vegetation with fencing, tree armoring, and retaining walls or tree wells.

Tree armoring protects tree trunks from being damaged by construction equipment. Fencing can also protect tree trunks, but should be placed at the tree's drip line so that construction equipment is kept away from the tree. The tree drip line is the minimum area around a tree in which the tree's root system should not be disturbed by cut, fill, or soil compaction caused by heavy equipment. When cutting or filling must be done near a tree, a retaining wall or tree well should be used to minimize the cutting of the tree's roots or the quantity of fill placed over the tree's roots.

g. Stockpile topsoil and reapply to revegetate site.

Because of the high organic content of topsoil, it cannot be used as fill material or under pavement. After a site is cleared, the topsoil is typically removed. Since topsoil is essential to establish new vegetation, it should be stockpiled and then reapplied to the site for revegetation, if appropriate. Although topsoil salvaged from the existing site can often be used, it must meet certain standards and topsoil may need to be imported onto the site if the existing topsoil is not adequate for establishing new vegetation.

h. Cover or stabilize topsoil stockpiles.

Unprotected stockpiles are very prone to erosion and therefore stockpiles must be protected. Small stockpiles can be covered with a tarp to prevent erosion. Large stockpiles should be stabilized by erosion blankets, seeding, and/or mulching.

i. Use wind erosion controls.

Wind erosion controls limit the movement of dust from disturbed soil surfaces and include many different practices. Wind barriers block air currents and are effective in controlling soil blowing. Many different materials can be used as wind barriers, including solid board fence, snow fences, and bales of hay. Sprinkling moistens the soil surface with water and must be repeated as needed to be effective for preventing wind erosion (Delaware DNREC, 1989); however, applications must be monitored to prevent excessive runoff and erosion.

j. Intercept runoff above disturbed slopes and convey it to a permanent channel or storm drain.

Earth dikes, perimeter dikes or swales, or diversions can be used to intercept and convey runoff above disturbed areas. An earth dike is a temporary berm or ridge of compacted soil that channels water to a desired location. A perimeter dike/swale or diversion is a swale with a supporting ridge on the lower side that is constructed from the soil excavated from the adjoining swale (Delaware DNREC, 1989). These practices should be used to intercept flow from denuded areas or newly seeded areas to keep the disturbed areas from being eroded from the uphill runoff. The structures should be stabilized within 14 days of installation. A pipe slope drain, also known as a pipe drop structure, is a temporary pipe placed from the top of a slope to the bottom of the slope to convey concentrated runoff down the slope without causing erosion (Delaware DNREC, 1989).

k. On long or steep, disturbed, or man-made slopes, construct benches, terraces, or ditches at regular intervals to intercept runoff.

Benches, terraces, or ditches break up a slope by providing areas of low slope in the reverse direction. This keeps water from proceeding down the slope at increasing volume and velocity. Instead, the flow is directed to a suitable outlet, such as a sediment basin or trap. The frequency of benches, terraces, or ditches will depend on the erodibility of the soils, steepness and length of the slope, and rock outcrops. This practice should be used if there is a potential for erosion along the slope.

l. Use retaining walls.

Often retaining walls can be used to decrease the steepness of a slope. If the steepness of a slope is reduced, the runoff velocity is decreased and, therefore, the erosion potential is decreased.

m. Provide linings for urban runoff conveyance channels.

Often construction increases the velocity and volume of runoff, which causes erosion in newly constructed or existing urban runoff conveyance channels. If the runoff during or after construction will cause erosion in a channel, the channel should be lined or flow control BMPs installed. The first choice of lining should be grass or sod since this reduces runoff velocities and provides water quality benefits through filtration and infiltration. If the velocity in the channel would erode the grass or sod, then riprap, concrete, or gabions can be used.

n. Use check dams.

Check dams are small, temporary dams constructed across a swale or channel. They can be constructed using gravel or straw bales. They are used to reduce the velocity of concentrated flow and, therefore, to reduce the erosion in

a swale or channel. Check dams should be used when a swale or channel will be used for a short time and therefore it is not feasible or practical to line the channel or implement flow control BMPs (Delaware DNREC, 1989).

o. *Seed and fertilize.*

Seeding establishes a vegetative cover on disturbed areas. Seeding is very effective in controlling soil erosion once a dense vegetative cover has been established. However, often seeding and fertilizing do not produce as thick a vegetative cover as do seed and mulch or netting. Newly established vegetation does not have as extensive a root system as existing vegetation and therefore is more prone to erosion, especially on steep slopes. Care should be taken when fertilizing to avoid untimely or excessive application. Since the practice of seeding and fertilizing does not provide any protection during the time of vegetative establishment, it should be used only on favorable soils in very flat areas and not in sensitive areas.

p. *Use seeding and mulch/mats.*

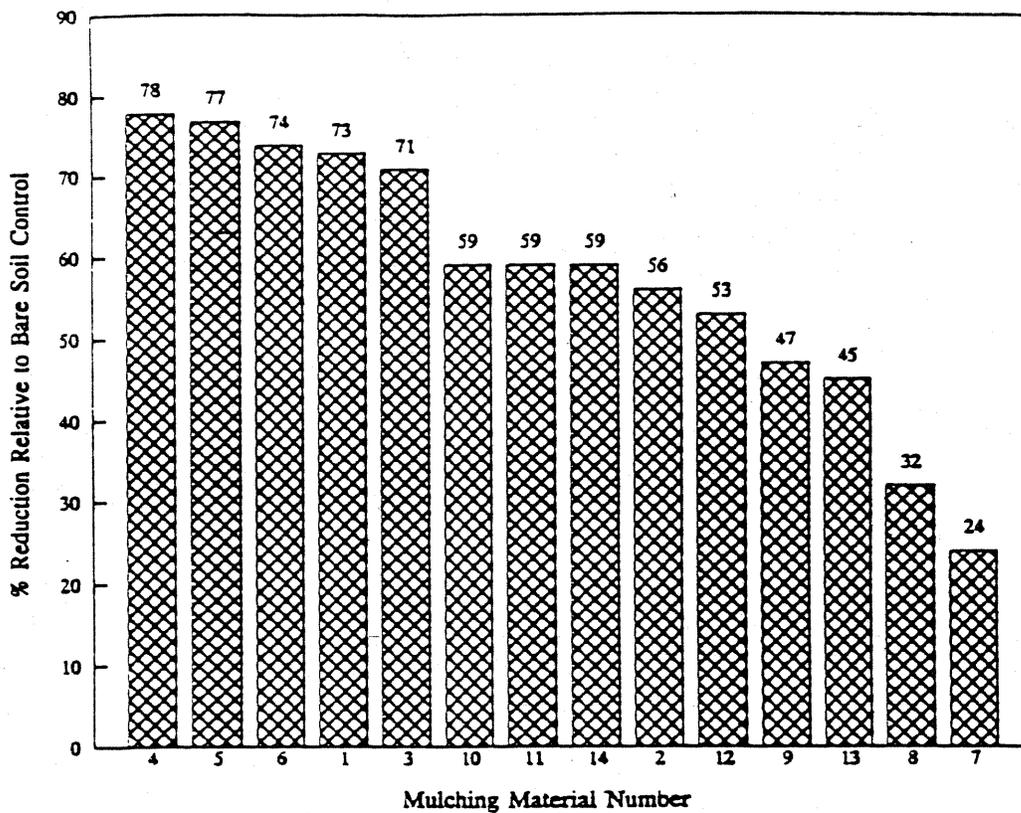
Seeding establishes a vegetative cover on disturbed areas. Seeding is very effective in controlling soil erosion once the vegetative cover has been established. The mulching/mats protect the disturbed area while the vegetation becomes established.

The management of land by using ground cover reduces erosion by reducing the flow rate of runoff and the raindrop impact. Bare soils should be seeded or otherwise stabilized within 15 calendar days after final grading. Denuded areas that are inactive and will be exposed to rain for 30 days or more should also be temporarily stabilized, usually by planting seeds and establishing vegetation during favorable seasons in areas where vegetation can be established. In very flat, non-sensitive areas with favorable soils, stabilization may involve simply seeding and fertilizing. Mulching and/or sodding may be necessary as slopes become moderate to steep, as soils become more erosive, and as areas become more sensitive.

q. *Use mulch/mats.*

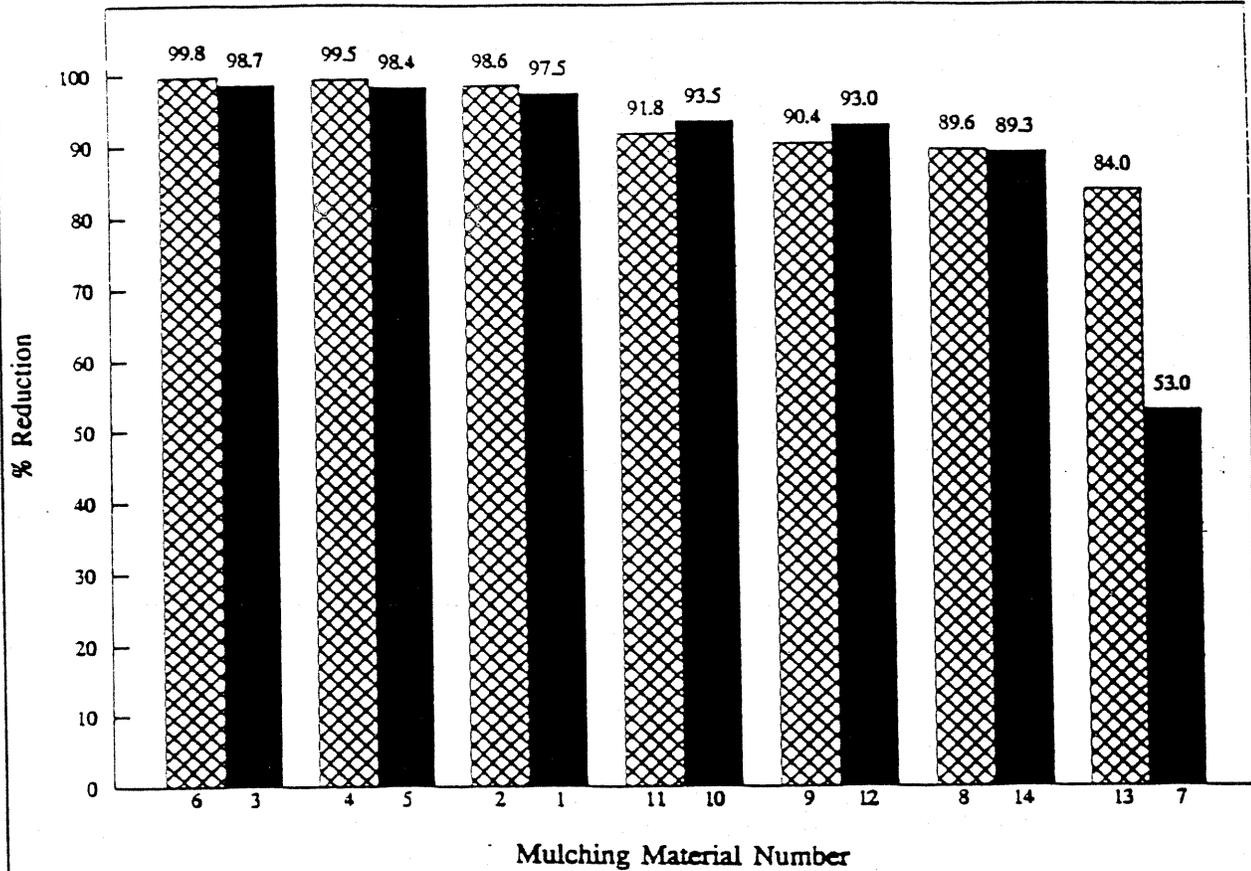
Mulching involves applying plant residues or other suitable materials on disturbed soil surfaces. Mulchs/mats used include tacked straw, wood chips, and jute netting and are often covered by blankets or netting. Mulching alone should be used only for temporary protection of the soil surface or when permanent seeding is not feasible. The useful life of mulch varies with the material used and the amount of precipitation, but is approximately 2 to 6 months. Figure 4-5 shows water velocity reductions that could be expected using various mulching techniques. Similarly, Figure 4-6 shows reductions in soil loss achievable using various mulching techniques. During times of year when vegetation cannot be established, soil mulching should be applied to moderate slopes and soils that are not highly erodible. On steep slopes or highly erodible soils, multiple mulching treatments should be used. On a high-elevation or desert site where grasses cannot survive the harsh environment, native shrubs may be planted. Interlocking ceramic materials, filter fabric, and netting are available for this purpose. Before stabilizing an area, it is important to have installed all sediment controls and diverted runoff away from the area to be planted. Runoff may be diverted away from denuded areas or newly planted areas using dikes, swales, or pipe slope drains to intercept runoff and convey it to a permanent channel or storm drain. Reserved topsoil may be used to revegetate a site if the stockpile has been covered and stabilized.

Consideration should be given to maintenance when designing mulching and matting schemes. Plastic nets are often used to cover the mulch or mats; however, they can foul lawn mower blades if the area requires mowing.



Mulch Material	Characteristics
1	100% wheat straw/top net
2	100% wheat straw/two nets
3	70% wheat straw/30% coconut fiber
4	70% wheat straw/30% coconut fiber
5	100% coconut fiber
6	Nylon monofilament/two nets
7	Nylon monofilament/rigid/bonded
8	Vinyl monofilament/flexible/bonded
9	Curled wood fibers/top net
10	Curled wood fibers/two nets
11	Antiwash netting (jute)
12	Interwoven paper and thread
13	Uncrimped wheat straw - 2,242 kg/ha
14	Uncrimped wheat straw - 4,484 kg/ha

Figure 4-5. Water velocity reductions for different mulch treatments (adapted from Harding, 1990).



Mulch Material	Characteristics
1	100% wheat straw/top net
2	100% wheat straw/two nets
3	70% wheat straw/30% coconut fiber
4	70% wheat straw/30% coconut fiber
5	100% coconut fiber
6	Nylon monofilament/two nets
7	Nylon monofilament/rigid/bonded
8	Vinyl monofilament/flexible/bonded
9	Curled wood fibers/top net
10	Curled wood fibers/two nets
11	Antiwash netting (jute)
12	Interwoven paper and thread
13	Uncrimped wheat straw - 2,242 kg/ha
14	Uncrimped wheat straw - 4,484 kg/ha

Figure 4-6. Actual soil loss reductions for different mulch treatments (adapted from Harding, 1990).

r. Use sodding.

Sodding permanently stabilizes an area. Sodding provides immediate stabilization of an area and should be used in critical areas or where establishment of permanent vegetation by seeding and mulching would be difficult. Sodding is also a preferred option when there is a high erosion potential during the period of vegetative establishment from seeding.

s. Use wildflower cover.

Because of the hardy drought-resistant nature of wildflowers, they may be more beneficial as an erosion control practice than turf grass. While not as dense as turfgrass, wildflower thatches and associated grasses are expected to be as effective in erosion control and contaminant absorption. Because thatches of wildflowers do not need fertilizers, pesticides, or herbicides, and watering is minimal, implementation of this practice may result in a cost savings (Brash et al., undated). In 1987, Howard County, Maryland, spent \$690.00 per acre to maintain turfgrass areas, compared to only \$31.00 per acre for wildflower meadows (Wilson, 1990).

A wildflower stand requires several years to become established; maintenance requirements are minimal once the area is established (Brash et al., undated).

5. Sediment Control Practices⁴

As discussed more fully at the beginning of this chapter and in Chapter 1, the following practices are described for illustrative purposes only. State programs need not require implementation of these practices. However, as a practical matter, EPA anticipates that the management measure set forth above generally will be implemented by applying one or more management practices appropriate to the source, location, and climate. The practices set forth below have been found by EPA to be representative of the types of practices that can be applied successfully to achieve the management measure described above.

Sediment controls capture sediment that is transported in runoff. Filtration and detention (gravitational settling) are the main processes used to remove sediment from urban runoff.

a. Sediment Basins

Sediment basins, also known as silt basins, are engineered impoundment structures that allow sediment to settle out of the urban runoff. They are installed prior to full-scale grading and remain in place until the disturbed portions of the drainage area are fully stabilized. They are generally located at the low point of sites, away from construction traffic, where they will be able to trap sediment-laden runoff.

Sediment basins are typically used for drainage areas between 5 and 100 acres. They can be classified as either temporary or permanent structures, depending on the length of service of the structure. If they are designed to function for less than 36 months, they are classified as "temporary"; otherwise, they are considered permanent structures. Temporary sediment basins can also be converted into permanent urban runoff management ponds. When sediment basins are designed as permanent structures, they must meet all standards for wet ponds.

b. Sediment Trap

Sediment traps are small impoundments that allow sediment to settle out of runoff water. Sediment traps are typically installed in a drainageway or other point of discharge from a disturbed area. Temporary diversions can be

⁴Adapted from Goldman (1986).

used to direct runoff to the sediment trap. Sediment traps should not be used for drainage areas greater than 5 acres and typically have a useful life of approximately 18 to 24 months.

■ c. *Filter Fabric Fence*

Filter fabric fence is available from many manufacturers and in several mesh sizes. Sediment is filtered out as urban runoff flows through the fabric. Such fences should be used only where there is sheet flow (i.e., no concentrated flow), and the maximum drainage area to the fence should be 0.5 acre or less per 100 feet of fence. Filter fabric fences have a useful life of approximately 6 to 12 months.

■ d. *Straw Bale Barrier*

A straw bale barrier is a row of anchored straw bales that detain and filter urban runoff. Straw bales are less effective than filter fabric, which can usually be used in place of straw bales. However, straw bales have been effectively used as temporary check dams in channels. As with filter fabric fences, straw bale barriers should be used only where there is sheet flow. The maximum drainage area to the barrier should be 0.25 acre or less per 100 feet of barrier. The useful life of straw bales is approximately 3 months.

■ e. *Inlet Protection*

Inlet protection consists of a barrier placed around a storm drain drop inlet, which traps sediment before it enters the storm sewer system. Filter fabric, straw bales, gravel, or sand bags are often used for inlet protection.

■ f. *Construction Entrance*

A construction entrance is a pad of gravel over filter cloth located where traffic leaves a construction site. As vehicles drive over the gravel, mud, and sediment are collected from the vehicles' wheels and offsite transport of sediment is reduced.

■ g. *Vegetated Filter Strips*

Vegetated filter strips are low-gradient vegetated areas that filter overland sheet flow. Runoff must be evenly distributed across the filter strip. Channelized flows decrease the effectiveness of filter strips. Level spreading devices are often used to distribute the runoff evenly across the strip (Dillaha et al., 1989).

Vegetated filter strips should have relatively low slopes and adequate length and should be planted with erosion-resistant plant species. The main factors that influence the removal efficiency are the vegetation type, soil infiltration rate, and flow depth and travel time. These factors are dependent on the contributing drainage area, slope of strip, degree and type of vegetative cover, and strip length. Maintenance requirements for vegetated filter strips include sediment removal and inspections to ensure that dense, vigorous vegetation is established and concentrated flows do not occur. Maintenance of these structures is discussed in Section II.A of this chapter.

6. Effectiveness and Cost Information

■ a. *Erosion Control Practices*

The effectiveness of erosion control practices can vary based on land slope, the size of the disturbed area, rainfall frequency and intensity, wind conditions, soil type, use of heavy machinery, length of time soils are exposed and unprotected, and other factors. In general, a system of erosion and sediment control practices can more effectively reduce offsite sediment transport than can a single system. Numerous nonstructural measures such as protecting natural or newly planted vegetation, minimizing the disturbance of vegetation on steep slopes and other highly

erodible areas, maximizing the distance eroded material must travel before reaching the drainage system, and locating roads away from sensitive areas may be used to reduce erosion.

Table 4-15 contains the available cost and effectiveness data for some of the erosion controls listed above. Information on the effectiveness of individual nonstructural controls was not available. All reported effectiveness data assume that controls are properly designed, constructed, and maintained. Costs have been broken down into annual capital costs, annual maintenance costs, and total annual costs (including annualization of the capital costs).

■ b. *Sediment Control Practices*

Regular inspection and maintenance are needed for most erosion control practices to remain effective. The effectiveness of sediment controls will depend on the size of the construction site and the nature of the runoff flows. Sediment basins are most appropriate for drainage areas of 5 acres or greater. In smaller areas with concentrated flows, silt traps may suffice. Where concentrated flow leaves the site and the drainage area is less than 0.5 ac/100 ft of flow, filter fabric fences may be effective. In areas where sheet flow leaves the site and the drainage area is greater than 0.5 acre/100 ft of flow, perimeter dikes may be used to divert the flow to a sediment trap or sediment basin. Urban runoff inlets may be protected using straw bales or diversions to filter or route runoff away from the inlets.

Table 4-16 describes the general cost and effectiveness of some common sediment control practices.

■ c. *Comparisons*

Figure 4-7 illustrates the estimated TSS loading reductions from Maryland construction sites possible using a combination of erosion and sediment controls in contrast to using only sediment controls. Figure 4-8 shows a comparison of the cost and effectiveness of various erosion control practices. As can be seen in Figure 4-8, seeding or seeding and mulching provide the highest levels of control at the lowest cost.

Table 4-15. ESC Quantitative Effectiveness and Cost Summary

Practice	Design Constraints or Purpose	Percent Removal of TSS	Useful Life (years) ^a	Construction Cost	Annual Maintenance Cost (as % construction cost)	Total Annual Cost
Sod	Immediate erosion protection where there is high erosion potential during vegetative establishment.	Average: 99% Observed range: 98% - 99% References: Minnesota Pollution Control Agency, 1989; Pennsylvania, 1983 cited in USEPA, 1991	2	Average: \$0.2 per ft ² [\$11,300 per acre] Range: \$0.1 - \$1.1 References: SWRPC, 1991; Schueler, 1987; Virginia, 1980	Average: 5% Range: 5% Reference: SWRPC, 1991	\$0.20 per ft ² \$7,500 per acre
Seed	Establish vegetation on disturbed area.	After vegetation established- Average: 90% Observed range: 50% - 100% References: SCS, 1985 cited in EPA, 1991; Minnesota Pollution Control Agency, 1989; Oberts, 1984 cited in City of Austin, 1988; Delaware Department of Natural Resources, 1989	2	Average: \$400 per acre Range: \$200 - \$1000 per acre References: Wisconsin DOT cited in SWRPC, 1991; SWRPC, 1991; Goldman, 1986; cited in SWRPC, Virginia, 1980	Average: 20% Range: 15% - 25% References: Wisconsin DOT cited in SWRPC, 1991; SWRPC, 1991	\$300 per acre
Seed and Mulch	Establish vegetation on disturbed area.	After vegetation established- Average: 90% Observed range: 50% - 100% References: SCS, 1985 cited in EPA, 1991; Minnesota Pollution Control Agency, 1989; Oberts, 1984 cited in City of Austin, 1988; Delaware Department of Natural Resources, 1989	2	Average: \$1,500 per acre Range: \$800 - \$3,500 per acre References: Goldman, 1986; Washington DOT, 1990; NC State, 1990; Schueler, 1987; Virginia, 1980; SWRPC, 1991	Average: NA ^b Range: NA References: None	\$1,100 per acre

Table 4-15. (Continued)

Practice	Design Constraints or Purpose	Observed range:	Percent Removal of TSS	Useful Life (years) ^a	Construction Cost	Annual Maintenance Cost (as % construction cost)	Total Annual Cost
Mulch	Temporary stabilization of disturbed area.	Observed range:		Straw mulch: 0.25	Straw mulch: Average: \$1,700 per acre Range: \$500 - \$5,000 per acre References: Wisconsin DOT cited in SWRPC, 1991; Washington DOT, 1980; Virginia, 1980	Average: NA ^b Range: NA References: None	Straw mulch: \$7,500 per acre
		sand:	20% slope 50-60%	50% slope 0-20%			
		wood fiber @ 1500 lb/ac wood fiber @ 3000 lb/ac straw @ 3000 lb/ac	50-60% 50-85% 90-100%	50-70% 95%			
		<u>Silt-loam:</u>	20% slope 20-60%	Wood fiber mulch: 0.33	Wood fiber mulch: Average: \$1,000 per acre Range: \$100 - \$2,300 per acre References: Washington DOT, 1990; Virginia, 1980		Wood fiber mulch: \$3,500 per acre
		wood fiber @ 1500 lb/ac wood fiber @ 3000 lb/ac straw @ 3000 lb/ac	20-60% 60-90% 80-95%	40-60% 60-70% 70-90%			
		<u>Silt-clay-loam:</u>	10-30% slope 5%	Jute netting: 0.33	Jute netting: Average: \$3,700 per acre Range: \$3,500-\$4,100 per acre References: Washington DOT, 1990; Virginia, 1980		Jute netting: \$12,500 per acre
		wood fiber @ 1500 lb/ac wood fiber @ 3000 lb/ac jute netting straw @ 3000 lb/ac wood chips @ 10,000 lb/ac mulch blanket excelsior blanket multiple treatment (straw and jute)	30-60% 40-70% 60-80% 60-80% 60-80% 90%	-- -- 30% 20-40% 50-60% 50-60% 50-60% and 90% jute: 0.33	Straw and jute: Average: \$5,400 per acre Range: \$4,000-\$9,100 per acre References: Washington DOT, 1990; Virginia, 1980		Straw and jute: \$18,000 per acre

References: Minnesota Pollution Control Agency, 1989; Kay, 1983 cited in Goldman, 1986

Table 4-15. (Continued)

Practice	Design Constraints or Purpose	Percent Removal of TSS	Useful Life (years) ^a	Construction Cost	Annual Maintenance Cost (as % construction cost)	Total Annual Cost
Terraces	Break up long or steep slopes.	Observed range: <u>Land Slope</u> 1-12% 12-18% 18-24%	2	Average: \$5 per lin ft Range: \$1 - \$12 References: SWRPC, 1991; Goldman, 1988; Virginia, 1991	Average: 20% Range: 20% Reference: SWRPC, 1991	\$4 per lin ft
All Erosion Controls	Reduce amount of sediment entering runoff.	Reduction in Erosion 70% 60% 55% Additionally, if the slope steepness is halved, while other factors are held constant, the soil loss potential decreases 2-1/2 times. If both the slope and length are halved, the soil loss potential is decreased 4 times. References: Goldman, 1988; Beasley, 1972	--	Varies but typically low	Varies but typically low	Varies but typically low

NA - Not available.
^a Useful life estimated as length of construction project (assumed to be 2 years).
^b For Total Annual Cost, assume Annual Maintenance Cost = 2% of construction cost.

Table 4-16. ESC Quantitative Effectiveness and Cost Summary for Sediment Control Practices

Practice	Design Constraints or Purpose	Percent Removal of TSS	Useful Life (years) ^a	Construction Cost	Annual Maintenance Cost (as % construction cost)	Total Annual Cost
Sediment basin	Minimum drainage area = 5 acres, maximum drainage area = 100 acres	Average: 70%	2	Less than 50,000 ft ³ storage	Average: 25%	Less than 50,000 ft ³ storage
		Observed range: 55% - 100% References: Schueler, 1990; Engle, BW and Jarrett, AR, 1990; Baumann, 1990		Average: \$0.60 per ft ³ storage (\$1,100 per drainage acre ^c) Range: \$0.20 - \$1.30 per ft ³ storage	Range: 25% References: Denver COG cited in SWRPC, 1991; SWRPC, 1991	\$0.40 per ft ³ storage \$700 per drainage acre ^b
Sediment trap	Maximum drainage area = 5 acres	Average: 60%	1.5	Greater than 50,000 ft ³ storage	Average: 20%	Greater than 50,000 ft ³ storage
		Observed range: (-7%) - 100% References: Schueler, et al., 1990; Tahoe Regional Planning Agency, 1989; Baumann, 1990		Average: \$0.60 per ft ³ storage (\$1,100 per drainage acre ^c) Range: \$0.10 - \$0.40 per ft ³ storage References: SWRPC, 1991	Range: 20% References: Denver COG cited in SWRPC, 1991; SWRPC, 1991	\$0.20 per ft ³ storage \$900 per drainage acre ^c
Filter Fabric Fence	Maximum drainage area = 0.5 acre per 100 feet of fence. Not to be used in concentrated flow areas.	Average: 70%	0.5	Average: \$3 per lin ft (\$700 per drainage acre ^c) Range: \$1 - \$8 per lin ft References: Wisconsin DOT cited in SWRPC, 1991; SWRPC, 1991; Goldman, 1986; Virginia, 1991; NC State, 1990	Average: 100%	\$7 per lin ft
		Observed range: 0% - 100% sand; 80% - 99% silt-loam; 50% - 80% silt-clay-loam; 0% - 20% References: Munson, 1991; Fisher et al., 1984; Minnesota Pollution Control Agency, 1989		Range: 100% References: SWRPC, 1991	\$850 per drainage acre ^c	

Table 4-16. (Continued)

Practice	Design Constraints or Purpose	Percent Removal of TSS	Useful Life (years) ^a	Construction Cost	Annual Maintenance Cost (as % construction cost)	Total Annual Cost
Straw Bale Barrier	Maximum drainage area = 0.25 acre per 100 feet of barrier. Not to be used in concentrated flow areas.	Average: 70% Observed Range: 70% References: Virginia, 1980 cited in EPA, 1991	0.25	Average: \$4 per lin ft (\$1,600 per drainage acre) ^d Range: \$2 - \$6 per lin ft References: Goldman, 1986; Virginia, 1991	Average: 100% Range: 100% References: SWRPC, 1991	\$17 per lin ft \$6,800 per drainage acre ^d
Inlet Protection	Protect storm drain inlet.	Average: NA Observed Range: NA References: None	1	Average: \$100 per inlet Range: \$50 - \$150 References: SWRPC, 1991; Denver COG cited in SWRPC, 1991; Virginia, 1991; EPA cited in SWRPC, 1991	Average: 60% Range: 20% - 100% References: SWRPC, 1991; Denver COG cited in SWRPC, 1991	\$150 per inlet
Construction Entrance	Removes sediment from vehicles wheels.	Average: NA Observed Range: NA References: None	2	Average: \$2,000 each Range: \$1,000 - \$4,000 References: Goldman, 1986; NC State, 1990	Average: NA ^e Range: NA References: None	\$1,500 each
				With washrack: Average: \$3,000 each Range: \$1,000 - \$5,000 References: Virginia, 1991		\$2,200 each

Table 4-16. (Continued)

Practice	Design Constraints or Purpose	Percent Removal of TSS	Useful Life (years) ^a	Construction Cost	Annual Maintenance Cost (as % construction cost)	Total Annual Cost
Vegetative Filter Strip	Must have sheet flow.	<p>Average: 70%</p> <p>Observed Range: 20% - 80%</p> <p>References: Hayes and Halrston, 1983 cited in Casman, 1990; Dillaha et al., 1989, cited in Glick et al., 1991; Virginia Department of Conservation, 1987; Nonpoint Source Control Task Force, 1983 cited in Minnesota PCA, 1989; Schueler, 1987</p>	2	<p>Established from existing vegetation-</p> <p>Average: \$0</p> <p>Range: \$0</p> <p>References: Schueler, 1987</p> <p>Established from sod-</p> <p>Average: \$11,300 per acre</p> <p>Range: \$4,500 - \$48,000 per acre</p> <p>References: Schueler, 1987; SWRPC, 1991</p>	<p>Average: NA</p> <p>Range: NA</p> <p>References: None</p>	NA

NA - Not available.

- ^a Useful life estimated as length of construction project (assumed to be 2 years)
- ^b For Total Annual Cost, assume Annual Maintenance Cost=20% of construction cost.
- ^c Assumes trap volume = 1800 cf/ac (0.5 inches runoff per acre).
- ^d Assumes drainage area of 0.5 acre per 100 feet of fence (maximum allowed).
- ^e Assumes drainage area of 0.25 acre per 100 feet of barrier (maximum allowed).

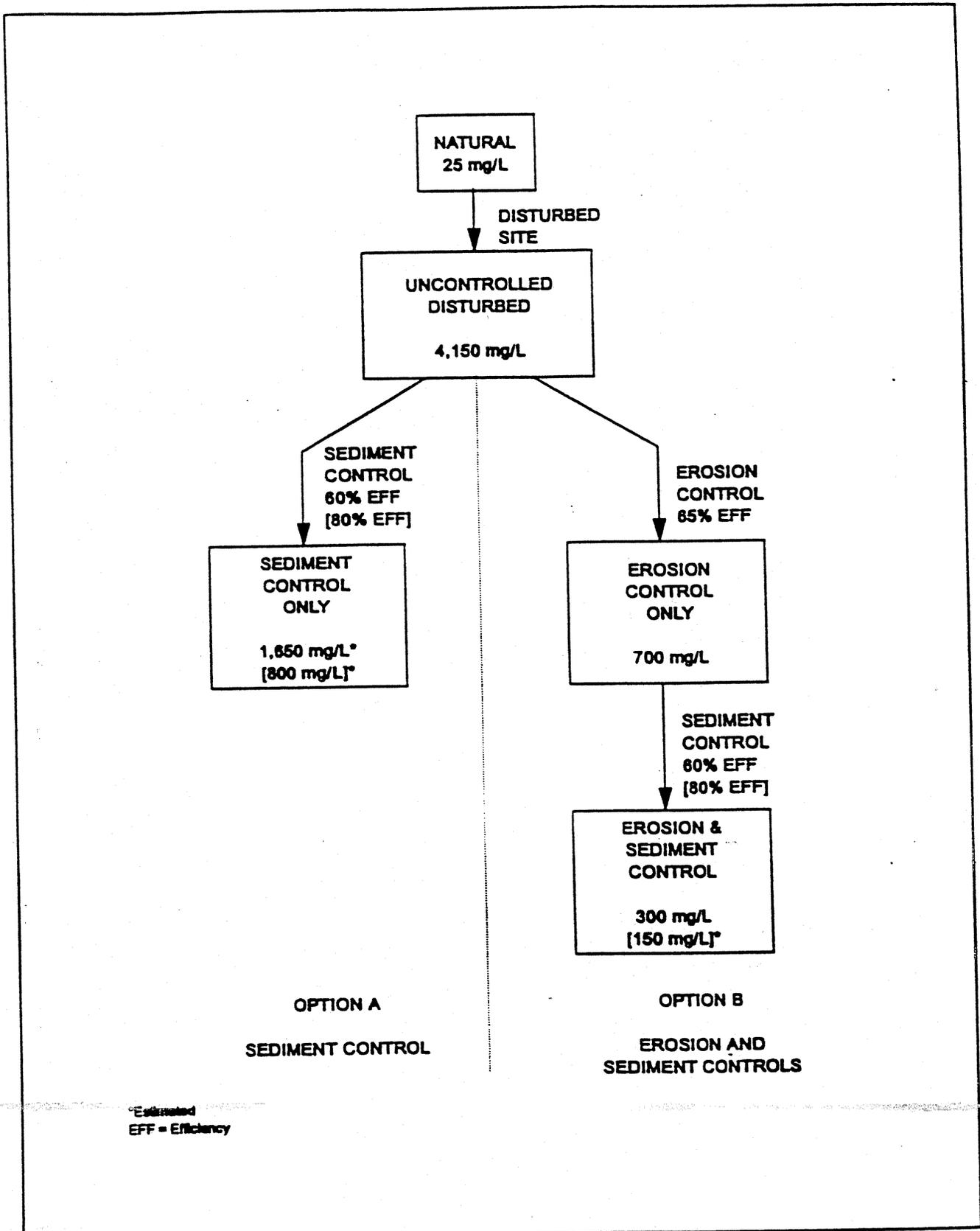


Figure 4-7. TSS concentrations from Maryland construction sites (Schueler, 1987).

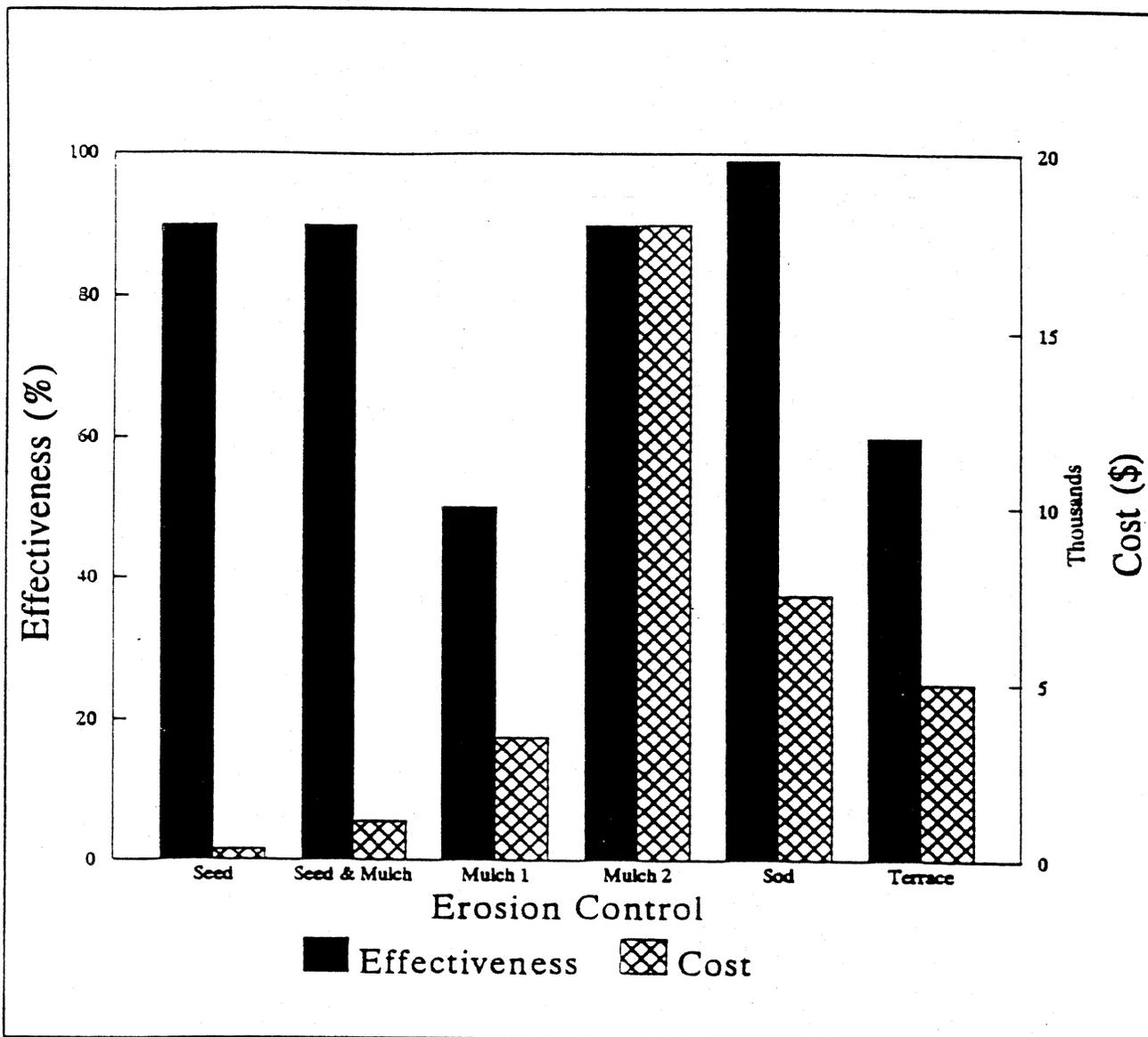


Figure 4-8. Comparison of cost and effectiveness for erosion control practices (based on information in Tables 4-15 and 4-16).

B. Construction Site Chemical Control Management Measure

- (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.

1. Applicability

This management measure is intended to be applied by States to all construction sites less than 5 acres in area and to new, resurfaced, restored, and reconstructed road, highway, and bridge construction projects. This management measure does not apply to: (1) construction of a detached single family home on a site of 1/2 acre or more or (2) construction that does not disturb over 5,000 square feet of land on a site. (NOTE: All construction activities, including clearing, grading, and excavation, that result in the disturbance of areas greater than or equal to 5 acres or are a part of a larger development plan are covered by the NPDES regulations and are thus excluded from these requirements.) Under the Coastal Zone Act Reauthorization Amendments of 1990, States are subject to a number of requirements as they develop coastal NPS programs in conformance with this management measure and will have flexibility in doing so. The application of management measures by States is described more fully in *Coastal Nonpoint Pollution Control Program: Program Development and Approval Guidance*, published jointly by the U.S. Environmental Protection Agency (EPA) and the National Oceanic and Atmospheric Administration (NOAA) of the U.S. Department of Commerce.

2. Description

The purpose of this management measure is to prevent the generation of nonpoint source pollution from construction sites due to improper handling and usage of nutrients and toxic substances, and to prevent the movement of toxic substances from the construction site.

Many potential pollutants other than sediment are associated with construction activities. These pollutants include pesticides (insecticides, fungicides, herbicides, and rodenticides); fertilizers used for vegetative stabilization; petrochemicals (oils, gasoline, and asphalt degreasers); construction chemicals such as concrete products, sealers, and paints; wash water associated with these products; paper; wood; garbage; and sanitary wastes (Washington State Department of Ecology, 1991).

The variety of pollutants present and the severity of their effects are dependent on a number of factors:

- (1) **The nature of the construction activity.** For example, potential pollution associated with fertilizer usage may be greater along a highway or at a housing development than it would be at a shopping center development because highways and housing developments usually have greater landscaping requirements.
- (2) **The physical characteristics of the construction site.** The majority of all pollutants generated at construction sites are carried to surface waters via runoff. Therefore, the factors affecting runoff volume,

such as the amount, intensity, and frequency of rainfall; soil infiltration rates; surface roughness; slope length and steepness; and area denuded, all contribute to pollutant loadings.

- (3) **The proximity of surface waters to the nonpoint pollutant source.** As the distance separating pollutant-generating activities from surface waters decreases, the likelihood of water quality impacts increases.

a. Pesticides

Insecticides, rodenticides, and herbicides are used on construction sites to provide safe and healthy conditions, reduce maintenance and fire hazards, and curb weeds and woody plants. Rodenticides are also used to control rodents attracted to construction sites. Common insecticides employed include synthetic, relatively water-insoluble chlorinated hydrocarbons, organophosphates, carbamates, and pyrethrins.

b. Petroleum Products

Petroleum products used during construction include fuels and lubricants for vehicles, for power tools, and for general equipment maintenance. Specific petroleum pollutants include gasoline, diesel oil, kerosene, lubricating oils, and grease. Asphalt paving also can be particularly harmful since it releases various oils for a considerable time period after application. Asphalt overloads might be dumped and covered without inspection. However, many of these pollutants adhere to soil particles and other surfaces and can therefore be more easily controlled.

c. Nutrients

Fertilizers are used on construction sites when revegetating graded or disturbed areas. Fertilizers contain nitrogen and phosphorus, which in large doses can adversely affect surface waters, causing eutrophication.

d. Solid Wastes

Solid wastes on construction sites are generated from trees and shrubs removed during land clearing and structure installation. Other wastes include wood and paper from packaging and building materials, scrap metals, sanitary wastes, rubber, plastic and glass, and masonry and asphalt products. Food containers, cigarette packages, leftover food, and aluminum foil also contribute solid wastes to the construction site.

e. Construction Chemicals

Chemical pollutants, such as paints, acids for cleaning masonry surfaces, cleaning solvents, asphalt products, soil additives used for stabilization, and concrete-curing compounds, may also be used on construction sites and carried in runoff.

f. Other Pollutants

Other pollutants, such as wash water from concrete mixers, acid and alkaline solutions from exposed soil or rock, and alkaline-forming natural elements, may also be present and contribute to nonpoint source pollution.

Revegetation of disturbed areas may require the use of fertilizers and pesticides, which, if not applied properly, may become nonpoint source pollutants. Many pesticides are restricted by Federal and/or State regulations.

Hydroseeding operations, in which seed, fertilizers, and lime are applied to the ground surface in a one-step operation, are more conducive to nutrient pollution than are the conventional seedbed-preparation operations, in which fertilizers and lime are tilled into the soil. Use of fertilizers containing little or no phosphorus may be required by

local authorities if the development is near sensitive waterbodies. The addition of lime can also affect the pH of sensitive waters, making them more alkaline.

Improper fueling and servicing of vehicles can lead to significant quantities of petroleum products being dumped onto the ground. These pollutants can then be washed off site in urban runoff, even when proper erosion and sediment controls are in place. Pollutants carried in solution in runoff water, or fixed with sediment crystalline structures, may not be adequately controlled by erosion and sediment control practices (Washington Department of Ecology, 1991). Oils, waxes, and water-insoluble pesticides can form surface films on water and solid particles. Oil films can also concentrate water-soluble insecticides. These pollutants can be nearly impossible to control once present in runoff other than by the use of very costly water-treatment facilities (Washington Department of Ecology, 1991).

After spill prevention, one of the best methods to control petroleum pollutants is to retain sediments containing oil on the construction site through use of erosion and sediment control practices. Improved maintenance and safe storage facilities will reduce the chance of contaminating a construction site. One of the greatest concerns related to use of petroleum products is the method for waste disposal. The dumping of petroleum product wastes into sewers and other drainage channels is illegal and could result in fines or job shutdown.

The primary control method for solid wastes is to provide adequate disposal facilities. Erosion and sediment control structures usually capture much of the solid waste from construction sites. Periodic removal of litter from these structures will reduce solid waste accumulations. Collected solid waste should be removed and disposed of at authorized disposal areas.

Improperly stored construction materials, such as pressure-treated lumber or solvents, may lead to leaching of toxics to surface water and ground water. Disposal of construction chemicals should follow all applicable State and local laws that may require disposal by a licensed waste management firm.

3. Management Measure Selection

This management measure was selected based on the potential for many construction activities to contribute to nutrient and toxic NPS pollution.

This management measure was selected because (1) construction activities have the potential to contribute to increased loadings of toxic substances and nutrients to waterbodies; (2) various States and local governments regulate the control of chemicals on construction sites through spill prevention plans, erosion and sediment control plans, or other administrative devices; (3) the practices described are commonly used and presented in a number of best management practice handbooks and guidance manuals for construction sites; and (4) the practices selected are the most economical and effective.

4. Practices

As discussed more fully at the beginning of this chapter and in Chapter 1, the following practices are described for illustrative purposes only. State programs need not require implementation of these practices. However, as a practical matter, EPA anticipates that the management measure set forth above generally will be implemented by applying one or more management practices appropriate to the source, location, and climate. The practices set forth below have been found by EPA to be representative of the types of practices that can be applied successfully to achieve the management measure described above.

■ a. *Properly store, handle, apply, and dispose of pesticides.*

Pesticide storage areas on construction sites should be protected from the elements. Warning signs should be placed in areas recently sprayed or treated. Persons mixing and applying these chemicals should wear suitable protective clothing, in accordance with the law.

Application rates should conform to registered label directions. Disposal of excess pesticides and pesticide-related wastes should conform to registered label directions for the disposal and storage of pesticides and pesticide containers set forth in applicable Federal, State, and local regulations that govern their usage, handling, storage, and disposal. Pesticides and herbicides should be used only in conjunction with Integrated Pest Management (IPM) (see Chapter 2). Pesticides should be the tool of last resort; methods that are the least disruptive to the environment and human health should be used first.

Pesticides should be disposed of through either a licensed waste management firm or a treatment, storage, and disposal (TSD) facility. Containers should be triple-rinsed before disposal, and rinse waters should be reused as product.

Other practices include setting aside a locked storage area, tightly closing lids, storing in a cool, dry place, checking containers periodically for leaks or deterioration, maintaining a list of products in storage, using plastic sheeting to line the storage area, and notifying neighboring property owners prior to spraying.

■ **b. *Property store, handle, use, and dispose of petroleum products.***

When storing petroleum products, follow these guidelines:

- Create a shelter around the area with cover and wind protection;
- Line the storage area with a double layer of plastic sheeting or similar material;
- Create an impervious berm around the perimeter with a capacity 110 percent greater than that of the largest container;
- Clearly label all products;
- Keep tanks off the ground; and
- Keep lids securely fastened.

Oil and oily wastes such as crankcase oil, cans, rags, and paper dropped into oils and lubricants should be disposed of in proper receptacles or recycled. Waste oil for recycling should not be mixed with degreasers, solvents, antifreeze, or brake fluid.

■ **c. *Establish fuel and vehicle maintenance staging areas located away from all drainage courses, and design these areas to control runoff.***

Proper maintenance of equipment and installation of proper stream crossings will further reduce pollution of water by these sources. Stream crossings should be minimized through proper planning of access roads. Refer to Chapter 3 for additional information on stream crossings.

■ **d. *Provide sanitary facilities for constructions workers.***

■ **e. *Store, cover, and isolate construction materials, including topsoil and chemicals, to prevent runoff of pollutants and contamination of ground water.***

■ **f. *Develop and implement a spill prevention and control plan. Agencies, contractors, and other commercial entities that store, handle, or transport fuel, oil, or hazardous materials should develop a spill response plan.***

Post spill procedure information and have persons trained in spill handling on site or on call at all times. Materials for cleaning up spills should be kept on site and easily available. Spills should be cleaned up immediately and the contaminated material properly disposed of. Spill control plan components should include:

- Stop the source of the spill.
- Contain any liquid.
- Cover the spill with absorbent material such as kitty litter or sawdust, but do not use straw. Dispose of the used absorbent properly.

■ *g. Maintain and wash equipment and machinery in confined areas specifically designed to control runoff.*

Thinners or solvents should not be discharged into sanitary or storm sewer systems when cleaning machinery. Use alternative methods for cleaning larger equipment parts, such as high-pressure, high-temperature water washes, or steam cleaning. Equipment-washing detergents can be used, and wash water may be discharged into sanitary sewers if solids are removed from the solution first. (This practice should be verified with the local sewer authority.) Small parts can be cleaned with degreasing solvents, which can then be reused or recycled. Do not discharge any solvents into sewers.

Washout from concrete trucks should be disposed of into:

- A designated area that will later be backfilled;
- An area where the concrete wash can harden, can be broken up, and then can be placed in a dumpster; or
- A location not subject to urban runoff and more than 50 feet away from a storm drain, open ditch, or surface water.

Never dump washout into a sanitary sewer or storm drain, or onto soil or pavement that carries urban runoff.

■ *n. Develop and implement nutrient management plans.*

Properly time applications, and work fertilizers and liming materials into the soil to depths of 4 to 6 inches. Using soil tests to determine specific nutrient needs at the site can greatly decrease the amount of nutrients applied.

■ *i. Provide adequate disposal facilities for solid waste, including excess asphalt, produced during construction.*

■ *j. Educate construction workers about proper materials handling and spill response procedures. Distribute or post informational material regarding chemical control.*

PLANNING SUBMITTAL REVIEW FORM

TITLE: Kahului Commercial Harbor Improvements
 REVIEW DATE 9/9/04 REVIEWER EMB ID: Draft EA

BWS ID BWS MAP # ACREAGE: 50 acres PLANNER: Edward K Noda & Assoc, Inc; Ishi, Brian

TMK 3-7-01:21-2; 3-7-10:2, 3, 6, 13, 15, 21-2, 24, 26-8, 30, 32, 34; 3-7-08:2-4, 6 AGREEMENTS RE: THIS TMK?

PROJECT DESCRIPTION: Includes short-term projects recommended in the DOT-HAR Kahului Commercial Harbor 2025 Master Plan. The projects will maintain Harbor operations based on the existing and forecast maritime demands for cargo and passengers. The proposed short-term projects include the: pier 1 extension; pier 1 comfort stations and sewer line; pier 3 expansion; new pier 4; new pier 2C extension, including a passenger terminal (ca 10,000 sf), roadway, and bridge; structural pavement, access bridge, and utilities at "Puunene Yard".

	<u>CURRENT</u>	<u>PROPOSED</u>
SLUD	Urban, Kanaha Pond: Conservation	
CP DESIGNATION	Heavy Industrial	
COUNTY ZONING	Heavy Industrial	
ACTUAL USE	Piers 1-3, circulation roadways, DOT-HAR Office, maintenance building, and Spill Response Boat House and storage yards	

<u>NEAREST LINES - DISTANCE</u>	<u>DIAMETER</u>	<u>MATERIAL</u>	<u>CAPACITY AT 10' PER SECOND</u>
N			
S			
E			
W			

<u>NEAREST HYDRANTS -</u>	<u>DISTANCE</u>	<u>SIZE TEE / MAIN</u>	<u>LAST FLOWCHECK RESULTS</u>	<u>DATE</u>	<u>LAST PRESSURE CHECK RESULTS</u>	<u>DATE</u>
N						
S						
E						
W						

<u>NEAREST STORAGE</u>	<u>DIRECTION</u>	<u>SIZE</u>	<u>NAME</u>	<u>MAP #</u>
		3 MG	Kahului	

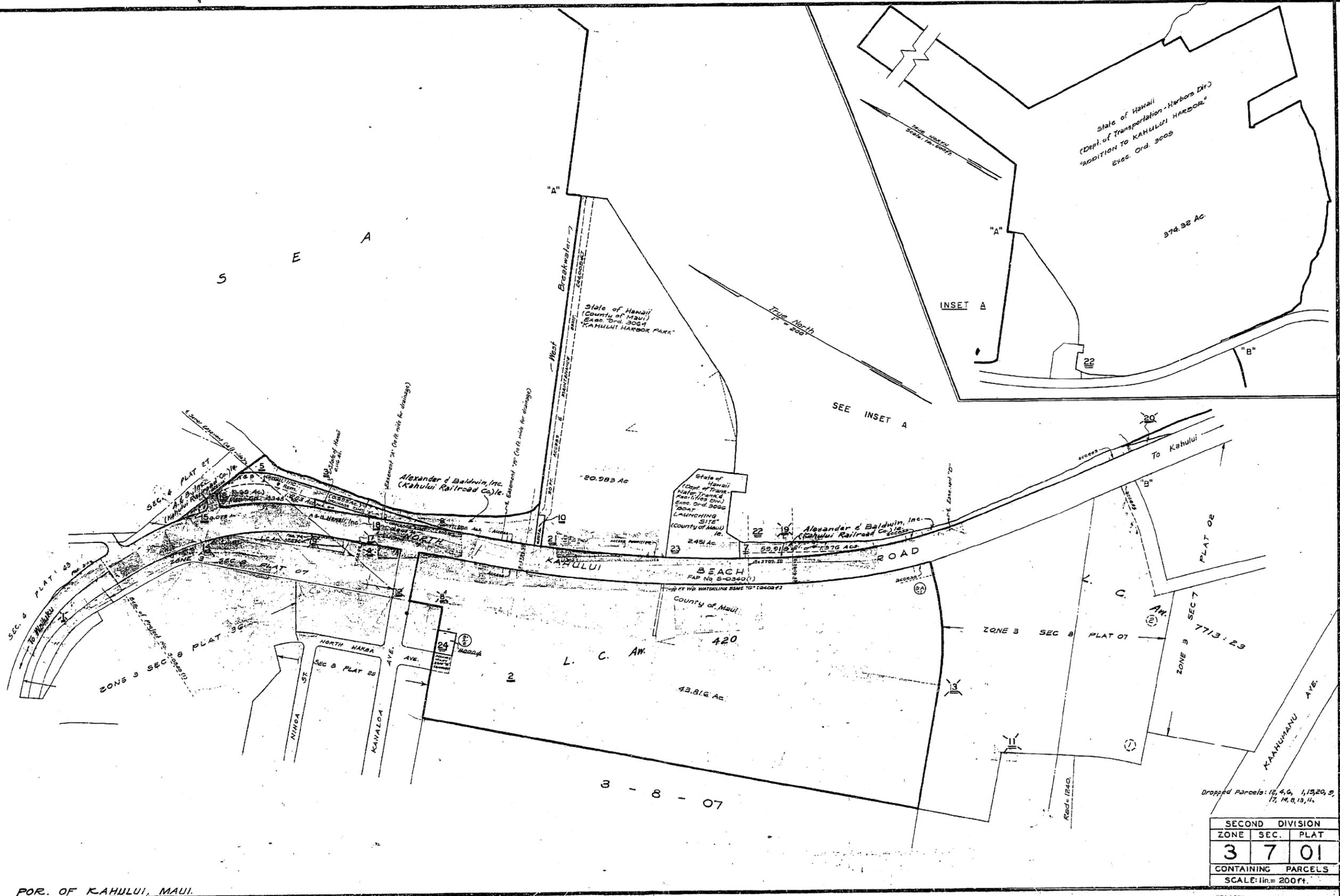
REQUIRED STORAGE AMOUNT (state if by standards or flow calcs submitted)	
<u>ANTICIPATED CONSUMPTION INFO</u>	<u>REQUIRED FIRE FLOW</u>
PER/ACRE STANDARDS	BY STANDARDS
PER/UNIT, PER/FT STANDS	BY CALCS (METHOD)
BY CALCS (STATE METHOD)	
CURRENT EMPIRICAL USE	
AQUIFER UNDER PROJECT	
IN WHPA or BUA?	

METER:	METER SIZE:	PREMID:	CUST ID:	<u>CONSUMPTION:</u>
				<u># OF UNITS/ SQUARE FEET (STATE WHICH)</u>
AQUIFER SERVING PROJ (YLD)	lao, 20 MGD		SF	
SYSTEM SERVING PROJ (AVL)	Central		MF	
ELEVATION			IND	
SOILS			COMM	
PLANT ZONE			OTHER	
POTENTIAL CONTAMINANTS			CONDITIONS	

COMMENTS

PLANNING COMMISSION ACTION
 COUNCIL ACTION
 OTHER FOLLOW-UP

CORRECTED
 NOV 26 1967
 FEB 28 1968
 JUL 23 1968
 NOV 1 1968
 DEC 20 1967
 JUL 1 1968
 JUN 2 1 1971
 EC 15 1971
 1.5 1975
 1.7 1988
 1.7 25 1981
 1.7 3 1981



Dwg. No. 1849
 Source: Top. Maps Bureau
 By: H.M. Feb. 1937

FOR. OF KAHULUI, MAUI.

SECOND DIVISION		
ZONE	SEC.	PLAT
3	7	01
CONTAINING PARCELS		
SCALE: 1 in. = 200 ft.		

PRINTED

1959
By: F.N.D. & N.A.
Source: Tax Maps Bureau



28 State of Hawaii (Young Brothers Ltd) Inc. Par. Rev. Act. H-25-1875

Note: All lots owned by Alexander & Baldwin, Inc. unless otherwise noted.

Parcels dropped: 9, 10, 11, 12, 13, 14, 15, 24, 23, 16, 20, 21, 22, 7, 18, 19, 22.

ADVANCE SHEET SUBJECT TO CHANGE

SECOND DIVISION	
ZONE	SEC. PLAT
3	7 08

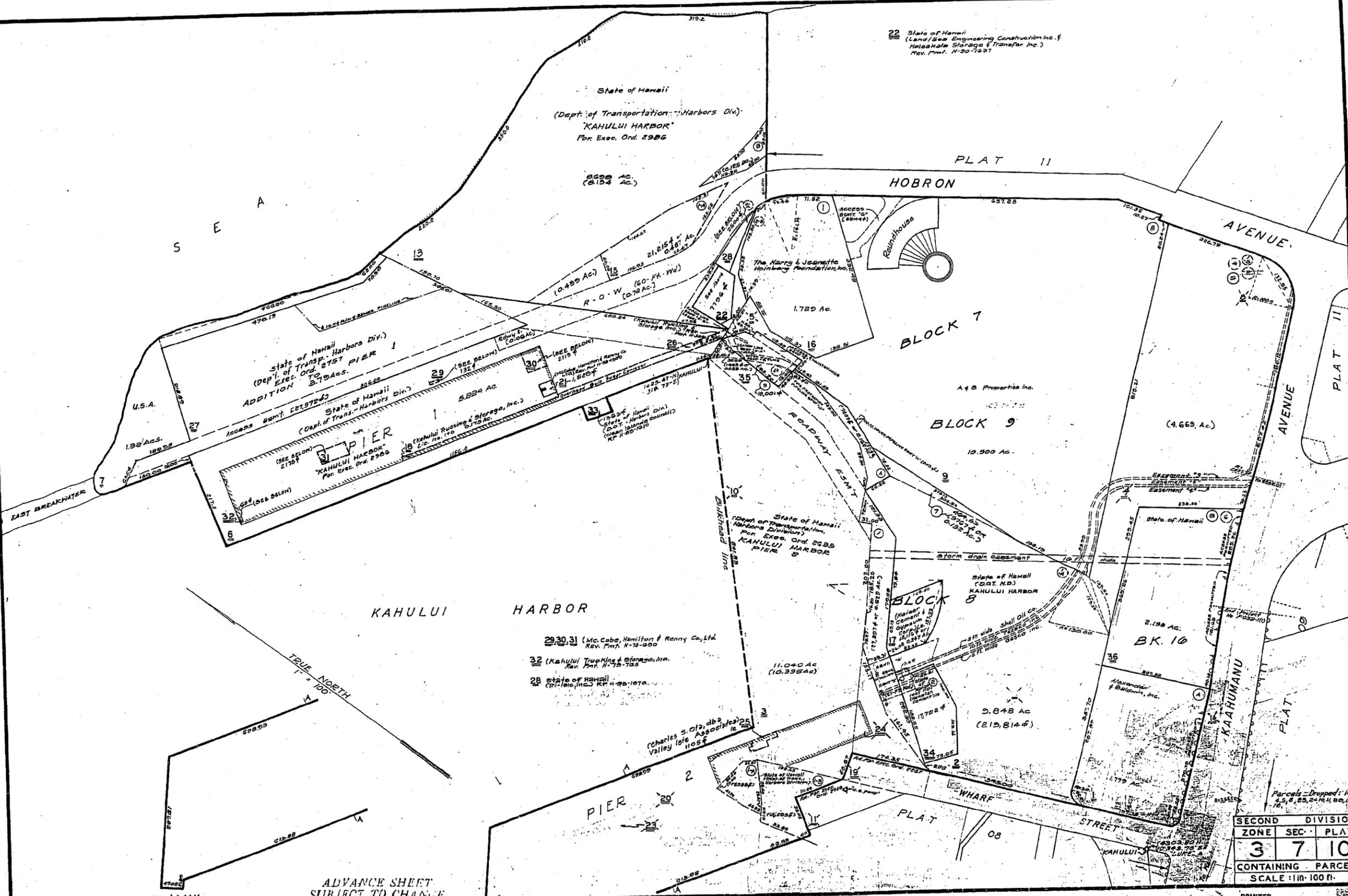
CONTAINING 24 PARCELS
SCALE: 1 in = 50 ft.

Por of KAHULUI, MAUI

PRINTED

CORRECTED
 NOV 16 1939
 NOV 23 1938
 JUL 23 1940
 OCT 2 1941
 JUN 30 1949
 FEB 25 1947

JAN 5 1968
 MAR 15 1969
 APR 30 1968
 JUL 1 1968
 DEC 13 1968
 MAY 23 1969
 JUL 8 1969
 DEC 31 1969
 JUN 1 1970
 JUN 5 1971
 MAY 20 1971
 JUN 1 1971
 NOV 11 1971
 NOV 7 1971
 DEC 11 1971
 FEB 11 1972
 APR 17 1972
 JUN 23 1972
 JUN 3 1972
 JUL 16 1973
 JUL 12 1973
 MAR 1 1974
 JUL 11 1974
 AUG 2 1974
 SEP 4 1974
 APR 31 1975



Div No. 1864
 By: N.A.
 Source: Maps, Eumozu, Public Works

Por. of KAHULUI, MAUI

ADVANCE SHEET
 SUBJECT TO CHANGE

SECOND DIVISION		
ZONE	SEC.	PLAT
3	7	10
CONTAINING PARCELS		
SCALE: 1 in. = 100 ft.		

PRINTED



STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
869 PUNCHBOWL STREET
HONOLULU, HAWAII 96813-5097

RODNEY K. HARAGA
DIRECTOR

Deputy Directors
BRUCE Y. MATSUI
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BRIAN H. SEKIGUCHI

IN REPLY REFER TO:

HAR-EP 7814.05

November 14, 2005

Mr. George Y. Tengan
Director
Department of Water Supply
County of Maui
200 South High Street
Wailuku, Hawaii 96793-2155

Dear Mr. Tengan:

Subject: Response to Comments, Kahului Commercial Harbor 2025 Master Plan
Environmental Assessment – H.C. 3334

Thank you for your comments on the subject document dated September 9, 2004. We offer the following responses.

1. Regarding your concerns on alien species. The alien species issues are addressed in the *Kahului Commercial Harbor 2025 Master Plan Environmental Assessment* (EA) Section 4.10.1.4. As stated in the document, the State Departments of Agriculture, Health, and Land & Natural Resources have the jurisdictional responsibilities over the control of alien species. These agencies will continue to develop, implement and enforce the measures to control the introduction and spread of alien species. As stated in the document, the proposed improvements will not have significant impacts on the introduction of alien species through the Harbor and therefore, no mitigation measures are being recommended.
2. Regarding your comment about water source availability and consumption. The EA will reflect the designation of the Iao Aquifer as a Groundwater Management Area by the Commission on Water Resource Management (CWRM).
3. Regarding your suggestion that the EA should include estimated water demand for the proposed improvements, including increased use due to the forecast increase in passengers and vessels utilizing the harbor. The projected water use for Kahului Commercial Harbor in 2010 is 0.04 million gallons-per-day (MGD). This will be included in the EA.

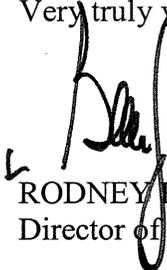
Mr. George Y. Tengan
Page 2
November 14, 2005

HAR-EP 7814.05

4. Regarding your comment about the system infrastructure. The Harbors Division will coordinate the improvements with the Maui County Department of Water Supply.
5. Regarding your comments on pollution prevention and adoption of best management practices (BMPs). BMPs will be utilized as mentioned in the EA Sections 1.3 and 4.8.
6. Regarding your comments that the following water conservation measures be included in the EA and implemented in project design and construction: Eliminate Single-Pass Cooling, Utilize Low-Flow Fixtures and Devices, Maintain Fixtures to Prevent Leaks, Use Climate-Adapted Plants, and Prevent Over-Watering By Automated Systems. To the extent possible, the Harbors Division will use water saving devices as stated in the EA Sections 1.3 and 3.4. Please be advised, however, that the Harbors Division's projects are not subject to county approvals.

We appreciate your interest in the environmental review process. If you have any questions, please contact Mr. Glenn Soma of my Harbor's planning staff at (808) 587-2503.

Very truly yours,



RODNEY K. HARAGA
Director of Transportation