This checklist provides water conservation tips successfully implemented by industrial and commercial users. Adapted from original material by: the Los Angeles Department of Water and Power; Amy Vickers "Handbook of Water Use & Conservation" and the North Carolina Division of Pollution Prevention.

GENERAL SUGGESTIONS

- Increase employee awareness of water conservation. Seek employee suggestions on water conservation; put suggestion boxes in prominent areas. Conduct contests for employees (posters, slogans, ideas, etc.)
- Install signs encouraging water conservation in employee and customer restrooms..
- Determine the quantity and purpose of water being used. Read water meters weekly to monitor success of water conservation efforts.
- Assign an employee to monitor water use and waste.

BUILDING MAINTENANCE

- Check water supply for leaks and turn off any unnecessary flows.
- Repair dripping faucets, continuously-running or leaking toilets and other leaking fixtures.
- Install flow reducers and faucet aerators in all plumbing fixtures where-ever possible.
- Install High Efficiency Toilets, or reduce water used in toilet flushing by adjusting the vacuum flush mechanism or installing toilet tank displacement devices (dams, bottles, or bags).
- As appliances or fixtures wear out, replace them with high efficiency water-saving models., ideally with *WaterSense* labels.
- Install high efficiency commercial washers.
- Shut off water supply to equipment rooms not in use.
- Keep hot water pipes insulated.
- Avoid excessive filter or softener back flush. Back flush only when needed.
- Avoid excessive air conditioner blow-down. (Monitor total dissolved solids levels and blow-down only when needed).
- Minimize the water used in cooling equipment in accordance with manufacturers recommendations. Shut off cooling units when not needed.
- When cleaning with water is necessary, use budgeted amounts

OPERATIONS

- Evaluate wash formula and machine wash cycles for water use efficiency.
- Operate equipment with full loads only.

- Reduce water levels if possible for partial loads to minimize required water per load.
- Replace or modify existing conventional laundry equipment to reduce water use.
- Replace traditional commercial clothes washers with high efficiency commercial washers, which can save as much as two thirds of the energy and water used by traditional models.
- Install a computer-controlled rinse water reclamation system. These can save as much as 25% of wash load's water demand by diverting rinse water to a storage tank for later re-use as wash water.
- Install a wash and rinse water treatment and reclamation system , except where prohibited by health codes in specialized situations. Recycling both wash and rinse water can reduce a laundry's water demand by as much as 50%.
- Install a continuous batch (or tunnel) washer, which can reduce water demand by about 60% compared with that of washer extractors.
- Install an electrically generated ozone laundry system, which can reduce water use by about 10% compared with that of traditional laundering systems. The ozone acts as a cleaning agent and reduces detergent use by 30 to 90 percent.
- Consult service personnel and the laundry's supplier of chemicals for the washer extractors to ensure that equipment is operating at optimal efficiency.
- Avoid excessive back-flushing of filters or softeners; back-flush only when necessary.
- Place "save water" notices in hotel and motel guest rooms, urging guests to save water by minimizing the amount of water that needs to be laundered.

EXTERIOR AREAS

- Convert from high-water using lawns, trees, and shrubs to *xeriscape*: Landscape design incorporating plants providing beautiful color and requiring less water. Plan landscapes that require less water.
- Inventory outdoor water use for landscaped areas.
- Make sure irrigation water does not run into gutters, streets or alleys. Use controllers on sprinkler systems.
- Do not water landscape everyday; two-to-three times a week is usually sufficient.
- Stop using water to clean sidewalks, driveways, loading docks and parking lots. Consider using brooms or motorized sweepers instead.
- Wash autos, buses, and trucks less often.
- Avoid plant fertilizing and pruning that would stimulate excessive growth. Install good control systems to monitor and manage values referred to in the following points.
- Remove weeds and unhealthy plants so remaining plants can benefit from the water saved.
- In many cases, older established plants require only infrequent irrigation. Look for indications of water need such as wilt, change of color, or dry soil.
- Install soil moisture overrides or timers on sprinkler systems.
- Time watering, when possible, to occur in the early morning or evening when evaporation and discourage weeds.
- Remove thatch and aerate turf to encourage the movement of water to the root zone.
- Avoid run-off and make sure sprinklers cover just the lawn or garden, not sidewalks, driveways, or gutters.
- Ensure that irrigation systems are equipped with a rain shut-off device.
- Install smart controllers capable of responding appropriately to weather or soil moisture conditions.

For more information, contact:
Maui County Department of Water Supply
Water Resources and Planning Division
59 Kanoa Street Wailuku, HI 96793
Telephone: (808) 244-8550 FAX 244-6701

A Checklist of Water Conservation Ideas For

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 student restrooms.
- When cleaning with water is necessary, use budgeted amounts.
- Read water meter weekly to monitor success of water conservation efforts.
- Assign an employee to monitor water use and waste.
- Seek employee and student suggestions on water conservation; put suggestion boxes in prominent areas.
- Determine the quantity and purpose of water being used.
- Determine other methods of water conservation.
- Conduct contests for employees and students (e.g., posters, slogans, or conservation ideas).
- Make up-to-date reading materials available for students and employees in the library and classroom.

BUILDING MAINTENANCE

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

- Install flow reducers and faucet aerators in all plumbing fixtures where possible.
  - Retrofit toilets with high efficiency models that use 1.28 gallons per flush or less.
  - Retrofit urinals with high efficiency models that use 0.5 gallons per flush.
  - Install showerheads with a flow rate of 1.5 gpm at 60 psi or less in all units.
  - Retrofit bathroom sink faucets with fixtures that do not exceed 1 gpm at 60 psi.
- Reduce the water used in toilet flushing by either adjusting the vacuum flush mechanism or installing toilet tank displacement devices (dams, bottles, or bags).
- As appliance 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, such as air compressors, in accordance with manufacturer recommendations.
- Reduce the load on air conditioning units by shutting air conditioning off when and where it is not needed.
- Keep hot water pipes insulated.
- Avoid excessive boiler and air conditioner blow-down. (Monitor total dissolved solids levels, and blow-down only when needed.)
- Instruct clean-up crews to use less water for mopping.
- Change window cleaning schedule from periodic to an on-call/as-required basis.

KITCHEN AND LAUNDRY AREAS

- Turn off the continuous flow used to clean the drain trays of the coffee/milk/soda beverage island; clean the trays only as needed.
- Turn dishwasher off when not in use. Wash full loads only.
- Make sure "electric eye" sensors are installed in your dishwasher to monitor dirt circulating in the water.
- Replace spray heads to reduce water flow.
- Recycle rinse water from the dishwater or re-circulate it to the garbage disposal.
- Do not use running water to melt ice or frozen foods. If necessary, use ponded water.
- Use water conserving ice makers.
- Presoak utensils and dishes in ponded water instead of using a running water rinse.
- Wash vegetables in ponded water; do not let water run in preparation sink.
- Use water from steam tables in place of fresh water to wash down cooking area.
- Reprogram washing machines to eliminate a rinse or suds cycles when possible and if not restricted by health regulations.
- Reduce water levels, where possible, to minimize water required per load of washing.
- Only wash full loads of clothes.
- Evaluate wash formula and machine cycles for water use efficiency.

POOL

- Lower pool water to reduce amount of water splashed out.
- Use a pool cover to reduce evaporation when pool is not in use.
- Reduce amount of water used to clean pool filters.

EXTERIOR AREAS

- Convert from high-water using lawns, trees, and shrubs to xeriscape – Landscape design incorporating plants that provide beautiful color and requiring less water. In the future, design landscapes that require less water, such as drought-resistant grass on playing fields.
- Inventory outdoor water use for landscaped areas.

- Water landscape only when needed: two-to-three times a week is usually sufficient.
- Wash autos, buses, and trucks less often.
- Discontinue using water to clean sidewalks, driveways, loading docks, and parking lots. Consider using brooms or motorized sweepers.
- Avoid landscape fertilizing and pruning that may stimulate excessive growth.

- Remove weeds and unhealthy plants so remaining plants can benefit from the water saved.
- In many cases, older, established plants require only infrequent irrigation. Look for indications of water needs such as wilt, change of color, or dry soils.
- Install soil moisture overrides or timers on sprinkler systems.
- When possible, time watering to occur in the morning or evening when evaporation is lowest.
- Make sure irrigation equipment applies water uniformly.
- Investigate the advantages of installing drip irrigation systems.
- Mulch around plants reducing evaporation and discouraging weeds.
- Remove thatch and aerate turf to encourage the movement of water to the root zone.
- Avoid run-off and make sure sprinklers cover just the lawn or garden, not sidewalks, driveways, or gutters.

- In winter, water only during prolonged hot and dry periods (During spring and fall, most plants need approximately half the amount needed during the summer.)

For more information, contact:
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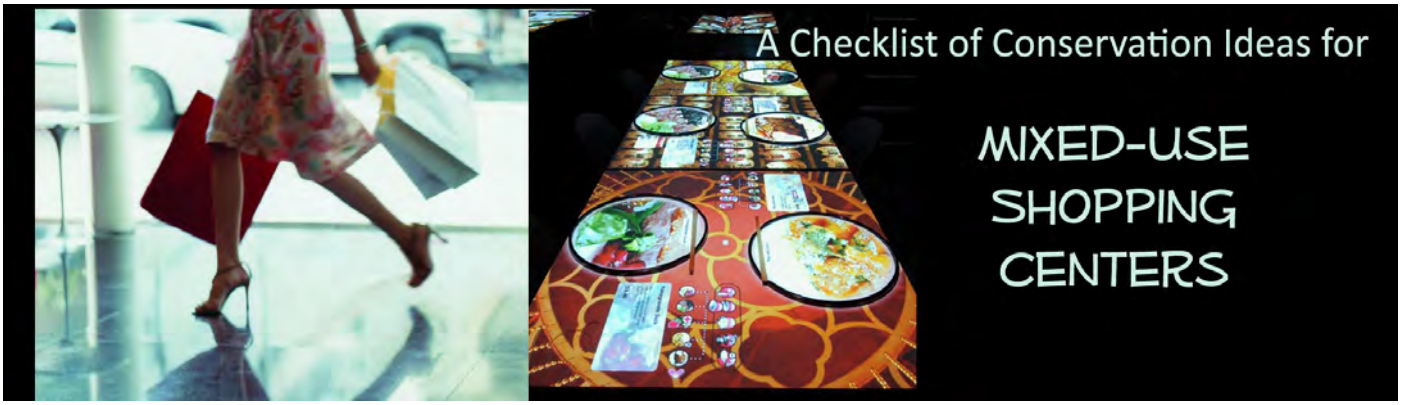


It's Easier To Save What You Measure & Watch

- Prepare an inventory of anticipated fixture units and counts, water uses and water using appliances and equipment, including landscapes, laundries, kitchens, cooling and other areas throughout the facility, locations and purposes of controls, sub-meters, water filters or recycling systems, locations and amounts of irrigated acreage, irrigation system elements, controllers, circuits and settings, acreage and volume of pools, filtration equipment, etc.
- Design structures such that individual units and or operations can be metered separately or at least sub-metered.
- Once an inventory of water uses and conservation opportunities has been made, and measures undertaken, it is important to take stock of the actual performance of conserving measures. A useful tool is an annual tally of what has been done, the goal of each measure taken, and how the results panned out. Document the recorded savings or reductions in peak factors, to assist in fine-tuning facility management for conservation as time goes on. An annual inventory of uses, performance, and changes made to fixtures or processes such as treatment, recycling, or other measures to conserve, as well as water use impacts of each, should become a regular practice.
- A regular, pro-active maintenance program should be established for all areas of the complex. This should include checking for and repairing leaks, both indoors and out. It should also include checking valves, water pressures etc. where specific water using operations call for this as part of normal maintenance.
- Inspect steam lines and traps, all plumbing fixtures, hot and cold water lines, drinking fountains, and water-using appliances routinely in order to catch problems early and to keep these devices operating optimally.
- Shut off the water supply to equipment in areas that are not currently in use.

Fixtures and Appliances

- Specify, select and or require tenants to utilize efficient fixtures and appliances. Efficient water use can save on electricity as well. A list of WaterSense certified high-efficiency toilets and other fixtures may be found at http://www.epa.gov/WaterSense/pp/index.htm .
- Toilets should be high efficiency models that use 1.28 gallons per flush or less
- Urinals should be high efficiency models that use 0.5 gallons per flush or less.
- Showerheads, if any, should have a flow rate of 2 gpm at 60 psi or less in all units.
- Bathroom sink faucets with fixtures should not exceed 1 gpm at 60 psi. (even more efficient models are available)

Cooling

- Cooling / HVAC systems should be constructed, commissioned and operated in a manner that conserves water as well as energy.
- Single pass cooling should not be permitted.
- Recent data indicate that increasing energy efficiency in coolers can also increase water efficiency. Consider ordering units that comply with LEED specifications for energy efficiency and

controllability, as well as the specific water conservation measures listed below for multi-pass systems:

- Install control systems and sub-metering to monitor and manage water quality and other parameters in make-up water and blow-down.
- Install appropriate treatment systems to manage water quality in cooling tower make-up water.
- Operate cooling towers with greater than 5 cycles of concentration if possible.
- Minimize drift losses with baffles or drift eliminators.
- Establish a proactive cooling system maintenance and monitoring program.

Kitchens, Restaurants, Snack Shops, Ice Making, Cooking and Washing

- Select efficient air cooled ice machines.
- Refrigeration systems should be air-cooled or closed-system recirculating systems.
- Pre-rinse spray valves on dishwashers shall have a flow rate equal to or less than 1.6 gpm at 60 psi.
- Food steamers should be self-contained "boilerless" or "connectionless" models.
- Wok stoves should be "waterless woks".
- Ware washing units should have flow rates of less than 1 gallon per rack.
- Install an on-demand water heater near sinks and other places where warm water is needed to avoid having customers and employees run water while waiting for hot water.
- Use water from steam tables to wash down cooking area.
- If it is necessary to use water (e.g., grocery store meat cutting rooms, commercial kitchens, and medical facilities), employ high pressure, low-volume sprays (which work better than lowpressure, high volume sprays). Use portable high pressure pumps where needed to reduce the amount of water used for cleaning by up to 40 percent. When cleaning with water, stick to budgeted amounts for each job.
- Do not use running water to thaw food.
- Place tent cards in restaurants informing guests that water is available upon request, rather than automatically serving it.

Laundries and Washing Services

- If tunnel washers or multi-load washer extractors are used, they should utilize no more than 2 gallons of water per pound of laundry.
- If regular commercial clothes washers are used, install washers that are Energy Star and WaterSense certified, or have a water factor (gallons/cubic foot of laundry) of not more than 6.

Landscape

- All irrigated areas shall be equipped with smart controllers capable of self-adjusting to account for moisture conditions, and of multiple programming for separation of turf and non-turf areas.
- Irrigation valves and circuits should be arranged such that plants with different water requirements are watered separately and appropriately. (hydrozones).
- Select native plant species that are adapted to the natural rainfall and salt conditions in the area. The use of climate-adapted native plants conserves water and protects watersheds from the spread of invasive plant species.
- Install spring-loaded valves or timers on all manually operated hoses.
- Water features are discouraged in general. However, even water features can be made more efficient. High efficiency filtration systems are available fountains.

Employee Involvement

- Aside from a regular pro-active inspection and maintenance, encourage employees to be conscious of water use. Think about how floors and other areas are cleaned. Is water necessary? Would brooms or wet wash rags work as well as hoses?
- Set up an easy procedure for employees to report leaks.
- Repair leaks and malfunctions promptly, not only to save water but to show employees that their reports of leaks are taken seriously.
- Place a “Water Conservation Suggestion Box” in a conspicuous place and ask for employee suggestions.

APPENDIX J

Conistency with the 1998 Community Plan

Community Plan Consistency

The last version of the Lana`i Community Plan was adopted by the Maui County Council on December 8th, 1998. The Maui County Charter, §8-11.2(3) requires that the Water Department's Long Range Plan conform with the County's general and community plans. For that reason, the entire Lana`i Community Plan has relevance for the Lana`i Water Use and Development Plan, and the reader is encouraged to review both plans. An update of the plan is expected shortly, However, some of the key goals, objectives, policies and implementing actions that pertain to water issues within that plan are noted, with comments as to how the WUDP addressed thse items.

Economic Activity:

Objectives and Policies:

Item 4: **Promote diversified agriculture as a means of establishing job and income stability.**

Implementing Actions

Item 5: **Establish and reserve a minimum water allocation to meet the needs of diversified agriculture, consistent with the Water Use and Development Plan for Lana`i as approved by law.**

WUDP Response: LWAC made pro-active efforts to identify current and future agricultural needs during the drafting of the Working Group Report. The allocation agreed to at that time, in the amount of a 500,000 GPD reserve has remained the recommended allocation of LWAC.

Land Use:

Objectives and Policies:

Item 6: Continue to encourage the development of a regulatory review process which encourages and facilitates public participation in all major land development activities.

WUDP Response: Establishment and implementation of Lana`i Water Advisory Committee by the Board of Water Supply, allowed for an additional community mechanism to discuss and resolve water issues involved in land use decisions, and make recommendations to the Lana`i Planning Commission or other governmental bodies regarding water aspects of land use decisions.

Item 11: Preserve and maintain lands used for hunting or which are designated as game management areas.

WUDP Response: LWAC discussion of need for watershed protection as primary need of the WUDP, efforts to obtain peer review on watershed protection priorities, discussion and review of fencing options and needs, public presentation of such options, DWS and LWAC participation in the development and on-going implementation of a Lana`i Forest and Watershed Partnership, support by DWS for acquisition of grant funding, and incorporation of a watershed protection chapter in the WUDP, with provision for continued game management.

Item 13: Ensure that coastal land uses are compatible with management, protection and restoration needs of Lana`i's coastal resources.

WUDP Response: Watershed protection chapter in the WUDP includes provision for fire prevention and erosion control measures among others that should help protect coastal resources as well as Lanaihale, also support by DWS for acquisition of grant funding for same during WUDP process.

Environment

Objectives and Policies: Ecosystems can not effectively be broken into constituent parts, but are rather intricately interconnected systems. Therefore, all of the environmental objectives, policies and implementing actions are listed herein, as all have at least some relation to water issues. Items specifically addressed in the WUDP are noted by explanations beneath.

Item 1: Manage, protect, and where appropriate, restore Lana`i's Coastal Resources.

Item 2: Protect and manage coastal water quality through best management land treatment practices.

WUDP Response: The watershed protection chapter in the WUDP includes provision for fire prevention and erosion control measures among others that should help protect coastal resources as well as Lanaihale, also support by DWS for acquisition of grant funding for same during WUDP process.

Item 3: Incorporate waste recycling and reuse as major elements of the island's environmental resource management and protection program.

Item 4: Ensure the long-term availability of low-cost water for agricultural purposes consistent with the Water Use and Development Plan for Lana`i as approved by law.

Item 5: Establish agricultural water needs as a priority in developing and allocating the island's limited water resources consistent with the Water Use and Development Plan for Lana`i as approved by law.

WUDP Response: LWAC made pro-active efforts to identify current and future agricultural needs during the drafting of the Working Group Report. The allocation agreed to at that time, in the amount of a 500,000 GPD reserve has remained the recommended allocation of LWAC.

Item 6: Protect, preserve restore and enhance Lana`i's existing and potential water recharge areas.

WUDP Response: In addition to watershed chapter, partnership, fencing and management efforts on Lanaihale prescribed in plan, the plan includes modeled wellhead protection areas as suggested by the University of Hawaii's Water Resources Research Center.

Item 7: Recognize and preserve traditional uses of the environment to address subsistence needs of the residents of Lana`i.

Item 8: Protect and restore native habitats through conservation, land management and educational programs.

Item 9: Restore the environmental integrity of Lana`i's terrestrial resources through development of a comprehensive forest management and reforestation program utilizing native species.

WUDP Response: LWAC discussion of need for watershed protection as primary need of the WUDP, efforts to obtain peer review on watershed protection priorities, discussion and review of fencing options and needs, public presentation of such options, DWS and LWAC participation in the development and on-going implementation of a Lana`i Forest and Watershed Partnership, support by DWS for acquisition of grant funding, and incorporation of a watershed protection chapter in the WUDP, with provision for continued forest management.

Item 10: Protect and enhance the island's native plant and animal species by prohibiting the importation of alien species.

WUDP Response: List of plants to avoid is attached as appendix to WUDP watershed chapter.

Item 11: Recognize and support agriculture, forestry and game management as key elements in maintaining, preserving and protecting Lanai's land, water and marine resources.

WUDP Response: Same as listed for items 8 and 9 above.

Implementing Actions:

WUDP response (general) to all 10 items below: WUDP Response items provided below are abbreviated because, except where otherwise noted, the response for most of these Environmental Implementing actions may be found within the WUDP in the watershed protection chapter, as well as supporting documentation such as the partnership MOU and in allocations for agricultural use as defined in consensus-based allocation tables.

Item 1: Update and implement watershed, flood prevention and soil conservation programs.

WUDP Response: See watershed chapter & funding applications to support management.

Item 2: Establish and reserve a minimum water allocation to meet the needs of diversified agriculture consistent with the Water Use and Development Plan as approved by law.

WUDP Response: See allocation tables.

Item 3: Maintain the Marine Life Conservation District at Manele/Hulopoe Bays

Item 4: Maintain the existing boundaries of the Kanepu`u Dryland Forest

WUDP Response: Lana`i Forest and Watershed Partnership formalizing MOU specifies continued protection of the dryland Kanepu`u preserve as well as Lanaihale.

Item 5: Identify coastal access opportunities through former agricultural roads and trails, including: Community Plan published as ordinance 2738 in county clerk's office lists 101 trails and roads on page 42

Item 6: Prohibit the use of high level aquifer water for golf course irrigation purposes, consistent with the Water Use and Development Plan for Lana`i, as approved by law.

WUDP Response: See allocation tables.

Item 7: Conduct a regional land resource assessment to:

Identify areas suitable for revegetation and reforestation with native plant species; and

Identify areas suitable for designation as groundwater recharge expansion areas.

WUDP Response: See watershed chapter AND Wellhead protection / groundwater recharge areas delineated by UH Water Resources Research Center.

Item 8: Establish a feral animal control program and apply appropriate game management techiniques (e.g. provision of feed and water stations) for purposes of protecting and preserving groundwater recharge areas.

WUDP Response: See watershed chapter, partnership activity, and periodic reports from conservation and game management divisions of CCR to LWAC.

Item 9: Develop a system of floating preserves (e.g. a "konohiki system") as a means of managing nearshore coastal resources.

Item 10: Encourage and support the establishment and/or expansion of native Lana`i plant species, utilizing appropriate practices and techniques for propagation, planting, and distribution of native plant species. Support the development of approval processes for nursery sources of native plant species.

WUDP Response: See watershed chapter, partnership and grant acquisition activity.

Cultural Resources

Objectives and Policies:

Item 3: Recognize the importance of historically and archaeologically sensitive sites and encourage their preservation.

Item 8: Preserve and protect native Hawaiian rights customarily and traditionally exercised for subsistence, cultural and religious purposes in accordance with Article XII, §7 of the Hawaii State Constitution, and the Hawaii Supreme Court's PASH opinion, 79 Haw. 425 (1995).

Implementing Actions:

Item 13: Stabilize the hillside at Luahiwa to protect petroglyphs from erosion. Consider the potential effects of increased foot traffic on erosion in the vicinity of the petroglyphs before deciding to develop and interpretive trail or other access.

WUDP Response to Cultural Resources Items: WUDP is only tangentially related, but response should be noted here. Watershed Protection Chapter and plans of the Forest and Watershed Partnership support protection of Native Hawaiian gathering rights to the extent that they are designed to protect the natural heritage of the island. Archaeologically sensitive sites and trails are protected inasmuch as the watershed protection chapter recommends survey of site to avoid inadvertent destruction of natural or cultural treasures in fence building, planting, erosion management or other maintenance activities. Finally, while erosion control efforts supported by the watershed protection chapter will not be enough to stabilize any specific hillside in the short term, over the longer term management efforts should support general stabilization of lands which are currently severely denuded, eroded and prone to further destabilization by erosion.

Indigenous Architecture:

WUDP Response: No items directly related to WUDP listed in Community Plan. However, indigenous architecture can only be enhanced by native endemic and indigenous landscaping. Use of native species for landscaping are mentioned in the WUDP. Suggest that provision encouraging use of native plants for landscaping be included in the event that an ordinance for indigenous architecture proposed by Community Plan is developed and passed.

Urban Design:

Objectives and Policies:

Item 2: Provide additional landscaping in Lana`i City to enhance the environment, utilizing native and non-invasive climate-adapted plants appropriate for the region..

WUDP Response: The DWS Brochure lists native plants appropriate for various climate zones adapted from the Maui County Planting Plan. This list is being peer-reviewed for its applicability and appropriateness to Lana`i, and is included in the WUDP appendices.

Implementing Actions:

Item 5: Prohibit the removal of plant material necessary for water recharge. Plant material necessary for water recharge shall not be used as a source of landscape planting materials.

WUDP Response: Watershed Chapter encourages establishment / enlargement of nursery with appropriate propagation techniques, and with limited, well-guided gathering of seed or cuttings as needed under supervision or in coordination with resource management agencies such as DOFAW, US F&WS, or other qualified specialists in native species preservation. Without proper guidance or expertise, gathering from key areas is discouraged in watershed chapter, and will be further discouraged by fence.

Physical Infrastructure- Water:

Objectives and Policies:

Item 1: Encourage and support comprehensive planning and management of Lana`i's water resources, consistent with the Water Use and Development Plan for Lana`i as approved by law, to ensure long-term economic stability and diversification, and sufficient water allocated for, but not limited to:

a. the agricultural park;

b. the Hawaiian Home Lands;

c. those lands designated for affordable housing;

d. the community gardens;

e. the Lana`i Horse Owner's Association paddock.

WUDP Response: Each of these items has a consensus allocation in the allocation table.

Item 2: Complete and properly maintain the existing potable water distribution system to provide sufficient water pressure throughout Lana`i City.

WUDP Response: CCR owns the only utility serving municipal water supply needs on the island. They were unwilling to provide maps or capital plans for their systems, nor to have these included in the WUDP. The Water Advisory Group did not insist on this.

Item 3: Use recycled or brackish water for irrigation.

WUDP Response: This recommendation is noted in the plan, and a year of reclaimed water use data is included. Data on reclaimed water use are reviewed regularly by the LWAC.

Item 4: Encourage comprehensive water resources planning and management for domestic and agricultural water systems prior to urban development outside of Lana`i City.

WUDP Response: This is the purpose of the Lana`i Water Advisory Committee, and the Water Use & Development Plan effort. The Resolution Establishing LWAC has been provided elsewhere in this document.

Item 5: Improve the quality of potable water

WUDP Response: Source water protection chapters of the WUDP, watershed protection, wellhead protection zone monitoring and others are aimed at improving the quality of potable water.

Item 6: Promote a water conservation program.

WUDP Response: A conservation program is included in the proposed plan.

Item 7: Support the creation of a permanent Lana`i Water Advisory Board comprised of Lana`i Residents.

WUDP Response: The Lana`i Water Advisory Committee was formally approved by the Board and established indefinitely by Resolution dated March 16, 1999. This Resolution is included as an appendix to the WUDP.

Item 8: Encourage, support and ensure protection and restoration of watershed and critical recharge areas.

WUDP Response: The watershed chapter, MOU of the Lana`i Forest and Watershed Partnership, and community efforts described in the *Watershed* chapter meet the intent of this item.

Implementing Actions:

Item 1: Provide incentives for water conservation practices.

WUDP Response: Provision for incentives is included in the proposed rate structure. Final program details will be the decision of the LWCI.

Item 2: Prepare a comprehensive water resource management plan for the island of Lana`i to establish priorities and allocations for water use.

WUDP Response: Entire WUDP for Lana`i is response to this question, particularly allocation tables.

Item 3: Implement a Lana`i Water Advisory Board as a mechanism for monitoring water conservation practices on the island as may be adopted by the Board of Water Supply.

WUDP Response: Resolution of March 16th, 1999 is included herein

Item 4: Include provisions for the protection of the watershed and recharge in the Water Use and Development Plan.

WUDP Response: Watershed chapter and wellhead protection/recharge protection zones in document.

Item 5: Include a proposal for continued community representation on water issues in the Water Use and Development Plan.

WUDP Response: Resolution of March 16th, 1999, as well as implementation guidelines drafted by LWAC are attached. DWS proposes quarterly meetings, with provision to increase to 6 if necessary. LWAC has been operating since 1997, formally established in 1999. Possible changes to frequency of meetings and establishment of subcommittees are issues of ongoing discussion as this plan is finalized.

Item 6: Ensure that water allocations as defined in the community plan are incorporated in the Water Use and Development Plan.

WUDP Response: No specific water allocations appear to have been set within the Community Plan, other than provision of "adequate" water for the following:

- the agricultural park;
- Hawaiian Home Lands;
- those lands designated for affordable housing;
- the Community Gardens;

- the Lana`i Horse Owner's Association paddock.

Elsewhere in the document, desire for allocation for the following facilities was listed, though without specific reference to allocation.

- Cavendish Golf Course
- Emergency medical facilities, public health facilities, medical service facility at Manele, and helipad transport site for medical purposes
- Maui Community College site
- Satellite government facility
- New Police Station
- 10 acre Light Industrial area above Kaumalapau Quarry (TMK 4-9-002:001 por) - half of which is to be sold in fee simple
- 10 acre Light Industrial area at the Shuttle Station (TMK 4-9-002:001 por) - half of which to be sold in fee simple
- 20 acre Heavy Industrial area at Miki Road (TMK 4-9-002:001 por and 050 por), half of which to be sold in fee simple
- 3.4 acre business-commercial area at Lana`i City shop area, (TMK 4-9-005:090 por), half of which to be sold in fee simple.
- 1 acre Hotel area behind Hotel Lana`i (TMK 4-9-011:001 por) from which no trees are to be removed.
- 10 acre business-commercial area at police station (TMK 4-9-006:004) for which no new zoning is to be filed until new police station has been built and courthouse relocated.

WUDP Response: Above items are included in the allocation table.

Item 7: Include suggestions for demand management opportunities in the Water Use and Development Plan..

WUDP Response: These are included in the *Supply Options* chapter.

Physical Infrastructure - Liquid and Solid Waste

Objectives and Policies:

Item 2: Support improvements to the wastewater collection and treatment system to ensure full and adequate service to Lana`i City and its immediate surrounding environs.

Item 3: Encourage a conservation ethic which supports wastewater reclamation and utilization of alternative resource conservation technologies.

Implementing Actions:

Item 1: Prepare a wastewater system master plan for Lana`i as a basis for programming and implementing facilities improvements which will meet the needs of the island's residents in a timely manner.

Item 2: Connect existing residences within the mauka portion of Lana`i City to the County's wastewater collection and treatment system.

Item 3: Conduct a wastewater reuse feasibility study for Lana`i

WUDP Response: Reclaimed water is in use on Lana'i and potential increases to that use are projejcted within the Water Use & Develpoment Plan.

Item 4: Provide funding to the Department of Public Works and Waste Management's Solid Waste Division for the proper landscaping and maintenance of solid waste facilities and surrounding environs.

Item 5: Provide for an alternate site for a new County landfill at Kaumalapau Quarry to permit compatible activity within the quarry.

Energy

WUDP Response: No items directly related to WUDP listed in Community Plan.

Housing

WUDP Response: No items directly related to WUPD listed in Community Plan.

Social Infrastructure

Objectives and Policies:

Item 1: Provide neighborhood parks which serve a variety of needs, including but not limited to active play fields and passive areas which may be used for community gardens.

WUDP Response: Water allocation for community gardens included in allocation table.

Implementing Actions:

Item 4: Maintain the quality and availability of Cavendish Golf Course for golf course use in perpetuity for Lana`i residents.

WUDP Response: Water allocation for Cavendish Golf Course included in allocation table.

Health and Public Safety

Objectives and Policies:

Item 3: Ensure the long term integrity of medical and emergency medical facilities and services with appropriate allocation of capital improvements funding and staff positions, adequate provision of supporting programs and facilities, and ready access to state-of-the-art medical technologies.

WUDP Response: Agenda item for LWAC to discuss whether allocation for medical, safety and emergency facilities should be added to allocation table.

Item 7: Improve water rescue service and fire protection by providing necessary equipment, training and staffing.

WUDP Response: Fire prevention needs discussed during preparation of watershed chapter, support of strengthened prevention and response incorporated into watershed chapter - mainly for watershed, but access to facilities should also help with other fire rescue needs.

Implementing Actions:

Item 3: Prepare a capital improvements plan to address the immediate and long term facilities requirements for medical and public health services.

Item 5: Study the feasibility of a medical service facility site at Manele.

Item 6: Identify and support a helipad site for medical transport purposes in accordance with the Maui County Disaster Plan for Lana`i.

WUDP Response: Add agenda item for LWAC to discuss whether allocation for medical, safety and emergency facilities should be added to table. Work with fire department and civil defense to acquire grant for helicopter for Lana'i - for prevention of fire spread in the extremely vulnerable key watershed as well as for medical emergencies.

Education

Implementing Actions:

Item 1: Designate an appropriate site consisting of a minimum of five acres for the use of Maui Community College in consultation with the Board of Regents and the University of Hawaii.

WUDP Response: Site is built..

Government

Objectives and Policies

Item 1: Streamline regulatory approval processes through means such as consolidated public hearings and concurrent processing of approvals.

Item 2: Develop land use, building and subdivision codes and standards which are appropriate for Lana`i.

WUDP Response: Recommend use of native and non-invasive non-native species for planting and landscaping codes, and low flow fixtures as per ordinance for building standards. Consider requiring water conservation tradeoff for development rights for new projects, some phases of existing projects.

Item 3: Utilize the County's budgeting process as a means to carry out the policies and priorities of the community plan.

Item 4: Utilize the County's real property tax assessment function as both a means to carry out the policies and priorities of the Community Plan and a mechanism for monitoring and updating the Community Plan.

Item 5: Acknowledge and support the role and responsibility of the Lana`i Planning Commission in monitoring and enforcing the implemnentation of the Lana`i Community Plan.

Item 6: Encourage and expand chore and transportation services for the elderly.

Item 7: Maintain and support non-profit preschool and childcare facilities and services.

Item 8: Provide Public information in multi-lingual formats.

WUDP Response: DWS staff has translated various water conservation materials into Tagalog, and will do the same for watershed protection materials.

Item 9: Encourage State and County Officials to conduct regularly scheduled public informational meetings on Lana`i, with appropriate follow-up to address questions and concerns of residents.

WUDP Response: The establishement of LWAC created a venue for water regular discussion and exchange of information.

Item 10: Encourage improved communications among government agencies and between the public and government agencies in order to improve public service reliability and efficiency.

WUDP Response: LWAC membership and invite list includes ex-officio representation by various agencies: Planning Dept, Public Works, and County Council as well as State DLNR-CWRM and DLNR-DOFAW. Voting membership by Lana`i Planning Commission member. DWS staffs the LWAC, as it is advisory to their Board.

Item 11: Encourage and support the use of telecommunications technology to link Lana`i residents with State and County Government functions and activities through an interactive communication mode.

WUDP Response: In deterimining its watershed priorities, LWAC held a SkyBridge meetiing with participation of forestry experts from several islands.

Item 12: Provide for adequate cemetery facilities to meet the current and future needs of Lana`i's residents.

Item 13: Establish a permanent Lana`i Water Advisory Board.

WUDP Response: The Lana`i Water Advisory Committee was formally approved by the Board and established indefinitely by resolution dated March 16th, 1999. This resolution is included as an appendix to the WUDP.

Implementing Actions:

Item 1: Develop a satellite government center for Lana`i with scheduled days for different State and County agencies.

Item 4: Support the centralization of government services in the Lana`i City town core. Establishment of centralized government services at the Administration Building shall be considered.

Item 5: Support the provision of land at Keomoku for distribution by the Department of Hawaiian Home Lands.

WUDP Response: Allocation table includes provision for Hawaiian Home Lands

Planning Standards

Landscaping Native plant species which are found on Lana`i shall be utilized for public and quasi-public facilities (ordinance 2738, pg 60).

WUDP Response: Identification of Public and Quasi Public Facilities, and establishment of native landscaping at said faclilities is an element of the watershed protection plan long term implementation matrix.

Project Districts

Project District 1 - Manele

Project District includes hotel, residential, golf course, commercial, open space, park, and public marina uses. Commercial uses are limited to the hotel, golf clubhouse and Manele small-boat harbor.

Total Area of Project District in Community Plan is 868 acres, including a minimum of 130 acres open space at the Pu`upehe Peninsula. The Community Plan update altered 25 acres from SF to MF and 6.6 acres from SF to Hotel.

WUDP Response:Allocation for Manele PD is included in WUDP. Table of allowable acreages and water-related conditions as these have changed over the years is also incorporated into the WUDP.

Project District 2 - Koele

Project District includes hotel, residential, golf course, open space and other uses. The Community Plan changed 57 acres at 4-9-002:001(por) from PD to Ag; 12 acres of existing woods from PD to OS at TMK 4-9-1:24; 98 acres of existing (Cavendish) Golf Course from PD to PK(GC) (park-golf course); and 238 acres at 4-9-2:001 (por) from Rural to OS (East of Keomoku Rd) and AG (West of Keomoku Road).

WUDP Response: Allocation for Koele PD is included in WUDP. Table of allowable acreages and water-related conditions as these have changed over the years is also incorporated into the WUDP.

Implementation Responsibilities

WUDP Response: Despite multiple water-related objectives and actions within the text of the plan, the Lana`i Community Plan matrix of Implementation Responsibilities assigns no tasks to the Department of Water Supply. However, it does refer repeatedly to insuring consistency with the WUDP.

LWAC has addressed various water and issues, from establishing watershed protection in concert with the Biodiversity Group, to questions as to the use of potable water on the upper elevation golf courses, to the scope and staging of Project Districts, to an ongoing venue for addressing water issues, to system monitoring and maintenance, to review of develpment projects and impacts on Lana‘i resources, to operational guidelines developed by a consultant for Castle & Cooke resorts, and reviewed by both the advisory committee and the CWRM.

APPENDIX K

Presentation Made at Public Fence Meeting 04/11/2000

Lanai Watershed Protection Fence Options

- Introduction
- Watersheds & Water
- Advisory Committee Priorities
- Lanai Species
- Protective Measures
- Peer Review Committee Advice
- Deer & Deer Damage
- Deer Control Options
- Fencing Options
- Close

Cloud Forest

Cloud Condensation
Complex Understory
Multiple Layers

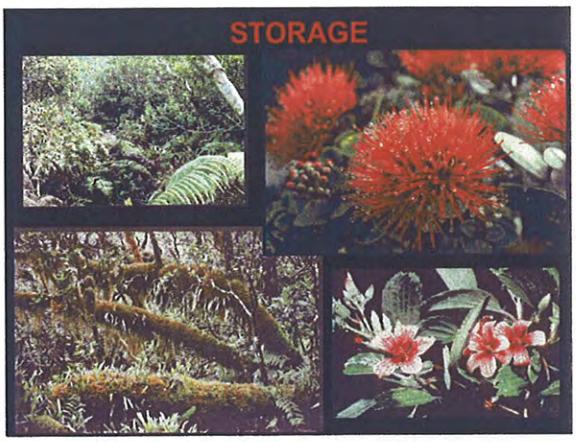
Healthy
Uluhe
and
Moss Cover

WATERSHEDS & WATER

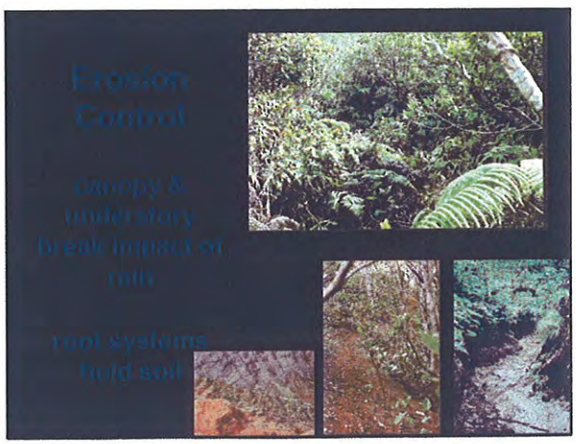
- COLLECTION
- STORAGE
- REGULATION OF DISHCARGE
- EROSION CONTROL
- WATER QUALITY


COLLECTION


COLLECTION


STORAGE


Regulation of Discharge


Erosion Control
canopy & understory break impact of rain
root systems hold soil

Water Quality

- Adsorption
- Absorption
- Filtration
- Uptake

- Diverse Cover
- Multiple Layers
- Interception
- Condensation
- Adsorption
- Leaf & Stem Drip
- Absorption

BIODIVERSITY
= Diverse Forms of Life

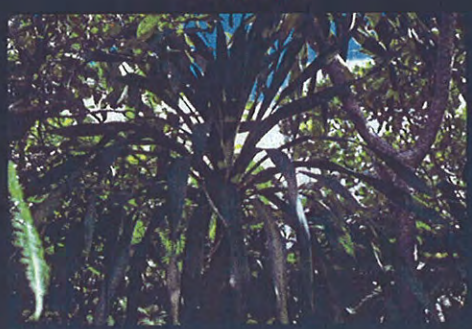
One part of an ecosystem affects the other parts. The ecosystem is healthier when all of its parts are intact.

Forms of Life Unique to Lanai
(Ex. Halapepe, Partulina variabilis)

Ama`u & Uluhe

Cyrtandra

Halapepe

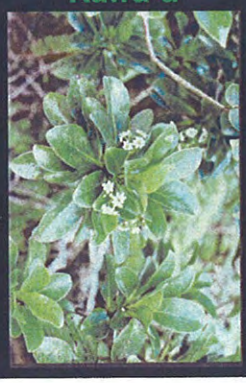


Ho`awa

Hue Hue

Isachne distichiophylla

Kawa`u



`Ohi`a

Pukiawe

Uki

Uki uki

Partulina Variabilis

`Apapane

WORKING GROUP PRIORITIES

- Protect Watershed
- Protect Native Ecosystems
- Consistent with Community Values

Protective Measures

- Control deer, sheep and rodents
- Control invasive plant species
- Prevent introduction of invasive plant and animal species (including insects)
- Provide fire protection
- Selective re-planting
- Collection, storage and maintenance of plant genetic material
- Protection from human disturbance
- Monitoring
- Public Education

Peer Review Committee #1 Issue:
Reduce Deer Population

WHY WORRY ABOUT DEER DAMAGE IN THE WATERSHED

? ? ? ? ? ? ?

Deer & Deer Damage

Trampling

Trampling

Trampling

Trampling

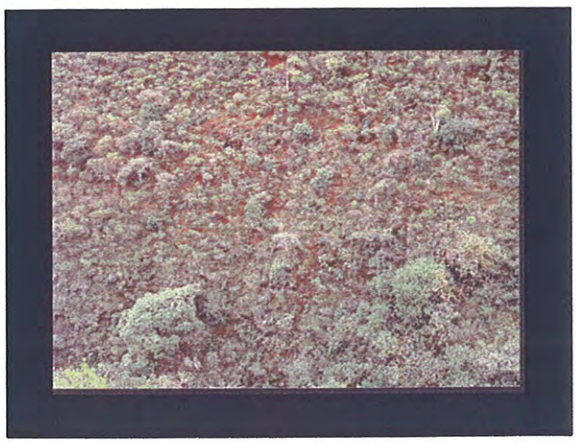
Trampling
Compaction
Distrubance
Trail Formation
Invading Plants

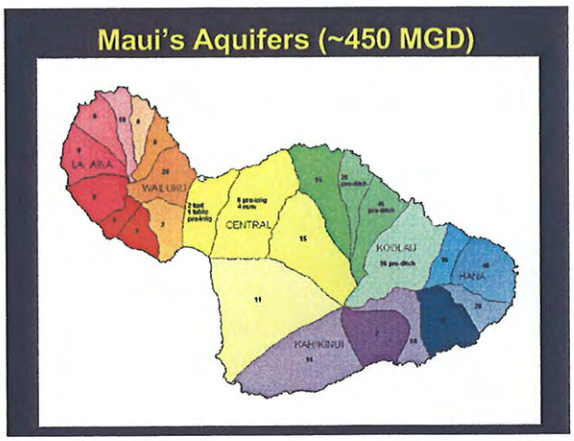
Browsing

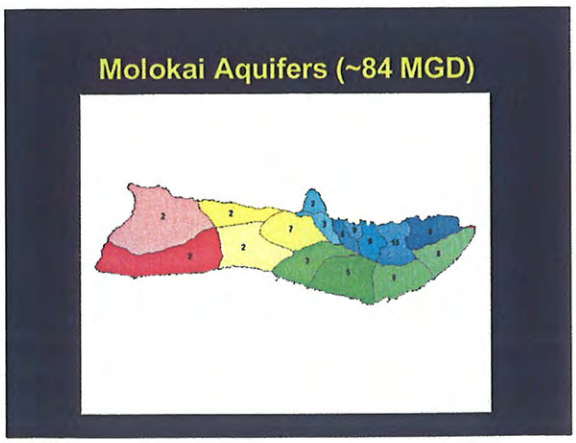
Browsing

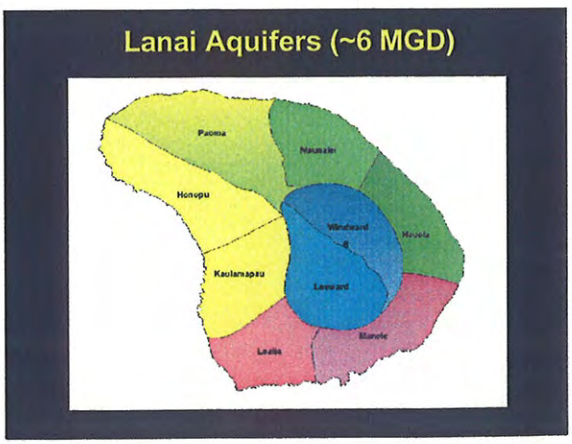
Browsing

Deer Rub




Maui's Aquifers (~450 MGD)
LA AHA
WAILUKU
CENTRAL
KOOLAU
HANA
KAHIKINUI


Molokai Aquifers (~84 MGD)


Lanai Aquifers (~6 MGD)
Paomia
Honopu
Kaulanapau
Leeward
Lanai

Control of Deer and Sheep

- hunting or other removal
- catch and transport
- fencing and other obstruction
- repellants, sterilizers
- habitat alteration
- introduced predators

Why Select Fencing?

- **Capture & Transport** very expensive, may not be places to send the deer, deer may die in transport
- **Sterilization or reproductive intervention** - administered either by darting or orally with bait. Vaccines still under development. Must be approved by FDA because deer is seen as "food animal", darting vaccine needs to be repeated annually, difficulty getting all deer reliably..OR, if animals are captured and surgically altered..difficulty getting all deer, very expensive, may not help situation in time to save watershed.

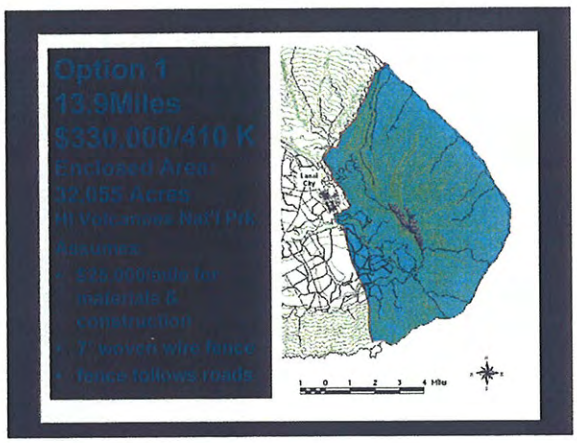
Why Select Fencing? (continued)

- **Repellants** - garlic oil, putrid egg solids, predator odor oils, sulphated cod liver oil have been tried. Putrid egg solids had some success in reducing browsing. But no information on how this impacts plants, insects, birds, pollination cycles, etc. Also will not address population problem.
- **Habitat Alteration** - planting desirable forage plants outside watershed, providing water outside watershed, surrounding watershed with thorny plants, etc. Such measures alone will not control population, may risk introduction of species, provision of water could lead to population increase.

Why Select Fencing? (continued)

- **Physical Barriers** - fence, canal, cattle guard, etc. can help keep deer out of desired exclosure or in desired area - not foolproof, but good in concert with other control measures.
- **Hunting** - animals may be able to be eradicated with one huge hunt, or numbers managed with on-going hunting. However steep grades, access problems and other issues mean that if this measure is used it would be more successful concert with other measures, and with some ongoing management .
- **Release of Predators** - introduction of new species poses multiple risks to already threatened watershed.

FENCELINE OPTIONS

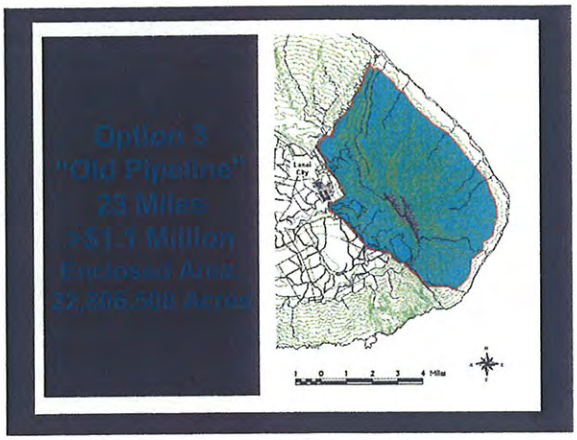


Option 1

- ADVANTAGES
  - Protects large area
  - Maintenance & monitoring easier near road
  - Per mile costs lower
  - Protects secondary recharge area (windward below cloud forest) as well as upper reaches
  - Requires tie-off in the ocean
- DISADVANTAGES
  - Prone to vandalism
  - More fence to maintain
  - Needs more coordination to mitigate hunter impacts

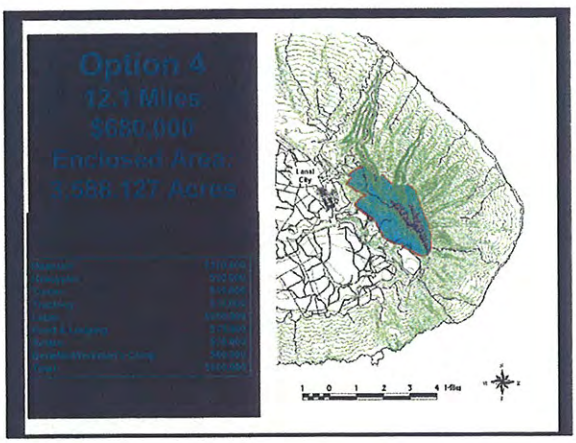
Option 2

- ADVANTAGES
  - Protects large area
  - Maintenance & monitoring easier near road
  - Per mile costs lower
  - Protects secondary recharge area (windward below cloud forest) as well as upper reaches
  - Second fence could be added in future to create different control level exclosures
  - Requires Tie-off in the ocean
- DISADVANTAGES
  - Prone to vandalism
  - More fence to maintain
  - Needs more coordination to mitigate hunter impacts



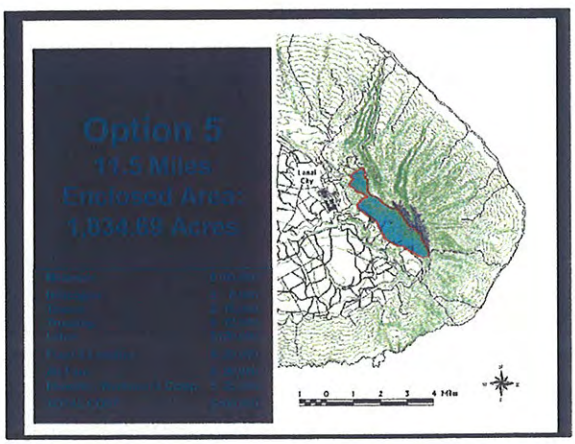
Option 3

- ADVANTAGES
  - Protects large area
  - Doesn't require ocean tie-off
  - Maintenance & monitoring easier near road
  - Per mile costs lower on upper side only
  - Protects secondary recharge area (windward below cloud forest) as well as upper reaches
- DISADVANTAGES
  - Most expensive option
  - Prone to vandalism
  - More fence to maintain - old pipeline route is not road - not efficient use of fence
  - Needs more coordination to mitigate hunter impacts



Option 4

- ADVANTAGES
  - Protects most critical recharge area
  - One of the less expensive options
  - Leaves lower reaches for hunter control
  - May be somewhat less prone to vandalism
  - Less impact on hunting community
  - Addresses both deer and sheep
- DISADVANTAGES
  - More difficult terrain for maintenance & monitoring
  - May be more expensive to repair



Option 5

- ADVANTAGES
  - Protects part of most critical recharge area
  - Leaves lower reaches for hunter control
  - May be somewhat less prone to vandalism
  - Less impact on hunting community
  - Addresses both deer and sheep
- DISADVANTAGES
  - Leaves out portion of most critical recharge area
  - More difficult terrain for maintenance & monitoring
  - May be more expensive to repair

Option 6
Eradication
&
Option 7
No Action

Option 6 Eradication

- ADVANTAGES
  - Most protective of watershed
  - End of deer problem
  - No fencing expense
  - No maintenance Expense
- DISADVANTAGES
  - Hunters likely to object
  - Massive undertaking
  - Loss of hunting-related economic input to community
  - Doesn't address sheep

Option 7 No Action

- ADVANTAGES
  - No effort until problems arise
  - No vandalism
- DISADVANTAGES
  - Watershed would be lost
  - Expense to re-create recharge greater than expense to preserve
  - loss of biodiversity

Fenceline Evaluation

	Cost	Miles	Acreage Protected	Recharge Impact *	Hunting Impact *
Option 1	$410,000	13.9	32,055		
19	4 (330K)	4	5	5	1
Option 2	$450,000	14.7	26,555		
15	3 (370 K)	2	4	4	2
Option 3	$1,100,000	23	22,807		
11	1	1	3	3	3
Option 4	$680,000	12.1	3,588		
14	2	4	2	2	4
Option 5	$400,000	11.5	1,835		
17	5	5	1	1	5

* Items from 1-5 where higher score is better