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**An Application of the Limits of Acceptable Change (LAC) Model to
Structure Long-Term Social and Resource Management for
South Maui, Hawaii**

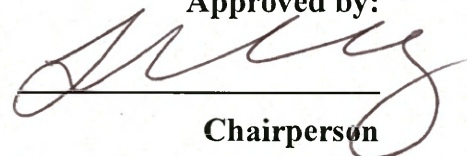


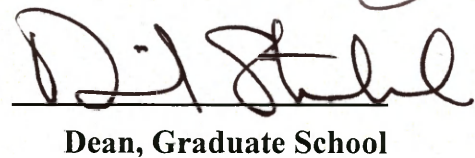
Keone'ō'io shoreline, Photo by John Boyden

**Professional Paper Submitted by
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B.A. in Human Biology, Stanford University, California 1994**

**In partial fulfillment of the requirements for the degree of
Masters of Science
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The University of Montana, Missoula
March 2005**

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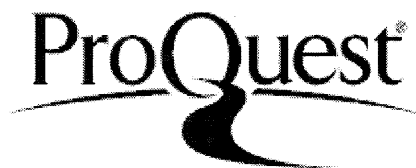


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An Application of the Limits of Acceptable Change (LAC) Model to Structure Long-Term Social and Resource Management for South Maui, Hawaii

Committee Chair: Len Broberg LB

Resource management is “messy” in that it is difficult to protect natural and cultural resources while allowing for their recreational and commercial use. The State of Hawaii Department of Land and Natural Resources (DLNR) is currently engaged in efforts to protect the South Maui coast, yet there is still no comprehensive long-term management plan for the area. This is in part because of limited personnel and funding available for these efforts, but also because there are many contentious issues requiring resolution.

This professional paper frames the key recreation and natural and cultural resources management issues for South Maui using a model that could be implemented by the DLNR. The Limits of Acceptable Change (LAC) model is a values-driven process relying on a transactive planning process involving the community as well as scientists and managers. While this paper can not and does not intend to replace the transactive planning process critical to the development of a long-term comprehensive management plan, it can serve as a springboard for discussion, and is meant to familiarize DLNR managers with the LAC model.

In this paper the nine-step LAC model is explained and applied to South Maui. Step 1 defines the social and natural and cultural resource values to be achieved. Step 2 defines three opportunity classes for the management area based on desired future conditions. Step 3 identifies two social and ten resource indicators pertaining to conditions within the management area. Step 4 inventories the range of existing conditions of these indicators, and Step 5 assigns standards of minimally acceptable conditions to these indicators. Step 6 identifies where opportunity classes could be allocated within the management area. Step 7 identifies a continuum of management actions for each of the indicators and implementation constraints. Step 8 suggests guidelines for finalizing opportunity class allocations and for identifying a specific management program to achieve the desired conditions. Step 9 suggests guidelines for implementing the management actions and conducting ongoing monitoring.

The LAC model proves to be a viable option for the DLNR and may be the simplest available approach for effectively dealing with the complexity of social and resource management in South Maui.

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PURPOSE STATEMENT

The purpose of this professional paper is to frame the key recreation and natural and cultural resources management issues for South Maui using a model that could be implemented by the State of Hawaii, Department of Land and Natural Resources (DLNR) and their Keone‘ō‘io-‘Ahihi-Kina‘u Advisory Group. The Limits of Acceptable Change (LAC) model is offered as the primary tool to guide management efforts. This model is recognized by many to be superior to the recreational carrying capacity concept. It is resource-based, comprehensive, and flexible, and addresses the fundamental concerns underlying the notion of recreational carrying capacity without being overly simplistic. It is being used nationally and internationally, although has not yet experienced widespread use in Hawaii. Managers in Hawaii may therefore not be familiar with the nine-step implementation process of this model. This paper defines each of the steps of the LAC model, and provides specific realistic examples of implementation, based on current South Maui social and resource protection issues.

This model is being offered to the DLNR and their Advisory Group as one possible management tool in recognition of the necessity of the development of a long-term comprehensive management plan for South Maui. For nearly 40 years a series of park and community plans have been written and a number of surveys and ecological assessments conducted by a variety of consulting, grassroots, and environmental groups, and state and federal agencies, with the goal of protecting South Maui. While some of these plans were never implemented, and some of these efforts have been piecemeal in their approach, they have been valuable in laying the foundation for a comprehensive effort. The application of the LAC model given in this paper should be used as a

springboard from which to work and from which to create the real standards needed in this management situation. It is meant to serve as a helpful model, be critiqued, and spark discussion about the issues that matter. It is not meant to be the management plan since such a plan can only be formulated by the cooperative efforts of the community, the DLNR, the Advisory Group, and scientists.

The first chapter of this paper focuses on the study approach and methodology of much of the scientific data that will be presented, and upon which the implementation examples are based. The second chapter provides the reader with background information on the importance of protecting Hawaii's natural and cultural resources, the difficulties involved in messy natural resources management situations, and what efforts have been made to date to protect South Maui. This chapter also describes the Limits of Acceptable Change (LAC) model and its predecessor, Recreational Carrying Capacity. The third chapter defines the management area boundary (for the purposes of this paper), and provides a physical description of the area. A realistic step by step application of the LAC model is then given. The fourth chapter, the conclusion, provides a discussion on the usefulness of the model to the DLNR, potential barriers to its implementation, and benefits of its implementation.

CHAPTER 1: STUDY APPROACH

The purpose of this chapter is to familiarize the reader with the study approach and with the sources of information upon which this paper is based. The topic of the paper requires in-depth knowledge both of the Limits of Acceptable Change model, and of the social and resource issues pertaining to South Maui. I began this project with a great deal of knowledge about South Maui, but little knowledge about management models. Based on literature reviews of natural resources management and on interviews with University of Montana professors, I decided to use the Limits of Acceptable Change model as my management tool. I then used this model to structure the existing data and information on social and resource concerns available for South Maui. My relevant personal experience with these issues is outlined below, followed by a brief description of the types of documents referenced and the sources of data used in this analysis.

My personal involvement in the protection efforts of South Maui, specifically of Keone‘ō‘io (La Perouse Bay), began in 1999. I helped form and became Program Coordinator of the grassroots community group “Friends of Keone‘ō‘io,” and over the next five years, in partnership with the non-profit organization Hawaii Wildlife Fund, wrote three grants to the Hawaii Community Foundation and one grant to the Coastal Zone Management Program. These funds have supported three years (2001-2004) of baseline human use data collection in South Maui (at Keone‘ō‘io), in addition to educational outreach efforts on-site and within the community. These research and educational outreach efforts increased my understanding of recreational use patterns, of social concerns, of the terrestrial and marine natural resources found in South Maui, and of the complexity of the issues surrounding natural resource protection.

I am also familiar with Hawaii's marine resources through my experience working as a naturalist, first on Oahu (beginning in 1995), and then with Hawaii Wildlife Fund on Maui (beginning in 1998). I have participated in the Hawaiian Monk Seal Watch program (protecting monk seals that haul out on beaches to rest), and the community turtle watch program (protecting green sea turtle and Hawksbill turtle nests and hatchlings) on Maui. I have led educational whale watching and snorkeling tours on Maui, and volunteered and worked in aquariums on Oahu and Maui. I have also conducted marine water quality surveys on the north shore of Oahu, turtle habitat surveys off Kaho'olawe with the Kaho'olawe Island Reserve Commission, and dolphin research (spotted and spinner dolphins) off Maui with PhD candidates from the University of Hawaii.

My understanding of cultural resources in South Maui is not as extensive as my knowledge of natural resources. However, I have gained a tremendous respect for these resources through my experience mapping and stabilizing archaeological sites under the guidance of archaeologist Theresa Donham, by meeting with Hawaiians within the community to learn from them and better understand their concerns and perspective, and by taking coursework in field archaeology and Hawaiian history and culture.

While conducting on-site research at Keone'ō'io has enabled me to learn much about South Maui's complex social and resource issues, there have been other significant sources of information worth mentioning. As Program Coordinator of Friends of Keone'ō'io, I participated in the Keone'ō'io-Kanaloa Working Group, which allowed me another opportunity to meet and work with many of the interested stakeholders. Friends of Keone'ō'io also conducted community meetings in South Maui every other month,

allowing frustrated residents to voice their concerns to management. Media attention on this group furthered our ability to serve as an important mouthpiece for the community.

As a result of our understanding of the human use patterns at Keone‘ō‘io and of our understanding of community concerns, Friends of Keone‘ō‘io was asked by the DLNR Chairman to co-host a series of meetings with DLNR on Maui to help resolve concerns relating to commercial kayaking. We were also asked to report our research findings to the Natural Area Reserve Commission on Oahu, to Maui council members, to the Maui Chapter of the Sierra Club, and to other scientists at conservation conferences. In January 2005, I was asked by the DLNR, Division of Forestry and Wildlife, for information on models that would be helpful in formulating strategies for managing the ‘Ahihi-Kina’u Natural Area Reserve in South Maui (Ramsey 2005). This paper will be presented to them in response to that request.

In addition to personal experience, this paper is also based on planning documents written for South Maui in the 1960s and 1970s, community meeting minutes, newspaper articles, internet sources, and interviews with Maui scientists, residents, and managers. A literature review of natural resources management and the Limits of Acceptable Change model was also conducted. Literature cited includes books, journals, handbooks, university curriculum (PowerPoint presentations), websites, and symposium proceedings. Information from informal interviews conducted with Montana-based consultants on the LAC process is also included.

The data and inventory information presented in the application of the LAC model chapter is based on several sources. I have been directly involved in the data collection and/or analysis of many of these surveys. I analyzed the human use data

collected by myself and other Friends of Keone‘ō‘io staff. These data, comprising the majority of the analysis in this paper, are explained in more detail in chapter 2. I also conducted Reef Environmental Education Foundation (REEF) surveys in La Perouse Bay, and participated in a team of Hawaii Wildlife Fund divers removing marine debris from La Perouse Bay. I served as a consultant for the team of National Park Service (NPS), DLNR, and University of Hawaii (UH) scientists conducting a biological inventory of the coastline as part of a NPS reconnaissance survey of South Maui. I also helped distribute surveys used in the Visitor Preference Survey conducted by the Sierra Club. Other sources of data included in this paper are water quality measurements of anchialine ponds performed by the USGS, and rapid ecological assessments conducted by the DLNR. Specifics on the location of these surveys and the time period during which they were conducted will be given later in the paper.

CHAPTER 2: HUMAN USE PATTERN RESEARCH AT KEONE‘Ō‘IO

Since July 2001, Friends of Keone‘ō‘io and Hawaii Wildlife Fund have conducted three types of human use pattern surveys at Keone‘ō‘io: Car Census Surveys, Technical Surveys, and Resident and Visitor Questionnaires (Appendix 1). These surveys provide both quantitative and qualitative data. The qualitative data is valuable for providing information on the range of behaviors and uses occurring, but is inherently subjective. In this paper, analyses from the Car Census Surveys and Technical Surveys will be used. Their methodology is described below.

Car Census Surveys document the number of cars and people entering Keone‘ō‘io throughout the day over a thirteen hour period between 6:00am and 7:00pm. Residents are distinguished from tourists and the arrival of commercial vehicles and patrol personnel is noted. Surveyors are stationed near the La Perouse monument at the entrance of Keone‘ō‘io and record data from their vehicles. This survey takes place twice a month—once on a weekday and once on a weekend. These data can be used to determine the average number of people that enter the area on a daily basis over time, to determine how that compares to overall visitor use on Maui, and to determine peak times of use. It can be analyzed for differences in weekend versus weekday use, and can determine the percentage of tourists versus residents using the area.

For the purposes of the Technical Survey, the study area was divided into eight areas as shown on Figure 1. A more detailed description of these areas is provided in Appendix 2. The Technical Surveys are conducted for a minimum of a three-hour period three days a week (two weekdays and one weekend). These surveys can begin at any time of day, and are done so at random. The majority of the surveys, though, have occurred

during the time span of 8am-3pm. The number of people is counted and their activities recorded every half hour in all eight study areas. This requires the researcher to walk throughout much of the site (primarily areas 1-3) and to use binoculars to assess the areas further away (such as areas 4, 5, 6, 7, and 8). Data recorded includes all of the activities occurring in the area (recreational, illegal, and otherwise), when these activities occur, the number of people found in each area at any one time interval, the level of commercial

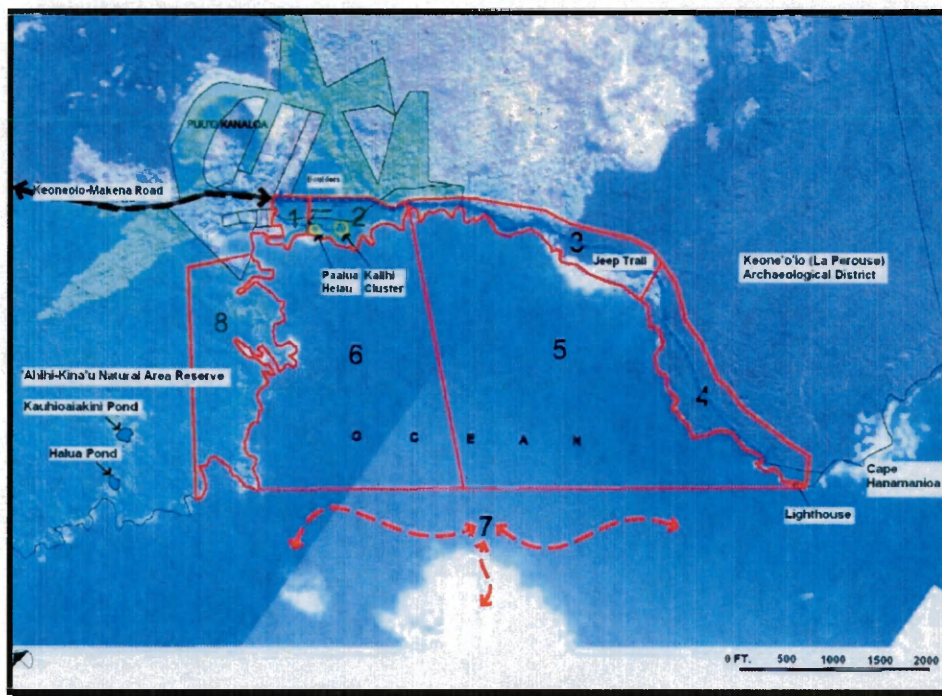


Figure 1: Research Areas 1-8 at Keone‘ō‘io (Created by David Sereda, 2002)

uses occurring both on land and in the water, and weather conditions during the survey. Sightings of protected marine life, such as whales, dolphins, turtles, and monk seals, are also recorded. Qualitative information recorded during technical surveys includes information on injuries occurring on-site, observations of archaeological site destruction, litter and coral rock graffiti removal efforts, and information (about protected animal sightings, etc.) from residents who frequent the site often. These data can be useful in

determining what the major site uses are, when and where they occur, and where the “hot spots” are for problems such as archaeological site impacts, litter accumulation, and coral rock graffiti.

Data from the Car Census Surveys and Technical Surveys were entered into Excel spreadsheets and compiled and analyzed. The program SPSS was used for statistical analysis of descriptive variables, including mean, median, mode, standard deviation, minimum and maximum values, and the distribution percentiles at 25, 50, and 75 percent.

For the purposes of this paper, the Technical Survey data was analyzed for the one year period of January through December 2003. Year 2001 was not a complete data year, Year 2002 closely followed the September 11 tragedy and use patterns may have been different in the wake of decreased tourism, and Year 2004 data was still being collected when analysis efforts for this paper began. Year 2003 was chosen, therefore, because it is a complete year (data for each of the 12 months is recorded), it is more current than the year 2002 data, and because a higher number of Technical Surveys were completed than in year 2004. It is representative data, reflecting the normal variation of peaks and troughs in visitation rates within and between months. The data analyzed from the Car Census Survey covers three one-year periods (Data Year 1: June 2001-May 2002, Year 2: July 2002-June 2003, Year 3: July 2003-June 2004).

A total of 120 Technical Surveys were completed in 2003¹. Low numbers of surveys were collected between October through December of 2003 due to delays in funding. While surveys can occur anytime between 6:30am and 7:00pm, a statistical

¹The number of surveys conducted per month in 2003 were as follows: Jan (15), Feb (12), Mar (14), Apr (12), May (14), Jun (10), Jul (11), Aug (13), Sept (14), Oct (1), Nov (2), and Dec (2).

analysis of the 120 survey days shows that the majority (67.5%) of the surveys were conducted between 10:00am and 2:00pm. Only 12% of the surveys were conducted prior to 10:00am, and 20.5% conducted after 2:00pm. The average survey length per day was 3.5 hours.

CHAPTER 3: BACKGROUND INFORMATION

The purpose of this chapter is to provide the reader with the necessary background information to understand why the protection of Hawaii's natural and cultural resources is important (see An Island Perspective), why such protection efforts are difficult (see Messy Natural Resources Management), and a brief summary of what efforts have been made to date to protect South Maui (see History of South Maui Protection Efforts). This chapter then familiarizes the reader with a management tool called the Limits of Acceptable Change (LAC) model. First, its predecessor will be explained (see Recreational Carrying Capacity), and then the LAC model will be described (see Limits of Acceptable Change Model). The description of the LAC model will include how it differs from recreational carrying capacity, where LAC is being used both nationally and internationally, the components of the model, and some of its strengths and weaknesses. In the next chapter, LAC will be applied to South Maui as an example of how the State of Hawaii Department of Land and Natural Resources (DLNR) could manage this area's recreational use while still protecting significant natural and cultural resources.

3.1 An Island Perspective

The Hawaiian Islands, located at roughly 20 degrees north latitude and 156 degrees west longitude, are the most isolated islands on earth, a minimum of 2,000 miles distant from any other land mass in any direction. Because of its isolation from large continental land masses, Hawaii has a high rate of endemism, meaning that its native species are found nowhere else in the world. Over 25% of Hawaii's reef animals are

endemic (NOAA, National Ocean Service and National Marine Sanctuary Program 2002). Native and endemic species in Hawaii are vulnerable; Hawaii makes up less than one percent of the land mass of the United States but has more than 30% of the nation's rare and endangered species (about 360 species in Hawaii) (Allen 2000). The rate of extinction in Hawaii "...has risen a thousandfold since Cook landed" (Allen 2000). This makes the job of natural resource managers all the more important and time-sensitive. There is a trend towards easier and easier access for the introduction of invasive species to Hawaii from elsewhere in the world from the ballast water of boats, from shipping containers, and from airplanes and imported produce. Invasive species can not only bring about the decline and extinction of native plants and animals, but also cause millions of dollars of damage to agricultural crops and can pose serious human health hazards (Staples and Cowie 2001). In short, managers must be aggressive to keep up with the pressures facing island ecosystems today.

Cultural resources in Hawaii are also extremely unique. The Polynesians that arrived on the islands between 700-1400 years ago evolved their own unique culture and blood lines, making Hawaiians unique. There are thought to have been two major migrations to the Hawaiian Islands. One was roughly in 600A.D. from the Marquasis Islands, and one in 1300 A.D. from Tahiti. Hawaiians occupied only eight small islands (Figure 2) within the entire Hawaiian chain of 132 islands stretching in the southeast from the Big Island, to Kure Atoll in the northwest, nearly 1600 miles away (Department of Labor and Industrial Relations 1993).

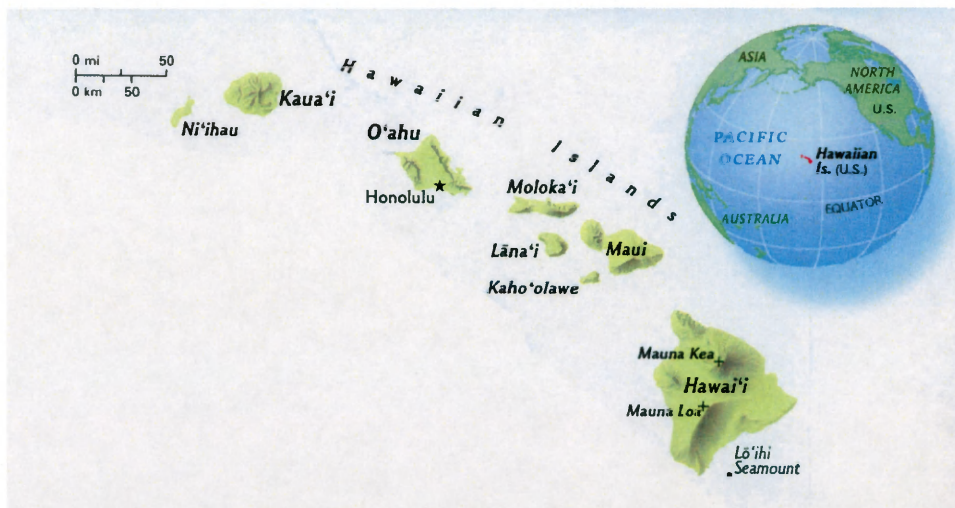


Figure 2: Main Hawaiian Islands (Modified from National Geographic Magazine, October 2004)

The Hawaiian culture has experienced enormous changes in the last 200 years, including massive die-offs from introduced illnesses, the immigration of a dozen different cultures, and the illegal overthrow of the Hawaiian royalty. The Hawaiian bloodline went from 100% pure in the 1790s to now less than 1% pure (Carson 1998). The ancestors of today's native Hawaiians passed down a legacy of cultural information, art, dance, chants, and a rich oral history, and left behind a physical legacy of archaeological sites, features, and petroglyphs. Archaeological sites are one of the important threads connecting Hawaiians back to their past. These sites "...constitute geographic links with their history and cultural heritage, sacred places...within a landscape vastly transformed by two centuries of economic 'development'..." (Kirch 1995). Protecting and preserving these sites and features should be a state priority.

The majority of the State of Hawaii lands are ceded lands. The term "ceded lands" refers to some 1.75 million acres of what originally were Government and Crown lands under the Kingdom of Hawaii that the Republic of Hawaii ceded to the United States when Hawaii was annexed in 1898, and that were transferred to the State of Hawaii in 1959

(Department of Labor and Industrial Relations 1993). Advocates of Hawaiian sovereignty believe these "ceded" lands were reserved by the sovereign and held for the benefit of all Hawaiian people. Their view is that these unalienable ceded lands should be returned to the Native Hawaiians. Therefore, while the DLNR is currently, under state law, the landowner of much of the land in South Maui, not everyone in Hawaii recognizes the DLNR as the legal owner.

3.2 Messy Natural Resources Management

One of the most challenging issues that the world faces today is how we can reconcile conservation of natural resources with their sustainable use (United Nations Educational, Scientific and Cultural Organization 2004). It is acknowledged on the Biosphere Reserve website that "Coastal areas and islands are particularly prone to such conflicts due to the limited space and resources" (United Nations Educational, Scientific and Cultural Organization 2004).

It is not a new concept that frustrations often accompany any attempt to manage a diverse and sensitive resource for the recreation and cultural needs of a diverse group of people with competing interests. A national survey of wilderness managers showed recreation-related problems in 25% to 75% of the areas managed, and recreation-related uses were a greater source of problems than non-recreation-related uses (Stankey et al. 1985).

The system of interrelated problems associated with natural resource management is referred to by managers as "messes." The process of coming up with solutions has been referred to as "sticky", "messy", and "wicked" (Cole 1998: 71). The incentive for taking

on these difficult issues is summed up by McCool and Cole: “Ultimately, the goal of planning is to intervene in a series of anticipated events to move toward a future that we project to be a more desirable one” (1997: 77). The messy system can be defined in terms of seven key points, which are described below in the context of South Maui.

First, messy systems are defined by several, and sometimes competing, values that are intrinsically subjective and political (Krumpe and McCool 1997). These include non-market, amenity, and biodiversity values (McCool, Guthrie and Smith 2000). In South Maui, competing values primarily fall into the category of recreational uses that degrade resources. More and more people continue to use the area as a playground in ways that degrade the area’s rich natural, cultural, and historic resources.

Second, issues of equity come into play and make value judgments difficult to make. Who will bear the costs of management actions needed to avoid unacceptable conditions? To what extent are costs borne related to benefits received? Do costs relate to impacts caused (McCool and Cole 1997)? Issues of equity are a concern that has surfaced at community meetings hosted by both the community grassroots group Friends of Keone‘ō‘io and the State DLNR. Limited access has been expressed as a cost of management that is unpalatable to many, yet considered necessary by many others.

Third, state agencies responsible for caring for the land are chronically under-funded and under-staffed. This leads to a lack of enforcement, which creates a scenario in which the resources inevitably suffer from overuse. The DLNR has been chronically under-funded and under-staffed, hindering their ability to sufficiently manage South Maui’s natural and cultural resources. That situation is slowly changing as grant monies are being raised to aid DLNR in their management and enforcement efforts.

Fourth, the need for information often grows faster than science can manage. It is preferable to make management decisions based on the best available information. If that information is lacking, managers are left to make decisions in a vacuum with no practical assurance that they're doing the right thing (Stankey et al. 1985). This can lead to “cart before the horse” management that is not founded on the actual state of the resource. Data collection in South Maui has been scattered, at best. This makes it difficult to manage based on a real understanding of the condition of the resources. Some areas, such as the wetlands at Makena Beach State Park, have been surveyed for 30 years, whereas other resources in South Maui have never been surveyed (Duvall 2005). The most recent comprehensive data collection effort was undertaken by the Hawaii Wildlife Fund and Friends of Keone‘ō‘io, which began human use surveys in the summer of 2001. This research, however, focuses primarily on Keone‘ō‘io, so there is limited information on human use in the ‘Ahihi-Kina‘u NAR and other areas of concern.

Fifth, population growth leads to increases in pressure on these natural areas. This population growth stems not only from local population growth, but also from increasing tourism. Maui, more than any of the other Hawaiian Islands, has experienced dramatic population growth in the last 30 years. The 1980 Census showed Maui's resident population to be a little under 63,000; by 1990 it was more than 91,000 (National Park Service 2002). According to the 2000 Census, Maui's population was more than 128,000 (DBEDT 2004). This growth is especially apparent in southwest Maui, primarily in and around Kihei (Figure 3). In 1970, the population of the Kihei-Makena area was 1,636. By 1980, it had grown to

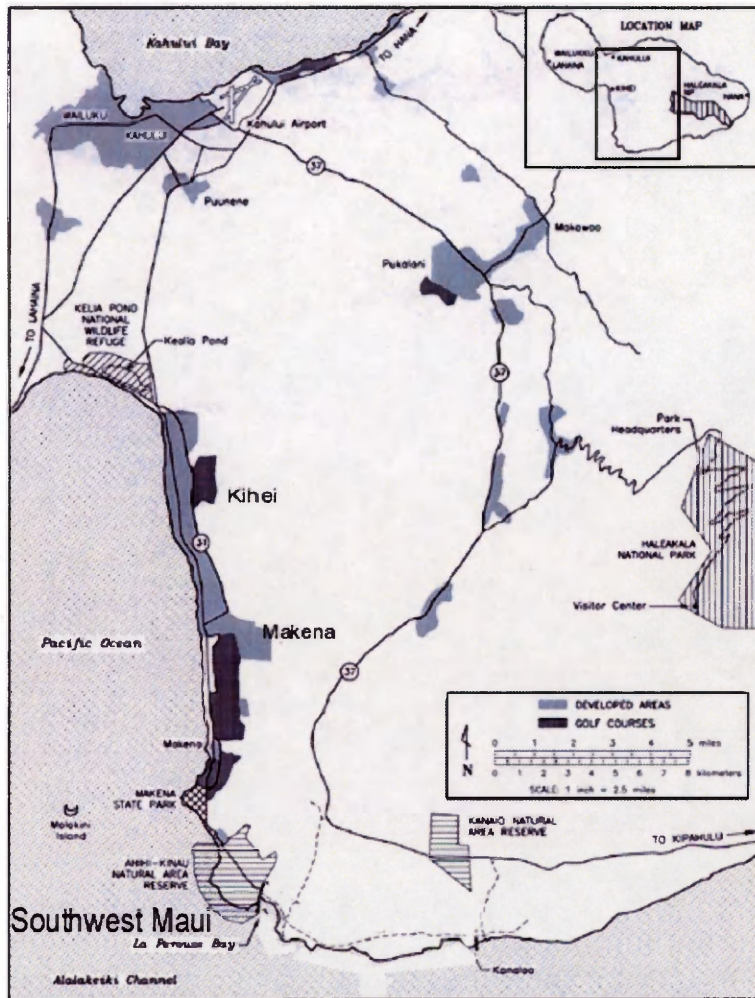


Figure 3: South Maui and the towns of Kihei and Makena (Modified from NPS 2002)

7,263 and by 1990 to 15,365 (National Park Service 2002). The *2000 State of Hawaii Data Book* shows a 50.8 percent increase in the resident population of Kihei from 1990 to 2000 (State of Hawaii 2001). In October 2001, the Maui County Council's Land Use Committee approved a rezoning application that calls for up to 1,100 new residences and a new hotel complex in Makena. The controversial proposed development has residents worried about the additional strain it will place on traffic and water resources (National Park Service 2002). The *Kihei-Makena Community Plan* anticipates that the 2010 population for this area will range from 22,830 to 24,514 (Maui County 1998).

Another strain on resources in South Maui, in addition to local population growth, is tourism. Tourism is the driving force of Hawaii's economy, and areas within South Maui are advertised to millions of people each year through guidebooks, visitor TV channels, hotel concierges, and websites. Tourism advertising is on the increase, even though hundreds of visitors are already arriving at sites such as La Perouse Bay each day (HWF 2004a). The average daily visitor population was estimated at more than 16,000 in 1990 (National Park Service 2002). The Kihei-Makena area has become the second largest visitor accommodation area on Maui; the largest is the Kapalua-Kaanapali-Lahaina region. As a planning document from 1977 attests, "attendant with the change of the Kihei area to a major tourist destination area is the intensified demand and use of the area's recreation facilities" (Mogi 1977: 2). A survey of the area completed by the National Park Service in 2002 sums up the situation:

What in the late 1970s and early 1980s was a quiet, rural area with miles of uncrowded beaches, a few small hotels and other low-key visitor accommodations, is now a ten-mile stretch of urban development consisting of condominiums, mini-malls, high-end resorts, golf courses and residential neighborhoods (p.13).

Sixth, some minority interest groups have the clout to politically veto decisions made by management (McCool, Guthrie and Smith 2000). These groups have the ability to sabotage the efforts of managers. Minority interest groups (including those with veto power) are already being incorporated by the DLNR in community meetings and as members of the Keone'ō'io-'Ahihi-Kina'u Advisory Group (KAAG), formed in 2003.

Finally, the seventh key point defining messy systems is that the traditional way of approaching resource management problem solving has been the rational-comprehensive (or top-down) process, where decisions are made by scientific experts and

agency personnel who often discount local knowledge (McCool, Guthrie and Smith 2000). There is a need, instead, for transactive planning, which puts the emphasis on learning from one another, the local citizens as well as the experts, scientists, and agency personnel (Krumpe and McCool 1997; Friedmann 1973). This type of planning not only involves all the stakeholders, but also better allows management to adapt to new information. The Advisory Group is composed of all the major stakeholders, which allows local knowledge to be incorporated into discussions and decision-making. People connected to the land advise the policy about the land. Many of these representatives participated in KAAG's predecessor, the Keone'ō'io-Kanaloa Working Group, formed in 2001. Even earlier than that, the Friends of Keone'ō'io hosted monthly meetings and encouraged the community to get involved. If the community is involved in the process and has a sense of ownership in the plan and the area, the plan is more likely to be implemented successfully (McCool and Cole 1997).

3.3 History of South Maui Protection Efforts

Table 1 below summarizes some of the key groups and individuals involved in South Maui protection efforts, starting in the 1960s.

Table 1: Summary of South Maui Protection Efforts, 1960s-present

Time Period	Protection Efforts
1960s	1968: <i>Environmental and Urban Design Study of the Makena-La Perouse, Wailuku and Lahaina Areas</i> (Warnecke and Associates) First plan documenting the idea of preserving South Maui.
1970s	1977 <i>Makena-La Perouse State Park Plan</i> (Mogi) First park plan developed for DLNR State Parks Division for Makena and La Perouse.
1980s	1982-1997: State Park At Makena (SPAM) Citizen's Movement Successful 15 year effort to save Big Beach from development.
1990s	1998: Sierra Club Visitor Preference Survey (documented views on why tourists return to Hawaii). Survey concluded that the state needs to spend more money to protect Hawaii's natural & cultural resources (Appendix 3).

1990s (continued)	<p>1998: Kihei-Makena Community Plan Designated South Maui as a park area (Appendix 4).</p> <p>1999: Friends of Keone‘ō‘io (grassroots group)</p> <p>Involves the community in identifying issues of concern for Keone‘ō‘io.</p> <p>Late 1990s: Maui activist Mary Evanson pushes for national park status for Keone‘ō‘io.</p>
2000-present	<p>2001-present: Hawaii Wildlife Fund and Friends of Keone‘ō‘io raise grant monies, conduct research, facilitate on-site educational outreach at Keone‘ō‘io, and conduct community meetings</p> <p>2001: Keone‘ō‘io-Kanaloa Working Group established (through a partnership of the NPS Rivers, Trails, and Conservation Assistance Program, Maui DLNR officials, and the nonprofit Maui Malama Pono)</p> <p>2002: NPS Reconnaissance Survey conducted between Keone‘ō‘io and Kanaloa as a result of Congresswoman Patsy Mink’s bill H.R. 591</p> <p>2003: Visioning Group meetings (a smaller group stemming from the Keone‘ō‘io-Kanaloa Working Group)</p> <p>2003-present: Oahu DLNR personnel host community meetings on Maui, and DLNR scientists conduct rapid ecological assessment surveys in the NAR</p> <p>2003: NARS Commission meetings on Oahu</p> <p>2003: Keone‘ō‘io resident Pat Borges collects over 300 signatures to ban commercial kayaks from Keone‘ō‘io</p> <p>2003: Keone‘ō‘io-‘Ahihi-Kina‘u Advisory Group established for DLNR</p> <p>April 2004: Commercial users removed from the NAR (and commercial kayakers removed from their launching area at Keone‘ō‘io)</p> <p>2004: \$460,000 HTA grant awarded to the DLNR and Hawaii Wildlife Fund for resource protection in the ‘Ahihi-Kina‘u NAR and Keone‘ō‘io. The grant pays for two Rangers, for naturalists and cultural specialists to conduct daily on-site educational outreach, for human use data collection, for buoys to mark the “no motorized zone” in the NAR, and for archaeological surveys.</p>

3.4 Recreational Carrying Capacity

The concept of Recreational Carrying Capacity (RCC) derives from the oldest concept of resource management (Mann 2003). It has its roots in range management, where carrying capacity is defined as the maximum number and density of animals a given unit of land can support on a sustained basis without destruction of the resource base (Mann 2003). The purpose of carrying capacity is to define the level of use an area

can tolerate. In 1978, the General Authorities Act (U.S. Public Law 95-625) required each National Park to develop visitor carrying capacities, due to the concern of resource destruction from overuse (Cole and Stankey 1997). This model was used in the 1980s for the management of natural resource areas (Mann 2003).

Some scientists, however, found that the limitations of RCC were “becoming increasingly apparent” (Cole and Stankey 1997: 5). There was concern that capacities would be developed in places where they were not needed and in ways that were neither productive nor defensible (Washburne 1982). Also, carrying capacity approaches often “...did not explicitly link use limit policies to improvements in desired or acceptable conditions” (McCool and Cole 1997: 73). They also often confused establishing a use limit with allocating a resource to a specific type of recreation opportunity (Schreyer 1976).

The major assumptions of the carrying capacity concept are that the amount of impact is related to the amount of use, that decreasing the amount of use will decrease the impacts, and that it is possible to calculate the number of users, below which impacts will be acceptable (Mann 2003). The problem is that recreation impacts differ with the type of use, timing of use, distribution of use, environmental setting, management actions, and with people’s expectations and norms (Mann 2003).

In essence, RCC focuses on the wrong question. Decreasing the number of users may not lessen impacts. In fact, research has shown that many problems of recreational use are a function not so much of the numbers of people, but of their behavior (McCool 1996). A large number of people can be accommodated in an area if there is enough education and access management (or other directive) in place to properly manage those

numbers (McCool 1996). Denali National Park in Alaska, for example, utilizes a shuttle bus system to minimize impacts to the natural resources while continuing to allow access for visitors. While the use of buses still causes some amount of dust and noise pollution, the number of vehicles needed to allow thousands of visitors to experience the park each summer is greatly reduced. Some visitors may feel inconvenienced at having to board a shuttle bus to drive into the park past mile 13, but on the other hand, they have not been barred from the majority of the 95-mile wilderness road. The buses stop on request, allowing visitors to take photos at any time and to experience wildlife encounters.

Use limit policies are only one of a number of potential management actions available to address visitor impacts, and use limit policies are one of the most intrusive actions that managers could deploy. They are controversial and have historically created a host of problems, including the problem of determining appropriate allocation and rationing techniques (McCool and Ashor 1984). Since recreation is a voluntary, pleasurable, free choice process, the principles of recreation management are that management should be sensitive, and should involve only the minimum regulation necessary using the minimum amount of tools necessary (Mann 2003). Indirect or “lighthanded” methods are preferable to direct management (such as regulations and enforcement) that can lead to conflict between managers and recreationists (Mann 2003).

User fees are one management tool that may or may not actually limit use. If fees are low enough, the fee in and of itself will not likely be the deciding factor for people deciding not to visit the area. Implementing user fees is still controversial, but can be one good way to raise funds to support long-term protection efforts in wilderness and other

natural and cultural resource areas. These fees and their applicability to South Maui are discussed in more length in the next chapter.

3.5 Limits of Acceptable Change Model

The Limits of Acceptable Change (LAC) model differs from RCC in that it seeks to address these two questions: Given recreational use, what are the acceptable resource and social conditions in the protected area? And what are the appropriate and effective actions needed to maintain those conditions? By focusing management and planning effort on these questions, the LAC process addresses the fundamental concerns underlying the notion of recreational carrying capacity without being overly reductionistic (Schultz, McCool and Kooistra 1999). The Limits of Acceptable Change model better encompasses the critical interaction between human and natural systems at every level (Howard and Potter 2002). The LAC model is considered by McCool and Cole (1997) to be the simplest available approach for effectively dealing with the complexity of the real world. Management actions, therefore, stem from an informed awareness of the resource condition after establishing a hierarchy of values upon which to base those decisions. This process helps managers avoid making the mistake of implementing decisions that are not reflective of clearly defined values, or that do not address the problem. It is also a comprehensive model that is an adaptable form of management. Management actions change as needed (as indicated by the resource through monitoring).

The Limits of Acceptable Change (LAC) protected area planning process was developed in 1985, deriving from the Management by Objective approach (Stankey et al.

1985). The National Park Services Visitor Experience and Resource Protection (VERP) protocol serves a similar function to the LAC model. Another spin-off of this idea is the National Parks and Conservation Association Visitor Impact Management (VIM), and the Parks Canada calls it the Visitor Activities Management Process (VAMP) (National Park Service 2005c).

This model was first applied in North American terrestrial wilderness settings and its use is becoming more widespread. Its first full application was in the Bob Marshall Wilderness in Montana in 1987 (Cole and Stankey 1997). The LAC model was first tested in the national park system in Utah at Arches National Park (National Park Service 1995). Other parks and wilderness areas in the United States and abroad that have applied the model in their management process include: the Mt. Shasta Wilderness in CA (Puttkammer 1994); the Glenn Allen wild and scenic river corridor in Alaska (Bureau of Land Management 2005); the Pere Marquette River in Michigan (Forest Service 2003); the Severn Gorge in Shropshire, UK (TACP 2005); Hell's Canyon National Recreation Area, which straddles the borders of northeastern Oregon and western Idaho (Forest Service 2005a; Krumpe 2005); Black Canyon National Park (National Park Service 2005a); the Red River Gorge in the Daniel Boone National Forest, Kentucky (Forest Service 2005b); in Aonach Mor near Ben Nevis, UK (Center for Ecology and Hydrology 2005); and the El Malpais National Conservation Area in New Mexico (Bureau of Land Management 1993). In 1999, the model was somewhat modified and applied for the first time to a marine park, the Saba Marine Park in the Caribbean (Schultz, McCool and Kooistra 1999). It has also been used in Hawaii. In 1997, the Board of Land and Natural

Resources flew two LAC experts from the mainland to Kauai to help them resolve boating issues in Hanalei (Staff Writer, *Environment HI* 1997).

Stankey et al. (1985) refine the LAC framework into four major components: (1) the specification of acceptable and achievable resource and social conditions, (2) an analysis of the relationship between existing conditions and those judged acceptable, (3) identification of management actions necessary to achieve those conditions, and (4) a program of monitoring and evaluation of management effectiveness. The process generally consists of nine steps (Figure 4), although in some cases these steps are modified into as few as six steps (Forest Service 2003).

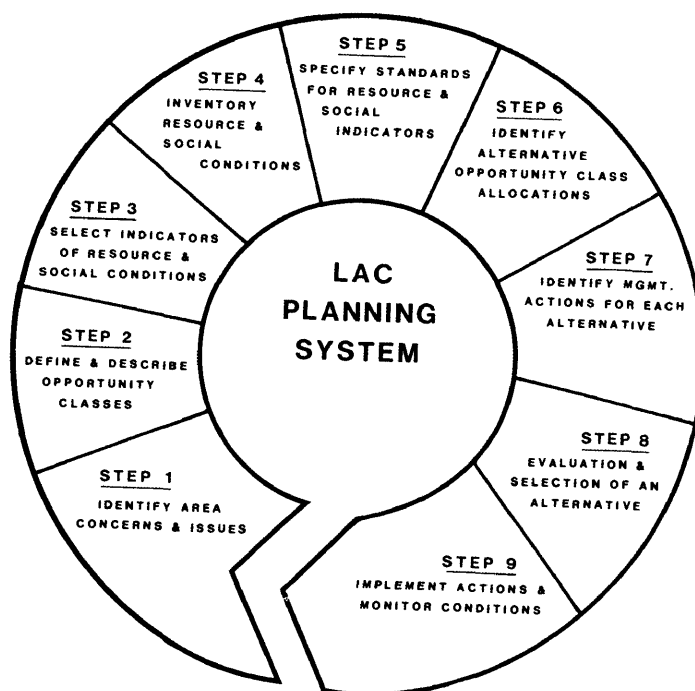


Figure 4: Nine Steps of the LAC Model (From Stankey et al. 1985)

Two of the primary strengths of LAC are that management decisions resulting from this process are resource-based and comprehensive. As Lucienne de Naie (affiliated with the Maui Chapter of the Sierra Club) stated, “We need a management system that

looks at the resource first” (Whitcraft 2002). Implementing this model is like putting the horse back in front of the cart. Desired future conditions are clearly defined and relevant indicators and standards are selected. Attention is focused on critical problems at specific locations (Stankey et al. 1985). The evaluation of management actions through monitoring makes management under the LAC process trackable and traceable (Krumpe 2005). The variety of alternative courses of action to follow also allows the manager a great deal of flexibility.

Two of the primary weaknesses of the LAC model are that it’s tough to implement all the steps when budgets are declining, and some agencies lack the political will to implement the management actions (McCool and Cole 1997). In addition, the process is still complex, and even the most practiced public meeting facilitator will struggle with balancing multiple competing interests. These are all considerations to be taken into account before implementing the LAC model. Nonetheless, LAC offers a pathway to making reasoned decisions balancing interests while providing basic protection to the resource. The next chapter will illustrate how to apply the model to DLNR lands in South Maui.

Chapter 3 Summary

- Hawaii’s unique native and endemic species are vulnerable and managers must be aggressive to keep up with the pressures facing island ecosystems today.
- Archaeological sites are one of the important threads connecting Hawaiians back to their past. The protection and restoration of these sites should be a state priority.

- Some advocates of the Hawaiian Sovereignty Movement do not recognize the DLNR as a legal landowner in South Maui, even though this ownership is sanctioned by state law.
- The system of interrelated problems associated with natural resource management in South Maui is messy, involving competing values, issues of equity, lack of funding and information, and the pressures of population growth and increasing tourism. However, the DLNR has set up an Advisory Group which includes minority interest groups with political veto power, and several years prior to the establishment of this group the community was involved in a transactive planning process involving all stakeholders.
- Since the 1960s, park plans, visitor preference surveys, reconnaissance surveys, human use surveys, and rapid ecological assessments have been conducted by a variety of consulting, grassroots, and environmental groups, and state and federal agencies, with the goal of protecting South Maui.
- Recreational carrying capacity has been used historically to define the level of use an area can tolerate, but it focuses on the wrong question.
- The nine-step LAC model addresses the fundamental concerns underlying the notion of recreational carrying capacity without being overly reductionistic, and is being used both nationally and internationally. It is resource-based, comprehensive, and flexible, but can be costly and time-consuming to implement.

CHAPTER 4: AN APPLICATION OF THE LAC MODEL

This chapter will define the project area within South Maui (see Management Area Boundary), describe its physical attributes (see Physical Description of the Management Area), and apply the nine steps of the LAC model to this area (see LAC Model Application). In recognition that the LAC model is built upon the interaction of the public with agency officials, these issues cannot be completely resolved in the context of a professional paper. What the professional paper can do is suggest what sorts of issues are appropriate for this process, and how such a process might proceed. This example provides a realistic representation of current concerns and issues in South Maui. It is based on the meeting minutes from dozens of community meetings, on several scientific surveys, and on five years of personal experience interacting with the stakeholders as the Program Coordinator for Friends of Keone‘ō‘io and as a member of the Keone‘ō‘io-Kanaloa Working Group.

4.1 Management Area Boundary

The South Maui community, the Keone‘ō‘io-‘Ahihi-Kina’u Advisory Group, and the DLNR need to clearly delineate and decide on an appropriate name for the proposed management area. Two areas in particular on the south shore of Maui, the ‘Ahihi-Kina’u Natural Area Reserve and Keone‘ō‘io (La Perouse Bay) (Figure 5), have been of interest to community groups and the DLNR. But a comprehensive long-term management plan would ideally include a larger area that encompasses these two. Studies from the 1960s and 1970s recommended the management area encompass several thousand acres, stretching along Maui’s south shore from Big Beach (Makena) to Kanaloa.



Figure 5: Aerial Photo of the ‘Ahihi-Kina’u NAR (bottom left) and La Perouse Bay
(Modified after USGS Photo # 2900, 1995)

Members of the working groups have suggested a larger ahupua’a approach that would extend the area of protection from the coastline upwards to merge with the boundary of Haleakala National Park and outward across the ocean to merge with the island of Kaho’olawe.

For the purposes of this professional paper, the management area stretches across roughly nine miles of shoreline from Makena Beach State Park in the northwestern-most section of the management area to Kanaloa in the southeastern-most section (Figure 6). It

extends roughly half a mile inland from shore, and roughly 600 yards offshore. It contains parts of many ahupua'a, spanning the coastline from Makena Beach to Kanaloa (Figure 6). These ahupua'a, starting from Makena and heading east, are Mooiki, Mohopilo, Mooloa, Moomuki, Onau, Kanahena, Kualapa, Kalihi, Papaka Kai, Kaunauhane, Kaloi, and Kanaio (U.S. Geological Survey 1995).

4.2 Physical Description of the Management Area

The management area occurs in one of the driest regions on Maui due to the barrier effect of Haleakala (Mogi 1977). There are gently sloping beaches in Makena, giving way to a rugged lava landscape composed almost entirely of unweathered, bare a'a lava flows with some cliff areas in Kanaloa. This landscape is rich in archaeological features, including six village complexes (Figure 7). The vegetation pattern is typical of the semi-arid climate of a leeward coastal area (Mogi 1977: 31). Some of the endemic plant and animal species found in the management area are federally protected. Biologically unique features include lava caves, wetlands, and anchialine ponds. Federally protected marine species in the management area include whales, dolphins, sea turtles, and monk seals. There are healthy fringing coral reefs along nearly the entire coastline.

There is a state beach park located in the northwestern-most corner of the management area. The management area also includes a natural area reserve, bays popular for recreational activities, and state unencumbered land (public land but not managed as a park). The eastern-most half of the management area is a rugged remote

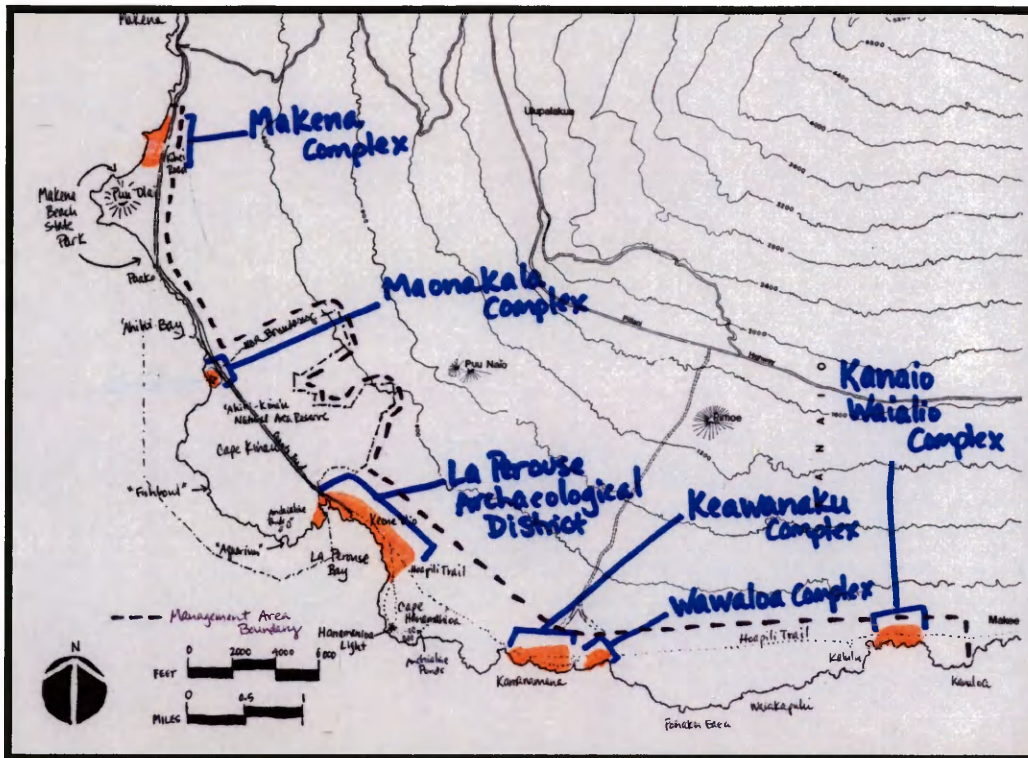


Figure 7: Six Village Complexes in Management Area

lava landscape with low use levels. Much of that land is owned by Ulupalakua Ranch and used for cattle grazing.

The DLNR describes the 164.4 acre Makena State Beach Park as a “scenic wild-land beach park characterized by a prominent cinder cone and a large white sand beach” (van der Jagt 2003). The cinder cone, called Pu’u Olai, is surrounded by a 37-acre white sand beach popularly referred to as Big Beach, and two smaller beaches, Little Beach and Naupaka Beach (Figure 8). The coastline here consists primarily of a sandy bottom. Little Beach is a 2-acre, secluded white sand beach located north of Big Beach and is known as a “clothing optional” beach. It is blocked from view from Big Beach by a cliff-like section of the Pu’u (cinder cone) that forms the northern-most feature of Big Beach. Naupaka Beach is a black sand beach located further to the north. Three federally and state protected wetlands occur here (Figure 8) and will be described in more detail in step

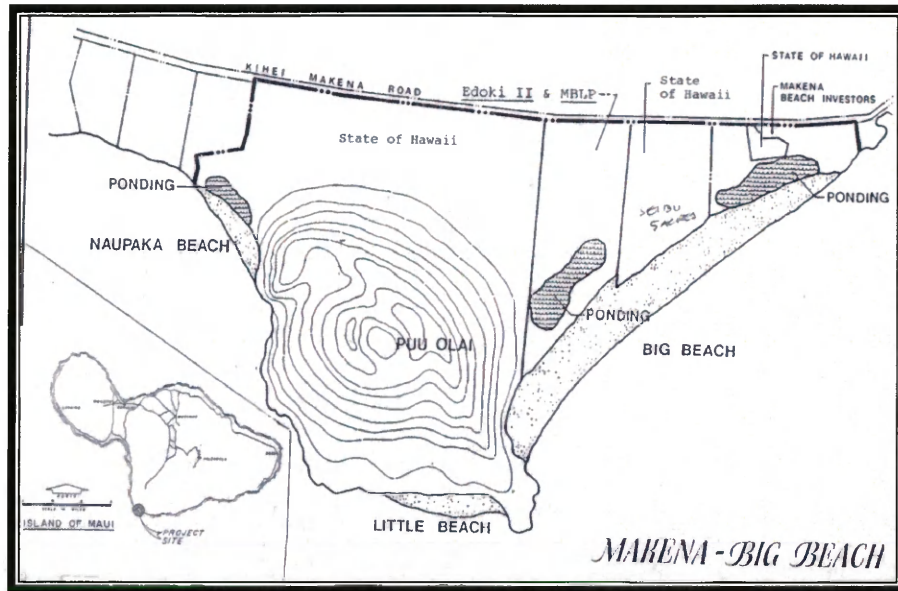


Figure 8: Makena Beach State Park showing Pu'u Olai, Big Beach, Little Beach, Naupaka Beach, and the three wetlands (ponding areas) (Adapted from Mogi, 1977)

3 (indicators) and step 4 (inventory).

'Ahihi Bay marks the entrance of the 2,045-acre 'Ahihi-Kina'u Natural Area Reserve, established in July 1973 by State Executive Order to protect coral reefs, water quality, archaeological sites, and the lava landscape (DLNR Division of Fish and Wildlife NARS Program 1992). This bay allows an easy entry point to the ocean. It is immediately adjacent to the road, which at this point narrows to one lane as it passes directly adjacent to the surf break in a bend of road supporting two or three private residences. There is no parking lot for this area; vehicles park along the shoulder of the roadside.

The 'Ahihi-Kina'u NAR (Figure 9) is located at Cape Kina'u, between 'Ahihi Bay and La Perouse Bay (Mogi 1977). It is unique in that it is the only NAR in the State of Hawaii that contains both terrestrial and marine resources, and that has easy public access. This makes its management more complex than other NARs on Maui, such as the Kanaio NAR, located outside the management area just mauka (mountain side) or north of Cape Hanamanioa (Figure 10).



Figure 9: The 'Ahihi-Kina'u NAR Boundary (USGS Topographic Map, "Makena Quadrat")



Figure 10: Kanao Natural Area Reserve (Adapted from NPS, 2002)

Once past 'Ahihi Bay, there is a parking lot (on the northwestern entrance to the NAR) that accesses the Maonakala Village archaeological site. There are no other large parking lots off this road as it travels through the lava field, only a few small pull-offs used to access trails leading across the lava flow to the shoreline and to cinder cones on

the mountainside. The county road that bisects the NAR travels through a large open field of multiple a'a (rough lava) flows that contain lava tubes. The makai (ocean) side of the flow is called Cape Kinau. The youngest of the lava flows in this area stems from the Kalua O Lapa cone, which was formed in a circa 1790 eruption (Mogi 1977). This open landscape provides dramatic views up the slopes of Haleakala, the highest point on Maui at 10,023 feet (Kyselka and Lanterman 1980). There are also unimpeded views to the neighbor island of Kaho'olawe, seven miles away across the Alalakeiki Channel. On a very clear day one can see the 14,000+ foot peaks of the Big Island, located nearly 30 miles away to the east across the rough Alenuihaha Channel (Basch 2002).

Adjacent to and east of the 'Ahihi-Kina'u NAR is "Keone'ō'io," meaning sandy place where the bonefish are. Keone'ō'io is more popularly known as La Perouse Bay, named after the French explorer, Francois de Galaup, Comte de la Perouse, who was the first European to set foot on Maui on May 30, 1786 (Dondo 1959). Keone'ō'io is a popular recreation area valued for its wilderness character and numerous and diverse archaeological sites that are of state-wide significance (NPS 2002). The Bay is slightly more than a mile wide at its mouth and has a maximum depth of about 60 feet (Mogi 1977). The county road which traverses the lava flow across the NAR ends at Keone'ō'io, which is classified as State of Hawaii unencumbered land. From there the only access is by foot, horseback, or, for a small segment, by four-wheel drive. There are two small unpaved parking areas near the La Perouse Monument at the entrance of La Perouse Bay, and a larger unpaved parking area immediately adjacent to the water.

The Hoapili Trail, or "King's Trail," leads from the eastern-most side of La Perouse Bay for several miles towards Kanaloa Point and beyond to Manawainui,

roughly following the coastline. It is a historic trail of major significance, built in the mid-19th century for foot and horse traffic. The first two miles of the trail bisect the large lava flow comprising Cape Hanamanioa, which contains the Hanamanioa Light station. The trail then continues to Kanaloa, and then out beyond the management area. The only other access to this remote area is from two gated four-wheel drive dirt roads that can only be accessed from the upper Piilani Highway.

4.3 LAC Model Application

Each of the nine steps of the LAC process outlined below starts with statements about the purpose, process, and product specific to this step. This will help managers, scientists, and the general public better understand the goal of each step, and how to go about achieving it. The example “products” given in this model application are meant as a springboard for discussion. They will change and evolve to mirror the issues and values expressed when DLNR involves the community in the transactive process essential for the development of any long-term management plan based on the LAC model.

Step 1: Identify Area Concerns and Issues
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Purpose: The purpose of step 1 is to identify the values of the area to be maintained or achieved. The rest of the steps in the LAC model, including the establishment of management objectives, rely on this values identification. Specific locations of concern should be identified in this step. This will help facilitate the distribution of the management area into different opportunity classes in step 2.

Process: A transactive planning process involving the state, landowners, Hawaiians, commercial operators, recreationists, and other stakeholders within the community will be initiated in this step. The idea is to come to a consensus (loosely defined as a “grudging agreement”) on the important values that represent the management area. Issues raised during prior public involvement will be identified. These include concerns raised by resource managers, planners, scientists, and policymakers. Agency policy and land use laws will be reviewed. Regional supply and demand should be discussed, along with the opportunities available in the area from a regional and national perspective.

Product: The product of step 1 is a narrative write-up which identifies unique values and special opportunities that will be featured in the area’s management, and which outlines problems that will require special attention.

One way to determine the unique values for the management area is to first identify the public issues and management concerns that relate to (1) the distinctive features and characteristics of the management area, and (2) the relationship of the management area to the larger region. Table 2 below summarizes matters that should be considered, along with possible responses to those questions. The responses have been gleaned from meetings held between 1999 and 2004 by a number of Maui groups, including the Friends of Keone‘ō‘io, the Kanaloa- Keone‘ō‘io Working Group, the Visioning Group, and the Keone‘ō‘io-‘Ahihi-Kina’u Advisory Group. For example, the value of fishing off the cliffs of La Perouse Bay (in areas such as “Planks” at the light station at Cape Hanamanioa), and the importance of having vehicular access to that area,

was expressed by local fishermen at the September 2004 Keone‘ō‘io-‘Ahihi Kina‘u Advisory Group meeting. The responses listed below do not constitute a comprehensive list, but summarize the key points from these meetings. Information in the responses also come from a number of scientific studies conducted by several groups, including the DLNR, University of Hawaii, National Park Service, Hawaii Wildlife Fund, Friends of Keone‘ō‘io, and the Maui Chapter of the Sierra Club.

Table 2: Values Determination: Matters to Consider & Possible Responses for South Maui

Matter to Consider	Possible Responses for South Maui
Does the area contain outstanding historic, ecological, conservation, recreational, cultural, scientific, or educational values that warrant special attention?	<ol style="list-style-type: none"> 1. Archaeological sites, features, and trails are an important part of Hawaii’s and Maui’s cultural heritage. 2. The management area contains native and endemic plant and animal species that are an important component of Hawaii’s natural history and biodiversity. 3. The area contains some rare and healthy, high functioning ecosystems and unique lava landscape features. 4. The management area provides for a diversity of recreation opportunities, both commercial and non-commercial, and can offer a wilderness or semi-wilderness experience. 5. Place-based cultural and traditional uses are tied to specific locations and features within the landscape. 6. Much can be learned (scientifically and culturally) from the cultural and natural resources within the management area. 7. There are outstanding opportunities for community and visitor educational outreach in the area.
Does the area provide critical habitat for threatened or endangered species?	<ol style="list-style-type: none"> 1. Waters within the management area are part of the Hawaiian Island Humpback Whale National Marine Sanctuary, which provides critical habitat for endangered humpback whales. Other federally protected whale species also pass through the area occasionally. 2. Makena Beach State Park provides nesting habitat for endangered Hawksbill turtles and threatened green sea turtles. 3. Three federally and state protected wetlands at Makena Beach State Park provide habitat for endemic, endangered shorebirds (such as the Hawaiian stilt), water birds, wading birds, and migratory birds. 4. Remote beaches within the management area are used by

<p>Does the area provide critical habitat for threatened or endangered species? (continued)</p>	<p>endangered Hawaiian monk seals.</p> <ol style="list-style-type: none"> 5. Hawaiian spinner dolphins, protected under the Marine Mammal Protection Act, rest in La Perouse Bay and swim offshore Big Beach. Other species of dolphins, including bottlenose, also use this area for habitat. 6. Two species of endemic red shrimp occur in the anchialine ponds. One of these, the endemic <i>Metabetaeus lohena</i>, is a candidate for endangered species status. 7. The endangered Hawaiian hoary bat may occur within the project area (it is known to occur in Ulupalakua and Kaupo). 8. The native Pueo (Hawaiian owl) is a candidate for threatened status in Hawaii and occurs in the management area. 9. A large population of the native shrub mai'apilo occurs between Keone'ō'io and Kanaloa, but is rare on the other main Hawaiian Islands, and is a candidate for endangered species listing. 10. A very small population of the rare native herb, 'ihi, a candidate for endangered species listing, occurs in Kanaio. 11. The endemic fern, Pololei, also occurs in the management area. The USFWS is planning to propose this species for threatened or endangered status.
<p>Has public input identified areas or issues that merit special attention?</p>	<p>Public input has focused on Keone'ō'io and the 'Ahihi-Kina'u NAR. Issues include sanitation, litter, traditional uses, access, enforcement of violations, human safety, trespassing, fire danger, illegal camping, overcrowding, protected species harassment, and natural and cultural resources destruction.</p>
<p>Do land uses on contiguous areas represent situations requiring special management attention?</p>	<p>The landowner throughout much of the study area is the State of Hawaii DLNR. However, Ulupalakua Ranch owns several thousand acres bordering and occurring within the more remote regions of the study area (Appendix 5). These areas are used primarily for cattle grazing. Land uses in Makena and the nearby town of Kihei include residential development, which put increasing population pressure on the management area.</p>
<p>Are there existing or potential nonconforming uses in the area that will require special attention?</p>	<ol style="list-style-type: none"> 1. Illegal fishing within the NAR. 2. Motorized vessels intruding upon the "no motorized zone" within NAR boundary waters. 3. Illegal camping and campfires at Keone'ō'io. 4. Illegal motorized bike use on the historic Hoapili Trail. 5. Overuse of shoreline trails within the NAR and overuse of "Fishbowl" and "Aquarium." 6. Four-wheel drive vehicle use in areas of Keone'ō'io that endangers archaeological sites.

What is the availability of wilderness and dispersed recreation opportunities in the planning region?	<ol style="list-style-type: none"> 1. There is limited camping available on Maui. Existing camping areas in East Maui include locations within Hana and Haleakala National Park. 2. The majority of recreation opportunities in South Maui are beach and golf-related, all of which are nearby medium to high density (by Maui standards) population centers. 3. The upper Piilani Highway allows access to the remote leeward side of East Maui (although tourists are told not to drive their vehicles on this road).
What is the regional demand for wilderness and dispersed recreation?	Hawaii Wildlife Fund and Friends of Keone‘ō‘io data taken between 2001 and 2004 show that roughly a quarter of a million people per year (tourists and residents) visit Keone‘ō‘io. This figure has remained fairly stable over the three years of data collection. However, increased tourism to the island could increase these numbers since 75% of visitors to Keone‘ō‘io are tourists. There is a high local demand for fishing and camping at Keone‘ō‘io.
Are the physical-biological features of the area found elsewhere in the region or does it possess unique features?	<ol style="list-style-type: none"> 1. The remote South Maui coastline represents the only area on the island with recent cinder cones, lava tubes, and a‘a and pahoehoe lava flows. 2. The anchialine ponds located within the NAR and Cape Hanamanioa are the only ones found on Maui. The only other Hawaiian island that contains anchialine ponds is the Big Island. 3. Big Beach, 37 acres of fine-grained white sand beach, is considered the “crown jewel” of Hawaii’s undeveloped beaches. They are kept clean naturally by the stormwater accumulation and filtering functions of three wetlands within Makena Beach State Park. 4. The coral reef system is healthy and stable offshore Keone‘ō‘io and Kanaloa. 5. Several places within La Perouse Bay, including the pinnacle, have an extremely high coral cover of 60%-80%. A number of rare species of coral occur within La Perouse Bay. 6. “Aquarium” has fragile, shallow corals and a number of unique biological communities. 7. There is a small, healthy robust coral reef immediately outside of the cove at “Fishbowl.” 8. A single cave system at the western edge of the Kanaio ahupua’a supports a unique subterranean biotic community, including a rare cave isopod, spiders, and possibly as yet undiscovered species. 9. An extremely rare coastal shrubland community dominated by ‘akoko occurs in one location within the Kanaio ahupua’a.

Are the types of recreation opportunities offered by the area available in other wildernesses or does the area offer opportunities not found elsewhere?	While there are opportunities to experience a lava landscape and beaches elsewhere within the United States, the Hawaiian Islands are unique in their geographically isolated location in the middle of the Pacific. It is also the state closest to the equator. Visitors travel thousands of miles to experience Hawaii. A recent Sierra Club (1998) Visitor Preference Survey shows that 91% of visitors indicated that the preservation of natural areas would be an important factor in their decision to return to the islands. And 53% said that excursions into nature were the most memorable part of their trip.
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Answers to the questions presented in the left column of this table will help managers, scientists, and the community identify the important values of the area. The values gleaned from the right column of Table 2 can be summarized into cultural preservation values, nature conservation values, and recreation values. Cultural preservation values include the archaeological sites, features, and trails that are an important part of Hawaii's and Maui's cultural heritage, the cultural knowledge that can be gained from the study of these sites, and the place-based traditional uses tied to specific locations and features within the landscape. Nature conservation values include the existence of healthy, high functioning ecosystems within the management area, the presence of native and endemic plant and animal species that are an important component of Hawaii's natural history and biodiversity, the unique lava and other landscape features, and the capacity to learn more about the functioning of these natural systems. Recreation values include a diversity of recreational opportunities (including a wilderness, or semi-wilderness experience), the capacity for both commercial and non-commercial recreational experiences, and a safe, clean environment in which to recreate.

Step 2: Define and Describe Opportunity Classes

Purpose: The purpose of step 2 is to define a series of opportunity classes for the management area based on desired future conditions. Desired here refers to what would be considered acceptable, not necessarily what would be ideal (e.g. while the maximum level of resource integrity may be ideal, what is acceptable is a high level of resource integrity). The kinds of resource and social conditions that are acceptable within each of these classes are defined. A diverse number of opportunity classes will allow for a diversity of experience within the management area and will target those natural and cultural resources needing special protection.

Process: In a transactive community meeting setting, the values and other information collected in step 1 will be reviewed. Then the opportunity classes will be created: the number of classes, the name of each, the value-based goal of the class, and their individual resource, social, and managerial settings.

Product: A narrative description of the resource, social, and managerial conditions defined as appropriate and acceptable for each opportunity class.

Public workshops held with Maui community groups during the formulation of the 1977 *Makena-La Perouse State Park Plan* revealed an interest in dividing intensive recreation areas, which would serve both residents and tourists, from areas that would be preserved primarily for local use, in keeping with environmental considerations (Mogi

1977). Three zones, differing in proposed function and intensity of use, were developed: recreation, nature conservation, and cultural preservation.

When formulating opportunity classes, the idea is not that social values and recreational uses are separate from and in conflict with resource protection. Rather, both a high level of social quality (e.g. uncrowded conditions) and a high level of resource integrity (e.g. protected wetlands) can be accommodated within one class (Cole 2005). The opportunity classes represent a sliding scale of compromise between low access and low resource compromise to high access and high resource compromise. Another way to say this is that desired conditions vary between a) a high level of social quality and resource integrity and b) uninhibited access and recreational use opportunities. The purpose of the opportunity classes is to generally describe these differences in desired (i.e. acceptable) access and protection levels. The specificity of allowed uses and required protection measures will be outlined in the indicators (step 3) and standards (step 5).

Choosing the names of the opportunity classes can be a difficult task. In the late 1970s and early 1980s the designation of opportunity classes followed the basic Recreation Opportunity Spectrum (ROS) system (Buist and Hoots 1982; Clark and Stankey 1979; Driver and Brown 1978). The ROS defined six classes: Primitive, Semiprimitive Non-motorized, Semiprimitive Motorized, Roaded Natural, Rural, and Urban. In an example application of the LAC process given by Stankey et al. (1985), the opportunity classes were defined as semiprimitive, primitive, and pristine. Names are often value laden, so in some cases it is easier to use numbers to define opportunity classes (Cole 2005).

In this example, the terms Opportunity Class 1, Opportunity Class 2, and Opportunity Class 3 will be used. A narrative description of these is provided below. Note that some goals (such as the protection of important and fragile natural and cultural resources) are consistent within all three classes, but many goals vary between classes.

Opportunity Class 1

A high level of resource integrity and a low level of crowding will receive top management priority in this opportunity class. The social factors being protected in this opportunity class are solitude, freedom from user conflicts, and access for cultural/traditional uses. The resources being protected include beaches, wetlands, anchialine ponds, coral reefs, native plants, geological/lava landscape features, threatened and endangered species, and cultural resources (archaeological sites, features, and trails).

This will require a willingness, where necessary, to restrict access. Access restrictions, if warranted by violated standards (step 7), may include the fencing off (or barricading) of important natural or cultural resources, or the implementation of use limitations. One example of a use limitation is that vehicles may be restricted from this area. Another example is that only guided tours may be allowed in some areas. While people would be limited in that they could only access this area through a tour, these guided tours could potentially allow for more people to use the area than would otherwise be allowed since their behavior would, to some extent, be controlled. Data collection and monitoring activities will be allowed. Sites providing opportunities for in-depth archeological research concerning subjects such as traditional Hawaiian fishing techniques and water use, patterns of domestic activity and variations, and similarities among ahupua`a

(NPS 2002) will be prioritized for scientific research. Management could also include educational outreach efforts, including signage, to promote a stewardship ethic. Patrols in this area will be conducted as necessary to monitor conditions and achieve management objectives.

This area is likely to be remote and rugged. It allows for a wilderness-like (or semi-wilderness) recreation experience. The topography and ocean conditions are likely to be rough, providing hardy and experienced hikers and divers the opportunity for some challenge and risk. Recreation in this area will cause minimal impacts natural and cultural resource integrity. Crowding and negative social interactions will be minimal. Inter-party contacts will likely be infrequent and other kinds of recreational uses seen will be few. Types of appropriate recreational uses may include hiking, kayaking, snorkeling, SCUBA diving, boating, and low levels of fishing. If managers choose to provide for extended experiences of solitude in this opportunity class, then low levels of low-impact camping may also be allowed. Few, if any, structural modifications/improvements (such as paving or providing port-o-potties) will be made in this area.

Opportunity Class 2

Resource integrity and crowding will be balanced with providing a fairly diverse array of commercial and non-commercial recreational opportunities in a safe, clean environment. The protected social factors being balanced in this opportunity class are a certain degree of solitude and freedom from user conflicts, with a certain degree of freedom of choice and range of recreational and cultural/traditional uses to engage in.

Protected resources include safe swimming beaches; sandy beaches; protected bays; good surfing, windsurfing, and boogie boarding areas; well-marked trails; accessible fishing; desired species fishing; campsites; and easy/safe kayaking and snorkeling.

Management will focus on human safety (which may be of more concern in this opportunity class as a result of higher use levels) and will allow more lax restrictions on crowding and on some natural and cultural resources than in Opportunity Class 1. Natural resources that will not be compromised include threatened and endangered species, wetlands, anchialine ponds, rare native plants, unique geological features, and pristine coral reef. Cultural resources that will not be compromised include the most culturally significant archaeological sites, features, and trails (as determined by the Hawaiian community and archaeologists) that are in good to excellent condition (this needs to be further defined by archaeologists).

The protected areas would occur as restricted point zones within the larger opportunity class. Managing for the protection of these resources may require fencing or other barricades, use limitations (such as guided tours only or vehicles restrictions), archaeological site inventories, and archaeological stabilization and/or restoration work. Resources requiring a more substantial buffer for their protection would be allocated back to Opportunity Class 1 (Moisey 2005).

Vehicles and motorized vessels are less likely to be restricted from this opportunity class than in Class 1 (unless warranted by restricted point zones). Preventive protection efforts will likely include the use of signage and educational outreach to promote a stewardship ethic. Some archaeological sites and/or features may be selected by on-site naturalists to be referred to or shown as a component of cultural education outreach

efforts. Research, data collection, and monitoring activities will be allowed. Patrols in this area will be conducted as necessary to monitor conditions and achieve management objectives.

This area is likely to be less remote and rugged than Opportunity Class 1, and more accessible to population centers. It may still allow for a semi-wilderness recreation experience, at least in some areas. Recreation impacts in this area will likely be greater than in Class 1, but crowding and negative social interactions will likely be less than in Class 3. Inter-party contacts may be frequent and many types of recreational uses may be occurring at once, within view of other users. Types of appropriate recreational uses may include hiking, kayaking, snorkeling, SCUBA diving, boating, camping, and fishing. Structural modifications/improvements (such as paving or providing port-o-potties) will likely be kept to a minimum.

Opportunity Class 3

The top priority of Class 3 is to provide a diverse array of commercial and non-commercial recreational opportunities in a safe, clean environment. Restrictions on access and behavior will be avoided as much as possible, or minimized to the extent possible. The social factors that are being protected are freedom of choice, availability of a wide range of recreational activities and cultural/traditional uses, and safety. Protected resources include safe swimming beaches; sandy beaches; protected bays; good surfing, windsurfing, and boogie boarding areas; well-marked trails; accessible fishing; desired species fishing; campsites; and easy/safe kayaking and snorkeling.

Management will focus on human safety (which may be of more concern in this opportunity class as a result of higher use levels) and will allow more lax restrictions on crowding and on some natural and cultural resources. Natural resources that will not be compromised include threatened and endangered species, wetlands, anchialine ponds, rare native plants, unique geological features, and pristine coral reef. Cultural resources that will not be compromised include the most culturally significant archaeological sites, features, and trails (as determined by the Hawaiian community and archaeologists) that are in good to excellent condition (this needs to be further defined by archaeologists). The protected areas would occur as restricted point zones within the larger opportunity class. Managing for the protection of these resources may require fencing or other barricades, use limitations, archaeological site inventories, and archaeological stabilization and/or restoration work. Resources requiring a more substantial buffer for their protection would be allocated back to Opportunity Class 1 (Moisey 2005). Vehicles and motorized vessels are less likely to be restricted from this opportunity class than Class 2 (unless warranted by restricted point zones). Management will likely include educational outreach efforts and signage to promote a stewardship ethic. Data collection and monitoring activities will be allowed. Patrols in this area will be conducted as necessary to monitor conditions and achieve management objectives.

This area is likely to be easily accessible from population centers. Recreational opportunities that are appropriate in this opportunity class may include fishing, camping, sunbathing, boogie boarding, and the following commercial and/or non-commercial activities: boating, SCUBA, snorkeling, kayaking, hiking, horseback riding, surfing, and

windsurfing. Structural improvements may include paved parking lots, picnic tables, trash receptacles, and either portable or permanent restroom facilities.

In summary, step 2 allows the community and managers to decide together what the desired future conditions for the management area should be, as defined in a series of opportunity classes that provide a sliding scale of compromise between high social and resource integrity on the one hand, and high freedom of choice, opportunity, and access on the other.

Step 3: Select Indicators of Resource and Social Conditions

Purpose: The purpose of step 3 is to identify easily measurable (and preferably quantifiable) indicators that reflect resource and social conditions. These indicators will be used to guide the inventory process in step 4 and will ultimately provide the basis for identifying where and what management actions are needed.

Process: In a transactive community meeting setting, all the stakeholders will review the opportunity classes as outlined in step 2, and will review the issues and concerns identified in step 1. Broad categories of issues or concerns (i.e. factors) will be developed. Then, indicators will be selected that will directly address these factors.

Product: A list of measurable resource and social indicators, which are, preferably, responsive to management control.

Some scientists argue that the LAC model is not appropriate for archaeological sites because there is zero tolerance for disturbance at these sites (Cole and McCool 1998). The criteria for implementing the model are that some degradation of the resource will be allowed, and in general this is not acceptable for archaeological sites. If they are to be absolutely protected, then they fall outside the framework of compromise that the LAC model provides. Archaeological sites are being included in this LAC application in the recognition that for decades many of these sites have already, through neglect and vandalism, been compromised, and many others have not yet been inventoried. Under current management, total protection is not feasible for all archaeological sites and features found within the management area. Therefore, the highest priority sites need to be selected to receive available protection measures.

There is also zero tolerance for a take of threatened or endangered species protected under the Endangered Species Act (ESA)¹. With unlimited funding and personnel, this could conceivably be achieved in practice. However, these animals have, on occasion, been harassed in South Maui. Spinner dolphins (protected under the Marine Mammal Protection Act) and endangered humpback whales (protected under the ESA) have been approached closely by snorkelers and kayakers, and threatened green sea turtles have been accidentally hooked by fishermen and released (Friends of Keone‘ō‘io and Hawaii Wildlife Fund 2004). In recognition that their protection is imperfect, an indicator for protected animal species will be included in this example LAC application.

¹ Although in theory both archaeological sites and protected species may have zero tolerance for disturbance, there is an important difference in these two resources in terms of their renewability and resilience (Moisey 2005). Once a rock is removed from an archaeological site it is gone forever, whereas there is a possibility that animals driven out of an area may return later.

Marine environments, in general, pose unique problems to developing indicators. Cause and effect relationships are often very complex and many factors affecting marine environments result from outside influences, such as storms. A number of indicators could be measured, including coral reef damage, water quality, fish species and abundance, and the presence or absence of protected species. Since conducting these types of studies is costly and time-consuming, initial efforts may need to rely more on qualitative data.

Table 3 below gives examples of possible social and resource factors and their indicators for the opportunity classes outlined in step 2. These factors and indicators were developed based on examples of indicators within the Limits of Acceptable Change literature (Stankey et al. 1985), interviews with natural resource managers on Maui (Duvall 2005), scientific reports conducted by coral reef biologists for the Keone‘ō‘io-‘Ahihi-Kina’u Advisory Group (DLNR 2003), feedback from my University of Montana committee members, and guidance from David Cole and Stephen McCool. Their development was also influenced by what types of data exist for the management area.

The social and resource factors and indicators outlined in Table 3 are described in more detail below, including the units of analysis for indicators (when applicable). Social indicators should be reflective of visitor experience, and resource indicators should be reflective of ecosystem health and cultural resource integrity. The two social factors chosen mirror the philosophy of the LAC model. User conflicts are a reflection of behaviors and activities, and crowding/solitude is a reflection of use levels. Both the numbers of people and their behaviors determine the impact on an area.

Table 3: Opportunity Class Factors and Indicators

Social Factor	Social Indicator	Resource Factor	Resource Indicator
1. User conflicts	1. Complaints reported	1. Condition of fish stock	1. Fish catch reports
2. Crowding/ Solitude	2. Inter-party interaction	2. Presence of protected animal species	2. Protected animal species sightings
		3. Condition of native plants	3. Number (or area of cover) of rare native plants
		4. Condition of wetlands	4. % of kiawe and <i>B. maritima</i> encroachment
		5. Condition of anchialine ponds	5. Physical impacts
			6. Water quality parameters
			7. Native shrimp populations
		6. Condition of coral reefs	8. Use levels
			9. Percent coral damage
		7. Condition of archaeological sites/features/trails	10. Percent rock removal or erosion/wall destabilization

Social Factor 1: User conflicts The degree to which user conflicts and crime are occurring is an important factor of social conditions. User conflicts include crowded conditions (i.e. high inter-party interaction levels), overcrowded parking lots (or lack of parking), loud nighttime activities in or near residential areas, hunting in residential areas, and use of motorized vehicles on hiking trails. Petty crimes known to have occurred within the management area include illegal camping, theft, drug use, littering, and vandalism. There have also been some cases of marine mammal harassment, and of motorized boats illegally operating within the ‘Ahihi-Kina’u NAR “no motorized zone” (a 600 yard wide swath of water surrounding the NAR, incorporating parts of ‘Ahihi Bay,

the entirety of Cape Kina'u, and the westernmost third of La Perouse Bay) (see Figure 9). Archaeological sites have also been abused. The area is monitored by the Maui Police, the Citizens Patrol, the DLNR Conservation Enforcement Division, and by Rangers funded through the HTA grant. Signage is posted in areas like Keone'ō'io, stating federal laws about marine mammal harassment and state laws on camping.

Social Indicator #1: Complaints reported The number, type, and frequency of complaints reported to the Maui Police, the DLNR, and others is one indicator of user conflicts. This information will come from police and DLNR reports and from on-site personnel, including Rangers and Naturalists, based on their own observations or on information provided by visitors to the area. Much of this information is also presented by the public at community meetings. How this information will be quantified needs to be determined. For example, the percentage of participants at meetings who agree that a certain issue merits attention could be measured, or the percentage of meetings at which a complaint is raised could be quantified.

Social Factor 2: Crowding/Solitude Solitude is part of what makes an area feel like a wilderness or semi-wilderness. It is evident, both from comments made at community meetings and from the observations of Friends of Keone'ō'io personnel, that problems with overcrowding (particularly at Keone'ō'io) have left both tourists and residents frustrated. The indicator described below could be used by managers to better understand human use trends in the area and to help determine whether or not current use levels are appropriate. The goal of the indicator is not to avoid exceeding some use level, but rather to avoid crowding (i.e. to minimize inter-party interaction).

Social Indicator #2: Inter-party interaction Inter-party interaction could be measured based on the number of other parties met while hiking (or snorkeling, etcetera). Rangers or volunteer naturalists could occasionally monitor this area, and people who use the area would be asked how many other people they encountered during their visit. However, if this is too time intensive and costly, then inter-party interaction could be projected from peak use data. Peak use levels generally reflect the degree to which inter-party interaction is occurring. A visitor sharing an area with twenty other people will likely have a very different experience than someone sharing it with 80 other people. Qualitative data reflecting visitor perceptions at different use levels could be used to determine what levels of usage and what social situations coincide with a positive visitor experience. Peak use level information could also be used by managers to determine when rangers should be patrolling to have the best opportunity to interact with visitors to encourage appropriate stewardship behaviors.

Resource Factor 1: Condition of fish stock Fish stock (diversity and abundance) is an important indicator of the health of reef ecosystems, but it is hard to get accurate measurements. These surveys require enough repetition to be reliable. Although fish diversity in Hawaii is low due to its geographic isolation, a relatively high diversity and abundance of fish (by Hawaii standards) tends to show low fishing impacts and a balanced reef ecosystem. Reef Environmental Education Foundation (REEF) fish surveys have been conducted in La Perouse Bay by Friends of Keone‘ō‘io, but these surveys provide only very general estimates of abundance. Some studies have been conducted in the ‘Ahihi-Kina‘u NAR by the DLNR, but not on a comprehensive scale. More baseline

information in these locations is needed. The NAR serves as an important measure of comparison for La Perouse Bay since fishing in the NAR has been illegal for more than 30 years. However, illegal poaching has been known to occur in the NAR, so fish stock measurements would serve both as a comparative baseline for La Perouse Bay and to determine any changes within the NAR.

Resource Indicator #1: Fish catch reports Qualitative reports on fishing practices and fish catches can be used as rough indicators of the overall health of the marine environment. A cost-effective way to obtain information on fish stock in opportunity classes that allow fishing (i.e. high, medium, and low intensity recreation opportunity classes) is by conducting fishermen surveys and having naturalists interact with the public. Fishermen could report on whether their catch size and amount is increasing or decreasing, and whether or not the fish are getting harder to find. They could also provide information on the species of fish caught. On-site naturalists and Rangers are one source of information on illegal fishing occurring within the NAR. Although not as comprehensive as quantitative information, these methods are inexpensive ways to obtain information from people who are spending hours of time “in the field.”

Resource Factor 2: Presence of protected animal species The continuation of use of terrestrial and marine habitats by protected animal species is a rough indicator of overall ecosystem health, but it is also recognized that wild animals vacate areas from time to time. A baseline could be established to supplement existing information about use of this

area by whales, dolphins, turtles, monk seals, endangered birds, Hawaiian owls, and the Hawaiian hoary bat.

Resource Indicator #2: Protected animal species sightings While, ideally, standards for listed species would be developed in consultation with the U.S. Fish and Wildlife Service (USFWS) and NOAA, an initial, cost-effective qualitative indicator of species presence that can be used is reports of species sightings. Naturalists could provide an input box, allowing visitors to report sightings of protected animal species. Species less commonly seen by the general public, such as owls and bats, could be recorded by scientists, managers, visitors, and residents within the management area. Bird species using the wetland areas at Makena Beach State Park could be reported by the DLNR as part of their regular monitoring. This general, qualitative information on species presence could possibly alert managers to negative population trends that may require more intensive research.

Resource Factor 3: Condition of native plants One of the most sensitive terrestrial natural resources in the management area are native plant species. As sensitive resources, they make ideal indicators of change over time. Four-wheel drive vehicles are one potential source of damage to the few species of native plants found in the management area (NPS 2002).

Resource Indicator #3: Number (or area of cover) of rare native plants The number (or area of cover) of rare native plants (as compared to their baseline survey condition), will serve as an indicator of ecosystem health and biodiversity.

Resource Factor 4: Condition of wetlands There are three federally and state protected wetlands in the Big Beach area (see Figure 8). Two, called Paniaka I and Paniaka II, are located between Big Beach and the road (Duvall 2005). The third, “Maluaka,” is located on the north side of Pu’u Olai by the black sand beach, and occurs on a parcel of land owned by a private developer (Duvall 2005). These wetlands experience tidal influences since they are located close to the shoreline, and Paniaka I and Paniaka II never fully dry out (Duvall 2005). All three wetlands perform storm water runoff accumulation and filtering functions that make the Big Beach white sands “outstandingly clean,” and they provide important habitat for endemic, endangered shore birds, water birds, wading birds, and migrating birds (Mogi 1977: 20). One concern is that invasive species, such as kiawe trees and the weed *Battis maritime*, are encroaching on these wetlands (Duvall 2005), potentially compromising the health of this ecosystem and its ability to provide essential bird habitat.

Resource Indicator #4: Percent of kiawe and *Battis maritime* encroachment

The percent of kiawe and *Battis maritime* encroachment into these three wetland areas could serve as an indicator. There may be other invasive plants that could also serve as indicators.

Resource Factor 5: Condition of anchialine ponds Anchialine ponds are only found on Maui within the management area (in the NAR and at Keone‘ō‘io) and on the west coast of the big island of Hawaii, from Kau to Kohala (Kay 1996). These are shoreline ponds without surface connection to the sea, but that have waters of measurable salinity (0.5 to 30 ppm) and show tidal fluctuations. The aquatic vegetation of these ponds is dominated

by benthic algae or non-crusting mats of blue-green algae (*cyanophytes*) (van der Jagt 2003). The dense algal mats surrounding the ponds (the lime green color in Figure 11) are very sensitive to human disturbance. These ponds are the only habitat type in the state to support populations of endemic red shrimp. They support two species of anchialine pond shrimp or `opae`ula: *Halocaridina rubra*, and the endemic *Metabetaeus lohena*, the latter a candidate for endangered species status (NPS 2002).

There are at least seven anchialine ponds within the management area, two in the NAR and five located near a small beach by the light station on Cape Hanamanioa. These were recently declared by the National Park Service to be of island-wide significance (NPS 2002). The study also stated there are “likely additional as yet undiscovered anchialine pools located within the study area which would increase its significance for this particular resource” (NPS 2002: 30). The ponds within the NAR are located near “Aquarium” and are called Halua Pond and Kauhioaiakini Pond (Figure 11).



Figure 11: Anchialine Ponds in the 'Ahihi-Kina'u NAR: Halua Pond (middle) and Kauhioaiakini Pond (top center) (Rack 2002)

Resource Indicator #5: Physical impacts in anchialine ponds One possible indicator for the condition of anchialine ponds in the management area is the percentage of visible human-induced impacts, such as footprints in the algal layer.

Resource Indicator #6: Water quality parameters Another possible indicator is water quality parameters. Experts could identify appropriate parameters that are relevant and sensitive enough to show changes in the health of the resource. For example, if native shrimp are especially sensitive to salinity levels, then those should be measured. Other parameters to choose from include pH, temperature, dissolved oxygen, particulate matter, and dissolved chemicals.

Resource Indicator #7: Native shrimp populations A third possible indicator of anchialine pond health is native shrimp population levels within the ponds (based upon baseline conditions and an understanding of natural population fluctuations). Again, scientists would need to work together with DLNR managers to determine the feasibility and appropriateness of this option.

Resource Factor 6: Condition of coral reefs Coral reefs serve many functions, including providing fish habitat. The DLNR Rapid Assessment team surveying the “Aquarium” in August 2003 found that it supported an “unusually high biodiversity and biomass” of fish, and that it contained large numbers of recently recruited fish (i.e. smaller sized, younger fish) (DLNR 2003: 4). Snorkelers are drawn to this area to see this abundant, colorful fish life, and these areas are being advertised in guide books and other media sources. The public, scientists, and the DLNR are concerned that the “Fishbowl” and “Aquarium” are being overused by snorkelers and kayakers. As early as the year

2000, local newspaper editorial artwork captured the essence of overcrowded conditions in these small bays (Figure 12).



Figure 12: Visit “The Aquarium” Snorkeler’s Paradise, Maui, Hawaii
(*Maui Weekly*, 2000)

Individuals both on-site and at public meetings have voiced concerns that coral heads within these shallow bays are being destroyed. These concerns have been validated by the DLNR Rapid Assessment team’s 2003 and 2004 survey findings of detrimental impacts to coral, in particular to shallow-growing corals, within the small bays.

There are also concerns about anchor damage in La Perouse Bay. There is one mooring buoy in the bay, located roughly in the middle of the mouth of La Perouse Bay at the pinnacle. The majority of boats set anchor. While much of this anchoring occurs in the sand, there is evidence of anchor damage in limited areas on the reef (Basch 2002). However, the extent of damage to corals within La Perouse Bay from anchors and other damage is thought to be minimal.

Another concern is the impact snorkelers from these tour boats may have on the marine environment. Studies have shown that environmental briefings are effective in

reducing damage to reefs and other natural resources (Medio 1997). While many of the boat and kayak operators give these briefings, this is not uniformly monitored or even required.

Resource Indicator #8: Use levels The number of users in the water in marine areas can be used as a rough indicator of potential impacts to coral reefs. Although numbers alone do not determine impacts, since impacts are also based on the behavior of those users, use levels will help indicate trends of user concentration. These hot spots of concentration can be earmarked for more specific studies designed to determine impacts to the resource. This is what happened in the NAR; the DLNR received reports of crowded conditions and coral reef damage at “Aquarium” and “Fishbowl,” so conducted biological assessments of these areas.

Resource Indicator #9: Percent coral damage The amount of broken and/or abraded coral will be used as an indicator to assess the amount of human-use impacts within small bays in the NAR and in other locations within the management area, as needed.

Resource Factor 7: Condition of archaeological sites, features, and trails The physical legacy of archaeological sites, features, and petroglyphs left behind by native Hawaiians are one of the important threads connecting Hawaiians to their past. These sites “...constitute geographic links with their history and cultural heritage, sacred places...within a landscape vastly transformed by two centuries of economic ‘development’...” (Kirch 1995).

The greatest concentration of the known archaeological sites within the management area is along the coastline (defined as the area below 300 feet), and this is the area of greatest archeological sensitivity (National Park Service 2002). Many of these features are intact and others have been seriously degraded (culturally important archeological sites have been raided, used as toilets and/or destroyed).

The majority of the degradation occurs in high use areas, so this factor is more of a concern in the high and medium intensity recreation opportunity classes. For example, at Keone‘ō‘io, people have been observed climbing on, doing yoga on, and throwing rocks off of the Paalua heiau and the chief’s residence (Site 1805) (Friends of Keone‘ō‘io and Hawaii Wildlife Fund 2004). In some places, stacked rocks appear to have been removed from nearby walls and enclosures to make campfire rings and windbreaks (NPS 2002). Coral rock graffiti (white coral rock placed on black lava rock to form messages) occurs along the shoreline pathways. At community meetings, residents have complained of motocross bikes being driven on the Hoapili (King’s) Trail, which is meant for foot traffic only (Keone‘ō‘io-Kanaloa Working Group 2003).

However, in some cases, even remote sites are vandalized. For example, artifacts, including Hawaiian skeletal remains, have been robbed from remote burial caves within the management area (Lindsey 2003). In addition, four-wheel drive vehicles making their own “roads” into roadless areas to access favorite fishing and camping spots were recognized by the Keone‘ō‘io-Kanaloa Working Group in 2001 as being particularly damaging to the archaeological features (Figure 13).



Figure 13: Four-wheel drive vehicles on the jeep trail at Keone'o'io (Area 3 in foreground, Area 2 in background)

Resource Indicator #10: Percent rock removal or erosion/wall destabilization

The percentage of a selected feature or site that has been damaged by rock removal, erosion, or wall destabilization (compared to baseline conditions) could be an indicator. Appropriate features and/or sites should be selected by a team involving archaeologists, Hawaiians, and the State Historic Preservation Division. One way to quantitatively determine the most significant sites is to use develop a scale from 1 to 100 based on a site or feature's cultural significance, level of integrity (how intact it is), level of threat, sensitivity to damage, and any other factors that may be relevant. Sites scoring 70 and above could be considered the most culturally important sites, and those scoring less than 70 could be considered sites of lesser cultural importance (Cole 2005).

In summary, in step 3 of the LAC process, important factors and indicators of social and resource conditions are identified and specifically defined. In this example, two social factors (with a total of two indicators) and seven resource factors (with a total of ten indicators) were defined. While indicators are preferably quantifiable, less costly qualitative methods may also, at least initially, serve to provide important information. In step 5, specific standards of acceptable change will be set for these indicators, and it will be explained how exceeded standards trigger an immediate management response.

Step 4: Inventory Resource and Social Conditions

Purpose: The purpose of step 4 is to inventory the range of existing conditions of the resource and social indicators identified in step 3. This provides managers with the range of conditions of the indicators and enables the establishment of meaningful standards in step 5. The inventory also helps determine how areas should be allocated to different opportunity classes in step 6. Finally, the inventory provides a critical step in understanding where and what management actions will be required, as outlined in the seventh step of the LAC process.

Process: Management agencies and scientists will conduct a field inventory of the conditions of the resource and social indicators selected in step 3. The data need to be collected in an objective and systematic fashion to be of value. Information is ideally recorded directly onto base maps, which facilitates the comparison in step 6 of existing conditions and those defined as acceptable for an opportunity class (Stankey et al. 1985). Resource inventories can be conducted at different levels of detail. It is often the case that

managers have some inventory data from previous fieldwork, as will be detailed below. If existing data is not current, then the data limitations should be clearly documented, and the monitoring plan in step 9 should prioritize creating an improved database (Stankey et al. 1985).

Product: A map of the existing conditions of each indicator throughout the management area.

Preparing a map of existing conditions is beyond the scope of this professional paper, but descriptions of as much as is currently known about the range of existing conditions for each of the twelve indicators (two social indicators and ten resource indicators) from step 3 are given below. Information presented in this step stems from research conducted by Hawaii Wildlife Fund and the Friends of Keone‘ō‘io between 2001 and 2004, inventories conducted by the DLNR in 2003 and 2004, and a reconnaissance survey of the eastern end of the management area conducted by the National Park Service in 2002.

Social Indicator 1: Complaints Reported Inventory

Data on complaints can be acquired from the DLNR DOCARE, Maui Police, Maui Citizens Patrol, NOAA, and Friends of Keone‘ō‘io. Incidents observed and recorded at Keone‘ō‘io include illegal camping and campfires, illegal motorized vessel use within the boundary waters of the NAR, drug use, littering, and theft. A summary of illegal incidents recorded during Friends of Keone‘ō‘io technical surveys (between

October 2001 and November 2002) is included in Appendix 6. The incidents in Appendix 6 are categorized by date, but could be reorganized by location so that managers begin to better understand where the problem areas occur.

Another source of complaints and community concerns are the meeting minutes from the Kanaloa- Keone‘ō‘io Working Group, the Keone‘ō‘io-‘Ahihi-Kina’u Advisory Group, and the Friends of Keone‘ō‘io. Social concerns have included sanitation and litter, human safety (hiking injuries from falling on sharp lava, coral reef cuts, and high wind and sea conditions making ocean activities dangerous), cars speeding on the county road traversing the NAR, nighttime disturbance of Keone‘ō‘io residents from large rave parties, trespassing, overcrowded parking areas and overcrowded kayak access points, fire danger from illegal campfires, and lack of legal camping areas. The location of areas where these activities are concentrated would be mapped as part of the product of step 4.

Resource concerns raised at community meetings have included complaints of motorized vessels illegally traveling within “no motorized zone” within the NAR, theft of archaeological artifacts, desecration and destruction of archaeological sites and features, reports of dolphin and humpback whale harassment, and damage caused to coral reefs and anchialine ponds. A table in Appendix 7 summarizes these key social and resource issues, identifies related management issues that have been discussed with the DLNR, identifies constraints to management, and establishes whether or not these concerns are historic.

Although illegal at Keone‘ō‘io, camping was occurring there regularly (Figure 14). Some were residents or tourists just there for a night or two, and others were parking and



Figure 14: Illegal camping at Keone‘ō‘io amidst archaeological site (From NPS, 2002)

living out of their vehicles (Friends of Keone‘ō‘io and Hawaii Wildlife Fund 2004).

Despite “no camping, no campfire” signs placed at Keone‘ō‘io, illegal campfires were lit in dry areas not far from residential homes, creating a fire hazard. This has become less of a problem since the DLNR began clamping down on this illegal activity by doing night patrols and placing “Notice to Vacate” fliers (Appendix 8) on vehicles at Keone‘ō‘io in the summer of 2003 warning of a fine of up to \$500 per day. The need for more camping locations on Maui has been expressed at numerous community meetings. The 1977 park plan allowed for five camping sites at Keone‘ō‘io (shown as the dotted red circles in Figure 15). Again, in the early 1980s, it was evident that more parks were needed on Maui, both for tourists and residents (Ranken 2003). In the early 1980s, less than one percent of State Park lands occurred on Maui, even though 29% of the state’s tourism occurred on Maui, and Maui contained 7% of the state’s population (Ranken 1986).

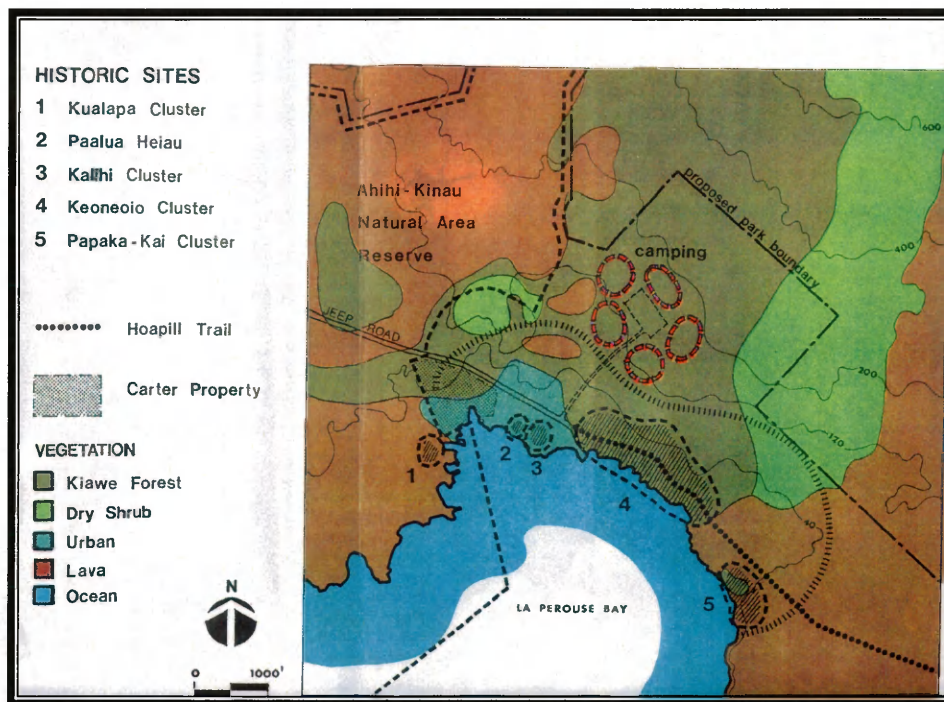


Figure 15: Proposed Camping Sites from 1977 Park Plan (Modified from Mogi 1977)

Local residents and Friends of Keone‘ō‘io staff and volunteers have observed people doing drugs and burglarizing in Areas 1-4, and fighting at Keone‘ō‘io in the parking lot (Area 1). One local resident also witnessed an alcohol-related traffic death on the narrow County road bisecting the ‘Ahihi-Kina’u NAR. Nighttime activities include 100-person rave parties, and hunting (Keone‘ō‘io-Kanaloa Working Group 2003), both of which pose dangers to Keone‘ō‘io residents. Other safety issues are posed by nature. Many people sustain injuries by making contact with the sharp coral reef or exposed lava rock, and windy conditions within the bay have led to more than one Coast Guard rescue for stranded kayakers. By early 2003 these rescues and other problems at Keone‘ō‘io were regular front-page news; in the span of three months, twenty one articles appeared (Appendix 9).

On weekends there are often dozens of beer bottles strewn about the parking lot with other garbage. Human waste has also been a major concern as, until early 2004, there were no restroom facilities available for the hundreds of daily visitors to Keone‘ō‘io. The DLNR installed four port-o-potties at Keone‘ō‘io in February 2004 (Evanson 2005).

Illegal trespassing also occurs frequently. While all beaches are public property in Hawaii, the small beach in front of the Schatz Estate is actually part of a historic fishpond, and as such, is private property. Although “no trespassing” signs are posted, these are largely ignored, because that small bay allows one of the few easy and safe access points to La Perouse Bay. This is also the area of the bay closest to the NAR and its inviting shoreline providing good snorkeling opportunities.

The enforcement arm of DLNR, the Division of Conservation and Resources Enforcement (DOCARE), patrols the management area periodically throughout the year. The division has full police powers and enforces all State laws and rules involving State lands, State Parks, historical sites, forest reserves, aquatic life and wildlife areas, coastal zones, Conservation districts, State shores, as well as county ordinances involving county parks (Department of Land and Natural Resources 2005). The Maui Citizens Patrol, a group of retirees volunteering for the Maui Police Department, drive into the Keone‘ō‘io parking lot nearly every day, and sometimes twice a day, although they normally only stay for a few minutes. They also patrol the Makena Beach parking lots. The Maui Police Department also, on occasion, patrols to the end of the county road and uses the Keone‘ō‘io parking lot as a turnaround. During the winter months, local police forces are joined by a federal NOAA officer, who patrols the bay a few days a week to enforce the

Endangered Species Act, primarily as it pertains to humpback whales. Keone‘ō‘io residents inform the Maui Police of illegal nighttime activities occurring at Keone‘ō‘io. Friends of Keone‘ō‘io personnel record data on complaints and illegal activities occurring at Keone‘ō‘io as part of the technical survey. Another source of information on complaints and illegal activity is community meeting minutes from meetings held between 1999 and 2004 by the Keone‘ō‘io-Kanaloa Working Group, the Friends of Keone‘ō‘io, and the Keone‘ō‘io-‘Ahihi-Kina’u Advisory Group.

Social Indicator 2: Inter-party Interaction Inventory

An estimate of current inter-party interaction could be projected from peak use data. The most thorough human use data available within the management area is for Keone‘ō‘io. General use levels and peak use data for Keone‘ō‘io are described below. Hawaii Wildlife Fund naturalists are collecting data for frequency of use at Maonakala during their daily four hour morning shifts in the NAR, but full-day car census surveys have not yet been initiated at Maonakala. Little, if any, data exists for numbers of vehicles and people using the pull-out areas along the county road in the NAR. While no car census surveys have been conducted at Makena Beach State Park, it is known that the two large parking lots there have a combined capacity of several hundred vehicles. According to the 1977 *Makena-La Perouse State Park* report, the capacity of Big Beach is 3,000 people per day, the capacity of Naupaka Beach is 800 people per day, and the capacity of Little Beach is 200 people per day (Mogi 1977).

Keone‘ō‘io General Use Levels

Use levels at Keone‘ō‘io between July 2001 and June 2004 from Car Census Surveys conducted by Friends of Keone‘ō‘io show an average of 705 people arriving at Keone‘ō‘io on a daily basis, with a range of 365 to 980 people per day (Table 4). The average number of vehicles arriving per day is 296, with a range of 143 to 396.

Table 4: Numbers of Vehicles and People at Keone‘ō‘io (averaged over 70 surveys)

Area #	N	Mean	Median	Mode	St. Dev.	Min	Max	Percentiles		
								25	50	75
Vehicles	70	296	298	298	50.75	143	396	260	298	335
People	70	705	702	863	132.61	365	980	597	702	813

As represented in Figure 16, roughly 75% of the visitation is by tourists, and 25% by residents. While Figure 16 only contains data from July 2003 through June 2004, these

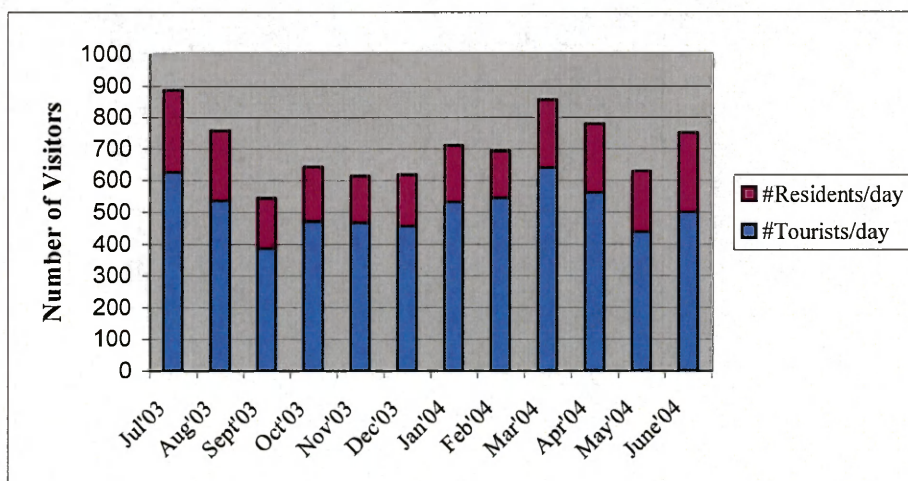


Figure 16: Proportion of Tourists to Residents at Keone‘ō‘io in Data Yr 3

percentages are consistent with visitation in years 2001 and 2002 (Friends of Keone‘ō‘io and Hawaii Wildlife Fund 2004).

Annual estimates for the number of people at Keone‘ō‘io, as shown on Figure 17, were 251, 485 for Year 1 (June 2001-May 2002), 260,610 for Year 2 (June 2002-May

2003), and 262,070 for Year 3 (June 2003-May 2004). The number of cars at Keone‘ō‘io for the first three years, also shown on Figure 17, was 104,390 vehicles, 109,865 vehicles, and 109,500 vehicles, respectively (HWF 2004a).

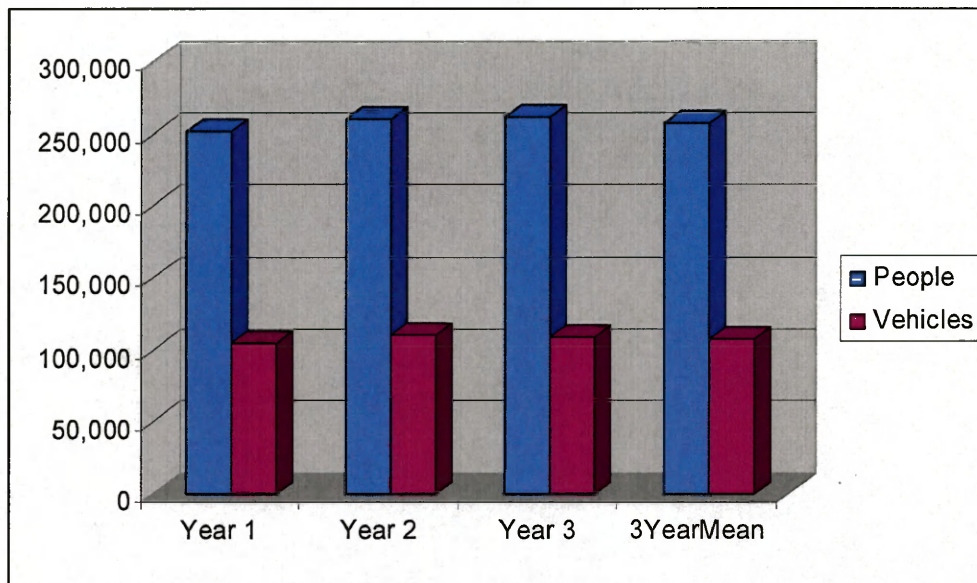


Figure 17: Annual Visitation to Keone‘ō‘io

To put these numbers into perspective, the mean monthly number of tourists to Keone‘ō‘io were compared to the mean monthly visitation to Maui as posted on the DBEDT website. The Friends of Keone‘ō‘io Year 1 data show a monthly mean of 15,241 tourists at Keone‘ō‘io out of a monthly mean of 166,150 tourists to Maui (9.2%) (HWF 2004a; DBEDT 2004). For Year 2, a monthly mean of 17,122 tourists were at Keone‘ō‘io out of a monthly mean of 179,977 visitors island-wide (9.6%) (HWF 2004b; DBEDT 2004). And in Year 3, 15,670 visited Keone‘ō‘io out of 175,268 (8.9%) (HWF 2004b; DBEDT 2004).

Vehicle use at Keone‘ō‘io can be further broken down in Areas 1-4. Area 1 is the primary shoreline parking area, and Areas 2-4 are accessed using the four-wheel drive

jeep trail that travels eastward along the shoreline and out to the light station at Cape Hanamanioa.

Results of vehicular use data (Table 5) in both the shoreline parking area (Area 1) and the four-wheel drive road at Keone‘ō‘io (Areas 2-4) show that the mean for the number of vehicles in Area 1 every half hour is nearly 23 vehicles, as opposed to only one vehicle in Area 2, two vehicles in Area 3, and only one vehicle every 2 ½ hours in Area 4 (Friends of Keone‘ō‘io and Hawaii Wildlife Fund 2004). These results are shown in Figure 18, and Areas 2-4 are highlighted in Figure 19.

Table 5: Monthly Averages of Vehicle Use in Areas 1-4, Keone‘ō‘io, Annual Mean (Year 2003), and Number of Observations/Month (N)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	MEAN
Area 1	29.60	21.79	36.03	21.45	24.92	22.86	17.88	16.21	10.25	24.75	17.08	24.83	22.51
Area 2	1.17	1.11	1.53	1.12	1.81	1.63	1.17	0.82	0.61	0.13	0.58	1.25	1.19
Area 3	2.38	1.74	2.60	2.40	3.66	2.77	2.69	1.53	1.09	0.88	1.83	1.92	2.28
Area 4	0.17	0.15	0.10	0.53	0.43	0.15	0.11	0.11	0.00	0.00	0.00	0.00	0.18
N	15	12	14	12	14	10	11	13	14	1	2	2	

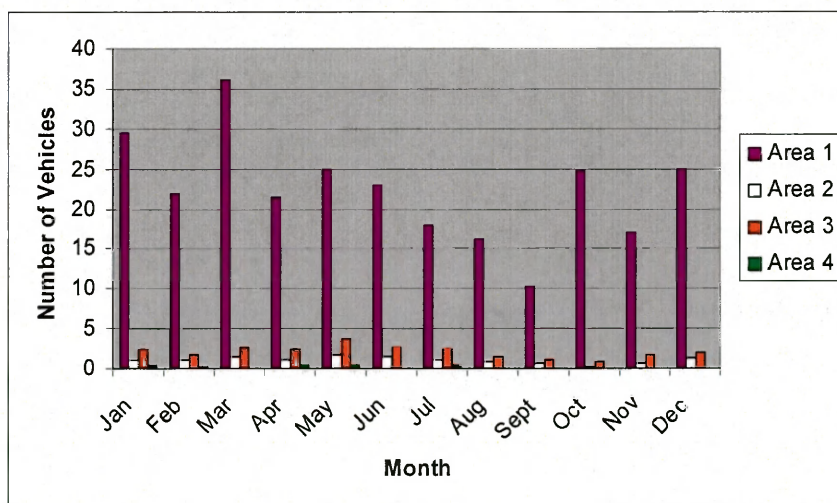


Figure 18: Average Vehicle Use in Areas 1-4, per half hour, Keone‘ō‘io, Year 2003

Although Area 1 can easily accommodate 23 vehicles, the range of values per half hour is between 4 and 58 vehicles (Table 6). Sixty vehicles at Keone‘ō‘io in Area 1 is excessive.

It creates overcrowded social conditions and prompts drivers to pull off the road in

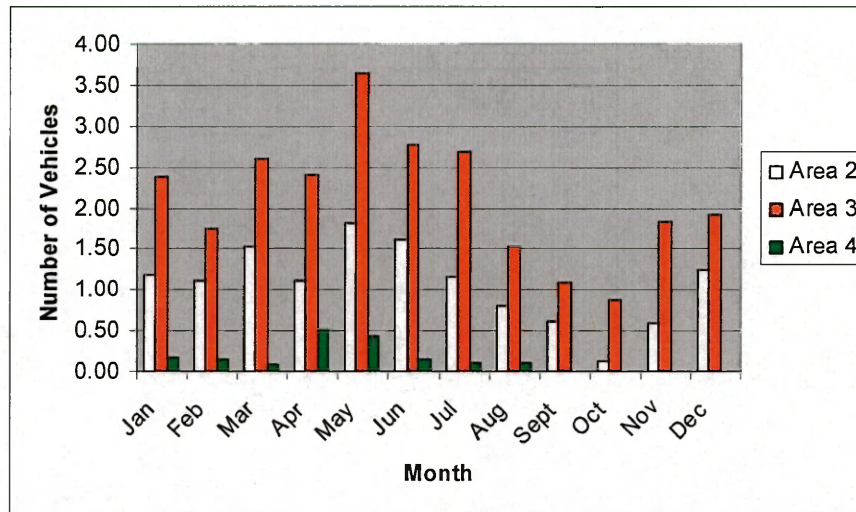


Figure 19: Average Vehicle Use in Areas 2-4, per half hour, Keone‘ō‘io, Year 2003

Table 6: Vehicle Use in Areas 1-4, per half hour, Year 2003, Keone‘ō‘io

Area #	N	Mean	Median	Mode	St. Dev.	Range	Min	Max	Percentiles		
									25	50	75
Area 1	120	22.51	22.23	15	10.878	54	4	58	14.53	22.23	29.33
Area 2	120	1.19	0.80	0	1.366	10	0	10	0.25	0.80	1.59
Area 3	120	2.28	2.00	1	2.051	12	0	12	0.83	2.00	3.13
Area 4	120	0.18	0.00	0	0.448	2	0	2	0	0	0

unsuitable areas that encroach on archaeological features (Figure 20). Nearly 87% of all vehicles at Keone‘ō‘io are found in Area 1 (Figure 21). Just over four percent are found in Area 2, eight percent in Area 3 and half a percent in Area 4.

Friends of Keone‘ō‘io car census data includes information on the number of passengers per vehicle arriving at Keone‘ō‘io. These data could be analyzed to determine the percentage of vehicles, on average, arriving with one, two, three, four, or more passengers. If cost-efficient road counters are installed in the future, that data on the



Figure 20: Vehicles in Area 1 Encroaching on Archaeological Features (Vann 2003)

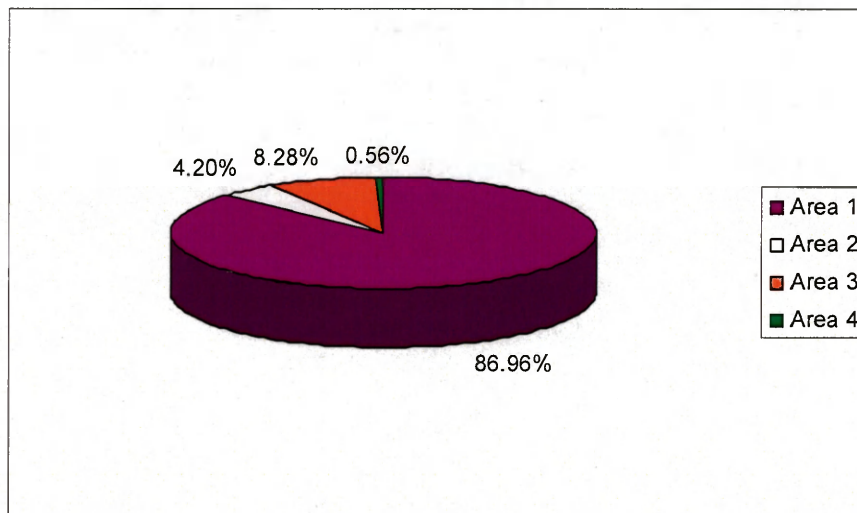


Figure 21: Percentages of Average Number of Vehicles in Areas 1-4, Keone‘ō‘io, Year 2003

number of cars arriving could be made more meaningful if, from it, the number of users could be extrapolated (using the Friends of Keone‘ō‘io data). Although the number of cars is what is being monitored, the purpose is to estimate the numbers of people. Then, if the standards provided in step 5 of the LAC process are violated and use limitations a required management action, managers can make a more reasonable judgment about what numbers to limit use to.

Use in only one portion of the 'Ahihi-Kina'u NAR was surveyed by the Friends of Keone'ō'io. Table 7 shows that the mean was roughly four hikers present in Area 8 every half hour, with a maximum of up to 12 hikers per half hour (Table 8).

Table 7: Average Number of Hikers per half hour in Area 8 (NAR) and Annual half hour mean, 2003

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	MEAN
4.58	2.44	5.13	4.18	4.08	4.16	5.05	4.38	2.64	8.13	6.00	4.58	4.15

Table 8: Mean Number of Hikers in Area 8 per half hour, Year 2003

Area #	N	Mean	Median	Mode	St. Dev.	Min	Max	Percentiles	25	50	75
Area 8	120	4.15	3.75	3	2.520	0.25	12.33		2.06	3.75	6.00

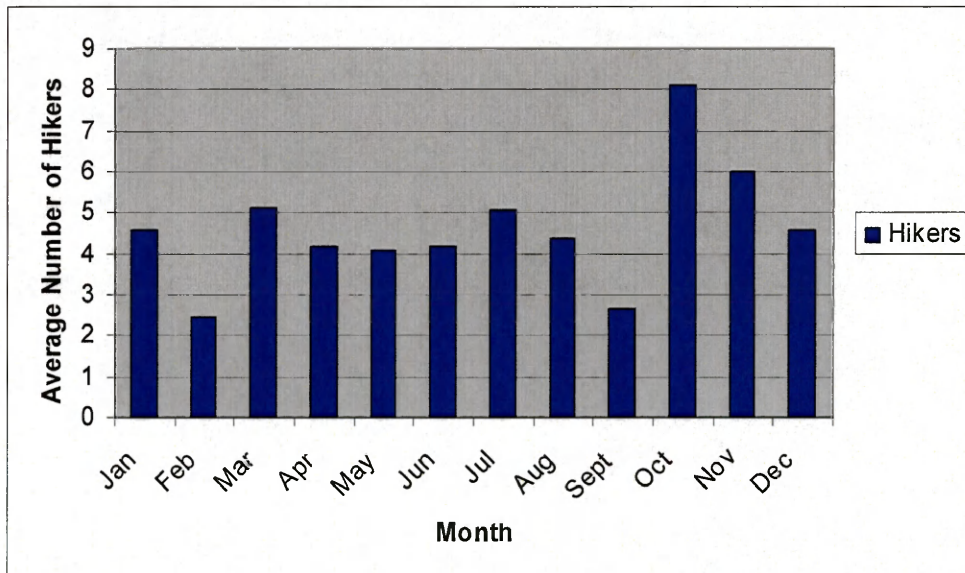


Figure 22: Average Number of Hikers in Area 8 (NAR) per half hour, Year 2003

Figure 22 shows a higher number of hikers in October and November, but this is based on a very small number of surveys (one and two, respectively).

Keone‘ō‘io Peak Use Levels

Data collected by the Friends of Keone‘ō‘io, summarized in Table 9, show that peak arrival times at Keone‘ō‘io are between 10:00am and 4:00pm (HWF 2004a). All three data years show the height of the peak to be between 11 am-noon, with an average of between 11% and 12% of the day’s total number of visitors arriving during that one hour time period (Table 9). Twelve percent of the average total number of daily arrivals, 705 people (Table 4), is 85 people. This can be considered the peak number of people found on-site at any one time.

Table 9: Summary of Daily Percentage of Arrivals at Keone‘ō‘io, based on Daily Totals Surveyed between 6:00am and 7:00pm.

Summary	6-7 am	7-8	8-9	9-10	10-11	11-12	12-1	1-2	2-3	3-4	4-5	5-6	6-7 pm
Year 1	3.2%	5.0%	4.5%	7.2%	10.5%	12.0%	10.9%	10.7%	10.8%	9.2%	7.2%	6.0%	2.6%
Year 2	5.1%	5.8%	5.1%	8.1%	9.8%	10.9%	10.4%	10.0%	10.3%	9.1%	7.5%	5.6%	2.2%
Year 3A	5.2%	8.1%	5.4%	6.6%	9.1%	10.8%	9.6%	9.8%	9.6%	9.6%	9.4%	4.9%	1.9%
Year 3B	1.5%	4.1%	4.9%	9.0%	11.2%	11.9%	10.9%	8.7%	11.8%	8.8%	7.3%	6.2%	3.6%

The small peak between 7:00-8:00am shown in Figure 23 represents arrivals for commercial kayak tours (HWF 2004b). Year 3 of the data was divided into two parts; Year 3A represents conditions before the kayak ban (June 2003-March 2004), and Year 3B represents conditions after the kayak ban (April 2004-July 2004). Note that after the kayak ban the number of early morning visitors to Keone‘ō‘io dropped to levels below those in Year 1 (June 2001- May 2002).

When commercial kayaking was at its peak at Keone‘ō‘io, an average of 90 people would arrive during the time period of 6:00-8:00am, many of them to join tours being operated by the eight commercial kayak companies launching from Keone‘ō‘io

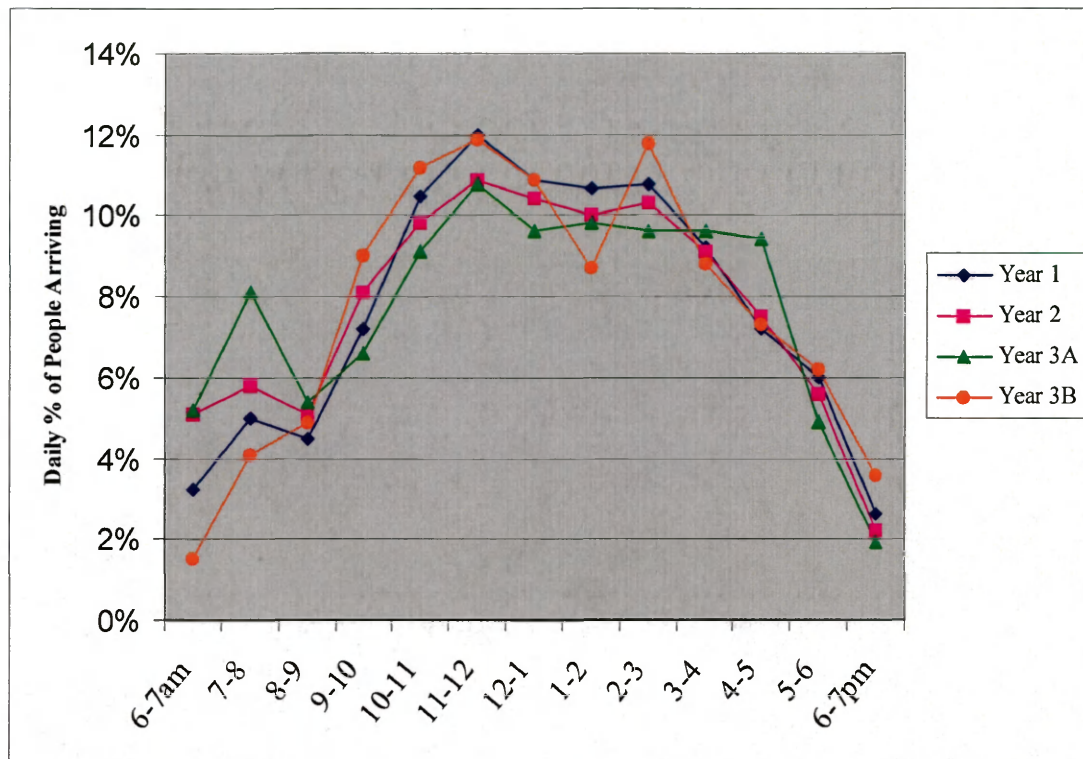


Figure 23: Daily Percentage of People Arriving at Keone'ō'io, Data Years 1-3



Figure 24: Commercial kayak use at Keone'ō'io (Photo by Vann 2002)

(Figure 24). These guests would leave their cars parked there until late afternoon.

Meanwhile, during the peak use hours of 10:00am-4:00pm, sometimes more than 600 people would arrive. This perceived natural, quiet, “wilderness area” was now being

referred to by visitors as “a zoo” (Friends of Keone‘ō‘io and Hawaii Wildlife Fund 2002). DLNR and the Friends of Keone‘ō‘io held public meetings with the commercial kayak companies and worked on developing a concession agreement to bring use levels down and to increase public safety. Other factions were in support of a commercial use ban. One Keone‘ō‘io resident, Pat Borges, collected over 300 signatures in four days in support of the ban. In the end, the concession idea was not approved by the NARs Commission, and commercial kayak tours were banned from La Perouse and the ‘Ahihi-Kina‘u NAR in April 2004. Between April and July 2004, early morning use levels dropped to 38 people between 6:00-8:00am, and between September and December 2004 they dropped to an average of 28 people (Friends of Keone‘ō‘io and Hawaii Wildlife Fund 2004).

Resource Indicator 1: Fish Catch Reports Inventory

Qualitative reports on fishing practices and fish catches is available for La Perouse Bay from the technical surveys and REEF surveys conducted by Friends of Keone‘ō‘io (Appendix 10). The technical surveys have documented several types of fishing occurring at Keone‘ō‘io. Pole fishing occurs from the cliffs in Area 4 as well as along the shoreline in Areas 2 and 3. Crossbow fishing occurs from land or in shallow water along the shoreline in Areas 1-3. Net fishing and trap fishing also occurs in shallow water in Areas 1-3. Opihi fishermen pry opihi (limpets) off the rocks in Area 2. Spearfishing occurs in the water in Areas 5 and 6, as does pole fishing from kayaks. Some kayak fishermen go around the eastern corner of the bay into Area 7. Table 10 shows that, on average, there are slightly more fishermen found in Area 3 than in Areas 2

or 4. The mean for the total number of fishermen found in all three areas is 1.4 per half hour.

Table 10: Monthly Averages of Number of Fishermen in Areas 2-4, Keone‘ō‘io, 2003

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Mean
Area 2	0.24	0.14	0.67	0.25	0.60	0.83	0.66	0.52	0.13	1.00	0.58	0.08	0.44
Area 3	0.77	0.35	0.86	1.05	0.66	0.28	1.16	0.50	0.32	0	1.00	0	0.65
Area 4	0.27	0.21	0.24	0.68	0.39	0.53	0.21	0.43	0	0	0	0	0.31
Total	1.28	0.71	1.77	1.98	1.66	1.65	2.03	1.45	0.45	1.00	1.58	0.08	1.40

Table 11: Fishing Use in Areas 2-4, Year 2003, Keone‘ō‘io

Area #	N	Mean	Median	Mode	St. Dev.	Min	Max	Percentiles		
								25	50	75
Area 2	120	0.44	0	0	0.757	0	3.33	0	0	0.61
Area 3	120	0.65	0.19	0	1.054	0	6.33	0	0.19	0.85
Area 4	120	0.31	0	0	0.732	0	3.83	0	0	0

It has been reported that illegal fishing is occurring in the ‘Ahihi-Kina’u NAR. Results of the DLNR Rapid Assessment team’s August 2003 survey of the “Aquarium” provide some evidence that these reports of poaching are accurate. The team noted that the “...large edible fish such as parrotfish were less frequent and appeared to be more wary than in the past (behavior suggesting illegal fishing pressure)” (DLNR 2003: 5).

Qualitative data gathered by the Friends of Keone‘ō‘io during Technical Surveys show that one site abuse associated with these fishing activities is litter (Appendix 11). While some fishermen, such as David Bloch, have conducted major cleanups (on the scale of ten large garbage bags full of glass, plastic, fishing line, cans, and car batteries) from fishing areas like “Planks” in Area 4, other fishermen have been noted to leave trash behind while fishing in Area 2.

Resource Indicator 2: Protected Animal Species Sightings Inventory

Generally speaking, coastal waters along the entire management area are used by humpback and other species of whales, green sea turtles, Hawksbill turtles, spinner dolphins, bottlenose dolphins, and Hawaiian monk seals. More specific information on the distribution and use patterns of these animals is available from several sources. The distribution of humpback whales during their annual migration to Maui can be provided by the Hawaiian Island Humpback Whale National Marine Sanctuary. Information on the frequency of turtle nesting on Makena Beach is available from Steve Williams, who coordinates the annual community turtle watch program for threatened green sea turtles and endangered Hawksbill turtles that nest on Maui's beaches during the summer months of May through October. Cheryl King, with HWF and the Kaho'olawe Island Research Council, can provide information on the nesting and foraging behaviors of green sea turtle and Hawksbill turtles nesting on Maui and offshore the island of Kaho'olawe. She is conducting satellite tracking research on adult females to determine their primary marine habitat between nesting episodes. Hawaii Wildlife Fund can provide data on spinner dolphin presence and location within La Perouse Bay as part of their 1999 study (HWF 1999), and information on the location of Hawaiian monk seals as part of their Monk Seal Watch program.

Additional information on dolphin behavior in La Perouse Bay is available from Kristi West of UH, who takes students to La Perouse Bay to conduct theodolite surveys from shore. Appendix 12 includes qualitative information gathered by the Friends of Keone'ō'io between August 2001 and November 2002 on protected marine species

sightings at La Perouse Bay, including sea turtles, spinner and bottlenose dolphins, and humpback whales.

There has been concern about spinner dolphin harassment since the late 1990s, due in part to the popularity of swimming with dolphins at La Perouse Bay. These dolphins, which hunt offshore at night and come into the bay in the daytime to rest, nurse their young, and socialize, are subject to frequent intrusions by swimmers, kayakers and boaters. Appendix 12 provides a particularly rich source of information on the habits of Hawaiian spinner dolphins in the bay as reported by people who swam with them. According to this information, the spinners frequent the bay often, although sometimes there are periods of time, on the order of several weeks or longer, when they do not make an appearance. Long-term residents speak of a time up until about five years ago when it was frequent for the spinners to approach very close to shore and swim within the ancient fishpond in front of the Schatz Estate (Ventura 2002).

One source of information on protected terrestrial animal species can be found in the National Park Service's 2002 reconnaissance survey report. The study states that the native Pueo (Hawaiian owl), a candidate for threatened status in Hawaii, occurs in the management area, and that the endangered Hawaiian hoary bat may occur in the management area (it occurs in the nearby towns of Ulupalakua and Kaupo).

Another source is the DLNR Forestry and Wildlife Division. They have monitored the Paniaka I and Paniaka II wetlands at Makena Beach State Park for 30 years, recording, among other things, bird species present. Endangered and endemic birds, such as the Hawaiian stilt or A'eo (*Himantopus himantopus knudseni*), utilize this habitat.

Resource Indicator 3: Number (or area of cover) of Rare Native Plants Inventory

In 1992, The Nature Conservancy surveyed plants in the eastern half of the management area (between Keone‘ō‘io and Kanaloa) as part of their Hawaii Heritage Program survey. Four plant communities described that contained native plants. Native components in the ‘A‘ali‘i Lowland Dry Shrubland community included ‘ilima (*Sida fallax*), ‘uhaloa (*Waltheria indica*), naio (*Myoporum sandwichense*), naupapka, (*Scaevola sericea*), alena (*Boerhavia repens*), and koali ‘awa (*Ipomoea indica*). The Mixed Coastal Shrubland/Herbland community contained the native sedge *Fimbristylis cymosa*, not considered rare. An extremely rare Coastal Shrubland community dominated by ‘akoko (*Chamaesyce celastroides*), occurs at only one location within the management area, at the western edge of the Kanaio ahupua‘a (i.e. east of Cape Hanamanioa). The ‘akoko, a taxon endemic to the Hawaiian islands, is known to occur only at one other location (Polihale State Park on the island of Kauai). This shrubland community also contained other native species, including naio, ‘ilima, ‘uhaloa, alena, koali‘awa, ‘aki‘aki (*Sporobolus virginicus*), kauna‘oa pehu (*Cassytha filiformis*). The coastal strand vegetation, which is poorly developed because of the predominance of rocky cliffs, consists primarily of *Fimbristylis cymosa*, with occasional patches of *Chamaesyce celastroides* and *Jacquemontia ovalifolia*.

Populations of the native shrub, mai‘apilo (*Capparis sandwichiana*), were common along the coast from between Keone‘ō‘io and Kanaio Beach. Although this lowland shrub has a large population within the study area, it is rare on the other main Hawaiian islands. The U.S. Fish and Wildlife Service has retained this species on its active list of candidates for endangered species listing.

A very small population of `ihi (*Portulaca villosa*), a rare native herb, was found in scattered locations from Kanaio Beach eastward to Kaupo. The `ihi is presently a candidate endangered plant species. Pololei (*Ophioglossum concinnum*), a fern endemic to Hawaii and usually found in coastal environments in dry habitats on all the major islands, were also identified within the management area. The U.S. Fish and Wildlife Service is preparing to propose the pololei for listing as threatened or endangered (NPS 2002).

While many of the plants listed above were indicated as occurring in the Kanaio area, the 1992 TNC Hawaii Heritage Program survey did not include the entire management area. If there are no reports identifying the current condition of rare native plant species within the NAR and the rest of the management area, then an inventory needs to be undertaken.

Resource Indicator 4: Percent of Kiawe and *Battis maritima* Encroachment in Makena Beach Wetlands Inventory

The DLNR Forestry and Wildlife Division record percent vegetation cover and percent open water as part of their monitoring of the Paniaka I and Paniaka II wetlands at Makena Beach State Park. Their 30-year data set provides important baseline information on historic encroachment of invasive plants. The DLNR also simultaneously records bird species present, so a historic comparison could be made between vegetation encroachment levels and bird use. Other variables measured include water level, human impact and degree of human presence, shoreline conditions (water depth and location), and rain and cloud cover conditions (Duvall 2005). Litter, including car bodies, axles, and car batteries, are also documented (Duvall 2005). A private developer is conducting water quality studies on the Maluaka wetland, located north of Pu'u Olai (Duvall 2005).

These water quality studies include salinity, temperature, dissolved oxygen, and particulate matter measurements to establish baseline conditions. If water quality is deemed to be another important indicator of the ability of these wetlands to provide endangered bird species habitat and stormwater filtration functions, then the DLNR could ask the private developer to provide this baseline data.

Resource Indicator 5: Physical impacts in Anchialine Ponds Inventory

Photographs of these ponds are available from local photographers, such as John Boyden, and aerial images from the USGS. These photographs are not currently compiled. In 2002, footprints were observed in the algal layer of one of the ponds within the NAR; these footprints lasted for months.

Resource Indicator 6: Water Quality Parameters in Anchialine Ponds Inventory

In January 2003, the USGS took water samples from three ponds within the management area (Halua Pond and Kauhioaiakini Pond in the NAR and the pond furthest from the beach at the Hanamanioa Light station on the eastern side of La Perouse Bay). Temperature and pH were recorded and chemical analyses were run on these water samples (this data is included in Appendix 13). The USGS is establishing these baseline chemical analyses so that possible future changes in chemistry may be used to interpret volcanic activity in the southwest rift zone of Haleakala volcano (USGS 2003). In addition, the USGS is using the stable isotope signature of the water to infer the altitude at which the aquifer receives recharge (USGS 2003). The salinity of the two ponds occurring in the NAR were measured by the DLNR Rapid Assessment team in August

2003. Their salinities were measured at 30/100 parts and 32/100 parts for Halua and Kauhioaiakini Ponds, respectively; the salinity range for ocean water was measured at 34/100 to 35/100 parts.

Resource Indicator 7: Native Shrimp Populations in Anchialine Ponds Inventory

To my knowledge there is no existing inventory of native shrimp populations occurring in anchialine ponds on Maui. Biologists would need to determine if shrimp populations are a suitable indicator. If so, non-invasive survey methods would need to be developed to develop a baseline inventory that will help scientists better understand natural population fluctuations. Since this is a time-consuming process, and since no quantitative data may currently exist, this may not be an immediately useful indicator to managers; its worth may be in the long-term.

Resource Indicator 8: Use Levels Inventory

While levels of use in and of themselves cannot necessarily be correlated with damage levels (since the behavior of those users is an important factor), levels of use can establish the status quo or baseline conditions upon which management actions can be based. The DLNR has some information on use levels at “Fishbowl.” During their August 2003 rapid assessment survey of the NAR, they recorded three kayaks groups and a number of hikers arriving at the “Fishbowl.” At one point there were more than 34 people in the water in this one small cove (DLNR 2003). More than three years of Friends of Keone‘ō‘io data on the number of snorkelers, swimmers, kayakers, divers, surfers, windsurfers, and boaters using La Perouse Bay is also available. While analysis

of this entire data set was outside the scope of this paper, boat use levels within La Perouse Bay have been analyzed and are presented below as an example.

Many boats primarily use La Perouse Bay as a haven when conditions in other areas along South Maui are too rough (Keone‘ō‘io-‘Ahihi-Kina’u Advisory Group 2004b). Boat use levels are shown in Table 12. While at times there can be six or more boats in the bay at one time, this is not usual, and the analysis shows that, on average, boats use La Perouse Bay at the frequency of 0.18 boats per half hour. It is important, though, to keep in mind that only 12% of the surveys (or 14 out of 120 surveys) were conducted in the early morning hours before 10:00am, which is often when boats use La Perouse Bay. Table 12 shows two apparent spikes in use, in February and in October. The data for October is not robust because it is only based on one survey, whereas the majority of the other months are based on between ten and fifteen surveys. In addition, the October survey was conducted prior to 10:00am, when boat use is usually higher. The spike in February is from early morning surveys conducted prior to 10:00am, although Table 13 demonstrates that there were other months that had a higher percentage of early morning surveys taken.

Table 12: Monthly Averages for Boat Use in La Perouse Bay and Annual Mean for Yr 2003

Area #	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	MEAN
Area 5	0.06	0.56	0.15	0.23	0.11	0.02	0.28	0.50	0.29	0.75	0	0	0.24
Area 6	0.07	0.42	0.10	0.03	0.11	0.12	0.17	0.07	0.01	0.38	0	0	0.12
Total	0.14	0.97	0.25	0.26	0.22	0.13	0.45	0.57	0.30	1.13	0	0	0.18

Table 13: Percentage of Monthly Surveys beginning prior to 10:00am, Yr 2003

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
a.m. surveys	0%	25%	21%	25%	21%	10%	55%	46%	43%	100%	0%	0%

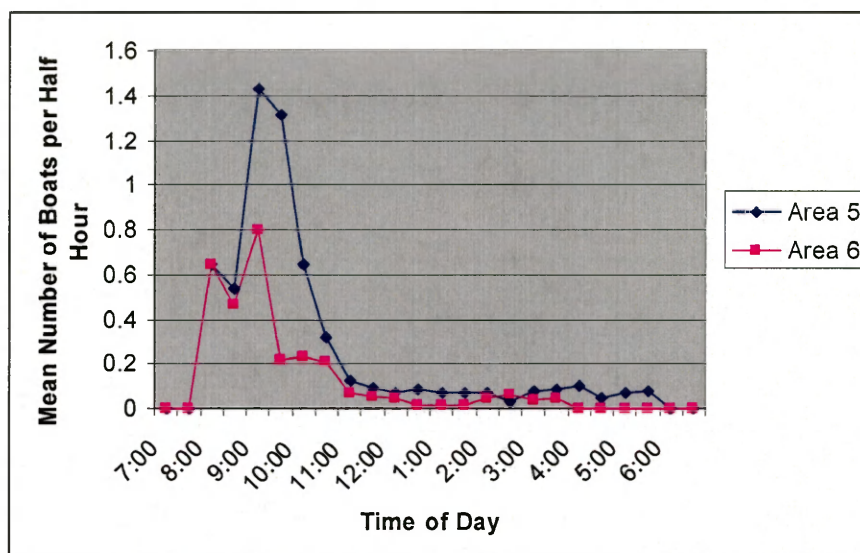


Figure 25: Mean Number of Boats per half hour in Areas 5 & 6, Keone‘ō‘io, 2003

Figure 25 shows the distribution of boat use by half hour in Areas 5 and 6 for the year 2003 data. As indicated by the figure, peak boat use in La Perouse Bay occurs between 8:00am-10:30am.

Resource Indicator 9: Percent Coral Damage Inventory

The condition of corals at “Aquarium,” “Fishbowl,” and a number of other small embayments and tidepools along the eastern edge of the NAR were briefly surveyed in August 2003, December 2003, and again in August 2004 by DLNR staff. They found the “Aquarium” to consist of shallow corals and a number of unique biological communities (DLNR 2003). Evidence of trampling, coral breakage, and findings of shreds of colorful plastic (like that from kayaks) on damaged coral heads was noted throughout the cove, “...suggesting that too many people are in the area at one time or that people’s activities in the area are not well regulated” (DLNR 2003: 5). They also found that “...kayaks floating around in the center of the cove or bumping against the southwestern, eastern and northeastern edges of the cove have caused some coastline and underwater evidence

of trampling and bumping marks” (DLNR 2003: 5). At the “Fishbowl” there was limited coral, but there was a small healthy, robust coral reef immediately outside the cove. A number of the other small embayments and tidepools surveyed contain unique cultural or biological components that appear “extremely vulnerable to unsupervised visitation” (DLNR 2003: 13). The survey team recommended that a formal assessment be conducted to document the range and amount of biological resources of this entire area.

Reconnaissance surveys of the coastal and offshore area between Keone‘ō‘io and Kanaloa Point were conducted in 2002 by the NPS, DLNR and University of Hawaii, using standard REA (Rapid Ecological Assessment) methods commonly performed in Hawaiian waters (Basch 2002). The pristine condition of coral reefs in the study area was “striking and very unexpected,” considering the prevailing exposure/disturbance regime along this portion of the Maui coast (Basch 2002: 4). The less exposed areas west of Kanaloa Point and west of most of the other major headlands and points contained the more developed coral reef communities. Algal and coral growth and cover appeared to be in equilibrium, which was also a major indicator of a vibrant and healthy coral reef ecosystem.

The surveys identified a total of 38 species of coral, primarily stony, reef-building corals, but also including soft coral, precious coral, and zoanthids. A number of rare species of coral also occur in La Perouse Bay. One shallow water site within La Perouse Bay had a total of 22 species, a very high species richness for anywhere in the main Hawaiian Islands. Several places within La Perouse Bay, including the pinnacle and the area just west of Kanaloa Point had extremely high coral cover of 60 to 80 percent. One of the most pristine *Pocillopora meandrina* reefs was an exposed reef east of Kamanamana Point. The numbers of Crown-of-Thorns present in the study area appeared to be low and to not pose a threat to

reef-building corals. Species such as the coral-eating butterfly fishes that tend to establish long-term territories indicate the stability of the associated coral reef system within the study area.

While this survey found much of the coast to be “quite pristine” and “...characterized by a lack of visible terrestrial or human input...” (Basch 2002: 3), there was one exception. At the east end of the mouth of La Perouse Bay, on the western side of Cape Hanamanioa, there were “...large amounts of marine debris in the form of heavy fishing gear (for ulua) – heavy gauge line, lead weights and large hooks or lures – an anchor, pieces of pipe and beer cans, with densities subjectively estimated to be about 1 kg/m²” documented (Basch 2002: 3). This area is within casting range of the shore fishing area known locally as “Planks.” Coral reefs have grown around some of these items and cemented them in place, meaning much of this gear has been in place for some time.

This area was the focus of a two-dive marine debris cleanup (Figure 26) conducted by four HWF divers in September 2004. Due to heavy surge conditions, the



Figure 26: Debris removed from offshore “Planks” by HWF, September 2004
(Photo by Vann, 2004)

cleanup did not occur directly offshore Planks but further inside the bay along the cliffs. Over 60 pounds of marine debris were removed, comprised primarily of fishing line, hooks, and lead weights, especially those used in ulua fishing.

Resource Indicator 9: Percent Rock Removal or Erosion/Wall Destabilization Inventory

Archaeological sites, features, and trails within the management area differ in important ways: their level of integrity or condition (how intact they are), their level of threat (depending on their location in high use versus remote areas), their cultural significance (as determined by Hawaiians and archaeologists), their sensitivity to damage (such as rock removal or human-induced erosion/wall destabilization), and their inventory status (ranging from not inventoried, to preliminarily inventoried, to officially mapped and recorded). While many of the sites and features inventoried show some form of damage, other sites (especially those that are more remote) are in good condition.

Archaeological investigations that have been conducted in the study area include Stokes' 1916 survey for the Bishop Museum, Walker's 1928 and 1929 survey for the Bishop Museum, the Bishop Museum's 1973 survey as part of an island-wide survey of Maui, the State of Hawaii's 1987 supplementary survey, The Nature Conservancy's Hawaiian Heritage Program 1992 study as part of a biological survey, and the Hawaii Army National Guard's 1997 survey of the Kanaio Training Area (NPS 2002). Many of the most prominent and accessible archaeological sites and features in South Maui were described and mapped during these surveys, but many went unrecorded. Types of documentation vary from rough sketches to detailed maps with GPS coordinates. Figure 27 portrays a detailed sketch of two features located in the middle of the shoreline parking area at

Keone‘ō‘io (van der Jagt 2003) that was drawn in 2002 by Friends of Keone‘ō‘io staff. Narratives also vary from simple descriptions of physical features to an analysis of their use and function. Since most of the study area has not been subject to intensive archeological survey to modern standards, professional archaeologists believe that additional

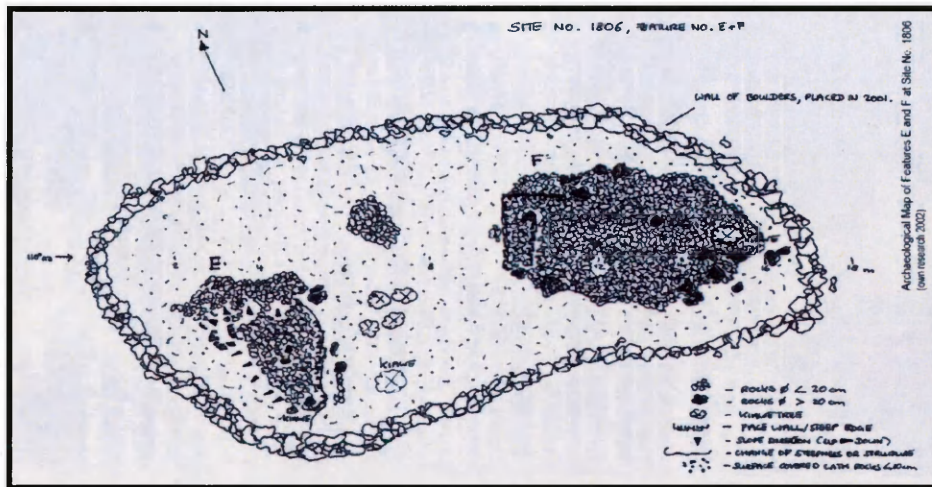


Figure 27: Sketch of two archaeological features at Keone‘ō‘io (Area 1)
(van der Jagt 2003)

surveys would identify as many as twice the known number of features within the study area (NPS 2002). It will be difficult to prioritize site protection before all sites are inventoried.

The most recent survey was a reconnaissance survey of the area conducted in 2002, to determine its suitability for designation as a national park. This was a result of the tireless efforts of activist Mary Evanson, a member of Maui Malama Pono and president of the Friends of Haleakala National Park, who lobbied for designation of La Perouse Bay as a National Park. In February 2001, Congresswoman Patsy Mink introduced bill H.R. 591, which resulted in the survey. The survey found that the most significant resources were the archaeological sites, which “constitute a significant material record of the indigenous Hawaiian occupation of the dry southeastern coastal zone of the island of Maui” (NPS 2002: 28-29). The survey found that four-wheel drive vehicles making their own “roads” in

this roadless area to access favorite fishing and camping spots have been particularly damaging to the archaeological features. The report recommended that motor vehicles not be allowed to drive through areas with numerous and significant Hawaiian archeological sites and features. It also recommended that camping opportunities be restricted to those areas where cultural resources would not be adversely affected (NPS 2002).

Qualitative information on archaeological site abuses, gathered by the Friends of Keone‘ō‘io as part of the Technical Survey (Appendix 14), identify the Paalua Heiau and Site 1805 as hotspots of abuse in Area 2 at Keone‘ō‘io (Figures 28 and 29). People have been observed climbing on, doing yoga on, urinating on, and throwing rocks off of these two important cultural sites. In some locations within Keone‘ō‘io, stacked rocks appear to have been removed from nearby walls and enclosures to make campfire rings and

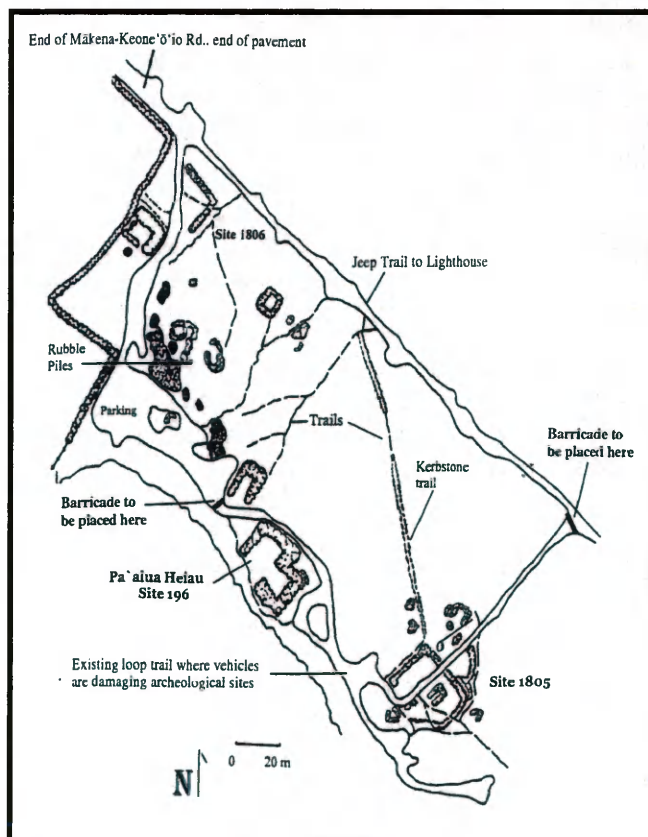


Figure 28: Pa'alua Heiau and Site 1805 Site Sketch (Donham 2002)



Figure 29: Aerial Photo of Keone'ō'io (Modified after USGS Photo #2900, 1995)

windbreaks (NPS 2002). In addition, coral rock graffiti (white coral rock placed on black lava rock to form messages) occurs along the shoreline pathways, and motocross bikes are being driven on the Hoapili (King's) Trail, which is meant for foot traffic only.

The Keone'ō'io-Kanaloa Working Group has addressed some of the worst four-wheel drive damage at Keone'ō'io by placing boulders to block an illegal jeep trail that drove by the Paalua Heiau and through the middle of Site 1805. Figure 30 shows the jeep

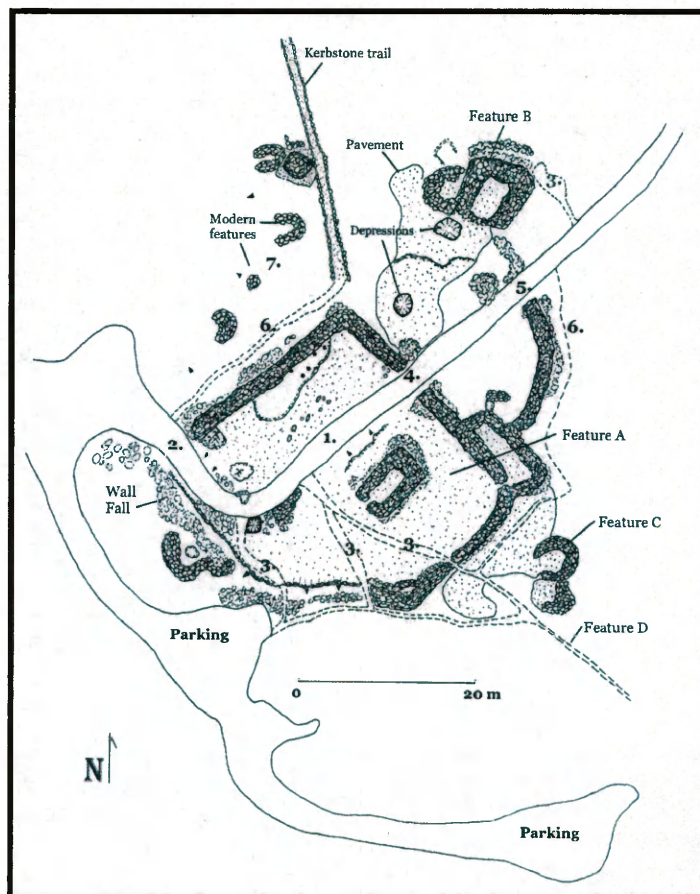


Figure 30: Damage to Site 1805 (the numbers refer to specific areas of damage as detailed in Theresa Donham's archaeology report) (Modified from Theresa Donham, 2002)

trail bisecting the site and the resulting wall damage. The Working Group also rerouted one section of the four-wheel drive road that passed over an adze grinding and salt pan site. Site 1805 has now been stabilized, signage has been designed for the heiau, and the adze grinding site has been surrounded by kiawe trunks and large rocks.

In summary, an initial inventory of the two social and ten resource indicators was described as a preliminary step towards creating the appropriate product for step 4, which is a map of existing conditions for each indicator throughout the management area. Some of these indicators are more quantifiable than others, and the amount of information currently available for each also varies. Further research will most likely be required to more accurately define the current condition of some of the indicators. Some may be immediately useful to managers, whereas others may show their worth in the long-term. This initial inventory suggests several sources of information that can be used to help create the comprehensive inventory required in this step.

Step 5: Specify Standards for Resource and Social Indicators

Purpose: The purpose of step 5 is to assign standards (highly specific quantitative measures) to the indicators defined in step 3. These standards provide the basis for evaluating where and what management actions are needed by permitting comparison of existing conditions with those defined as acceptable for each indicator in each opportunity class (Stankey et al. 1985). These standards indicate minimally acceptable conditions, not necessarily those that are desirable. Violation of these standards requires immediate management action.

Process: The DLNR, and other professionals as needed, will review the opportunity class descriptions developed in step 2 and analyze the inventory data collected in step 4 for each indicator. Then, they will create standards for the indicators defined in step 3, for each of the opportunity classes to which that indicator pertains. Standards are not just

idealistic goals; they are conditions managers feel can be achieved over a reasonable time period. They should be stringent enough to be meaningful, but not so stringent that they cannot be attained. In some cases, standards may merely reflect current conditions. In other cases, standards can be written to purposefully direct the modification of conditions towards the desired outcome. There needs to be a balance between these two, based on professional judgment and public input. While setting standards is a judgmental process, the process is logical, traceable, and subject to public review. Another feedback loop is the monitoring in step 9. If monitoring shows that the level of sensitivity of the standard is not accurately reflecting resource change, the standard can be adjusted as needed.

Product: A table of specific (quantified where possible) measures of acceptable conditions for each indicator in each opportunity class.

Standards based on social and resource indicators appear in Table 14. A number of standards specify that no change beyond current conditions will be allowed. The phrase “current conditions” can be interchanged with “baseline conditions” in this table. Baseline information from many years prior could be used to set standards, or standards could be determined based on a current inventory. In some cases where prior baseline information is used to set standards, current conditions may already be degraded beyond the standard, requiring immediate management action.

Table 14: Standards based on Social and Resource Indicators

Opportunity Class	Factor	Indicator	Standard
Social Indicator 1			
Classes 1, 2, and 3	User conflicts	Complaints reported	An issue of concern expressed at 80% of the meetings (over 12 months) will receive priority. Issues that 90% of meeting participants think is important will receive priority. Reports of serious human safety issues or serious resource abuse require immediate management action.
Social Indicator 2			
Class 1	Crowding/ Solitude	Inter-party interaction	Reduce status quo peak use levels by 10%. These new levels should only be exceeded 10% of the time.
Class 2	Crowding/ Solitude	Inter-party interaction	Status quo peak use levels only exceeded 10% of the time
Class 3	Crowding/ Solitude	Inter-party interaction	Status quo peak use levels only exceeded 20% of the time
Resource Indicator 1			
Classes 1, 2, and 3	Condition of fish stock	Fish catch reports	Fishing is illegal in the NAR. Current fish catch levels may be used as the standard for all other areas. Available information needs to be compiled/evaluated.
Resource Indicator 2			
Classes 1, 2, and 3	Presence of protected animal species	Protected animal species sightings	Current sighting frequency may be used as the standard. Available information needs to be compiled/evaluated.
Resource Indicator 3			
Class 1	Condition of native plants	Number (or area of cover) of rare native plants	No loss of the number of plants (or area of cover) beyond current conditions.
Class 2	Condition of native plants	Number (or area of cover) of rare native plants	Do not exceed 5% loss (either of cover or of individual plants, as determined by biologists) of the current 'ihi, akoko, mai`apilo, or pololei populations.
Class 3	Condition of native plants	Number (or area of cover) of rare native plants	Do not exceed 5% loss (either of cover or of individual plants, as determined by biologists) of the current 'ihi, akoko, mai`apilo, or pololei populations.

Opportunity Class	Factor	Indicator	Standard
		Resource Indicator 4	
Classes 1, 2, and 3	Condition of wetlands	% kiawe or <i>B. maritima</i> encroachment	Cannot encroach into more than 15% (or other percentage as determined by biologists) of open water.
		Resource Indicator 5	
Classes 1, 2, and 3	Condition of anchialine ponds	Physical impacts	No more than 5% of the algal surface area of the ponds should show signs of human disturbance.
		Resource Indicator 6	
Classes 1, 2, and 3	Condition of anchialine ponds	Water quality parameters	Standards could be based on quantitative levels of selected parameters for a certain % of surveys conducted.
		Resource Indicator 7	
Classes 1, 2, and 3	Condition of anchialine ponds	Native shrimp populations	Biologists need to determine whether this is a viable indicator. If so, then current population levels need to be established before standards can be set.
		Resource Indicator 8	
Class 1	Condition of coral reefs	Use levels	90% of monitoring surveys show a decrease in current use by 10%
Class 2	Condition of coral reefs	Use levels	80% of monitoring surveys show current (or lower) use levels
Class 3	Condition of coral reefs	Use levels	50% of monitoring surveys show current (or lower) use levels
		Resource Indicator 9	
Class 1	Condition of coral reefs	Percent coral damage	5% improvement above current conditions (immediate management action required).
Class 2	Condition of coral reefs	Percent coral damage	Status quo maintained based on current conditions. No additional damage allowed.
Class 3	Condition of coral reefs	Percent coral damage	Damage not to exceed 10% of current conditions.

Opportunity Class	Factor	Indicator	Standard
		Resource Indicator 10	
Class 1	Condition of archaeological sites, features, and trails	Percent rock removal or erosion/ wall destabilization	No additional damage beyond baseline conditions for all archaeological sites, features, and trails.
Classes 2 and 3	Condition of archaeological sites, features, and trails	Percent rock removal or erosion/ wall destabilization	No additional damage to the most culturally significant sites, features, and trails that are in good to excellent condition ¹ (scoring 70 and above, as determined by the Hawaiian community and archaeologists).

No time period over which the change occurs was indicated for the standards including 5% loss of native plant cover, 15% encroachment of open water, or 5% coral reef damage. This is because the time frame is if it ever happens. When the specified percentage of change beyond current/baseline conditions is reached, then immediate management actions to prevent further change are required. These may include use limitations until the resource has a chance to recover to baseline conditions. The danger in setting a time frame of, for example, a 5 year period, is that a 10% loss beyond baseline conditions allowed every five years potentially becomes a 30% loss beyond baseline conditions over 15 years.

In summary, standards should describe a range of conditions that are minimally acceptable and achievable. Standards may specify current conditions (i.e. status quo) as acceptable, they may allow some further degradation of the resource (e.g. 5%), or they may specify a needed improvement over current conditions. Standards are often best expressed as probabilities (e.g. visitation levels of a maximum of 700 people/day for at

¹ Sites in good to excellent condition are more cost-effective to stabilize or restore than highly damaged sites.

least 90 percent of the surveys) since specific, absolute standards are unrealistic. On occasion, the standards set for an indicator might be shared by two or more opportunity classes (but these classes will still be distinguishable from one another as defined in step 2). Indicators and standards can be revised based on monitoring and as new information becomes available.

Step 6: Identify Alternative Opportunity Class Allocations

Purpose: The purpose of step 6 is to identify where the opportunity classes should be allocated within the management area, and to identify at least one alternative allocation plan. The placement of these opportunity classes should address area issues and concerns, as well as existing resource and social conditions. It is a prescriptive step, concerned with establishing what should be.

Process: This is an important step in the transactive planning process. Both managers and the public need to review the issues and concerns identified in step 1 and the opportunity class descriptions in step 2, and balance these against the realities of existing conditions within the management area (from the inventory map produced in step 4). The public will also play an important role in reviewing and evaluating alternative plans.

Product: In step 6, maps and summaries of alternative opportunity classes will be completed.

For the purposes of this professional paper, a map (Figure 31) and summaries of opportunity class allocations are presented. Only one scenario is given here, but the DLNR should provide one or two alternatives. Specific areas, such as restricted point zones requiring extra protection within the opportunity class designations, should be mapped in more detail once they are designated through the transactive process.

Opportunity Class 1

The entire ‘Ahihi-Kina’u NAR is designated for a high level of resource protection and a high level of social integrity. This is consistent with its designation in 1973 as a Natural Area Reserve established to protect coral reefs, water quality, archaeological sites, and the lava landscape (DLNR Division of Fish and Wildlife NARS Program 1992). The two anchialine ponds, the coral reefs in “Fishbowl” and “Aquarium,” any native plants occurring in the area, and unique lava/geological features are among the natural resources that will receive a high level of protection. All archaeological sites, features, and trails in this opportunity class, regardless of their cultural significance rating, will receive some level of protection. The most significant sites will likely receive higher levels of protection. Access for traditional and cultural uses will be allowed and there will be experiences for solitude. Use of this area for the general public may be limited to guided tours.

Opportunity Class 2

This opportunity class includes ‘Ahihi Bay, Keone‘ō‘io, and the area east of Keone‘ō‘io to Kanaloa. This zonation is primarily consistent with current use. ‘Ahihi Bay

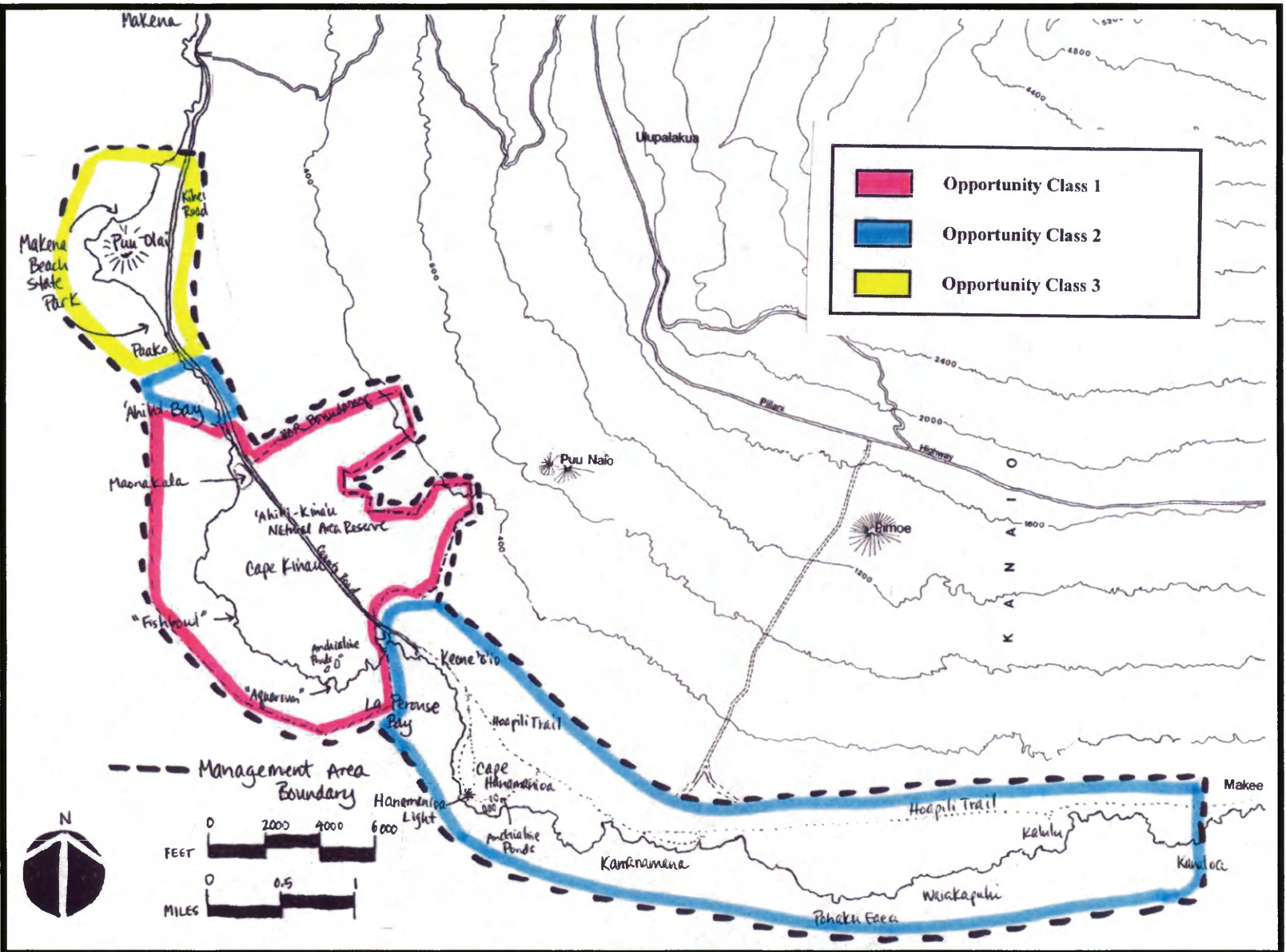


Figure 31: Suggested Zonation of Opportunity Classes within the Management Area

is typically crowded, providing a safe snorkeling location with easy access. A diverse number of recreational pursuits occur at Keone‘ō‘io, but there are still opportunities for solitude and, in the more remote areas, a semi-wilderness experience. Use levels east of Keone‘ō‘io to Kanaloa are much lower, providing the best opportunities for solitude. The rugged environment also provides experienced hikers and divers the opportunity for some challenge and risk. Local community residents (participating in the development of the 1977 park plan) saw this area as being left primarily for local use because of rough topographic conditions as well as preservation of traditional local fishing and opihi picking activity. The five anchialine ponds located on the shoreline of Cape Hanamanioa will be restricted zones of higher protection, as will any archaeological sites, features, or trails that are defined as the most culturally significant and that are in good to excellent condition.

Opportunity Class 3

This opportunity class includes Makena Beach State Park and its surrounding offshore waters. This designation is consistent with its current use. It is amendable to intensive recreation activity with its easy access, large sandy beach resource, protected waters, and vegetation/wildlife characteristics (Mogi 1977). The three wetlands occurring here will be restricted zones of higher protection, as will any archaeological sites, features, or trails that are defined as the most culturally significant and that are in good to excellent condition.

In summary, in step 6 alternative opportunity classes are allocated within the management area. When other alternatives are developed through the transactive process, one alternative may show a preference towards unlimited access and a wide array of recreational opportunities, while another may show a preference towards a high level of social and resource integrity. The selection of the preferred alternative occurs in step 8 and will depend, among other things, upon management constraints that are outlined in step 7.

One of the management challenges that will result from the opportunity class allocation example described in this step is that a Class 1 area (the ‘Ahihi-Kina’u NAR) is immediately bordered on both sides by Class 2 areas (‘Ahihi Bay on the northwest and Keone‘ō‘io on the southeast). It may prove difficult to keep use levels low in the NAR since the NAR facilitates the travel of visitors to and from Keone‘ō‘io. This has been an issue raised at numerous community meetings over the past few years, and is a challenge managers will have to grapple with.

Another concern is that once lines are drawn on a map, it becomes a static designation that drives management (Moisey 2005). That is why, even in the Class 3 designation that caters to access, there are mechanisms in place for protecting important natural and cultural resources.

Step 7: Identify Management Actions for Each Alternative

Purpose: In step 7, managers identify management actions and evaluate the implications (costs, benefits, and constraints) of implementing each alternative. This is an important step towards selecting the preferred alternative in step 8.

Process: Using the alternative opportunity class allocations defined in step 6, managers need to identify the differences, if any, that exist between current conditions inventoried in step 4, and the standards developed in step 5. There will likely be a number of possible management actions that could be undertaken to achieve the standards. The managerial guidelines given in the opportunity class descriptions in step 2 will help define what kinds of management actions are appropriate.

Product: The product of this step is a list or map of all the places (for each alternative) where existing conditions are worse than the standard. In addition, the management actions that would bring conditions up to standard should be identified.

A continuum of management actions is available to managers, ranging from the least restrictive and most preventive (such as education and outreach) to the most restrictive and corrective (such as limiting access). Education includes interaction with on-site naturalists and rangers, as well as signage, and access to handouts and the on-site information table currently at Maonakala. Enforcement powers reside primarily with the Maui Police and the DLNR Conservation Enforcement officers. The front line individuals who can call upon these two agencies for assistance are the on-site Rangers, Naturalists, Citizen's Patrol, and other community members. Use levels may dictate management actions. For example, protecting a wetland in a high use area may require fencing, whereas protecting a wetland in a low use area may not require fencing.

In this section, within each of the three opportunity classes the standards of the indicator are summarized, along with existing conditions of the indicator. Possible

management actions needed to align existing conditions with standards are recommended, and the costs, benefits, and constraints associated with those management actions identified. Table 15 below summarizes which indicators will be discussed within each of the opportunity classes. Management actions for every indicator marked with an “X” will be suggested. Some indicators will not be discussed in this paper either because the indicator doesn’t apply to that opportunity class, because no standards have been set (and therefore management actions cannot be recommended), or because a lack of inventory information prevents a description of existing conditions of the resource.

Table 15: Indicators that Apply to Each of the Opportunity Classes

Indicator	Class 1 (‘Ahihi-Kina’u Natural Area Reserve)	Class 2 (‘Ahihi Bay, Keone‘ō‘io, east to Kanaloa)	Class 3 (Makena Beach State Park and offshore waters)
Complaints reported	X	X	X
Inter-party interaction	X	X	(Lack information)
Fish catch reports	X	(No standards)	(No standards)
Protected animal species sightings	(No standards)	(No standards)	(No standards)
Number /area cover of rare native plants	(Lack information)	X	(Lack information)
Percent invasive plant encroachment into wetlands	N/A	N/A	X
Physical impacts to anchialine ponds	X	(Lack information)	N/A
Water quality in anchialine ponds	(No standards)	(No standards)	N/A
Native shrimp populations in ponds	(No standards)	(No standards)	N/A
Use levels near coral reefs	X	X	(Lack information)
Percent coral damage	X	X	(Lack information)
% rock removal or erosion/wall destabilized	X	X	X

In cases where DLNR managers do not have enough information to set standards, they will need to focus their efforts on compiling and evaluating existing data and perhaps initiating the collection of new data. The primary constraint to these management actions will be the cost of these studies.

Opportunity Class 1

A goal of this opportunity class is to maintain a high level of resource integrity and a low level of crowding. In areas like “Aquarium” and “Fishbowl,” current use is not consistent with this goal, and social and resource integrity are being compromised. This requires immediate management action, including a willingness, where necessary, to restrict access. Access restrictions, if warranted by violated standards, may include the fencing off (or barricading) of important natural or cultural resources, or the implementation of use limitations, such as guided tours only.

Table 16: Opportunity Class 1 Management Actions

Standards	Existing Conditions	Management Actions	Costs, Benefits, & Constraints
Complaints reported An issue of concern expressed at 80% of the meetings (over 12 months) will receive priority. Issues that 90% of meeting participants think is important will receive priority. Reports of serious	Numerous complaints about overcrowded conditions and coral reef impacts in the NAR. Complaints for this area also include speeding cars along the county road	1. Compile and evaluate available data. 2. Clarify standards based on this evaluation 3. Provide trash receptacles in the Maonakala parking lot. 4. Conduct educational outreach	Costs of studies and signage. Vehicle speeds on the county road depend somewhat on the road condition. The DLNR should ask the County to advise them in advance of any future paving

human safety issues or serious resource abuse require immediate management action.	transecting the NAR.	5. Implement guided tours only, if necessary 6. Patrol	plans for this stretch of road. ² Two Rangers are funded by the HTA grant through 2007.
Inter-party interaction Reduce status quo peak use levels by 10%. These new levels should only be exceeded 10% of the time.	Use levels are too high on trails within the NAR. Use levels may be too high on the county road transecting the NAR (complaints of speeding and traffic accidents).	1. Continue collecting data at Maonakala, initiate car census surveys there, and compare use trends over time. 2. Compile any existing information for use levels on the two trails in the NAR. Document current conditions. 3. Complement this quantitative data with qualitative reports of visitor experiences during normal and peak use periods. 4. Study peak use conditions along the county road transecting the NAR (including use of the turnouts). 5. Set standards for use levels on the county road.	Cost of studies. HWF researchers are funded by the HTA grant through 2006. Two rangers, funded by HTA through 2007, could also help with research efforts. Volunteers available to assist.

² In the early 1980s, Keone‘ō‘io residents protested the paving of the County road leading to Keone‘ō‘io. Although they met with the Mayor then and more recently, when plans were laid to repave the road once more, they were not able to keep the road from being resurfaced. Residents complain that this resurfacing results in greater access to Keone‘ō‘io (Ventura 2002; Borges 2002). A 1968 environmental and urban design study of this area foresaw that the County would be pressured to improve the road into and beyond Makena, and that this improved access would perhaps be one of the greatest dangers the wilderness area would face (Warnecke, J.C. and Associates 1968:17).

<p>Fish catch reports Fishing is illegal in the NAR.</p>	<p>Illegal fishing is occurring within the NAR. At “Aquarium,” the DLNR documented that large edible fish were less frequent and appeared more wary than in the past.</p>	<ol style="list-style-type: none"> 1. Rangers and naturalists will report any poaching occurring. 2. Prosecute poachers 3. Offer free community workshops to educate the community about how restricted fishing in the NAR enhances biodiversity and recruitment levels along this coastline, leading to better fishing in the long-term. 	<p>DLNR DOCARE: limited enforcement funding constraint (possible solution is to coordinate efforts with NOAA, the Maui Police, the Maui Citizen’s Patrol, and others)</p> <p>Prosecutions can be time-consuming and expensive.</p> <p>Two Rangers funded by the HTA grant through 2007</p> <p>Naturalists, trained by HWF, could undertake education efforts.</p> <p>Funding required to organize/develop free community workshops</p>
<p>Physical impacts to anchialine ponds No more than 5% of the algal surface area of the ponds should show signs of human disturbance.</p>	<p>In 2002, footprints were observed in the algal layer of one of the ponds within the NAR; these footprints lasted for months. No comprehensive data is available for this analysis.</p>	<ol style="list-style-type: none"> 1. Compile/develop a digital photo database of existing conditions of these ponds. 2. Initiate educational outreach efforts. 3. Install signage. 4. Allow only guided hikes and/or close areas off to general public. 5. Patrol 	<p>Cost of developing a database</p> <p>On-site naturalists funded by the HTA grant through 2006.</p> <p>Cost of signs</p> <p>Legalities of area closures. Does the NARS Commission have the authority?</p> <p>Two Rangers funded by HTA through 2007.</p>

<p>Use levels near coral reefs 90% of monitoring surveys show a decrease in current use by 10%</p>	<p>The August 2003 DLNR rapid assessment survey recorded three kayaks groups and a number of hikers arriving at the “Fishbowl.” At one point there were more than 34 people in the water in this one small cove.</p>	<ol style="list-style-type: none"> 1. Conduct additional use surveys 2. Decrease current use levels by allowing guided trips only. 3. Educational outreach efforts and signage 4. Patrol 	<p>Cost of surveys and signage.</p> <p>Deciding on who should lead guided tours/costs associated with this.</p> <p>Two Rangers funded by HTA through 2007 for patrols.</p>
<p>Percent coral damage 5% improvement above current conditions (immediate management action required).</p>	<p>Shallow-growing corals, in particular, have been impacted at the “Aquarium.” There is also a small, healthy robust coral reef immediately outside of the cove at “Fishbowl.” Both bays show evidence of trampling, coral breakage, and coral abraded by shreds of plastic from kayaks.</p>	<ol style="list-style-type: none"> 1. Continue to inventory baseline conditions and conduct studies as necessary. 2. Place buoys to demarcate the “no motorized zone” in the waters surrounding the NAR. 3. Enforce the “no motorized zone.” 4. Recreational use will be limited to guided tours. 5. Allow access for appropriate cultural and traditional uses.³ 6. Patrol 	<p>Cost of studies</p> <p>Enforcement cases regarding violations in the “no motorized zone” have, in some cases, been thrown out of court, and DLNR officers held in contempt of court for presenting what was considered too little evidence.</p> <p>Buoy installation in the NAR funded by the HTA grant, so restrictions should be clearer.</p> <p>Two Rangers funded by HTA through 2007.</p> <p>DLNR has limited enforcement funding</p>

³ The only legal exception to the ban on fishing in the NAR is through the issuance of a permit for traditional cultural fishing practices. In 1998 a working group was convened to address the question of allowing traditional cultural fishing practices in the NAR (Ahihi-Kinau Working Group 1998), and a one year permit was issued to one local family of Hawaiian descent in October 1999. Two extensions of the permit were granted; the last one expired in August 2001 (Evanson 2005).

Percent coral damage (continued)			<p>Authority of NARS Commission to limit use of the trails and bays?</p> <p>Deciding on who should lead guided tours/costs associated with this. Tours may be able to draw on the volunteer base for support.</p>
Percent rock removal or erosion/ wall destabilization No additional damage beyond baseline conditions for all archaeological sites, features, and trails.	Archaeological sites and features within the NAR have been compromised. Not all are inventoried. Important complexes include the Maonakala Complex and the westernmost section of the La Perouse Archaeological District.	1. Update inventory as much as possible. 2. Determine sites/features that will be monitored ⁴ 3. Create a digital photo database of several angles of each of the features chosen so that % rock removal and erosion/wall destabilization can be determined. 4. Protect sites with use limitations, barricades, fences, and/or signage as necessary. 5. Prevent camping and off-road vehicle use in this area. Issue fines as necessary. 6. Stabilize and restore sites as required to restore	<p>Archaeological sites are protected by law</p> <p>Cost of a complete archaeological inventory would likely be exorbitant but HTA grant is funding mapping efforts through 2006</p> <p>Cost of creating a digital database</p> <p>Authority of DLNR to limit use</p> <p>Cost and time required for site stabilization and/or restoration</p> <p>Naturalists funded by the HTA grant are already providing on-site educational outreach</p>

⁴ Management will be based primarily on cultural significance and condition level. The most culturally significant sites will receive higher priority, and the most intact sites will receive higher priority (due to the complication and expense involved in trying to restore sites that have already been heavily degraded).

⁵ A Hawaiian cultural specialist, funded by the HTA grant, will complement the on-site naturalist education efforts. Community programs could be offered occasionally to keep the community involved and better educated about the cultural importance of the area. There will be an effort by naturalists to use Hawaiian place-names.

Percent rock removal or erosion/ wall destabilization (continued)		below-minimum standards. 7. Conduct educational outreach to visitors, residents, and landowners. ⁵ 8. Place signage where appropriate. 9. Patrol	HTA-funded Rangers can take the lead on patrols
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Opportunity Class 2

The goal of this opportunity class is to balance resource integrity and solitude conditions with providing a fairly diverse array of commercial and non-commercial recreational opportunities in a safe, clean environment. Current uses and conditions at ‘Ahihi Bay and Keone‘ō‘io are primarily consistent with this goal, although there have been episodes of resource damage and overcrowding that will require immediate management action. Current use levels east of Keone‘ō‘io to Kanaloa are much lower, and use appears consistent with this goal. Management will focus on human safety and on balancing social and resource integrity with limiting use restrictions as much as possible. Resources that will not be compromised (and may be managed as restricted point zones) include threatened and endangered species, anchialine ponds, rare native plants, unique geological features, pristine coral reef, and the most culturally significant archaeological sites, features, and trails that are in good to excellent condition.

Table 17: Opportunity Class 2 Management Actions

Standards	Existing Conditions	Management Actions	Costs, Benefits, & Constraints
<p>Complaints reported An issue of concern expressed at 80% of the meetings (over 12 months) will receive priority. Issues that 90% of meeting participants think is important will receive priority. Reports of serious human safety issues or serious resource abuse require immediate management action.</p>	<p>Appendix 6 details some of the illegal activities occurring at Keone‘ō‘io, and Appendix 11 details accounts of litter and coral rock graffiti occurring there. Complaints for this area also include illegal drug use at night at Keone‘ō‘io. Generally a low level of complaints from Cape Hanamanioa to Kanaloa Point.</p>	<ol style="list-style-type: none"> 1. Compile and evaluate available data. 2. Clarify standards 3. Continue to provide trash receptacles and port-o-potties at Keone‘ō‘io. 4. Do not pave the parking area at Keone‘ō‘io. 5. Maintain “no camping” signage in areas of Keone‘ō‘io unsuitable for camping. 5. Post “no motorized vehicle” signs on the Hoapili Trail. 6. Respond to serious human safety and resource abuse issues with fines/citations. 6. Address the need for legal camping areas (consider fire danger, water, and sanitation issues). 7. Approach media sources to print information on rules, such as no trespassing at properties like the Schatz Estate. 8. Patrol the area (including nighttime patrols as needed at Keone‘ō‘io) 	<p>Costs of studies and signage.</p> <p>Two Rangers are funded by the HTA grant through 2007.</p> <p>Camping at Keone‘ō‘io is currently illegal. The water supply in the area is marginal and sanitation facilities limited.</p> <p>Fire danger is present in this dry area and residential homes are in the vicinity.</p>

<p>Inter-party interaction Status quo peak use levels only exceeded 10% of the time</p>	<p>Friends of Keone‘ō‘io data show an average of 705 people arriving at Keone‘ō‘io on a daily basis, with a range of 365 to 980 people per day. The average number of vehicles arriving per day is 296, with a range of 143 to 396.</p> <p>Peak arrival time at Keone‘ō‘io is between 11am-noon, with roughly 12% of the day’s 705 visitors arriving, which is 85 people.</p>	<ol style="list-style-type: none"> 1. Continue collecting car census survey data at Keone‘ō‘io and compare use trends over time. 2. Complement this quantitative data with qualitative reports of visitor experiences during normal and peak use periods. 3. Rangers will be notified by on-site naturalists if use levels are too high and some vehicles need to be directed back towards Makena. 4. Study peak use conditions at ‘Ahihi Bay and east of Keone‘ō‘io to Kanaloa. 5. Set standards for ‘Ahihi Bay and east of Keone‘ō‘io to Kanaloa. 	<p>Much of this land is owned by Ulupalakua Ranch for cattle grazing.</p> <p>Car census surveys at Keone‘ō‘io are funded by the HTA grant through 2006.</p> <p>Cost of funding for implementing additional studies not funded by HTA.</p> <p>Two rangers are funded by HTA through 2007, and could assist with data collection.</p> <p>Volunteer naturalists, trained by HWF, could assist with data collection.</p> <p>Jurisdiction issues over the county road need to be resolved.</p>
<p>Number (or area of cover) of rare native plants Do not exceed 5% loss (either of cover or of individual plants, as determined by biologists) of the current ‘ihi, akoko, mai‘apilo, or pololei populations.</p>	<p>Many species of native plants occur at Keone‘ō‘io (including ‘ilima and naupaka), none of which are extremely rare, listed, or candidate species. Some, but fewer, species of native plants occur at ‘Ahihi Bay, including naupaka.</p>	<ol style="list-style-type: none"> 1. Compile and analyze available data (lower priority than in the nature conservation opportunity class). 2. Conduct more plant surveys 3. Revise standards as necessary based on new information. 4. Use barricades, as necessary, to protect plants from vehicles and animal trampling. 	<p>Cost of studies</p> <p>Potential for vandalism (or other damage) of plant barricades</p>

<p>Use levels near coral reefs 80% of monitoring surveys show current (or lower) use levels</p>	<p>Peak boat use in La Perouse Bay occurs between 8:00am-10:30am. Mean use levels are low (<1 boat per half hour). Data on the number of snorkelers, swimmers, kayakers, divers, surfers, and windsurfers using La Perouse Bay is available for analysis. Use levels east of Keone‘ō‘io to Kanaloa tend to be low.</p>	<ol style="list-style-type: none"> 1. Compile and analyze available data 2. Conduct additional surveys for ‘Ahihi Bay. 3. Revise standards as necessary based on newly analyzed information. 4. Educational outreach efforts and signage 5. Patrol 	<p>HWF will soon be compiling a habitat map of La Perouse Bay as part of the CZM grant. Once this map is completed, it can be used by managers to choose strategic locations within the bay for monitoring (for example, those areas of high coral cover that overlap with frequent boat use).</p> <p>Cost of studies</p> <p>Rangers and naturalists currently funded by the HTA.</p> <p>A large volunteer base available to help with monitoring efforts.</p>
<p>Percent coral damage Status quo maintained based on current conditions. No additional damage allowed.</p>	<p>Several places within La Perouse Bay, including the pinnacle, have an extremely high coral cover of 60%-80%. A number of rare species of coral occur within La Perouse Bay. The only area with visible human impact was offshore “Planks,” where large amounts of marine debris in the form of heavy ulua fishing gear were</p>	<ol style="list-style-type: none"> 1. Compile and analyze data for ‘Ahihi Bay. 2. Naturalists and rangers will engage in educational outreach efforts. 3. Commercial boats using La Perouse Bay will be required to give environmental briefings to their passengers. 4. Boats will be encouraged to use the mooring or to anchor only in sandy areas (they 	<p>Legalities of implementing use limitations.</p> <p>If use limitations are implemented for La Perouse Bay, managers must consider what kinds of transfer impacts (or recreational use pressures) this will cause elsewhere on the island.</p> <p>Some areas are remote and may be hard to consistently survey</p>

<p>Percent coral damage (continued)</p>	<p>found.</p> <p>No data on ‘Ahihi Bay was available for this analysis.</p> <p>The coral reef system is healthy and stable offshore Keone‘ō‘io and Kanaloa.</p>	<p>will be provided with a habitat map of these zones).</p> <p>5. Implement use limitations (such as the number of times boats can use the area on an annual or monthly basis) if necessary to maintain minimum standards.</p>	<p>Tourism forms the basis of Hawaii’s economy, and commercial operations need to be accommodated where possible.</p> <p>Cost of studies</p> <p>Rangers and naturalists funded by HTA.</p>
<p>Percent rock removal or erosion/ wall destabilization</p> <p>No additional damage to the most culturally significant sites, features, and trails that are in good to excellent condition⁶ (scoring 70 and above, as determined by the Hawaiian community and archaeologists).</p>	<p>Four village complexes located here: La Perouse Archaeological District, Keawanaku Complex, Wawaloa Complex, and Kanaio Waialio Complex.</p> <p>Existing conditions and inventory levels vary throughout the management area. One of the heaviest concentrations of sites is at Keone‘ō‘io. Paalua Heiau and Site 1805 as hotspots of abuse. Four-wheel drive vehicles making their own “roads” in this roadless area to access favorite fishing and camping</p>	<p>1. Update inventory as much as possible.</p> <p>2. Determine sites/features that will be monitored</p> <p>3. Create a digital photo database of several angles of each of the features chosen so that % rock removal and erosion/wall destabilization can be determined.</p> <p>4. Protect sites with use limitations, barricades, fences, and/or signage as necessary.</p> <p>5. Prevent camping and vehicle use in this area. Issue fines as necessary.</p> <p>6. Stabilize and restore sites as</p>	<p>Archaeological sites are protected by law</p> <p>Cost of a complete archaeological inventory would likely be exorbitant but HTA grant is funding mapping efforts through 2006</p> <p>Cost of creating a digital database</p> <p>Does the DLNR have the authority to limit use (or install gates) in some of these areas?</p> <p>Much of the land east of Keone‘ō‘io is owned by Ulupalakua Ranch</p>

⁶ Sites in good to excellent condition are more cost-effective to stabilize or restore than highly damaged sites.

⁷ Local fishermen representatives could meet with Ulupalakua Ranch personnel to determine whether keys could be provided for access to “Planks” for ulua fishing.

⁸ Educational signage will be erected at some sites, but many sites will be kept “oblique”, so as not to attract attention and potential damage. In the 1977 park plan, the Maonakala village site was recommended to be displayed for self-interpretation through the use of signs identifying features and explaining their historical and cultural significance (Mogi 1977).

Percent rock removal or erosion/ wall destabilization (continued)	spots have been particularly damaging to the archaeological features (NPS 2002). Appendix 14 has more information on specific abuses at Keone‘ō‘io.	required to restore below-minimum standards. 7. Educational outreach to visitors, residents, and landowners. 8. Educational signage where appropriate. 9. Install a gate to limit vehicle use in Areas 2-4 at Keone‘ō‘io. ⁷ 10. Patrols ⁸	Areas east of Keone‘ō‘io are intermittently used by the Hawaii Army National Guard for military training purposes ⁹ Cost and time required for site stabilization and/or restoration Naturalists funded by the HTA grant are already providing on-site educational outreach Educational signs have been paid for an already designed. They are just awaiting official SHPD acceptance. HTA-funded Rangers can take the lead on patrols
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Opportunity Class 3

The top priority of Class 3 is to provide a diverse array of commercial and non-commercial recreational opportunities in a safe, clean environment. Restrictions on access and behavior will be avoided as much as possible, or minimized to the extent possible. The use of Makena Beach State Park and its offshore waters is primarily consistent with this goal, although, for the purposes of this paper, no information on

⁹ The Hawaii Army National Guard currently has a lease arrangement with the DLNR to use a portion of the land in the eastern part of the management area as a military exercise and training area. In the past, training has consisted mostly of aerial bombardment of ground targets by low-flying aircraft (King 2002).

actual use levels was available. Management may initially need to focus on collecting that kind of data. Management will also focus on human safety (which may be of more concern in this opportunity class as a result of higher use levels) and will allow more lax restrictions on crowding and on some natural and cultural resources. Resources that will not be compromised (and may be managed as restricted point zones) include threatened and endangered species, anchialine ponds, rare native plants, unique geological features, pristine coral reef, and the most culturally significant archaeological sites, features, and trails that are in good to excellent condition.

Table 18: Opportunity Class 3 Management Actions

Standards	Existing Conditions	Management Actions	Costs, Benefits, & Constraints
<p>Complaints reported An issue of concern expressed at 80% of the meetings (over 12 months) will receive priority. Issues that 90% of meeting participants think is important will receive priority. Reports of serious human safety issues or serious resource abuse require immediate management action.</p>	<p>Complaints include port-o-pottie vandalism at Makena Beach State Park and lack of legal camping sites.</p>	<ol style="list-style-type: none"> 1. Compile and evaluate available data. 2. Clarify standards. 3. Patrol 4. Address priority issues (such as the need for legal camping areas). 5. Maintain port-o-potties, trash receptacles, picnic tables, and the paved parking lots. 6. Respond to serious human safety and resource abuse issues with fines/citations. 	<p>DLNR has limited enforcement funding (possible solution is to coordinate efforts with NOAA, the Maui Police, the Maui Citizen's Patrol, and others)</p> <p>A history of port-o-pottie vandalism (burning) at Makena Beach State Park and replacement costs</p>

<p>Percent kiawe or <i>B. maritima</i> encroachment Cannot encroach into more than 15% (or other percentage as determined by biologists) of open water.</p>	<p>The DLNR has a 30-year database on percent vegetation cover and percent open water at the Paniaka I and Paniaka II wetlands at Makena Beach State Park.</p>	<ol style="list-style-type: none"> 1. Continue current monitoring and add a water quality monitoring component if necessary. 2. Clear invasive plant species to stay within standards. 3. Remove litter from wetlands. 4. Fence wetlands, if necessary, to keep people, litter, and feral animals out. 5. Once fenced, initiate predator control measures (primarily for anis deer, mongoose, and feral cats) to protect the endangered birds. 	<p>Wetland studies already being conducted by DLNR. They may be able to add in the additional water quality component with no or minimal extra cost.</p> <p>Cost of invasive plant removal and fencing</p> <p>The developer owning the land on which the “Maluaka” wetland occurs, may clear trees, fence the wetland, and engage in predator control.</p>
<p>Percent rock removal or erosion/ wall destabilization No additional damage to the most culturally significant sites, features, and trails that are in good to excellent condition (scoring 70 and above, as determined by the Hawaiian community and archaeologists).</p>	<p>The Makena Complex occurs in the northern section of Makena Beach State Park.</p>	<p>See recommendations in Class 2 (all but #9 apply)</p>	<p>Archaeological sites are protected by law</p> <p>Cost of a complete archaeological inventory would likely be exorbitant but HTA grant is funding mapping efforts through 2006</p> <p>Cost of creating a digital database</p> <p>Does the DLNR have the authority to limit use (or install gates) in some of these areas?</p> <p>Rangers and naturalists available</p>

In summary, in step 7 managers identify a continuum of management actions for the social and resource indicators relevant to each of the three opportunity classes. The costs, benefits, and constraints of these potential management actions are also identified. Within this section, the difference between inventoried conditions (from step 4), and minimum standards (from step 5) is determined. Areas within the management area that are found to be substandard are ideally presented in map form for all of the alternatives, along with a list of the management actions needed to bring them up to standard.

Management actions suggested are reflective of the specific managerial conditions appropriate for each of the opportunity classes, as defined in step 2, for the purpose of protecting social and resource values identified in step 1. The continuum of potential management actions provided in this step offers both preventive and restrictive/corrective options. Management should draw on cultural knowledge when considering final management actions, as informed by cultural representatives. The area should be managed as one ahupua'a, and educational outreach efforts and signage should reflect the Hawaiian cultural heritage. For example, the use of Hawaiian words, such as "kapu" (taboo), should be considered for use in signage.

Securing funding for management beyond the HTA grant will be a priority. The DLNR and their Advisory Committee need to discuss future funding sources for the management and protection of this area. User fees are one alternative. Funding could be in the form of voluntary memberships for residents, and mandatory user fees for non-residents. Government grants are another alternative. For example, the Dingell-Johnson and the Wallop-Breaux Amendment of the Pittman-Robertson Wildlife Restoration Act provides federal funding for several programs, including Aquatic Resource Education,

Coastal Wetlands Planning, Clean Vessel Pumpout, and Boating Infrastructure (which includes money for mooring buoys). The federal government pays 75% and the state pays 25% (Fish and Wildlife Service 2004).

Volunteer trainings could be conducted several times a year to increase the support base for paid personnel. Special programs and annual recognition events for volunteers could be held to keep interest in the program strong.

Step 8: Evaluation and Selection of An Alternative

Purpose: The purpose of step 8 is to finalize the opportunity class allocations and a specific management program to achieve the desired conditions.

Process: In this step managers analyze, and receive public input on, all the resource, social, and managerial costs as compared to the resource and social benefits. Public participation will play an important role in selecting the final alternative and will lend credibility to implementation efforts.

Product: The product of this step is the final allocation of opportunity classes and the selection of a management program.

Questions to ask that can guide managers through this step are (Stankey et al. 1985):

1. What user groups are affected and in what ways are they affected? Are certain groups restricted? Is the purpose of other groups furthered?
2. Which values are promoted and which diminished?

3. How does a particular alternative fit into the regional and/or national supply and demand considerations? Does the alternative contribute a unique kind of wilderness/recreational setting to the system?
4. What is the feasibility of managing the areas as prescribed, given budget, personnel, legal, and other constraints? What is the political climate?

A variety of costs need to be considered in this step. These include financial costs (personnel and materials), information costs (costs associated with acquiring information needed to implement actions), and opportunity costs associated with not carrying out a proposed action (Stankey et al. 1985). While some of these costs are difficult to quantify monetarily, the mere recognition of their existence will improve the ability of managers and the public to evaluate each alternative.

At this point in the LAC process the components of the alternative management plans have been defined to a level of specificity allowing for very focused public participation. Stakeholders will be better able to understand how the different alternatives affect their specific interests, so their comments can be focused on specific assumptions, actions, or areas in the alternatives.

Step 9: Implement Actions and Monitor Conditions

Purpose: The purpose of step 9 is twofold: 1) to implement a management program that will achieve the objectives of the selected alternative, and 2) to provide periodic, systematic feedback regarding the performance of the management program.

Process: Step 9 does not involve managers in a new process. Rather, it requires that managers periodically reassess existing conditions (step 4 inventory), and make a comparison of those conditions to the standards (as was done in step 7). Monitoring will guide when changes in management actions are warranted, and will provide feedback on the effectiveness of those actions.

Product: The product of step 9 is a summary of the relationship between existing conditions and standards for indicators in all of the opportunity classes (updated over time).

Monitoring gives managers early warning signs of potential problems and negative trends, and provides the hard data upon which to gauge when standards have been violated. Managers need to be alert to changes in external circumstances that could affect resource and social conditions within the management area. These include adjacent land uses, population growth, or the relative availability of alternative types of recreational opportunities (Stankey et al. 1985). Impacts from these adjacent uses may be resolved through management actions within the existing plan, or, in the case of major external changes, fundamental alterations in management objectives may be required.

Monitoring can also be used to evaluate the effectiveness of management actions and serve to improve future programs. If monitoring indicates that conditions remain better than standards, then current uses of the area can be maintained until monitoring shows that standards will likely be exceeded. If monitoring shows that conditions have deteriorated to below standards, then immediate management action to improve

conditions is required. If these conditions do not improve over time under the new management actions, then these actions can be judged to be ineffective and replaced with more effective efforts. An action may prove ineffective for various reasons. The action itself may have been appropriate, but its implementation not effective or the program may not have been in place long enough to yield the desired result. Trends reflected in the monitoring data will be helpful in indicating where the problem lies (Stankey et al. 1985).

A major concern regarding monitoring is how frequently it should be done. The monitoring plan should attempt to balance the trade-off between the desire for more information with the reality of limited financial resources. In general, monitoring priority should be given in situations where (Stankey et al. 1985):

1. Conditions were very close to standards at the time of the last assessment
2. Rates of resource or social change are judged to be the highest
3. The quality of baseline data is the poorest
4. The understanding of management action effects is the poorest
5. There have been unanticipated changes in factors such as access or adjacent land uses.

Chapter 4 Summary

- The proposed management area stretches across roughly nine miles of shoreline from Makena Beach State Park to Kanaloa, extending roughly half a mile inland from shore, and roughly 600 yards offshore. It contains the 'Ahihi-Kina'u NAR, the state unencumbered lands of Keone'ō'io, and hundreds of acres of Ulupalakua Ranch land.

- The management area contains spectacular white sand beaches and a rugged a'a landscape containing numerous archaeological features (including six village complexes). Endemic and federally protected plant, terrestrial animal species, and marine species are found in the area. Biologically unique features include coral reefs, lava caves, wetlands, and anchialine ponds.
- Step 1 of the LAC model identifies the values of the area to be maintained or achieved. The rest of the steps in the model rely on this values identification. The values of South Maui can be summarized into cultural preservation values, nature conservation values, and recreation values.
- Step 2 defines a series of opportunity classes for the management area based on desired future conditions. Three opportunity classes were recommended for South Maui that represent a sliding scale of compromise between low access and low resource compromise (Class 1) to high access and high resource compromise (Class 3).
- Step 3 identifies easily measurable, and preferably quantifiable, indicators that reflect social and resource conditions. Examples of two indicators were given for the social factors of user conflicts and solitude, and examples of ten indicators were given for the resource factors of the presence of protected animal species, and the condition of fish stock, native plants, wetlands, anchialine ponds, coral reefs, and archaeological sites, features, and trails.
- Step 4 is an inventory of the range of existing conditions of the resource and social indicators identified in step 3. Several sources of information were suggested that can

be used to help create the comprehensive inventory map of South Maui required in this step.

- Step 5 assigns standards of minimally acceptable conditions to the indicators (in each of the opportunity classes to which the indicator applies). Table 14 lists all standards.
- Step 6 identifies where the opportunity classes should be allocated within the management area. The NAR was selected as Opportunity Class 1, ‘Ahihi Bay, La Perouse Bay, Keone‘ō‘io, and east to Kanaloa were selected as Opportunity Class 2, and Makena State Beach Park and its surrounding offshore waters were selected as Opportunity Class 3.
- Step 7 identifies a continuum of management actions for each of the social and resource indicators. Tables for each of the three opportunity classes are given in this step, listing the standards and existing conditions of these indicators, along with management actions and costs, benefits, and constraints to be considered.
- Step 8 finalizes the opportunity class allocations and identifies a specific management program to achieve the desired conditions. Questions designed to guide managers through this step are given.
- Step 9 involves implementing the management actions and monitoring conditions. Monitoring guidelines are suggested.

CHAPTER 5: CONCLUSION

The Limits of Acceptable Change model appears to be a useful tool for DLNR in the formation of a long-term management plan for South Maui. The model is comprehensive enough to allow for an ahupua'a style of management, and flexible enough to allow for adjustments in the process over time as new issues or needs arise. The resources should be adequately protected while still allowing recreational use within the management area. Sensitive natural and cultural resources, many of which are found in the 'Ahihi-Kina'u NAR, are placed in the opportunity class prioritizing their protection. Resources occurring in other, less restrictive, opportunity classes can still receive maximum protection through their management as restricted point zones within those opportunity classes.

The monitoring step is critical to ensuring that the values identified during the LAC process are adhered to. A criticism of the 1987 LAC implementation in the Bob Marshall Wilderness is that not enough monitoring has occurred (Moisey 2005). Monitoring requires a strong agency commitment and funding. While there is often funding for the planning phase of projects, there is not always funding available for monitoring (Moisey 2005). Without monitoring, there is no way to determine whether current conditions are within standards, and therefore no mechanism for triggering protective management actions.

Agency culture affects how LAC is used (McCool and Cole 1997). For some protected management agencies these steps closely follow existing planning processes, while for others the LAC system may represent a significant departure. Implementing the

LAC model does require some changes in bureaucracy, which brings up issues of training, knowledge transfer, longevity, and funding (McCool 1996).

Difficulties that the DLNR and their Advisory Group may face while instituting this model include the challenge of getting stakeholders to come to a grudging agreement over values and goals, upon which the rest of the management model is based. Indicators, standards, management, and monitoring all have to relate back to these values and goals. While quantifiable indicators are easier to base management decisions upon, due to time and money constraints, some indicators may need to be qualitative. Initiating management actions based on qualitative evidence is more challenging and will require more explanation.

Another challenge the DLNR may face is that, while support for long-term protection of this area has gained momentum, many of the key stakeholders are out of patience. It may be difficult to convince them that taking the time to implement the LAC model is worthwhile. It will be important to clearly outline from the beginning the benefits of using this approach.

The exercise of using the LAC model to frame South Maui resource and cultural preservation issues has exposed some weaknesses in the current approach used by the DLNR. While the DLNR is commended for holding community meetings on Maui to address the community's concerns, these community meetings could be more productive. A review of the meetings minutes of the Friends of Keone'ō'io, the Keone'ō'io-Kanaloa Working Group, and the Keone'ō'io-'Ahihi-Kina'u Advisory Group indicate that there has been progress in identifying issues, values, and management options, but that little has been achieved in reaching a consensus regarding values and goals, or in identifying

indicators, standards, or monitoring approaches. The implementation of the LAC model at this juncture in the process could prove very helpful in addressing these issues that are not equally represented at current meetings.

Employing the LAC process could also lead to more balanced decision-making. A host of options are available to DLNR managers, yet often it is the more extreme management measures that receive the most attention at the meetings and in the media. The HTA grant has provided funding for two rangers and part-time naturalists to provide an on-site presence, education outreach, and enforcement. In other words, the tools are now in place for managers to influence visitors at the site, which reduces the need for complete site closure.

The LAC process would also assist the DLNR at community meetings where differentiating between proposed ideas and management actions has been problematic. Fishermen at community meetings in September 2004 were fearful of proposed management actions that would exclude access. The extent of excluded access (whether 24 hours or nighttime only), and what would be excluded (vehicles only, or no access allowed), were not clearly defined at these meetings. In addition, it was not made clear whether traditional user groups would still be allowed access. Many community members assumed that these ideas were going to be implemented as management actions, rather than viewing them as discussion points.

Accountability is important in nurturing and maintaining the public's trust. By working through the LAC process, managers should be able to avoid restricting and regulating visitors and residents except when and where truly necessary (Stankey et al. 1985). Any management actions that are implemented will be based on common

community values established in the beginning of the process and for the purpose of maintaining agreed-upon standards.

Recently, on January 12, 2005, the NARS Commission in Honolulu unanimously approved a motion to request the Board of Land and Natural Resources to use whatever emergency declaratory powers they have to immediately close off to the public the makai (ocean) side of the 'Ahihi-Kina'u NAR and its access to "Aquarium" and "Fishbowl" (Evanson 2005). While this may be an appropriate emergency measure based on the DLNR Rapid Assessments of the area (DLNR 2003), as a long-term management strategy it falls into the "most controversial" category. As McCool (1996) stated, limiting use is "...one of the most intrusive actions that managers could deploy" (p.6). There is also some question as to whether the Board has the power to do this since currently the authority to close areas is not within DLNR rules (Evanson 2005). At a minimum, the DLNR will place rocks and boulders to block off parking areas that facilitate access to "Fishbowl" and "Aquarium." As McCool and Cole recommend (1997), planning needs to be grounded in legislation and with an understanding of the realistic constraints and parameters that must be worked within.

One constraint that must be recognized is that the future manager of South Maui's resources is uncertain. Congressman Ed Case may be requesting the area be designated as a National Seashore (a seacoast recreational area that is protected and maintained by the federal government for public use), or that the National Park option be revisited. In addition, the Hawaiian Sovereignty Movement is gaining strength in Hawaii, and the ownership of ceded lands by the state remains controversial among Hawaiian sovereignty advocates.

With these uncertainties in mind, a viable option for the DLNR at this juncture is to use the LAC model to structure a comprehensive long-term management plan for the cultural and natural resources of South Maui. The LAC process provides a publicly acceptable method of setting standards that should be adequate for protecting the resources. The indicator standards trigger management actions and can be modified and further refined based on feedback from the monitoring process. As such, the LAC model is the simplest available approach for effectively dealing with the complexity of the contentious issues inherent in any “messy” system. It is being used to protect resources and the visitor experience throughout the United States and abroad. It is recognized by prominent scientists as a concept that surpasses the older idea of recreational carrying capacity; it moves beyond numbers and better encompasses the critical interaction between human and natural systems at every level (Howard and Potter 2002).

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APPENDIX 1

Resident and Visitor Questionnaires

(Friends of Kconc‘ō‘io and HWF)

VISITOR
FRIENDS OF KEONE'O'IO
QUESTIONNAIRE

Date: _____
Time: _____

Aloha, and mahalo for taking the time to answer the following questions. The data gathered will help determine usage patterns of this area and will aid in its conservation.

1) How did you hear about Keone'o'io (La Perouse)?

- ☐ hotel concierge: _____
- ☐ magazine/newspaper: _____
- ☐ television: _____
- ☐ just stumbled upon it (did NOT hear about it)
- ☐ other, please specify: _____

2) What attracted you to this area? (Please do not answer if you "just stumbled upon it")

- ☐ Fishing
- ☐ Camping
- ☐ Swimming
- ☐ Snorkeling
- ☐ Kayaking
- ☐ Hiking (archaeological sites)
- ☐ Other, please specify: _____

3) What did you actually do here today?

- ☐ Fished
- ☐ Camped
- ☐ Swam
- ☐ Snorkeled
- ☐ Kayaked
- ☐ Hiked (explored archaeological sites)
- ☐ Other, please specify: _____

4) How long did you stay?

- ☐ Less than 1/2 hour
- ☐ Up to 1 hour
- ☐ Up to 2 hours
- ☐ More than 2 hours
- ☐ More than 4 hours
- ☐ Overnight

5) How many people are in your party?

6) What changes would you like to see?

This project is supported by a grant from the Hawaii Community Foundation and is coordinated by Hawaii'i Wildlife Fund. www.wildhawaii.org

RESIDENT
FRIENDS OF KEONE'O'IO
QUESTIONNAIRE

Date: _____
Time: _____

Aloha, and mahalo for taking the time to answer the following questions. The data gathered will help determine usage patterns of this area and will aid in its conservation.

How often do you use the bay?

- ☐ Less than once a month
- ☐ Once a month
- ☐ Two to three times a month
- ☐ Every week
- ☐ Other, please specify: _____

What do you do most often here?

- ☐ Fish
- ☐ Camp
- ☐ Swim
- ☐ Snorkel
- ☐ Kayak
- ☐ Hike
- ☐ Surf
- ☐ Other, please specify: _____

How long did you stay this visit?

- ☐ Less than 1/2 hour
- ☐ Up to 1 hour
- ☐ Up to 2 hours
- ☐ Up to 4 hours
- ☐ More than 4 hours
- ☐ Overnight

How many people are in your party?

What changes would you like to see?

If you would like to be informed of Keone'o'io news, future events and educational programs, please provide the following information (optional):

Name _____ Phone# _____
Address _____
City, State _____ ZIP _____
E-mail _____

This project is supported by a grant from the Hawaii Community foundation and is coordinated by Hawaii Wildlife Fund. www.wildhawaii.org

*Comments:

APPENDIX 2

Detailed Description of Friends of Keone‘ō‘io and HWF

Technical Survey Areas 1-8

Area 1 is the entrance to Keone‘ō‘io and includes the La Perouse monument, the two small parking areas in the vicinity of the monument, the larger shoreline parking area, and a portion of the upper jeep trail. Area 2 is adjacent to Area 1 and begins where the large boulders were placed in the shoreline parking area to prevent vehicles from driving along the shoreline. Included in Area 2 are the Paalua heiau, Site 1805 (the chief’s residence) as part of the Kalihi Cluster, a portion of the upper jeep trail, a shoreline trail that bypasses the blowhole and two small beach areas, and a point jutting out towards the water that is used by fishermen. Area 2 ends where the large sandy area begins and where the jeep trail hits the shoreline. This is the beginning of Area 3, where the jeep trail hugs the shoreline, passing near many archaeological features, including the adze-grinding/saltpan site, a canoe haul out, and several walls. There are also two grave crosses (for surfers) in this area, and a black cobble and white coral rock beach area. Area 4 begins with the beginning of the Hoapili Trail (roughly where the sign marks the trail) and includes the ridge of lava that extends out to include “Planks” and the other fishing areas on the lighthouse point. Area 5 is the easternmost half of the bay and Area 6 is the westernmost half. The dividing line between the two is mirrored on land by the divide between Areas 2 and 3 (i.e. at the sandy beach by the fishing point). Area 7 is the visible offshore waters outside of the bay, and Area 8 is the visible section of the NAR that is terrestrial and used by hikers. (The aquatic portion of the NAR that extends within the western edge of La Perouse Bay is counted as Area 6). The small bay in front of the Schatz property (the historic fishpond) is also counted as Area 6. However, use of the private shoreline there by sunbathers who trespass, is counted as use in Area 1.

APPENDIX 3

Summary of Sierra Club Report

“A Visitor’s View of Paradise”

In 1998 the Sierra Club conducted a Visitor Preference Survey entitled “A Visitor’s View of Paradise.” After the Conde Nast Travel magazine readers voted Maui the “number one island destination in the world” for two years in a row, the Sierra Club decided to find out why visitors go there and what makes them return. Hawaii spends millions on promotion; \$55 million in public funds were appropriated by the State Legislature in 1997 to expand promotion of Hawaii as a visitor destination (Sierra Club 1998). However, the state rarely explores the larger questions of why Maui is perceived as so attractive by so many.

In the course of five months the Sierra Club, Maui Group, collected 1000 surveys from visitors on Maui. The demographics and response patterns of visitors taking this survey were very similar to those found in larger surveys done statewide, such as the Hawaii Visitors and Convention Bureau 1996 Visitor Satisfaction Report (Sierra Club 1998). The preservation of Hawaii’s natural areas, rural charm and cultural identity were crucial in respondent’s decisions as to whether they would like to return to Maui. Fifty-three percent said excursions into nature were the most memorable part of their trip. Forty-six percent of visitors surveyed wanted to see more of natural coastlines and 40.0% wanted to see more of natural areas. Only 5.2% wanted more shopping, 3.0% wanted more luxury resorts and 2.8% more golf courses. The study also found that tourists are willing to pay more to protect Hawaii’s environment, and that building more to accommodate more tourists will only hurt the visitor industry. Eighty-one percent were willing to contribute one dollar to a land use trust (charged to their room rate) to preserve Maui’s natural areas, coastline, and Hawaiian cultural sites. Seventy-nine percent did not want to see infrastructure expanded to accommodate more visitors.

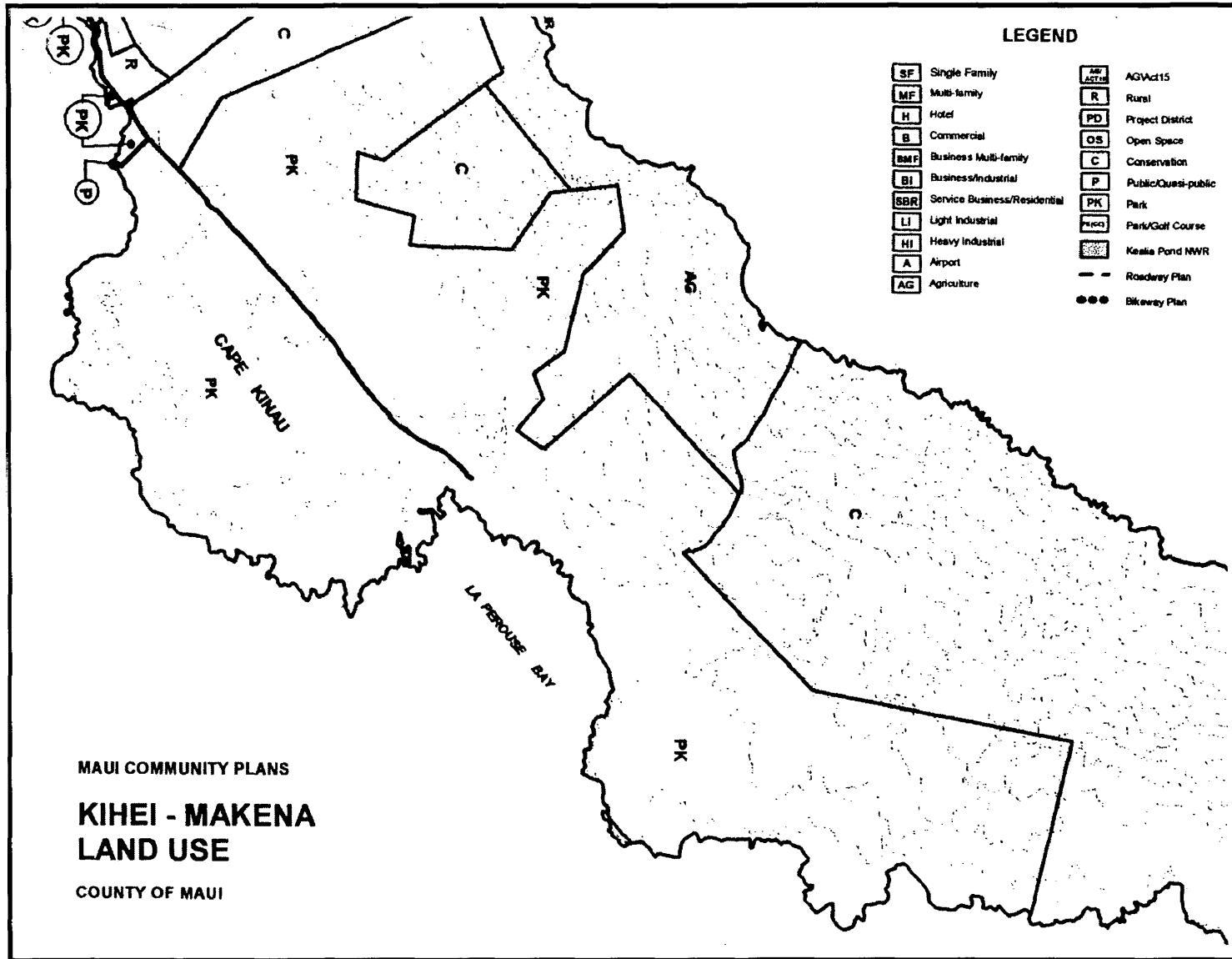
Some of the quotes from visitors included in the report were: “Don’t turn Maui into another Oahu.” “There is clearly a lot of unthought (sic) out expansion in Maui.” “I can’t believe the change from 24 years ago, when I was here. Less commercialization!” “I hope your decision makers know how important Maui’s natural environment is to people like me who come here and spend our hard earned dollars. If Maui becomes like Oahu I would have no interest in returning.”

The Sierra Club report (1998) concludes that “instead of spending more money to market Hawaii to tourists, the state needs to spend more money to protect Hawaii’s natural and cultural resources. Ninety-one percent of visitors indicated that the preservation of natural areas would be an important factor in their decision to return to the islands. Seventy-eight percent also indicated that the preservation of the Hawaiian cultural identity was also important.”

APPENDIX 4

Maui Community Plans, County of Maui

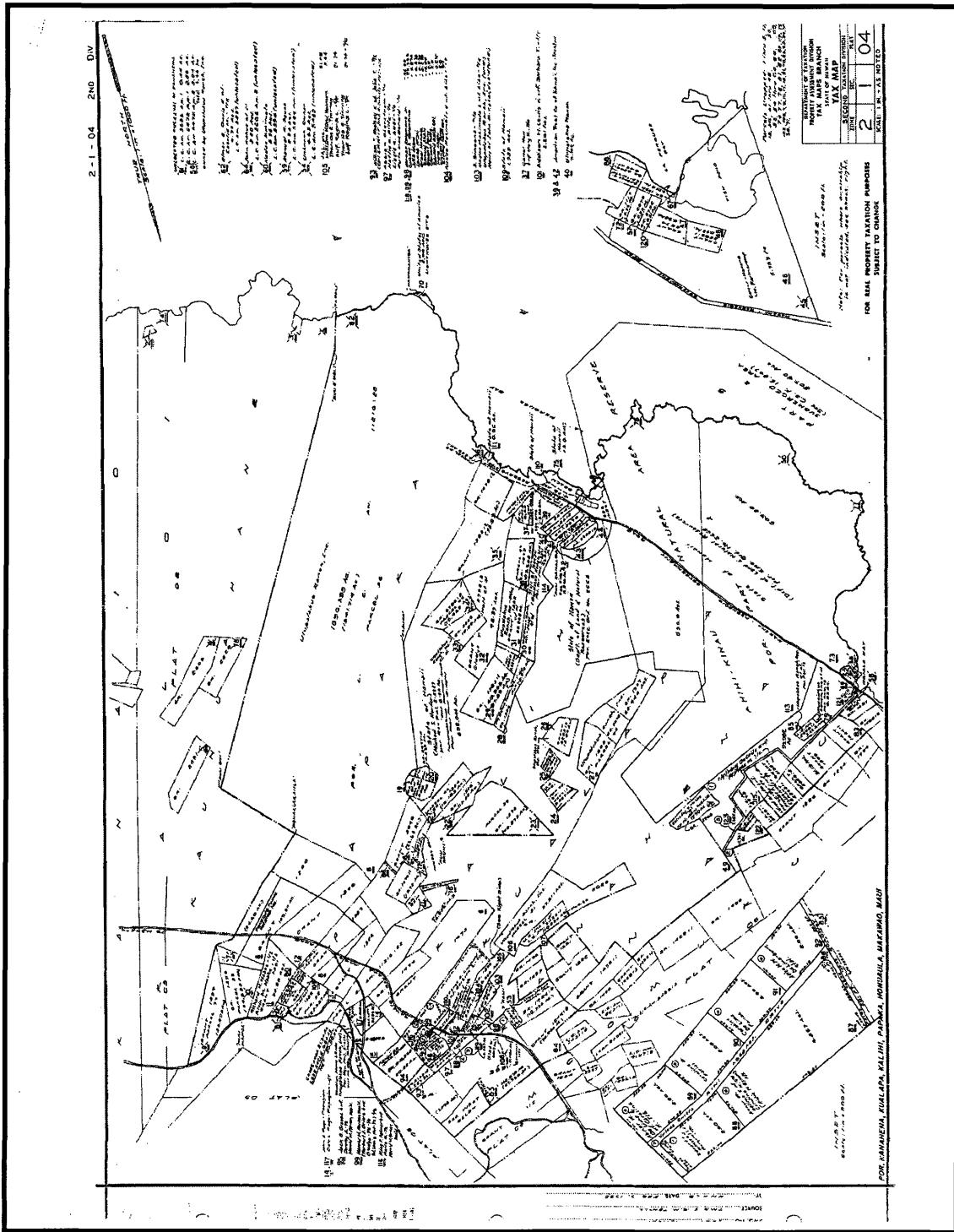
Kihei-Makena Land Use



APPENDIX 5

Tax Map Key

For ‘Ahihi-Kina’u NAR, Keone‘ō‘io, and Kanaio



APPENDIX 6

Illegal Activities at Keone‘ō‘io

Qualitative Data from Technical Surveys: August 2001-November 2002

Friends of Keone‘ō‘io

Topic: Camping/Campfires

<u>Date</u>	<u>Comment</u>
10/13/01	At 8:00am, two DLNR enforcement field officers came through the area to warn campers that if they were still there on Monday they would be told to leave. “Weekend campers” are tolerated , but that’s it.
10/26/01	I talked to one of the campers in Area 1 (of all places!). Two of the guys work for one of the kayak companies and the only way they can wake up early enough to get here on time is to sleep in their car/camp right there.
10/29/01	Two campers in one campsite in Area 2 (7am-11am)
11/15/01	A car pulled up at 5:55pm which I recognize from often being here early in the morning (the guy is sleeping in his car).
11/18/01	Richard Marks, who filled out a questionnaire, said that last night (Nov 17) there were about 50 people camping down at La Perouse to see the meteor shower. (Another camper I asked estimated that there were only 10-15 people.)
1/18/02	A campfire in Area 3 from 10:30am-just after noon.
1/18/02	At 12:50pm two DLNR DOCARE enforcement trucks drove down the jeep trail to Area 3. The two guys got out and walked to the larger campsite (only 2 left at this time, but they consisted of 5 tents total). I know that one of the tents has been there since last Thursday (Jan 10), if not longer. I don’t know exactly what was said, but the campers immediately started breaking down their campsites! I didn’t see them talking to the owner of the other tent—there probably wasn’t anyone there (it’s a small jade green tent). It remained intact.
2/1/02	Two of the campsites that were here this morning appear to be two of the same ones this afternoon. I saw two local guys walking back there (to Area 3) with camping gear at around 4:45pm. One local girl walked back there with camping gear at around 5:35pm (I’ve seen her here several times before—she has a light blue mini van, Chrysler). A tourist couple walked back there at 6:15pm carrying sleeping mats, but I didn’t see a tent. A local guy and his dog walked back at 6:29pm with camping gear and a guitar. When I left at 6:30pm, there were 8 parked cars (6 local and 2 rentals).
3/11/02	Fourteen “young hippies” all together in one group hanging out at their campsite. Six hiked out at 10:40am and drove away in an old, beat up Chevy.
3/26/02	On March 23 the County bulldozed the campsites/trees at Olowalu. We’ll probably see the repercussions of that at La Perouse in terms of increased camping.
5/7/02	A smoldering campfire in a pit out on the point at the junction of Areas 2 and 3.

- 6/9/02 In Area 1 (parking area just before the boulders) I asked a group of four people with a campervan if they had slept here overnight. They told me that they had camped there for 2 nights already without anybody ever asking them.
- 7/7/02 Four people camping in Area 3 (campsite there at 9am when we began the survey and there til 10:30am).
- 7/16/02 Four people at a campsite in Area 3 between 8am and 11:30am (length of entire survey).
- 7/21/02 All four campsites with surfers and surfboards. (Must have know the big surf forecast.)
- 7/31/02 The campsites multiplied through the course of the day instead of the other way around. I'm not sure if DLNR talked to the one campsite that was there, but they did not move. Probably just there for the day.
- 8/30/02 The same campers that have been here for over a week are remaining (by the edge of Area 2 and 3). **Bill Evanson mentioned that they might be claiming Hawaiian land rights and will be sticking around for a while!** The lady that was camping out by the white coral beach (and the palm tree—brown tent) is finally gone (after more than a week also). But her car is still here (jade convertible). I have been counting them as two campsites because they are taking over a large area and they typically have a lot of people and cars. At 12:25 they appeared to be packing everything up.
- 9/2/02 Two vehicles with 6 passengers total arrived at 2:30pm with a lot of gear (camping, fishing, a kayak). They are probably campers.
- 9/22/02 In Area 3, one campsite had made a campfire. I told them no campfires, but I guess they didn't care.
- 9/29/02 I walked by a campfire in Area 3 in late afternoon that was still smoldering, so I dumped some saltwater on the logs.
- 9/29/02 Four campers (residents) walked in at 6:14pm to Area 3.
- 10/18/02 Two campers walked in at 6:25pm.
- 10/29/02 Two campers walked out at 4:42pm and three more at 4:45pm.
- 11/10/02 In Area 3, only one campsite with tourists. The rest were locals.
- 11/20/02 Two bikers had backpacks and bags on their bikes, probably for overnight camping, because there was a tent with it.

- 11/22/02 A vehicle driving into Area 2 at 4:30pm was obviously with camping gear, and drove further into Area 3. Also, in Area 3 there were four people at the one campsite. Looked like a group of young tourists (about 25 years old) with a little jeep.
- 11/27/02 No campers. Maybe because it rained here late yesterday (and note that this survey didn't start til 11am).

Topic: Other Illegal Activities

<u>Date</u>	<u>Comment</u>
11/9/01	An approximately 20 foot boat anchored way inside the 'Ahihi-Kina'u NAR boundary and two SCUBA divers jumped off (too far away to read the #s or name of the boat). A red inflatable came up alongside it and talked to the Captain (possibly mentioning their infraction) but they did not move (the divers were down). Stanley from DOCARE enforcement was called about the boat and he told us that these are the boundaries for 'Ahihi (see sketch on the back of the technical survey sheet). He is going to meet up with the boat when it pulls into the harbor.
11/25/01	Boat in reserve. HA 2503 G. White boat, green panel, 8 people, Bayliner. Dropping off snorkelers and swimmers with dolphins
12/2/01	A woman said that last night some kids in trucks (in Area 3) were drinking, littering, doing drugs (marijuana), and playing loud music. They reluctantly turned down the music after she asked, but turned it up again two songs later. Their car registration fell out! She has it and will look up their address and return the empty beer cans!
12/7/01	At 3:35pm I smelled pakalolo (marijuana) from a tourist car parked in Area 1. Two young guys inside.
3/9/02	Five locals talked about smoking marijuana, but they decided to wait until they got to the beach instead.
9/15/02	At 2:30pm, three guys (residents) were smoking marijuana in the parking lot.
10/22/02	As I was walking through Area 2 (on my way to Area 3), just after the 4pm survey, I crossed paths with a girl. She asked me if I had seen a guy on a bike (red, BMX kind) ride by. I told her that I had not seem him ride out, only ride in (on the back jeep trail, through Area 2). I had counted him in Area 1 at 3pm, just as I pulled in, so I knew exactly who she was talking about. I told her to follow me because I knew a good lookout spot. We walked to where I take a lot of the surveys from (the high mound of lava by the Chief's residence). We couldn't see him anywhere. I told her that I would drive down the road a bit to see if I could catch up to him. She said she and her boyfriend (Josh) would catch up to me in their white Isuzu Trooper (early 90s model). I drove down to Secret Beach but

didn't see anything. They caught up to me soon after and they didn't see anything either. I told them to call the police to report it because they need to know what goes down out there. I urged them to, but they seemed hesitant. I should have taken down their names, but I didn't. I was standing in the middle of the road and needed to get back for the 4:30 survey, etcetera. My mistake! I started driving back to Keone'ō'io and I saw the guy riding his bike on the road about 200 yards past Dumps (towards Keone'ō'io). I turned around and drove after him. I pulled up to him and asked if I could talk to him. He said "yes" and I pulled over in a small space just past Dumps. I told him I was surveying people and asked him his name. He didn't speak English very well, but "nombre" worked. He said it was Victor Montanyo and he was 20 years old, worked as a cook and dishwasher in some restaurant (couldn't figure out the name) somewhere... The whole time I'm talking with him I'm trying to see the camera that is under his shirt (strap around his neck). And I was stalling because I didn't know quite what to do. I was just about to say good-bye, then CP drove by. I then said that I was done surveying him (if he understood that) and he got back on his bike. I followed him and finally passed him by the kayak pull-off. I caught up with CP at the kabob and told them the story. The guy saw me talking with them, I think. I gave CP my card and they proceeded to report it. I started to go back to Keone'ō'io but turned back around towards Big Beach. I saw Victor at the top of the hill by the south parking lot and didn't want him to see me, but he did (I think). I pulled in the parking lot and sat and waited, then was going to go back a little further when CP told me that four cops had him and they wanted to talk with me. I drove up there (by the fruit stand) and told them everything.

- 11/6/02 A ten foot grey inflatable (GEMINI, can't read the #s) with outboard engine was inside the 'Ahihi boundary (close to shore) from 10:25-11:35am. There were two passengers that were trading off pulling the boat as they snorkeled. Seeing this made me notice that the buoy marking the Reserve is gone!

APPENDIX 7

Table: Key Resource and Use Issues for South Maui

Key Resource and Use Issues	Related Management Issues	Constraints	Historic Concern
Sanitation/Litter	1. Install port-o-potties and trash cans 2. Organize community clean up days 3. Volunteers/rangers to educate re: coral rock graffiti	1. History of port-o-potty vandalism at Makena Beach 2. Cost of potties 3. Training volunteers 4. Cost of rangers	The 1968 study mentioned the litter problem.
Fishing	1. Allow traditional uses at La Perouse Bay 2. No fishing in NAR		1968 study: establish new "Recreation Reserve" land use category
Traditional and cultural Hawaiian use	1. Allow access (but no fishing in NAR without special permit)		
Motorized boaters violating "no motorized zone" in NAR	1. Enforcement/ citing violators	1. Enforcement cases thrown out of court ¹	
Ocean safety	Ban on commercial kayak operations	Requires DLNR to decide & enforce in coordination with the NAR Commission	1977 study: post warning signs when ocean conditions rough
Nighttime disturbance of Keone'ō'io residents	1. Ranger patrol in association with Maui police 2. Install gate and close at night (would affect other resource issues, like fishermen and cultural/religious uses)	1. Funding for ranger positions 2. Can a gate be installed on a County road? 3. How does private property ownership affect gate installation?	The 1968 study recommended establishing a State Ranger System, where ranger would reside on-site
Human safety (on land)	1. Volunteers on-site with cell phones	1. Volunteer training program	
Speeding cars	No solution discussed	N/A	

¹ In the past, DLNR law enforcement officers have been held in contempt of court for presenting no motorized zone violations with what the court considered too little evidence. DLNR needs to work more closely with the local police and the county prosecutor's office.

Key Resource and Use Issues	Related Management Issues	Constraints	Historic Concern
Fire Danger from illegal campfires	1. Signage already posted—not effectual 2. Ranger patrol at night	1. Funding for rangers, Maui Police	
Overcrowding	1. Determine source 2. Contact media 3. Control commercial use of area 4. Clearly demarcate parking area and spaces (possibly as part of a CIP at Maonakala) 5. Gate the road 6. Close the road	1. Data collection and analysis 2. Political pull to attract media sources of advertisement 3. DLNR and NARS decision 4. Jurisdictional conflicts if a gate is to be installed 5. The role of land ownership 6. Can't close the road, it's a County right-of-way ²	1968 study: establish special standards for roads leading into and across these wilderness areas (such as keeping them from being paved) 1977 study: make only minimum improvements to road thru NAR
Archaeological Site protection	1. Understanding problem 2. Further studies needed ³ 2. Coordinate stabilization, mapping, restoration, and signage efforts with SHPD 3. Allow interpretation of some sites 4. Nominate Keone'ō'io Historic District to National Register 5. Affects other issues-like jeep road access for fishermen	1. Archaeological sites protected by law 2. Budget and Volunteers 3. Obtain survey of government lands and easements	1968 study: Nominate sites at La Perouse Bay as a Historic District ⁴ . 1977 study: protection and opportunities for interpretive programs

² Source: 9/3/03 Meeting Minutes for the K-K Working Group

³ A thorough cultural resources survey should be conducted for Keone'ō'io, and ultimately for the region from Keone'ō'io to Kanaloa, in order to address the impacts on cultural resources. An important component of the survey will be consultations with Native Hawaiians and kama'aina knowledgeable about the area, archaeologists, botanists, marine biologists, and others. The survey should lead to further archaeological studies, gathering of oral histories, and preparation and implementation of an interpretive plan for the most heavily used areas.

Key Resource and Use Issues	Related Management Issues	Constraints	Historic Concern
Dolphin and Humpback Whale Harassment	1. Understanding problem 2. Etiquette guidelines 3. Enforcement/partnerships in addition to seasonal ranger from the mainland	1. Dolphins protected under the MMPA 2. Whales protected also by ESA	
Camping	1. Clear rules 2. Enforcement/partnerships 3. Establish campsites at nearby Makena State Park ⁵ and possibly elsewhere to address regional/island shortage	1. On-site camping has been illegal for years 2. Marginal water supply ⁶	1977 study: demarcates uphill areas as limited camping sites
Coral Reef Destruction	1. Understanding problem 2. Education/Outreach with volunteers 3. Enforcement/partnerships 4. Block access/close trails (affects Hawaiian traditional uses, may be harder to enforce, etc.)	1. Cost of studies and personnel 2. Legalities of trail closure	
Anchialine Pond Destruction	1. Understanding problem 2. Education/Outreach with volunteers 3. Enforcement (identify creative partnerships) 4. Block access/close trails (affects Hawaiian traditional uses, may be harder to enforce, etc.)	1. Cost of studies and personnel 2. Legalities of trail closure	

⁴ The 1968 study recommended requiring a thorough archaeological investigation before any development within the Makena-La Perouse area was permitted.

⁵ Maui Malama Pono and Sierra Club will lobby for full funding to DLNR State Parks to implement facilities and staffing plans at the park

⁶ The 1977 Park Plan recognized that this could be a problem for drinking water and irrigation for park vegetation.

APPENDIX 8

Department of Land and Natural Resources, Land Division

Notice to Vacate

LINDA LINGLE
GOVERNOR OF HAWAII



STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

54 High Street, Room 101
Wailuku, Hawaii 96793
PHONE: (808) 984-8103
FAX: (808) 984-8111

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

DAN DAVIDSON
DEPUTY DIRECTOR - LAND

ERNEST Y.W. LAU
DEPUTY DIRECTOR - WATER

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

NOTICE TO VACATE

TO WHOM IT MAY CONCERN:

THIS IS TO INFORM YOU that the lands at Moomoku, Honuaula, Makawao, Maui, situated along the seaward side of Keoneoio-Makena Road and further identified by Tax Map Key: (2) 2-1-006: 010 are owned by the State of Hawaii.


ANYONE placing any structures to include but not limited to a dwelling, lean-to, tent, campsite, vehicles, equipment or materials; anyone occupying, camping and/or residing on said lands without the written authorization of the Board of Land and Natural Resources, State of Hawaii, is encroaching upon public lands in violation of Chapter 171-6, Hawaii Revised Statutes, and shall be subject to a fine of up to **\$500.00 per day**, plus charges for administrative costs incurred by the Department of Land and Natural Resources, State of Hawaii, and for payment of damages.

NOTICE TO VACATE is hereby given to all persons occupying, camping and/or residing on said lands and that you must vacate said lands and remove all structures, vehicles, and personal belongings placed thereon.

ANY AND ALL PERSONS FOUND OCCUPYING, CAMPING AND/OR RESIDING ON SAID LANDS AFTER 6:00 A.M., JUNE 16TH, 2003, SHALL BE SUBJECT TO A FINE OF UP TO \$500.00 PER DAY PLUS ADMINISTRATIVE COSTS FOR VIOLATION OF THE PROVISIONS OF CHAPTER 171-6, HAWAII REVISED STATUTES, AND FOR PAYMENT OF DAMAGES.

FURTHER, ANY AND ALL FIXTURES, EQUIPMENT, STRUCTURES, VEHICLES, AND PERSONAL BELONGINGS PLACED, MAINTAINED, AND/OR FOUND ON SAID LANDS AFTER 6:00 A.M., JUNE 16TH, 2003, SHALL BE CONSIDERED ABANDONED AND SHALL BE DISPOSED BY THE STATE OF HAWAII AT THE FORMER OWNER'S COST AND EXPENSE.

DATED: Wailuku, Hawaii, 13th day of June, 2003.


JASON K. KOGA
District Land Agent

APPENDIX 9

Newspaper Articles Listing

March-May 2003

In the span of three months, the following 21 articles appeared about South Maui:

- March 2003, “Natural Area Commission Grapples With Commercial Use Pressure,” *Environment Hawaii*
- March 16, 2003, “Man vs. Nature: Trouble at Keoneoio. Kayak tours launch despite high winds, hazardous seas. Kayakers have had to be rescued; calls made for increased regulation,” *The Maui News*
- March 16, 2003, “Not much being preserved on historic coastline,” *The Maui News*
- March 16, 2003, “Friends try to take care of the area. Group provides information to visitors, conducts research, picks up trash,” *The Maui News*
- March 16, 2003, “Commercial use rules being drawn up,” *The Maui News*
- March 20, 2003, “Ocean safety a real concern,” *The Maui News*
- March 25, 2003, “La Perouse too popular for the space there and on the way,” *The Maui News*
- April 13, 2003, “Special Hawaii Issue: Maui. Going overboard on the south shore,” *Los Angeles Times*
- April 20, 2003, “BLNR seeks partners, solutions. New chairman open to hearing public’s ideas,” *The Maui News*
- April 20, 2003, “Young: Kayak operators can self-regulate or be regulated,” *The Maui News* (Note: Peter Young is DLNR Chairman)
- April 26, 2003, “It was a hairy situation. . .Kayak trip turns bad; owner blames ‘rogue wave,’ but others disagree; state investigating incident,” *The Maui News*
- May 1, 2003, “Kayaking in Dangerous Waters,” *The Maui Time*

- May 4, 2003, "Report: Keoneoio doesn't meet national park criteria, but planner's survey finds area resources warrant protection," *The Maui News*
- May 9, 2003, "State, kayak tour talks part of meeting May 22," *The Maui News*
- May 12, 2003, "Maui coastal region rejected as national park: Preservation of coastal area urged," *The Honolulu Advertiser*
- May 18, 2003, "Kayak tour operators say rules needed. Land Board chief: State will act if self-regulation does not work," *The Maui News*
- May 18, 2003, "New law requires most boaters to have emergency radios," *The Maui News*
- May 21, 2003, "The power of community activism," *Haleakala Times*
- May 22, 2003, "Keoneoio coast denied national park status," *Maui Weekly*
- May 29, 2003, "Kayak battle at La Perouse," *Maui Weekly*
- May 29, 2003, "Looking into the future of La Perouse," *Maui Time Weekly*



APPENDIX 10

Fishing Practices at Keone‘ō‘io

Qualitative Data from Technical Surveys: August 2001-November 2002

Friends of Keone‘ō‘io

<u>Date</u>	<u>Comment</u>
10/13/01	Divers reported coral dead and no fish in Area 6; crossbow fisherman hunting for parrotfish; spearfisherman caught 2 orange spined unicornfish and one unidentified fish.
11/21/01	At 8:15am four kayakers (local spearfishermen) went around the point by the lighthouse.
12/2/01	At 3:15pm a group of 10 spearfishers and their friends were on land at the fishing point (border of Areas 2 and 3), tormenting a dying hee (octopus) on the end of their spear.
8/4/02	The three trucks driving out of Area 3 during the 11am survey were all loaded with fishing poles/gear.
8/22/02	These three guys were scrambling the shoreline picking opihi. They even repelled down into the blowhole!
10/1/02	An opihi picker in Area 2 picked a bagful (mesh bag) of small ones (1 inch x 1 inch x 1 inch) between 8:30-9:30am.
10/8/02	Two opihi pickers in Area 2 between 12-1pm, and 1 opihi fisherman between 1-2pm.
11/2/02	The crossbow fisherman in Area 2 from 7-8:30am did not catch anything that I saw.
11/6/02	As I was walking through Area 3, I passed a local man carrying a snorkel bag full of fish and his gill net. I said "good morning" but he didn't appear friendly...
11/23/02	Two people in Area 6 at 5pm each had a fishing pole on the back of their kayak.

APPENDIX 11

Litter and Coral Rock Graffiti at Keone‘ō‘io

**Qualitative Data from Technical Surveys:
August 2001-November 2002**

Friends of Keone‘ō‘io

Topic: Litter

<u>Date</u>	<u>Comment</u>
10/17/01	From 1:30-2pm I picked up trash and broken glass in Area 1, the parking area by the ocean.
10/24/01	I picked up one large ziplock bag full of nails, fishing line, glass, and trash. Three dolphin swimmer enthusiasts gathered some nails, hoping their “reward” would be the dolphins coming their way.
11/4/01	We hiked out to area 4 and picked up trash (mostly fishing line).
11/9/01	Volunteer Brenda Brown came and picked up trash in area 3 for 2 hours.
12/2/01	One lady (a resident) has seen guys burn trash (20-30 of the 50 gallon bins) at Keone‘ō‘io last year!
1/6/02	Garbage cans overflowing by 11am!
1/17/02	There is a smashed wooden crate by the heiau in Area 2, and a whole one by the waters edge in the middle of Area 2. They are typically used in bonfires (marked by piles of nails that remain after the wood has burnt).
3/12/02	Our volunteer Brenda Brown and her friend picked up trash on their hike back through the area.
6/17/02	Picked up a lot of trash today, especially in the little beach areas in Area 2.
7/10/02	Picked up one big plastic bag of trash from the beach in Area 2.
7/22/02	There must’ve been a raging party this past weekend because there were beer bottles all over the parking lot (southeast end). I picked up over 8 cases of bottles and about 12 cans to be recycled.
9/6/02	Picked up some fishing line and lures from Area 2.
9/9/02	I picked up trash along the way back, then spent 2 ½ hours picking up fishing line, firecrackers, cigarette butts, candy wrappers, nails, etcetera at the Area 2 and Area 3 border. There’s still a lot left, but my bag was overflowing. Another day. The major rubbish area is where the large groups of campers have been congregating lately (just down the hill from there)—it is really bad!
9/15/02	The trash cans were filled to their capacity, plus four large bags were sitting next to them.
9/23/02	In the bay between Area 2 and 3 I picked up a lot of trash, especially beer cans and plastic bags.

- 9/29/02 The trash cans were overflowing!
- 10/6/02 I picked up 8 beer bottles that were in the parking lot. A fishing pole lying near the path by the chief's residence (Area 2) appears to be disguard.
- 10/8/02 I picked up some coral graffiti in Area 2 "PC + LC." There was a pile of glass in the Chief's residence that I got rid of. I hate glass!
- 10/16/02 One local man was drinking a soda and carrying his cast net in Area 1. When he was pau with his soda, he threw the can on the ground. He attempted to throw his net, but did not catch anything (two tries only). He left after that without picking up his can.
- 10/23/02 A lot of trash on the little beach between Areas 2 and 3. A local pick-up truck collected it all with a big black trash bag and took it to Kihei, to the recycle place. I gave them a six-pack of beer for that, which I had in my car, by chance.
- 10/29/02 Since it's such a quiet day (and cool) I decided to pick up the glass that was covering the mound of lava where I usually stand up on to take the technical surveys. It took forever and filled a Safeway plastic bag (2 for support) about a quarter full.
- 10/29/02 The fishermen left 3 large ziplock bags partially full of their bait (octopus) which stunk! But I took them to the trashcan on-site. Very uncool!
- 11/2/02 Michael and I were talking to Tom and he had a large tub of trash (granola bar boxes, water bottles, etc.) from his kayakers. I noticed it and thought "that's great—he's recycling!" About ten minutes later, he picked it up and carried it to the Keone'ō'io trash cans and dumped it. He came back and I said "Tom, you should recycle!" He wasn't thrilled with that comment, so I left. Michael was disgusted as well.
- 11/5/02 I finished picking up the broken glass at my "lava lookout" platform—one more Safeway bag filled a quarter of the way.

Topic: Coral Rock Graffiti

- | <u>Date</u> | <u>Comment</u> |
|-------------|--|
| 10/18/01 | At 10am in Area 2, two tourists made coral graffiti but at my request very nicely took it apart. |
| 10/29/01 | We eliminated the rest of the coral graffiti in Areas 1 and 2. Yeah! |

- 11/15/01 At 4:12pm I had to explain to an older couple who was interested in the archaeological sites **that the white rocks atop of the lava pinnacles were not sacred** and that they've been put there recently.
- 3/9/02 Found some coral graffiti on the makai side of the heiau in Area 2.
- 7/22/02 There was some scattered coral graffiti along the path in Area 2 and 3 and on the large heiau.
- 7/29/02 I cleared two different coral graffiti: "MATT" and a big "H" (both in Area 2 along the coastal path). I just noticed a rock that had been spray painted (?) white just south of the tiny beach in Area 2. Was 2 feet by 2 feet big. Maybe we should get some black spray paint and paint over it? It looks ugly...
- 10/26/02 I dismantled a 3' long x 2' tall "Reg" made out of coral in Area 2. And a similar sized "JAN" also in Area 2 that magically appeared sometime as I was walking through Area 3 (because it wasn't there before).
- 10/29/02 Large coral graffiti in Area 2/3 "HI" and a nine foot tall "Go Gettum Ola"
- 11/27/02 Three coral graffiti on the mauka side of the heiau. As I walked through Area 2, there were at least 10 spots where there was coral stacking (between 2-8 corals piled on top of one another, usually on a large piece of lava). I dismantled them.

APPENDIX 12

Protected Species at Keone‘ō‘io

Qualitative Data from Technical Surveys: August 2001-November 2002

Friends of Keone‘ō‘io

<u>Date</u>	<u>Comment</u>
8/24/01	Group of 9 dolphins today and 4 here yesterday. Michael believes a dolphin party/orgy happened here 2 weeks ago. There were about 200 dolphins here from different areas (and this same behavior happened this time last year too)
8/29/01	A monk seal was recorded in the water at 4:30pm in Area 5.
10/7/01	Dolphins arrived at 7:40am and left by 8:30am.
10/17/01	Three sea turtles observed near the blowhole (Area 2) at 2:30pm
10/20/01	Archaeologist Cecile Milleschie saw a monk seal off the point that morning.
10/24/01	Michael and Scott said there were dolphins here yesterday for 2 ½ hours til 9:30ish. There were approximately 45-60, were “spinning like crazy” and very receptive to everybody. But BlueWater Rafting and Ocean Magic came in and dropped their passengers in, which caused everything to be too crowded. The dolphins left soon after that (coincidence?) [This is Scott’s perspective.] Tom Sol (South Pacific Kayak Company owner) agreed with him...but he said that he’s seen a lot more people than that out there!
10/29/01	The dolphins began swimming extremely close to shore at 10:40am until 11:35am. They began coming into the north end of the bay (by the parking lot), leaving, then reentering really close to the shore (less than 15 feet away!), back and forth. Between the lagoon (from of the house/old fishpond) and the parking lot, when there were no people, they cruised. But when the people started coming in, they abandoned the area and moved south along the shore, staying really close still.
10/31/01	Up to 70-80 dolphins today. I jumped in the water just after 8am and saw 30+ dolphins.
11/8/01	Swimmers said there were up to 80 dolphins here all morning.
11/9/01	The dolphins were here the three previous days and were very sexual and friendly on Nov 8.
11/10/01	“There were too many dolphins to count!” said Captain Samone Yust. (more than 50). The dolphins were spotted by us at 7:20am and they were outside the bay. (They weren’t seen by the kayakers or the boats.) They finally came in at 9:30am, just as Samone predicted, and swam right with the swimmers, very close in fact!
11/15/01	The spinners were here this morning (I spotted them when I did my first survey at 1:00pm but I don’t know where they went after that). I talked with a tourist who swam with them. He said he was with only one other person (he waited until “everyone else” got out – the wind picked up) and the dolphins got really close to

him. It was his first time, so he was really excited. I explained to him the “swim-with” debate and he seemed pretty concerned.

- 11/15/01 At 2:26pm I spotted a blow—and then four more blows. My first **whale** spotting of the season! They were way out towards Kaho’olawe.
- 11/18/01 I was told there were no dolphins at the site for the last three days (Nov 16-18). Also found out later that no dolphins on Nov 19.
- 11/20/01 Scott says that this is the fifth day in a row that the dolphins have not been here (a record as his experience goes). There was a guy sitting down by the water’s edge playing his flute, hoping to “bring in” the dolphins. It didn’t work.
- 11/21/01 Dolphins did not stay long in the bay (about a half hour at 8am).
- 11/25/01 These dolphins are the same ones from yesterday (about 30-40). Ten of them are considered “the wild ones”—very active, zipping all over the place. Barry told me about one adult that he saw yesterday and today that has two stars under its flipper. He was leading the pod of sleepers today (he is not one of the Wild Ones, they are juveniles). After all of the kayaks and boats left, 8 swimmers were left (the local crew) with the dolphins. The dolphins definitely could have gone anywhere in the bay, but they stuck right with the people, circling and “playing” with them for about an hour. “Great encounter!”
- 11/25/01 I asked a fisherman, Derrick, what would happen if he caught a **turtle**. He said that **he catches them all the time!** He cuts the line as close as he can and when he can he gets the hook out too. (I explained to him about the danger of the fishing line in particular--he knew.)
- 11/26/01 Ken counted 19 turtles in one day at ‘Ahihi!
- 12/8/01 Scott said that this is the first time in about a week that anyone has swam with the spinners. They have come in briefly, but not long enough (or close enough to shore—they’ve been out at the southern point briefly) for anyone to swim. They were spotted at Ahihi a couple of times last week. Today there were about 30 of them—very interactive with them. No boats all day! And only two swimmers at a time.
- 12/16/01 At 11:10am I ran into Samone Yust, an old timer from our Friends of Keone‘ō‘io group. She was sitting with 6 people on the rocks in Area 2, prepping to swim with dolphins. By 11:15am the dolphins came right into that area and the folks got into the water with them.
- 12/18/01 The dolphins were here the last two days and today. Today the spinners were divided into pods. One large pod (couldn’t get a good # because they didn’t get close enough) came into Area 5, swam real close to the shore, along the wall.

They stayed there for about 15 minutes, then left again, going the same way. They went out to Area 7, swam about 100 yards to the right (north), then we didn't spot them anymore. Meanwhile, a smaller pod came to the center of the bay and stayed in that area for a few hours. Another pod stayed between this pod and the southern lava finger (Area 5), usually quite close to the lava wall. The swimmers hung out with both groups and reported to me that they were very "friendly and playful." After everyone left, the dolphins stayed around, and at the end they were in Area 5 (were still there when I left at 2pm).

- 1/4/02 Scott Wenham was there this morning. He said there have been no dolphins in the bay since Christmas Eve (12/24-1/4/02) and none today either. That's 12 days!

- 1/6/02 Whale exhalations spotted at 11:45am. Three of them offshore in Area 7.

- 1/6/02 Dolphin swimmer Michael said no dolphins here today. He was just leaving as I arrived at 10am.

- 1/8/02 Scott Wenham said dolphins here yesterday (Jan 7) but not today. Yesterday the Maui Dive boat followed them closely so the dolphins left the area within 20 minutes or so. None of the swimmers or kayakers got to be with them.

- 1/10/02 Regarding the 7 boats in the bay (as documented under the "Commercial Use" section): Luckily the kayaks didn't linger too long in the bay, and only a few swimmers were with the dolphins. The dolphins stayed in the area marked by the crosshatches (see sketch on back of technical data sheet), and no one really noticed them. There were about 20-30 dolphins and 2 of them were very lightly pigmented. I spoke too soon—from noon to 1pm, three different groups came out from shore and went directly over to the dolphins. The first two groups stayed in their kayaks, for the most part, but the last group (of 7) jumped in with them.

- 1/17/02 I showed two people where a turtle was by the blowhole (Area 2) right by the shore (the small one that is usually there). Eleven people crowded around to watch it. Luckily none of them jumped in the water with it!

- 1/25/02 As I was watching the spinners (large group of about 50), two humpbacks were double breaching over and over again (about 7 times) and traveling from north to south. They weren't that close (out in Area 7), but it was great because one of the spinners started breaching as well. This probably wasn't in response to the whales, but it was still wonderful! Four kayaks (two 2-person kayaks) came out from shore to check out the dolphins, who were in their usual spot in the bay, milling around. I can't say conclusively that the kayakers "chased the dolphins away," but when they approached the dolphins, the dolphins headed out of the bay, towards Ahihi. The kayakers followed. Maybe they [the dolphins] were leaving anyway, maybe not...

- 1/30/02 At about 9:15am one of the blue ribs boats (large one) came into the bay from the north (after they had gone past the bay earlier, from north to south, which is typical), and a pod of spinner were bowriding. They stayed on the outer limits of the bay, with the boat, traveling south at a slow speed. When the boat was gone the spinners were too. At 9:45am, two adult humpbacks were spotted super close to shore (within 200 yards!). Two of the female dolphin swimmers were playing their flute for them... The whales stayed in the bay for a couple of hours.
- 2/9/02 A couple of Kristi West's students saw a few dolphins (at about 9:45am) by one of the rafting boats in Area 6, but pretty far out. The boat wasn't anchored, so maybe the snorkelers were thrown into the water for the dolphins, so I'm not positive they were here.
- 3/12/02 Michael told me that he swam with two **bottlenose** (or what he believes were bottlenose) here the other day. His latest request is for a cement slab (or grass) to be put in so they can do yoga while they wait for the spinners to come in (ha ha ha).
- 3/17/02 It looked to me that the spinners "chose" to interact with the snorkelers and kayakers. They did not actively avoid the people and the people did not actively pursue the dolphins. Note: this was observed by C. King from the Pu'u above Makena Stables.
- 3/26/02 Kristi was here with her group of 7 dolphin researchers.
- 4/21/02 Dolphins here 8-11am. 40+ of them. Scott did interpretation for a family of 6.
- 4/24/02 Dolphins were here on April 21 and 22 in the morning (roughly 8:45-9:45). Same pod of roughly 50 animals both days.
- 6/17/02 Started the tech survey at noon. About 30 dolphins from noon until 12:45pm.
- 6/29/02 Two **turtles** near the blowhole for almost 3 hours.
- 7/1/02 Dolphins in Area 6 only for about 20 minutes (once the survey began at 8am), then they took off.
- 8/8/02 The spinners numbered at around 50 with at least two babies. At 8am, Michael was the only one swimming with them, then another lady joined him. At the 9am survey, the "18 swimmers" consisted of 12 kayakers (with one guide staying with the kayaks—tied together and attached to the Ahihi marking buoy) and six dolphin swimmers were locals. The two boats were rafts who anchor at the southeast end of the bay to let their passengers snorkel (about 14 passcngers on each boat). Michael suggested to Tom that his guides do this because Michael has seen the dolphins get "aggravated" when the kayakers paddle after them, jump in to swim with them, over and over again. Michael told me that a couple of weeks

ago, **a spinner was speared right in front of Little Beach!** He followed a spearfisherman from shore until he came out of the water at red sand beach. He talked to the guy and he probably wasn't the one who did it. There were three local kids leaving the area who had been spearing when Michael arrived that day—maybe they were the culprits. **The dolphin probably died.**

- 8/24/02 The spinners came in at 9:40am and immediately all of the regular dolphin swimmers got in. The spinners (about 50-70 of them) seemed very interactive, swimming super close to the swimmers frequently. They approached the kayaks very close as well (from my perspective). A boat ("Palikiko", non-commercial) came in and the dolphins approached it. Eventually its passengers (3) jumped in while the captain stayed on board. He would sometimes pick them back up and drop them off closer to the dolphins. At around 10:45am they [the dolphins] started heading deeper, almost to Area 7, and I thought they were leaving. A lot of other people must have thought so too, because a lot of them got out of the water. The spinners stayed out there for about 20 minutes, then came back in, closer to shore (still in Area 6). They started coming really close to shore (about 30 yards away), readvertising their presence. Lots of people went out and the dolphins kept on approaching them. I made a real conscious effort to watch these interactions and I really do not believe that the people were hindering their use of the bay or harassing them. The spinners used parts of the bay that I don't usually see them use (where everybody snorkels, along the shore of Area 8) where people were, they just kept going back and forth through the swimmers. It really seemed that they were seeking out the interactions... At 1:45pm they were still in the bay (I had to end the survey and leave.). Did they stay in the bay all day because of the lack of the windline?
- 8/27/02 The pod of spinners numbered between 10-15 and I did not see any babies. They stayed on the mid-outermost part of the bay. They didn't seem to avoid the swimmers, but I never saw them get really, really close like they sometimes do. When a raft (the large blue one with small white letters on the port tubes—can't read it) came in, they checked it out and stayed around it (while the raft was maneuvering with them, of course), not with the two kayaks. Then the boat let its passengers jump in with the spinners—16 of them were in the water with them. Again, the spinners stayed in the area, but not getting too close (that I could see). The passengers did "give chase" a few times, but overall seemed mellow. They [the dolphins] milled around the bay after all the swimmers/kayakers/boats left them alone. They stayed in the same general area, and seemed to spread out more and move in different directions—not all in sync.
- 8/30/02 About a 100 dolphins at 7am in Area 6. At 11am, about 50 spinners (I saw at least 3 babies), pretty active aurally. They stayed with the swimmers and kayakers. They went all the way to the southern edge of the bay at 12:10pm, but they came back to Area 6 again.
- 9/18/02 Michael said that the dolphins haven't been here since Sunday (9/15).

- 10/18/02 I talked with a local fisherman and he told me that he saw a large turtle on Tuesday out at Planks. He also mentioned that there is a smaller turtle that they catch (by accident because the turtle takes the bait) sometimes. They always let him go (and take all the fishing line off). He assumes it's the same one, but he's not sure.
- 10/26/02 When I drove in at 8:54am, the dolphins were at the place where Tom's company usually exits (the spot right next to the road past Dumps and the tourist's cove—'Ahihi Bay). I talked with Michael and he said that he swam with them there yesterday and that they were at Keone'ō'io on Mon, Tues and Thurs this week (Oct 21, 22, and 24). When I told Tom about where the dolphins were, he got annoyed and said "That's the second time in a row!" And he got even more bummed when I told him that there weren't any kayakers with them (just about 8 swimmers that I could see). He wasn't angry, but you could tell it bothered him.
- 11/2/02 Michael said that the dolphins were here yesterday (Nov 1). There appeared to him to be two pods of about 25 spinners each. One pod had 2 calves. One of the calves had a 5 inch remora on it that appeared to be really aggravating it and his whole right side looked really irritated/inflamed. He asked me, "Why don't the adults take it off for him?" That's a good question! It's probably really difficult to do, but other than that, there might be a good reason we don't know of. He also said that he saw a **monk seal** on Oct 26 (Saturday) while he was hiking. It was between the lighthouse and Kanaio Bay, just lying on the rocks with his head touching the water when the waves came up. It was about 8 feet long and pretty fat. They got within about 15-20 feet of it and watched it for about 20 minutes before the seal got into the water via this narrow shoot and swam off. They didn't see any tags.
- 11/5/02 Between 11:02 and 11:28 am I saw **five turtles** at the surface off of the blowhole. I'm pretty sure they were all different because they each stayed at the surface to breathe for about 30 seconds to 1 ½ minutes. And they were rather spread out. I saw two different turtles at the surface on two occasions. One of them appeared large, but the rest were medium and small sized. **This is the most I've seen here!**
- 11/6/02 The spinners were way out on the southeastern point of the bay. Michael was the only swimmer from shore—the rest were from boats. A bunch of folks were waiting in the middle of the bay for them to come closer, but they never did. I couldn't get a solid count because they were so far away. I hiked out to where the two grave markers are in Area 3 and watched for a bit. I'm guestimating under 20—I only saw a few at a time briefly. The max I saw at the surface was 6. I also saw a real small **turtle** about 50 yards offshore from the grave markers. It was only on the surface for a couple of breaths that I saw.
- 11/11/02 About 70 dolphins (according to the kayak tour folks).

- 11/16/02 Visitors told me that there were dolphins in the bay at 10:30 or 11am (in Area 6).
- 11/27/02 At 11:47pm when I was out at the two grave site in Area 3 a medium-sized honu (**sea turtle**) surfaced and took ten breaths. It was only about 20 feet offshore. No visible fibropapiloma viruses on it.

APPENDIX 13

U.S. Geological Survey Anchialine Pond Water Quality Sampling



U.S. Geological Survey, 431 National Center, 12201 Sunrise Valley Dr., Reston VA 20192

Ms. Cheryl Vann
Program Coordinator
Hawaii Wildlife Fund
1059 Po'okela Rd.
Makawao, Maui, HI 96768

February 19, 2003

Dear Ms. Vann,

Thank you for directions to the anchialine ponds near Makena. Here are the chemical analyses from samples taken from Halua Pond, Kauhioaiakini Pond, and Hanamanioa Pond for your files. The names of the ponds were taken from the topo map, I hope they correspond to the names you use. For the ponds at Hanamanioa light, I sampled the pool that was farthest from the beach. Our purpose in sampling wells and coastal springs in the area is to establish baseline chemical analyses so that possible future changes in chemistry may be used to interpret volcanic activity in the southwest rift zone of Haleakala volcano. In addition, we use the stable isotope signature of the water to infer the altitude at which the aquifer receives recharge, and these will be added to our regional database of isotopic values. Please feel free to contact me if you have any questions about the analyses, sample sites, or would like more information.

Best regards,

Martha Scholl
Hydrologist, National Research Program

phone: 703-648-5890

e-mail: mascholl@usgs.gov

web site: <http://water.usgs.gov/nrp/proj.bib/hawaii/index.htm>

Halua Pond

Sample date/time: 1/9/03 14:15

Temperature: 24.5° C

pH: 8.0 (with test strip, approximate)

Calcium	Ca ²⁺	225 mg/L
Magnesium	Mg ²⁺	779 mg/L
Strontium	Sr ²⁺	3.5 mg/L
Silica	SiO ₂	24.2 mg/L
Sodium	Na ⁺	6240 mg/L
Potassium	K ⁺	236 mg/L
Dissolved Iron	Fe ²⁺	<0.1 mg/L
Silicon	Si	11.3 mg/L
Manganese	Mn ²⁺	<0.1 mg/L
Bicarbonate	HCO ₃ ⁻	293.1 mg/L (alkalinity)
Chloride	Cl ⁻	10800 mg/L
Sulfate	SO ₄ ²⁻	1680 mg/L
Nitrate	NO ₃ ⁻	<0.1 mg/L
Fluoride	F ⁻	<0.05 mg/L
Bromide	Br ⁻	39 mg/L

Analysis: U.S. Geological Survey, National Research Program, Water Resources Division, Reston, VA

Kauhioaiakini Pond

Sample date/time: 1/9/03 15:00

Temperature: 24.5° C

pH: 7.5 (with test strip, approximate)

Calcium	Ca ²⁺	249 mg/L
Magnesium	Mg ²⁺	833 mg/L
Strontium	Sr ²⁺	4.0 mg/L
Silica	SiO ₂	15.2 mg/L
Sodium	Na ⁺	6910 mg/L
Potassium	K ⁺	257 mg/L
Dissolved Iron	Fe ²⁺	<0.1 mg/L
Silicon	Si	7.1 mg/L
Manganese	Mn ²⁺	<0.1 mg/L
Bicarbonate	HCO ₃ ⁻	163.0 mg/L (alkalinity)
Chloride	Cl ⁻	12600 mg/L
Sulfate	SO ₄ ²⁻	1880 mg/L
Nitrate	NO ₃ ⁻	<0.1 mg/L
Fluoride	F ⁻	<0.05 mg/L
Bromide	Br ⁻	49 mg/L

Analysis: U.S. Geological Survey, National Research Program, Water Resources Division, Reston, VA

Hanamanioa Pond

Sample date/time: 1/11/03 11:55

Temperature: 22.5° C

pH: 7.0-7.5 (with test strip, approximate)

Calcium	Ca ²⁺	110 mg/L
Magnesium	Mg ²⁺	267 mg/L
Strontium	Sr ²⁺	1.6 mg/L
Silica	SiO ₂	31.9 mg/L
Sodium	Na ⁺	2290 mg/L
Potassium	K ⁺	99 mg/L
Dissolved Iron	Fe ²⁺	<0.1 mg/L
Silicon	Si	14.9 mg/L
Manganese	Mn ²⁺	<0.1 mg/L
Bicarbonate	HCO ₃ ⁻	225.6 mg/L (alkalinity)
Chloride	Cl ⁻	3940 mg/L
Sulfate	SO ₄ ²⁻	575 mg/L
Nitrate	NO ₃ ⁻	<0.1 mg/L
Fluoride	F ⁻	<0.05 mg/L
Bromide	Br ⁻	15 mg/L

Analysis: U.S. Geological Survey, National Research Program, Water Resources Division, Reston, VA

APPENDIX 14

Archaeological Site Abuses at Keone‘ō‘io

Qualitative Data from Technical Surveys: August 2001-November 2002

Friends of Keone‘ō‘io

<u>Date</u>	<u>Comment</u>
8/20/01	Four people walking on the heiau. We let them know the significance of the site, but they didn't seem to care. Ten minutes later, the dad proceeded to walk on top of a wall in the chief's residence!
8/24/01	One man urinated in the chief's residence, then proceeded to walk on the walls (11am). At 11:30am, 4 people were climbing on the heiau.
9/22/01	One man standing on heiau , then continuing to walk through chief's residence. I tried to get his attention, but he didn't hear me and was walking fast.
10/12/01	At 10:30am a Carnival Cruise tourist was standing on a lava formation in the middle of Area 2, kicking a big piece of lava off with his foot. I asked him to stop and explained about the archaeological sites, etc. He was drawn out there by the coral graffiti!
11/8/01	A young boy was throwing rocks from a stone fence near the private property in Area 1. I asked him to stop. He did for a while, then resumed.
11/10/01	A group of three people were climbing on the heiau at 11:55am. By the time I got there, they were already walking to the parking lot.
11/15/01	At 3:07pm I talked with a couple who was videotaping the site from atop the heiau . I told them about what they were doing and to stick to the paths. (They probably got me on tape reprimanding them...) They were nice about it.
1/18/02	See "Reactions to management" section for Martin climbing on top of the archaeological site within the parking area (the one we were surrounding with dike rock to protect).
2/14/02	At 9:12am a guy walked back into the Chief's residence and relieved himself . At 2:37pm, as I was pulling out of the parking lot, I witnessed a man urinating along the side of the road, right over the archaeological wall!
3/9/02	While I was doing the car survey today, I witnessed one lady climb over the rock wall opposite me (the residence's) to use the bathroom.
3/12/02	Two kids were climbing all over the heiau and throwing rocks! I told them that it was made by ancient Hawaiians for ceremonial purposes and if anybody saw them doing that, they would be angry. They immediately understood and explained that they didn't realize it. They were really nice kids and I told them more about the area...(the parents were nowhere to be found).
8/27/02	One man standing on top of heiau at 9:28am—checking the waves with binoculars.

- 9/8/02 Two guys checking the surf (looking towards Area 3) **climbed the heiau** in Area 2.
- 9/9/02 GENERAL NOTE: I walked into Area 3 to check on the grinding sites/collecting pans. Bill Evanson and crew did a great job blocking this site off—they used huge boulders as well as kiawe trees. That should do the job—I hope. We'll see how long it takes for da guys to move them...
- 10/10/02 I told three guys who **were standing on top of the heiau** (checking the surf) to not do that. They got down immediately. I've seen their car before, so it'll be interesting to see if they climb the heiau ever again. I'll recognize them if they do! I really want to make a sign to put on that post by the heiau. **A local looking wooden painted sign saying "NO CLIMB" would be perfect, I think.**
- 10/18/02 At 5:56pm a woman **relieved herself right in the Chief's residence.**
- 11/27/02 Someone ran into the rock barrier in the parking lot (with their vehicle) and four big rocks were displaced (these are the rocks recently placed there to protect those 2 arch sites). I put them back the best I could.