National Park Service
U.S. Department of the Interior
Hawai'i Volcanoes National Park

HAWAI'I VOLCANOES NATIONAL PARK

Draft General Management Plan, Wilderness Study, and Environmental Impact Statement

MAY 2015

Hālau o Kekuhi at Halemaʻumaʻu. *NPS Photo*

DRAFT GENERAL MANAGEMENT PLAN / WILDERNESS STUDY / ENVIRONMENTAL IMPACT STATEMENT FOR HAWAIʻI VOLCANOES NATIONAL PARK

Hawaiʻi County, Hawaiʻi
Prepared by United States Department of the Interior: National Park Service

Hawaiʻi Volcanoes National Park was established on August 1, 1916, as Hawaiʻi National Park, and on September 22, 1961, its name was changed to Hawai'i Volcanoes National Park when it was split from what is now Haleakalā National Park. The 1975 *Hawai'i Volcanoes National Park Master Plan* no longer provides adequate guidance to address the management and operational issues now facing the park.

This draft general management plan / wilderness study / environmental impact statement examines three possible management strategies or "alternatives," including the impacts of implementing these alternatives in the park. These alternatives address visitor use and the preservation of natural and cultural resources to protect and interpret the significance of the park. They comply with National Park Service (NPS) planning requirements and respond to issues identified during the public scoping process. Alternative 2 is the NPS preferred alternative. If approved in a record of decision following the release of the final environmental impact statement, the preferred alternative will become the general management plan for the park.

Alternative 1: the no-action alternative would assume that existing programming, facilities, staffing, and funding would generally continue at current levels to protect the values of Hawaiʻi Volcanoes National Park. There would be no major changes in current management or visitor use, and implementation of currently approved plans would continue as funding allows.

Alternative 2: the preferred alternative would strengthen and broaden opportunities to connect people with the volcanic world treasure, Hawaiʻi Volcanoes National Park, and provide a wide range of high-quality visitor experiences based on different geographic areas. This alternative emphasizes the park's role as a refuge and haven for native biota, people, and cultures in a world constantly adapting to volcanic activity and island-building processes and emphasizes Native Hawaiian values such as mālama ʻāina (nourishing or taking care of the land) and kuleana (responsibility) as important concepts in park stewardship of resources.

Alternative 3 emphasizes building new connections with the park, primarily through expanded education and hands-on stewardship opportunities. As in the preferred alternative, this alternative emphasizes the park's role as a refuge and haven for native biota, people, and cultures in a world constantly adapting to volcanic activity and island-building processes and emphasizes Native Hawaiian values such as mālama ʻāina (nourishing or taking care of the land) and kuleana (responsibility) as important concepts in park stewardship of resources.

These alternatives would provide guidance to park managers about which resource conditions and visitor uses and experiences should be achieved rather than the details of how these conditions and experiences should be achieved.

This document includes a detailed description of the alternatives followed by a description of park resources affected by the alternatives and the projected environmental consequences of the alternatives. Also included in this document are the results of public involvement and consultation with other agencies, organizations, and individuals associated with planning for the park's future.

Please refer to "How to Use This Document" on the following page for comment procedures and submittal methods and addresses. This draft general management plan / wilderness study / environmental impact statement has been distributed to agencies, organizations, and individuals for review and comment. The public comment period will extend for 60 days following the publishing of the notice of availability in the Federal Register.

Dedication of the Wahi Kapu sculpture. *NPS photo by Jay Robinson*

HAWAIʻI VOLCANOES NATIONAL PARK

Draft General Management Plan, Wilderness Study, and Environmental Impact Statement

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Lava tree. *NPS photo by Stephen Geiger*

LETTER FROM THE SUPERINTENDENT

Aloha Friends,

Hawai‘i Volcanoes National Park is pleased to present for your consideration this draft general management plan, wilderness study, and environmental impact statement (GMP/WS/EIS). This draft document is the result of four years of public scoping and comment, interdisciplinary research, field assessments, stakeholder discussions, and Native Hawaiian consultation.

General management plans are intended to be long-term documents that establish and articulate a management philosophy and framework for decision making and problem solving in our national parks. In this document, three alternatives for Hawai‘i Volcanoes National Park are presented for your review. Each alternative offers a different approach to protecting and managing park resources, using facilities, and providing a range of access and visitor experiences to meet the needs of local residents, off-island visitors, and students of all ages. These alternatives were developed with the intent to include and celebrate Native Hawaiian values such as mālama ‘āina (nourishing and taking care of the land) and kuleana (responsibility). The park planning team developed these alternatives based on the park’s purpose and significance, issues that need to be addressed, legal mandates, and comments that you provided for the preliminary alternatives.

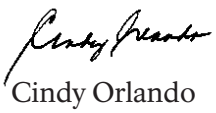
We hope that you will give these alternatives serious consideration, take the time to comment, and continue to stay involved to help us determine how this national treasure will be protected and managed over the next 20 years.

Inside you will find many different ways you can make your voice heard. You can comment online at http://parkplanning.nps.gov/havogmp or join us at one of the scheduled talk story sessions to be held on the islands. A wilderness hearing will be held during the talk story sessions to receive comments specifically on the wilderness study. The public comment period will extend for 60 days following the publishing of the notice of availability in the Federal Register.

The staff, partners, and volunteers at Hawai‘i Volcanoes National Park remain committed to fulfilling our kuleana to protect the park’s geologic features and native ecosystems, preserve its rich cultural heritage, and provide unforgettable visitor experiences.

Mahalo for your continued interest in the park. We hope that you will continue to stay engaged with the GMP planning process. We look forward to seeing you in the park.

Mahalo nui loa,



Cindy Orlando

Superintendent

You can access information about the *Hawai‘i Volcanoes National Park* GMP/WS/EIS at http://www.nps.gov/havo/parkmgmt/plan.htm.

Halemaʻumaʻu Vent. *NPS photo by Stephen Geiger* Credit:

HOW TO USE AND COMMENT ON THIS PLAN

This Draft General Management Plan / Wilderness Study / Environmental Impact Statement for Hawai'i Volcanoes National Park (GMP/WS/EIS) is presented in seven chapters and appendixes, consistent with federal requirements that guide the preparation of an environmental impact statement.

The **Executive Summary** at the beginning of the document is a condensed version of this document.

Chapter 1: Introduction and Background sets the stage for the draft GMP/WS/EIS by describing the national park, the planning process, the purpose and need for the plan, and implementation of the plan. It also describes the issues that are addressed in the GMP/WS/EIS, resources and values at stake in the planning process, and the relationship of this GMP/WS/EIS to other plans in the park and region.

Chapter 2: Foundation for Planning and Management includes the foundation document, which describes the national park's purpose, significance, interpretive themes, and fundamental resources and values. It also describes the special congressional designations, authorizations, mandates, and legal and policy constraints and guidance.

Chapter 3: Alternatives describes three management alternatives, including the National Park Service (NPS) preferred alternative. The alternatives represent reasonable sets of management directions consistent with NPS policy and applicable laws and planning requirements. This chapter includes two tables that allow a quick review of each alternative: "Summary of Alternatives" and "Summary of Impacts."

Chapter 4: Wilderness Study and Proposal assesses the feasibility of designating wilderness in recently acquired lands in Hawai'i Volcanoes National Park. This chapter includes a summary of the Wilderness Eligibility Assessment completed for the Kahuku Unit in 2012, assesses a number of alternatives for designating wilderness, proposes wilderness designation in the Kahuku Unit, and outlines the implications of such a designation.

Chapter 5: The Affected Environment provides detailed information on the national park, focusing on those resources that could be affected by the decisions contained in the individual management alternatives.

Chapter 6: Environmental Consequences describes the impacts of each alternative on affected resources within the national park.

Chapter 7: Public Involvement summarizes the public involvement and consultation process that was an integral part of the creation of this draft GMP/WS/EIS. This chapter also summarizes public comments received by the National Park Service during scoping and public review of the preliminary alternatives.

The appendixes provide more detailed information related to the plan, including the full text of the Commercial Services Strategy and the Analysis of Boundary Modification and Land Protection.

All maps and figures are placed within the text of the applicable chapters. In many cases, actions or other discussions contained in this draft GMP/WS/EIS refer directly to maps and figures. In fact, many actions themselves are map-based. The reader must rely on the text, maps, and figures taken together to fully understand the actions described in this draft GMP/WS/EIS.

HOW TO COMMENT ON THIS DOCUMENT

The public comment period for this draft GMP/WS/EIS will extend for 60 days following the publishing of the notice of availability in the Federal Register. We encourage you to review the document and we welcome your comments. During the comment period, comments may be submitted using several methods:

1. We prefer that readers submit comments online at the Hawai‘i Volcanoes National Park GMP project website at http://parkplanning.nps.gov/havogmp
2. A postage-paid comment form is included in the Hawai‘i Volcanoes National Park Draft GMP/WS/EIS Summary Newsletter, Number 4. You may use this form and attach additional pages as necessary, or
3. Letters may be sent to:

   Superintendent, Hawai‘i Volcanoes National Park
   PO Box 52
   Hawai‘i National Park, HI 96718

In addition, comments may be made in person at one or more of the upcoming talk story sessions. The specific dates and times for these public meetings will be announced in local newspapers, in the draft GMP/WS/EIS newsletter, and on the Hawai‘i Volcanoes National Park homepage (http://www.nps.gov/havo) and the GMP/WS/EIS project website (http://parkplanning.nps.gov /havogmp). A limited number of additional paper and digital copies of this report are available from the above mailing address. The full report is available for viewing and downloading at the GMP/WS/EIS project website (http://parkplanning.nps.gov/havogmp). This document is also available for viewing at the park, at all public libraries on the Island of Hawai‘i, and at the NPS Pacific West Region’s library in Seattle, Washington.

Your comments and contributions have been a valuable component of this planning process, and we look forward to your additional comments on this draft GMP/WS/EIS.

Please note: before including your address, phone number, e-mail address, or other personal identifying information in your comment, you should be aware that your entire comment—including your personal identifying information—may be made publicly available at any time. While you can ask us in your comment to withhold your personal identifying information from public review, we cannot guarantee that we will be able to do so.

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Hula on crater rim by Halau Hula Kalehuakiʻekiʻeʻikaʻiu. *NPS photo by David Boyle*

EXECUTIVE SUMMARY

View from Palm Trail at Kahuku. *NPS photo by Jay Robinson*

Engagement with youth and volunteers in stewardship activities. *NPS photo.*

EXECUTIVE SUMMARY

INTRODUCTION

Hawai‘i Volcanoes National Park is on the southeastern edge of the Island of Hawai‘i, the southernmost island of the Hawaiian Archipelago. The park was established by Congress on August 1, 1916, as Hawai‘i National Park (subsequent legislation separated Hawai‘i Volcanoes National Park and Haleakalā National Park).

Today, Hawai‘i Volcanoes National Park protects approximately 330,086[1] (368,106)[2] acres of public land, which includes some of the most unique geologic, biologic, and cultural landscapes in the world. Extending from sea level to the summit of Mauna Loa at 13,677 feet, the park encompasses the summits and rift zones of two of the world's most active shield volcanoes—Kīlauea, representing the newest land in the Hawaiian Islands chain, and Mauna Loa, the largest volcano in the world.

Lava flow. *NPS photo by Jay Robinson*

While these two volcanoes are the primary features of the park and the principal reason for its establishment, this volcanic topography also supports one of the most fascinating biologic landscapes in the world, sustaining incredibly diverse populations of plant and animal communities across seven ecological life zones. Located more than 2,000 miles from the nearest continent, Hawaiian plants and animals evolved in almost complete isolation for the past 30 million years. As a result, over 90% of the native terrestrial flora and fauna in Hawai‘i are endemic to this small archipelago. The park provides habitat for 52 federally listed endangered or threatened species and eight species that are candidates for listing. Included among these species are the nēnē (Hawaiian goose), ‘io (Hawaiian Hawk), and ‘āhinahina (Mauna Loa silversword). Considering this diversity of life and its distinction on the planet, Hawai‘i Volcanoes National Park is both a fantastic laboratory for the study of biogeography and evolution within the Pacific Islands and a cornerstone for recovery of native Hawaiian species found nowhere else in the world.

In addition to its geological and biological significance, the park also plays a unique role in the history of human development on the Hawaiian Islands and remains an important home to living cultures in Hawai‘i. Just as the volcanic and biologic features of the land have shaped the landscape of Hawai‘i Volcanoes National Park, so too have the people who have been a part of its history. Over five centuries before the establishment of the park, Native Hawaiians lived, worked, and worshiped on this sacred ground. Later, in the 19th and early 20th centuries, adventurers, explorers, scientists, philanthropists, and individuals also left their mark on the

[1] The official, designated acreage of Hawai‘i Volcanoes National Park is 323,431 acres. However, the park also manages an area called ‘Ōla‘a, which is outside the park's official designated boundary. Because this area has been managed by Hawai‘i Volcanoes National Park since federal acquisition in 1952 and continues to affect current management decisions in the park, this GMP includes ‘Ōla‘a within the total acreage that the park protects.

[2] Determining acreage at Hawai‘i Volcanoes National Park is a complex process by which varying sources provide different estimations of total acreage. Unless otherwise specified, acreage listed in this document includes two numbers: the first is the official acreage derived from deeds of conveyance to the United States and county/state tax assessor records, the sum total of which constitute the official NPS acreage for the park. (The official park acreage is maintained by the NPS Land Resource Division, WASO.) The second (listed in parentheses) is an estimation generated by geographic information systems (GIS) software that uses projections on the land to calculate acreage within geographically defined boundaries. When available and appropriate, both numbers are included in this GMP/WS/EIS because deed/tax assessor estimates, which are used in legislation and policy for the park, do not exist for some areas in the park such as those acres analyzed for wilderness eligibility in the Kahuku Unit.

landscape. Today, ancient petroglyphs, stone walls, and footpaths persist between massive lava flows. Historic housing districts, historic structures, and historic roads dot the developed corridors of the park, together revealing the diverse cultures and history that have been, and continue to play, an integral role on this landscape.

New life on lava flow. *NPS photo*

Hawai‘i Volcanoes National Park contains 123,100 (130,950) acres of federally designated wilderness set aside in 1978. In 1980, Hawai‘i Volcanoes and Haleakalā National Parks were jointly designated as “Hawai‘i Island International Biosphere Reserve” by United Nations Educational, Scientific and Cultural Organization (UNESCO), and seven years later, in 1987, the park was also declared a World Heritage Site by the World Heritage Convention of UNESCO. Very few areas in the United States are designated as both a Biosphere Reserve and World Heritage Site.

The last master plan for Hawai‘i Volcanoes National Park was completed in 1975 and no longer provides adequate guidance to address the policy and operational issues now facing park management. Many conditions in Hawai‘i Volcanoes National Park and throughout the region have changed since the current master plan was completed in 1975, including: continuous eruptions at Pu‘u ‘Ō‘ō on Kīlauea Volcano since 1983 and related impacts on resources and visitor opportunities; increased visitation and changing visitor patterns (approximately 1.6 million visitors annually) and resulting transportation conflicts and parking congestion; the loss of visitor facilities, cultural resources, and significant habitat for numerous federally listed threatened, endangered, and candidate species from volcanic activity; the continuing spread of introduced invasive species and avian disease; increased impacts to the soundscape and acoustic environment; expansion of the park with the addition of the Kahuku Unit; impacts on resources due to climate change; and new international designations including designation as a World Heritage Site and International Biosphere Reserve.

The purpose of this general management plan (GMP) is to articulate a vision and overall management direction for Hawai‘i Volcanoes National Park that reflects contemporary and future issues and challenges facing the park and provide a framework that will guide decision making for the foreseeable future. The general management plan includes management strategies for resource protection and preservation; visitor use; interpretation and education; use of facilities and the need for new facilities; and long-term operations and management of the park. This general management plan also includes a wilderness study, or a formal study of lands eligible in the park for possible recommendation to Congress for wilderness designation as well as a commercial services strategy that articulates goals and strategies for managing commercial services in the park.

‘A‘ā flow with Halema‘uma‘u in background.
NPS photo by Jay Robinson

ISSUES

The general public; NPS staff; Native Hawaiian groups; Hawaiian communities; federal, state, and local agencies; organizations; and businesses identified issues and concerns during the scoping phase (early information gathering) for this general management plan. An issue is defined as an opportunity, conflict, or problem regarding the use or management of public lands. The GMP alternatives provide strategies for addressing these issues within the context of the park's purpose, significance, and special mandates. A detailed description of issues and concerns addressed in the general management plan can be found in the "Purpose and Need" section of *Chapter 1: Introduction and Background* under the heading "Planning Issues and Concerns."

This general management plan provides direction on the following topics:

- a management framework for park managers to use when making decisions about how best to protect **natural resources,** including desired resource conditions and long-term guidance for protection, restoration, and stewardship of the park's natural resources
- a management framework for park managers to use when making decisions about how best to protect the park's **historic structures, cultural landscapes, archeological sites, ethnographic resources, and museum collections,** including desired resource conditions and long-term guidance for preservation and management
- a management framework for park managers to use when making management decisions on issues related to **Native Hawaiian values and ongoing traditional use** as part of preservation, management, and interpretation of park resources
- overall direction for managing the qualities of **wilderness** character in designated wilderness and a **wilderness study** to assess lands eligible in the park for wilderness designation *(Chapter 4: Wilderness Study and Proposal)*
- guidance for park managers to use when making decisions about the park's **research and monitoring** efforts
- guidance on how the park will assess, respond to, and interpret the impacts of global **climate change**, including objectives for reducing or offsetting emissions and an evaluation of the impacts of proposed actions for their impacts on the park's carbon footprint
- a management framework for park managers to use when making decisions about **visitor use, experiences, and opportunities** in different areas of the park by identifying the appropriate types of visitor use and experience at various park sites incorporating visitor demand and resource sensitivity
- general guidance for establishing the types and levels of **commercial activities** that are necessary and appropriate for Hawai'i Volcanoes National Park, including recommendations for any commercial services in Kahuku *(Appendix F: Commercial Services Strategy)*

Hōlei sea arch. *NPS photo by Stephen Geiger*

- guidance for **transportation** options and infrastructure, including circulation patterns and visitor access, that will improve visitor experiences, connect park sites, and provide access to neighboring communities while ensuring protection of resources *(Appendix E: Analysis of Boundary Modification and Land Protection)*
- a sustainable vision for **park facilities** that supports visitors, park operations, and park partners
- a vision for sustainable **park operations**, including operations for the Kahuku Unit, and for natural event and disaster planning
- opportunities to increase efficiency, reduce costs, and create better communication while expanding the park's capacity to accomplish its mission through **interagency coordination and collaboration and partnerships**
- an evaluation of the adequacy of **park boundaries** based on specific criteria for protecting park resources, providing opportunities for public enjoyment consistent with the purpose of the park, and addressing operational and management issues *(Appendix E: Analysis of Boundary Modification and Land Protection)*
- integrated planning for the **Kahuku Unit** as part of a cohesive vision for the entire park

DEVELOPMENT OF THE GENERAL MANAGEMENT PLAN AND WILDERNESS STUDY

This *Draft General Management Plan / Wilderness Study / Environmental Impact Statement* (GMP/WS/EIS) was developed in consultation with NPS staff and program managers; Hawai'i Volcanoes National Park visitors; Native Hawaiian groups; local communities; federal, state, and local agencies; organizations; and businesses. Public involvement efforts were ongoing throughout the planning process and provided critical input into this plan.

The GMP/WS/EIS is based on an analysis of existing and predicted natural and cultural resource conditions, visitor experiences, environmental impacts, and costs. It primarily provides a framework for administration and management and a vision to be realized through future actions. This document also includes an environmental impact statement (EIS), which considers at a general qualitative level the impacts that each of the alternatives could have on the park environment. The environmental impact statement sets the framework for future compliance with the National Environmental Policy Act (NEPA) and the National Historic Preservation Act (NHPA) for the park. It also assists decision makers and the public in assessing the relative merits and effects of the alternatives.

Nēnē with Southwest Rift of Mauna Loa in background. *Photo courtesy of USGS*

ALTERNATIVES

Three alternatives for future management of Hawai'i Volcanoes National Park are presented in this draft GMP/WS/EIS. Each of the alternatives supports and is consistent with the park's purpose and significance, desired future conditions, and current laws, regulations, and policies. The three alternatives represent the range of ideas that NPS sources; the public; federal, state, and local agencies; and Native Hawaiian and stakeholder groups identified regarding natural and cultural resource conditions, visitor use and experiences, and overall management of Hawai'i Volcanoes National Park.

The three alternatives are characterized as follows:

- Alternative 1 (the No-Action Alternative)
- Alternative 2 (the NPS Preferred Alternative)
- Alternative 3

Several other actions and alternatives were also considered but were eventually dismissed from further analysis. These actions and alternatives, along with the rationale for their dismissal, are described near the end of *Chapter 3: Alternatives*.

Management Zones

Management zones define specific resource conditions and visitor experiences to be achieved and maintained in each particular area of the park. Each zone includes the types of activities and facilities that are appropriate in that management zone. For Hawai'i Volcanoes National Park, four management zones were developed by the planning team. These include the following:

- Visitor Services Zone
- Transitional/Semi-primitive Zone
- Wild/Primitive Zone
- Park Support Zone

These zones form the basis of the GMP alternatives and are applied to different geographic locations or areas of the park in alternatives 2 and 3. In alternative 1, the zones were taken from the 1975 *Hawai'i Volcanoes National Park Master Plan*. Each zone gives a general level of management guidance or direction. A map depicting the application of management zones for each alternative can be found in *Chapter 3: Alternatives*.

Deep impression in Footprints area. *NPS photo*

Actions Common to All Alternatives

Actions common to all alternatives present management guidance, desired conditions, and actions that would apply to all alternatives (alternatives 1–3). This section is included before the detailed descriptions of the three alternatives and contains direction the park would follow, regardless of which alternative is selected.

Many aspects of natural and cultural resources management (such as an emphasis on restoring native ecosystems, preservation of wilderness character, and continued support for research), visitor use and experience (such as providing access to the iconic places and volcanic processes), and collaboration with partners on a variety of issues (including coastal and shoreline management) are common to all alternatives. The park would continue to operate Volcano House[SM] as a concession operation for lodging, retail, and food and beverage services in all alternatives.[3] Guidance for Kilauea Military Camp (KMC) and use of the 1877 Volcano House should

[3] The service mark (SM) inserted after "Volcano House" is associated with a legally registered name or designation used in the manner of a trademark to distinguish an organization's services from those of its competitors.

conditions change is also common to all alternatives. The park would continue to provide interpretation at the Jaggar Museum, with improved exhibits, and the Hawaiian Volcano Observatory would continue to operate adjacent to Jaggar Museum.

The park would also continue to implement recommendations in recent planning efforts including: *Fire Management Plan (2007), Crater Rim Drive Rehabilitation Environmental Assessment (May 2010), Archeological Preservation Plan for Kealakomo Ahupua'a (January 2011)*, and the *Final Plan/EIS for Protecting and Restoring Native Ecosystems by Managing Nonnative Ungulates (2013)*.

Situated on two active volcanoes, the need for flexibility in managing Hawai'i Volcanoes National Park is great. Nature is dynamic and volcanic eruptions are possible at any time. Planning for a national park unit in this type of unpredictable environment presents both challenges and opportunities and requires flexibility in how the park may respond to different scenarios. Actual management decisions will likely be guided by the magnitude of an individual event. Rather than provide specific recommendations in the general management plan for how the park may respond to a given event, the planning team developed some general guidance for managers facing volcanic activity in the future, notably with respect to facilities and infrastructure in the park. This guidance is also common to all alternatives.

A 5.5 mile segment of the Chain of Craters Road that ran through the park towards Kalapana was buried by lava flows generated by Pu'u 'Ō'ō. Due to a change in the direction of the lava flow in 2014, an unpaved emergency access route was constructed following the historic road alignment. This route is for emergency access only. When this route is no longer needed for emergency access, it would be used as an equestrian, biking, and hiking trail (similar in character and functionality to the Escape Road from the summit to Mauna Ulu) to provide a quality non-motorized visitor use opportunity and future emergency route without compromising natural values and without adding the management complexity of managing a coastal entrance for public vehicles to enter the park.

Alternative 1: No-action Alternative

Under alternative 1, existing programming, facilities, staffing, and funding would generally continue at current levels to protect the values of Hawai'i Volcanoes National Park. There would be no major changes in current management or visitor use. Implementation of currently approved plans would continue as funding allows. This alternative provides the baseline for evaluating actions and impacts in other alternatives.

KĪLAUEA VISITOR CENTER AND SURROUNDING AREA

The park would continue to maintain the current use and function of buildings with no expansion to buildings. The park would retain the current function of Kīlauea Visitor Center as the main park visitor contact station, as well as park headquarters and administrative offices. The park would continue to upgrade Kīlauea Visitor Center, as needed, for building maintenance and interpretive exhibits.

Bicycling along Crater Rim Trail. *NPS photo by Jay Robinson*

CRATER RIM DRIVE

The park would continue to maintain Crater Rim Drive as a two-way road in keeping with its historic character and, if and when possible, would reopen the closed section for both public and administrative use. The park would also continue to evaluate the pilot hydrogen shuttle technology. This includes the performance of the shuttles that will service proposed stops along Crater Rim

Drive (scheduled to begin in 2015). The park would reopen Halemaʻumaʻu Overlook and parking lot when hazards associated with the volcanic plume are diminished and the park determines, through active monitoring, that air quality and other hazards are at a level that is consistent with general visitor use. This area would continue to be used and maintained for visitor use.

THURSTON LAVA TUBE AND SURROUNDING AREA

The park would continue to implement recommendations from the Thurston Parking Area Improvement Project for specific site improvements at Thurston Lava Tube. Park staff would continue to respond to congestion at Thurston Lava Tube as issues arise and as staff is available. The park would implement transportation congestion management strategies to improve visitor experience and safety in this area. Kīlauea Iki, Puʻu Puaʻi, and Devastation would be maintained in their current configurations to serve existing parking, trailhead, and overlook functions.

CHAIN OF CRATERS ROAD

The park would continue to maintain the character of Chain of Craters Road to NPS standards, ensuring a park-like feel to the driving experience, while providing for visitor safety. The park would identify and clear over-vegetated turnouts to restore views and vistas and to encourage stops along the road. Mauna Ulu and Kealakomo would continue to be maintained as day use areas and viewing locations.

The park would continue to work with partners to provide a sustainable and moveable visitor contact station at the current end of Chain of Craters Road for interpretation and safety on a trial basis. If the pilot project is successful, the park would retain the structure for visitor contact at the end of Chain of Craters Road to replace some of the functions provided by the Waha'ula Visitor Center, destroyed by lava in 1989. This contact station could be relocated along Chain of Craters Road, if necessary, in response to volcanic activity.

Thurston Lava Tube. *NPS photo by Stephen Geiger*

ʻĀINAHOU RANCH HOUSE AND GROUNDS

ʻĀinahou Ranch would continue to provide a management area for nēnē recovery. The park would also continue to administer the ranch house and grounds under the existing interim operating plan, which emphasized activities necessary for maintaining the house and cultural landscape in good condition so as not to preclude future uses. The water system would be maintained for house fire suppression, and the access road to ʻĀinahou would be maintained as an unpaved road.

Kahuku forest restoration volunteers. *NPS photo by Jay Robinson*

KAHUKU UNIT

Kahuku would continue to be managed under an interim operating plan with limited day use visitation on weekends and for special events, but over time and with adequate funding for staff and infrastructure, the park would open

this unit seven days a week. The park would maintain the existing entrance at Kahuku but address safety issues by clearing vegetation, improving signage, and possibly lowering existing berms to improve the line of sight for drivers, in coordination with state highways. The park would also seek to collaborate with the state to evaluate and add a turn lane.

The park would continue to adaptively reuse the site for a mix of visitor services and administrative and operational use, as needed. The park would develop an orientation/interpretive strategy to define and site various media to interpret Mauna Loa geologic and natural history, native species and forest conservation, history of cattle ranching, and Native Hawaiian presence in this area, and also consider broader historical context including World War II military history. The park would maintain a single visitor contact station in lower Kahuku.

The current main road would be maintained for vehicle access to Upper Glover. The park would continue to convert some old pasture roads to trails, and the trail from Kahuku to ʻAinapō could be considered for future use but would not be improved. Interpretation would be enhanced along the current road system and the park would restore the former paddock and pasture areas to natural conditions and/or native communities, as funding allows.

The area above Upper Glover would remain closed to public access because of safety and resource management concerns, including lack of adequate staff or vehicles to adequately patrol this remote area of the park.

Endangered nēnē at Kahuku. *Photo courtesy of USGS*

Alternative 2: Preferred Alternative

The NPS preferred alternative would strengthen and broaden opportunities to connect people with the volcanic world treasure, Hawaiʻi Volcanoes National Park, and provide a wide range of high-quality visitor experiences based on different geographic areas. Kīlauea summit would continue to be the most actively visited area of the park with the greatest concentration of services and amenities for park visitors. Along Chain of Craters Road and Mauna Loa Road, the park would strive to provide visitors with improved opportunities to experience and connect with park resources and values, including new opportunities at places like Mauna Ulu and Kealakomowaena, while dispersing use to create a less congested and more tranquil experience. At Kahuku, although visitor access and recreation opportunities would be expanded from what is currently offered, infrastructure and development would be minimal, gradually phased in over time, and remain rustic in design to provide a primitive visitor experience.

Natural and cultural resources would continue to be managed and protected with a high degree of integrity, consistent with direction provided by existing laws and policies. The preferred alternative emphasizes the park's role as a refuge and haven for native biota, people, and cultures in a world constantly adapting to volcanic activity and island-building processes. The preferred alternative would honor the Native Hawaiian people and culture by recognizing Native Hawaiian values such as mālama ʻāina (nourishing or taking care of the land) and kuleana (responsibility) and perspectives from Native Hawaiian land management such as ahupuaʻa management (managing land from mauka (mountains) to makai (sea)) as important concepts in park stewardship of resources. Native Hawaiian traditional ecological knowledge would be used to enhance current scientific understanding to protect park resources and provide additional interpretive and educational opportunities for visitors.

KĪLAUEA VISITOR CENTER AND SURROUNDING AREA

The park would produce a development concept plan and site-specific interpretive strategy to integrate visitor experiences among the complex of buildings on the summit of Kīlauea. This integrated campus, or kauhale, would include the Kīlauea Visitor Center, Ohia Wing, Volcano Art Center, pā hula (place reserved for hula dancing), and other buildings in the vicinity. The priority would be to stay within the existing footprint of development; however, modest expansion could be necessary to achieve the overall vision and to accommodate walkways, improve circulation, and reduce conflicts between vehicles and visitors.

The park would continue to use Kīlauea Visitor Center as one of two primary visitor facilities as well as park headquarters and administrative offices. Additional parking would be provided to address increased visitor use, the current restrooms would be removed and replaced with a facility of similar capacity behind the visitor center to provide more interpretive space, and the park would construct a 2.5-mile separate shared trail for both pedestrian and bicycle use from Kīlauea Visitor Center to Jaggar Museum.

The park would adaptively reuse the historic Ohia Wing as a cultural museum and administrative offices to also complement the visitor functions of the Kīlauea Visitor Center and Jaggar Museum.

CRATER RIM DRIVE

Assuming eruptive activity ceases or changes in Halemaʻumaʻu Crater and the park determines through active monitoring that air quality and other hazards are at a level that is consistent with general visitor use, the park would reopen the southern section of Crater Rim Drive and keep the road open to the public for two-way traffic, allowing a mix of private vehicles and smaller shuttles (nonmandatory). The historic character and historic alignment of the road would be preserved. To improve safe bicycle access around Crater Rim Drive, the park would also improve signage along the road corridor, provide adjacent bicycle trails when feasible, and consider vehicular traffic closures during specific times of day or days of the week to encourage bicycle use.

As part of a pilot program, large commercial buses or vehicles over 98 inches in width and/or over 38 feet in length would be limited to one-way traffic between Jaggar Museum and Chain of Craters Road junction along the southern portion of road. Administrative use of the road for two-way vehicle traffic would continue to be allowed. Once the Halemaʻumaʻu Overlook is reopened to visitation, the parking lot would be maintained to accommodate the existing capacity, but the park could evaluate site modifications to address sensitive cultural issues and values and improve resource protection.

The park would also continue to evaluate the pilot hydrogen shuttle technology, including the performance of the shuttles that will service proposed stops along Crater Rim Drive (scheduled to begin in 2015).

THURSTON LAVA TUBE AND SURROUNDING AREA

In the preferred alternative, the park would maintain the current mix of parking for private and commercial vehicles at Thurston and use a suite of tools to address congestion and improve visitor experience. These tools could include improved visitor information and outreach for trip planning (emphasizing less busy times of day to visit), increased ranger presence to direct traffic, the use of intelligent transportation systems (such as electronic message boards giving real-time information), vehicle size limitations for parking, time-of-day restrictions on certain vehicles, and/or reservations for commercial vehicles only. Additional restriping and reconfiguration of parking at Thurston Lava Tube along the road may also be required. In addition, the park would consider developing a more specific site plan or development concept plan to integrate trails and parking areas from Kīlauea Iki to Devastation.

Large commercial buses would be able to load and unload at Thurston, but these buses may be required to park at nearby underutilized lots such as Devastation Trail and Puʻu Puaʻi. Some reconfiguration within the existing developed footprint of these parking lots may be needed to accommodate large buses, and improved signing and accessibility ramping would be needed. The park would continue to evaluate implications of implementing one-way traffic between Jaggar Museum and the Chain of Crater Road junction on Crater Rim Drive for large commercial buses and requiring buses to only load and unload at Thurston as conditions change.

The park would also improve and increase interpretive opportunities and themes at Thurston while still protecting rainforest resources.

CHAIN OF CRATERS ROAD

The park would continue to maintain the character of Chain of Craters Road to NPS standards, ensuring a park-like feel for the driving experience, while providing for visitor safety. The park would identify and clear over-vegetated turnouts to restore views/vistas and to encourage stops along the road.

The park would also explore the option of locating an educational pavilion, in addition to a mobile visitor contact station, along Chain of Craters Road to orient visitors, communicate visitor safety information, and provide an alternative visitor experience when the summit is closed to disperse visitation. Potential locations include Mauna Ulu or where the 1974 flows first cross Chain of Craters Road.

The park would continue to work with partners to provide a sustainable and moveable visitor contact station at the current end of Chain of Craters Road for interpretation and safety on a trial basis, replacing some of the functions provided by the Wahaʻula Visitor Center and administration area that was destroyed by lava in 1989. If the pilot project is successful, the park would retain the structure as a contact station to provide visitor services and emergency operations over the long term. If the pilot project is unsuccessful, the park would develop a long-term replacement visitor contact station in the form of an open pavilion or similar structure at the end of Chain of Craters Road. The structure would not be mobile, but interior elements could be made to be quickly removable in the event of an active lava flow that threatens the structure and the framing could be salvaged.

A 5.5 mile segment of the Chain of Craters Road that ran through the park towards Kalapana was buried by lava flows generated by Puʻu ʻŌʻō. Due to a change in the direction of the lava flow in 2014, an unpaved emergency access route was constructed following the historic road alignment. This route is for emergency access only. When this route is no longer needed for emergency access, it would be used as an equestrian, biking, and hiking trail (similar in character and functionality to the Escape Road from the summit to Mauna Ulu) to provide a quality non-motorized visitor use opportunity and future emergency route without compromising natural values and without adding the management complexity of managing a coastal entrance for public vehicles to enter the park.

ʻĀinahou Ranch House. *NPS photo by Jay Robinson*

ʻĀINAHOU RANCH HOUSE AND GARDENS

As in all alternatives, ʻĀinahou Ranch would continue to provide a core management area for nēnē recovery. Park staff would continue to maintain the house and cultural landscape

in good condition. The water system would be maintained for fire protection, and the access road to ʻĀinahou would be maintained as an unpaved road.

Under the preferred alternative, the National Park Service would focus on restoration for nēnē. Additional measures to provide opportunities for public stewardship of the ranch house and gardens and habitat restoration may be allowed through the use of trained volunteers and small service groups under the direction of NPS staff in the field. Within the formal gardens, the park would work with cultural resource staff to replace invasive nonnatives with native species, minimize any new plantings or cultivation, and prevent any inadvertent introduction of nonnatives. Interpretation of ʻĀinahou Ranch and its significance as a cultural resource and important site for nēnē would occur off-site for the general public.

KAHUKU UNIT

Under the preferred alternative, over time and with adequate funding for staff and infrastructure, the park would strive to for operational capacity seven days a week. Recreational infrastructure, such as trails, small-scale campgrounds, and interpretive and educational programs and activities, would be developed to optimize visitor access and provide a range of opportunities to experience Kahuku's unique natural and cultural resources and participate in the recovery of species and sites. The focus would be on recreational activities such as hiking, camping, and nature-viewing, with some biking and scenic driving opportunities. The park would offer opportunities for the community, visitors, and school groups to volunteer on restoration projects in Kahuku and participate in hands-on resources management activities.

The park would maintain the existing entrance at Kahuku but address safety issues by clearing vegetation, improving signage, and possibly lowering existing berms to improve the line of sight for drivers. The park would also seek to collaborate with the state to evaluate and add turn lanes on Highway 11 and would work with the state and other partners to expand interpretive and scenic opportunities along Highway 11.

The park would produce a development concept plan for the lower Kahuku area to provide detailed guidance on adaptive reuse of existing buildings for specific uses, and would determine the numbers and locations of campgrounds, picnic areas, and trails consistent with the overall vision for this alternative.

The park would upgrade and maintain the main road from the existing developed area to Upper Glover for two-wheel-drive access, primarily as one-lane with turnouts, similar in character to the Hilina Pali or Mauna Loa Roads. The main road from Upper Glover east to a designated location near the 1916 lava flows (approximately 3 miles) would be maintained for four-wheel-drive access. There would be no public vehicular access west from Upper Glover. No new roads would be developed in lower Kahuku.

The park would develop a trail network in lower Kahuku that would accommodate different visitor abilities across a series of loop trails and trail connections in an effort to promote hiking, bicycling, and equestrian use. The park would prioritize re-establishing traditional and historic travel routes before any new trail construction; however, new trails could also be constructed in order to create trail connections.

Kahuku mist. *NPS photo by Stephen Geiger*

Overnight camping in Kahuku would be allowed and multiple small-scale designated campgrounds with a low level of infrastructure and minimal services, such as water and compost or vault toilets, would be developed. Sites would be developed for both drive-in and walk-in campers, with some wheelchair-accessible campsites provided.

1924 Kīlauea eruption. *NPS photo*

The park would implement a small pilot program for equestrian use in lower Kahuku pastures to explore allowing equestrian use in Kahuku while managing resource concerns such as the spread of invasive nonnative species. Under the pilot program, vegetation monitoring would be required and limited equestrian use would be allowed by special permit and potentially through a commercial use authorization (CUA) for guided trips.

Under the preferred alternative, the park would manage upper Kahuku for its wilderness characteristics based on its determination of eligibility for inclusion in the national wilderness preservation system. Recreational access in upper Kahuku would be permitted and visitor opportunities, such as hiking and camping, would be managed consistent with a wilderness experience. Trails would provide the primary recreational experience for visitors. The park would also consider developing a small campground in proximity to the existing cabins, outside nēnē habitat and wilderness, for walk-in users, which could also serve as a launching point for backcountry users. Rainwater catchment/shelter could also be provided.

No commercial services or commercially guided recreation would be permitted in upper Kahuku.

Alternative 3

This alternative emphasizes building new connections with the park primarily through expanded education and hands-on stewardship opportunities. Traditional visitor opportunities would continue and capacity could be expanded at some existing sites to allow increased visitation, but new development would be very limited and a suite of management tools would be used to disperse visitors and manage congestion throughout the park. A greater focus would be placed on science and learning opportunities for visitors from mauka (mountains) to makai (sea). The park would immerse visitors in the protection and restoration of native species and ecosystems by maximizing opportunities to participate in restoration activities and additional emphasis would be placed on providing opportunities for visitors to engage in research, scientific investigation, and projects associated with natural and cultural resources management, notably in Kahuku.

Similar to the preferred alternative, natural and cultural resources would continue to be managed and protected with a high degree of integrity, consistent with direction provided by existing laws and policies. This alternative also emphasizes the park's role as a refuge and haven for native biota, people, and cultures in a world constantly adapting to volcanic activity and island-building processes. This alternative would honor the Native Hawaiian people and culture by recognizing Native Hawaiian values such as mālama ʻāina (nourishing or taking care of the land) and kuleana (responsibility) and perspectives from Native Hawaiian land management such as ahupuaʻa management (managing land from mauka to makai) as important concepts in park stewardship of resources. Native Hawaiian traditional ecological knowledge would be used to enhance current scientific understanding to protect park resources and provide additional interpretive and educational opportunities for visitors.

KĪLAUEA VISITOR CENTER AND SURROUNDING AREA

Same as alternative 2.

CRATER RIM DRIVE

Assuming no eruptive activity, the park would maintain the closure of the southern section of Crater Rim Drive to private vehicle traffic from Jaggar Museum to the Chain of Craters Road junction and explore the feasibility of implementing a mandatory shuttle system that would be owned by the National Park Service but operated by a commercial service, or partner. If implemented, this shuttle would run, with two-way service, the length of Crater Rim Drive and would be mandatory from Jaggar Museum south and east to the Chain of Craters Road junction. Locations for parking would be explored and would likely include expanding existing parking areas at Jaggar Museum and Devastation Trail. Large commercial buses would be allowed to run on Crater Rim Drive but would be limited to one-way traffic on the southern section of Crater Rim Drive from Jaggar Museum to Chain of Craters Road. The historic character of the road would be preserved.

ʻApapane and yellow lehua. *NPS photo by Jay Robinson*

In addition, the park would continue to allow administrative use of the road for two-way vehicle traffic. The park also would encourage bicycle use of the road with improved signage for safety concerns. Halemaʻumaʻu Overlook and parking area would be treated the same as alternative 2.

THURSTON LAVA TUBE AND SURROUNDING AREA

Under alternative 3, the park would address congestion and improve visitor experience at Thurston by increasing reliance on shuttle systems, reducing private vehicle parking, and continuing to allow commercial vehicles at Thurston. The park would strive to improve visitor information and outreach for trip planning and emphasize less busy times of the day to visit and expand use of intelligent transportation systems.

To circulate visitors and provide visitor access to Thurston Lava Tube, the park would rely on the Crater Rim Drive shuttle, if implemented, and redirect private vehicle parking to other parking areas such as Kīlauea Iki, Devastation, or Puʻu Puaʻi. Thurston Lava Tube would be maintained as a stop for large and small buses for commercial or educational groups around Crater Rim Drive as well as a shuttle stop. Except for Americans with Disabilities Act (ADA) parking, private vehicle parking at Thurston would be removed. Reconstruction of some of the parking may be necessary to provide compliant ADA parking.

As a way to disperse visitor use and take some of the demand off Thurston Lava Tube, the park would explore the option of expanding public access to other lava tubes for ranger-guided tours that would be focused on science.

CHAIN OF CRATERS ROAD

Chain of Craters Road would be managed the same as alternative 1. In addition, the park would use existing trails, historic trails, turnouts, and waysides to improve visitor experience and limit new development along Chain of Craters Road. New connections between existing trails could create loop hiking opportunities along Chain of Craters Road. To limit informal turnouts, the park would improve signage of features and viewpoints at existing road turnouts.

A 5.5 mile segment of the Chain of Craters Road that ran through the park towards Kalapana was buried by lava flows generated by Puʻu ʻŌʻō. Due to a change in the direction of the lava flow in 2014, an unpaved

emergency access route was constructed following the historic road alignment. This route is for emergency access only. When this route is no longer needed for emergency access, it would be used as an equestrian, biking, and hiking trail (similar in character and functionality to the Escape Road from the summit to Mauna Ulu) to provide a quality non-motorized visitor use opportunity and future emergency route without compromising natural values and without adding the management complexity of managing a coastal entrance for public vehicles to enter the park.

Mauna Loa wilderness. *NPS photo*

ʻĀINAHOU RANCH HOUSE AND GROUNDS

Similar to alternative 2, ʻĀinahou Ranch would continue to provide a core nēnē management area for nēnē recovery. Park staff would continue to maintain the house and cultural landscape in good condition with limited use of volunteers or other support groups. The water system would be maintained for house fire suppression, and the access road to ʻĀinahou would be maintained as an unpaved road.

Alternative 3 would provide greater emphasis on restoration for nēnē and minimize human presence in the ranch house and gardens only as directly related to the protection of the site. NPS staff would conduct the majority of the project work at ʻĀinahou, with less use of volunteers or other groups, to minimize the amount of human presence at the site and emphasize nēnē recovery.

KAHUKU UNIT

Similar to alternative 2, park management activities in Kahuku would continue to concentrate on protecting and recovering native species, including special status species, and ecosystems, developing interpretive programs, and conducting surveys and inventories of cultural resources. Alternative 3 would also provide additional recreation opportunities in Kahuku from what is currently offered, such as camping, as well as additional trails and interpretive and educational programs; however, the emphasis would be on a more primitive recreational experience with dispersed recreation and minimal facilities. Opportunities and programs would place additional emphasis on science, stewardship, and service-learning and focus more heavily on coordinated group activities.

Similar to alternative 2, a development concept plan would provide detailed guidance on how best to implement the recommendations of the general management plan, including adaptively reusing existing buildings for specific uses, and would determine the numbers and locations of campgrounds, picnic areas, and trails consistent with the overall vision for this alternative. Recreation opportunities in lower Kahuku would be similar to alternative 2—related to road access, trails, and establishing overnight camping opportunities; however, there would be no commercially guided access for recreation in this alternative. Upper Kahuku would be managed the same as alternative 2, except there would be no additional campground developed in proximity to existing cabins.

Boundary Modifications

Under the two action alternatives, including the preferred alternative, the following boundary modifications are proposed:

- Legislation to include ʻŌlaʻa within the official park boundary since the parcel is not contiguous with the park. The land was donated to the park in 1952 and has been managed by the park since that time.
- The Great Crack parcels (1,951 acres), proposed in the park's previous 1975 master plan, and the

Ala Wai'i parcel (3,478 acres), which is adjacent to the Great Crack parcels and contains important archeological and natural resources.

- Private parcel (222 acres) along the southern edge of Kahuku (west of the present entrance off Highway 11), which would essentially connect the entire Kahuku parcel with Highway 11 and protect lower Kahuku from incompatible development, protect rare dryland forest habitat, and provide access to a historic trail.
- Private parcel at Pōhue Bay (16,457 acres) that extends from lower Kahuku on Highway 11 down to the coast. Acquisition of this parcel would extend the park's portion of Kahuku from mauka to makai, protecting important natural and cultural resources and providing a wider range of options for recreation improvements in lower Kahuku.

No legislation would be needed for acquisition of these parcels contiguous to the boundary; however, acquisition by the National Park Service would be restricted to a willing-seller purchase only. Additional information, including a map of proposed parcels can be found in *Appendix E: Analysis of Boundary Modification and Land Protection*.

WILDERNESS STUDY

The National Park Service proposes wilderness designation of the lands found eligible in the Kahuku Unit (121,015 acres [GIS]) as a natural extension of the existing wilderness within the park. This designation of wilderness at Kahuku would further a conservation vision for high-elevation protection of natural and cultural resources and would create connectivity for park wilderness that would span from the summit of Mauna Loa Volcano all the way down its massive Southwest Rift. This rugged and remote environment offers outstanding opportunities for solitude and the potential for high-challenge recreational hiking. Nearly all of this mauka area of Kahuku is a place where the imprint of humans is scarcely noticeable, overpowered by the vast lava expanse and aura of wildness. Consistent with NPS policy, the park would continue to manage these proposed eligible lands for their wilderness qualities prior to formal designation. Additional information including implications for managing lands proposed for wilderness can be found in *Chapter 4: Wilderness Study and Proposal*.

Koa regeneration at Kahuku within an ungulate-proof exclosure. *NPS Photo*

COMMERCIAL SERVICES

A Commercial Services Strategy (CSS) has been produced as part of the general management plan that includes criteria for evaluating new commercial services, consistent with existing concession law and other statutes (see *Appendix F: Commercial Services Strategy for Hawai'i Volcanoes National Park)*. This strategy would provide broad guidance for future decisions involving commercial services but would not apply retroactively to previously made decisions. The Commercial Services Strategy would not affect the terms of ongoing contracts or authorizations previously signed or issued prior to the completion of the final GMP/WS/EIS.

Coast at Keauhou. *NPS photo*

ENVIRONMENTAL CONSEQUENCES

The potential effects of the three alternatives are analyzed for impacts to natural and cultural resources, wilderness, visitor use and experience, transportation and access, socioeconomics, park operations, and greenhouse gas emissions, climate change, and sustainability. This analysis is the basis for comparing the advantages and disadvantages of the alternatives. Impacts are described in terms of whether they are beneficial or adverse. If adverse, their intensity and duration are described. Cumulative impacts result from the incremental (i.e., additive) impact of an action when added to other past, present, and reasonably foreseeable future actions, regardless of who undertakes such actions. Conclusions for each topic area are provided, comparing each action alternative to the no action alternative.

Summary of Impacts

The following discussion summarizes the impacts of the alternatives considered, in accordance with the National Environmental Policy Act.

IMPACTS FROM ALTERNATIVE 1

Under alternative 1, natural resources would continue to experience adverse impacts in localized areas related to nonnative species, social trails, noise, and disturbances related to park operations, facilities, and visitor use. Cultural resources would continue to be vulnerable to surface disturbance, inadvertent damage, and vandalism. Natural and cultural resources would continue to benefit from ongoing assessment, restoration, treatments, and survey work. Visitor use, including interpretation and education, would continue to benefit from a wide variety of opportunities and programming, but would continue to be hampered by limited staff, overcrowding in some locations, and limited opportunities for some modes of recreation. Visitor access and transportation would continue to be adversely impacted in high visitor use areas, particularly during peak periods. Park operations would continue to be adversely affected by limited staff and the backlog of deferred maintenance.

2011 Kamoamoa eruption with Pu'u 'Ō'ō in background.
NPS photo by Jay Robinson

IMPACTS FROM ALTERNATIVE 2

Many of the adverse and beneficial effects of alternative 1 would continue under alternative 2. Natural resources would benefit from mitigation measures and restoration activities, as well as improved visitor management. Some adverse impacts would occur due to construction of new facilities and trails in some areas, particularly at Kahuku. Cultural resources could experience adverse impacts due to construction of new facilities and trails, but would be mitigated by strict adherence to departmental policy. Beneficial impacts would result from the enhanced ability to document and protect cultural resources. Visitor use, including interpretation and education, would continue to benefit from a wide variety of opportunities and programming and would be enhanced through improved facilities, expanded opportunities (such as at the Kahuku Unit), and increased staff capacity. There could be adverse impacts due to potential restrictions on vehicles in some areas of the park, but overall the changes would be beneficial to visitor access and transportation due to enhanced visitor and vehicle management. Park operations would be improved through increased staff capacity, increased environmental sustainability of facilities, and a decrease in deferred maintenance.

IMPACTS FROM ALTERNATIVE 3

Many of the adverse and beneficial effects of alternative 1 would continue under alternative 3. Effects on natural and cultural resources would be similar to alternative 2. Visitor use, including interpretation and education, would continue to benefit from a wide variety of opportunities and programming and would be enhanced through improved facilities, expanded opportunities (such as at the Kahuku Unit), and increased staff capacity. There would be adverse impacts due to restrictions on vehicles, such as Crater Rim Drive and other areas, and no commercial services at the Kahuku Unit. Overall, the changes would generally be beneficial to visitor access and transportation due to enhanced visitor and vehicle management. Under alternative 3, there would be some noticeable changes to facilities, such as the conversion of Volcano House to energy independence, and new facilities such campgrounds and education pavilions could be added, but the overall new development would be less than under alternative 2. Park operations would be improved through increased staff capacity, increased environmental sustainability of facilities, and a decrease in deferred maintenance.

Environmentally Preferable Alternative

The environmentally preferable alternative is defined as "the alternative that will promote national environmental policy as expressed by NEPA (section 101(b)) in Section 101 of the National Environmental Policy Act." The environmentally preferable alternative for Hawai'i Volcanoes National Park is alternative 2, the NPS preferred alternative. This alternative best satisfies the national environmental goals by providing the highest level of protection of natural and cultural resources while concurrently providing a wide range of neutral and beneficial uses of the environment. This alternative maintains an environment that supports a diversity and variety of individual choices, and it integrates resource protection with an appropriate range of visitor uses and understanding.

IMPLEMENTATION

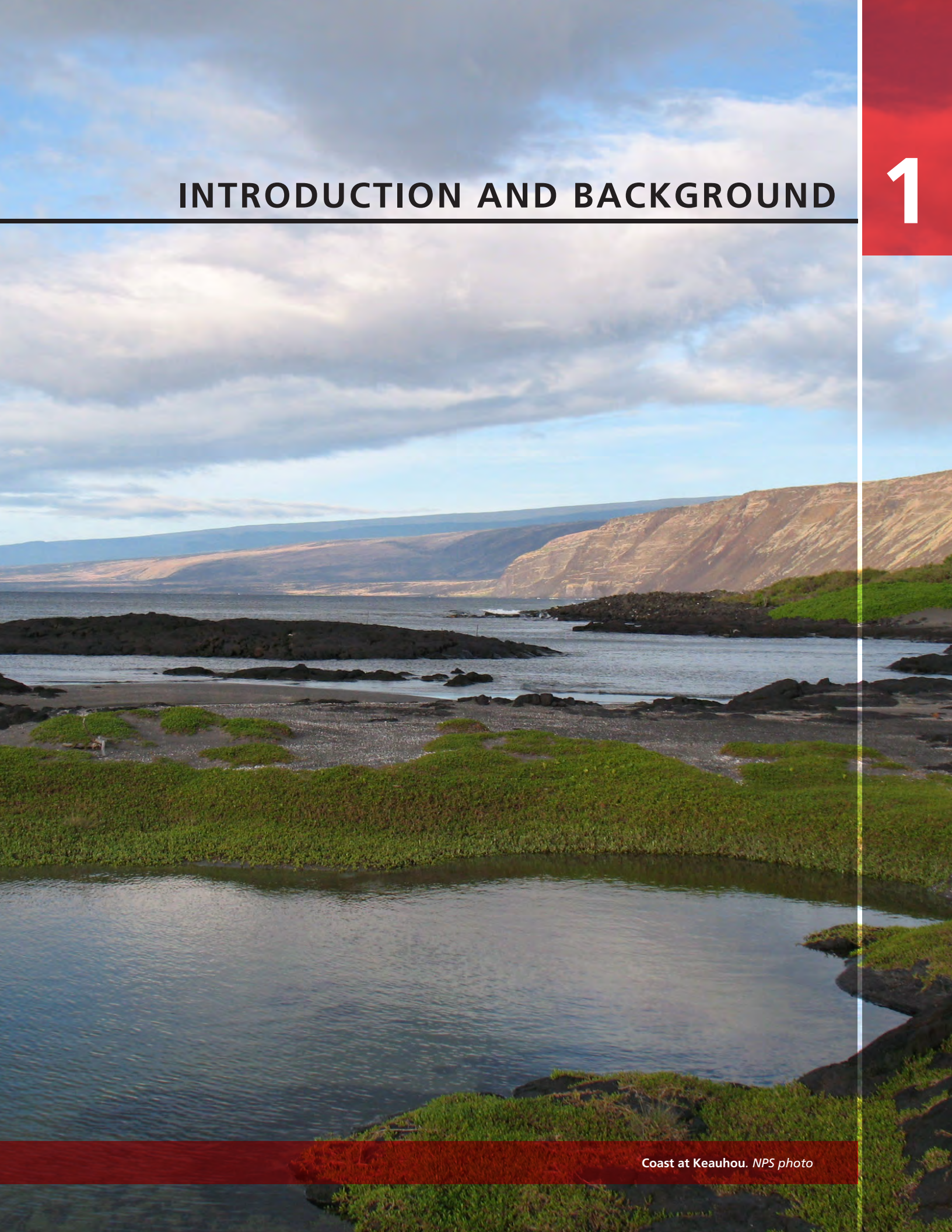
Once the general management planning process is completed, the selected alternative would become the new management plan for Hawai'i Volcanoes National Park and would be implemented in phases over the next couple of decades. Implementation of the actions and developments proposed within this management plan is dependent on funding available at the time of need. The approval of this general management plan does not guarantee that the funding and staffing needed to implement the plan would be forthcoming. Instead, the plan establishes a vision of the future that will guide future management of the park. In addition to funding, implementation of any preferred alternative could be affected by other factors. More detailed planning, environmental documentation, and studies could be required before most actions proposed in the alternatives are completed. Additionally, all of the alternatives were developed on the assumption that certain mitigating actions would be incorporated into the proposed actions in order to reduce the degree of adverse impacts.

Hālape coast. *NPS photo by Jay Robinson*

Rugged coastal shoreline. *NPS photo*

INTRODUCTION AND BACKGROUND

1



Coast at Keauhou. *NPS photo*

Flowering māmane. *NPS photo by Jay Robinson*

CHAPTER 1: INTRODUCTION AND BACKGROUND

INTRODUCTION

Hawai‘i Volcanoes National Park is on the southernmost island of the Hawaiian Archipelago, more than 2,000 miles from the nearest continental land mass. It is a unit of the national park system in the Pacific West Region and is part of the Hawaiian High Islands Ecoregion. The park is within the Second Congressional District in Hawai‘i County, Hawai‘i.

LOCATION AND ACCESS

Situated on the southeastern edge of the Island of Hawai‘i, the park is approximately 30 miles southwest of Hilo and 95 miles southeast of Kona and is bisected by the Mamalahoa Highway (State Route 11)—the primary road that stretches between these two cities along the southern half of the island. The boundary of the park extends from the coast (south of the town of Pahoa) up to the summits of two of the five shield volcanoes on Hawai‘i Island (Kīlauea and Mauna Loa) and drops down along the southwest rift zone of Mauna Loa to State Route 11, west of the town of Nā‘ālehu. Located within Hawai‘i County, the park stretches across the rapidly growing rural Puna and Ka‘ū Districts *(Figure 1.1. Park Vicinity*).

Regional Context

Hawai‘i Volcanoes National Park encompasses approximately 10% of the land on the island and is surrounded by state and privately held lands, including those owned by the State of Hawai‘i, Kamehameha Schools, and The Nature Conservancy *(Figure 1.2. Adjacent Land Ownership)*. These entities are all part of a consortium of partner organizations and land management agencies known as the Three Mountain Alliance, the largest cooperative land management effort focused on watershed protection in Hawai‘i. Kamehameha Schools, owners of a 30,000 acre parcel called the Keauhou Ranch that abuts the park, and the State of Hawai‘i, who manages a conglomeration of designated natural area reserves (NARS), forest reserves, and game management areas, both share boundaries with Hawai‘i Volcanoes National Park. These areas include: the Keauhou Ranch, the Kahauale‘a, Pu‘u Maka‘ala, Kīpāhoehoe, and Manukā Natural Area Reserves; the Mauna Loa Forest Reserve and Game Management Area; and the Kapāpala, Ka‘ū, ‘Ōla‘a, and Upper Waiākea Forest Reserves.

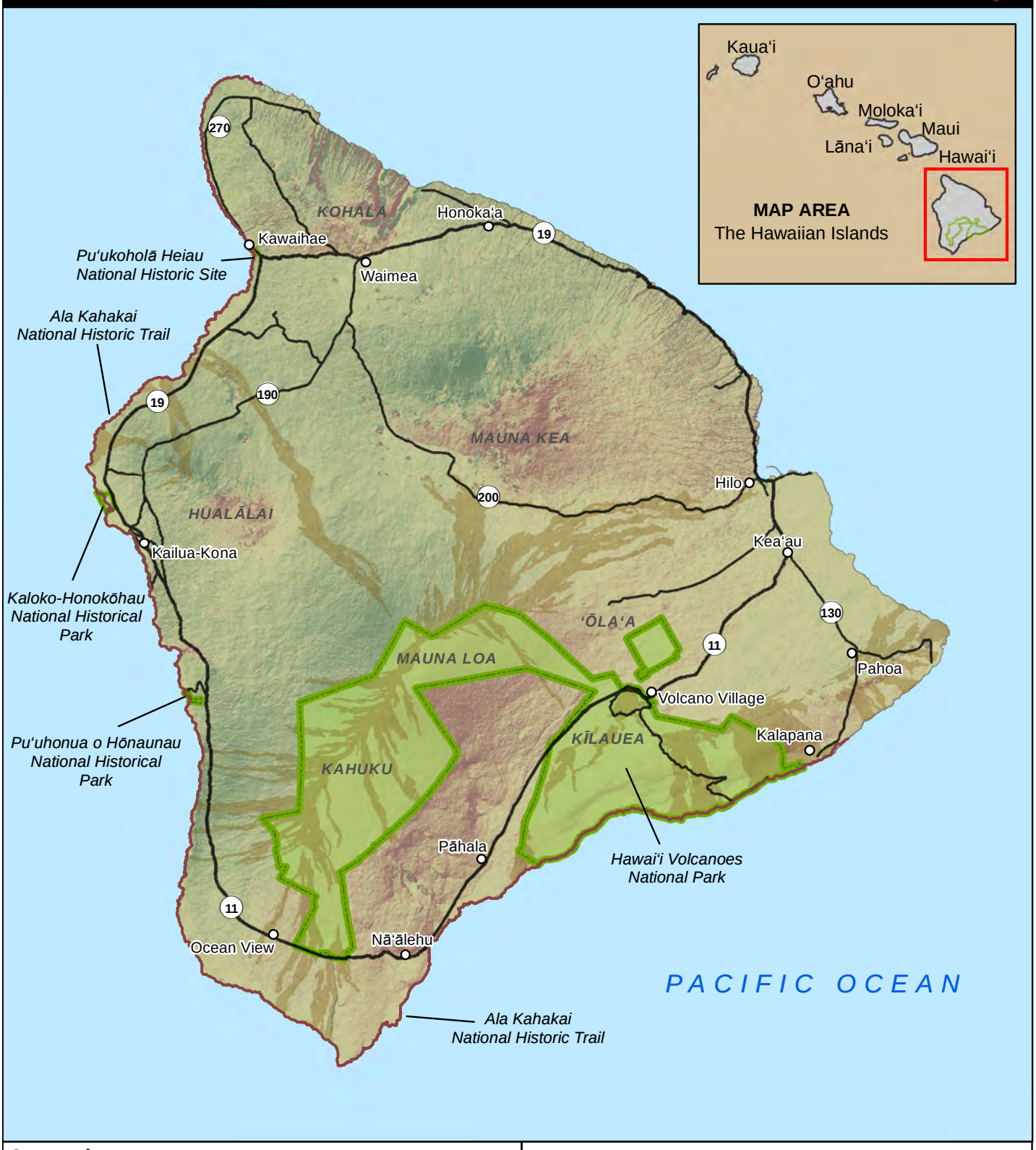
Four other units of the national park system are located on the west coast of the Island of Hawai‘i: Pu‘ukoholā Heiau National Historic Site, Kaloko-Honokōhau National Historical Park, Pu‘uhonua o Hōnaunau National Historical Park, and Ala Kahakai National Historic Trail (*Figure 1.1. Park Vicinity*).

The closest communities to Hawai‘i Volcanoes National Park are Volcano Village to the north and Ocean View to the west of the Kahuku Unit. Nā‘ālehu and Pāhala are also located along the Māmalahoa Highway between Kahuku Unit and the main entrance of the park. Kalapana, a community located just outside the park’s east boundary was connected to the park via a scenic byway prior to 1986, when a large portion of the road became covered by lava. Within the park, military personnel and their guests vacation at Kilauea Military Camp (KMC), an Army-operated 54-acre historic recreational complex on park land currently under a special use permit.

Classic depiction of Kīlauea eruption in 1894.
Painting by D. Howard Hitchcock 1894 from NPS archives

Figure 1.1 Park Vicinity

Hawai'i Volcanoes National Park GMP/WS/EIS



Legend

- NPS Boundaries
- Major Roads
- Ala Kahakai National Historic Trail
- Recent Lava Flows

Kilometers: 0 — 25

Miles: 0 — 10

Produced by: PWR - Seattle Planning Office

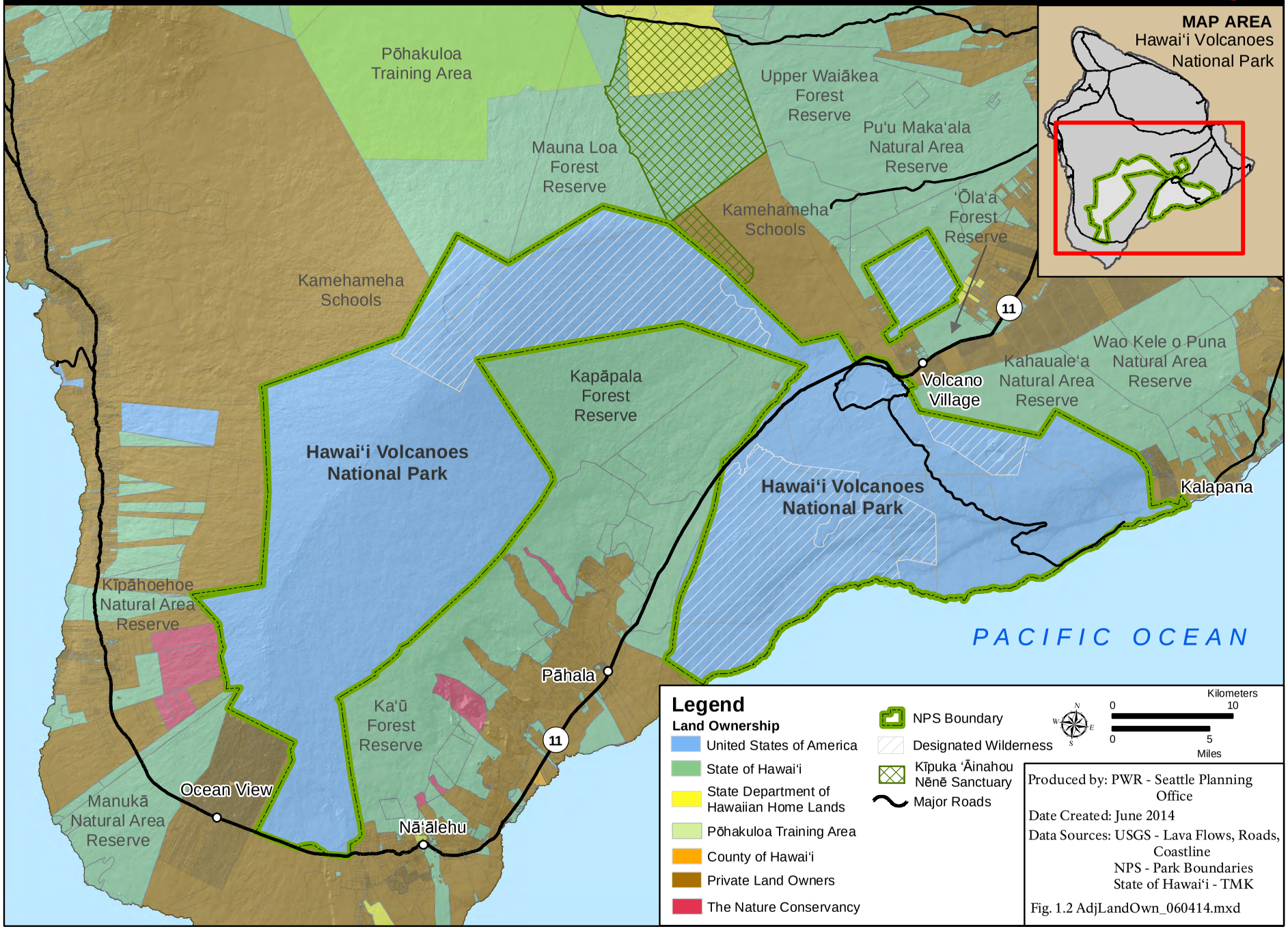
Date Created: June 2014

Data Sources: USGS - Lava Flows, Roads, Coastline
NPS - Park Boundaries

Fig. 1_1 Park Vicinity_060414.mxd

Figure 1.2 Adjacent Land Ownership

Hawai'i Volcanoes National Park GMP/WS/EIS



BACKGROUND OF HAWAIʻI VOLCANOES NATIONAL PARK

Congress established Hawaiʻi National Park (later to become, separately, Hawaiʻi Volcanoes National Park and Haleakalā National Park) on August 1, 1916 "for the benefit and enjoyment of the people of the United States … [and to provide for] … the preservation from injury all timber, birds, mineral deposits, and natural curiosities or wonders within said park, and their retention in their natural condition as nearly as possible" (16 *United States Code* [USC]391). The purpose of the park is to protect, study, and provide access to Kīlauea and Mauna Loa, two of the world's most active volcanoes and to perpetuate endemic Hawaiian ecosystems and the traditional Hawaiian culture connected to these landscapes (Park 2009f).

Today, Hawaiʻi Volcanoes National Park protects approximately 330,086[1] (368,106)[2] acres of public land, which includes some of the most unique geologic, biologic, and cultural landscapes in the world. Extending from sea level to the summit of Mauna Loa at 13,677 feet, the park encompasses the summits and rift zones of two of the world's most active shield volcanoes—Kīlauea, representing the newest land in the Hawaiian Islands chain and Mauna Loa, the largest mountain in the world *(see Figure 1.1. Park Vicinity)*.

[1] The official, designated acreage of Hawaiʻi Volcanoes National Park is 323,431 acres. However, the park also manages an area called ʻŌlaʻa, which is outside the park's official designated boundary. Because this area has been managed by Hawaiʻi Volcanoes National Park since federal acquisition in 1952 and continues to affect current management decisions in the park, this GMP includes ʻŌlaʻa within the total acreage that the park protects.

[2] Determining acreage at Hawaiʻi Volcanoes National Park is a complex process by which varying sources provide different estimations of total acreage. Unless otherwise specified, acreage listed in this document includes two numbers: the first is the official acreage derived from deeds of conveyance to the United States and county/state tax assessor records, the sum total of which constitute the official NPS acreage for the park. (The official park acreage is maintained by the NPS Land Resource Division, WASO.) The second (listed in parentheses) is an estimation generated by geographic information systems (GIS) software that uses projections on the land to calculate acreage within geographically defined boundaries. When available and appropriate, both numbers are included in this GMP/WS/EIS because deed/tax assessor estimates, which are used in legislation and policy for the park, do not exist for some areas in the park, such as those acres analyzed for wilderness eligibility in the Kahuku Unit.

Halemaʻumaʻu glow. *Photo courtesy of USGS-HVO*

While these two volcanoes are the primary features of the park and the principal reason for its establishment by Congress as a unit of the national park system, this volcanic topography also supports one of the most fascinating biologic landscapes in the world. As trade winds sweep across the eastern shores of Hawaiʻi and up the vast alpine slopes of Mauna Loa, moisture from these winds creates large variations in precipitation that, in turn, sustain incredibly diverse populations of plant and animal communities across eight ecological life zones. Located more than 2,000 miles from the nearest continent, Hawaiian plants and animals evolved in almost complete isolation for the past 30 million years. As a result, over 90% of the native terrestrial flora and fauna in Hawai`i are endemic to this small archipelago. The park provides habitat for 52 federally listed endangered or threatened species and eight species that are candidates for listing. Included among these species are the nēnē (Hawaiian goose), ʻio (Hawaiian Hawk), and ʻāhinahina (Mauna Loa silversword). Considering this diversity of life and its distinction on the planet, Hawaiʻi Volcanoes National Park is both a fantastic laboratory for the study of biogeography and evolution within the Pacific Islands and a cornerstone for recovery of native Hawaiian species found nowhere else in the world.

In addition to its geological and biological significance, the park also plays a unique role in the history of human development on the Hawaiian Islands and remains an important home to living cultures in Hawaiʻi. Just as the volcanic and biologic features of the land have shaped the landscape of Hawaiʻi Volcanoes National Park, so too have the people who

have been a part of its history. Over five centuries before the establishment of the park, Native Hawaiians lived, worked, and worshiped on this sacred ground. Later, in the 19th and early 20th centuries, adventurers, explorers, scientists, philanthropists, and individuals also left their mark on the landscape. Today, ancient petroglyphs, stone walls, and footpaths persist between massive lava flows, and historic housing districts, ranch buildings, and historic roads dot the developed corridors of the park, together revealing the diverse cultures and history that have been, and continue to play, an integral role on this landscape.

Because of these diverse landscapes, its own legislative history and political boundaries, and patterns of human use, Hawai‘i Volcanoes National Park is now geographically separated into four units: Kīlauea, Mauna Loa, ‘Ōla‘a, and Kahuku Unit *(Figure 1.3. Existing Conditions—Full Park)*.

Keanakāko‘i Overlook. *NPS photo by Stephen Geiger*

The Kīlauea Unit is the most accessible and developed unit of the park. Located just off Māmalahoa Highway west of Volcano Village, this unit extends from approximately 4,000 feet elevation down to the coast between the east and southwest rift zones of Kīlauea *(Figure 1.4. Existing Conditions—Crater Rim Drive)*. Characterized primarily by the volcanic, biologic, and cultural significance of this shield volcano and its crater, Halema‘uma‘u, this unit also sees the highest visitor and administrative use of any other unit in Hawai‘i Volcanoes National Park. The Kīlauea Visitor Center, Jaggar Museum, and Volcano House[SM], a historic commercially operated hotel on the rim of Kīlauea caldera, are all in this unit, as are most of the NPS administrative buildings, the Hawaiian Volcano Observatory (operated by the US Geological Survey), and Kilauea Military Camp (operated by the US Army).[3] The park's primary entrance and two primary roads—Crater Rim Drive, which provides access around the Kīlauea summit area, and Chain of Craters Road, which provides access to the coast—are also in this unit.

Snow on Mauna Loa. *NPS photo by Stephen Geiger*

The Mauna Loa Unit extends approximately 10,000 feet in elevation northeast from State Route 11 near Volcano Village to the summit of Mauna Loa. Characterized primarily by the diversity of life zones that span this volcanic landscape, this unit provides visitors with the opportunity to explore several volcanic, biologic, and historic features of the park, including the Tree Molds Area, the Kīpukapuaulu (Bird Park) Nature Trail, and the Mauna Loa Lookout. This unit also includes hiking access (with cabins and water catchment systems) along the southeast rift zone to Moku‘āweoweo, the caldera of Mauna Loa, for those willing to brave the 20 miles of ascending gradient, fluctuating weather conditions, and volcanic terrain. The Nāmakanipaio campground, the only frontcountry campground in the park, is also in this unit along the Māmalahoa Highway. The only other public vehicular access to this unit is along Mauna Loa Road, an 11.3-mile, one-lane paved road.

[3] The service mark (SM) inserted after "Volcano House" is associated with a legally registered name or designation used in the manner of a trademark to distinguish an organization's services from those of its competitors.

The ʻŌlaʻa Unit, donated to the National Park Service in 1952 via the Hawaiʻi Territorial Executive Order 1540, is geographically separated from the other units of the park by Volcano Village and has therefore never been formally designated as part of Hawaiʻi Volcanoes National Park. (Language in the 1938 legislation for the park stated that Hawaiʻi Volcanoes National Park could acquire lands only if "adjacent and contiguous" to park boundaries.) However, the unit is managed by park administrators for its valuable forest habitat and presence of endemic and/or rare and endangered species. A large portion of the unit (9,329 acres) was designated as wilderness in 1978. Today, this unit remains undeveloped, with no formal trails or services provided to the general public.

As the newest addition to the park, Kahuku Unit, at 115,788 (150,865) acres in size, was acquired by the National Park Service in 2003 *(Figure 1.5. Existing Conditions, Kahuku Unit)*. Stretching from approximately 2,000 to 12,500 feet in elevation, this unit encompasses the southwest rift zone of Mauna Loa and extends across lava fields, pastures, forests, shrubland and mesic, subalpine, alpine, and desert environments. Prior to NPS acquisition, portions of Kahuku had been profoundly transformed by almost two centuries of resource use—most recently that of cattle ranching in the lower section of the unit. Although Hawai`i Volcanoes National Park has begun restoration efforts by fencing and removing nonnative ungulates, controlling localized nonnative plants, and conducting restoration experiments over the last nine years, restoration of native forest will likely take decades. Currently, public access to this unit is limited to weekends and special events and limited to the lower portion of the unit where several ranching roads provide vehicular, bicycling, and pedestrian access.

Bicycling Mauna Loa Road. *NPS photo by Jay Robinson*

Figure 1.3 Existing Conditions, Full Park

Hawai'i Volcanoes National Park GMP/WS/EIS

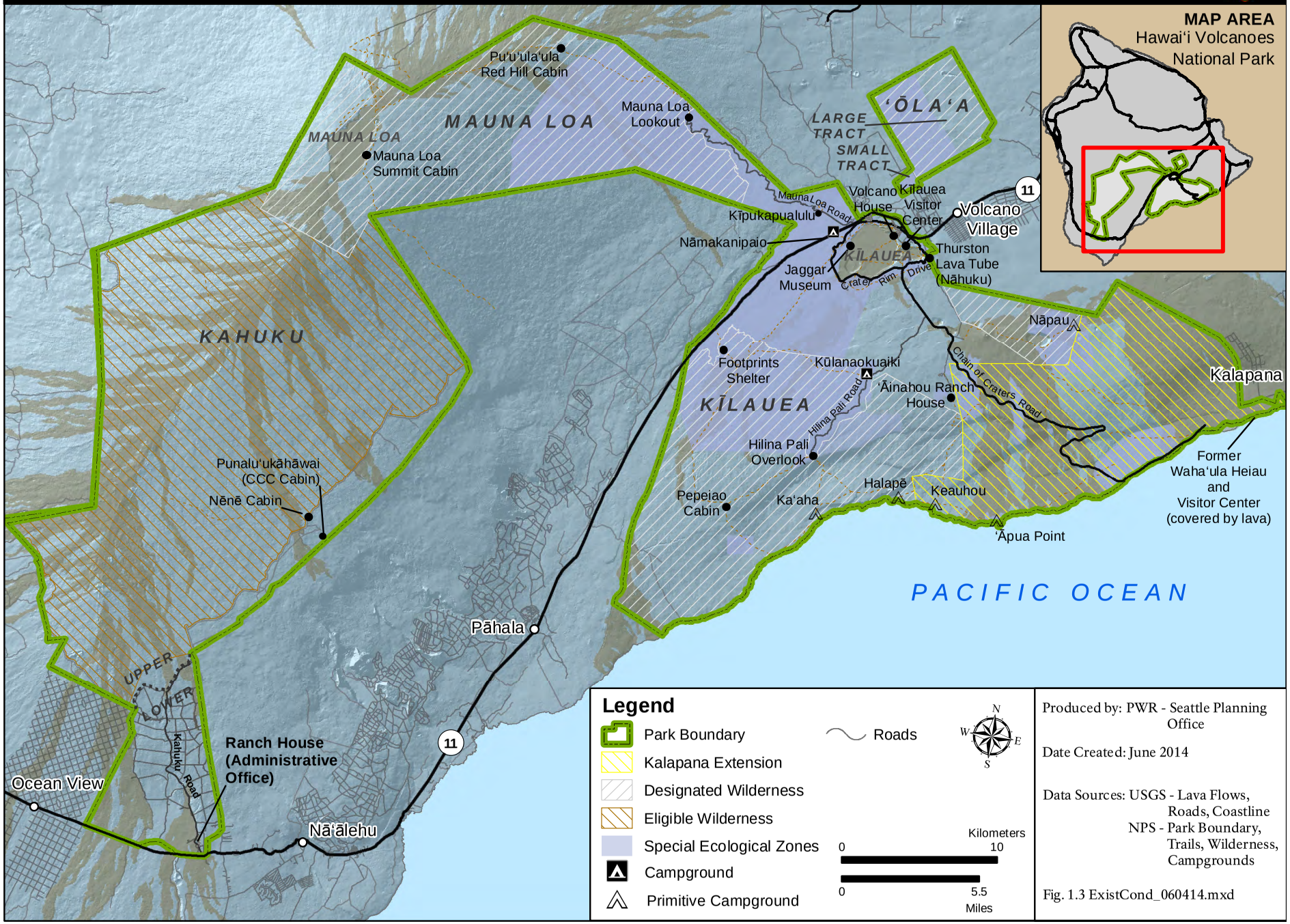
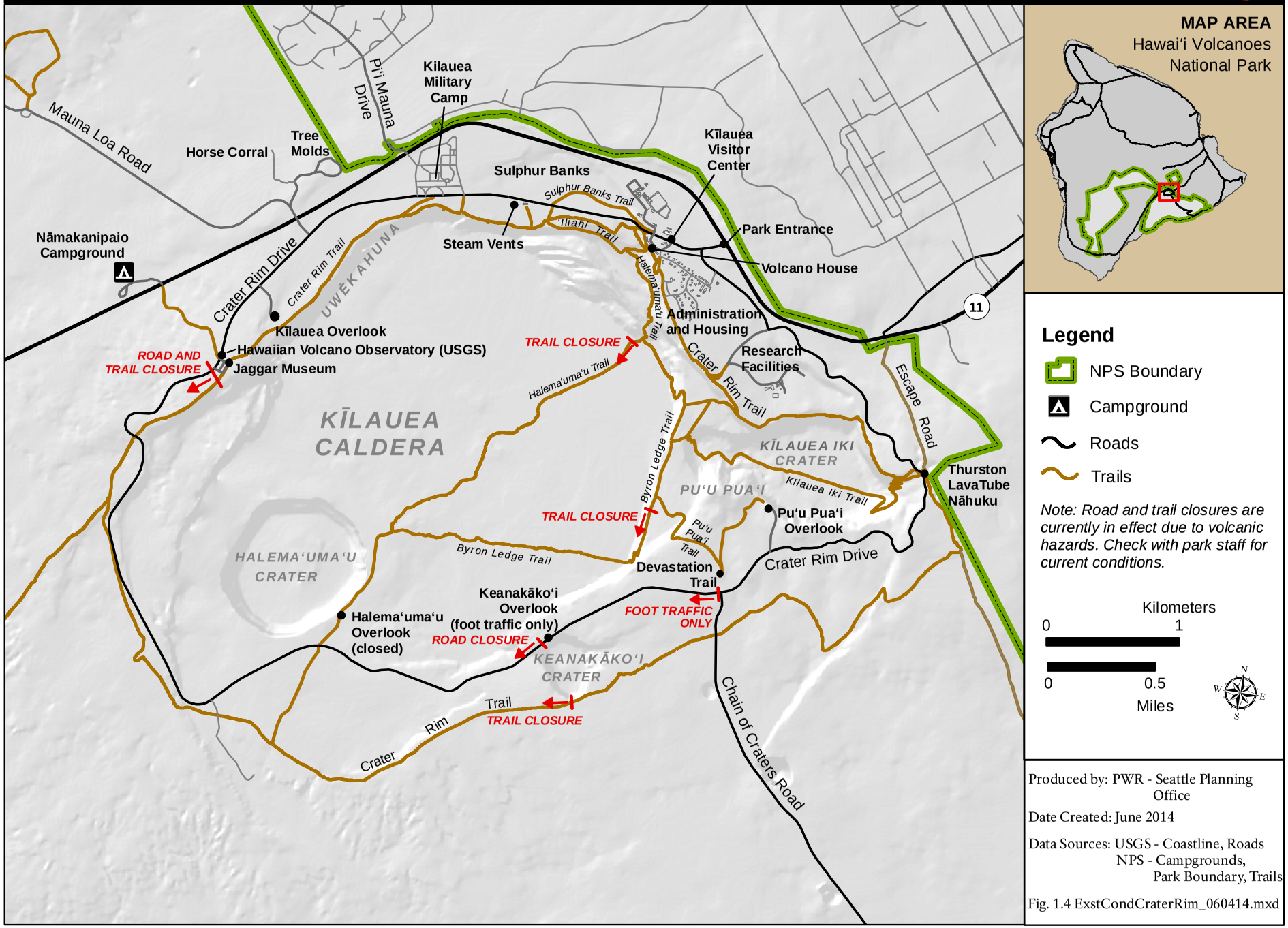


Figure 1.4 Existing Conditons, Crater Rim Drive

Hawai'i Volcanoes National Park GMP/WS/EIS



Legend

- NPS Boundary
- Campground
- Roads
- Trails

Note: Road and trail closures are currently in effect due to volcanic hazards. Check with park staff for current conditions.

Kilometers
0 1
0 0.5
Miles

Produced by: PWR - Seattle Planning Office

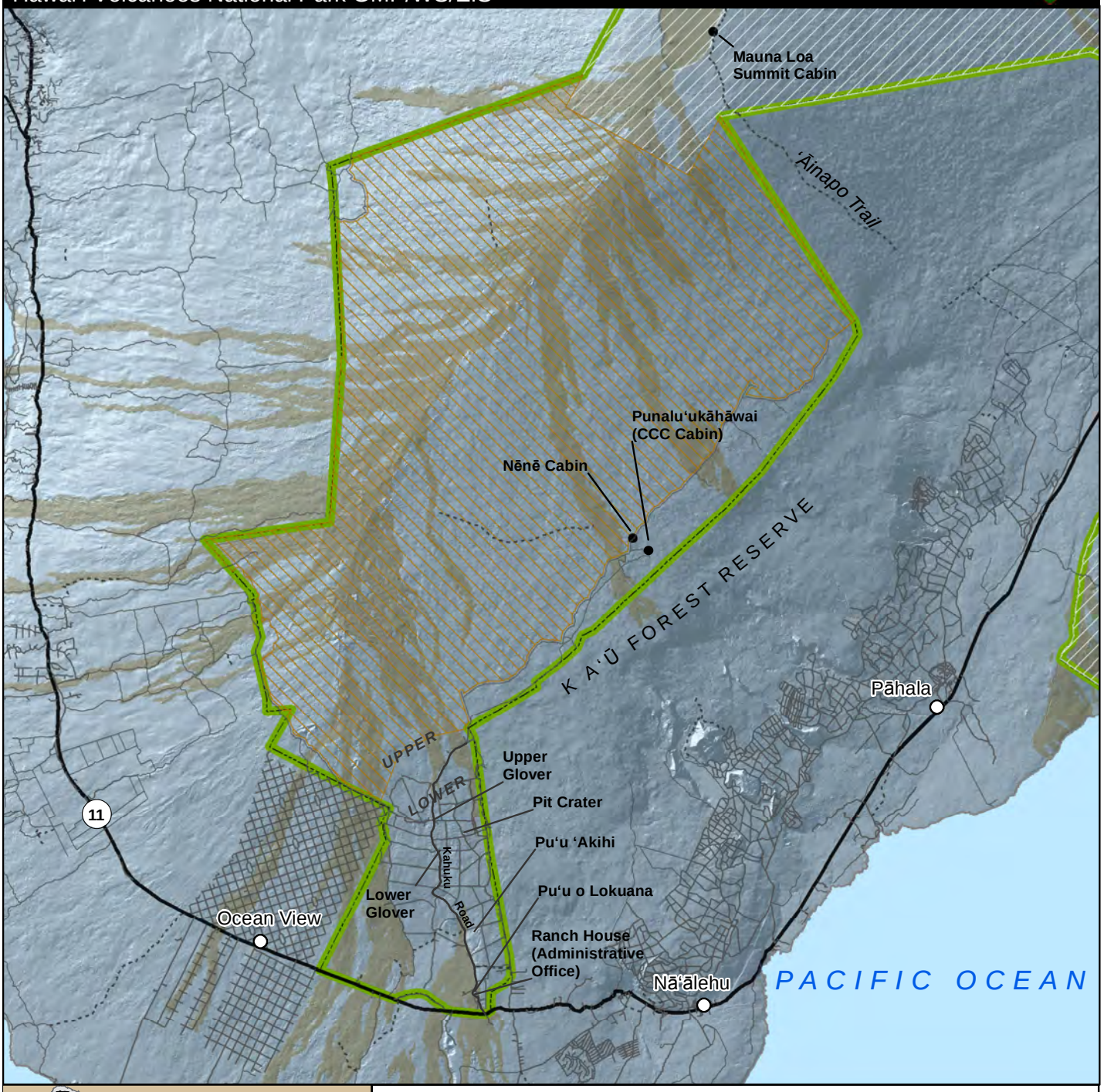
Date Created: June 2014

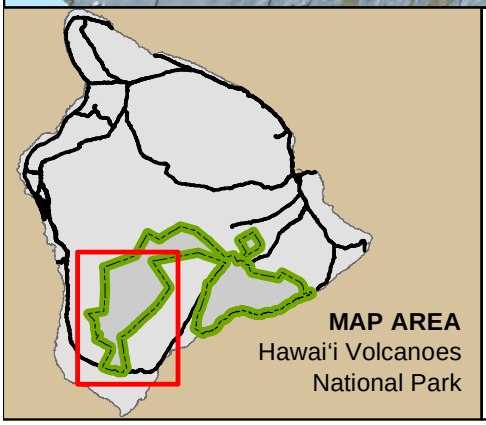
Data Sources: USGS - Coastline, Roads
NPS - Campgrounds, Park Boundary, Trails

Fig. 1.4 ExstCondCraterRim_060414.mxd

Figure 1.5 Existing Conditions, Kahuku Unit

Hawai'i Volcanoes National Park GMP/WS/EIS





Legend

- NPS Boundary
- Designated Wilderness
- Eligible Wilderness
- Cabins
- Recent Lava Flows
- Roads
- Trails

N W E S

Kilometers
0 10
0 5
Miles

Produced by: PWR - Seattle Planning Office

Date Created: June 2014

Data Sources: USGS - Roads, Coastline, Lava Flows
NPS - Park Boundary,Trails, Cabins

Fig. 1.5 ExistCond_Kahuku_060414.mxd

Establishment of Hawai‘i Volcanoes National Park

Congress established Hawai‘i National Park (later to become Hawai‘i Volcanoes National Park and Haleakalā National Park) on August 1, 1916, declaring:

> *The tracts of land on the Island of Hawai‘i and the Island of Maui, in the Territory of Hawai‘i . . . shall be perpetually dedicated and set apart as a public park or pleasuring ground for the benefit and enjoyment of the people of the United States . . . [and provide for] . . . the preservation from injury of all timber, birds, mineral deposits, and natural curiosities or wonders within said park, and their retention in their natural condition as nearly as possible.*

Skylights to lava. *NPS photo*

Since that time, the enabling legislation of the park has been modified several times, both to establish the national parks on the islands of Hawai‘i and Maui as separate parks and to expand the boundary of Hawai‘i Volcanoes National Park. Below is the complete list of amendments made to the enabling legislation.

Subsequent Acts

The following acts occurred after enabling legislation and served to shape the park (see appendix A for full legislation):

- The Act of 1920 authorized the governor of the Territory of Hawai‘i to acquire privately owned lands and rights-of-way within the boundaries of Hawai‘i National Park.
- The Act of 1922 added additional lands to the park, specifically those lands of the Ka‘ū Desert and Kapāpala.
- The Act of 1928 modified the park boundary on the Island of Hawai‘i.
- The Act of 1930 stated that the United States had sole and exclusive jurisdiction over Hawai‘i National Park and further defined the purpose of the park and the activities allowed or prohibited. Specifically, the act stated:

> *All hunting or the killing, wounding, or capturing at any time of any wild bird or animal, except dangerous animals when it is necessary to prevent them from destroying human lives or inflicting personal injury, is prohibited within the limits of said park . . . That the Secretary of the Interior shall make and publish such general rules and regulations as he may deem necessary and proper for the management and care of the park and for the protection of the property therein, especially for the preservation from injury or spoliation of all timber, natural curiosities, or wonderful objects within said park, and for the protection of animals and birds in the park from capture or destruction, and to prevent their being frightened or driven from the park.*

- The Act of 1938 added additional lands, known as the Kalapana extension, to Hawai‘i National Park. This Act eventually passed in legislation authorizing 42,000 acres for addition to the park. It includes provisions for Native Hawaiian fishing access and short-term leases for homesites for Native Hawaiians from the Kalapana community.
- The Act of 1959 formed part of the legislation for the admission of Hawai‘i to the Union, approved March 18, 1959.
- The Act of 1961 separated the parks on Maui and Hawai‘i; officially establishing the park on the Island of Hawai‘i as “Hawai‘i Volcanoes National Park.”
- The Act of 1978 added 269 acres to Hawai‘i Volcanoes National Park.
- The Act of 2000 eliminated restrictions on the acquisition of certain lands contiguous to Hawai‘i Volcanoes National Park and changed the spelling of the park name to include the okina, Hawai‘i Volcanoes National Park.

‘Apapane on a māmane tree. *NPS photo by Jay Robinson*

International Biosphere Reserve and World Heritage Site Designations

Hawai‘i Volcanoes National Park has also been designated as an International Biosphere Reserve and as a World Heritage Site. In 1980, Hawai‘i Volcanoes and Haleakalā National Parks were jointly designated as “Hawai‘i Island International Biosphere Reserve” as part of the Man and the Biosphere Program by UNESCO. This designation identifies the park as an internationally significant ecosystem within the world’s biogeographical provinces. Biosphere reserves are created “to promote and demonstrate a balanced relationship between humans and the biosphere” and must “encompass a mosaic of ecological systems.”

Seven years later, in 1987, the park was also declared a World Heritage Site by the World Heritage Convention of UNESCO, joining it with a system of natural and cultural properties that are considered irreplaceable treasures of outstanding universal value. The park’s designation was based on its qualification as a unique example of significant island building through ongoing volcanic processes that represents the most recent activity in the continuing process of the geologic origin and change of the Hawaiian Archipelago. The World Heritage Committee is currently in the process of developing Statements of Outstanding Universal Value (OUV) for each site that identify the site’s resources or values that are of global significance. These statements, which are expected to be finalized in 2015, can be seen as a sort of “contract” between the host nation and the international community about what resources or values must be preserved to retain the site’s designation as a World Heritage Site. The draft OUV statement for Hawai‘i Volcanoes National Park is based on the following statement of significance:

> *Hawai‘i Volcanoes National Park contains Mauna Loa and Kīlauea, two of the world’s most active and accessible volcanoes where ongoing geological processes are easily observed. This property serves as an excellent example of island building through volcanic processes. Through the process of shield-building volcanism, the park’s landscape is one of relatively constant, dynamic change. The park contains significant parts of two of the world’s most active and best understood volcanoes, Kīlauea and Mauna Loa. The volcano Mauna Loa, measured from the ocean floor, is the greatest volcanic mass on earth.*

Having these global designations, the park is linked with the planet's most cherished and endangered treasures and is protected for people worldwide. Very few areas in the United States are designated as both a Biosphere Reserve and World Heritage Site. There is no jurisdiction implied by either of the UNESCO designations, and the United States and the National Park Service have full authority and jurisdiction over park lands.

Lava ball. *NPS photo by Jay Robinson*

Hiking Palm Trail at Kahuku. *NPS photo by Jay Robinson*

Hāpaimamo at Kahuku. *NPS photo by Jay Robinson*

OVERVIEW OF THE NATIONAL PARK SERVICE PLANNING PROCESS

General Management Plans and the National Park System

The National Parks and Recreation Act of 1978 requires each unit of the National Park Service to have a general management plan; and NPS *Management Policies 2006* (2.3.1) states "The National Park Service will maintain a general management plan for each unit of the national park system."

The purpose of a general management plan is to ensure that a national park system unit (park unit) has a clearly defined direction for resource preservation and visitor use that will best achieve the NPS mandate to preserve resources unimpaired for the enjoyment of future generations. General management planning also makes the National Park Service more effective, collaborative, and accountable by:

- Providing a balance between continuity and adaptability in decision making

  General management plans define the desired conditions to be achieved and maintained in a park unit and provide a touchstone that allows NPS managers and staff to constantly adapt their actions to changing situations while staying focused on what is most important about the park unit.

- Analyzing the park unit in relation to its surrounding ecosystem, cultural setting, and community

  This helps NPS managers and staff understand how the park unit can interact with neighbors and others in ways that are ecologically, socially, and economically sustainable. Decisions made within this larger context are more likely to be successful over time.

- And, providing everyone who has a stake in decisions affecting a park unit an opportunity to be involved in the planning process and to influence and understand the decisions that are made.

  Park units are often the focus of intense public interest. Public involvement through the planning process provides focused opportunities for NPS managers and staff to interact with the public and learn about public concerns, expectations, and values. Public involvement also provides opportunities for NPS managers and staff to share information about the park unit's purpose and significance, as well as opportunities and constraints for the management of park unit lands.

Native hau kuahiwi.
NPS photo by Jay Robinson

The National Environmental Policy Act (NEPA) requires federal agencies to fully consider the environmental costs and benefits of their proposed actions before they make any decision to undertake those actions. NEPA and the Council on Environmental Quality (CEQ) regulations implementing NEPA put two important mechanisms in place to achieve this goal. One is the requirement that all agencies make a careful, complete, and analytical study of the impacts of any proposal that has the potential to affect the human environment, and alternatives to that proposal, well before any decisions are made. The other is the mandate that agencies be diligent in involving any interested or affected members of the public in the NEPA process.

As plans that focus on desired conditions to be achieved and maintained over a relatively long period of time, general management plans are generally large in scope, implemented in phases over many years, and contain little or no detail about specific actions. As a result, the NEPA analysis for general management plans is typically a programmatic, or broad-scale analysis, rather than a site-specific analysis. As decision making moves from general management planning into program planning, strategic planning, and implementation planning, the need for information becomes increasingly focused and specific, requiring additional analysis at those levels.

The ultimate outcome of general management planning for park units is an agreement among the National Park Service, its partners, and the public on why each area is managed as part of the national park system, what resource conditions and visitor experience should exist, and how those conditions can best be achieved and maintained over time. General management plans are intended to be long-term documents that establish and articulate a management philosophy and framework for decision making and problem solving in the parks.

Public involvement provided critical input into this plan. The planning team held many stakeholder and public meetings (talk story sessions) throughout the Hawaiian Islands to discuss the GMP progress. A detailed account of the public involvement process and public comments received by the National Park Service is provided in *Chapter 7: Public Involvement in this draft GMP/WS/EIS*.

Members of park's Kupuna consultation group. *NPS photo*

PURPOSE AND NEED FOR THE PLAN

Purpose of the Plan

The approved general management plan will be the foundational document guiding management of Hawai'i Volcanoes National Park for the next 15 to 20 years. The purposes of this general management plan are as follows:

- confirm the purpose, significance, and special mandates of Hawai'i Volcanoes National Park
- clearly define resource conditions and visitor uses and experiences to be achieved in the park
- provide a framework for managers to use when making decisions about how to best protect the park's resources, how to provide quality visitor uses and experiences, how to manage visitor use, and what kinds of facilities, if any, to develop in the park
- formally study lands eligible in the park for possible recommendation to Congress for wilderness designation
- provide goals and a strategy for managing commercial services within the park
- evaluate whether park boundaries are adequate for protecting resources or whether they need to be adjusted to carry out park purposes
- ensure that this comprehensive plan for decision making that includes a wilderness study and commercial services strategy has been developed in consultation with interested stakeholders and adopted by NPS leadership after an analysis of the benefits, impacts, and economic costs of alternative courses of action

Legislation establishing the National Park Service as an agency and governing its management provides the fundamental direction for the administration of Hawai'i Volcanoes National Park (and other units and programs of the national park system). This general management plan is intended to build on these laws and the legislation that

established and governs Hawai‘i Volcanoes National Park to provide a vision for the park’s future *(Appendix A: Hawai‘i Volcanoes National Park Enabling Legislation and Appendix C: Pertinent Laws, Policies, and Procedures)*.

This *Draft General Management Plan / Wilderness Study / Environmental Impact* Statement presents and analyzes three alternative future directions for the management and use of Hawai‘i Volcanoes National Park. Alternative 2 is the NPS preferred alternative *(*see *Chapter 3: Alternatives)*. The potential environmental impacts of all alternatives are identified and assessed in *Chapter 6: Environmental Consequences*.

Visitors learning about park. *NPS photo*

Actions directed by general management plans or in subsequent implementation plans are accomplished over time. Budget restrictions, requirements for additional data or regulatory compliance, and competing priorities may delay implementation of many actions. Major or especially costly actions could be implemented ten or more years into the future.

This general management plan is a programmatic document that provides conceptual guidance to NPS managers as well as more detailed strategies and actions where appropriate. This general management plan will not describe how particular programs or projects will be implemented or prioritized. Those decisions will be deferred to more detailed implementation planning, which will follow the broad, comprehensive plan presented in this document. All future plans would be consistent with the approved general management plan.

Need for the Plan

The last master plan for Hawai‘i Volcanoes National Park was completed in 1975 and no longer provides adequate guidance to address the policy and operational issues now facing park management.

Many conditions in Hawai‘i Volcanoes National Park and throughout the region have changed since the current master plan was completed in 1975, including: continuous eruptions at Pu‘u ‘ Ō‘ō on Kīlauea Volcano since 1983 and related impacts on resources and visitor opportunities; increased visitation and changing visitor patterns (approximately 1.6 million visitors annually) and resulting transportation conflicts and parking congestion; the loss of visitor facilities, cultural resources, and significant habitat for numerous federally listed threatened, endangered, and candidate species from volcanic activity; the continuing spread of introduced invasive species and avian disease; increased impacts to the soundscape and acoustic environment; expansion of the park; impacts on resources due to climate change; and new international designations including designation as a World Heritage Site and International Biosphere Reserve.

Specifically, Mauna Loa Volcano last erupted in 1984, and Kīlauea Volcano has been in nearly continuous eruption since 1983. Given the uncertainty of operating on a volcanic landscape, there is a great need for flexibility in management that would benefit from a general management planning process. Due in part to this volcanic activity, park visitation has also changed dramatically over the last 35 years. Both the demographics and size of visitation has changed and diversified, as have the ways in which people interact with park resources. These changes require

creative strategies to connect visitors to the park, provide visitor services, and manage congestion and conflicts. In addition, these changes in visitation, along with ecological changes both at home and around the world, have created a number of natural and cultural resource protection issues, such as the introduction of invasive nonnative species, that need to be addressed in the new general management plan.

In 1978, 123,100 (130,950) acres of Hawai'i Volcanoes National Park were also designated as wilderness. Two years later, Hawai'i Volcanoes and Haleakalā National Parks were jointly designated as "Hawai'i Island International Biosphere Reserve" by UNESCO, and eight years later, in 1987, the park was also declared a World Heritage Site by the World Heritage Convention of UNESCO. Then, in 2003, the park acquired 115,788 (150,865) acres of the Kahuku Ranch, creating the Kahuku Unit, located on the southwest rift of Mauna Loa summit down to State Route 11. This acquisition increased the park size by 50% and now provides unique opportunities and challenges for resource management and visitor use. These changes in lands and designations need to be integrated into park planning efforts, and the wilderness potential of these new lands needs to be assessed.

Hilina Pali Overlook. *NPS photo*

Scope of the Plan

The following topics describe some of the preliminary needs and challenges this *Draft General Management Plan / Wilderness Study / Environmental Impact Statement* must address for the park to preserve resources while providing for public use and enjoyment. The general public; NPS staff; and representatives from Native Hawaiian groups; local communities; county, state, and federal agencies; and various organizations and businesses identified issues and concerns about park management during the scoping phase (early information gathering) for this general management plan. An issue is defined as an opportunity, conflict, or problem regarding the use or management of public lands. Comments were solicited at public open houses, through planning newsletters, and at meetings with agencies and community stakeholders (see *Chapter 7: Public Involvement* for more information about the scoping efforts).

PLANNING ISSUES AND CONCERNS

NATURAL RESOURCE PRESERVATION AND MANAGEMENT

Hawai'i Volcanoes National Park is home to an amazing diversity of life contained in habitats that span from subtropical rainforest to mesic and dry forest, subalpine and alpine ecosystems and coastal strand communities. Invasive species are an overriding natural resource issue at the park. Invasive nonnative species have degraded natural ecosystems and compromised the flora and fauna. They threaten many species with local extirpation which, in some cases, can threaten an entire population's viability.

Fifty-two species in the park are federally listed as threatened or endangered, eight species are candidates considered for listing, and several dozen more species are considered State Species of Concern or locally rare. Strategies are needed to staff and fund preservation and restoration activities to sustain resource viability. Improving the capacity of the park to manage, preserve, and perpetuate natural resources is likely to

require innovative problem solving, creative funding, dynamic partnerships, and regional collaboration. The general management plan will provide a framework for park managers to use when making decisions about how best to protect natural resources. The general management plan will also articulate desired resource conditions and provide long-term guidance for protection, restoration, and stewardship of the park's natural resources.

CULTURAL RESOURCE PROTECTION AND MANAGEMENT

The park has many significant cultural landscapes, historic structures, archaeological sites, ethnographic resources, and museum collections. Managing these resources presents challenges, such as identifying appropriate adaptive reuse options; determining appropriate treatments in a changing or harsh environment; protection from visitor impacts, weathering, and vandalism; and ensuring funding for preservation and education. The general management plan will provide a framework for park managers to use when making decisions about how best to protect the park's historic structures, cultural landscapes, archaeological sites, ethnographic resources, and museum collections. The general management plan will also convey desired resource conditions and provide long-term guidance for preservation and management.

Historic trail across the lava. *NPS photo*

NATIVE HAWAIIAN VALUES AND TRADITIONAL CULTURAL USE

There are many places in the park that are significant to Native Hawaiians for cultural continuity and ongoing traditional use. Natural conditions such as unobstructed mountain vistas, soundscapes and the acoustic environment, and native ecosystems are valued. The general management plan will address Native Hawaiian values and ongoing traditional use as part of preservation, management, and interpretation of park resources. The general management plan will also create a framework for park managers to use when making management decisions on issues related to Native Hawaiian values and traditional uses and provide long-term guidance for the preservation, management, and interpretation of park resources.

Lei making at 2013 Cultural Festival. *NPS photo by Jay Robinson*

WILDERNESS

Approximately 123,000 (130,950) acres of the park are designated wilderness, and, according to the 2012 Kahuku Unit Wilderness Eligibility Assessment, another 121,015[4] acres in the Kahuku Unit meet the eligibility criteria and requirements necessary to qualify for the National Wilderness Preservation System. Based on this eligibility assessment, this planning process formally incorporates a wilderness study into the

[4] This figure was estimated using GIS; no official government survey has been completed to determine the acreage for the wilderness eligible portion of this parcel. The official estimate of the size of the entire Kahuku Unit is based on the state Tax Map Key maps that have not been verified by cadastral surveys. The deed to the land recognizes that the actual acreage may be different than the Tax Map Key acreage (due to the age of the Tax Map Key documents, which were created in the early 1900s).

general management plan that assesses lands eligible in the park for possible recommendation to Congress for wilderness designation *(Chapter 4: Wilderness Study and Proposal)*.

In addition, the park's large expanses of lava produce soundscapes that offer little sound shielding, such that noise from mechanized sources or air tour and military overflights in many wilderness areas are audible for long periods of time. An air tour management plan is underway, but the general management plan will provide general guidance that is needed for noise and wilderness issues.

The general management plan will address the full range of wilderness values and potential impacts to wilderness values, including noise and visual impacts. All wilderness and potential wilderness will be zoned to protect wilderness values in the action alternatives of this plan.

ʻIo. *Photo by Lanaya Deily*

RESEARCH

The park is the home of pioneering studies in conservation biology, ecosystem development, island bio-geography, evolution, invasive species ecology, and long-term monitoring of climate change. Cultural resources also provide significant research potential. There are opportunities to explore how the park can best facilitate research and monitoring efforts, provide for the sharing of research findings, and promote public and staff understanding and appreciation for the value of scientific investigation. The general management plan will provide guidance for park managers to use when making decisions about the park's research and monitoring efforts.

Ash layers. *NPS photo by Jay Robinson*

CLIMATE CHANGE

The effects of global climate change are anticipated to include changes in local weather patterns, wildfire and hurricane frequency, sea levels and ocean resources, distribution of plant and animal communities, and increased avian disease. Proactive planning and management actions will allow the park to adjust to climate change and interpret changing conditions while reducing the impacts to park resources, NPS operations, and visitors. The general management plan will provide guidance on how the park will assess, respond to, and interpret the impacts of global climate change on fundamental resources, including objectives for reducing or offsetting emissions. The general management plan will evaluate the impacts of proposed actions for their impacts on the park's carbon footprint.

VISITOR USE

Approximately 1.6 million people visit the park each year. The park offers these visitors an opportunity to witness the active volcanoes, biodiversity, and cultural richness of the park while encouraging enjoyment, understanding, and stewardship of these resources. Park managers must address competing uses, demands of incompatible activities, and levels of use that may overwhelm resources and infrastructure. Changes in volcanic activity and gas emissions also require proactive management to protect visitor health and safety, yet allow access. The general management plan will provide a framework for park managers to use when making decisions about visitor use in different areas of the park by identifying the appropriate types of visitor use and experience at various park sites incorporating visitor demand and resource sensitivity. The plan will also provide guidance to promote, evaluate, and adaptively manage appropriate and desired types and levels of visitor use in the park. This will include guidance on managing various types of recreation in the park and providing visitors with connections to the resources through interpretation and education.

Learning about kapa bark cloth. *NPS photo*

COMMERCIAL VISITOR SERVICES

Commercial visitor service operators provide a range of visitor services within the park, including food service, lodging, retail sales, guided tours, and educational programs. How can the park improve visitor experiences and promote services that are necessary and appropriate to support visitor needs? The general management plan will provide general guidance for establishing the types and levels of commercial activities that are necessary and appropriate for Hawai'i Volcanoes National Park, including recommendations for any commercial services in Kahuku.

Bicycle tour stopped at Kīlauea Iki. *NPS photo*

TRANSPORTATION, ACCESS, AND CIRCULATION

Current transportation options and infrastructure do not support the high level of visitation at the park and result in congestion, degradation of existing infrastructure, and resource impacts at several popular destinations, including sections of Crater Rim Drive and the Thurston Lava Tube (Nāhuku) areas. Volcanic events have led to closures of park roads and may continue to disrupt established travel patterns. Park roads, parking lots, trails, and modes of transportation need to be evaluated in relationship to visitor needs, commercial use trends, and resource protection. In addition, climate-friendly modes of transportation need to be evaluated. The general management plan will evaluate all modes of transportation, circulation patterns, and identify visitor access that will improve visitor experiences, connect park sites, and provide access to neighboring communities while ensuring protection of resources.

FUNCTIONAL AND FLEXIBLE PARK FACILITIES

The needs for administrative and visitor facilities in the park have changed significantly since the last general management plan was completed, with increases in staffing, growth in park partnerships, and changes in volcanic activity and visitor use patterns. Today, park

operations are scattered throughout the park, often in structures that were not intended for these uses and that may not be sustainable or efficient. Since 1986, lava flows have destroyed a number of facilities including a visitor center, campground, and ranger residences. The flows have covered cultural sites, trails, and miles of highway. The park needs to determine which facilities need to be replaced, and if so, where and how. The park needs to consider whether any facilities and functions should be moved outside the park, further from expected volcanic activity. In addition, the park needs to determine what types of facilities are needed in the recently acquired Kahuku Unit. The general management plan will present a sustainable vision for park facilities, including determining locations, uses, and design guidelines.

EFFECTIVE AND ADAPTABLE PARK OPERATIONS

Having a park situated on two active volcanoes presents many challenges for park operations. The uncertainty of future volcanic activity and concerns about health and safety require operational and emergency procedures that are flexible and responsive to changing conditions. The park needs to determine how park operations will respond to natural events and disasters in terms of communication, access, commitment of facilities, and monitoring in the event of evacuation. With the addition of the Kahuku Unit, the park needs to determine how to extend park operations to cover basic visitor services throughout the park. The general management plan will develop a vision for sustainable park operations, including operations for the Kahuku Unit, and for natural event and disaster planning.

Mauna Ulu eruption (1969-1974) covered Chain of Craters Road by Alanui Kahiko Overlook. *NPS photo*

PARTNERSHIPS AND INTERAGENCY COLLABORATION

Partnerships, both inside and outside park boundaries, have profoundly aided the capacity of the park to meet its mission and have greatly enhanced the quality of services provided. Interagency coordination and cooperation have been ongoing at the park since its inception, focusing on volcanic activity and processes, research, control of invasive species and species recovery. In 2009, the park had over 30 written agreements with various private entities, governmental agencies, and tour groups, educational programs, and cultural and natural resource stewardship projects. The park's involvement with local, regional, and landscape-level conservation partnerships include the Three Mountain Alliance and close relationships with the USGS Hawaiian Volcano Observatory and the Pacific Island Ecosystems Research Center.

Hawai'i Volcanoes National Park has reimbursable agreements for use of park facilities with several federal agencies occupying the park. These relationships provide crucial services and opportunities to the park. The general management plan looks at ways to increase efficiency, reduce costs, and create better communication while expanding the park's capacity to accomplish its mission.

Volunteer assisting with restoration. *NPS photo*

The general management plan also provides guidance to improve communication, coordination, and participation with partners with a goal of protecting ecosystems, watersheds, and visitor opportunities that cross jurisdictional boundaries. The general management plan will develop a framework for interagency coordination and collaboration that enables NPS managers to make effective decisions and foster flexible, productive relationships.

PARK BOUNDARY

The National Park Service, in accordance with the National Parks and Recreation Act of 1978 (Public Law 95-625), also requires that general management plans determine whether park boundaries are adequate for protecting resources or whether they need to be adjusted to carry out park purposes. NPS *Management Policies 2006* state that the National Park Service will conduct studies of potential boundary adjustments and may make boundary revisions to include significant resources or opportunities for public enjoyment related to the purposes of the park; to address operational and management issues such as boundary identification by topographic or other natural features; or to protect park resources critical to fulfilling park purposes. NPS policies also instruct that any recommendation to expand park boundaries be preceded by determinations that the added lands will be feasible to administer considering size, configuration, ownership, cost and other factors, and that other alternatives for management and resource protection have been considered and are not adequate.

Activities adjacent to the park's boundaries have the potential to impact park resources. Resources don't stop at the park's boundary. The ʻŌlaʻa rainforest area is managed by the National Park Service, but was never officially included within the park boundary. The NPS jurisdiction for coastal areas within the park stops at the mean high-water line limiting enforcement efforts regarding coastal resources and visitor safety. The general management plan will address how to best protect the park's resources and evaluate whether any boundary changes should be recommended.

KAHUKU UNIT

Hawaiʻi Volcanoes National Park increased in size by over 50% when the 115,788 (150,865) acre Kahuku Unit was added to the park in 2003. There are currently minimal visitor facilities at the Kahuku Unit, and highway access to this unit needs to be analyzed. The Kahuku Unit includes areas with native ecosystem values, as well as indigenous Hawaiian cultural resources and traditional ranching landscapes. Resource inventory and monitoring has begun, and a wilderness eligibility assessment for the Kahuku Unit, as required by NPS management policy, was completed in 2012.

Forested pit crater at Kahuku. *NPS photo by Jay Robinson*

Planning for the Kahuku Unit will be included in the general management plan as part of a cohesive vision for the entire park, but due to the unique needs of this unit, the general management plan will provide specific guidance on the following issues in the Kahuku Unit: the entrance to the Kahuku Unit; facilities and infrastructure, including roads, existing buildings, and campgrounds; public use, access, and recreation in both the lower and upper sections of the unit; education and interpretation opportunities; resources management; commercial services; and wilderness. Chapter 4 of this plan includes a wilderness study that evaluates any foreseeable effects associated with possible designation of wilderness within the Kahuku Unit.

Planning Issues and Concerns Not Addressed

Not all of the issues or concerns raised by the public are included in this general management plan. Issues that were raised by the public were not considered if they are already prescribed by law, regulation, or policy; if they would be in violation of law, regulation, or policy; or if they were at a level that was too detailed for a general management plan and would be more appropriately addressed in subsequent planning documents.

IMPACT TOPICS

Impact topics allow comparison of the environmental consequences of implementing each alternative. These impact topics were identified based on federal laws and other legal requirements, the CEQ guidelines for implementing the National Environmental Policy Act, NPS *Management Policies 2006*, subject-matter expertise and knowledge of limited or easily impacted resources, and issues/concerns expressed by other agencies or members of the public during scoping. Impact topics were developed to focus the environmental analysis and to ensure that alternatives were evaluated against relevant topics. A brief rationale for the selection of the impact topics that are analyzed in the environmental consequences chapter is given below, as well as a more detailed justification for dismissing other topics from further consideration.

Endangered Cyanea shipmanii. *NPS photo*

Impact Topics to Be Considered

NATURAL RESOURCES

GEOLOGIC RESOURCES—According to NPS *Management Policies 2006* (4.8.2), the National Park Service will preserve and protect geologic resources and features from adverse effects of human activity, while allowing natural processes to continue. Geologic resources found in the park include volcanoes, faults, earth cracks, cinder cones, lava tubes, collapse features, geothermal features, spatter ramparts, tree molds, pahoehoe, ʻāʻā, ash layers, and many more. The alternatives include ground-disturbing activities, as well as potential disturbance of other geologic features. For example, alternatives include actions such as new trail construction, which would result in disturbance to soils and geologic features. Shifts in visitor use patterns or increases in visitor concentrations may impact geologic features. Therefore, geologic resources are included as an impact topic.

SOUNDSCAPES— For management and planning purposes, it is important to distinguish and define certain key terms. Acoustic resources are physical sound sources, including both natural sounds (wind, water, wildlife, vegetation) and cultural and historic sounds (battle reenactments, tribal ceremonies, quiet reverence). The acoustic environment is the combination of all the acoustic resources within a given area—natural sounds as well as human-caused sounds. While the acoustic environment includes sound vibrations made by geological processes, biological activity, and even sounds that are inaudible to most humans, such as bat echolocation calls, the soundscape is the component of the acoustical environment that can be perceived and comprehended by humans. The character and quality of the soundscape influences human perceptions of an area, providing a sense of place that differentiates it from other regions. Noise refers to sound which is unwanted, either because of its effects on humans and wildlife, or its interference with the perception or detection of other sounds. Cultural soundscapes include opportunities for appropriate transmission of cultural

and historic sounds that are fundamental components of the purposes and values for which a park was established.

NPS Director's Order 47: *Soundscape Preservation and Noise Management* defines operational policies that will protect, maintain, or restore soundscapes and the acoustic environment (NPS 2000). Natural sounds are part of the park environment, are vital to the functioning of ecosystems, and may also be valuable indicators of ecosystem health. The alternatives include various motorized activities associated with visitor use and park management, as well as potential shifts in visitor use and concentrations, which may impact soundscapes and the acoustic environment.

VEGETATION, INCLUDING NONNATIVE SPECIES— NEPA calls for examination of the impacts on the components of affected ecosystems. NPS *Management Policies 2006* calls for protecting the natural abundance and diversity of park native species and communities, including avoiding, minimizing, or mitigating potential impacts from proposed projects. The alternatives are likely to result in vegetation loss in some areas, as well as enhancement or restoration of vegetation. In addition, various management actions may risk introduction of nonnative plant species, particularly in upper Kahuku Unit. Mitigations will be developed to minimize risk. Therefore vegetation is included as an impact topic.

WILDLIFE AND WILDLIFE HABITAT, INCLUDING NONNATIVE SPECIES— NEPA calls for examination of the impacts on the components of affected ecosystems. NPS policy is to protect the natural abundance and diversity of park native species and communities, including avoiding, minimizing, or mitigating potential impacts from proposed projects. Many wildlife species may reside in or near the project areas. The alternatives would involve impacts to wildlife such as the removal of wildlife habitat and increased noise levels caused by construction activities or increased concentrations of visitors. The loss or alteration of habitat has a direct effect on wildlife, which is often greatest when nesting and/or foraging areas are affected. Various management actions outlined in the alternatives may risk introduction of nonnative wildlife species, particularly in upper Kahuku Unit. Mitigations will be developed to minimize risk. Therefore wildlife and wildlife habitat is included as an impact topic.

SPECIAL STATUS SPECIES— The federal Endangered Species Act (ESA) requires an examination of impacts to all federally listed threatened or endangered species. NPS *Management Policies 2006* also calls for an analysis of impacts to state-listed threatened or endangered species and federal candidate species, as well as rare, declining, and sensitive species. There are multiple special status species in the park, some of which may be impacted by the proposed alternatives; therefore, special status species are included as an impact topic.

Newly emerged endemic Kamehameha butterfly.
NPS photo by Jay Robinson

CULTURAL RESOURCES

ARCHAEOLOGICAL RESOURCES / HISTORIC STRUCTURES / CULTURAL LANDSCAPES— Consideration of the impacts to historic properties is required under provisions of Section 106 of the 1966 National Historic Preservation Act (NHPA), as amended, and the 2008 NPS Programmatic Agreement among the National Park Service, the National Conference of State Historic Preservation Officers, and the Advisory Council on Historic Preservation (NPS 2008). It is also

required under the NPS *Management Policies 2006*. Conformance with the Archaeological Resources Protection Act in protecting known or undiscovered archaeological resources is necessary. NPS *Management Policies 2006* calls for ongoing inventory and analysis of the significance of archaeological resources found within parks. Federal land managing agencies are required to consider the effects proposed actions may have on properties listed in, or eligible for inclusion in, the National Register of Historic Places (i.e., historic properties), and to allow the Advisory Council a reasonable opportunity to comment. Agencies are required to consult with federal, state, local, and tribal government/ organizations; identify historic properties; assess adverse effects to historic properties; and negate, minimize, or mitigate adverse effects to historic properties while engaged in any federal or federally assisted undertaking (36 CFR Part 800).

The National Historic Preservation Act also requires the inventory of national register-eligible properties under Section 110. The extent of cultural resources at Hawai'i Volcanoes documents nearly 600 years of human activity and includes a range of resources from indigenous island cultural adaptations to a unique lava landscape (e.g., Tuggle and Tomonari-Tuggle 2008 and others). Cultural resources in the park include archaeological resources, cultural landscapes, ethnographic resources, and historic structures. The park contains archaeological resources, prehistoric/historic structures, and cultural landscapes, which may be impacted by the proposed alternatives (e.g., new or expanded trails or other facilities, changes in visitor use concentrations); therefore, these topics will be analyzed.

ETHNOGRAPHIC RESOURCES— NHPA, NPS *Management Policies 2006*, and Director's Order 28 direct parks to consider potential impacts of planned actions on cultural resources, including ethnographic resources. An analysis of impacts to known resources is important under the National Historic Preservation Act and other laws, including the Native American Graves Protection and Repatriation Act and the American Indian Religious Freedom Act. The National Park Service defines American Indian or Native Hawaiian traditional cultural (ethnographic) resources as any "site, structure, object, landscape, or natural resource feature assigned traditional legendary, religious, subsistence, or other significance in the cultural system of a group traditionally associated with it" (NPS 2006a). Traditional uses by native populations still occur today, including ceremonial activities. Elements of the proposed alternatives may have impacts on ethnographic resources; therefore this topic will be analyzed.

Birdwatching at Kīpukapuaulu. *NPS photo*

VISITOR USE AND EXPERIENCE

The Organic Act directs the National Park Service to promote and regulate the use of national parks to conserve resources and to provide for their enjoyment by existing and future generations. NPS *Management Policies 2006* and Director's Order 17 provide guidance on visitor use patterns and the desired visitor carrying capacity, and discuss appropriate recreational activities within park units (NPS 1999). Depending on the selected alternative, a variety of impacts to visitor use may occur. The impacts to be considered in this section related to visitor use include visitor use opportunities, range of recreational opportunities, interpretation and education, and scenic resources.

SOCIOECONOMIC ENVIRONMENT

The National Environmental Policy Act requires evaluation of the impacts of federal actions on the social and economic environment. The general management plan alternatives could affect the social and economic environment and opportunities of residents and businesses in the park vicinity through potential changes in park management, operations, and visitor use and experience. Hawai'i County makes up the affected area for socioeconomic analysis. Local communities within the county and private sector businesses, including visitor services facilities and operators could be affected by actions proposed in this management plan. Consequently, the socioeconomic environment is retained as an impact topic.

Steaming bluff. *NPS photo by Stephen Geiger*

WILDERNESS

NPS wilderness management policies are based on provisions of the 1916 NPS Organic Act, the Wilderness Act (1964), and legislation establishing individual units of the national park system. These policies establish consistent direction for the preservation, management, and use of wilderness, and they prohibit the construction of roads, buildings, and other human-made improvements, as well as the use of mechanized transportation in wilderness. All park management activities proposed within wilderness are subject to review following the minimum requirement concept and decision guidelines. The public purpose of wilderness in national parks includes the preservation of wilderness character and wilderness resources in an unimpaired condition, and provides for recreational, scenic, scientific, educational, conservation, and historical use. The wilderness study included in this GMP/WS/EIS proposes recommending new lands for wilderness designation; therefore, wilderness is retained as an impact topic.

Going green – solar powered cart for staff transport. *NPS photo*

PARK MANAGEMENT AND OPERATIONS

The alternatives proposed in this plan could affect park operations and facilities in the park. Topics include staffing, maintenance, facilities, ability to enforce park regulations and protect park values, employee and visitor health and safety, and management of other resources. Therefore park management and operations was retained as an impact topic.

TRANSPORTATION AND ACCESS

NPS *Management Policies 2006* (9.2) calls for NPS managers to identify solutions to transportation issues that preserve natural and cultural resources while providing a high-quality visitor experience. Management decisions regarding transportation generally require a comprehensive alternatives analysis and thorough understanding of natural systems and trends and their consequences. The location, type, and design of multi-modal transportation facilities (such as roads, parking areas, bikeways, and pedestrian trails) strongly influence the quality of the visitor experience and the preservation of park unit resources. Different alternatives are proposed regarding transportation and access, therefore the impacts to these resources will be analyzed further.

Native forest trees ʻōhiʻa, ʻōlapa, and hapuʻu. *NPS photo*

GREENHOUSE GAS EMISSIONS, CLIMATE CHANGE AND SUSTAINABILITY

Recent reports by the U.S. Climate Change Science Program, the National Academy of Sciences, and the United Nations Intergovernmental Panel on Climate Change provide evidence that climate change is occurring and could accelerate in the coming decades. While climate change is a global phenomenon, it manifests differently depending on regional and local factors. Increasing average temperatures have been documented for Hawaiʻi, particularly at higher elevations. Climate models for Hawaiʻi predict increasing severity and frequency of *El Niño* drought events and changes in the mean elevation level of the inversion layer. However, predicting the specific effects of global climate change at a regional level is in a preliminary stage.

There is strong evidence linking global climate change to human activities, especially greenhouse gas emissions associated with the burning of fossil fuels (IPCC 2007). Although it is also likely that changing weather patterns may affect the distribution of both nonnative and native plant and wildlife populations, analysis of the degree to which effects may occur over the time frame of this plan would be speculative. The general management plan will provide guidance on how the park will assess, respond to, and interpret the impacts of global climate change on fundamental resources, including objectives for reducing or offsetting emissions. The general management plan will evaluate the impacts of proposed actions for their impacts on the park's carbon footprint.

Impact Topics Dismissed from Further Consideration

Some impact topics that are commonly considered during the planning process were not relevant to the development of this general management plan for Hawaiʻi Volcanoes National Park due to the following: (a) implementing the alternatives would have no effect, a negligible effect, or a minor effect on the topic or resource or (b) the resource does not occur in the national park. These topics are as follows.

GEOLOGIC HAZARDS

Geologic hazards, including lava flows, earthquakes, rock slides, and others, are present within Hawaiʻi Volcanoes National Park. As stated in the Hawaiʻi Volcanoes National Park *Strategic Plan* (Park 2000) the park's mission is "to protect, conserve, and study the volcanic landscapes . . . and to facilitate safe public access to active volcanism . . . ." The activity from these volcanoes would not be impacted by any of the alternatives in the general management plan; rather the volcanoes may impact actions taken under the alternatives. The geologic processes that are a part of active volcanism are sometimes hazardous. NPS *Management Polices 2006* states that geologic processes would be addressed during planning and other management activities in an effort to reduce hazards that can threaten the safety of park visitors and staff and the long-term viability of the park infrastructure (NPS 2006a). Due to the interconnectedness of this topic with other impact topics, the potential impacts from geological hazards will be addressed throughout the environmental consequences analysis, not as its own topic.

AIR QUALITY

The Clean Air Act of 1963, as amended, was established to promote public health and welfare by protecting and enhancing the nation's air quality (42 USC 7401 et seq., PL 88-206). The act establishes specific programs that provide special protection for air resources and air quality-related values associated with national park units. Section 118 of the Clean Air Act requires a park unit to meet all federal, state, and local air quality pollution standards.

Moon over Kīlauea. *NPS photo by Ed Shiinoki*

By virtue of its 1978 wilderness designation, Hawai'i Volcanoes National Park is a Class I airshed under the Clean Air Act Amendments of 1977. Class I airsheds are afforded the highest degree of protection, meaning that very little additional deterioration of air quality is permitted. The act states that park managers have an affirmative responsibility to protect air quality-related values (including visibility, plants, animals, soils, water quality, cultural resources, and visitor health) from adverse air pollution impacts (NPS 2006a). The greatest impact to air quality at the park is the volcanic emissions, which the park has no control over.

Overall, there would be slight and temporary degradation of local air quality due to the use of construction equipment in the park, such as construction equipment emissions and dust. This effect would last only as long as the particular construction activity, and the park's Class I air quality would not be affected by the proposal. Impacts would be negligible and short-term. The proposed actions would not adversely affect the long-term air quality; therefore, air quality is dismissed as an impact topic.

LIGHTSCAPES

NPS *Management Policies 2006* (4.10) states that "the Service will preserve, to the greatest extent possible, the natural lightscapes of parks, which are natural resources and values that exist in the absence of human-caused light." The extreme isolation of the Hawaiian Islands allows for excellent air quality at high elevations and results in clear night skies that provide outstanding opportunities to see the stars and constellations. Dark night skies are so important that Hawai'i County passed lighting ordinances to protect the dark night sky (Hawai'i County Outdoor Lighting Ordinance, 1988, Ord. No. 88-122, sec. 3; Chapter 14, Article 9). More recently, the State of Hawai'i (Act 287, Hawai'i Night Sky Protection Act, 2012; Chapter 201 - Night Sky Protection Strategy, Hawai'i Revised Statutes revision) recently passed an act to ensure the rest of the state is protecting night skies (previously only Hawai'i and Maui Counties had ordinances).

The dark night sky has tremendous scientific value for astronomy and is vitally important for wildlife in Hawai'i, including birds and turtles, because the absence of artificial light allows native wildlife to navigate without becoming disoriented. The proposed actions under the alternatives could introduce or increase artificial light sources in the environment beyond current or historic levels, which, without mitigation, could affect the ability to see natural features visible on clear nights. However, due to county ordinances as well as park policy, any new lighting installed would strictly adhere to county ordinances and park standard operating procedures for protection of night skies. This is necessary not just to protect the lightscapes, but also to protect night-flying birds and other nocturnal animals, including special status species. The

park has in the past, and will continue to protect the lightscapes to the highest degree possible; this will ensure the impact levels of the proposed actions are minor or less over the life of the plan. Therefore lightscapes has been dismissed as an impact topic.

WATER QUALITY OR QUANTITY

The 1972 Federal Water Pollution Control Act, as amended by the Clean Water Act (33 USC 1251 et seq., Public Law 92-500 and Public Law 95-217), is a national policy to restore and maintain the chemical, physical, and biological integrity of the nation's waters, to enhance the quality of water resources, and to prevent, control, and abate water pollution. NPS *Management Policies 2006* provides direction for the preservation, use, and quality of water in national parks.

Minimal surface waters, including a small number of temporary streams that occur during heavy rain events, are located in or adjacent to the park; therefore, the possibility that this resource would be impacted by the proposed alternatives would be negligible so this topic is dismissed from further analysis. Please refer to the "Marine and Estuarine Resources" section below for more information about anchialine pools.

STREAMFLOW CHARACTERISTICS

There are no permanent streams in the park. Minimal surface waters, including a small number of temporary streams that occur during heavy rain events, are in or adjacent to the park; therefore, the possibility that this resource would be impacted by the proposed alternatives would be negligible so this topic is dismissed.

MARINE AND ESTUARINE RESOURCES

The boundary of Hawai'i Volcanoes National Park includes the shoreline and associated habitats along the Pacific Ocean. Within the park, brackish anchialine pools along the shoreline serve as the only habitat for certain species. None of the actions proposed in this plan would affect the shoreline environments of the park, and other marine and estuarine environments are outside of the park jurisdiction. The park is the primary owner of the watershed and does not extract groundwater. The park's water supply is wholly from rainwater catchment, so there are no impacts to the aquifer quantity or quality. No new impacts from runoff are anticipated from the proposed actions because very little new development is proposed and the changes would be distant from the coastal resources. In addition, no changes are proposed for the coastal campsites. It is not anticipated that upstream water quality or quantity would be measurably affected by the proposed alternatives; therefore downstream impacts would be negligible.

Impacts on marine and estuarine habitats would not likely be measurable; therefore, impacts on species inhabiting these environments are not anticipated. Of particular concern in these environs are federally listed threatened and endangered species. These include the Hawaiian monk seal (*Monachus schauinslandi*), green sea turtle (*Chelonia mydas*), hawksbill sea turtle (*Eretmochelys imbricate*), and a candidate endangered endemic shrimp (*Metabetaeus lohena*).

Endangered Hawaiian monk seal at 'Āpua. *NPS photo*

- The Hawaiian monk seal is endangered throughout its range, with critical habitat designated in the Northwestern Hawaiian Islands (a remote archipelago of small islands, largely protected as a marine reserve). Within the park, Hawaiian monk seals have been observed to haul out

and bask along the shoreline. Because the use of the park by this species is limited, and because the marine and shoreline habitats of the park would not be affected under the proposed alternatives, the Hawaiian monk seal is not carried forward for analysis.

- Green sea turtles are most commonly found in fairly shallow waters (except when migrating) inside reefs, bays, and inlets. They prefer lagoons and shoals with an abundance of marine grass and algae and require open beaches with a sloping platform and minimal disturbance for nesting (USFWS 2009g). The green sea turtle may forage offshore and occasionally haul out to bask on the park's beaches, but there are no known nesting sites at the park. Because the use of the park by this species is limited to basking on the shoreline, and because the marine and shoreline habitats of the park would not be affected under the proposed alternatives, the green sea turtle is not carried forward for analysis.
- Hawksbill turtles occur along the shoreline and surrounding waters of the island (Park 2009e). They are typically found feeding in the vicinity of rock or reef habitats in shallow tropical waters with little turbidity (NMFS and USFWS 1998b). Preferred nesting habitat includes low-energy sandy beaches under the cover of woody vegetation (NMFS and USFWS 1998b). Hawksbill nests are monitored and protected at ʻĀpua Point, Halapē, and Keauhou in the park. Because the marine and shoreline habitats of the park would not be affected under the proposed alternatives, the hawksbill sea turtle is not carried forward for analysis.
- The brackish-water shrimp (Metabetaeus) is known to occur in low- to high-salinity anchialine pools. Anchialine pools are rare, localized brackish waters along coastal lava flows that are subject to tidal fluctuations but are not openly connected to the ocean (USFWS 2009c; USGS 2005b). Recent surveys (2004–2009) for Metabetaeus in national parks in Hawaiʻi have documented that it is widespread in this unique habitat type. Current studies indicate that adults are sensitive to increases in pool salinity (Foote 2009b). Because none of the proposed alternatives would affect water quantity, quality, or salinity in the shoreside anchialine pools, this species is not carried forward for analysis.

Halapē. *NPS photo*

UNIQUE OR ESSENTIAL FISH HABITAT

The boundary of Hawaiʻi Volcanoes National Park includes the shoreline and associated habitats along the Pacific Ocean, but does not extend into the marine environment. In addition, there are no perennial or intermittent streams in the park. Therefore, no unique or essential fish habitat is designated at Hawaiʻi Volcanoes. Because this habitat does not occur in the park, and because impacts on upstream water quality and quantity are not likely to be measurable, no impacts on nearby unique or essential fish habitat would be anticipated. Therefore, this topic is not carried forward for analysis.

WILD AND SCENIC RIVERS

The purpose of designating a river as "Wild and Scenic" is to protect its free flow, water quality, and "outstandingly remarkable scenic, recreational, geologic, fish and wildlife,

historic, cultural or other similar values" (16 USC 1271). These rivers and others eligible for this designation must be managed to avoid impacts on the values for which they were designated (NPS 2006a, 2.3.1.9). There are no wild and scenic rivers or rivers that may be eligible for wild or scenic status within the park. Therefore, this topic was dismissed from further analysis.

FLOODPLAINS AND WETLANDS

Executive Order 11988, "Floodplain Management," requires an examination of impacts to floodplains and the potential risk involved in placing facilities within floodplains. NPS *Management Policies 2006*; *The Planning Sourcebook: General Management Planning* (NPS 2005); Director's Order 12: *Conservation Planning, Environmental Impact Analysis, and Decision-making* (NPS 2001); and Director's Order 77-2: *Floodplain Management* (NPS 2003a) provide guidelines for proposals that occur in floodplains. Executive Order 11988 requires that impacts to floodplains, if present, be addressed. There are no designated floodplains in the park that would be impacted by the actions in the general management plan.

Executive Order 11990, "Protection of Wetlands," requires an examination of impacts on wetlands. In Kahuku, vegetation mapping surveys in the 1970s and in 2005 failed to locate significant bogs in the area. The park has some small semi-bog areas in wet forests in ʻŌlaʻa that could be affected by management activities, particularly the management of nonnative ungulates. However, these adverse impacts would be short-term negligible, with long-term minor beneficial impacts. Therefore, this topic has been dismissed from further analysis.

PRIME AND UNIQUE FARMLANDS

The Farmland Protection Policy Act was implemented to preserve and protect the dwindling supply of farmland in the nation. In 1980, the CEQ directed that federal agencies assess the effects of their actions on farmlands classified as prime or unique by the U.S. Department of Agriculture (USDA) Natural Resources Conservation Service. Prime farmland, as defined by the USDA, is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is available for these uses. It may include cultivated land, pastureland, forestland, or any other type of land that is not considered an urban or built-up land or water areas. In prime farmland areas, the soil quality, growing season, and moisture supply are optimal for the soil to economically produce sustained high yields of crops when proper management—including water management—and acceptable farming methods are applied. Unique farmlands are lands other than prime farmland that are used for the production of specific high value food and fiber crops.

A 1973 soil survey conducted for the Island of Hawaiʻi, which included Hawaiʻi Volcanoes National Park, identified some soils in Hawaiʻi Volcanoes that could be classified as prime or unique farmland soils. They are as follows (USDA-NRCS 2009): Alapai hydrous silty clay loam consociation; Maunaʻiu-ʻAkelelu complex; Haʻa-Keʻamoku complex; Ki medial loam consociation; and Manu medial silt loam consociation. However, areas containing these soils are not currently in active production, nor does the potential exist for them to be converted or developed, thereby precluding their potential use as productive areas in the future. As a result, prime and unique farmlands are not carried forward for further analysis.

MUSEUM COLLECTIONS

NPS *Management Policies 2006* and cultural resources laws identify the need to evaluate effects on museum collections, if applicable. Requirements for proper management of museum objects are defined in NPS *Management Policies 2006*; Director's Order 24: NPS *Museum Collections Management*; and the NPS Museum Handbook. Museum collections would not be adversely affected by the proposed alternatives, except by the potential addition of material to the collections, if any is found. Under all

alternatives, the park would adaptively reuse the historic ʻŌhiʻa Wing, also known as the 1932 Administration Building, as a cultural museum and for museum collections storage. The improved storage facilities in the ʻŌhiʻa Wing would have a long-term beneficial effect on museum collections; however, any storage location in the park (or on the island for that matter) would have the potential to be threatened by volcanic and seismic activity. Currently 0.04% of the park's museum collection is stored off-island and in one NPS and two non-NPS facilities. Due to limited facilities and space, only eight items from the park's collection are currently on display in the park. The park maintains emergency response plans for the collections, including evacuation and mitigation plans.

1877 Volcano House. *NPS photo*

INDIAN TRUST RESOURCES

Secretarial Order 3175: *Departmental Responsibilities for Indian Trust Resources*, requires that any anticipated impacts to Indian trust resources from a proposed project or action by the Department of the Interior (DOI) agencies be explicitly addressed in environmental documents. The federal Indian trust responsibility is a legally enforceable fiduciary obligation on the part of the United States to protect tribal lands, assets, resources, and treaty rights. It represents a duty to carry out the mandates of federal law with respect to American Indian and Alaska Native tribes.

There are no Indian trust resources in Hawai'i Volcanoes National Park. The lands comprising the park are not held in trust by the Secretary of the Interior for the benefit of Indians due to their status as Indians. For these reasons, this topic is dismissed from further analysis in this document.

LAND USE AND BOUNDARY

NPS *Management Policies 2006* provides direction for protection of lands and resources within park units, acquisition of nonfederal lands that are within park units, and cooperation with agencies, tribes, and private property owners to provide appropriate protection measures. Land use refers to the general characteristics of how land is allocated among various administrative, preservation, recreational, and development needs. There would be beneficial effects from the potential boundary adjustments and from development of management zoning in the park. No alternatives would adversely impact neighboring landowners. The lands proposed for acquisition are currently undeveloped, so no significant changes in use will occur. The impacts to land use are anticipated to be negligible or less; therefore, land use is dismissed as an impact topic.

Photovoltaic system at the park's fire station. *NPS photo*

ENERGY RESOURCES AND RESOURCE CONSERVATION

Under any alternative, the National Park Service would continue to implement its policies of reducing costs, eliminating waste, and conserving resources by using energy efficient and cost-effective technology (NPS 2006a). Irrespective of this plan, NPS staff would continue to look for energy saving opportunities in all aspects of park operations. As directed by NPS *Management Policies 2006*, the National Park Service strives to minimize the short- and long-term, environmental impacts of development and other activities through resource conservation, recycling, waste minimization, and the use of energy-

efficient and ecologically responsible materials and techniques. None of the alternatives being considered would result in the extraction of resources from the park. Implementation of the proposed actions would not cause measurable increases in the consumption of energy resources. Actions are proposed that would continue to improve the resource conservation at the park. Therefore, this topic was dismissed from further analysis.

ENVIRONMENTAL JUSTICE

Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-income Populations" (59 FR 7629, as amended by Executive Order 12948, 60 FR 6381, 42 USC 4321), requires all federal agencies to incorporate environmental justice into their missions by identifying and addressing disproportionately high and adverse levels of human health or environmental effects from their programs and policies on minorities and low-income populations and communities. This executive order does not apply to the subject of this document. The actions evaluated in this document would not have an effect (either beneficial or adverse) on socially or economically disadvantaged populations. There are also no indications that disadvantaged persons would be disproportionately affected. Therefore this topic was dismissed from further analysis.

PUBLIC HEALTH AND SAFETY

The proposed developments and actions in the alternatives would not result in any identifiable adverse impacts on human health or safety. Under all of the alternatives, the park would manage visitor use to ensure visitor safety and reduce the risks associated with managing park use on an active volcano. Therefore, this topic was dismissed from further analysis.

Keanakākoʻi Overlook. *NPS photo by Stephen Geiger*

RELATIONSHIP TO OTHER PLANNING EFFORTS

The following plans, agreements, and related documents have influenced the preparation of this general management plan, or may be modified based on the information in this general management plan. The following list in not all inclusive. Rather, it represents the plans most relevant to the management actions, issues, policies, and procedures addressed in this general management plan.

National Park Service Plans

HAWAIʻI VOLCANOES NATIONAL PARK MASTER PLAN/ENVIRONMENTAL IMPACT STATEMENT (1975)

In 1975, the National Park Service finalized the *Hawaiʻi Volcanoes National Park Master Plan/Environmental Impact Statement* that, at the time, outlined a future vision for interpretation, research, resources management, visitor use, special use areas, transportation and access, and facilities at Hawaiʻi Volcanoes National Park. This master plan also assessed park boundaries (recommending inclusion of ʻŌlaʻa within the formal boundary) and developed management zones in the park, including a primary use zone, Kīlauea Vicinity zone, wilderness threshold zone, and backcountry zone. The Hawaiʻi Volcanoes National Park General Management Plan, once finalized and approved, will replace and supersede the 1975 Master Plan.

FINAL ENVIRONMENTAL STATEMENT FOR THE PROPOSED WILDERNESS AREAS AT HAWAIʻI VOLCANOES NATIONAL PARK (1975)

The National Park Service completed the *Final Environmental Statement for the Proposed Wilderness Areas at Hawaiʻi Volcanoes National Park* in 1975 which proposed that Congress designate 123,100 (130,950) acres within the park as wilderness and an additional 7,580 acres outside the park as potential wilderness. In 1978, Congress moved forward with this designation, resulting in 62% of Hawaiʻi Volcanoes National Park's then 210,667 acres, being designated as wilderness. This environmental impact statement and the wilderness recommendation (1974) also recognized the need for certain uses to continue in the recommended wilderness areas. These include: continuation of existing and proposed shelters for rainwater collection and storage, volcanic research and monitoring (including the use of helicopters), and the use of whatever minimum fences, tools, and equipment were necessary for control of invasive feral animals. While this language did not go into the wilderness designation language, minimum requirement analyses have been done and will be done in the future, as needed, to continue these uses.

Because this wilderness designation occurred after the completion of the *Hawaiʻi Volcanoes National Park Master Plan/Environmental Impact Statement*, this general management plan provides the first opportunity to integrate management planning across the park's wilderness and nonwilderness areas within the broader scope of law and policy.

Sulfur Banks boardwalk. *NPS photo*

HAWAIʻI VOLCANOES LAND PROTECTION PLAN (1986)

All NPS units that contain private or other nonfederal land or interest in land within their authorized boundaries are required by policy to complete a land protection plan (LPP) in order to achieve management purposes consistent with public objectives of the unit.

Hawai‘i Volcanoes National Park completed the unit’s most recent land protection plan in 1986 which identified 7,846 acres for future proposed protection by fee acquisition and 4,033 acres with no action proposed. The park also identified three tracts that are unsuitable for national park purposes (Park 1986). The 1986 land protection plan informs the boundary analysis included within this general management plan and provides guidance for future boundary adjustments in Hawai‘i Volcanoes National Park.

HAWAI‘I VOLCANOES NATIONAL PARK RESOURCE MANAGEMENT PLAN (1999)

The National Park Service completed the *Hawai‘i Volcanoes National Park Natural Resources Management Plan* in 1999 that is a composite plan for recovering park ecosystems; restoring lost biodiversity including endangered and rare plant and animal species; completing scientific research to develop understanding of populations, communities, ecosystems, threats and stressors; maintaining and expanding park partnerships for natural resources management; and providing avenues for expanding and sharing public knowledge of these unique resources. Aimed at fulfilling applicable congressional mandates for natural resources management in the park, this plan specifically outlines strategies to re-establish species into their former ranges and protect Hawaiian ecosystems from nonnative species in the Mauna Loa, ‘Ōla‘a, and Kīlauea Units in the park.

Native old growth rain forest in ‘Ōla‘a Unit. *NPS photo*

HAWAI‘I VOLCANOES NATIONAL PARK FIRE MANAGEMENT PLAN (2005)

The purpose of this plan is to develop and improve the park’s fire management program to protect human life, property, and natural and cultural resources. This plan facilitates the implementation of current national fire plan direction and provides guidance for addressing wildland/urban interface areas in the park, particularly near Volcano Village and Hawaiian Ocean View Estates.

KA‘Ū COAST RECONNAISSANCE SURVEY (2006)

In 2006, the National Park Service completed the Ka‘ū Coast Reconnaissance Survey which provided a preliminary evaluation of 20,365 acres along 27 miles of shoreline on the southeast coast of Ka‘ū, including its resources and its suitability and feasibility of including the area in the national park system. This survey provides preliminary evaluations that the study area is of national significance, would be a suitable addition to the national park system, and could be feasibly managed for resource protection and public enjoyment, provided that its protection could be achieved through community-supported approaches that limit acquisition costs and are based on partnership with local entities. The National Park Service found that further study of the resources was warranted and recommended that Congress consider authorizing a special resource study for the Ka‘ū Coast of Hawai‘i. The Ka‘ū Coast Reconnaissance Survey informs the boundary analysis included within this general management plan.

KAHUKU: AN INTERIM OPERATING PLAN (2006)

This interim operating plan directs the management and public use of the Kahuku Unit, an approximately 115,788 (150,865)-acre area that was added to Hawai‘i Volcanoes National Park in 2003. This document provides guidance for managing this section of the park using established procedures and policies. The Hawai‘i Volcanoes National Park General Management Plan, once finalized and approved, will replace and supersede this interim plan.

ALA KAHAKAI NATIONAL HISTORIC TRAIL FINAL COMPREHENSIVE MANAGEMENT PLAN/ENVIRONMENTAL IMPACT STATEMENT (2008)

Added to the National Trails System on November 13, 2000, the Ala Kahakai National Historic Trail extends approximately 175-miles along the prehistoric ala loa (long trail) on or parallel to the seacoast extending from ʻUpolu Point on the north tip of Hawaiʻi Island down the west coast of the island around Ka Lae (South Point) to the east boundary of Hawaiʻi Volcanoes National Park. In 2008, as required by the National Trails System Act (16USC 1241–1251), the National Park Service completed the *Ala Kahakai National Historic Trail Final Comprehensive Management Plan / Environmental Impact Statement* which outlines how the national trail would be administered and managed for approximately 15 years. Under the proposed action, a continuous trail parallel to the shoreline would be protected; however, on public lands and where landowners wish it, the Ala Kahakai National Historic Trail could include inland portions of the ala loa or other historic trails that run lateral to the shoreline, and the shoreline ala loa would be connected to ancient or historic mauka-makai (mountain to sea) trails that would have traditionally been part of the ahupuaʻa system. Also, through an agreement, the state of Hawaiʻi could convey to the National Park Service a less-than-fee management interest in trail segments that are state-owned under the Highways Act of 1892 within the Ala Kahakai National Historic Trail corridor. The National Park Service would then be responsible for managing these segments and federal law would fully apply. Due to the historic significance of this trail and the trail linkages and signage proposed in this plan, this comprehensive management plan plays a role in cultural resources management and interpretation/visitor use at Hawaiʻi Volcanoes National Park and informed some of the actions proposed in this plan.

Caldera view from ʻIliahi Trail. *NPS photo*

CRATER RIM DRIVE REHABILITATION / ENVIRONMENTAL ASSESSMENT (2010)

The *Crater Rim Drive Rehabilitation / Environmental Assessment* (EA) was finalized on August 3, 2010. Under this environmental assessment, Hawaiʻi Volcanoes National Park rehabilitated 2.8 miles of Crater Rim Drive (between the junction with Highway 11 and Jaggar Museum) in 2012 by improving the road's structural section to accommodate heavy vehicle load and average daily traffic volume. This included widening or reducing the width of the road to a typical design template of 22 feet.

This environmental assessment provides a foundation for some of the actions considered in this general management plan because it considered but dismissed several options for managing the park's busiest road, Crater Rim Drive, and in some instances, deferred decisions to a general management plan. Actions that were dismissed in the planning process include adding bicycling lanes to Crater Rim Drive because of the potential impacts to threatened and endangered species and cultural resources. Actions that the plan deferred to a general management plan include: limit all vehicles to one-way traffic on Crater Rim Drive, limit all vehicles to one-way traffic between the Jaggar Museum and the Halemaʻumaʻu Parking Area, limit the size and direction of commercial vehicles to one-way traffic between the Jaggar Museum and the Halemaʻumaʻu parking area, implement an alternative transportation system, and allow concurrent use of park roads by commercial vehicles, personal vehicles, bicycles, and pedestrians. The general management planning process considered all of these actions when developing and refining alternatives for the plan.

ARCHAEOLOGICAL PRESERVATION PLAN FOR KEALAKOMO AHUPUA‘A, HAWAI‘I VOLCANOES NATIONAL PARK (2011)

The focus of this site (Kealakomowaena) is to highlight Hawai‘i Volcanoes National Park’s rich prehistoric and early historic period archeology. The plan assists the park in identifying the archaeological sites to be interpreted. The plan recommends appropriate interpretive themes and primary messages for interpretive trails and signage and mitigates impacts to sensitive resources. The preservation plan discusses specific archaeological sites and clusters to be interpreted, makes recommendations for site preparation requirements, and helps guide the park in managing the natural and cultural resources within the designated interpretive site. The preservation plan also recommends appropriate artifacts from the area that may be used in tactile exhibits and hands-on activities.

Sail image at Pu‘uloa Petroglyphs. *NPS photo*

WILDERNESS ELIGIBILITY ASSESSMENT FOR KAHUKU (2012)

The National Park Service completed a Wilderness Eligibility Assessment for Kahuku and other potentially eligible areas in the park which was signed by the regional director in June 2012. As required by the Wilderness Act of 1964, Secretarial Order 2920, and NPS *Management Policies 2006*, this assessment was conducted in order to determine the eligibility of Kahuku for preservation as wilderness. The assessment determined that 29,848 acres (GIS) of Kahuku’s total 115,788 (150,865) acres are ineligible for wilderness designation due to the changes wrought by past cattle ranching activities and the presence of past development. However, Kahuku’s remaining 121,015[5] acres (GIS) are eligible for wilderness designation and exemplify the qualities of wilderness character. As a result of this determination of eligibility, this general management plan includes a wilderness study to evaluate any foreseeable effects associated with possible designation of additional wilderness within Hawai‘i Volcanoes National Park.

PROTECTING & RESTORING NATIVE ECOSYSTEMS BY MANAGING NONNATIVE UNGULATES PLAN/ ENVIRONMENTAL IMPACT STATEMENT (2013)

The National Park Service completed the *Final Plan/Environmental Impact Statement for Protecting and Restoring Native Ecosystems by Managing Nonnative Ungulates* for Hawai‘i Volcanoes National Park in April 2013. This plan/EIS creates a parkwide comprehensive, systematic management framework for ungulates that relies on scientifically based methods for managing nonnative ungulate populations to allow for the protection and recovery of park resources. Actions include expanding boundary fencing to encompass remaining unfenced portions of Kahuku and ‘Ōla’a rainforest, and the potential use of localized internal fencing to assist in the exclusion of nonnative ungulates, expansion of lethal and nonlethal techniques, and a population objective of zero nonnative ungulates, or as low as practicable in managed areas. Actions in this plan were incorporated within the general context of natural resource management when developing alternatives for the general management plan.

KAHUKU RESTORATION PLAN/ ENVIRONMENTAL ASSESSMENT (DRAFT PLAN/EA TO BE RELEASED IN 2014)

The National Park Service plans to release the *Draft Kahuku Restoration Plan / Environmental Assessment* in 2014 with the goal of creating a plan to restore former native ‘ōhi‘a or mixed ‘ōhi‘a /koa forest in the Kahuku Unit. The preferred alternative in this plan outlines restoration strategies

[5] Again, this figure was estimated using GIS; no official government survey has been completed to determine the acreage for this parcel.

for the former pastures that facilitate or augment natural recovery, such as suppression of nonnative grasses, stimulation of koa and ʻōhiʻa seedling establishment, and augmentation and reintroduction of lost or depleted species. Although not finalized, if approved as is, this plan provides guidance for natural resource management and restoration activities in portions of Kahuku and therefore informed the development of the alternatives in this general management plan.

AIR TOUR MANAGEMENT PLAN/ ENVIRONMENTAL IMPACT STATEMENT (PRELIMINARY ALTERNATIVES RELEASED IN 2011)

The Federal Aviation Administration, National Park Service, and the Volpe National Transportation Systems Center are working together to develop the *Hawai'i Volcanoes National Park Air Tour Management Plan/ Environmental Impact Statement* whose objective, as outlined under the National Parks Air Tour Management Act (NPATMA) of 2000, "shall be to develop acceptable and effective measures to mitigate or prevent the significant adverse impacts, if any, of commercial air tour operations upon the natural and cultural resources, visitor experiences, and tribal lands." In April 2011, the Federal Aviation Administration and the park released the preliminary alternatives for this plan, and have currently analyzed public comments and refined the alternatives. During the scoping phase of this general management plan, park staff received comments from the public concerning commercial air tours. This issue was not originally included in the scope of the general management plan; however some general guidance is included in this general management plan in both the management zones and alternatives. Decisions made through this plan will impact both the visitor experience and natural and cultural resources in the park, just as this general management plan will inform the ATMP about anticipated future visitor use patterns. The lead agency for the ATMP/EIS is the Federal Aviation Administration; the National Park Service is a cooperator. As the FAA is the lead on the document, it is not currently known when this plan will be completed.

Ropey pāhoehoe lava. *NPS photo*

MISSION CRITICAL ADMINISTRATIVE AVIATION PLAN/ENVIRONMENTAL ASSESSMENT (PUBLIC REVIEW PROCESS INITIATED FEBRUARY 2014)

The National Park Service, United States Geological Survey (USGS), and other cooperating agencies use helicopters in the park for approximately 250 hours per year in order to respond to eruptive activity, monitor the volcano, control invasive species, recover rare species, restore degraded ecosystems, protect cultural resources, and conduct wildland fire, search and rescue, and law enforcement operations. In an effort to provide a decision-making framework for managing the administrative use of aviation over the park, Hawaiʻi Volcanoes National Park completed public scoping for a *Mission Critical Administrative Aviation Plan / Environmental Assessment* (plan/EA) in spring 2012 and released the draft plan/ EA for public review in February 2014. The purpose of this plan/EA is to provide for operational use of aviation by the park staff and cooperators in a safe, timely, and efficient manner while avoiding or minimizing impacts to the park's natural and cultural resources, soundscapes, wilderness, and visitor experience. Under the preferred alternative in this plan, aviation would continue to be used for the health and safety of visitors, employees, and island residents and for park resource protection and restoration. However, formal best management practices (BMPs), area closures, and flight restrictions would be instituted to minimize impacts to park resources, soundscapes, wilderness, visitors, and adjoining landowners. The final plan and its approval will likely beneficially impact

both the visitor experience and natural and cultural resources in the park, just as this general management plan will inform this plan/EA about anticipated future visitor use patterns in the park.

Other Agency Plans

US FISH AND WILDLIFE SERVICE RECOVERY PLANS

The US Fish and Wildlife Service (USFWS) has developed several recovery plans for species with known habitat in Hawai‘i Volcanoes National Park. These plans play an important role in managing natural resources in the park as they direct both protection of these species of special status and their habitats. The recovery plans informed both the development of alternatives for this general management plan as well as the analysis of environmental consequences. Changes to the recovery plans may affect future natural resources management decisions in the park.

These plans include, but are not limited to, recovery plans for the Hawaiian goose, Hawaiian hawk, Hawaiian crow, Hawaiian hoary bat, hawksbill turtle, Hawaiian petrel, 21 taxa of Hawaiian forest birds, and multiple plant species.

Plans for Adjacent Lands

STATE OF HAWAI‘I DIVISION OF FORESTRY AND WILDLIFE PLANS

KA‘Ū FOREST MANAGEMENT RESERVE MANAGEMENT PLAN FINAL ENVIRONMENTAL ASSESSMENT— The Hawai‘i Department of Land and Natural Resources (DLNR), Division of Forestry and Wildlife (DOFAW)released the *Final Ka‘ū Forest Reserve Management Plan / Environmental Assessment* in October 2012. This final plan, which provides guidance for the Ka‘ū Forest Reserve located to the southeast of the Kahuku Unit (*Figure 1.1. Park Vicinity)*, was created with the goal of maintaining and restoring a key watershed while providing for continued and expanded

Hawaiian Volcano Observatory. *NPS photo*

public use. While actions proposed by this plan include monitoring and controlling invasive species and improving access for hunters and hikers, DOFAW's most notable proposed action includes fencing approximately 12,000 acres along the southeastern border of Kahuku, removing ungulates in this area, and restoring the site in order to foster the potential reintroduction and survival of the ʻalalā (Hawaiian crow). Due to the proximity of Kaʻū to the park, this action provides a wonderful interagency partnership opportunity to restore endemic species and habitat across the landscape.

PUʻU MAKAʻALA NATURAL AREA RESERVE MANAGEMENT PLAN/ FINAL ENVIRONMENTAL ASSESSMENT— The DLNR, Division of Forestry and Wildlife, Natural Area Reserves System (NARS) released the *Puʻu Makaʻala Natural Area Reserve Management Plan / Final Environmental Assessment* in October 2013. This plan includes a 15-year general management strategy for Pu'u Makaʻala Natural Area Reserve (NAR or Reserve) that updates the 1989 Management Plan to reflect management accomplishments and current management needs of this reserve. The overall management goal is to protect, maintain, and enhance the reserve's unique natural, cultural, and geological resources. Proposed actions to achieve this goal include fencing (including areas along the park's boundary), feral ungulate removal, weed control, habitat restoration, out-planting rare pants, monitoring, public access, outreach and education, fire management, enhanced enforcement, and continued collaboration with partners.

Endemic Hawaiian mint. *NPS photo*

Established in 1981 by Governor's Executive Order 3102 to protect native wet forest, Puʻu Makaʻala NAR is, as of 2010, approximately 18,706 acres in size and links the ʻŌlaʻa Unit and the upper elevation native forests of Kīlauea, Keauhou, and Upper Waiakea (*Figure 1.1. Park Vicinity*). These forests comprise an important water resource for the lower Puna and Hilo regions of Hawai'i Island, and provide exceptional habitat for a wide diversity of native plant and animal species. As a result of this relationship between the Reserve and the park, the Final *Puʻu Makaʻala Natural Area Reserve Management Plan* provides continued partnership opportunities for natural resource management across interagency boundaries.

THREE MOUNTAIN ALLIANCE

THREE MOUNTAIN ALLIANCE MANAGEMENT PLAN— Formed in 2007, the Three Mountain Alliance (TMA) is a formal nine-member partnership between large, private, and public landowners on the Island of Hawai'i (including the National Park Service and neighbors of Hawai'i Volcanoes National Park) who have shared interests in watershed protection and management across Mauna Loa, Kīlauea, and Hualālai. TMA encompasses over one million acres, or 45%, of Hawai'i Island. Because of the differing management goals and priorities of TMA members, the Three Mountain Alliance created a management plan in 2007 that identifies and builds upon jointly identified priorities and collaborative management and research efforts. This plan identifies the resources that are shared by TMA members, the threats to TMA, and the current management practices of TMA, and develops a management program to support the goals of TMA. Because this plan applies to both Hawai'i Volcanoes National Park and neighboring lands, like the Kahauale'a NAR and Pu'u Maka'ala NAR, it informs natural and cultural resource management alternatives in the general management plan.

Local, State, and Regional Plans

KA‘Ū COMMUNITY DEVELOPMENT PLAN

The County of Hawai‘i is in the process of developing a community development plan (CDP) for the Ka‘ū District. While the first draft of the CDP is under development, Hawai‘i County has identified the following community objectives: (1) manage and conserve natural resources; (2) build a resilient, sustainable local economy; and (3) preserve and strengthen community character.

PUNA COMMUNITY DEVELOPMENT PLAN

The *Puna Community Development Plan* was adopted by Hawai‘i County in September 2008, and was most recently updated in December 2011. Outlining some of the major planning issues affecting this district in Hawai‘i County, this plan develops goals and actions for addressing: Mālama I Ka ‘Āina (how contextual natural, historic, and cultural features of Puna should be preserved and respected), growth management (how the future pattern of human settlement and land use should be shaped), and transportation (how to develop sustainable approaches to transportation). Included among the proposed actions in the plan is the creation of a biosphere reserve buffer zone immediately adjacent to the park, between the park boundary and Volcano Village.

Halema‘uma‘u glows red. *Photo by Peter Anderson*

VOLCANO LONG RANGE PLAN: VOLCANO 2020

Tiered from the *Puna Community Development Plan, the Volcano Long Range Plan* (VLRP) is an action plan for the village of Volcano. With the primary goal “to live in harmony with the environment and among each other, to be good stewards of the land and of our community, and to strive for a sustainable way of living, and provide for the benefit of future generations”, VLRP promotes action in the areas of environmental quality and resource conservation; historic preservation and education; land use, agriculture, and economic development; recreation; public health, safety and sanitation and; improvements in public infrastructure and transportation. Specifically related to Hawai‘i Volcanoes National Park, VLRP identifies Volcano Village as a gateway to the national park and establishes a Biosphere Reserve Transition Area between the National Park and NARS/ Forest Reserves and the suburban and industrial areas beyond Volcano. The intent of the transition area is to ensure a gradual, rather than abrupt, landscape/ habitat change between the park or NAR and the more intensely used lands further away.

KA‘Ū SCENIC BYWAY CORRIDOR MANAGEMENT PLAN

Designated as a State Scenic Byway in February 2012, the Ka‘ū Scenic Byway – The Slopes of Mauna Loa follows the Māmalahoa Highway for 54 miles from Manukā State Park near sea level south of Kona to Hawai‘i Volcanoes National Park at more than 4,000 feet. In order to maintain this designation, the byway sponsor group, the Ka‘ū Chamber of Commerce, developed a required corridor management plan in December 2013 which outlines strategies to enhance the visitor experience through the Ka‘ū District while preserving the natural beauty of the area. The plan identifies some of the more significant sites along the Byway, three (of 16) of which are (1) Kahuku, (2) the turn-off for Mauna Loa Road, and (3) the main entrance to Hawai‘i Volcanoes National

Park, and key resources along the byway, including those located in the park. While none of the projects proposed by this plan are located within the park, some of the overlooks and viewpoints identified for development would overlook resources in the park and would enhance the visitor experience for park visitors by providing visitor information to many of the park's visitors before or following their visit to Hawai'i Volcanoes National Park. The designation of the scenic byway may also increase tourism in the area, drawing an increasing number of visitors from Kona toward and into the park.

NEXT STEPS IN THE PLANNING PROCESS

After distribution of the draft GMP/WS/EIS, there will be a 60-day public review and comment period after which the NPS planning team will evaluate comments from federal agencies, Native Hawaiian groups, organizations, businesses, and individuals regarding the draft plan. The planning team will then incorporate appropriate changes to produce a final GMP/WS/EIS.

The final plan will include letters from governmental agencies, any substantive comments on the draft GMP/WS/EIS, and NPS responses to those comments. Following public distribution of the final GMP/WS/EIS and a 30-day no-action period, a record of decision approving the final plan will be signed by the NPS regional director. The record of decision documents the NPS selection of an alternative for implementation. With the signing of the record of decision, and its publication in the *Federal Register*, the plan can then be implemented.

IMPLEMENTATION OF THE GENERAL MANAGEMENT PLAN

Although the final GMP/WS/EIS will be implemented in phases over the next 15–20 years, implementation of the specific actions and developments proposed within the management plan is dependent upon funding available at the time of need. The approval of this general management plan does not guarantee that the funding and staffing needed to implement the plan would be forthcoming. Instead, the plan establishes a vision of the future that will guide future management of Hawai'i Volcanoes National Park.

Implementation of the approved plan also could be affected by other factors, such as changes in visitor use patterns, management agreements among partner agencies, and unanticipated environmental changes. Once the general management plan has been approved, additional feasibility studies and more detailed site-specific documentation, planning, and compliance will be completed, as appropriate, before many proposed actions could be carried out. Full implementation of the approved general management plan may be many years in the future.

This general management plan does not describe how particular programs or projects should be prioritized or implemented. Those decisions will be addressed during the more detailed planning associated with strategic plans, implementation plans, or other plans. All of these future plans will tier from this approved general management plan and will be based on the goals, future conditions, and appropriate types of activities established in this plan.

Volcanic landscape. *NPS photo*

Hōlei Sea Arch. *Photo by Peter Anderson*

FOUNDATION FOR PLANNING AND MANAGEMENT

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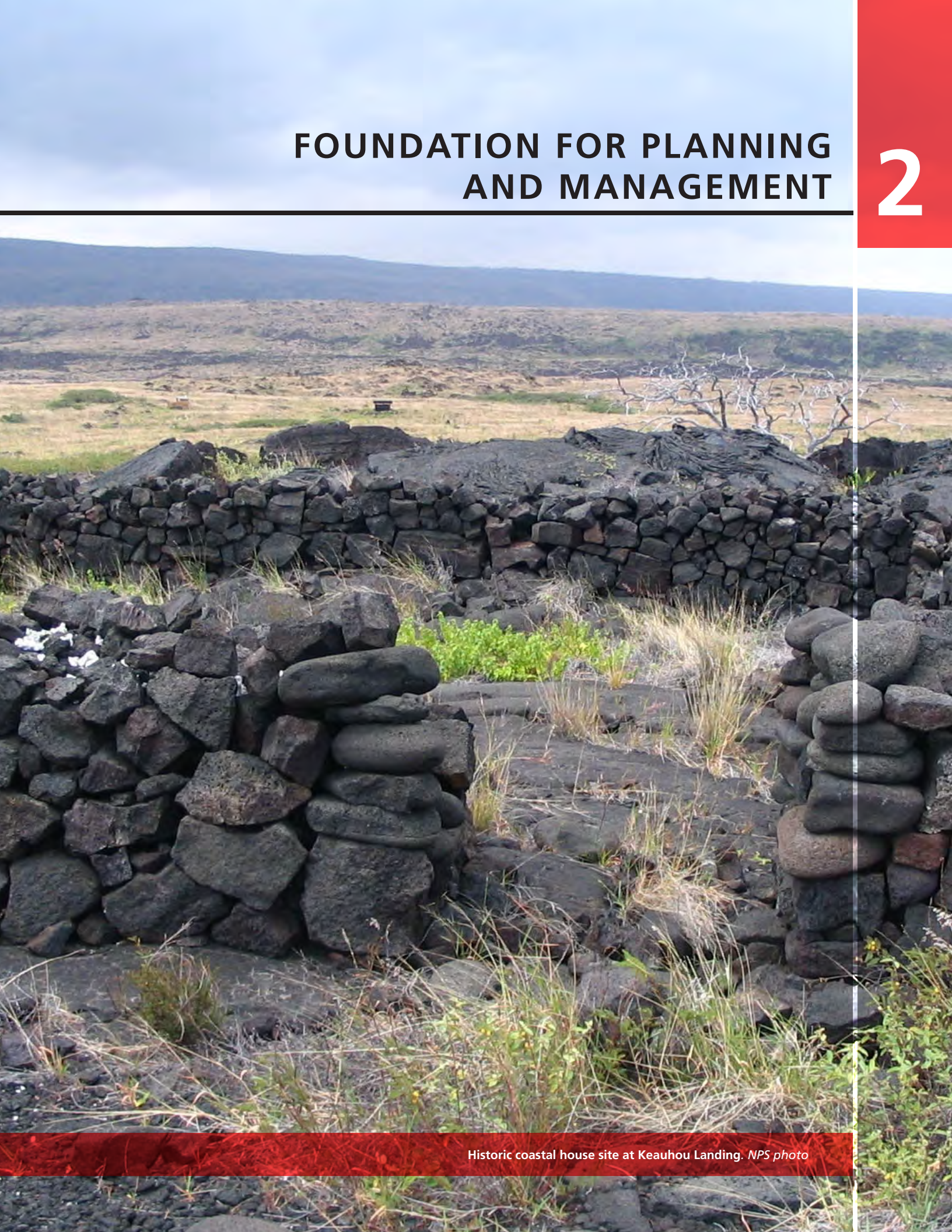


Historic coastal house site at Keauhou Landing. *NPS photo*

Halapē Iki. *NPS photo*

CHAPTER 2: FOUNDATION FOR PLANNING AND MANAGEMENT

This chapter contains a summary of the foundation document developed for Hawai'i Volcanoes National Park. This foundation document provides a shared understanding of the park's purpose, significance, resources and values, interpretive themes, and special mandates. These statements identify the park's unique characteristics and what is most important about the park and provide basic guidance for decision making and management. This chapter also contains guiding principles to help inform park management.

FOUNDATION DOCUMENTS

A foundation document serves as the underlying guidance for all management and planning decisions in a national park unit. Based on the park unit's enabling legislation, the foundation document describes the core mission of the park unit by identifying the unit's purpose and significance, fundamental resources and values, interpretive themes, special mandates, and legal and policy requirements.

The primary advantage of developing and adopting a foundation document is the opportunity to integrate and coordinate all kinds of levels of planning and decision making from a single, shared understanding of what is most important about the park. The process of preparing a foundation document develops understanding by park managers, staff, and stakeholders of what is most important about the park and the additional information needed to plan for the future.

The foundation document can be used in all aspects of park management to ensure that the most important objectives are accomplished before turning to items that are not directly critical to achieving the park purpose and maintaining its significance.

The foundation for planning and management is generally developed (or revised or expanded) early in the general management planning process, as part of agency scoping and data collection for a park's general management plan. Partner and public involvement as well as scholarly analysis are incorporated into the development of a foundation document.

The foundation document, as identified in the Park Planning Program Standards, has the following elements.

Park Purpose

The park purpose is a clear statement of the reason or reasons for which the park was set aside as part of the national park system. Statements of the park's purpose are grounded in a thorough analysis of the park's enabling legislation and legislative history. This includes studies prior to authorization that go beyond a restatement of the law to document shared assumptions about what the law means in terms specific to the park. It is the most fundamental criteria against which the appropriateness of all plan recommendations, operational decisions, and actions are tested. The purpose is derived from law and policy; however, developing the park purpose often requires some interpretation of the language in the park's establishing legislation or presidential proclamation.

Earth fissure during 2011 Kamoamoa eruption.
Photo by Kelly Wooten, courtesy of USGS

Park Significance

Statements of significance express why the park's resources and values are important enough to warrant national park designation. These statements are directly linked to the purpose of the park and describe why an area is important within a global, national, regional, and system-wide context. Hawai'i Volcanoes National Park contains many significant resources, but not all the resources contribute to the park's significance. The significance statements are used to guide management decisions and planning alternatives, interpretive themes, desired conditions, in addition to setting priorities. Significance statements are substantiated by data or consensus, and reflect the most current scientific or scholarly inquiry and cultural perceptions, which may have changed since the park's establishment.

Halema'uma'u Vent in distance. *NPS photo*

Interpretive Themes

Interpretive themes connect park resources to relevant ideas, meanings, concepts, contexts, beliefs, and values. Based on the park purpose and significance, these themes are intended to increase visitor understanding and appreciation of the significance of a park's resources. Identification of primary themes is part of a park's basic foundation document. Themes are derived from—and should reflect—the park's significance. Additional perspectives may be obtained from the identification and analysis of fundamental and other important resources and values. It is anticipated that the interpretive themes may be revised through development of the park's future comprehensive interpretive plan.

Fundamental Resources and Values

Fundamental resources and values articulate the most important ideas or concepts to be communicated to the public about a park and warrant primary consideration during planning and management because they are critical to achieving the park's purpose and maintaining its significance. These may include systems, processes, features, visitor experiences, stories, scenes, sounds, smells, or other resources and values.

The identification of fundamental resources and values should not be interpreted as meaning that some park resources are not important. This exercise is primarily done to separate those resources or values that are covered by the service-wide mandates and policies from those that have important considerations to be addressed in the general management plan.

Special Mandates and Constraints

Special mandates or constraints often direct park planning and management decisions. The special mandates are specific directions or agreements that relate directly to the park. Mandates might be a legislative requirement or signed agreement that adds another dimension to a park's purpose and significance or commits park managers to specific actions and limits their ability to modify land use in the park. Examples of these mandates and constraints include wilderness designations, unique designations such as a world heritage site or biosphere reserve, and long-term cooperative agreements or easements. Special mandates and constraints are specific to the park and are not an inventory of all the laws and policies applicable to the National Park Service.

PARK PURPOSE, SIGNIFICANCE, FUNDAMENTAL RESOURCES AND VALUES, AND SPECIAL MANDATES OF HAWAIʻI VOLCANOES NATIONAL PARK

Purpose of Hawaiʻi Volcanoes National Park

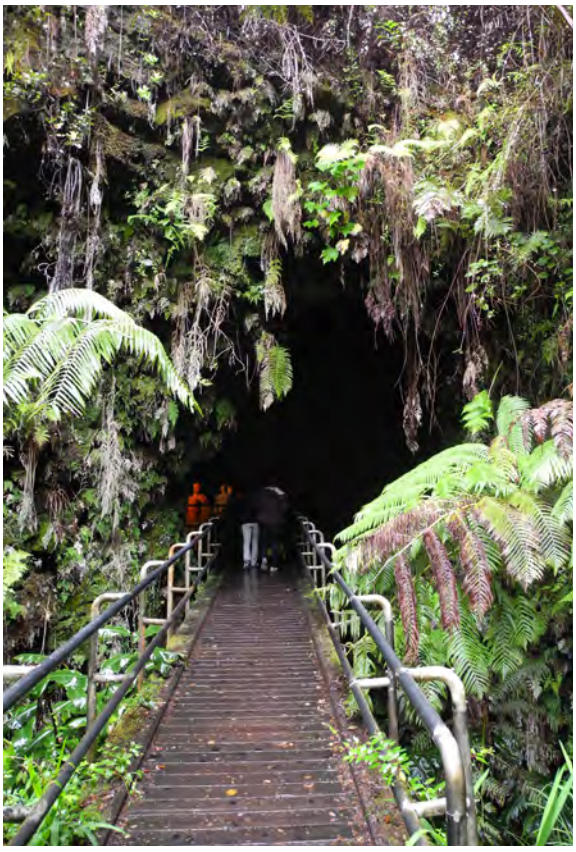
The following purpose was developed for Hawaiʻi Volcanoes National Park:

Hawaiʻi Volcanoes National Park protects, studies, and provides access to Kīlauea and Mauna Loa, two of the world's most active volcanoes and perpetuates endemic Hawaiian ecosystems and the traditional Hawaiian culture connected to these landscapes.

Significance Statements for Hawaiʻi Volcanoes National Park

The following significance statements were developed for Hawaiʻi Volcanoes National Park based on the park's legislation and previous management and resource plans:

- Hawaiʻi Volcanoes National Park protects and interprets the largest and most continuously active shield volcanoes in the United States and provides the best physical evidence of island building processes that continue to form the 2,000-mile-long Hawaiian archipelago.
- Hawaiʻi Volcanoes National Park's active volcanoes serve as a living laboratory for scientific investigations that began over a century ago and continue to advance global understanding of volcanic processes.
- Hawaiʻi Volcanoes National Park protects, restores, and studies unique and diverse ecosystems and endemic species that are the result of over 30 million years of evolution on an isolated environment characterized by its active volcanic landscape and wide climate variations.
- Hawaiʻi Volcanoes National Park encompasses the largest and most ecologically diverse wilderness in the Pacific Islands.
- Hawaiʻi Volcanoes National Park embraces the Native Hawaiian spiritual significance of this landscape and interprets related cultural traditions.
- Hawaiʻi Volcanoes National Park encompasses sites, structures, objects and landscapes that document over 600 years of human life and activities on an active volcanic landscape.
- Hawaiʻi Volcanoes National Park provides access to two of the most active volcanoes in the world and an opportunity to understand and appreciate the distinctive geology and natural and cultural adaptations to the land.



Entrance to Thurston Lava Tube. *NPS photo*

Interpretive Themes for Hawai‘i Volcanoes National Park

The following interpretive themes have been developed for Hawai‘i Volcanoes National Park:

- Monitoring the daily pulse of active volcanoes in Hawai‘i active volcanoes leads to new discoveries and advances in the understanding of volcanic eruptions and hazard monitoring.
- The approachable active volcanoes of Mauna Loa and Kīlauea allow first-hand discovery and connection with one of the most fundamental forces in our world, in both its creative and destructive roles.
- In Hawai‘i, active volcanism created an isolated home for a few immigrant species and gave rise to a rich yet fragile endemic biota. Due to the accelerating change brought about by human actions and introduced plants and animals, much of that unique heritage is being lost to extinction, challenging all of us to learn from the past and work together to preserve and restore the remaining native plants and animals.
- The park's designation as a World Heritage Site and International Biosphere Reserve attests to the compelling values that the park's unique geologic resources and island biota hold for people worldwide and its global importance as a benchmark for monitoring environmental change.
- Hawai‘i Volcanoes National Park protects a diverse wilderness that stretches from rich coastline to stark alpine summit, providing visitors with opportunities to connect with nature's challenges, remote solitude and wild spirit.
- Kīlauea Volcano, the home of Pelehonuamea, and Mauna Loa Volcano are sacred to many Native Hawaiians. The park is a place of birth and the physical representation of many spirits and forces; the active volcanism, the features of the terrain, and the plants and animals that live there are all important to the Native Hawaiian sense of identity, unity, and continuance.
- The journeys of the Hawaiian people, and those who followed, portray cultural clashes, adaptations and assimilations that provide enduring lessons about human resourcefulness, interdependence and respect on an active volcanic landscape.

Kīlauea Iki hikers. *NPS photo by Stephen Geiger*

Pu‘u Pua‘i and Kīlauea Iki. *NPS photo by Stephen Geiger*

Fundamental Resources and Values for Hawai‘i Volcanoes National Park

The following fundamental resources and values have been identified for Hawai‘i Volcanoes National Park.

VOLCANOES AND ASSOCIATED VOLCANIC FEATURES AND PROCESSES

Two active hot-spot shield volcanoes, dynamic geologic processes and volcanic features demonstrate the effects of the forces of nature and record the geologic history.

BODY OF SCIENTIFIC KNOWLEDGE AN INVESTIGATIONS

Documents, collections, and observations contribute to scientific discovery and range from early first-hand accounts of eruptive events to current scientific research and museum collections.

OPPORTUNITIES FOR SCIENTIFIC RESEARCH AND MONITORING

The park serves as a world-class living laboratory for geologic research, conservation biology, ecosystem development, island biogeography and evolution that continues to build on the existing body of scientific knowledge for resource protection, public safety, and environmental understanding.

BIOLOGICAL DIVERSITY

The park contains an extraordinary assemblage of native plants and animals—over 90% of which are endemic to the Hawaiian Islands and many of which are rare, endangered and threatened with extinction.

Endangered ‘ōhai at ‘Āpua. *NPS photo*

ECOLOGICAL INTEGRITY

The park perpetuates native ecosystems and communities, many of which are unique to the park, and provides a refuge for endemic plants and animals that span seven ecological zones ranging from seacoast to alpine. The park also supports the continuation of natural processes and interactions among species and between the biotic and abiotic environments.

NATURAL SOUNDS

Park soundscapes are protected from many human-caused sounds and are dominated by the sounds of wind, ocean, volcanic activity, and native species.

NIGHT SKY

The unobscured night sky is characterized by an absence of artificial light.

REMOTE AND CHALLENGING EXPERIENCES

The park promotes opportunities for visitors to experience solitude, primitive conditions, and challenge.

NATURAL LANDSCAPE CHARACTER

From mauka (toward the mountain) to makai (toward the ocean), vast expanses of the park’s wilderness have been affected primarily by the forces of nature—retaining their primeval character.

FIRST-HAND VOLCANIC EXPERIENCES

The park provides opportunities for visitors to approach and experience the park’s active volcanic eruptions including fountains, fissures and flows.

PELEHONUAMEA

Volcanic landscapes and all active flows and products of eruptive events are the representation of Pelehonuamea, deity of Hawaiian volcanoes.

WAHI KAPU (SACRED PLACES) AND WAHI PANA (CELEBRATED PLACES)

The entire park landscape and all of its inhabitants and features are sacred to Native Hawaiians, particularly Halema‘uma‘u Crater (home of Pelehonuamea), Mauna Loa’s Moku‘āweoweo caldera (a focal point for the greater Hawaiian relationship to the universe-stars, sun, moon), and mauka forested areas.

OPPORTUNITY FOR TRADITIONAL CULTURAL USE

Native Hawaiian traditional uses in the park perpetuate traditional practices, knowledge, and the cultural importance of this area. These practices, including chants and dances, depend upon natural sounds, unobstructed views of mountain summits and an environment that has not been greatly altered by man-made changes.

CULTURAL RESOURCES

The park's rich and varied cultural resources, including objects, archeological sites, cultural landscapes, historic structures and ethnographic resources are preserved and contribute to interpreting and understanding the greater Hawaiian culture and the more recent human history within the park.

Lava entering ocean. *NPS photo by Jay Robinson*

Special Mandates and Constraints for Hawai‘i Volcanoes National Park

The following mandates and constraints are specific to Hawai‘i Volcanoes National Park:

Topic	Explanation	Public Law
Kalapana Fishing and Homesteading Rights	Fishing and the lease of homesites under specific conditions shall be permitted in the Kalapana extension only by native Hawaiian residents of said area or of adjacent villages and by visitors under their guidance.	Public Law No. 680, June 20, 1938.
Wilderness Designation	Designation of 123,100 (130,950) acres[1] of known wilderness and 7,850 acres as potential wilderness additions to be known as the Hawai‘i Volcanoes Wilderness.	Public Law No. 95-625, November 10, 1978.
International Biosphere Reserve	Hawai‘i Volcanoes and Haleakalā National Parks were designated as "Hawai‘i Island International Biosphere Reserve" in 1980. Biosphere reserves are created "to promote and demonstrate a balanced relationship between humans and the biosphere." Biosphere reserves must "encompass a mosaic of ecological systems." Through appropriate zoning and management, the conservation of these ecosystems and their biodiversity is sought to be maintained. This effort requires relevant research, monitoring, education and training.	Designated 1980
World Heritage Site Designation	Hawai‘i Volcanoes National Park was designated as a World Heritage Site in 1987. The United States, as a country that has ratified the World Heritage Convention, has pledged to conserve its World Heritage Sites and to protect its national heritage. The United States. Also has committed to ensuring the identification, protection, conservation, presentation and transmission to future generations of the World Heritage Sites and shall endeavor by all appropriate means, and in particular through educational and information programs, to strengthen appreciation and respect by their peoples of the cultural and natural heritage of these sites.	Designated 1987

[1] Determining acreage at Hawai‘i Volcanoes National Park is a complex process by which varying sources provide different estimations of total acreage. Unless otherwise specified, acreage listed in this document includes two numbers: the first is the official acreage derived from deeds of conveyance to the United States and County/State tax assessor records, the sum total of which constitute the official NPS acreage for the park. (The official park acreage is maintained by the NPS Land Resource Division, WASO.) The second (listed in parentheses) is an estimation generated by GIS software that uses projections on the land to calculate acreage within geographically defined boundaries. When available and appropriate, both numbers are included in this GMP/WS/EIS because deed/tax assessor estimates, which are used in legislation and policy for the park, do not exist for some areas in the park, such as those acres analyzed for wilderness eligibility in the Kahuku Unit.

Halema‘uma‘u Crater from Jaggar Museum Overlook. *NPS photo*

GUIDING PRINCIPLES

Park managers must follow many laws, policies, and directives when managing national parks. In addition, the following guiding principles of Hawai'i Volcanoes National Park express a philosophy and commitment that also inform management decisions.

Global Responsibility

The park acknowledges a global responsibility to further international relationships that are inherent in the World Heritage Site and International Biosphere Reserve designations. The World Heritage Site and International Biosphere Reserve designations attest to the compelling values that the park's unique geologic resources and island biota hold for people worldwide, as well as its global importance as a benchmark for monitoring environmental change. These designations provide an important visible reminder for all visitors about why this park is special. Participation in training and information exchange within this international network brings a richness and depth to park management.

Hale (traditional thatched house) at pā hula. *NPS photo*

Stewardship

The park is committed to the ongoing involvement of individuals and organizations in understanding, caring for, preserving and restoring the park's native species and habitats, cultural sites, geologic features, trails and facilities. Opportunities that immerse people in this dynamic landscape nourish a common vision and commitment to preserving this globally important site, sustaining species and places whose long-term survival depends on the help of others.

Partnerships and Collaboration

In working to preserve and restore the park's resources unimpaired for future generations, the park will continue to build on the legacy of the many partnerships that have extended its ability to protect resources and serve the public since the park was established. Park managers will establish and maintain cooperative relationships with managers of adjacent public and private lands; state and local governments; Native Hawaiians and community organizations. The park will collaborate to ensure that watersheds, ecosystems, endangered species, cultural resources, viewsheds, and trail and transportation systems that extend beyond park boundaries are considered holistically. Through mutual collaboration, shared values and learning, partnerships create outcomes beyond any one organization's individual capacity. Partnerships will continue to be an important way to accomplish the park's mission.

Research

Hawai'i Volcanoes National Park is a world class living laboratory, and the park is committed to hosting and fostering research and studies that continue to advance knowledge and understanding. Numerous universities, agencies and organizations are involved in on-going studies related to geology, ecosystem development, island biogeography and evolution, habitat restoration, climate change, human connections to the landscape, historical settlement patterns, human resource procurement, and paleoenvironmental studies. The world's first Volcano Observatory, operated by the US Geological Survey, is within the park and serves as a global center for volcanic study and hazard monitoring. The park is committed to nurturing a home for the science community whose work continues to build on the existing body of scientific knowledge for resource protection, public safety and environmental understanding.

Sustainability and Environmental Leadership

The park will continue to explore and use practices that help sustain the Earth's resources. Sustainability is fundamental to the facilities, projects, programs, and operations of the park. The park will demonstrate environmental leadership and seek opportunities to promote sustainability and stewardship to park visitors, neighboring communities, and stakeholders. The park is committed to reducing its carbon footprint and interpreting the impacts of global climate change on natural and cultural resources.

Mauna Loa silversword.
NPS photo by Mark Wasser

DESIRED CONDITIONS AND POTENTIAL MANAGEMENT STRATEGIES DERIVED FROM LAWS, REGULATIONS, AND POLICIES

To fully understand the implications, limitations, or requirements of an alternative proposed in this GMP/WS/EIS, it is important to compare the service-wide laws and policies with the management actions described in the alternatives. To facilitate this process, this section identifies what must be done at Hawai'i Volcanoes National Park to comply with applicable laws, regulations, and policies. Management directives derived from these sources are summarized in two ways: as the desired conditions they set forth and as the potential management strategies that park managers may employ to achieve them. These are then used to assess the merits of alternatives during the planning process.

Many management directives for Hawai'i Volcanoes National Park are specified in laws, regulations, and policies guiding the National Park Service and, therefore, are not subject to alternative approaches. For example, there are laws and policies about managing environmental quality (such as the Clean Air Act and the Endangered Species Act), laws governing the preservation of cultural resources and cultural values (such as the National Historic Preservation Act and the Native American Graves Protection and Repatriation Act) and laws about providing public services (such as the Americans with Disabilities Act), to name only a few. In other words, a general management plan is not needed to decide, for instance, that it is appropriate to protect endangered species, control nonnative species, protect archeological sites, conserve artifacts, or provide for universal access, where feasible— laws and policies already require the National Park Service to fulfill these mandates. The National Park Service would continue to strive to implement these and other legal requirements with or without a new general management plan.

Some laws and executive orders are applicable solely or primarily to units of the national park system. These include the 1916 Organic Act that created the National Park Service, the General Authorities Act of 1970, the National Parks and Recreation Act of 1978 relating to the management of the national park system, and the National Parks Omnibus Management Act (1998). Other laws and executive orders, such as those addressing environmental quality, have much broader application.

The national park system General Authorities Act affirms that while all national park system units remain "distinct in character," they are "united through their interrelated purposes and resources into one national park system as cumulative expressions of a single national heritage." The act makes it clear that the NPS Organic Act and other protective mandates apply equally to all units of the system. Further, the Redwood Act of 1978 states that NPS management of park units should not "derogat[e]…the purposes and values for which these various areas have

been established." The National Park Service also has established policies for all units under its stewardship. These are identified and explained in a guidance manual entitled NPS *Management Policies 2006*. The alternatives considered in this document incorporate and comply with the provisions of these mandates and policies.

The most pertinent servicewide laws and policy topics related to planning and managing Hawai'i Volcanoes National Park are examined below. For each topic, there are a series of desired conditions that staff at Hawai'i Volcanoes National Park are achieving and will continue to strive to achieve. The laws or policies behind these desired conditions are cited, and examples of the types of actions being pursued by NPS staff are given. The alternatives in this GMP/WS/EIS address the desired future conditions that are supported, but not mandated, by law and policy and must therefore be determined through a planning process.

Early morning mist. *NPS photo*

Natural Resources

ECOSYSTEMS MANAGEMENT

LAW AND POLICY SOURCE— NPS *Management Policies 2006* (1.5, 4, 4.1, 4.1.4, 4.4.1) provides general direction for managing park units from an ecosystem perspective.

DESIRED CONDITIONS—

- Components and processes of park ecosystems are protected and highly altered ecosystems restored, including the natural abundance, diversity, and genetic and ecological integrity of the plant and animal species native to those ecosystems.
- Regular monitoring and condition assessments are made on key indicators of ecosystem health.
- Ecosystems and habitats damaged by nonnative species or human activities are restored. Future development avoids sensitive habitats and dynamic areas prone to natural disturbances.
- Develop and maintain an understanding of populations, communities, ecosystems, threats, stressors, and ecosystem health through a systematic, science-based program of inventory, monitoring and research.
- Effective management strategies to perpetuate and restore park ecosystems are developed and implemented based on the best available science.

POTENTIAL MANAGEMENT STRATEGIES—

- Restore park ecosystems recently invaded by nonnative species through removal of key nonnative species followed by natural recovery; restore highly altered park ecosystems through a program of active rehabilitation to conditions as natural as practicable. Expand restoration efforts focused on localized model areas to a park-wide scale.
- The most intensive management of ecosystems is focused in park special ecological areas. These special ecological areas are representatives

of the wide diversity of native plant and animal habitats, and natural landscapes in the park, and are prioritized based on the areas representativeness of a particular ecological zone and/or rarity in the park or on the islands, concentrations of species diversity and rare species, and value for research and interpretation to the public.

- Restore lost biodiversity in park ecosystems by recovering endangered, threatened and rare plant and animal species, and by reintroducing locally extirpated species.
- Develop and maintain an understanding of populations, communities, ecosystems, threats, stressors, and ecosystem health through a systematic, science-based program of inventory, monitoring and research.
- Support research and experimental studies to develop and implement effective strategies to perpetuate and restore park ecosystems.
- Incorporate current and future climate change research in the development of strategies to perpetuate and restore park ecosystems.
- Maintain and expand park partnerships for natural resource management, particularly those involving neighboring lands.
- Participate in collaborative planning efforts with adjacent land and resource managers to identify common goals, pursue solutions, and build a knowledge base through information sharing.
- Provide interpretive and educational programs about ecosystem processes, "ecological services," and methods to sustain these. Update interpretations at interpretive stops or displays.

Kamoamoa eruption (2011) with tree molds from previous eruptions in foreground. *NPS photo by Jay Robinson*

FIRE MANAGEMENT

LAW AND POLICY SOURCE— NPS *Management Policies 2006* (4.5), Federal Wildland Fire Management Policy; Director's Order 41: *Wilderness Preservation and Management;* and Director's Order 18: *Wildland Fire Management,* and accompanying Reference Manual 18 provide guidance on the basic principles and strategic guidelines governing NPS management of wildland fire.

DESIRED CONDITIONS—

- All wildland fires are effectively managed, considering resource values to be protected and firefighter and public safety, using the full range of strategic and tactical operations as described in an approved fire management plan.
- Fire management programs will be designed to meet resource management objectives prescribed for the various areas of the park and to ensure that the safety of firefighters and the public are protected.
- The best available technology and scientific information are used to manage fire within the park, to conduct routine monitoring to determine if objectives are met and to evaluate and improve the fire management program.

- Hazard fuel reduction efforts protect structures, wildland-urban interface areas, and natural and cultural resources where appropriate and necessary.
- Maintain and strengthen partnerships with local, state and federal cooperators on and adjacent to the park. Continue to develop agreements and operating plans to facilitate mutual cooperation in detection, prevention, training and suppression activities.

POTENTIAL MANAGEMENT STRATEGIES—

- Maintain a current fire management plan to reflect the most recent wildland fire policy, fire use applications, and the body of knowledge on fire effects within the unit's vegetation types.
- Maintain cooperative agreements for fire detection, prevention, training and suppression activities with appropriate federal, state, and local agencies and organizations.
- Develop fuel maps, conduct fire history research, fire behavior and effects studies, and fire restoration experiments to gain a better understanding of historic and current natural fire regimes, to mitigate the detrimental effects of fire in highly altered fire regimes and to ensure that long-term resource objectives are met.
- Conduct research and monitor the effects of fires in the park to ensure that long-term resource objectives are met.
- Monitor individual prescribed fires to provide information on whether specific objectives regarding smoke behavior, fire effects, etc. are met.
- Minimum requirement methods and tools are used to manage fires in wilderness.
- Provide information to visitors about the role of fire in Pacific Islands ecosystems.

NATIVE SPECIES

LAW AND POLICY SOURCE— NPS *Management Policies 2006* (4.4) calls for the National Park Service to maintain natural ecosystems in parks and to restore native plant and animal populations. Natural Resource Management Reference Manual #77 also provides general direction on the restoration of natural resources in the park.

ʻŌhiʻa seedling on nurse log. *NPS photo*

DESIRED CONDITIONS—

- The National Park Service strives to protect the full range of genetic types (genotypes) of native plant and animal populations by perpetuating natural evolutionary processes and minimizing human interference with evolving genetic diversity.
- Native animal and plant populations in the park are stable and managed to promote long-term viability, including maintaining age-structures, abundance, density and distributions within normal ranges, and a full range of natural genetic variability. Locally extirpated species are reintroduced to former habitat.

- The most intensive management of native plant and animal habitat is focused in park special ecological areas.
- Effects of native diseases and pests are within normal range of variation and are not worsened by human-caused factors.
- Effective management strategies to perpetuate and restore native species are developed and implemented based on the best available science.

Endangered halapepe. *NPS photo by Mark Wasser*

POTENTIAL MANAGEMENT STRATEGIES—

- Restore lost biodiversity by recovering endangered, threatened and rare plant and animal species, and by reintroducing locally extirpated species.
- Develop and maintain an understanding of populations, communities, ecosystems, threats, stressors, and ecosystem health through a systematic, science-based program of inventory, monitoring, and research.
- Support research and experimental studies to develop and implement effective strategies to perpetuate and restore park species and native plant and animal communities.
- Incorporate current and future climate change research in the development of strategies and implementation to perpetuate native species and communities.
- Maintain and expand park partnerships for species and habitat management, particularly those involving neighboring lands.
- Protect the park's biotic communities from impacts due to human activities and facilities while ensuring that visitors have opportunity to observe and enjoy them.
- Provide interpretive and educational programs about native species and habitat and methods to sustain these. Update interpretations at interpretive stops or displays.

Volcanic plume from Halemaʻumaʻu (2008). *NPS photo*

NONNATIVE SPECIES

LAW AND POLICY SOURCE—

NPS *Management Policies 2006* (4.4) calls for the National Park Service to maintain natural ecosystems in parks and to restore native plant and animal populations. This includes managing all nonnative plant and animal species up to and including eradication (4.4.4). "Natural Resource Management Reference Manual #77" also provides general direction on the restoration of natural resources in the park. Executive Order 13112, "Invasive Species" provides direction for the management of nonnative species.

DESIRED CONDITIONS—

- Populations of nonnative plant and animal species are monitored and controlled. These populations are eradicated wherever such species threaten park resources or public health and when control is prudent and feasible.
- If an invasive plant is part of a historic resource, the park removes or replaces with a noninvasive, or preferably, native plant with similar form and size.
- Particularly sensitive habitats in Hawai'i Volcanoes National Park, including those containing endemic or rare species, are maintained free of invasive nonnative species, when feasible.
- Effective management of invasive nonnative species is based on the best available science.

POTENTIAL MANAGEMENT STRATEGIES—

- Complete an inventory of nonnative plants, animals, and, as feasible, other organisms in the park. Regularly monitor the distribution and population trends of invasive nonnatives.
- Study the environmental and ecological effects of nonnative species invasion to assess threats, prioritize management actions, and prevent introduction and establishment of nonnative species. Highest priority is given to managing nonnative species that have, or potentially could have, a substantial impact on park resources, and that can reasonably be expected to be successfully controlled.
- Support scientific studies to develop and implement effective strategies to manage invasive nonnative species and restore park ecosystems.
- Highest priority for intensive management of widespread disruptive nonnative species are in park special ecological areas and in areas required for the protection of rare and special status species.
- Implement park management actions in a manner that minimizes the introduction of or increase in nonnative species, in both number and type.
- Control of nonnative species is part of an integrated pest management approach that prevents unacceptable levels of pest effects by cost-effective means while minimizing risk to people, resources, and the environment.
- Cooperate with agencies, adjacent land owners, and local communities to monitor and control invasive nonnative species.
- Provide interpretive and educational programs on the impacts of invasive nonnative species on park resources.

Park greenhouse facilities. *NPS photo by Carol Johnson*

Endangered honohono. *NPS photo*

RARE, THREATENED, AND ENDANGERED SPECIES

LAW AND POLICY SOURCE— Under the Endangered Species Act, the National Park Service is mandated to promote the conservation of all federal threatened and endangered species and their critical habitats within park unit boundaries. NPS *Management Policies 2006* (4.4.2.3) also call for the agency to survey for, protect, and strive to recover all species native to park units that are listed under the Endangered Species Act. In addition, the National Park Service is directed to inventory, monitor, and manage state-listed species in a manner similar to the treatment of federally listed species to the greatest extent possible.

DESIRED CONDITIONS—

- Federally listed and state listed threatened and endangered and rare species and their habitats are protected and sustained.
- Native threatened and endangered and rare species populations that have been severely reduced or extirpated are restored where feasible and sustainable.
- Populations of threatened, endangered, or otherwise imperiled species in the park are increasing, leading to improvement in the species' status and, ultimately, to recovery. State and federally listed and rare wildlife populations are stable or increasing, as measured by recovery goals outlined in USFWS species recovery plans.
- Habitats that support or are suitable for sensitive, rare, endemic, or listed species are protected.
- Visitors learn about species in the park that are rare or listed under the Endangered Species Act, as well as actions that may assist their recovery.
- Effective management strategies to perpetuate and restore rare and listed species are developed and implemented based on the best available science.

POTENTIAL MANAGEMENT STRATEGIES—

- Support research that contributes to management knowledge of rare and protected species and their habitat. Incorporate findings in interpretive and educational programs.
- Inventory rare, state and federally listed species in the park and regularly monitor their distribution, condition, and population trends. Modify management plans to be more effective, based on the results of monitoring.
- Support research and experimental studies to develop and implement effective strategies to perpetuate and restore rare and listed species in the park.
- Manage critical habitat, essential habitat, and recovery areas to maintain and enhance their value for listed species.
- Consult with the USFWS and NOAA-Fisheries to ensure that NPS actions comply with the Endangered Species Act.
- Implement management actions in the park in a manner that minimizes the potential adverse effect on listed species and their habitat.
- Manage nonnative species that have unacceptable impacts on listed and rare species and their habitat.

- Participate in the recovery planning process when appropriate. Cooperate with the USFWS and NOAA-Fisheries to implement recovery plans approved by those agencies for listed species found in the park.
- Maintain and expand park partnerships for managing rare and listed species and their habitat, particularly those involving neighboring lands.
- Provide information to visitors regarding listed species that occur in the park and measures to promote their recovery. Update interpretations at interpretive stops or displays.

Hawaiian Volcano Observatory at sunrise.
NPS photo by Stephen Geiger

AIR QUALITY

LAW AND POLICY SOURCE— The Clean Air Act (42 USC 7401 et seq.) gives federal land managers the responsibility for protecting air quality and air quality related values, including visibility, plants, animals, soils, water quality, cultural resources, and public health, from adverse air pollution impacts. NPS *Management Policies 2006* (4.7) and "Natural Resource Management Reference Manual #77" provide further direction on the protection of air quality and related values for park units. Hawai'i Volcanoes National Park is a Class I air quality area under the Clean Air Act.

Since monitoring for sulfur dioxide (SO_2) began in the park in 1986, the SO_2 National Ambient Air Quality Standard has been violated routinely. Because the volcanic source is natural, the exceedances of the standard are considered to be "exceptional events" by the US Environmental Protection Agency (EPA), meaning that controls are not possible but that the public must still be protected. EPA states that for exceptional events, protection of public health is the highest priority and that the public should get timely information and measures be taken to safeguard public health. The protection of visitors and staff within parks from unusual and largely unseen hazards is a concern.

DESIRED CONDITIONS—

- Air quality in Hawai'i Volcanoes National Park meets national ambient air quality standards for specified pollutants and is maintained or improved with little or no deterioration, except for volcanic-related emissions.
- Visibility is excellent, such that scenic views, including integral vistas and views of landscapes within and outside the park, are clear and meet visibility standards, except for volcanic-related visibility reductions.
- Views from park overlooks, integral vistas, and scenic stops are not obstructed or marred by human-caused air pollution for most of each year.
- Hawai'i Volcanoes National Park management and visitor service activities promote preservation of excellent air quality, including healthful indoor air quality in NPS concession facilities.
- Air quality monitoring within or near the park is able to verify whether trends are improving or deteriorating and whether air quality standards are met within the park, discounting any "exceptional events."
- Air pollution ecological effects research and monitoring confirms air quality related values are not being impacted by human-caused air pollution.

POTENTIAL MANAGEMENT STRATEGIES—

- Cooperate with local air pollution control authorities, the Idaho Hawai'i State Department of Health, and the EPA to monitor air quality and visibility and ensure that these authorities maintain high-quality characteristics consistent with EPA and state and local standards.
- Inventory and monitor air quality related values associated with the park. Establish baseline conditions for and monitor native plants or other species that may be sensitive to air pollution.
- Evaluate air pollution impacts to air quality related values and identify causes.
- Participate in federal, regional, and local air pollution control planning efforts and drafting of regulations, and coordinate with the NPS Air Resources Division to review permit applications for major new air pollution sources that may affect the park.
- Through timing and appropriate equipment, minimize air pollution emissions associated with park operations and visitor use activities. Use and demonstrate sustainable practices and pollution prevention measures in park operations. Use best available practices and technologies to provide healthful indoor air quality at facilities.
- Form regional partnerships to develop alternative transportation systems and promote clean fuels.
- Provide information regarding air quality and related values to park visitors and encourage them to reduce their air pollution emissions.
- Conduct and assist research on air quality related values to learn about effects of local and long-range atmospheric deposition on plants and soils within the park. Determine changes in ecosystem function caused by atmospheric deposition and assess the resistance and resilience of native ecosystems from the effects of air pollution.
- Work to meet the NPS Pacific West Region's "carbon neutral" goal as soon as possible.
- Ensure the park warning system and monitoring are in place to protect park visitors and staff when volcanic emissions are increased. Participate in information and health warnings to the public based on in-park monitoring.
- Provide visibility and haze data for background and current condition assessments.

GEOLOGIC AND SOIL RESOURCES

LAW AND POLICY SOURCE— NPS *Management Policies 2006* (4.8) and NPS-77 "Natural Resources Management Guidelines" provide general direction on the protection of geologic and soil resources, including geologic features and geologic processes.

Hiking through the Ka'ū Desert. *NPS photo by Jay Robinson*

DESIRED CONDITIONS—

- Hawai'i Volcanoes National Park's geologic resources are preserved and protected as integral components of the park's natural systems.
- The National Park Service actively seeks to understand and preserve the soil resources of the park, and to prevent, to the extent possible, the unnatural erosion, physical removal, or contamination of the soil, or the soil's contamination of other resources.
- Natural soil resources and processes function in as natural a condition as possible, except where special considerations are allowable under policy.
- Monitoring and research programs assess conditions and trends in the park's geoindicators, particularly those that are both important to the park's ecosystem and management, and those that are subject to human influence (e.g., sea level and shoreline position, erosion, and volcanic processes).
- Surficial geology is mapped and geo-hazards are identified.

Hāpaimamo and the Southwest rift of Mauna Loa.
NPS photo by Jay Robinson

POTENTIAL MANAGEMENT STRATEGIES—

- Assess the impacts of natural processes and human-related events on geologic and soil resources and restore as warranted.
- Partner with the US Geological Survey and others to identify, address, and monitor geologic hazards.
- Collect baseline information on soils, and develop surficial geology maps.
- Update geologic interpretations at interpretive stops, displays, and wayside exhibits.
- Identify interpretive themes or other opportunities for interpreting the notable geologic events or processes that are preserved, exposed, or occur in the park.
- Prevent or minimize adverse irreversible human impacts to geologic resources. Implement mitigations to reduce impacts, such as area closures, trail development to protect surrounding area, or enhanced visitor education.
- Prevent or minimize adverse, potentially irreversible impacts on soils. Possibly implement soil conservation and soil amendment practices to reduce impacts, and import clean, weed-free, off-site soil or use soil amendments as necessary to restore damaged sites.
- Minimize soil excavation, erosion, and off-site soil migration during and after any ground-disturbing activity.
- Survey areas of the park with soil resource problems and take actions appropriate to the management prescription to prevent or minimize further erosion, compaction, or deposition.
- Apply effective best management practices to areas with soil erosion and compaction in a manner that stops or minimizes erosion, restores soil productivity, and reestablishes or sustains a self-perpetuating vegetative cover.

ʻUaʻu prepares for takeoff. *NPS photo*

WATER QUALITY

LAW AND POLICY SOURCE— NPS *Management Policies 2006* (4.6.1, 4.6.2) calls for the National Park Service to perpetuate surface and groundwater as integral components of park aquatic and terrestrial ecosystems. "Natural Resource Management Reference Manual #77" provides further direction on the management of water quantity on parks, stating the National Park Service will manage and use water to protect resources, accommodate visitors, and administer park units within legal mandates.

DESIRED CONDITIONS—

- Surface water and groundwater are protected, and water quality meets or exceeds all applicable water quality standards.
- NPS and NPS-permitted programs and facilities are maintained and operated to avoid pollution of surface water and groundwater.
- Water resources meet state criteria for Class 1.a (highest level).
- Hydrologic processes continue unimpeded.

POTENTIAL MANAGEMENT STRATEGIES—

- Promote water conservation by the National Park Service, partners, visitors, and park neighbors.
- Apply best management practices to all pollution-generating activities and facilities in the park. Take positive steps to reduce such activities.
- Minimize the use of pesticides, fertilizers, and other chemicals, and manage them in keeping with NPS policy and federal regulations.
- Monitor water quality in selected areas, such as anchialine pools.
- Manage stormwater runoff appropriately.
- Promote greater public understanding of water resource issues at Hawaiʻi Volcanoes National Park, and encourage public support for and participation in protecting watersheds.

Halemaʻumaʻu at sunset. *NPS photo by Ed Shiinoki*

LIGHTSCAPE MANAGEMENT / NIGHT SKY

LAW AND POLICY SOURCE— NPS *Management Policies 2006* (4.10) recognizes that natural lightscapes are natural resources and values that contribute to the visitor experience. The policy further states that the park staff will seek to minimize the intrusion of artificial light into the night scene. In natural areas, artificial outdoor lighting will be limited to meet basic safety requirements, will be shielded, full-cut off fixtures with long-wavelength bulbs, and will take advantage of other minimum impact techniques.

DESIRED CONDITIONS—

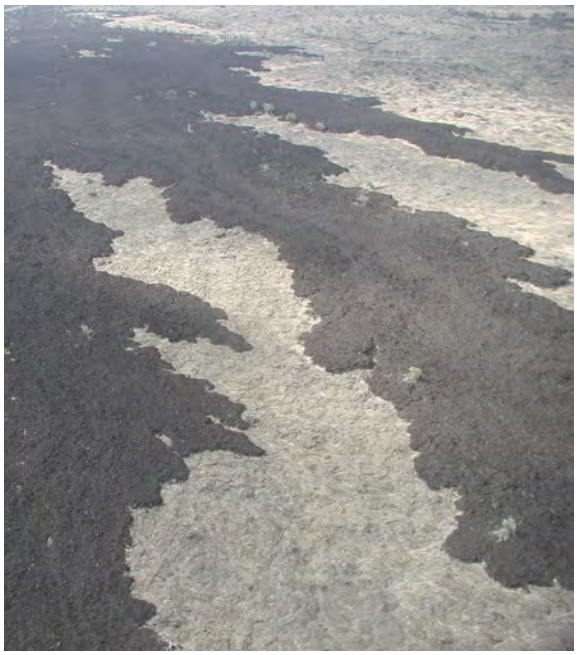
- Natural darkness and other components of the natural lightscape in the park are protected.
- The National Park Service will seek the cooperation of park visitors, neighbors, concessioners, and local government agencies to prevent or minimize the intrusion of artificial light into the night scene of the ecosystems of the park.
- The park's inventory of natural resources identifies ecological processes or components that uniquely depend upon or are affected by nighttime light.
- Artificial light sources in the park's developed areas are designed to prevent light pollution and should serve as an example to educate the public about night sky and wildlife friendly lighting.
- Throughout a majority of the park, visitors have opportunities to experience a naturally dark night sky free of light pollution.

POTENTIAL MANAGEMENT STRATEGIES—

- Cooperate with park visitors, neighbors, concessioners, and local government agencies to find ways to prevent or minimize the intrusion of artificial light into the night scene in the park.
- In developed areas, limit artificial outdoor lighting to basic safety requirements and design to minimize impacts on the night sky and be wildlife friendly.
- Evaluate the impacts on the night sky caused by park operations. If light sources in the park are on at night, consider alternatives such as shielding lights, changing lamp types, reducing intensity, reducing time of operation, or eliminating unnecessary sources. Examine alternatives such as wayfinding markers and the use of portable flashlights.
- Develop lighting zones to delineate where outdoor lighting is appropriate and what type of lighting is needed, and match outdoor lighting to visitor expectations and basic safety needs.
- Strictly adhere to the park's best management practices for mitigating light pollution.
- Meet or exceed standards set in local night sky ordinances.
- Inventory and track, as feasible, night sky quality for the NPS Night Sky Program.
- Provide interpretive programs and materials to help visitors understand the role and value of natural lightscape and the status of natural lightscapes within the park and communicate what can be done to protect this resource.

SOUNDSCAPES AND THE ACOUSTIC ENVIRONMENT

LAW AND POLICY SOURCE— NPS *Management Policies 2006* (4.9) and NPS Director's Order 47: *Soundscape Preservation and Noise Management* require park managers to preserve the soundscapes and acoustic resources associated with the physical and biological resource components of the park, such as the sounds of the wind in the trees and birds singing.



East Rift Zone. *NPS photo by Jim Gale*

DESIRED CONDITIONS—

- The National Park Service preserves the natural ambient soundscape, restores degraded soundscape to the natural ambient condition wherever possible, and protects the acoustic environment from degradation due to noise (such as inappropriate/undesirable human-caused sound).
- Noise from management or recreational uses is minimized to provide a high-quality visitor experience and protect biological resources and processes that rely on sound (for example intraspecies communication, courtship, predation and predator avoidance, and effective use of habitat).

Thurston Lava Tube. *NPS photo*

- The acoustical environment remains unimpaired.
- Natural sounds predominate in the park. Noise would not affect appropriate transmission of natural sounds.
- Ecological processes and interactions that depend upon or are affected by sound are protected.
- Visitors have opportunities to experience, understand, and appreciate the park's soundscapes and acoustic environment.
- The park maintains an inventory of natural sounds and, as feasible, monitors key locations throughout the park to ensure protection of soundscapes and the acoustic environment.
- The park uses best available technology and methods to minimize or mitigate artificial noises produced by equipment and management activities.

POTENTIAL MANAGEMENT STRATEGIES—

- Monitor and prevent or minimize unnatural sounds that adversely affect park resources or values or visitors' enjoyment of them.
- Require park staff, concessioners, contractors, and commercial use companies to comply with measures designed to reduce noise levels.
- Minimize noise generated by NPS management activities by moderating administrative functions such as the use of motorized equipment.
- Use best technologies and methods to minimize noise when procuring or using equipment.
- Encourage visitors to avoid unnecessary noise, such as minimizing the use of generators and maintaining quiet hours in the campgrounds.
- Provide interpretive programs and materials to help visitors understand the role of natural sounds and the value of the park's soundscape.

SCENIC RESOURCES/VIEWSHEDS

LAW AND POLICY SOURCE— NPS Organic Act and NPS *Management Policies 2006* (1.4, 1.6, 3.1) call for the National Park Service to conserve and protect scenery and scenic vistas.

View from Kealakomo Overlook. *NPS photo by Jay Robinson*

DESIRED CONDITIONS—

- The scenic views at Hawai'i Volcanoes National Park continue to stir imaginations, inspire, and provide opportunities for visitors to understand, appreciate, and forge personal connections to the Pacific Islands.
- Intrinsically important scenic vistas and scenic features are not significantly diminished by human-made developments.
- In collaboration with landowners inside and outside the park, viewsheds within and adjacent to the park are protected.

POTENTIAL MANAGEMENT STRATEGIES—

- Work with adjacent and nearby landowners to minimize any visual impacts from nearby developments and to ensure that developments do not encroach on the park.
- Consider scenic vistas, cultural landscapes, and visual impacts when planning park projects.

CLIMATE CHANGE

LAW, POLICY, AND GUIDANCE SOURCES— Executive Order 13423, DOI Secretarial Order 3226, DOI Secretarial Order 3289, The Presidents Climate Change Action Plan (2013), NPS 2010 Climate Change Response Strategy, NPS Climate Change Action Plan 2012–2014, 2012 Green Parks Plan, and PWR Vision for Climate Change provide guidance to parks for managing resources and providing interpretation services in light of climate change. The Hawai'i Volcanoes National Park 2007 Climate Change Action Plan also provides guidance for determining desired conditions and potential management strategies for responding and adapting to climate change.

DESIRED CONDITIONS—

- The park works together with other federal, state, and local governments, and private landowner partners to develop strategies at multiple scales, including landscape-level strategies, for understanding and responding to climate change impacts.
- Park staff considers and analyzes potential climate change impacts when undertaking long-range planning exercises, setting priorities for scientific research and investigations, and/or when making major decisions affecting natural and cultural resources.
- The park engages in partnerships to implement projects and activities that contribute to the conservation of species, natural communities, and lands and waters placed at risk by changing climate conditions.
- Continue to provide and foster state-of-the art science to better understand the impacts of climate change and to develop science-based adaptive management strategies for natural and cultural resource managers.

- Continue to minimize the park's contributions to climate change by implementing strategies to improve sustainability and energy efficiency and decrease the park's carbon footprint and consumption of resources.

POTENTIAL MANAGEMENT STRATEGIES—

- Meet or exceed the requirements of Executive Order 13423.
- Meet or exceed the goals of the Federal Green Challenge.
- Follow regional policy and guidance on sustainable energy, water, fuel, fleet, buildings, waste, and purchasing practices.
- Inventory park emissions, implement the park's climate action plan and relevant or applicable portions of regional climate change action plan, and implement climate friendly actions within the Environmental Management Systems framework.
- Inventory park emissions, implement the park's climate action plan and relevant or applicable portions of regional climate change action plan, and implement climate friendly actions within the Environmental Management Systems framework.
- Collaborate with partners to develop, test, and distribute the best results from climate change models to inform NPS activities.
- Work with others to inventory and monitor key attributes of the natural resources, cultural resources, and visitor experiences likely to be impacted by climate change. Systematically assess the vulnerability of these resources to climate change.
- Acquire, provide, and apply scientific information to reduce the national park system carbon footprint.
- Incorporate climate change considerations and responses in all levels of the NPS planning framework.
- Implement adaptation strategies that promote ecosystem resilience and enhance restoration, conservation, and preservation of park natural resources.
- Develop, prioritize, and implement management strategies to preserve climate-sensitive cultural resources.
- Include climate-related vulnerability assessments in project approval and funding decisions.
- Enhance the sustainable maintenance, design, and construction of park infrastructure.
- Substantially reduce the national park system's carbon footprint from 2008 levels by 2016 through aggressive commitment to greener operations.
- Integrate climate change mitigation into NPS business practices and culture.
- Incorporate biological carbon sequestration as a mitigation option where it is consistent with the NPS mission.
- Coordinate and distribute climate change information throughout the National Park Service.
- Increase climate change knowledge and understanding within the National Park Service.
- Provide external communications about the implications of climate change and the National Park Service response.
- Model and communicate sustainable practices that lead by example.

Halemaʻumaʻu Trail. *NPS photo by David Boyle*

Historic 1941 Volcano House. *NPS photo by Jay Robinson*

Cultural Resources

ARCHEOLOGICAL RESOURCES

LAW AND POLICY SOURCE— The Antiquities Act of 1906; the Historic Sites Act of 1935; the National Historic Preservation Act of 1966, as Amended; the Archeological Resources Protection Act of 1979, as Amended; *Secretary of the Interior's Standards and Guidelines for Archeology and Historic Preservation;* Programmatic Agreement among the National Park Service, the Advisory Council on Historic Preservation, and the National Conference of State Historic Preservation Officers (2008); NPS *Management Policies 2006* (5.3.5.1) and Director's Order 28: *Cultural Resource Management* call for the National Park Service to manage archeological resources in situ unless physical disturbance is justified and mitigated by data recovery or other means in concurrence with the State Historic Preservation Officer. See also 36 CFR Part 79 and the *Secretary of the Interior's Standards and Guidelines for Archeological Documentation.*

Historic canoe shed at Kamoamoa that was covered by lava in 1992. *NPS photo*

DESIRED CONDITIONS—

- Archeological sites are identified and inventoried, and their significance is determined and documented.
- Archeological sites are protected in an undisturbed condition unless it is determined through formal processes that disturbance or natural deterioration is unavoidable.
- When disturbance or deterioration is unavoidable, the site is professionally documented and excavated, and the resulting artifacts, materials, and records are curated and conserved in consultation with the Hawai'i state historic preservation office and Native Hawaiians.
- Some archeological sites that can be adequately protected may be interpreted to the visitor.
- Archeological site baseline data are available. Site conditions are monitored to record changes in resource conditions as a result of environmental conditions or visitor use impacts.
- To the extent feasible, archeological resources degrading from environmental conditions and visitor impacts are mitigated through data recovery or other preservation strategies, including site-hardening.
- To the extent feasible, archeological resources threatened by project development are mitigated first through avoidance or secondly through other preservation strategies such as data recovery.
- Archeological collections are handled, stored, cleaned, conserved, and exhibited in a way that is appropriate to the nature of the materials, protects the objects, and preserves data.
- Archeological collections are made available for scientific, educational, and religious uses.
- Access to information on the specific location, character, etc. of objects or collections that may create risk of theft or destruction is limited.

POTENTIAL MANAGEMENT STRATEGIES—

- Gather field data regarding habitation-sites, rock shelters, lithic scatters, hunting camps, gathering areas, and other resources to develop a more accurate predictive model of prehistoric site distribution and to address related research questions.
- Inventory, evaluate, and manage archeological resources that reflect post-contact activities, such as park development and protection, early development sites, and associated trash dumps.
- Document and evaluate national register-eligible resources. As appropriate, nominate these resources for listing on the National Register of Historic Places.
- Monitor sites, as needed, on a case by case basis monthly, annually, or biannually, or as required under Section 106 for projects.
- Educate visitors on regulations governing protection and conservation of archeological resources.
- Document, track, and prosecute for violations of cultural resource laws associated with disturbance/vandalism, removal, or transport.
- Survey and inventory archeological sites throughout the park; determine and document their significance.
- Treat all archeological resources as eligible for listing on the National Register of Historic Places pending a formal determination by the National Park Service, the state historic preservation office, and the park's Native Hawaiian kupuna group as to their significance.
- Determine which archeological sites should be added to the Archeological Sites Management Information System and the National Register of Historic Places.

Ohia Wing a.k.a. 1932 Administration Building. *NPS photo*

HISTORIC STRUCTURES

LAW AND POLICY SOURCE—The Antiquities Act of 1906 and the National Historic Preservation Act of 1966 as amended, call for analyzing the effects of possible federal actions on historic structures on, or eligible for, the national register and for inventorying and evaluating their significance and condition. The programmatic agreement among the National Park Service, the Advisory Council on Historic Preservation, and the National Conference of State Historic Preservation Officers for Compliance with Section 106 of the National Historic Preservation Act (2008) and NPS *Management Policies 2006* (5.3.5.4) call for the treatment of historic and prehistoric structures to be based on sound preservation practices to enable the long-term preservation of a structure's historic features, materials, and qualities. All treatment of historic structures must comply with the *Secretary of the Interior's Standards for the Treatment of Historic Properties*. *See also Director's Order 28: Cultural Resource Management*.

DESIRED CONDITIONS—

- Historic structures are inventoried and their significance and integrity are evaluated under National Register of Historic Places criteria.

- The qualities that contribute to the listing or eligibility for listing of historic structures on the national register are protected in accordance with the *Secretary of the Interior's Standards and Guidelines for Archeology and Historic Preservation,* unless it is determined through a formal process that disturbance or natural deterioration is unavoidable.
- Laws pertaining to historic preservation remain applicable within wilderness but must be generally administered to preserve the area's wilderness character.
- The historic character of historic buildings and structures are managed in accordance with Section 5.3.5.4 of NPS *Management Policies 2006*.
- Historic structure inventories and reports are prepared and existing reports amended as needed. Actions identified in historic structure reports are implemented and a record of treatment is added to the reports.
- Identified and evaluated historic structures are monitored, inspected and managed to enable the long-term preservation of a resource's historic features, qualities and materials.

POTENTIAL MANAGEMENT STRATEGIES—

- Employ the comprehensive maintenance, protection and preservation measures in accordance with the *Secretary of the Interior's Standards for the Treatment of Historic Properties*. For properties lacking specific plans, preservation actions would be based on the Secretary of the Interior's Standards and NPS *Management Policies 2006*. Treat all historic structures as eligible for listing on the National Register of Historic Places pending formal determination (by the National Park Service and State Historic Preservation Division).
- Consider frontcountry historic buildings not actively being used in the park for adaptive reuse by other public and private entities to assist in preservation of the structures.
- Create design guidelines and/or historic structure/cultural landscape reports for all developed areas in the park to preserve the architectural and landscape-defining features. Include design review oversight to ensure the compatibility of new planning, design, and construction.
- Pursue basic preservation maintenance activities to avoid costly rebuilding or reconstruction of historic structures.
- Comply with cultural resource protection and preservation policies and directives and the wilderness minimum requirements analysis in wilderness areas for the maintenance of historic structures.
- Before modifying any historic structure on the National Register of Historic Places, consult with the state historic preservation office and the Advisory Council for Historic Preservation, as appropriate.

ETHNOGRAPHIC RESOURCES

LAW AND POLICY SOURCE— NPS *Management Policies 2006* (5.3.5.3) calls for gathering ethnographic information through anthropological and collaborative community research that recognizes the sensitive nature of such cultural data and documenting the meanings that traditionally-associated groups assign to traditional natural and cultural resources and the landscapes they form. In accordance with the National Historic Preservation Act, the purpose is to preserve, conserve, and encourage the continuation of the diverse traditional prehistoric, historic, ethnic, and folk cultural traditions that underlie and are a living expression of American heritage as manifested in the traditional use of ethnographic resources in park units. American Indian Religious Freedom Act also calls for NPS managers to accommodate the access to and the ceremonial use of sacred sites by practitioners and to preserve the sites' physical integrity.

DESIRED CONDITIONS—

- Appropriate cultural anthropological research is conducted in cooperation with groups associated with the park.
- To the extent practicable, permitted by law, and not clearly inconsistent with essential agency functions, the National Park Service accommodates access to and ceremonial use of Hawaiian sacred sites by Hawaiian religious practitioners and avoids adversely affecting the physical integrity of these sacred sites.
- All ethnographic resources determined eligible for listing or listed in the national register are protected. If disturbance of such resources is unavoidable, formal consultation with the state historic preservation officer, the Advisory Council on Historic Preservation, and, as appropriate, with Native Hawaiians is conducted.
- The identities of community consultants and information about sacred and other culturally sensitive places and practices are kept confidential when research agreements or other circumstances warrant.
- Potentially sensitive natural and cultural resources and traditional cultural properties (ethnographic resources eligible for the National Register of Historic Places) are identified, recorded, and evaluated through consultation with Native Hawaiians. The integrity of traditional cultural properties is preserved and protected.
- Positive and productive relationships exist with each of the Native Hawaiian groups that have traditional with the park.

POTENTIAL MANAGEMENT STRATEGIES—

- Survey and inventory ethnographic resources and document their significance.
- Treat all ethnographic resources as eligible for listing in the National Register of Historic Places pending a formal determination by the National Park Service and the state historic preservation officer.
- Continue to encourage the employment of Native Hawaiians on the NPS staff to improve communications and working relationships and encourage cultural diversity in the workplace.
- Conduct consultation with Native Hawaiians throughout the course of the planning processes at the park.
- Continue to work collaboratively with Native Hawaiians when conducting research related to the resources they value.

Hawai'i Volcanoes National Park recognizes that the Native Hawaiians' relationships to lands in the park have endured for hundreds of years, and park staff will continue to work with them to ensure that sites of traditional importance are preserved and protected.

Members of the park's Kupuna Consultation Group at the opening of the Museum of the Native American Indians.
NPS photo

CULTURAL LANDSCAPES

LAW AND POLICY SOURCE— NPS *Management Policies 2006* (5.3.5.2) calls for the preservation of the physical attributes, biotic systems and uses of cultural landscapes that contribute to historical significance.

DESIRED CONDITIONS—

- Cultural landscape inventories are conducted to identify landscapes potentially eligible for listing in the national register and to assist in future management decisions for landscapes and associated resources, both cultural and natural.
- The management of cultural landscapes focuses on preserving the landscape's physical attributes, biotic systems, and uses when that use contributes to its historical significance.
- The preservation, rehabilitation, restoration, or reconstruction of cultural landscapes is undertaken in accordance with the *Secretary of the Interior's Standards for the Treatment of Historic Properties*.
- Laws pertaining to historic preservation remain applicable within wilderness but must be generally administered to preserve the area's wilderness character.
- The cultural landscapes of the park retain a high degree of integrity.
- Cultural landscape inventories and reports are prepared, and existing reports are amended as needed.
- Identified and evaluated cultural landscapes are monitored, inspected, and managed to enable the long-term preservation of a resource's historic features, qualities, and materials.
- Actions identified in cultural landscape reports are implemented, and a record of treatment is added to the reports.

POTENTIAL MANAGEMENT STRATEGIES—

- Treat cultural landscapes that are potentially eligible for listing in the national register as eligible until a formal determination is made (by the National Park Service and state historic preservation office).
- Comply with cultural resource protection and preservation policies and directives and the wilderness minimum requirements analysis in wilderness areas for the maintenance of cultural landscapes.
- Create design guidelines and/or cultural landscape reports for all developed areas in the park to ensure that the landscape-defining features of these areas are preserved. These guidelines would include provisions for design review oversight to ensure the compatibility of new planning, design, and construction.

Adult moth of the carnivorous caterpillar.
NPS photo by Jay Robinson

MUSEUM COLLECTIONS

LAW AND POLICY SOURCE— NPS *Management Policies 2006* (5.3.5.5) states that the National Park Service "…will collect, protect, preserve, provide access to, and use objects, specimens, and archival and manuscript collections…in the disciplines of archeology, ethnography, history,

biology, geology, and paleontology to aid understanding among park visitors and to advance knowledge in the humanities and sciences." The Antiquities Act (16 USC 431-433), the Reservoir Salvage Act (16 USC 469-469c), section 110 of the National Historic Preservation Act (16 USC 470h-2), the Archeological Resources Protection Act (16 USC 470aa-mm), NPS Director's Orders 28 and 36 CFR 79, Curation of Federally Owned and Administered Archeological Collections also provide guidance on managing and protecting museum collections.

DESIRED CONDITIONS—

- All museum collections and associated records (objects, specimens, and manuscript collections) are identified and inventoried, cataloged, documented, preserved, and protected. The collections are periodically inspected to monitor their conditions and written report of the results of the inspections and inventories are provided.
- Provision is made for access to and use of the park's museum collections for exhibits, research, and interpretation.
- The qualities that contribute to the significance of collections are protected in accordance with established standards.
- Research and development projects include plans for the curation of collected objects and specimens.
- The park's museum collections are housed in appropriate facilities that provide protection for current collections and allow for future collection expansion. These facilities are periodically inspected to monitor physical security and environmental conditions.
- Park museum collections provide documentation of park natural and cultural resources.

POTENTIAL MANAGEMENT STRATEGIES—

- Inventory and catalog all park museum collections in accordance with standards in the NPS Museum Handbook.
- Develop and implement a collection management program according to NPS standards to guide the protection, conservation, and use of museum objects.
- Continue outreach efforts to park visitors, provide access to and give tours of the collections to the community, and provide field assistance with park research projects as needed. Provide digital access to images of and information about collections.
- Collections facilities would be upgraded, improved, and expanded according to the recommendations of the Hawai'i Volcanoes National Park Museum Management Plan.
- Provide efficient access to reference materials and information.

Wilderness

WILDERNESS RESOURCES, CHARACTER, AND VALUES

LAW AND POLICY SOURCE— The Wilderness Act of 1964; the National Historic Preservation Act; the Archeological and Historic Preservation Act; NPS *Management Policies 2006* (6.3, 6.4); Director's Order 41: *Wilderness Preservation and Management* and corresponding Reference Manual 41; and Director's Order 28: *Cultural Resource* Management provide guidance and direction for the management of wilderness areas and the preservation of wilderness character and wilderness resources. The Wilderness Act specifies that each agency administering any areas designated as wilderness shall be responsible for preserving the wilderness character of the areas and shall so administer such area for other purposes for which it may have been established and also to preserve its wilderness character.

The Wilderness Act also specifies that the designation of any area of the park system as wilderness "shall in no manner lower the standards evolved for the use and preservation of such unit of the park system under the various laws applicable to that unit" (16 USC 1133 (a)(3)).

DESIRED CONDITIONS—

- The National Park Service will manage wilderness areas including those proposed for wilderness designation for the use and enjoyment of the American people in such a manner as will leave them unimpaired for future use and enjoyment as wilderness.
- The park ensures that the land's primeval character and influence is retained and protected, that visitors continue to find opportunities for solitude and primitive, unconfined recreation and that the landscapes generally appear to have been affected primarily by the forces of nature, with the imprint of mans' work substantially unnoticeable.
- Cultural resources that have been included within wilderness will be protected and maintained according to the pertinent laws and policies governing cultural resources using management methods that are consistent with the preservation of wilderness character and values.
- Natural processes, native components, and the interrelationships among them are protected, maintained, and/or restored to the extent possible, while providing opportunities for their enjoyment as wilderness.
- Present and future visitors enjoy the unique qualities offered in wilderness. These include the experiences of solitude, remoteness, risk, challenge, self-sufficiency, discovery, and observation of an untrammeled ecosystem.
- Scientific studies are encouraged that contribute to understanding wilderness resources, threats, and restoration of wilderness character.
- Wilderness management is based on the minimum requirement concept, allowing only those actions necessary and appropriate for administration of the area as wilderness and that do not cause a significant impact to wilderness resources and character.
- The values of the wilderness in the park are understood by the public and staff through education in wilderness ethics and use, and by using management skills and techniques to promote and preserve these values.
- Park operations and wilderness functions are coordinated in the unit to manage and protect natural and cultural resources in wilderness and preserve wilderness character. Management is coordinated to provide consistency in regulations, standards, and guidelines to the extent feasible, and work will continue to be done with other local and regional groups, communities, agencies, and Native Hawaiians to preserve wilderness values.

Viewing the coastal wilderness from Pepeiao Trail. *NPS photo*

POTENTIAL MANAGEMENT STRATEGIES—

- Develop and implement research programs related to the wilderness ecosystem and key natural resources and visitor experiences.
- Inventory wilderness resources, facilities, and operational activities.
- Assess management actions using the minimum requirement analysis.
- Develop a wilderness stewardship plan to articulate wilderness character and determine wilderness character monitoring techniques. In the plan, further define a range of desired conditions for wilderness resources, visitor wilderness experiences, wilderness character, and management and operational techniques.
- Develop and implement a program to restore conditions that are outside the range of desired conditions for wilderness resources, visitor wilderness experiences, and wilderness character.
- Manage activities to maintain and restore resource conditions, to protect visitor experiences, and to protect and restore wilderness character.
- Develop an educational program for visitors, staff, and local community members, and others that enhances the appreciation of wilderness resources.
- Monitor the wilderness resources and incorporate the results of monitoring to refine management programs.

Visitors on a ranger-guided hike at Puʻuloa Petroglyphs.
NPS photo by David Boyle

Visitor Use and Experience

VISITOR OPPORTUNITIES

LAW AND POLICY SOURCE— The NPS Organic Act, NPS General Authorities Act, and NPS *Management Policies 2006* (1.4, 8.1) all address the importance of park units being available to all Americans to enjoy and experience. Current laws, regulations, and policies leave considerable room for judgment about the best mix of types and levels of visitor use activities, programs, and facilities. For this reason, most decisions related to visitor experience and uses are addressed in the alternatives. However, all visitor use of the national park system must be consistent with the following guidelines.

DESIRED CONDITIONS—

- Park resources are conserved unimpaired for the enjoyment of future generations. Visitors have opportunities for forms of enjoyment that are uniquely suited and appropriate to the superlative natural and cultural resources found in the park. No activities occur that would cause derogation of the values and purposes for which the park has been established.
- Park visitors will have opportunities to understand and appreciate the significance of the park and its resources and to develop a personal stewardship ethic.
- To the extent feasible, programs, services, and facilities in the park are accessible to and usable by all people, including those with disabilities.
- For all zones or districts in the park, the types and levels of visitor use are consistent with the desired resource and visitor experience conditions prescribed for those areas.
- The park visitor is able to obtain visitor orientation and trip-planning information through a variety of media. Educational programs are available.
- Frontcountry day use visitation and overnight facilities are

provided in some developed areas. Roads, trails, campgrounds, and related facilities are provided, but locations and numbers may be modified for resource protection, restoration, visitor experience, or increased visitation.
- The level and type of commercial guided activities would be managed to protect park resources and the visitor experience.

POTENTIAL MANAGEMENT STRATEGIES—
- For all zones, districts, or other logical management divisions in a park, identify visitor carrying capacities for managing public use and ways to monitor for and address unacceptable impacts on park resources and visitor experiences.
- Monitor visitor comments on issues such as crowding, encounters with other visitors in the backcountry, availability of campsites at busy times of the year, and availability of parking.
- Conduct periodic visitor surveys to stay informed of changing visitor demographics and desires to better tailor programs to visitor needs and desires.
- Develop outreach programs for and with schools, Native Hawaiians, and community organizations.
- Provide a variety of educational opportunities in the park with continued facility-based contacts and guided activities. Web-based education would be provided. Some activities could be for a fee.
- Coordinate education programs with partners and focus on improving the general understanding of park natural and cultural resources, biodiversity, the protection of resources and natural processes, research, stewardship, wilderness, park values, and recreational and visitor opportunities.

Steam Vents viewing area. *NPS photo*

PUBLIC HEALTH AND SAFETY

LAW AND POLICY SOURCE— NPS *Management Policies 2006* (8.2.5) states that the saving of human life would take precedence over all other management actions as the National Park Service strives to protect human life and provide for injury-free visits. Other federal statutes and regulations that apply to the protection of public health and safety include Director's Order 50 and RM-50, "Safety and Health"; Director's Order 58 and RM-58, "Structural Fire Management"; Director's Order 83 and RM-83, "Public Health"; Director's Order 51 and RM-51, "Emergency Medical Services"; Director's Order 30 and RM-30, "Hazard and Solid Waste Management"; and OSHA 29CFR.

DESIRED CONDITIONS—
- While recognizing that there are limitations on its capability to totally eliminate all hazards, the National Park Service and its partners, contractors, and cooperators work to cooperatively to provide a safe and healthful environment for visitors and employees.
- The NPS staff strives to identify recognizable threats to safety and health and protect property by applying nationally accepted standards.

- Consistent with mandates and nonimpairment, the NPS staff reduces or removes known hazards or applies appropriate mitigating measures, such as closures, guarding, gating, education, and other actions.

POTENTIAL MANAGEMENT STRATEGIES—

- Maintain a documented safety program in the park to address health and safety concerns and identify appropriate levels of action and activities.
- Continue maintenance efforts to ensure that all potable water systems and waste water systems in the park would continue to meet state and federal requirements.
- Provide interpretive signs and materials as appropriate to notify visitors of potential safety concerns, hazards and procedures to help provide for a safe visit to the park and to ensure visitors are aware of possible risks of certain activities.
- Encourage scientific studies, and rely on best available science to identify, evaluate, and mitigate environmental hazards.

NPS staff would continue to work with local emergency and public health officials to make reasonable efforts to search for lost persons and rescue sick, injured or stranded persons.

Traffic congestion at Thurston Lava Tube. *NPS photo*

Transportation to and within Hawai‘i Volcanoes National Park

LAW AND POLICY SOURCE—

NPS *Management Policies 2006* (9.2) calls for NPS managers to identify solutions to transportation issues that preserve natural and cultural resources while providing a high-quality visitor experience. Management decisions regarding transportation generally require a comprehensive alternatives analysis and thorough understanding of their consequences. The location, type, and design of multimodal transportation facilities (e.g., roads, bridges, parking areas, sidewalks, bikeways, pedestrian trails, transit centers, and shelters) strongly influence the quality of the visitor experience and the preservation of park unit resources.

DESIRED CONDITIONS—

- Multimodal transportation facilities in the park provide access for the protection, use, and enjoyment of park resources. They preserve the integrity of the surroundings, respect ecological processes, protect natural, cultural, and scenic resources, and provide the highest visual quality and a rewarding visitor experience.

POTENTIAL MANAGEMENT STRATEGIES—

- Participate in transportation studies and planning processes that may result in links to the park's units or impacts to park resources. Work closely with other federal agencies (such as the Federal Highway Administration), state and local governments (e.g., Hawai‘i Department of Transportation), regional planning bodies, citizen groups, and others to enhance partnering and funding opportunities and to encourage effective regional transportation planning.
- Implement transportation strategies that contribute to maximum visitor enjoyment of, and minimum adverse impacts to, park resources and values. Before a decision is made to design, construct, expand, or upgrade

transportation access to or within the park, fully explore nonconstruction alternatives, such as distributing visitors to underutilized locations. If nonconstruction alternatives would not achieve satisfactory results, then a design strategy should consider whether the project:

» is appropriate and necessary to meet management needs
» is designed with extreme care and sensitivity to the landscape through which it passes
» would not cause adverse impacts to natural and cultural resources, and would minimize or mitigate those impacts that cannot be avoided
» reduces traffic congestion, noise, and air pollution
» would not violate federal, state, or local air pollution control plans or regulations
» would not cause use in the areas to exceed the areas' physical capacity
» incorporates the principles of energy conservation and sustainability
» is able to demonstrate financial and operational sustainability
» incorporates universal design principles to provide for accessibility for all populations, including those with disabilities
» takes maximum advantage of interpretive opportunities and scenic values
» is based on a comprehensive and multidisciplinary approach that is fully consistent with the parks general management plan and asset management plan; and enhances the visitor experience by offering new or improved interpretive or visitor opportunities, by simplifying travel within the park, or by making it easier or safer to see park features

ʻAʻā lava forming. *NPS photo by Jay Robinson*

Management and Operations

UTILITIES AND COMMUNICATION FACILITIES

LAW AND POLICY SOURCE— The Telecommunications Act of 1996 directs all federal agencies to assist in the national goal of achieving a seamless telecommunications system throughout the United States by accommodating requests by telecommunication companies for the use of property, rights-of-way, and easements to the extent allowable under each agency's mission. The National Park Service is legally obligated to permit telecommunication infrastructure in park units if such facilities can be structured to avoid interference with park unit purposes.

Rights-of-way for utilities to pass over, under, or through NPS property may be issued only pursuant to specific statutory authority and generally only if there is no practicable alternative to such use of NPS lands. Statutory authorities in 16 USC 5 and in NPS *Management Policies 2006* (8.6.4) provide guidance on these rights-of-way.

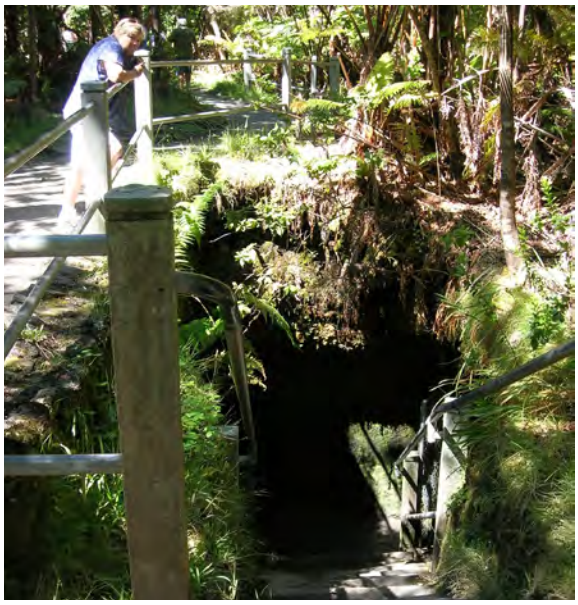
DESIRED CONDITIONS—

- Park resources or public enjoyment of the park are not denigrated by nonconforming uses.
- Utility structures are permitted in the park to the extent they do not jeopardize the park's mission and resources.
- No new nonconforming use or rights-of-way are permitted

through the park without specific statutory authority and approval by the director of the National Park Service or their representative and are permitted only if there is no practicable alternative to such use of NPS lands.

POTENTIAL MANAGEMENT STRATEGIES—

- Work with service companies, local communities, and the public to locate new utility lines and maintain existing lines so that there is minimal effect on park resources.
- If necessary, and there are no other options, place new or reconstructed utilities and communications infrastructure in association with existing structures and along roadways or other established corridors in developed areas. For reconstruction or extension into undisturbed areas, select routes that minimize impacts on the park's natural, cultural, and visual resources. Place utility lines underground to the maximum extent possible away from sensitive resources.
- Follow NPS polices in processing applications for commercial telecommunications facilities.



Exit of Thurston Lava Tube. *NPS photo*

Relations with Private and Public Organizations, Owners of Adjacent Land, and Governmental Agencies

LAW AND POLICY SOURCE— NPS *Management Policies 2006* (1.6) stresses the need for cooperative conservation beyond park boundaries. This cooperation is necessary in order for the National Park Service to fulfill its mandate to preserve the natural and cultural resources unimpaired for future generations. Local and regional cooperation may involve other federal agencies, state, and local governments, neighboring landowners, and nongovernmental and private sector organizations.

DESIRED CONDITIONS—

- Hawai'i Volcanoes National Park is managed as part of a greater ecological, social, economic, and cultural system.
- Good relations are maintained with adjacent landowners, such as the state of Hawai'i, Kamehameha Schools, The Nature Conservancy, surrounding communities, and private and public groups that affect, and are affected by, Hawai'i Volcanoes National Park.
- Hawai'i Volcanoes National Park is managed proactively to resolve external issues and concerns and ensure that the resources and values of the park are not compromised.
- Because the park is an integral part of a larger regional environment, the National Park Service works cooperatively with others to anticipate, avoid, and resolve potential conflicts, protect national park resources, and address mutual interests in the quality of life for community residents. Regional cooperation involves federal, state, and local agencies, Native Hawaiians, neighboring landowners, and all other concerned parties.

POTENTIAL MANAGEMENT STRATEGIES—

- Continue to establish and foster partnerships with public and private organizations to achieve the purposes and missions of Hawai'i Volcanoes National Park. Partnerships would continue to be sought for resource protection, research, education, and visitor enjoyment purposes.
- To foster a spirit of cooperation with neighbors and encourage compatible adjacent land uses, continue to keep landowners, land managers, local governments, and the public informed about management activities. Continue periodic consultations with landowners who might be affected by visitors and management actions.
- Continue to respond promptly to conflicts that arise over NPS activities, visitor access, and proposed activities and developments on adjacent lands that could affect the park.
- Consider providing technical and management assistance to landowners to address issues of mutual interest. Continue to work closely with adjacent landowners, local, state, and federal agencies whose programs affect, or are affected by, activities in the park.
- Continue to pursue cooperative regional planning whenever possible to integrate the unit into issues of regional concern.

Fog is common in park upland forests. *NPS photo*

RELATIONS WITH NEARBY COMMUNITIES

LAW AND POLICY SOURCE— As noted earlier, NPS *Management Policies 2006* (1.6) stresses the need for cooperative conservation beyond park boundaries. The cooperation includes working with nearby communities.

DESIRED CONDITIONS—

- NPS staff maintains close working relationships with nearby communities.
- NPS staff and local officials maintain a high level of trust and goodwill. Local officials feel they have an important stake in the park, and NPS staff feel they have an important stake in the local communities.
- NPS managers are familiar with local issues and concerns.

POTENTIAL MANAGEMENT STRATEGIES—

- Communicate and meet with local officials to identify problems and concerns facing the communities and the park and actions that can be taken to address these problems and concerns.
- Inform local officials of planning and other actions in the park that could affect the communities. Continue to work with local law enforcement, emergency services, and community education programs, as appropriate.
- When appropriate, provide technical and management assistance to local communities, including sharing information and resources, to address problems and issues of mutual interest, such as the spread of nonnative, invasive species. Continue to be involved in community-based efforts.

Earth cracks along the Southwest Rift of Kīlauea.
Photo by J.D. Griggs courtesy of USGS

ALTERNATIVES 3

Family of endangered nēnē. *NPS photo*

Happy face spider. *NPS photo by Jay Robinson*

CHAPTER 3: ALTERNATIVES

INTRODUCTION

In the summer of 2010, the general management planning team composed of staff from Hawai'i Volcanoes National Park and the Pacific West Region began the process of developing management alternatives for Hawai'i Volcanoes National Park, incorporating public responses from newsletters and public meetings. The National Environmental Policy Act and National Park Service planning regulations require the formulation of a reasonable range of alternatives that address identified planning issues and management concerns as described in the Purpose and Need section in Chapter 1.

The development of alternatives for the future of Hawai'i Volcanoes National Park was based on the purpose of the park, including providing access to Kīlauea and Mauna Loa volcanoes, preserving endemic Hawaiian ecosystems, and perpetuating the traditional Hawaiian culture connected to these landscapes. The alternatives define and present proposed strategies for the protection, preservation, and management of shared values at Hawai'i Volcanoes National Park.

It is intended that all the alternatives presented in this draft GMP/WS/EIS meet both the spirit and the intent of the laws establishing the park. In meeting this goal, the interdisciplinary planning team developed a range of alternatives that provide for the long-term protection of the park's resources and the public enjoyment of those resources in a way that is respectful of Native Hawaiian culture.

This chapter contains the following elements:

- Description of the four management zones for the action alternatives
- Actions common to all alternatives
- Description of Alternatives 1, 2, and 3, including:
  - » Alternative concept
  - » Desired conditions/ proposed actions
  - » Boundary modifications
  - » Estimated costs
- User capacity prescriptions
- Mitigation Measures
- Other actions and alternatives considered
- Environmentally preferred alternative
- Summary of alternatives table detailing the components of the alternatives
- Summary of Costs Associated with Implementation of the Alternatives
- Summary of Impacts Chart based upon the analysis in Chapter 6, "Environmental Consequences"
- Implementation of the General Management Plan

In some cases, decisions or other discussions contained in this draft GMP/WS/EIS refer directly to maps and figures; thus many decisions themselves are "map-based." The reader must rely on the text, maps, and figures taken together to fully understand the range of alternatives described in this draft GMP/WS/EIS.

Three alternatives are described in this draft GMP/WS/EIS. Each alternative has a different overarching concept, application of management zones on the landscape, series of desired conditions and/or actions, and associated costs. The three alternatives are characterized as follows:

Alternative 1: *the no-action alternative* would assume that existing programming, facilities, staffing, and funding would generally continue at current levels to protect the values of Hawai'i Volcanoes National Park. There would be no major changes in current management or visitor use. Implementation of currently approved plans would continue as funding allows. This alternative provides the baseline for evaluating actions and impacts in other alternatives.

Alternative 2: *the NPS preferred alternative* would strengthen and broaden opportunities to connect people with the volcanic world treasure, Hawai'i Volcanoes National Park, and provide a wide range of high-quality visitor experiences based on different geographic areas. Experiences would range from a concentration of visitor services and amenities on Kīlauea summit, to a less congested experience with new opportunities to disperse use along Chain of Craters Road and Mauna Loa Road. Kahuku would provide additional visitor services that offer more primitive recreational opportunities.

Natural and cultural resources would continue to be managed and protected with a high degree of integrity, consistent with direction provided by existing laws and policies. This alternative emphasizes the park's role as a refuge and haven for native biota, people, and cultures in a world constantly adapting to volcanic activity and island building processes. This alternative also emphasizes Native Hawaiian values such as mālama 'āina (nourishing or taking care of the land) and kuleana (responsibility) as important concepts in park stewardship of resources.

Alternative 3: This alternative emphasizes building new connections with the park primarily through expanded education and hands-on stewardship opportunities. Traditional visitor opportunities would continue and capacity could be expanded at some existing sites to allow for increased visitation, but new development would be very limited and a suite of management tools would be used to disperse visitors and manage congestion throughout the park. A greater focus would be placed on science and learning opportunities for visitors from mauka to makai. The park would immerse visitors in the protection and restoration of native species and ecosystems by maximizing opportunities to participate in restoration activities and additional emphasis would be placed on providing opportunities for visitors to engage in research, scientific investigation, and projects associated with natural and cultural resources management, notably in Kahuku.

Natural and cultural resources would continue to be managed and protected with a high degree of integrity, consistent with direction provided by existing laws and policies similar to the preferred alternative. As in the preferred alternative, this alternative emphasizes the park's role as a refuge and haven for native biota, people, and cultures in a world constantly adapting to volcanic activity and island building processes. This alternative also emphasizes Native Hawaiian values such as mālama 'āina (nourishing or taking care of the land) and kuleana (responsibility) as important concepts in park stewardship of resources.

Formulation of Alternatives

Development of the alternatives was based on information about the park's resources and visitor use, as well as from NPS sources, including public, federal, state, and local agencies, and Native Hawaiian and stakeholder groups. Each of the alternatives supports and is consistent with the park's purpose and significance, desired future conditions, and current laws, regulations, and policies. The alternatives avoid unacceptable resource impacts and respond to issues or concerns raised by the public during the scoping and preliminary alternatives phases of the project.

The alternatives vary in how management zones are applied geographically, according to the overall concept of the alternative. The alternatives also vary in the management prescriptions, or actions, that the park would take to achieve the desired conditions for various key resources.

Identification of the Preferred Alternative

The preferred alternative is the alternative that the National Park Service has determined would best fulfill its mission and responsibilities. The preferred alternative was identified following an initial assessment of the impacts of the alternatives. The public's ideas, preferences, and reasoning greatly assisted the National Park Service in its selection of the preferred alternative. A decision-making process was used to compare the relative advantages and costs of each alternative in a workshop attended by the GMP team. The preferred alternative for Hawai'i Volcanoes National Park was identified because, of the alternatives considered, it: preserves resources and promotes long-term stewardship of the park, provides a range of high-quality visitor opportunities and experiences, preserves the wilderness character and values of the area, and provides for cost-effective, efficient and sustainable facilities and operations.

Identification of the environmentally preferable alternative is discussed at the end of this chapter.

Implementation of the General Management Plan

Once the general management planning process is completed, the selected alternative would become the new management plan for Hawai'i Volcanoes National Park and would be implemented in phases over the next 15–20 years.

Implementation of the actions proposed within this management plan is dependent upon funding availability. The approval of this general management plan does not guarantee that funding and staffing needed to implement the plan would be forthcoming. Instead, the general management plan establishes a vision to guide future management of Hawai'i Volcanoes National Park. In addition to funding, implementation of the preferred alternative could also be affected by other factors. More detailed planning, environmental impact analysis, and studies could be required before most conditions proposed in the alternatives are achieved. All of the alternatives were developed based on the assumption that mitigation measures would be incorporated into the proposed actions to reduce the degree of adverse impacts.

MANAGEMENT ZONES USED IN THE ALTERNATIVES

Management zones define specific resource conditions and visitor experiences to be achieved and maintained in each particular area of the park. Each zone includes the types of activities and facilities that are appropriate in that management zone. For Hawai'i Volcanoes National Park, four management zones were developed by the planning team. These include the following:

- Visitor Services Zone
- Transitional/Semi-primitive Zone
- Wild/Primitive Zone
- Park Support Zone

These zones form the basis of the general management plan's alternatives and are applied to different geographic locations or areas of the park in Alternatives 2 and 3. In Alternative 1, the zones were taken from the 1975 *Hawai'i Volcanoes National Park Master Plan*. Each zone gives a general level of management guidance or direction.

For Alternatives 2 and 3, management zone boundaries were assigned according to the overall concept of each alternative. For example, for an alternative whose overall concept emphasizes a high level of visitor use with a wide range of facilities, a larger Visitor Services Zone makes sense. For an alternative that emphasizes wild character and wilderness, a larger Wild/Primitive Zone would be appropriate.

The management zones for Hawai‘i Volcanoes National Park are presented in *Table 3.1. Management Zones.* For each zone, the table depicts the zone concept; the natural and cultural resource conditions; special uses such as communication facilities; visitor experience; and facilities and operations.

In addition to the management zones, park managers would continue to use the Superintendent's Compendium (NPS 2012). The compendium is a list of designations, closures, requirements, and other restrictions imposed under the discretionary authority of the superintendent as provided in Title 36 of the *Code of Federal Regulations (CFR)*.

Table 3.1. Management Zones

Category	Visitor Services Zone	Transitional/ Semi-primitive Zone	Wild/Primitive Zone	Park Support Zone
ZONE CONCEPTS				
	The Visitor Services Zone is managed primarily for a high level of visitor use, access, and interpretation with a wide range of media and facilities to support diverse visitor needs.	*The Transitional/Semi-primitive Zone is managed as a transition between areas of high development and remote areas of the park. It focuses on natural and cultural resource protection with more rustic visitor facilities, experiences, and activities that encourage visitors to connect with the resource.*	*The Wild/Primitive Zone is managed primarily for natural and cultural resource protection and its wild character and wilderness values. Visitor experiences are consistent with wilderness character and provide opportunities for immersing visitors with the resource.*	*The Park Support Zone is managed primarily to support park operations and maintenance, including the operational needs of park partners. Access for visitors is primarily for limited visitor services (such as backcountry permitting), orientation, and organized meetings or events.*
NATURAL RESOURCES				
Overall Conditions	Native species, communities and ecological processes are perpetuated and restored in as natural condition as possible. Specific areas are disturbed to accommodate visitor and administrative needs, but resources are protected elsewhere. If resource modification does occur, the goal is to avoid sensitive areas to the extent practical and feasible and focus development in less sensitive areas in this zone.	Native species, communities and ecological processes are perpetuated and restored in as natural condition as possible. Resource impacts or manipulation of resources for visitor or administrative purposes is generally avoided.	Native species, communities and ecological processes are perpetuated and restored in as natural condition as possible. Resource impacts or manipulation of resources for visitor or administrative purposes is rare and generally consistent with preserving wilderness character.	Native species, communities and ecological processes are perpetuated and restored in as natural condition as possible. Specific areas are disturbed to accommodate administrative and visitor needs, but resources are protected elsewhere. If resource modification does occur, the goal is to avoid sensitive areas to the extent practical and feasible and focus development in less sensitive areas in this zone.
Wildlife and Vegetation	If development occurs, landscape and habitat areas elsewhere, preferably within the zone, are restored for a "no net green loss" policy. Habitat restoration to provide wildlife corridors could occur in this zone.	Modification or impacts to native wildlife and vegetation are avoided. Consider relocating or removing current and proposed development to restore wildlife and vegetation. Habitat restoration to provide wildlife corridors could occur in this zone.	Modification or impacts to native wildlife and vegetation are avoided. Consider relocating or removing current development to restore wildlife and vegetation. The minimum requirements analysis is required in designated and eligible wilderness.	If development occurs, landscape and habitat areas are restored elsewhere, preferably within the zone, for a "no net green loss" policy.
Geology and Soils	Geologic features and soils are protected and geologic processes continue. Consider relocating or removing development (reroute roads, trails, and parking). Facilities and infrastructure provide visitor access to geologic resources and could impact those resources that are non-sensitive. Some nonsensitive areas are disturbed to facilitate visitor access, but resources are protected elsewhere in the zone.	Geologic features and soils are protected and geologic processes continue. Consider relocating or removing development (reroute roads, trails, and parking).	Geologic features and soils are protected and geologic processes continue. Consider relocating or removing development (reroute roads, trails, and parking). The minimum requirements analysis is required in designated and eligible wilderness.	Geologic features and soils are protected and geologic processes continue. Consider relocating or removing development (reroute roads, trails, and parking). Some nonsensitive areas are disturbed to support park administration and facilitate visitor access, but resources are protected elsewhere in the zone.

TABLE 3.1. MANAGEMENT ZONES

Category	Visitor Services Zone	Transitional/ Semi-primitive Zone	Wild/Primitive Zone	Park Support Zone
Soundscapes	Natural sounds are generally audible, but sounds from park activities and visitors dominate during the day. New facilities are sited and designed to minimize impacts on the acoustical environment.	Natural sounds dominate, but sounds from visitor and park operations may be heard. New facilities are sited and designed to minimize impacts on the acoustical environment.	Natural sounds dominate, but distant artificial sounds may be heard in some areas of the zone. New installations are sited and designed to minimize impacts on the acoustical environment. The minimum requirements analysis is required in designated and eligible wilderness.	Natural sounds are generally audible, but sounds from park activities and visitors dominate during the day. New facilities are sited and designed to minimize impacts on the acoustical environment.
Natural Lightscapes	A natural lightscape can be experienced at certain locations within this zone. Permanent artificial lighting is minimized and retrofitted to be Dark Sky compliant, which would restore views of night sky and minimize impacts to nocturnal wildlife . New facilities are sited and designed, and existing facilities retrofitted, to minimize intrusions to the night sky.	Natural lightscape is largely unobscured. Lighting from developed areas may be visible from certain locations. Permanent artificial lighting is minimal and would be Dark Sky compliant. Permanent artificial lighting is retrofitted to restore views of night sky and to minimize impacts to nocturnal wildlife. New facilities are sited, designed, and existing facilities retrofitted, to minimize intrusions to night sky.	The natural lightscape is unobscured, with the exception of personal lighting. No permanent lighting is present though distant lighting may be visible from certain locations. Public enjoyment and understanding of natural lightscapes is encouraged. The minimum requirements analysis is required in designated and eligible wilderness.	A natural lightscape can be experienced at certain locations. Permanent artificial lighting is minimized and would be Dark Sky compliant. Permanent lighting is retrofitted to restore views of night sky and minimize impacts to nocturnal wildlife. New facilities are sited and designed, and existing facilities retrofitted, to minimize intrusions to the night sky.
Sensitive Species and Natural Resources	All sensitive species and resources are perpetuated and restored in as natural condition as possible. Visitor access may be limited as needed. If administrative/visitor facilities are destroyed by natural elements in sensitive areas, they may not necessarily be replaced in their existing location.	All sensitive species and resources are perpetuated and restored in as natural condition as possible. Visitor access may be limited as needed. If administrative/visitor facilities are destroyed by natural elements in sensitive areas, they may not necessarily be replaced in their existing location.	All sensitive species and resources are perpetuated and restored in as natural condition as possible. Visitor access may be limited as needed. If administrative or visitor facilities are destroyed by natural elements in sensitive areas, they may not necessarily be replaced in their existing location. The minimum requirements analysis is required in designated and eligible wilderness.	All sensitive species and resources are perpetuated and restored in as natural condition as possible. If administrative or visitor facilities are destroyed by natural elements in sensitive areas, they may not necessarily be replaced in their existing location.

Table 3.1. Management Zones

Category	Visitor Services Zone	Transitional/ Semi-primitive Zone	Wild/Primitive Zone	Park Support Zone
CULTURAL RESOURCES				
Overall Conditions	Cultural sites are protected and interpreted in a manner that reflects the high visitor use of this zone. Key cultural sites related to specific themes may be featured and actively interpreted. Traditional cultural practices are facilitated as allowed by NPS policy and regulations. Small-scale exhibits of cultural resources (temporary, low-impact facilities) are appropriate in this zone.	Cultural sites are protected and may be interpreted to facilitate public understanding and preservation. Key cultural sites related to specific themes may be featured and actively interpreted. Traditional cultural practices are facilitated as allowed by NPS policy and regulations.	Cultural sites are part of the wild character of this zone and are protected and interpreted consistent with wilderness values. Traditional cultural practices are allowed as by NPS policy and regulations.	Cultural sites are protected and interpreted in a manner that reflects the primary administrative and operational use of this zone. Traditional cultural practices are facilitated as allowed by NPS policy and regulations.
Archeological Resources	Archeological resources are inventoried and protected, which is key to informing management decisions and determining a protection strategy that is consistent with the primary visitor use of this zone. Archeological sites are interpreted on-site, where appropriate. Archeological sites in areas of high visitation may require a higher degree of protection and monitoring to minimize impacts to those resources.	Archeological resources are inventoried and protected, which is key to informing management decisions and determining a protection strategy that is consistent with the transitional/semi-primitive use of this zone. Archeological sites are interpreted on-site, where appropriate. Archeological sites in areas of high visitation may require a higher degree of protection and monitoring to minimize impacts to those resources.	Archeological resources are inventoried and protected, which is key to informing management decisions and determining a protection strategy that is consistent with wilderness character and values. Archeological sites are primarily interpreted to visitors off-site. The minimum requirements analysis is required in designated and eligible wilderness.	Archeological resources are inventoried and protected, which is key to informing management decisions and determining a protection strategy that is consistent with the primary administrative and operational use of this zone. Archeological sites are primarily interpreted to visitors off-site.
Historic Structures and Features	Historic structures and features are inventoried and monitored, and may be actively interpreted in place, compatible with the historic character of the site. Historic structures are adaptively reused for visitor and administrative use. Historic roads and trails are typically used and maintained for their historic and scenic values.	Historic structures and features are inventoried and monitored, and may be actively interpreted in place, compatible with the historic character of the site. Historic structures may be adaptively reused for visitor and administrative use. Historic roads and trails are typically used and maintained for their historic and scenic values.	Historic structures and features are inventoried and monitored, and are primarily interpreted off-site. Historic structures are maintained and may be adaptively reused, consistent with wilderness values. Historic routes may be maintained and used for their historic and scenic values, consistent with wilderness character. In designated and eligible wilderness, management actions are consistent with minimum requirements analysis.	Historic structures and features are inventoried and monitored and are primarily interpreted off-site. Historic structures are adaptively reused for visitor and administrative use. Historic roads and trails are typically used and are maintained for their historic and scenic values.

TABLE 3.1. MANAGEMENT ZONES

Category	Visitor Services Zone	Transitional/ Semi-primitive Zone	Wild/Primitive Zone	Park Support Zone
Cultural Landscapes	Cultural landscapes are inventoried, monitored, and maintained. Cultural landscapes may be actively interpreted in place, compatible with the historic character and features of the site.	Cultural landscapes are inventoried, monitored, and maintained. Cultural landscapes may be actively interpreted in place, compatible with the historic character and features of the site.	Cultural landscapes, though typically not prevalent in this zone, are inventoried and monitored. Cultural landscapes are primarily interpreted off-site. In designated and eligible wilderness, management actions are consistent with minimum requirements analysis.	Cultural landscapes are inventoried, monitored, and maintained. Cultural landscapes are primarily interpreted off-site.
Museum Collections	Museum collections are curated in this zone. They are accessible for research and exhibits and offer opportunities for research and learning.	Small-scale exhibits of museum collections provide learning opportunities in this zone.	Museum collections are not compatible with this zone.	Museum collections are curated in this zone. They are accessible for research and exhibits and offer opportunities for research and learning.
Culturally Sensitive Resources	If natural elements destroy administrative or visitor facilities in sacred areas, they may not necessarily be replaced in their existing location. Further development is limited in recognized sacred areas based on consultation. Rehabilitate landscapes and screen or buffer facilities that are in sacred areas to protect resources and blend into landscape.	If natural elements destroy facilities in sacred areas, they may not necessarily be replaced in their existing location. Further development is limited in recognized sacred areas based on consultation. Rehabilitate landscapes and screen or buffer facilities that are in sacred areas to protect resources and blend into landscape.	If natural elements destroy facilities in sacred areas, they may not necessarily be replaced in their existing location. Further development is limited in recognized sacred areas based on consultation. Rehabilitate landscapes, and screen or buffer facilities that are in sacred areas to protect resources and blend into landscape. The minimum requirements analysis is required in designated and eligible wilderness.	If natural elements destroy administrative/visitor facilities in sacred areas, they may not necessarily be replaced in their existing location. Further development is limited in recognized sacred areas based on consultation. Rehabilitate landscapes and screen or buffer facilities that are in sacred areas to protect resources and blend into landscape.
WILDERNESS				
	N/A	Wilderness character is preserved in areas that contain the qualities of wilderness character.	Wilderness character is preserved in designated and eligible wilderness and in areas that contain the qualities of wilderness character. Cultural sites are protected consistent with law and policy. The minimum requirements analysis is required for all management actions in designated and eligible wilderness.	N/A

TABLE 3.1. MANAGEMENT ZONES

Category	Visitor Services Zone	Transitional/ Semi-primitive Zone	Wild/Primitive Zone	Park Support Zone
VISITOR EXPERIENCE				
Overall Conditions	This zone is the primary visitor use zone. Visitor opportunities, experiences, and services are emphasized with high levels of access to features, resources, and personal services. This zone has capacity for a large number of park visitors and is an access point for park experiences and opportunities. There is high probability of contact with rangers, park staff, and other visitors. Commercial services and concession facilities are readily available in conjunction with the park mission. Appropriate stewardship opportunities (such as removal of kahili ginger and planting natives in and around facilities) may occur in this zone.	In this zone, visitors have more opportunities for less congested or solitary discovery, relaxation, and exploration in a relatively natural environment with limited interpretation, based on time of day. The visitor experience is primarily unstructured, including some self-guided interpretive trails and possibly some guided trails. Facilities are more dispersed. Visitors have the opportunity to be immersed in a particular natural or cultural resource setting. Appropriate commercial services and stewardship opportunities may occur in this zone.	Visitor experience in this zone affords opportunities for personal challenge, self-reliance, self-discovery, and for solitude. Visitors experience a primitive and wild environment that can be hostile and dangerous. In designated wilderness, the visitor experience is consistent with wilderness character—a natural and untrammeled landscape and primitive and unconfined recreation. Visitors have the opportunity to be immersed in a particular natural or cultural resource setting. Stewardship opportunities may occur in this zone.	This zone is managed for limited visitor access to services such as permitting, organized meetings or events, and limited orientation.
Types of Visitor Activities	This zone supports a wide range of visitor activities, opportunities, and services with easy access to recreation, education, and interpretation programming. Activities are available to visitors of all abilities and can include large groups. Typical activities include ranger-led programs, biking, hiking, picnicking, scenic driving, sightseeing, star gazing, camping and overnight stays, lava viewing, birding, educational and stewardship programs, cultural demonstrations, special events, and commercial visitor services activities.	Visitor activities in this zone are primarily self-guided activities with some ranger or commercially guided programs. A medium range of more dispersed activities is available to small and medium groups. Large group use is limited. Typical activities include biking, hiking, equestrian, picnicking, scenic driving, sightseeing, stargazing, camping and overnight stays, lava viewing, birding, educational and stewardship programs, and cultural demonstrations.	Visitor activities are unstructured, self-guided, and human-powered. This zone supports small groups; large groups are limited. Activities do not degrade the integrity of resources or compromise wilderness values. Visitor use and activities could be controlled to ensure that activities and their intensities are compatible with protecting resource integrity and wilderness values. Typical activities include hiking, camping, backpacking, equestrian, lava viewing, route finding, exploring, and cultural demonstrations, and include some stewardship programs consistent with wilderness values.	This zone supports very limited visitor activities and use.

TABLE 3.1. MANAGEMENT ZONES

Category	Visitor Services Zone	Transitional/ Semi-primitive Zone	Wild/Primitive Zone	Park Support Zone
Interpretation and Education Programming	Visitors have opportunities to connect with the meanings and themes of the park. A wide variety of interpretive methods provide connections between the meanings and values of the resource being highlighted. This zone provides orientation and intensive interpretation that is programmatically accessible with a wide range of media and facilities to support diverse visitor needs. The focus is placed on interpreting, protecting, and preserving geologic, biologic, and cultural resources and emphasizing specific stories or themes.	Interpretation and education is focused, site-specific, and place-based in this zone. A moderate range of interpretive services, methods, facilities, and programs are available, in keeping with the surrounding environment. The focus is placed on interpreting, protecting, and preserving geologic, biologic, and cultural resources and emphasizing specific stories or themes. Facilities and interpretive infrastructure may primarily be clustered at trailheads and nodes. Waysides and self-guided interpretive trails are characteristic of this zone.	Interpretation and education is minimal, focused on wilderness values and is mostly self-directed, consistent with wilderness values and minimum requirements analysis. No facility based interpretation occurs in the zone; however, interpretation and education may be provided through off-site materials, such as trail guides.	Interpretive and education programming in this zone occurs primarily in specific facilities designated for this purpose such as the Visitor Emergency Operations Center and the Education Center.
Encounters with Other Visitors	A high level of encounters with other visitors is expected, but concentrations of visitors are managed. Visitors can expect congested experiences during peak visitation hours. A wide range of group sizes, ages, and diverse populations may be accommodated.	A low to moderate level of encounters with other visitors is expected with occasionally high levels of encounters around key destinations or facilities, such as trailheads, or new volcanic activity. Visitors can easily avoid congested experiences, and opportunities for solitude are available with minimal effort in this zone. Small to moderate group sizes may be accommodated.	Encounters with other visitors are rare, occurring most likely around designated campsites, cabins, and wilderness trailheads. This zone offers for the highest level of solitude, accommodating small group sizes.	A low level of encounters with other visitors is expected. Encounters are primarily around facilities and services that do provide some visitor support (e.g., permitting offices).
Safe Visitor Access to Volcanic Events	This zone supports the highest level of visitor access that provides safe viewing. Access to volcanic events for visitors is made available as quickly as possible with an appropriate level of visitor orientation. This zone also supports the highest level of operational support as well.	This zone could support a high level of visitor access to volcanic events, depending on proximity to existing infrastructure such as roads and trails. New visitor access to volcanic events could be accommodated, though the level of access provided varies.	Visitor access to volcanic events is heavily dependent on self-reliance and not facilitated with permanent infrastructure by the park. Signs and reflectors could be used as opposed to construction of new trails, roads, and parking. This zone could support a temporary higher level of operations to support visitor access, if feasible. The minimum requirements analysis would be applied in designated and eligible wilderness.	Visitor access that provides safe viewing for visitors could be accommodated in this zone.

TABLE 3.1. MANAGEMENT ZONES

Category	Visitor Services Zone	Transitional/ Semi-primitive Zone	Wild/Primitive Zone	Park Support Zone
SCIENCE, RESEARCH, AND LEARNING				
Overall Condition	Research is encouraged and manipulative research or permanent structures may be allowed with appropriate orientation and consultation. Public safety hazard monitoring instrumentation and equipment could be in this zone. Learning occurs in indoor and outdoor classrooms, emphasizing a hands-on experience with the resource and including stewardship projects (field labs, outdoor classroom). Information sharing and collaborative efforts among disciplines and partners are focused and coordinated in this zone.	Research is encouraged and manipulative research or permanent structures may be allowed with appropriate orientation and consultation. Public safety hazard monitoring instrumentation and equipment could be in this zone. Learning occurs in outdoor classrooms away from high-density visitor use areas and emphasizes a hands-on experience with the resource, including stewardship projects (field labs, outdoor classroom). Information sharing and collaborative efforts among disciplines and partners are focused and coordinated in this zone.	Research that contributes to understanding and management of wilderness resources and public safety is permitted. Public safety hazard monitoring instrumentation and equipment could be in this zone. Learning occurs in wilderness in smaller groups and emphasizes a hands-on experience with the resource, including stewardship projects and opportunities to learn about wilderness (field labs, outdoor classroom). The minimum requirements analysis would be applied in designated and eligible wilderness.	Research is encouraged and manipulative research or permanent structures may be allowed with appropriate orientation and consultation. Public safety hazard monitoring instrumentation and equipment could be in this zone. Management of documents, research, and learning could occur in this zone. Limited learning opportunities occur in existing park offices and facilities. Information sharing and collaborative efforts among disciplines and partners are focused and coordinated in this zone.
TYPES OF FACILITIES				
Overall Conditions	Areas of high-density infrastructure occur in this zone. Facilities in this zone support concentrations of park visitors and their diverse needs, such as visitor centers, museum, interpretive waysides, picnic areas, developed campgrounds, parking lots, and staging areas, and include commercial facilities such as lodging, food services, gift shops, bookstores. Some administrative and park operational facilities may exist in this zone, such as administrative offices and curatorial storage. All facilities are mixed within open space and natural settings. Adaptive reuse of historic buildings and structures could occur. Alternative energy or water treatment facilities could also be used as interpretive elements in this zone.	Facilities in this zone support visitor interaction with resources such as trails, campgrounds with minimal services, picnic areas, wayside exhibits, water tanks, boardwalks, turnouts, storage sheds or caches, small transit shelters, overlooks, and benches. Temporary facilities needed to address changing conditions (e.g., new lava flows) and could include ranger contact stations, emergency services, and research installations. Facilities conform to the natural surroundings and do not dominate the landscape. Facilities are limited and dispersed, predominately clustered at trailheads and nodes. Temporary, small-scale commercial facilities that support operational needs may be present, compatible with the visitor experience. Adaptive reuse of historic buildings and structures could occur.	Facilities are very minimal and are consistent with wilderness character. In designated wilderness, facilities must be consistent with the minimum requirements analysis. Types of facilities could include trails, composting toilets, water catchments, and temporary structures to support research and resource management activities.	Areas of high-density infrastructure occur in this zone. Limited visitor service facilities may exist in this zone, such as backcountry permitting. Facilities in this zone primarily support park operations, such as administrative offices, monitoring and research, maintenance, energy infrastructure, utilities, park housing, storage, and parking. Partner research facilities are part of this zone, as well as administrative aviation facilities (helipads). All facilities are mixed within open space and natural settings. Adaptive reuse of historic buildings and structures could occur.

TABLE 3.1. MANAGEMENT ZONES

Category	Visitor Services Zone	Transitional/ Semi-primitive Zone	Wild/Primitive Zone	Park Support Zone
TRANSPORTATION AND ACCESS				
Overall Conditions	Access throughout this zone uses a full range of multi-modal transportation options (hiking, biking, equestrian, vehicles, and public transit (Hele-On)). Some areas in this zone may have limited or restricted access which may be temporary or permanent (i.e., for research, housing, sensitive resources, or administration). Roads are prevalent and accommodate a high density of travelers; roads are wider, typically a two-lane road, and provide a less-intimate driving experience (such as Crater Rim Drive or Highway 11). Paved and unpaved trails, including multi-use trails, allow for mechanized and non-mechanized use. This zone provides linkages to areas and transit outside the park. Aircraft use is allowed for administrative purposes for resource and visitor protection.	A range of multi-modal (foot, bicycle, motorized, transit) transportation options exist, but emphasis is on smaller vehicles and nonmotorized access (biking, hiking, pedestrian, equestrian). Roads, including administrative roads, are very limited in this zone and accommodate a lower density of travelers. The road character is narrow, sometimes one-lane, and creates an intimate driving experience (such as Hilina Pali Road, Mauna Loa Road). Emphasis is on maintaining the historic character of the roads. Primarily unpaved trails and some paved trails (including multi-use trails) allow for mechanized and non-mechanized use. This zone provides linkages to areas and transit outside the park. Aircraft use is allowed for administrative purposes for resource and visitor protection.	Access throughout this zone is primarily by foot or equestrian (trails allow for nonmechanized use). No new roads are developed. Existing unpaved roads may be maintained for occasional administrative access including research. In designated wilderness, the maintenance of trails and existing roads must be consistent with the minimum requirements analysis. Unpaved, multi-use trails (equestrian, pedestrian) occur in this zone. Bicycles will not be allowed on trails, consistent with wilderness policy. Aircraft use is allowed for administrative purposes for resource and visitor protection, following minimum requirements analysis where necessary.	Access throughout this zone uses multi-modal (foot, bicycle, motorized, transit) transportation options and focuses on park employees and partners. Visitor access may be limited or restricted. Roads are prevalent in this zone. Road character may vary from typical two-lane roads to less developed administrative roads, possibly one-lane service roads. Paved and unpaved trails, including multi-use trails, are primarily for administrative use and allow for mechanized and nonmechanized use. Aircraft use is allowed for administrative purposes for resource and visitor protection.

ACTIONS COMMON TO ALL ALTERNATIVES

The following section includes management guidance, desired conditions, and actions that would apply to all alternatives (Alternatives 1–3). This section describes guidance the park would follow under this plan, regardless of which alternative is selected.

Natural and Cultural Resource Management

- The park would continue to protect and provide access to the iconic places, volcanic processes, and experiences that the park is known for—volcanic features and active eruption sites, endemic species, evolutionary and ecological processes, traditional Hawaiian culture, and historic properties.
- Native species, communities, and ecological processes would be perpetuated and restored in as natural condition as possible.
- The National Park Service would continue to rely on the best available science to guide management actions so as to minimize impacts to park resources and visitor experience and as required by policy and law.
- Park management actions would continue to recognize the sacredness of the park to Native Hawaiians, notably Kīlauea and Mauna Loa Volcanoes, important to the Native Hawaiian sense of identity, unity, and continuance. Pelehonuamea, more widely known as Pele, is the deity of the volcano. The literal meaning of Pelehonuamea is lava earth matter; hence lava is a manifestation of the deity. She is the creative force that provides the land that we need to live.
- Restoration activities would emphasize restoring native ecosystems, and the recovery of rare species (including endangered and threatened species) and biological diversity of native species. Specific activities include fencing and nonnative ungulate removal; control of other invasive nonnative plant and animal species; reintroducing, augmenting, and otherwise bolstering native species; and monitoring to assess both short and long-term management impacts.
- Restoration activities would continue to be implemented consistent with the park's *Final Plan/EIS for Protecting and Restoring Native Ecosystems by Managing Nonnative Ungulates* (2013).
- The park would also consider additional techniques for establishing native species and plant communities, such as mechanized tools or prescribed fire to stimulate native species recovery and remove invasive species in severely degraded areas, such as those provided in the *Fire Management Plan* (2007) *and Kahuku Pasture Restoration Plan / Environmental Assessment* (currently in progress). The park would continue to provide opportunities for communities, visitors, and school groups to volunteer on restoration projects in the park, notably at Kahuku. The park would also continue to coordinate activities with members of Three Mountain Alliance and other partners on research and restoration measures, including reintroduction activities.
- The park would continue to improve interpretation and preservation of Kealakomowaena and its resources by implementing recommendations from the *Archeological Preservation Plan for Kealakomo Ahupua'a* (January 2011) in a phased approach, including primary messages and themes for interpretive trails and signage, sites to be interpreted, site preparation required to mitigate impacts to sensitive resources, and guidance for managing natural and cultural resources in the area.

- The park would continue to collaborate with and engage other partners in monitoring and protecting of terrestrial, coastal, and marine resources. The park would continue to maintain formal and informal partnerships in support of broader landscape protection, including Three Mountain Alliance, the largest land partnership in the state of Hawai‘i.
- Use of personal lighting (flashlights) would be limited when required for safe movement and work and/or modified (such as using red or blue light bulbs as opposed to white) to protect wildlife.
- Traditional cultural practices would be facilitated as allowed by NPS policy and regulations.
- Shoreline resources that the park manages above the high water mark would be perpetuated and restored in as natural condition as possible, while acknowledging that some ethnographic use of nonsensitive shoreline resources may be allowed.

Visitor Experience—Recreation, Interpretation, and Education

- The park would strive to provide high-quality visitor experiences, and visitors would continue to be offered a menu of options depending on length of stay, interests, and capabilities.
- Visitors would continue to experience the park's world treasures, iconic landscapes, and other significant highlights.
- Continue existing recreation opportunities such as camping, picnicking, hiking, biking, equestrian use, and viewing lava, scenery, and wildlife.
- Continue to provide a variety of interpretive and educational programs, events, and guest speakers to engage park visitors and diverse audiences.
- Continue to maintain the Kūlanaokuaiki Campground as a frontcountry campground with less than ten sites and a vault toilet, i.e. no water. (Kūlanaokuaiki Campground was constructed in 1999 to replace the Kipuka Nēnē Campground, which had to be closed due to conflicts with the endangered nēnē.)
- Over time and with adequate funding for staff and infrastructure, strive to expand recreation opportunities at Kahuku and provide public access seven days a week.
- Update the park's Accessibility Plan to help prioritize and locate accessibility improvements.
- Continue to make accessibility improvements to park facilities, such as campgrounds, trails, and overlooks, as feasible.
- Continue to rehabilitate and interpret the historic Civilian Conservation Corps (CCC) shelter and footprints in the Ka‘ū Desert area.
- Establishment of the Ala Kahakai National Historic Trail in November 2000 included approximately 27 miles of trail segments along the coast in Hawai‘i Volcanoes National Park. The park would continue to work with Ala Kahakai National Historic Trail staff to sign and interpret those trail segments through the park.

Facilities

- Continue to maintain trails and provide visitor facility improvements as needed.
- Continue to manage the 2.8 miles of Crater Rim Drive between the entrance station and Jaggar Museum, consistent with the *Crater Rim Drive Rehabilitation Environmental Assessment* (May 2010).
- Continue to provide vehicular access along the rest of the open section of Crater Rim Drive (from entrance station to Chain of Craters Road junction).

- Continue to provide vehicular access along Chain of Craters Road from Kīlauea summit to the ocean and maintain the character of the road to NPS standards.
- Kilauea Military Camp would continue to operate in the park under permit as a military recreation facility for the duration of the existing special use permit. The park would continue to coordinate with Kilauea Military Camp on natural and cultural resource protection, including the List of Classified Structures eligible for the national register, and to interpret the park's military and KMC history, including the World War II Japanese internment and prisoner of war (POW) history.
- When the special use permit for Kilauea Military Camp expires in 2021, the National Park Service would review existing laws, policies, authorities, and park goals to (1) assess the appropriateness and/or necessity of the commercial services provided by Kilauea Military Camp and their alignment with the goals and strategies identified by this CSS and the GMP, and (2) to determine or reaffirm the appropriate authority by which these commercial services should be authorized to operate, such as whether or not the operation could occur under a special use permit or lease or some other legal instrument.
- If the permitted military recreation operations at Kilauea Military Camp are discontinued, the land will revert to the exclusive use of the National Park Service. The National Park Service would prepare a master plan to explore options for the site such as: adaptively reusing the site for the park main visitor center, a multiagency research and education campus, converting the site to a commercial visitor services operation under a concession contract, or leasing to or otherwise authorizing the use of the facilities by a noncommercial visitor service tenant, such as a nonprofit. Nonhistoric structures could be removed and areas of native forest and habitat restored.
- When the cooperating association agreement with the Volcano Art Center expires in 2014, the National Park Service would review existing laws, policies, authorities, and park goals to:
  1. assess the appropriateness and/or necessity of the commercial service and its alignment with the goals and strategies identified by this CSS and the general management plan; and
  2. to determine or reaffirm the appropriate legislative authority by which the commercial service should operate.
- If the Volcano Art Center Gallery were to relocate, the National Park Service would consider the following options for the 1877 Volcano House, the first hotel on the rim of Kīlauea that was relocated next to the visitor center in 1921, (not in priority order): continue to maintain and adaptively reuse the building for continued visitor services, including potential commercial services, evaluate restoring the building to its original layout and developing a living history demonstration with period furnishings and interpretive programs and media, examine adaptively reusing the building for additional self-guided interpretive visitor services and as a staging area for educational groups, or lease to or otherwise authorize the use of the facility by a noncommercial visitor service tenant, such as a nonprofit.

Research

- The park would continue park research efforts and collaboration with partners and continue to support independent research under the NPS permitting system consistent with NPS *Management Policies 2006*. Particular emphasis would be placed on research related to volcanology and geologic processes, ecology and evolutionary processes, biology of rare plant and animal species, invasive species and their impacts, weather and climate change, air quality, archeology, history, and traditional cultural properties.
- Hawaiian Volcano Observatory (HVO) would continue to operate out of its present location adjacent to Jaggar Museum.

Wilderness

- Hawai‘i Volcanoes National Park would continue to manage designated and eligible wilderness consistent with NPS management policies and the Wilderness Act. The park would continue to manage proposed eligible wilderness in upper Kahuku for its wilderness qualities.
- The minimum requirements analysis would continue to be completed as required for all management actions in designated and eligible wilderness.

Park Operations

- The park would continue to maintain the existing park entrance off Highway 11 for both public and administrative use. A second entrance off Highway 11 near the intersection of Mauna Loa Road would continue to be used for administrative use and to address safety and emergency concerns.
- Aircraft use would continue to be allowed for administrative purposes throughout the park and minimum requirements analysis would be used when appropriate, as outlined in the *Draft Mission Critical Administrative Aviation Plan/Environmental Assessment* (Park 2014).
- Continue to consult with the Kalapana community about issues and projects in the Kalapana Extension.

Boundary

- The park would seek legislation to include ‘Ōla‘a within the legislated park boundary. ‘Ōla‘a is comprised of two tracts of land noncontiguous to the park boundary totaling 9,654.67 (9,684.5)[9] acres and has already been managed by the park since 1952.
- In accordance with the park’s 1975 Master Plan, the park would seek to acquire the Great Crack parcels (1,951 acres) to the south of the Kīlauea Unit. No legislation would be needed for acquisition of these parcels contiguous to the boundary; however, acquisition by the National Park Service would be restricted to a willing seller purchase only.

[9] Determining acreage at Hawai‘i Volcanoes National Park is a complex process by which varying sources provide different estimations of total acreage. Unless otherwise specified, acreage listed in this document includes two numbers: the first is the official acreage derived from deeds of conveyance to the United States and County/State tax assessor records, the sum total of which constitute the official NPS acreage for the park. (The official park acreage is maintained by the NPS Land Resource Division, WASO.) The second (listed in parentheses) is an estimation generated by GIS software that uses projections on the land to calculate acreage within geographically defined boundaries. When available and appropriate, both numbers are included in this GMP/WS/EIS because deed/tax assessor estimates, which are used in legislation and policy for the park, do not exist for some areas in the park, such as those acres analyzed for wilderness eligibility in the Kahuku Unit.

Additional Guidance for Alternatives—Need for Flexibility

Situated on two active volcanoes, the need for flexibility in managing Hawai'i Volcanoes National Park is great. Nature is dynamic and volcanic eruptions are possible at any time. Planning for a national park unit in this type of unpredictable environment presents both challenges and opportunities and requires flexibility in how the park may respond to different scenarios.

Actual management decisions will likely be guided by the magnitude of an individual event. Rather than provide specific recommendations in the GMP for how the park may respond to a given event, the planning team developed some general guidance for managers facing volcanic activity in the future. The need for this type of flexible management guidance is most notable with respect to facilities and infrastructure in the park.

Continuing to replace facilities that could be destroyed within a few years of being rebuilt is not necessarily fiscally sound or a good public investment, especially when other options for replacing structures or the functions provided by structures exists. However, the park may choose to repair or replace a high value structure that incurs light damage. A lower value facility that sustains more significant damage may not be rebuilt or replaced. Decisions about individual facilities will in large part be guided by the park's asset management plan.

In addition to buildings, other infrastructure, such as roads, are vulnerable to volcanic and seismic activity. There are very few roads in the park and visitors rely on them for experiencing the park's various environments and features. Closing a road may result in measurable impacts to communities, visitors, and park operations; therefore, replacing a road or maintaining vehicular access to certain areas may be a viable and sound management decision.

Rather than attach potential scenarios to individual alternatives about what park management might undertake if a specific building or road were impacted by volcanic or seismic activity, the planning team developed three broad strategies to consider.

1. designing new facilities that could be mobile and moved out of harm's way (similar to the movable visitor contact station proposed near the end of Chain of Craters Road);
2. adaptively reusing existing buildings in the park to replace lost functionality so new construction may not be needed; and
3. determining that some buildings would not be rebuilt within the park if they are significantly damaged or destroyed. The park and its partners would strive to replace necessary functionality provided by lost facilities in less vulnerable or culturally sensitive locations outside the park.

The following general guidance is also provided for several specific areas within the park. The guidance for these locations should also serve as examples of the types of solutions the park might consider for responding to different events in other areas of the park.

VOLCANO HOUSE℠

If the Volcano House℠ is destroyed or significantly damaged, the National Park Service would consider either rebuilding the lodging facility inside the park as close to the present location as is safe or not rebuilding Volcano House℠ on the rim of the crater but rather relying on lodging outside the park in adjacent communities. Rebuilding the facility in the park would allow the National Park Service to continue to provide an overnight volcano experience to visitors and maintain the tradition of lodging at the summit of Kīlauea which dates back to 1848. Relying on lodging outside the park would reduce the amount of infrastructure the park needs to maintain and would provide more

opportunities for the adjacent communities to benefit from the revenue generated by park visitors.

JAGGAR MUSEUM AND THE HAWAIIAN VOLCANO OBSERVATORY

If Jaggar Museum and the Hawaiian Volcano Observatory facilities are destroyed or significantly damaged, the National Park Service would consider three options:

- Repair or rebuild Jaggar and HVO in the current location to the greatest extent possible. Keeping the facilities on the edge of Kīlauea Caldera and in close proximity to Halemaʻumaʻu Crater continues the link between science and visitor interpretation which has been instrumental at Hawaiʻi Volcanoes National Park. Both buildings also have their own cultural significance with the site.
- Explore alternative locations, preferably inside the park and off the crater edge and Uwekahuna Bluff but still within Kīlauea Caldera, to maintain continuity for the historic visitor experience and scientific operations as much as possible.
- Remove all facilities from the edge of Kīlauea Caldera, and specifically Uwekahuna Bluff, restore the site as a sacred place to Native Hawaiians, and strive to rebuild the functions provided by Jaggar Museum and HVO in a less culturally sensitive location, outside the park. The park and USGS would maintain the minimum amount of instrumentation and infrastructure necessary for monitoring volcanic activity, but offices and other components of HVO would be relocated outside the park. The visitor exhibits provided by Jaggar Museum would preferably be relocated to other buildings within the park, but could be combined with a new HVO facility, depending on location and proximity to the park.

HILINA PALI AND MAUNA LOA ROADS

Should Hilina Pali Road or Mauna Loa Road be impassible due to volcanic or seismic activity, the National Park Service would consider the following three options: (1) maintaining and restoring road access to the historic features such as the Hilina Pali Overlook or Mauna Loa Observatory (2) converting the former road into a trail for pedestrians and/or bicycles, and (3) evaluating the areas for potential wilderness designation.

CHAIN OF CRATERS ROAD

A 5.5 mile segment of the Chain of Craters Road that ran through the park towards Kalapana was buried by lava flows generated by Puʻu ʻŌʻō. Due to a change in the direction of the lava flow in 2014, an unpaved emergency access route was constructed following the historic road alignment. This route is for emergency access only. When this route is no longer needed for emergency access, it would be used as an equestrian, biking, and hiking trail (similar in character and functionality to the Escape Road from the summit to Mauna Ulu) to provide a quality non-motorized visitor use opportunity and future emergency route without compromising natural values and without adding the management complexity of managing a coastal entrance for public vehicles to enter the park.

ALTERNATIVE 1: NO-ACTION ALTERNATIVE

Description of Alternative

Under Alternative 1, existing programming, facilities, staffing, and funding would generally continue at current levels to protect the values of Hawaiʻi Volcanoes National Park. There would be no major changes in current management or visitor use. Implementation of currently approved plans would continue as funding allows. This alternative provides the baseline for evaluating actions and impacts in other alternatives.

Management Zones Applied to the No-action Alternative

Alternative 1 would continue to use the three management zones developed in the 1975 master plan for the park. These zones include: (1) Primary Use Zone, (2) Wilderness Threshold Zone, and (3) Backcountry Zone. Because the Kahuku Unit was not owned or managed by the National Park Service at the time the 1975 master plan was completed, none of these management zones would be applied to this unit of the park under Alternative 1. Rather, the park would continue to manage Kahuku under the interim guidance which does not utilize zoning within its suite of management tools.

The specific configurations of the management zones for Alternative 1 are provided in *Figure 3.1. Management Zones for Alternative 1, Full Park*.

PRIMARY USE ZONE

The Primary Use Zone would serve as the center for visitor and management activities and would provide the most accessible facilities and intensive interpretive opportunities for visitors. Facilities in this zone would provide a brief glimpse of the park's attractions, make detailed information available for those who wish to spend longer periods of time in the park, and provide a variety of overnight accommodations for visitors, including facilities like Volcano House℠, the cabins at Nāmakanipaio, and frontcountry campgrounds. Areas within this zone would include Crater Rim Drive and Kīlauea Crater, Chain of Craters Road corridor, the Kalapana Coast, and the small tract of ʻŌlaʻa.

WILDERNESS THRESHOLD ZONE

The management intent of this zone would be to provide a more intimate experience for visitors to the park who would have more time and energy to enjoy the attractions than the average visitor. Interpretation would be low-key in this zone and predominantly of a self-guiding nature. Access into this zone and its development would be on gravel or more narrow roads that have been designed to retain an intimate association with the environment, rather than solely provide access. Areas within this zone would include Hilina Pali Road, backcountry trailheads along the Chain of Craters Road, and the Mauna Loa Road corridor.

BACKCOUNTRY ZONE

The management intent of this zone is to provide visitors with opportunities to connect with the unique resources at Hawaiʻi Volcanoes National Park. Visited less intensively than other zones in the park, the Backcountry Zone would provide unique opportunities to visitors who have considerably more time and energy to spend within the park than the average visitor. This management zone would be the largest in the park and would encompass the Hawaiʻi Volcanoes Wilderness (which includes the Kaʻū Desert, East Rift, Mauna Loa, and ʻŌlaʻa Forest wilderness units) as well as all coastal lands in the park beyond the Chain of Craters Road Corridor.

Site-Specific Management Guidance

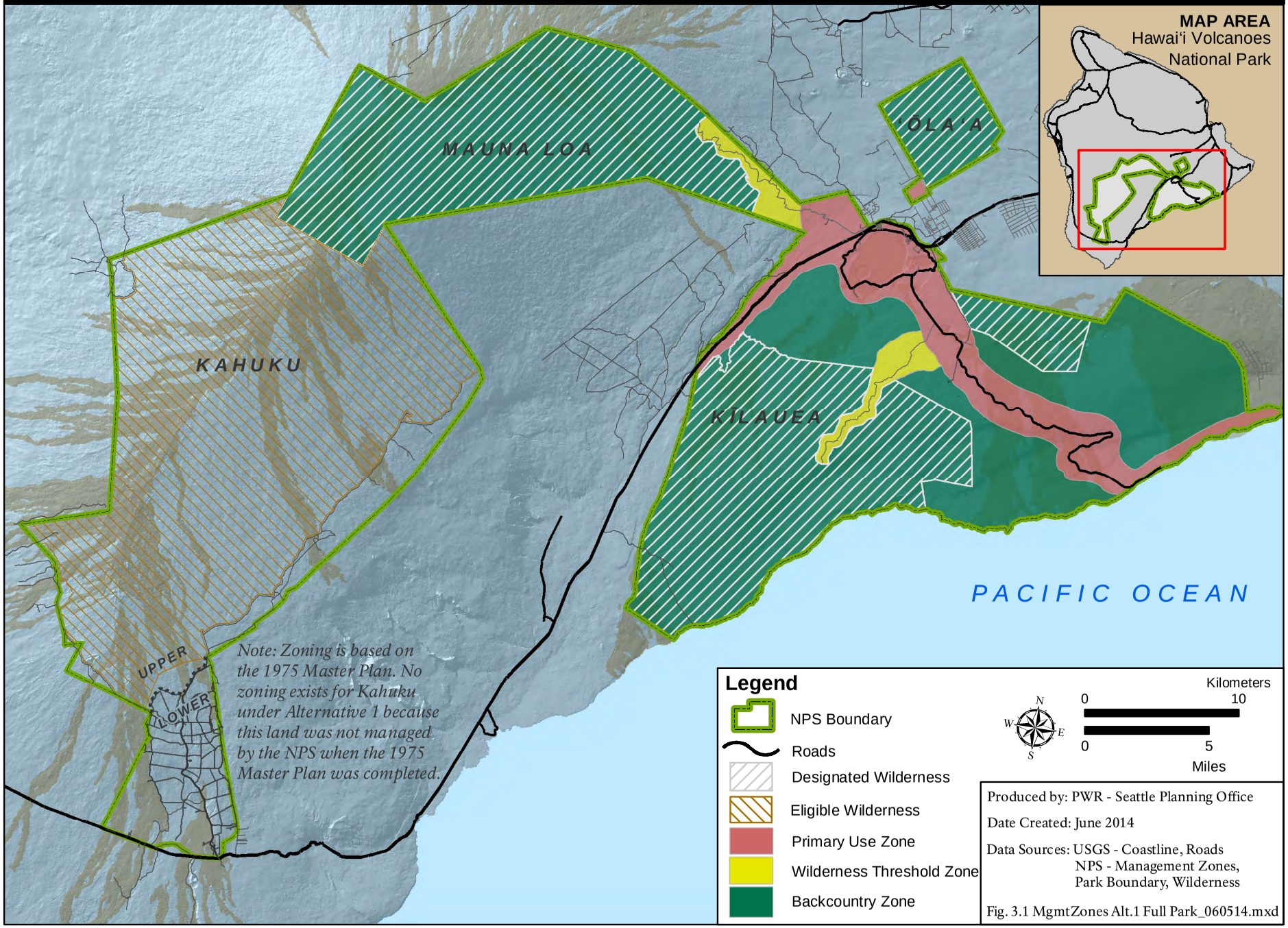
The following section presents an overview of the management strategies for the no-action alternative for specific areas of Hawaiʻi Volcanoes National Park.

KĪLAUEA VISITOR CENTER AND SURROUNDING AREA

The park would continue to maintain the current use and function of buildings with no expansion to buildings.

Figure 3.1 Management Zones for Alternative 1, Full Park

Hawai'i Volcanoes National Park GMP/WS/EIS



KĪLAUEA VISITOR CENTER— Kīlauea Visitor Center is one of two small visitor centers and one of the most visited sites in the park. In Alternative 1, the park would retain the current function of Kīlauea Visitor Center as the main park visitor contact station, as well as park headquarters and administrative offices. The park would continue to upgrade Kīlauea Visitor Center, as needed, for building maintenance and interpretive exhibits.

VOLCANO HOUSE℠— Located on the rim of Kīlauea Caldera, the historic 1941 Volcano House℠ provides overnight accommodations, food and beverage service, and retail to park visitors. Since 1969, the services provided in this location have been authorized under a concession contract with the Secretary of the Interior. Between 2010 and 2012, a number of renovations were made by the National Park Service to the Volcano House℠ concession facilities, including deferred maintenance projects, seismic and fire suppression retrofits, and other upgrades related to life, health, and safety. Due to the extensive nature of this work as well as a concession facility improvement program implemented by a new concessioner, the National Park Service closed the Volcano House℠ concession facilities to the visiting public beginning January 1, 2010, and did not re-open it until August 2012.[10] The Volcano House℠ now has 33 hotel rooms, an approximate 219-seat dining room with additional outdoor seating, an approximate 58-seat snack bar, a cocktail lounge, and a retail sales operation. In 2012, the CC-HAVO001-12 concession contract for operations at the Volcano House℠ was awarded to Hawai‘i Volcanoes Lodge Company, LLC, which will expire in 2025. Under the no-action alternative, the park would continue to operate Volcano House℠ as a concession operation for lodging, retail, and food and beverage services. The park would also continue to provide interpretive and educational programs at the Volcano House℠ as provided by park partners.

[10] Re-opening occurred in phases. The retail store reopened on August 18, 2012. The Annex reopened on March 22, 2013, and the full hotel operations, along with the restaurant, bar, and gift shops reopened on May 23, 2013.

1877 VOLCANO HOUSE— The 1877 Volcano House, relocated in 1921 to its present site adjacent to the visitor center, was the first hotel on the rim of Kīlauea. Currently, the 1877 Volcano House is occupied by the Volcano Art Center, an environmental nonprofit organization, who operates a fine art gallery under a cooperating association agreement.

In Alternative 1, the park would continue the current function of 1877 Volcano House as a nonprofit educational arts center and would continue to interpret the structure as one of the early buildings that provided lodging to visitors on the summit of Kīlauea, primarily through existing waysides. The building would be maintained in its present location.

OHIA WING (1932 ADMINISTRATION BUILDING)— Under the no-action alternative, the park would adaptively reuse the historic 1932 Ohia Wing (Administration Building) as a cultural museum. The Ohia Wing once served as the original park headquarters building, but was used for lodging from 1949-2010 and was named the Ohia Wing during this period. This action would be taken, in part, to replace the function of the Waha‘ula Visitor Center, which emphasized cultural exhibits but was destroyed by lava in 1989. Adaptively reusing the Ohia Wing as a museum complements the visitor-use functions of its neighbor, the Kīlauea Visitor Center. Due to its associated costs, rehabilitating the Ohia Wing may need to be phased over time.

CRATER RIM DRIVE

Providing vehicular access along the entire rim of Kīlauea Caldera, Crater Rim Drive is the most visited corridor in the park and provides access to a number of unique volcanic, scenic, and cultural features such as Thurston Lava Tube and the Steam Vents. Because of eruptive activity beginning in 2008 in Halema‘uma‘u Crater and the resultant hazardous volcanic plume and volcanic gases, the southern portion of this historic two-lane road from Jaggar Museum to Chain of Craters Road intersection has been closed. Most visitors

exploring Crater Rim Drive usually drive from the visitor center to Jaggar Museum but must double back again to view the remaining open portion of Crater Rim Drive.

In Alternative 1, the park would continue to maintain Crater Rim Drive as a two-way road in keeping with its historic character and, if and when possible, would reopen the closed section for both public and administrative use. The park would also continue to evaluate the pilot hydrogen shuttle technology. This includes the performance of the shuttles that will service proposed stops along Crater Rim Drive (scheduled to begin in 2015).

HALEMAʻUMAʻU PARKING AND OVERLOOK— Considered by Native Hawaiians as the home of the deity Pelehonuamea, Halemaʻumaʻu Crater is a culturally recognized sacred site in Hawaiʻi Volcanoes National Park. However, as an accessible crater of an active volcano, Halemaʻumaʻu has also historically been one of the most highly visited locations in the park and as such, houses the largest parking lot in the park, with 300 spaces. Because of eruptive activity beginning in 2008 in Halemaʻumaʻu Crater and the resultant hazardous volcanic plume, this area is currently closed.

In Alternative 1, the park would reopen Halemaʻumaʻu Overlook and parking lot when hazards associated with the volcanic plume are diminished and the park determines through active monitoring that air quality and other hazards are at a level that is consistent with general visitor use. This area would continue to be used and maintained for visitor use.

KILAUEA MILITARY CAMP

Kilauea Military Camp is a Department of Army-operated historic recreational complex that serves military branch personnel (including retired and inactive members), their dependents and guests, in addition to serving nonprofit educational organizations in Hawaiʻi Volcanoes National Park. Spanning 54 acres, this complex includes 90 rooms for overnight accommodations, a cafeteria, bar, grocery store, gas station, bowling alley, recreation room, exercise facility, conference rooms, theater, and bus and van tours for guests staying at Kilauea Military Camp, as well as other support programs and facilities.

Under the no-action alternative, Kilauea Military Camp would continue to operate under a special use permit as a military recreation facility in park-owned historic structures and land for the duration of their existing permit. The site would maintain its current function as a military morale, welfare, and recreation center—a self-supporting operation under a Non-Appropriated Funding Instrument (NAFI) for active duty military and military retirees and their guests.

As such, the park would continue to coordinate with Kilauea Military Camp on resource protection, particularly historic resources on the List of Classified Structures and resources eligible for the national register, and to interpret the park's military history and the camp's history, including the World War II Japanese internment and POW history. The park would work with Kilauea Military Camp to develop and implement interpretive waysides at Kilauea Military Camp that highlight important features and stories.

Kilauea Military Camp would continue to be used as a staging and/or parking area for special events, such as the park's Cultural Festival, and emergencies.

JAGGAR MUSEUM AND HAWAIIAN VOLCANO OBSERVATORY

Jaggar Museum was the first park museum in Hawaiʻi Volcanoes National Park and continues today as an interpretive visitor center on the rim of Kīlauea Crater, overlooking Halemaʻumaʻu. Considering its location, historic significance, and easy access for commercial buses, Jaggar is one of the most heavily visited places in the park.

Connected to the museum is the Hawaiian Volcano Observatory operated by the US Geological Survey. Hawaiian Volcano Observatory houses scientists, laboratories,

offices, and monitoring equipment. As its mission, HVO provides timely and effective disaster warnings for emergencies to land managers and the affected population using hazard assessments, research, and monitoring.

In Alternative 1, the park would continue its current interpretation at the Jaggar Museum, and the Hawaiian Volcano Observatory would continue to operate adjacent to Jaggar Museum. The park would continue to upgrade Jaggar Museum as needed for building maintenance and interpretive exhibits.

THURSTON LAVA TUBE AND SURROUNDING AREA

THURSTON LAVA TUBE (NĀHUKU)— As the only publicly accessible lava tube in the park, Thurston Lava Tube is one of the most congested areas in Hawai‘i Volcanoes National Park, and both transportation and visitor studies have been conducted recently to address this issue.

In the no-action alternative, the park would continue to implement recommendations from the Thurston Parking Area Improvement Project for specific site improvements at Thurston Lava Tube. Park staff would continue to respond to congestion at Thurston Lava Tube as issues arise and as staff is available.

The park would implement transportation congestion management strategies to improve the visitor experience and safety in this area.

Park ranger-guided tours of Pua Po‘o would also continue, as staffing and funding permits, to provide an additional lava tube experience.

KĪLAUEA IKI, PU‘U PUA‘I, AND DEVASTATION— Kīlauea Iki would continue to be maintained as a parking lot and trailhead to Thurston Lava Tube. The trail begins at Kīlauea Iki and provides a half-mile walk to Thurston.

Pu‘u Pua‘i would continue to be maintained as a parking lot, overlook, and trail connection to Devastation Trail and parking lot.

Devastation would continue to be maintained as a parking lot and serve as a trailhead for the Devastation Trail.

ESCAPE ROAD— The Escape Road offers an unimproved road between Highway 11 near the junction with Old Volcano Highway, past Thurston Lava Tube and down to Mauna Ulu on Chain of Craters Road. The Escape Road is made up of two historic routes, the upper portion of the Keauhou Trail/Road and Lee’s Short Cut, and is an escape route in the event that Chain of Craters Road is cut off.

The park would continue to maintain the Escape Road as an emergency egress route and as a trail for pedestrians, bicycles, and equestrians. Given that it is comprised of two historic routes, the park would not significantly alter the route in the course of maintenance activities.

CHAIN OF CRATERS ROAD

The park would continue to maintain the character of Chain of Craters Road to NPS standards, ensuring a park-like feel to the driving experience, while providing for visitor safety. Chain of Craters Road would continue to immerse people in the volcanic landscape and history of the area from mauka to makai.

The park would identify and clear over-vegetated turnouts to restore views and vistas and to encourage stops along the road.

CHAIN OF CRATERS ROAD TO MAUNA ULU— Mauna Ulu would continue to be maintained as a day use area with parking for viewing lava fields and associated lava features, as well as the trailhead for Pu‘u Huluhulu and Nāpau Crater and campground.

KEALAKOMO— Kealakomo would continue to be maintained as a day use area and viewing location. In addition, the park would continue to improve interpretation and preservation of Kealakomowaena, located further down Chain of Craters Road, and its resources by implementing recommendations from the *Archeological Preservation Plan for Kealakomo Ahupua‘a* (Tomonari-Tuggle 2011) (see “Common to All Alternatives”).

END OF CHAIN OF CRATERS ROAD— The end of Chain of Craters Road is defined as the place where vehicles currently turn around before parking. The actual end of the pavement is approximately 0.5 mile beyond the visitor contact station and provides pedestrian access to where the lava flows crossed the road.

The park would continue to work with partners to provide a sustainable and movable visitor contact station at the current end of Chain of Craters Road for interpretation and safety on a trial basis. If the pilot project is successful, the park would retain the structure for visitor contact at the end of Chain of Craters Road to replace some of the functions provided by the Waha'ula Visitor Center, destroyed by lava in 1989. This contact station could be relocated along Chain of Craters Road if necessary in response to volcanic activity.

A 5.5 mile segment of the Chain of Craters Road that ran through the park towards Kalapana was buried by lava flows generated by Pu'u 'Ō'ō. Due to a change in the direction of the lava flow in 2014, an unpaved emergency access route was constructed following the historic road alignment. This route is for emergency access only. When this route is no longer needed for emergency access, it would be used as an equestrian, biking, and hiking trail (similar in character and functionality to the Escape Road from the summit to Mauna Ulu) to provide a quality non-motorized visitor use opportunity and future emergency route without compromising natural values and without adding the management complexity of managing a coastal entrance for public vehicles to enter the park.

HILINA PALI ROAD

The Hilina Pali Road is a historic 8.5-mile paved one-lane narrow spur road dating from the early 1930s. It extends southwest from the Chain of Craters Road to a view of the Pacific Ocean and Ka'ū Desert wilderness unit. The Hilina Pali Road is significant for its association with NPS road design and construction principles as well as for its NPS Rustic architectural style. In the no-action alternative, the park would maintain the existing road width and historic alignment indicative of the architecture style. The park would also continue to maintain the Hilina Pali Lookout, a historic CCC shelter, and adjacent trails.

KŪLANAOKUAIKI CAMPGROUND— Kūlanaokuaiki Campground was constructed in 1999 to replace the Kipuka Nēnē Campground, which had to be closed due to conflicts with the endangered nēnē. The park would maintain Kūlanaokuaiki Campground as a frontcountry campground as it currently exists with eight sites and a vault toilet (no water).

'ĀINAHOU RANCH HOUSE AND GROUNDS

'Āinahou Ranch was purchased by National Park Service from B. P. Bishop Estate under the authority of the Endangered Species Conservation Act of 1969 (Public Law 91-135) for the purpose of protecting, restoring and propagating endangered bird species. Since then, the area has served an important role in the conservation and reestablishment of endangered nēnē on the island. In 1995 the Ranch House was listed in the National Register for Historic Places, and in 2004 the Cultural Landscape Inventory amended the NR nomination to include the gardens with concurrence from the State Historic Preservation Officer.

In the no-action alternative, 'Āinahou Ranch would continue to provide a management area for nēnē recovery. The park would also continue to administer the ranch house and grounds under the existing interim operating plan which emphasized activities necessary for maintaining the house and cultural landscape in good condition so as not to preclude future uses. The water system would be maintained for house fire suppression, and the access road to 'Āinahou would be maintained as an unpaved road.

MAUNA LOA ROAD

Mauna Loa Road extends just over 11 miles, from Highway 11 to an elevation of approximately 6,662 feet. A two-lane road constitutes the lower 1.5 miles, then the upper section of road is a narrow two lane road for 2.1 miles at which point it narrows further to one-lane (approximately 10 feet wide) for the next 7.7 miles. The road ends at the Mauna Loa Observatory, a historic CCC lookout shelter.

The road has low visitation, so the park would maintain the existing road width and historic alignment. To address safety issues along the one-lane section, the park would improve signage and employ other management actions, such as adding more turnouts to allow for easier passing.

NĀMAKANIPAIO CAMPGROUND— Nāmakanipaio Campground would continue to be maintained as one of two frontcountry campgrounds and would function as the primary campground for visitors on the summit offering both tent and cabin camping. It would be managed for fee camping as part of the concession contract with Volcano House℠ and would include retail services at the campground.

KAʻŪ FOOTPRINTS AREA AND KAʻŪ DESERT

Kaʻū Footprints area and Kaʻū Desert would continue to be maintained as a self-guided interpretive experience with limited visitation. No improvements would be made to facilitate public access.

The National Park Service would continue to ensure protection and preservation of cultural resources while addressing visitor use issues (see "Common to All Alternatives").

ʻŌLAʻA

ʻŌlaʻa is composed of two tracts of land noncontiguous to the park boundary totaling 9,654.67 (9,684.5) acres. This unit, though not officially within the boundary of Hawaiʻi Volcanoes National Park, has been managed by the park since it was donated to the National Park Service in 1952. The park would seek legislation to include ʻŌlaʻa within the legislated park boundary (see "Common to All Alternatives").

ʻŌLAʻA SMALL TRACT— The small tract of ʻŌlaʻa is 356.13 (355.9) acres in size and is not designated wilderness (as opposed to the "large tract"). Currently, visitors accessing the small tract informally park along Wright Road in Volcano Village.

ʻŌLAʻA LARGE TRACT— The large tract of ʻŌlaʻa is comprised of 9,298.54 (9,329.5) acres of designated wilderness. Under Alternative 1, the park would maintain custodial responsibility for the large tract of ʻŌlaʻa. The park would continue to manage the large tract for its wilderness values without developing trails for day use. There would be no on-site guided interpretation or overnight camping opportunities, and no improvements would be made to facilitate public access. Interpretation would occur off-site for this wilderness portion of ʻŌlaʻa.

KAHUKU UNIT

In 2003 Hawaiʻi Volcanoes National Park acquired 115,788 (150,867) acres of land that straddles the Southwest Rift Zone of Mauna Loa and extends across lava fields, pastures, forests, shrubland, mesic, subalpine, alpine, and desert environments in the Kaʻū District in Hawaiʻi County. Referred to as the Kahuku Unit, this acquisition increased the size of the park by 38% and essentially doubled the size of the park and expanded opportunities for visitor use and resource protection. Kahuku is noted for its biological diversity, ecological integrity, and wild character. Existing park management activities in the unit concentrate on protecting and recovering native species and ecosystems, controlling invasive nonnative plants and animals, developing interpretive programs, and conducting surveys and inventories of cultural and natural resources.

The Kahuku Unit is currently managed under an interim operating plan with limited day use visitation on weekends and for special events, but over time and with adequate funding for staff and infrastructure, the park would open this unit seven days a week.

KAHUKU ENTRANCE— The entrance to Kahuku is 43 miles to the southwest of the main park entrance on Highway 11. The existing entrance is a safety concern to the park due to its location on a curve with limited line-of-sight. Under the no-action alternative, the park would maintain the existing entrance at Kahuku but address safety issues by clearing vegetation, improving signage, and possibly lowering existing berms to improve the line of sight for drivers, in coordination with state highways. The park would also seek to collaborate with the state to evaluate and add a turn lane.

LOWER KAHUKU— For the purposes of this GMP/WS/EIS, lower Kahuku is defined as the acreage below a line that is 100 meters above the upper most road in the paddock system (see *Figure 1.5. Existing Conditions, Kahuku*). Lower Kahuku extends down the Southwest Rift Zone of Mauna Loa from this line to Highway 11.

DEVELOPED AREA AND USE OF EXISTING BUILDINGS

The park would continue to adaptively reuse the site for a mix of visitor services and administrative and operational use, as needed. Some limited use of existing ranch buildings would continue.

The park would develop an orientation/interpretive strategy to define and site various media to interpret Mauna Loa geologic and natural history, native species and forest conservation, history of cattle ranching, and Native Hawaiian presence in this area. The interpretive strategy should also consider the broader historical context of Kahuku that would include military history, World War II development, and other themes that could be identified through further site investigation.

The park would maintain a single visitor contact station in lower Kahuku.

RECREATION ACTIVITIES AND VISITOR OPPORTUNITIES

Recreational access at Kahuku would continue to be limited to day use only on weekends and for special events in the short-term; however, the long-term goal is to provide access seven days per week. Recreational opportunities would include sightseeing, picnicking, self-guided hiking, bird watching, wildlife viewing, and ranger-led programs on biodiversity, conservation, and history of the area, among others.

The National Park Service would continue to provide for bicycle use on designated roads and trails and prohibit or restrict equestrian use and overnight camping.

Road Access: The current main road would be maintained for vehicle access to Upper Glover. Selected unimproved pasture roads would be maintained for administrative use, and some pasture roads could continue to be converted to trails for public access. Any roads not used for visitor and/or administrative use may be restored to natural conditions and/or native communities.

Interpretation would be enhanced along the current road system and the park would restore the former paddock and pasture areas to natural conditions and/or native communities, as funding allows.

Trails and Trailheads: Trails at Kahuku would be opened primarily for weekend use during the day and for special events, with the goal of opening seven days a week in the long-term. The park would continue to convert some old road beds to trails at Kahuku, and the trail from Kahuku to ʻAinapō could be considered for future use but would not be improved.

UPPER KAHUKU— For the purposes of this GMP/WS/EIS, upper Kahuku is defined as the acreage above a line that is 100 meters above the upper most road in the paddock system.

Upper Kahuku extends up the Southwest Rift Zone of Mauna Loa (see *Figure 1.5. Existing Conditions, Kahuku*).

In Alternative 1, the park would seek to manage upper Kahuku for its wilderness characteristics based on its determination of eligibility. There would be no public vehicular access above Upper Glover, though vehicular access for administrative use and emergencies would be allowed on existing roads.

RECREATIONAL ACTIVITIES AND VISITOR OPPORTUNITIES

Under the no-action alternative, the area above Upper Glover would remain closed to public access because of safety concerns and to limit the spread of harmful invasive plants and animals, such as argentine ants which threaten the park's high-altitude ecosystems. The road above Upper Glover is rugged and lacks adequate infrastructure to support public vehicular access. There would also not be adequate staff or vehicles to adequately patrol the area which is a remote part of the park. There would be no opportunities for recreation and visitor use in upper Kahuku. Upper Kahuku would be managed for its wilderness characteristics.

Boundary Modifications

Under the no-action alternative, Hawai'i Volcanoes National Park would seek legislation to include 'Ōla'a within the official park boundary. Donated to the National Park Service in 1952 via the Hawai'i Territorial Executive Order 1540, 'Ōla'a is geographically separated from the rest of the park by Volcano Village and has therefore never been formally designated as part of Hawai'i Volcanoes National Park. Language in the 1938 legislation for the park stated that Hawai'i Volcanoes National Park could acquire lands only if "adjacent and contiguous" to park boundaries. However, the unit is managed by park administrators for its valuable forest habitat and presence of endemic and/or rare and endangered species. In addition, in accordance with the park's 1975 Master Plan, the park would continue to seek acquisition of the Great Crack parcels (1,951 acres), located to the south of the Kīlauea Unit. No legislation would be needed for acquisition of these parcels contiguous to the boundary; however, acquisition by the National Park Service would be restricted to a willing seller purchase only. This means that the seller would be willing to sell and adequate funds would be available to support the purchase.

Program Specific Management Guidance

The following section presents an overview of management strategies for program areas at Hawai'i Volcanoes National Park.

Although this plan separates resource protection into discrete categories of natural and cultural resources, park management recognizes that these resources are inextricably integrated, particularly within Native Hawaiian understanding. In Hawaiian culture, the land or 'āina is sacred. The natural and cultural worlds are intricately bound together, and the spiritual world is not separate from the secular at Hawai'i Volcanoes National Park. For example, volcanic activity is a part of geological processes and history, but Kīlauea volcano is also home to Pelehonuamea (Pele), the volcano deity, and her family. Observed in the lava flows and other natural phenomena associated with volcanic activity, Pele and her family continue to be a presence in Native Hawaiians' lives both physically and spiritually. Management of Hawai'i Volcanoes National Park will continue to recognize and embrace the interconnectedness of natural and cultural resources into the future.

NATURAL RESOURCES

Under the no-action alternative, the natural resource program would continue efforts to perpetuate and restore native ecosystems and recover populations of rare species (including threatened and endangered) and biological diversity of native species by using scientifically informed methods. Management activities include monitoring and control of invasive nonnative plants and animals, reintroduction of historical species, augmentation of locally rare, threatened

and endangered species, fire restoration, fuels reduction, and supporting research that informs natural resources management activities (e.g., climate change studies, fire ecology, vegetation mapping, wildlife monitoring, etc.). The degree to which these actions are implemented would vary year to year depending on available funding and staff.

CULTURAL RESOURCES

Under the no-action alternative, the cultural resources program would continue to provide cultural resources protection for park-related projects as required by law. Program development would continue to be dependent on available funding and staff. Documentation, research, and stewardship of cultural resources would continue with opportunities to expand program capabilities dependent on increased funding and staff made available.

Under the no-action alternative documentation of cultural landscapes, historic structures and national register eligible properties would remain dependent on available non-base funding. The park would continue to stabilize and maintain significant landscapes or national register eligible properties or contributing elements. Due to inadequate numbers of staff, a slow decline in resource condition would occur.

WILDERNESS

Hawai'i Volcanoes National Park would continue to manage designated wilderness consistent with NPS management policies and the Wilderness Act. The park would continue to manage proposed eligible wilderness in upper Kahuku for its wilderness qualities.

SOUNDSCAPES AND THE ACOUSTIC ENVIRONMENT

The National Park Service would continue to use a variety of methods to reduce human-caused noise and improve natural sounds.

The park, as a cooperator with the FAA, would also complete an air tour management plan/environmental impact statement that would develop measures to limit or prevent any significant impacts that may be caused by commercial air tour operations upon the natural and cultural resources, or visitor experiences at the park. This plan would be consistent with the guiding principle of reducing noise/human sound in sensitive areas.

VISITOR EXPERIENCE

Hawai'i Volcanoes National Park would continue to provide visitors with safe access to volcanic features, active lava, cultural resources, and ecosystems from sea to summit under the no-action alternative.

To help manage visitor congestion, the park would use a variety of methods, such as educating the public and dispersing visitor use through information.

RANGE OF RECREATIONAL ACTIVITIES— Under the no-action alternative, the park would continue to allow for a range of recreational activities such as camping, hiking, backpacking, biking, equestrian use, bird-watching and other wildlife viewing, lava viewing, picnicking, general sightseeing, and stargazing. Opportunities at Kahuku would continue to be limited.

TRAILS: HIKING, BIKING, AND EQUESTRIAN— Under the no-action alternative, the existing trail network within the main part of the park would be maintained, with an emphasis on maintaining frontcountry trails.

Park staff would continue to improve and create safe trail corridors that link key features or park sites such as Nāmakanipaio Campground, Kīlauea Visitor Center, Jaggar Museum, and Thurston Lava Tube (Nāhuku) to encourage bicycling, pedestrian, and equestrian use as recreational activities and to support alternative means of transportation and access to park sites.

In addition, the park would continue to seek solutions to provide safe pedestrian and bicycle access around Crater Rim Drive and would continue to identify key needs for trail improvement on the summit and throughout the park.

Establishment of the Ala Kahakai National Historic Trail in November 2000 included 27 miles of trail segments along the coast in Hawai'i Volcanoes National Park. In Alternative 1, Hawai'i Volcanoes National Park would work with Ala Kahakai National Historic Trail staff to sign and interpret those trail segments through the park.

CAMPING—
FRONTCOUNTRY CAMPING
Nāmakanipaio Campground and Kūlanaokuaiki Campground would continue to serve as the only formal frontcountry campgrounds that offer drive-in camping facilities in the park under Alternative 1, and Nāmakanipaio Campground would continue to be run as a concession/fee operation.

BACKCOUNTRY CAMPING
The park would maintain the existing backcountry campsites and associated facilities including water catchment systems, restrooms, shelters, etc.

INTERPRETATION AND EDUCATION—
PROGRAMS
The park would continue to offer a range of interpretive programs, media, and techniques.

In addition, the park would develop a comprehensive interpretive plan that would expand interpretive opportunities to introduce visitors to all of the park's interpretive themes through the use of interpretive standards and methods. Under the no-action alternative, Kahuku would be integrated into the park's comprehensive interpretive plan that is currently under development and would continue to develop a wayside plan for Kahuku and interpretive techniques as part of the plan. In the short-term, planning is occurring for some waysides at trailheads and current features. Interpretation at Kahuku would focus on a range of themes and media for visitor immersion.

The park would also continue to promote environmental education, ranger-led programs and tours, and a variety of curriculum-based activities.

INTERPRETATION AND
EDUCATIONAL FACILITIES
Kīlauea Visitor Center and Jaggar Museum would continue to be used as primary locations for visitor orientation and in-depth exposure to the park's interpretive themes. Kahuku would also serve as an important location for visitor orientation on days it is open for public access.

The basic infrastructure for visitors and education groups would be maintained with upgrades to these facilities as needed.

COMMERCIAL SERVICES

Under the no-action alternative, Hawai'i Volcanoes National Park would continue to authorize existing commercial services through a range of legal authorities using a variety of different permits, contracts, and other authorizations, depending on the type and location of the activity involved.

ADMINISTRATIVE FACILITIES AND INFRASTRUCTURE

The park would continue to maintain, and upgrade when necessary, administrative infrastructure in the park such as offices, storage, and utilities and improve provisions for accessibility.

Similarly, at Kahuku, the park would continue to maintain, and upgrade when necessary, existing infrastructure in lower Kahuku and continue to use existing buildings for office space and storage.

TRANSPORTATION AND ACCESS

Under Alternative 1, park roads would be maintained to provide for safety consistent with the park setting, ensuring a park-like and scenic driving experience. Historic road alignments would be maintained to the extent possible. The current range of roads and road standards would continue, and the park would continue to work cooperatively with the state and other partners, particularly on Highway 11, for visitor safety, signage, and information.

The park would also continue to maintain parking areas and turnouts with upgrades as needed. No major new parking areas are anticipated for this alternative.

PARTNERSHIPS

The park would continue to maintain existing partnerships with organizations that are key to the park's mission under Alternative 1. As examples, the park would continue to partner with Hawaiian Volcano Observatory to ensure the safety and education of park visitors and with co-members of the Three Mountain Alliance to protect regional watersheds.

CLIMATE CHANGE AND SUSTAINABILITY

As a leader in responding to the potential impacts from climate change, the park would continue to implement the climate action plan for Hawai'i Volcanoes National Park and participate in the Climate Friendly Parks program. The park would strive to reduce greenhouse gas emissions, continue monitoring and research, increase climate change education and outreach, and develop climate change adaptation strategies.

Operations

ESTIMATED COSTS

Cost estimates for Alternative 1 are identified on *Table 3.3. Alternative 1: Summary of Costs*. Costs shown are not intended for budgeting purposes; instead they are used to show a relative comparison of costs among the alternatives. Implementation of the approved plan will depend on future funding, and approval of a general management plan does not guarantee that funding and staffing needed to implement the plan would be forthcoming. Full implementation of the plan may take many years. The National Park Service will also evaluate proposed facility investments prior to project approvals using the best scientific information available related to climate change and other possible scenarios to ensure the long-term sustainability of these investments. Due to potential vulnerabilities of some of the park's facilities, it is feasible that the National Park Service may conclude that such financial investments for facilities would be unwise and that other options would be considered or potentially the project would not be pursued or implemented.

These costs are presented in 2012 dollars and are based upon general "Class C" estimates for site development and construction and are referred to as conceptual estimates by the design and construction industry. Class C costs are general in nature and representative of a broad based vision rather than focused on specific details. Prior to submitting funding requests for the design and construction phases, "Class B" estimates are required, based on detailed site and facility designs. "Class A" estimates would be prepared from completed construction documents.

ONE-TIME COSTS— The estimated costs for Alternative 1 reflect the continuation of current management, including the current level of facilities. One-time facility costs would include costs associated with projects already approved and fully funded such as the construction of a visitor contact station at lower Kahuku and rehabilitation of the shelter at Ka'ū Footprints. One-time nonfacility costs would include actions for the preservation of cultural or natural resources not related to facilities, the development of visitor use tools not related to facilities, and other park management activities that would require substantial funding above park annual operating costs. Examples would include construction and rehabilitation of fencing for animal control at Kahuku.

Projects in the one-time costs for the alternatives are identified as either Priority 1 or Priority 2. Priority 1 projects include projects that emphasize resource protection, threats, and visitor safety. Priority 2 projects which are less urgent include all other projects important to the full implementation of the alternative, including those that address visitor opportunities and experiences such as enhanced facilities (as funding allows and could be sustained). Priority 1 projects in Alternative 1 include construction and rehabilitation of fencing needed for animal control in Kahuku and renovation of the Ohia

Wing. Although the Ohia Wing is a Priority 1 project, it should be noted that this renovation effort is expected to take many years so it may be completed after implementation of other Priority 1 projects.

Deferred maintenance, also presented in *Table 3.3. Alternative 1: Summary of Costs*, is maintenance and repair activities that were not performed when they should have been or were scheduled to be and which, therefore, are put off or delayed for a future period. Maintenance and repairs are activities directed toward keeping fixed assets in an acceptable condition. Many of the proposals in Alternative 1 address deferred maintenance issues; therefore, deferred maintenance costs would "offset" the total one-time costs.

STAFFING

Alternative 1 assumes current staffing levels would be maintained at 143 classified full-time equivalent employees (FTEs). One FTE employee is one person working 40 hours per week for one year, or the equivalent. The total number of FTE employees is the number of staff required to maintain the assets of Hawai'i Volcanoes National Park at an appropriate level, provide acceptable visitor services, protect resources, and generally support park operations. In addition, 10.5 additional staff would be needed to implement Alternative 1, which is specifically for the operational requirements to open the Kahuku Unit seven days a week.

Table 3.2 does not include seasonal staffing, which would vary depending on specific project needs and funding allocations.

ANNUAL OPERATING COSTS— Annual operating costs are the total costs per year for maintenance and operations associated with Alternative 1, including utilities, supplies, staff salaries and benefits, leasing, and other materials. Costs and staffing estimates assume that the alternative is fully implemented as described in the narrative, including opening the Kahuku Unit seven days a week. The park's annual operating budget for fiscal year 2014 was $7,281,000. Full implementation of Alternative 1 would include filling vacant positions and filling an additional 10.5 FTE ($638,000). Additional operations and maintenance costs related to capital investments would be $71,000. Total operating costs for Alternative 1 would be $7,990,000.

FTE employee salaries and benefits are included in the annual operating costs.

Table 3.2. Alternative 1: Staffing

Park Management Division	FTE
Administrative and Management (includes Kahuku staff)	27 + 9 new
Natural and Cultural Resource Management	29
Interpretation and Education	12
Facilities and Maintenance	28
Visitor Protection/Fire	26 + 1.5 new
Vacant positions	21
Total New Positions	**10.5**
Total Positions	**153.5 FTE**
Total Staffing Costs	**$7,919,000**

Table 3.3. Alternative 1: Summary of Costs

Description of Cost	Estimated Summary of Costs
ANNUAL OPERATIONAL COSTS	
Existing Annual Operational Costs	$7,281,000
Additional Staffing Costs (+10.5 FTE)*	$638,000
Additional Operations & Maintenance Costs Related to Capital Investments	$71,000
Total Annual Operational Costs	**$7,990,000**
ONE-TIME CAPITAL COSTS	
Program Support	
Priority 1 Projects**	$0
Priority 2 Projects	$0
Facility Rehabilitation	
Priority 1 Projects	$0
Priority 2 Projects	$0
Natural Resource Management	
Priority 1 Projects	$1,575,000
Priority 2 Projects	$0
Cultural Resource Management	
Priority 1 Projects	$5,260,000
Priority 2 Projects	$0
New Construction	
Priority 1 Projects	$245,000
Priority 2 Projects	$0
Transportation	
Priority 1 Projects	$0
Priority 2 Projects	$0
Total Priority 1 Projects	**$7,080,000** (Kahuku costs are $1,820,000 of this total)
Total Priority 2 Projects	**$0**
Total One-time Costs	**$7,080,000** (Kahuku costs are $1,820, 000 of this total)
Deferred Maintenance Offset	**$5,275,000**

* The additional 10.5 FTE under alternative 1 are included in OFS requests. The current staffing level is below the authorized level of 143 FTE; the additional staffing level would add 10.5 FTE to the authorized level of 143. The new staffing level would be 153.5 FTE.
** Priority 1 projects include projects that emphasize resource protection, threats, and visitor safety. Priority 2 projects include all other projects important to the full implementation of the alternative, including those that address visitor opportunities and experiences such as enhanced facilities as funding allows and could be sustained. Costs are in 2012 dollars.

ALTERNATIVE 2: PREFERRED ALTERNATIVE

Description of Alternative

The NPS preferred alternative would strengthen and broaden opportunities to connect people with the volcanic world treasure, Hawai‘i Volcanoes National Park, and provide a wide range of high-quality visitor experiences based on different geographic areas. Kīlauea summit would continue to be the most actively visited area of the park with the greatest concentration of services and amenities for park visitors. Along Chain of Craters Road and Mauna Loa Road, the park would strive to provide visitors with improved opportunities to experience and connect with park resources and values, including new opportunities at places like Mauna Ulu and Kealakomowaena, while dispersing use to create a less congested and more tranquil experience. At Kahuku, although visitor access and recreation opportunities would be expanded from what is currently offered, infrastructure and development would be minimal, gradually phased in over time, and remain rustic in design to allow for a primitive visitor experience.

Natural and cultural resources would continue to be managed and protected with a high degree of integrity, consistent with direction provided by existing laws and policies. This alternative emphasizes the park's role as a refuge and haven for native biota, people, and cultures in a world constantly adapting to volcanic activity and island building processes. The preferred alternative would honor the Native Hawaiian people and culture by recognizing Native Hawaiian values such as mālama ‘āina (nourishing or taking care of the land) and kuleana (responsibility) and perspectives from Native Hawaiian land management such as ahupua‘a management (managing land from mauka (mountains) to makai (sea)) as important concepts in park stewardship of resources. Native Hawaiian traditional ecological knowledge would be used to enhance current scientific understanding to protect park resources and provide additional interpretive and educational opportunities for visitors.

Native Hawaiian Traditional Ecological Knowledge is a cumulative body of knowledge, beliefs, practices that refer to the relationships and effects between living things and their environment which passes from one generation to the next through traditional practice, stories, chants and songs. The Native Hawaiian culture was an oral culture; therefore the stories, chants, and songs documented significant events, and documented and perpetuated their scientific understanding of the environment. The traditional land management system of the ahupua‘a is an example of the application of traditional ecological knowledge, which informed individuals of the appropriate uses, harvest times, and planting sequences from the ocean to the mountain tops. This knowledge was applied across each island and managed by the people so that the resources from all environments within the ahupua‘a would be sustainable for future generations.

Management Zones Applied to Preferred Alternative

The management zones for Alternative 2 are geographically located to identify an area's predominant use and desired future conditions. The specific configurations of the management zones for Alternative 2 are provided in *Figure 3.2. Management Zones for Alternative 2, Full Park* and *Figure 3.3. Management Zones for Alternative 2, Crater Rim Drive and Kahuku*. The following description identifies the locations and details for the application of management zones in Alternative 2.

Figure 3.2 Management Zones for Alternative 2, Full Park

Hawai'i Volcanoes National Park GMP/WS/EIS

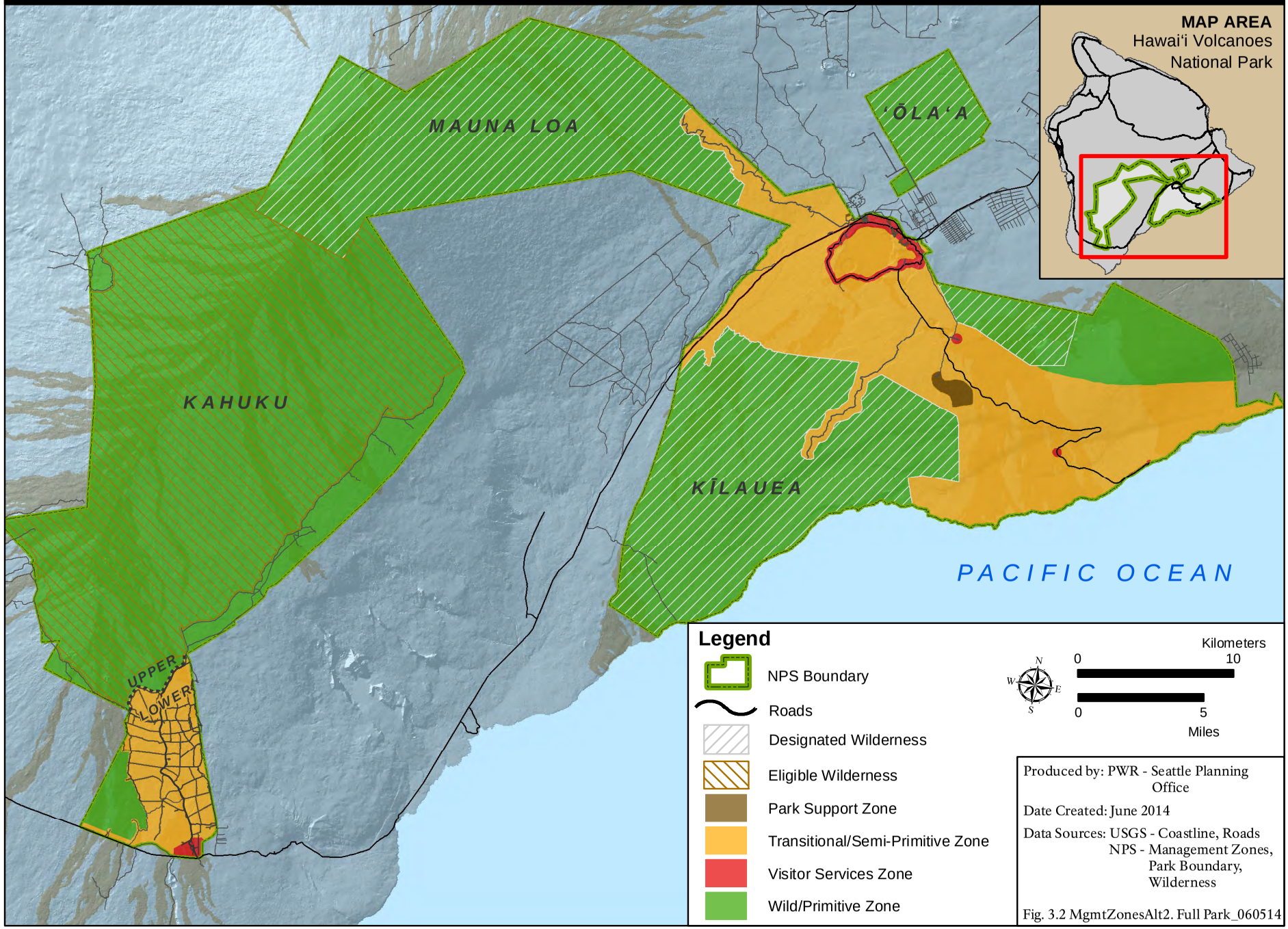
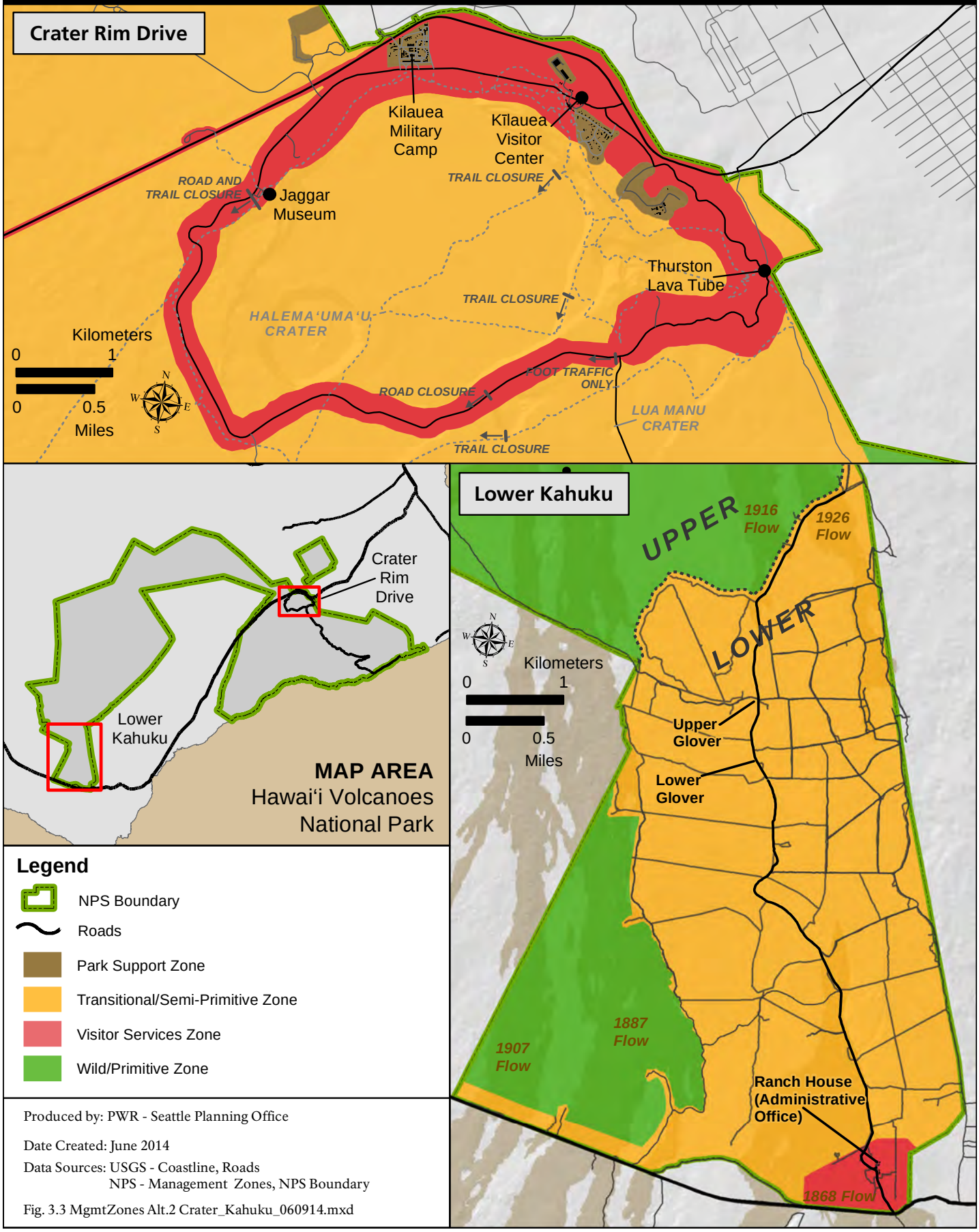


Figure 3.3 Management Zones for Alternative 2, Crater Rim Drive and Kahuku

Hawai'i Volcanoes National Park GMP/WS/EIS



Legend

- NPS Boundary
- Roads
- Park Support Zone
- Transitional/Semi-Primitive Zone
- Visitor Services Zone
- Wild/Primitive Zone

Produced by: PWR - Seattle Planning Office

Date Created: June 2014

Data Sources: USGS - Coastline, Roads
NPS - Management Zones, NPS Boundary

Fig. 3.3 MgmtZones Alt.2 Crater_Kahuku_060914.mxd

VISITOR SERVICES ZONE

In Alternative 2, the Visitor Services Zone would include the Highway 11 corridor through the park, all of Crater Rim Drive and surrounding visitor facilities, Mauna Ulu, Kealakomowaena, the end of Chain of Craters Road, and the vicinity around the existing development in lower Kahuku.

Around Crater Rim Drive, the Visitor Services Zone would include 0.1 mile on either side of the road between Jaggar Museum and the junction with Chain of Craters Road, along the southwestern section of the road, and would extend 0.25 mile on either side of the northeastern section of the road between these two locations in order to accommodate higher volumes of traffic and multiple uses along this corridor. The Visitor Services Zone would also include high visitor use facilities/locations along Crater Rim Drive including Kīlauea Visitor Center and 1877 Volcano House, the Ohia Wing and Volcano House℠, the Steam Vents, Kīlauea Overlook, Jaggar Museum, Halemaʻumaʻu Overlook, Devastation, Puʻu Puaʻi and Kīlauea Iki parking lots, and Thurston Lava Tube. Nāmakanipaio Campground, off Highway 11, would also be included in this zone.

Along Chain of Craters Road, the Visitor Services Zone would include Kealakomowaena and the area surrounding the movable visitor contact station near the end of the current road that is intended to replace the current temporary structures. However, because this visitor contact station would be movable and likely relocated in response to future eruptions and sea-level rise, the zone in this area is intended to be flexible.

In Kahuku, the Visitor Services Zone would encompass all of the existing ranch buildings in lower Kahuku and the Puʻu o Lokuana Trailhead, extending north to the far side of Puʻu o Lokuana and west to the eastern edge of the Old Mamalahoa Highway.

TRANSITIONAL/SEMI-PRIMITIVE ZONE

The Transitional/Semi-primitive Zone would include areas that are dominated by natural conditions where visitor experiences focus on providing a sense of solitude, relaxation, and exploration in a relatively natural environment with limited interpretation. In Alternative 2, this zone would include the nonwilderness area of the Mauna Loa Unit, a large portion of the Kīlauea Unit, and most of lower Kahuku.

In the Kīlauea Unit, the Transitional/Semi-primitive Zone would include all areas east of the Kaʻū Desert wilderness unit to Chain of Craters Road (except the Park Support Zone around ʻĀinahou), including Hilina Pali Road. This zone would then extend south to the coast along Chain of Craters Road and east to the East Rift wilderness unit, the vicinity of Puʻu ʻŌʻō, and to the east boundary of the park. Around Crater Rim Drive, this zone would include all areas except those included in the visitor services and park support zones along Crater Rim Drive, including Kīlauea Caldera.

In Kahuku, the Transitional/Semi-primitive Zone would include the road corridors and surrounding lands in lower Kahuku, extending from the eastern edge of the 1887 flows north to the top of lower Kahuku and east to the eastern park boundary of lower Kahuku. The quarter-mile corridor on north side of the Highway 11 along the park boundary, beginning near the eastern edge of the rare dry land forest and extending westward, would also be included in this zone.

WILD/PRIMITIVE ZONE

The Wild/Primitive Zone would include all areas designated wilderness or eligible wilderness within Hawaiʻi Volcanoes National Park, including the Hawaiʻi Volcanoes Wilderness (which includes the East Rift, Kaʻū Desert, ʻŌlaʻa, and Mauna Loa wilderness units). This zone would also include the small tract of ʻŌlaʻa and the lands extending east and south of the East Rift wilderness unit to 2.5 miles from the coast. All of upper Kahuku and the southwest corner of Lower

Kahuku (including the 1887 flows west to the western boundary of Kahuku) minus the road corridors would also be included within the Wild/Primitive Zone.

PARK SUPPORT ZONE

The Park Support Zone in Alternative 2 includes only those facilities and surrounding areas in the park used primarily for NPS administration, such as the research facilities, administration and housing area, the rainshed, the NPS horse corral, and Kilauea Military Camp. Both ʻĀinahou and Kilauea Military Camp are zoned Park Support Zone because they are not open to the general public under this alternative.

The greatest proportion of Hawai‘i Volcanoes National Park (about 76.6%) would be managed in the wild/primitive zone. The transitional/semi-primitive zone would cover about 22.6%, and the visitor services zone would cover approximately 0.7%. The park support zone would cover the smallest portion (less than 0.1%) of the park.

See *Table 3.1. Management Zones* for a comparison of the zone concept; desired natural and cultural resource conditions; shoreline and wilderness management practices; visitor opportunities; science, research, and learning opportunities; facility conditions; and access and transportation conditions of the proposed management zones.

Site-Specific Management Guidance

The following section presents an overview of the preferred strategies for managing specific areas of Hawai‘i Volcanoes National Park.

KĪLAUEA VISITOR CENTER AND SURROUNDING AREA

Under the action alternatives, including the preferred alternative, the park would produce a development concept plan (DCP) and site-specific interpretive strategy to integrate visitor experiences among the complex of buildings on the summit of Kīlauea. This integrated campus, or kauhale, would include the Kīlauea Visitor Center, Ohia Wing, Volcano Art Center, pā hula (place reserved for hula dancing), and other buildings in the vicinity. Individual building functions would be evaluated as part of a larger vision for the entire campus for improving visitor services. The priority would be to stay within the existing footprint of development; however some potentially modest expansion could be necessary to achieve the overall vision. As part of the kauhale DCP, the park would consider redesigning walkways around the buildings to improve circulation and reduce potential conflicts between vehicles and visitors.

KĪLAUEA VISITOR CENTER— Kīlauea Visitor Center (KVC) is one of two small visitor centers in Hawai‘i Volcanoes National Park, with approximately 1,700 square feet of interior space for visitors which includes exhibits, auditorium, and a book sales area, and is one of the most visited sites in the park. Under the preferred alternative, the park would continue to use Kīlauea Visitor Center as one of two primary visitor facilities as well as park headquarters and administrative offices. Additional parking would be provided to address increased visitor use to the Kīlauea campus. The park would also install an HVAC (heating, ventilation, and air conditioning) system in the building to improve efficiency.

The covered outdoor lanai at Kīlauea Visitor Center offers 24-hour trip planning and orientation. To provide more interpretive space on the often crowded lanai, the current restroom would be removed and replaced with a facility of similar capacity behind the visitor center and closer to the 1877 Volcano House, where Volcano Art Center Gallery is located. Relocating the restrooms would lessen the noise level and reduce congestion in this visitor use area, improving the experience for visitors using the displays and attending interpretive programs and information sessions on the lanai. The relocated restrooms would also replace the restrooms near the 1877 Volcano House building and may include a covered walkway to provide rain-free path to the restrooms.

In the preferred alternative, the park would also construct a 2.5-mile separate shared trail for both pedestrian and bicycle use from Kīlauea Visitor Center to Jaggar Museum. The new trail would help promote safe bicycle access between these two popular visitor destinations. The historic character of Crater Rim Drive and attributes of the existing Crater Rim Trail make it difficult to modify existing infrastructure for safe bicycling. However, if possible, the new trail alignment should use portions of the existing trail and road that are safe for shared use, without compromising natural and cultural resources.

VOLCANO HOUSE℠— Dating back to 1846, Volcano House℠ is the oldest operating hotel in Hawai‘i. In the preferred alternative, Volcano House℠ would be managed as a great historical hotel, providing high quality-service, embodying traditional elegance, and expressing a true aloha spirit to visitors from entrance to departure. As a historical hotel, the park would continue to operate Volcano House℠ as a concession operation for lodging, retail, and food and beverage services and would strive for environmentally sound and sustainable practices for the entire operation of Volcano House℠. Additional detail is provided in the Commercial Services Strategy in Appendix F.

In addition, as part of the concession contract, the concessioner would work with the park to provide interpretive services.

If in the future for any reason, the Volcano House℠ is no longer operating as a commercial lodging facility, it could be adaptively reused for other park visitation and/or administrative functions.

1877 VOLCANO HOUSE— The 1877 Volcano House was the first hotel on the rim of Kīlauea and was relocated in 1921 to its present site adjacent to the visitor center. Currently, the 1877 Volcano House is occupied by the Volcano Art Center, a nonprofit organization dedicated to arts and environmental education, who operates a fine art gallery under a cooperating association agreement with Hawai‘i Volcanoes National Park.

In the preferred alternative, the park would continue to maintain the 1877 Volcano House in its present location and would evaluate accessibility improvements for the front entrance, lanai, and parking. The park would also continue to interpret the historic structure and landscape, primarily through interpretive waysides, as one of the park’s early buildings providing lodging to visitors on the summit of Kīlauea. Inside the building, interior exhibits could include additional historic photos of the 1877 Volcano House to highlight historic uses of the building.

OHIA WING (1932 ADMINISTRATION BUILDING)— Constructed in 1932, the Ohia Wing served as the original park administration building. For many years it was used as a lodging wing of the Volcano House℠. Under the preferred alternative, the park would adaptively reuse the historic Ohia Wing as a cultural museum and administrative offices. Adaptive reuse of the Ohia Wing would in part replace the function of the Waha‘ula Visitor Center, which emphasized cultural exhibits but was destroyed by lava in 1989. This action would also complement the visitor functions of the Kīlauea Visitor Center and Jaggar Museum. Due to its associated costs, rehabilitating and adaptively reusing the Ohia Wing may need to be phased over time.

CRATER RIM DRIVE

Providing vehicular access along the entire rim of Kīlauea Caldera, Crater Rim Drive is the most visited corridor in the park and provides access to a number of unique volcanic, scenic, and cultural features such as Thurston Lava Tube and Steam Vents. Since the eruptive activity beginning in 2008 in Halema‘uma‘u Crater and the resultant hazardous volcanic plume, the southern portion of Crater Rim Drive from Jaggar Museum to Chain of Craters Road intersection has been closed. As a result of this closure, most visitors exploring Crater Rim Drive usually drive from Kīlauea Visitor Center to Jaggar Museum, which serves as the park’s other main visitor center, but must double back again to view the remaining open portion of Crater Rim Drive.

Assuming eruptive activity ceases or changes in Halemaʻumaʻu Crater and the park determines through active monitoring that air quality and other hazards are at a level that is consistent with general visitor use, the park would reopen Crater Rim Drive and keep the road open to the public for two-way traffic, allowing a mix of private vehicles and smaller shuttles (nonmandatory). Allowing two-way vehicular access around Crater Rim Drive provides a number of benefits to park visitors and management, and is consistent with the rationale for designing the original road. Loop roads are popular with visitors, allowing them to approach the crater without having to back track along the same road on which they entered. Visitors can also approach the crater from two directions, helping disperse visitation. Further, when eruptions bring increased traffic, the road could be converted to one-way access for a temporary duration, increasing safety, especially at night. Finally, a loop road can provide an escape route in an emergency should lava block a portion of the road.

The historic character and historic alignment of the road would be preserved. As part of a pilot program, large commercial buses or vehicles over 98 inches in width and/or over 38 feet in length would be limited to one-way traffic between Jaggar Museum and Chain of Craters Road junction along the southwest portion of road. Administrative use of the road for two-way vehicle traffic would continue to be allowed.

The park would also continue to evaluate the pilot hydrogen shuttle technology. This includes the performance of the shuttles that will service proposed stops along Crater Rim Drive (scheduled to begin in 2015). Current proposed stops include Kīlauea Iki, Thurston Lava Tube, Puʻu Puaʻi, and Devastation Trail. If this project proves successful, the shuttle operations could be extended under the preferred alternative to include other stops along Crater Rim Drive, such as Kīlauea Visitor Center, Steam Vents, Kilauea Military Camp, and Jaggar Museum, or other areas of the park.

Prior to the 2008 closure of part of Crater Rim Drive, a ride around Halemaʻumaʻu Crater was a popular riding loop for bicyclists. To improve safe bicycle access around Crater Rim Drive, the park would also improve signage along the road corridor, provide adjacent bicycle trails when feasible, and consider vehicular traffic closures during specific times of day or days of the week to encourage bicycle use.

HALEMAʻUMAʻU PARKING AND OVERLOOK— Considered by Native Hawaiians as the home of the deity Pelehonuamea, Halemaʻumaʻu Crater is a culturally recognized sacred site. However, as an accessible crater of an active volcano, Halemaʻumaʻu has also historically been one of the most highly visited locations in the park, with parking for 300 cars. Because of eruptive activity beginning in 2008 in Halemaʻumaʻu Crater and the resultant hazardous volcanic plume, this area is currently closed to the public. In the preferred alternative, once the overlook is reopened to visitation, the parking lot would be maintained to accommodate the existing capacity but the park could evaluate site modifications to address sensitive cultural issues and values and improve resource protection.

KILAUEA MILITARY CAMP

Kilauea Military Camp is an army-operated historic recreational complex that serves military branch personnel, including retired and inactive members, and their dependents and guests, in addition to serving nonprofit educational organizations in Hawaiʻi Volcanoes National Park. Spanning 54 acres, this complex includes 90 rooms for overnight accommodations, a cafeteria, bar, grocery store, gas station, bowling alley, recreation room, exercise facility, conference rooms, theater, and bus and van tours for guests staying at Kilauea Military Camp, as well as other support programs and facilities.

Under the preferred alternative, Kilauea Military Camp would continue to operate as a military recreation facility using park-owned historic structures and land for the duration of

its existing special use permit. The site would maintain its current function as a military morale, welfare, and recreation center—a self-supporting operation under a Non-Appropriated Funding Instrument, primarily for active duty military, military retirees, and their guests.

The park would continue to coordinate with Kilauea Military Camp on resource protection, particularly historic resources on the List of Classified Structures and those that are eligible for the National Register of Historic Places. The park would also coordinate with the camp to expand interpretation of the park's military history and the camp's history, including the World War II Japanese internment and POW history. This interpretation could include the placement of additional waysides and guided tours.

Kilauea Military Camp may continue to be used for parking during special events. When the special use permit expires, the National Park Service would review existing laws, policies, authorities, and park goals to (1) assess the appropriateness and/or necessity of the commercial services provided by Kilauea Military Camp and their alignment with the goals and strategies identified by the CSS and the general management plan, and (2) to determine or reaffirm the appropriate authority by which these commercial services should be authorized to operate, such as whether or not the operation could occur under a special use permit or lease or some other legal instrument. If the permitted military recreation operations at Kilauea Military Camp are discontinued, the National Park Service would prepare a plan and explore future options for the site (see "Common to All Alternatives").

JAGGAR MUSEUM AND HAWAIIAN VOLCANO OBSERVATORY

Jaggar Museum was the first park museum in Hawai'i Volcanoes National Park and continues today as a interpretative visitor center located on the rim of Kīlauea Crater, overlooking Halema'uma'u. Considering its location, historic significance, and easy access for commercial buses, Jaggar Museum, like the Kīlauea Visitor Center, is another one of the most heavily visited locations in the park, especially when Kīlauea is active. However, its current exhibits, installed in the 1980s, are dated and worn and do not reflect the park's interpretive themes. Under the preferred alternative, the park would rehabilitate and upgrade the interpretive exhibits at Jaggar Museum. Improved exhibits would enable Jaggar Museum to continue to serve as the premier location for visitors to learn about past and current volcanic eruptions and to view Halema'uma'u Crater. Connected to the museum is the Hawaiian Volcano Observatory operated by the US Geological Survey. Hawaiian Volcano Observatory houses scientists, laboratories, offices, and monitoring equipment. As its mission, HVO provides timely and effective disaster warnings for emergencies to land managers and the affected population using hazard assessments, research, and monitoring. Under the preferred alternative, Hawaiian Volcano Observatory would continue to operate adjacent to Jaggar Museum.

Staying within the existing developed footprint around Jaggar Museum and HVO, the park would consider adding an outdoor seating area for about 30 people to allow for ranger demonstrations and programs, such as night programs for visitors viewing the current lava glow from Halema'uma'u Crater. The outdoor seating area would improve overall visitor experience and provide a venue for park programs to inform visitors about the cultural significance of the site. This addition would also make better use of the limited space on the rim with its views of the caldera. If an outdoor seating area is not feasible around Jaggar Museum, other locations that could be considered would be in the vicinity of the pā hula.

THURSTON LAVA TUBE AND SURROUNDING AREA

THURSTON LAVA TUBE (NĀHUKU)— As the only lava tube in the park that is open to visitation, Thurston Lava Tube is one of the most congested areas in the park.

Transportation studies have been conducted recently to better understand and develop solutions to address this issue.

In the preferred alternative, the park would maintain the current mix of parking for private and commercial vehicles at Thurston and use a suite of tools to address congestion and improve the visitor experience. These tools could include improved visitor information and outreach for trip planning (emphasizing less busy times of day to visit), increased ranger presence to direct traffic, the use of intelligent transportation systems (such as electronic message boards giving real-time information), vehicle size limitations for parking, time-of-day restrictions on certain vehicles, and/or reservations for commercial vehicles only. Additional restriping and reconfiguration of parking at Thurston Lava Tube along the road may also be required. In addition, the park would consider developing a more specific site plan or DCP to integrate trails and parking areas from Kīlauea Iki to Devastation.

Large commercial buses would be able to load and unload at Thurston but these buses may be required to park at nearby underutilized lots such as Devastation Trail and Puʻu Puaʻi. Some reconfiguration within the existing developed footprint of these parking lots may be needed to accommodate large buses, and improved signing and accessibility ramping would be needed. The park would continue to evaluate implications of implementing one-way traffic on Crater Rim Drive between Jaggar Museum and Chain of Craters Road junction for large commercial buses and requiring buses to only load and unload at Thurston as conditions change.

The park would also improve and increase interpretive opportunities and themes at Thurston while still protecting rainforest resources. Improvements could include a focused rain forest experience and interpretive rainforest trail and interpretation of Hawaiian caves. Improved visitor information about the site's unique geological and biological resources and the site's significance to Native Hawaiian cultural would be disseminated at Thurston to expand visitor appreciation. To improve the overall visitor experience as well as respect traditional Hawaiian regard for the area, signage could emphasize and encourage appropriate visitor behavior, such as use of soft voices and turning off cell phones, among others, so that bird sounds and other natural sounds could be heard.

The park would also continue ranger-guided tours of Pua Poʻo, as staffing and funding permits, similar to Alternative 1.

KĪLAUEA IKI, PUʻU PUAʻI, AND DEVASTATION— New or improved trail connections would be explored for pedestrians and bicycles from these parking areas and other locations in the park, such as trails linking Thurston to Puʻu Puaʻi and Devastation Trail parking lots in order to create more pedestrian access to Thurston.

At Kīlauea Iki parking lot, there is an existing half-mile rainforest trail linking Kīlauea Iki to Thurston. In the preferred alternative, the park would consider creating a return trail from Thurston to Kīlauea Iki on the other side of the road using part of the Escape Road to create a loop trail experience. Any new or renovated trail would incorporate trail design features that protect rainforest resources and meet visitor capacity, such as adequate trail width and surface, improved signage, and better definition of the trail edge.

The park would explore the feasibility of establishing an educational covered pavilion in the vicinity of Devastation Trail or the 1974 lava flow for outdoor educational use. Ideally, this pavilion would be situated near the trail and users would park at the Devastation Trail parking lot located at the intersection of the park's two main roadways, however a final location would also be dependent on a site that would avoid disturbing nēnē in the area. The pavilion would provide an opportunity for student groups to observe and learn about the cinder outfall of the 1959 eruption of Kīlauea Iki. In addition, the park would update the environmental education curriculum and waysides in the Devastation Trail area.

ESCAPE ROAD— The Escape Road is an unpaved road off of Highway 11, near the junction with Old Volcano Highway that continues through the park past Thurston Lava Tube and down to Mauna Ulu on Chain of Craters Road. The Escape Road is made up of two historic routes, the upper portion of the Keauhou Trail/Road and Lee's Short Cut, and is primarily used as a multipurpose trail for nonmotorized use. It is also maintained as an escape route in the event that Chain of Craters Road is cut off.

Under the preferred alternative, the park would continue to maintain the historic road as an emergency egress route, but also improve the trail surface on the Escape Road to accommodate increased bicycle, equestrian, and pedestrian use and improve connections from the park to the Volcano community. The park would also consider linking the Escape Road with possible loop trail connections outside of wilderness and sensitive wildlife habitat.

CHAIN OF CRATERS ROAD

The park would continue to maintain the character of Chain of Craters Road to NPS standards, ensuring a park-like feel for the driving experience, while providing for visitor safety. Chain of Craters Road would continue to immerse people in the volcanic landscape and history of the area from mauka to makai.

The park would limit new development along Chain of Craters Road and would prioritize use and maintenance of existing trails, historic trails, turnouts, and waysides to improve the visitor experience, dispersing use and providing a more tranquil experience than in other areas of the park. The park would identify and clear over-vegetated turnouts to restore views/vistas and to encourage stops along the road. In order to limit informal turnouts and social trails, the park would improve signage of features and viewpoints at road turnouts. The park would also explore the option of locating an educational pavilion, in addition to a mobile visitor contact station, along Chain of Craters Road to orient visitors, communicate visitor safety information, and provide an alternative visitor experience when the summit is closed to disperse visitation. The mobile contact station could be located at Mauna Ulu (around the developed area or the 1969 flows) or where the 1974 flows first cross Chain of Craters Road.

CHAIN OF CRATERS ROAD TO MAUNA ULU— Mauna Ulu would continue to be used as a day use area similar to Alternative 1. In addition, around the 1974 lava flows near the Lua Manu Crater, the park would develop a site plan to create a more comprehensive and organized interpretive experience to improve visitor opportunities and connect visitors to the entire eruption story that stretches from the crater to the sea. The park would strive to work with existing trails and historic alignments and prioritize using those alignments first, before any new trail construction; however trail development would be needed at the 1974 flows to prevent trampling and protect geologic resources. The park would also explore options to locate an educational pavilion in the vicinity of Mauna Ulu or elsewhere along the 1974 flows as part of this new interpretive experience. The pavilion could be tied to the staging area for the mobile contact station, or could stand alone.

Mauna Ulu would continue to be maintained as a day use area for viewing lava fields and associated lava features and would continue to provide trailhead parking for Puʻu Huluhulu and Nāpau Crater and campground. Mauna Ulu also provides the best views of Puʻu ʻŌʻō, which is part of the current eruption.

KEALAKOMO— Kealakomo would continue to be maintained as a day use picnic area and viewing platform.

Further makai in the Kealakomo ahupuaʻa, or closer to the ocean along Chain of Craters Road, the park would continue to improve interpretation and preservation of Kealakomowaena and its resources by implementing recommendations from the *Archeological Preservation Plan for Kealakomo Ahupuaʻa* (Tomonari-Tuggle 2011) (see "Common to All Alternatives").

In the preferred alternative, the park would also explore the establishment of an educational pavilion at Kealakomowaena. Other site improvements needed would include expanding parking at the turnout along Chain of Craters Road, creating an area for school bus parking, and installing vault toilets near the pavilion. The park would interpret and protect archeological sites along the loop trail at Kealakomowaena.

END OF CHAIN OF CRATERS ROAD— The end of Chain of Craters Road is defined as the place where vehicles currently turn around before parking. The actual end of the pavement is approximately 0.5 mile past the visitor contact station and provides pedestrian access to where the lava flows crossed the road.

In the preferred alternative, the park would strive to replace some of the functions provided by the Waha‘ula Visitor Center and administration area that was destroyed by lava in 1989. These functions being replaced include visitor contact information, exhibit space, interpretation and outdoor education, emergency operations, restrooms, and an alternative visitor center when the summit is closed. To achieve this goal, the park would continue to work with partners to provide a sustainable and movable visitor contact station at the current end of Chain of Craters Road for interpretation and safety on a trial basis. If the pilot project is successful, the park would retain the structure as a contact station to provide visitor services and emergency operations over the long-term.

If the pilot project is unsuccessful, the park would develop a long-term replacement visitor contact station in the form of an open air pavilion or similar structure at the end of Chain of Craters Road.

Under either scenario, the existing temporary mobile infrastructure would be removed once a long-term contact station was finalized and any additional site requirements such as improved vehicle turnaround and parking facilities would be evaluated.

As in all alternatives, the park would continue to consult with the Kalapana community about issues in the Kalapana Extension related to the community.

A 5.5 mile segment of the Chain of Craters Road that ran through the park towards Kalapana was buried by lava flows generated by Pu‘u ‘Ō‘ō. Due to a change in the direction of the lava flow in 2014, an unpaved emergency access route was constructed following the historic road alignment. This route is for emergency access only. When this route is no longer needed for emergency access, it would be used as an equestrian, biking, and hiking trail (similar in character and functionality to the Escape Road from the summit to Mauna Ulu) to provide a quality non-motorized visitor use opportunity and future emergency route without compromising natural values and without adding the management complexity of managing a coastal entrance for public vehicles to enter the park.

HILINA PALI ROAD

The Hilina Pali Road is a historic 8.5-mile paved, one-lane narrow spur road dating from the early 1930s. It extends southwest from the Chain of Craters Road to a view of the Pacific Ocean and Ka’ū Desert wilderness unit. The Hilina Pali Road is significant for its association with NPS road design and construction principles as well as for its NPS Rustic architectural style. The park would maintain the existing road width and historic alignment indicative of the architecture style. The park would also continue to maintain the Hilina Pali Overlook, a historic CCC shelter, and adjacent trails.

Under the preferred alternative, the park would consider expanding interpretive opportunities, such as waysides and turnouts for interpreting wilderness values. Interpretive signs could be placed at trailheads leading into wilderness, at short trails along the road corridor, and at the end of Hilina Pali Road near the CCC shelter and outside of wilderness boundaries. An outdoor covered education pavilion could also be developed

in the vicinity of Kūlanaokuaiki Campground in an area that avoids sensitive wildlife, and the park could expand on the interpretive themes in this area.

The park would improve trailhead management at the end of the road by removing nonnative plants and restoring native species.

As a way to encourage hiking and biking, the park would consider management strategies to provide safer access. The park would consider identifying days or parts of days when Hilina Pali Road could be closed to day use vehicles and would become hike/bike only. Overnight campers staying at Kūlanaokuaiki and backpackers with permits would still have vehicular access on the road during these times. The park would also consider developing a bicycle loop access to connect Escape Road with Hilina Pali Road outside designated wilderness and sensitive wildlife habitat.

ʻĀINAHOU RANCH HOUSE AND GARDENS

The 6,324 acre ʻĀinahou Ranch was acquired under the authority of the Endangered Species Conservation Act of 1969 (Public Law 91-135) for the purpose of protecting, restoring and propagating endangered bird species. Since then, the general area has served an important role in the conservation and reestablishment of endangered nēnē on the island. In 1995, the Ranch House was listed in the national register for Historic Places, and in 2004, the Cultural Landscape Inventory amended the national register nomination to include the 13-acre garden with concurrence from the State Historic Preservation Officer.

As in all alternatives, ʻĀinahou Ranch would continue to provide a core management area for nēnē recovery. Park staff would continue to maintain the house and cultural landscape in good condition. The water system would be maintained for fire protection, and the access road to ʻĀinahou would be maintained as an unpaved road.

Under the preferred alternative, the National Park Service would focus on restoration for nēnē. Additional measures to provide opportunities for public stewardship of the ranch house and gardens and habitat restoration may be allowed through the use of trained volunteers and small service groups under the direction of NPS staff in the field. Such opportunities would be consistent with NPS management policies and with appropriate consultation with USFWS so as to avoid impacts to nēnē and other endangered species in the area.

Within the formal gardens, the park would work with cultural resource staff to replace invasive nonnatives with native species, minimize any new plantings or cultivation, and prevent any inadvertent introduction of nonnatives. In the areas surrounding the formal gardens and where invasive faya tree (*Morella faya*) and European olive (*Olea europaea*) have taken over, habitat restoration to remove these invasives and re-establish native plant communities would occur, improving forage for native forest birds (e.g., amakihi, apapane, ʻiʻiwi).

Interpretation of ʻĀinahou Ranch and its significance as a cultural resource and important site for nēnē would occur off-site for the general public.

MAUNA LOA ROAD

Mauna Loa Road extends just over 11 miles, from Highway 11 to an elevation of 6,662 feet. A two-lane road constitutes the lower 1.5 miles, then the upper section of road is a narrow two lane road for 2.1 miles at which point it narrows further to one-lane (approximately ten feet wide) for the next 7.7 miles. The road ends at the Mauna Loa Observatory, a historic CCC lookout shelter.

Under the preferred alternative, the park would maintain the existing road width and historic alignment. To address safety issues along the one-lane section, the park would improve signage and employ other techniques, such as adding more turnouts to allow for safer passing.

Because of the current low visitation levels along the Mauna Loa Road and the unique resources in this area of the park, the focus at Mauna Loa would be on increasing the unique interpretive and bird-watching opportunities with minimal additional infrastructure or impacts. The park would consider a turnout at a designated area for bird-watching at about the 6,000 feet elevation. Forest restoration could also be an important interpretive theme for this location with parallels between Mauna Loa and Kahuku.

The park would also consider adding interpretive waysides and one or two loop trails along the road for hiking and watching native birds (such as elepaio and i'iwi), which would also provide opportunities for visitors to experience a wide range of mesic and dry montane habitats not found in the rest of the park. Possible trail linkages could include trails to Kīpuka Kī and the mosaic of native koa forest, shrublands, and grasslands above the Powerline Road; a trail linking the lookout to Kīpukapuaulu; and trails linking Ka'ū Desert and Mauna Loa wilderness units.

For outdoor education use, the park would provide two covered educational pavilions along Mauna Loa Road at different elevations to represent different types of habitat.

Similar to Hilina Pali Road, the park could consider identifying days or parts of days when Mauna Loa Road is closed to private day use vehicles and would become hike/bike only. Backpackers would not be restricted from using the road for trailhead access during these times.

NĀMAKANIPAIO CAMPGROUND—Nāmakanipaio Campground, a property eligible for inclusion in the national register, would continue to function as the primary campground for visitors on the summit and be managed as part of the park's concession contract for commercial services. In order to expand capacity and address demand for amenities, concession operations could expand at Nāmakanipaio under the preferred alternative to include the construction and operation of an indoor lodging opportunity such as a dormitory style or hostel-like facility, cabins, or similar. The construction and operation of such facility could be included in the park's concession contract covering operations at Nāmakanipaio. The concession operation would incur the construction costs for such a facility.

Under the preferred alternative, a pedestrian and possibly a bicycle trail could be created to link the Nāmakanipaio Campground with Kīpukapuaulu on Mauna Loa Road and key sites on Crater Rim Drive. The park would take particular caution in siting the trail due to the high concentration of sensitive resources in the area.

KA'Ū FOOTPRINTS AREA AND KA'Ū DESERT

A DCP would be developed to address issues and needs for interpretation of the Ka'ū Footprints and the Ka'ū Desert area. Planning for the Ka'ū area would focus on concentrating use in existing development areas and improving amenities for visitor use while ensuring the protection and preservation of cultural and natural resources. Planning should also address: (1) expanding and promoting access, including accessible access, to the area, (2) providing trail connections and interpretive opportunities, and (3) determining other visitor support facilities needed such as signs, toilets, and parking. Within the existing development areas, the park could consider slightly expanding the development footprint to accommodate the goals of the DCP.

'ŌLA'A

'Ōla'a is comprised of two tracts of land totaling 9,679 (9,684.5) acres that are noncontiguous to the park boundary. Donated to the National Park Service in 1952 via Hawai'i Territorial Executive Order 1540, this area, though not officially within the boundary of Hawai'i Volcanoes National Park, is managed by the park. Under the preferred alternative, the park would seek legislation to include 'Ōla'a within the legislated park boundary.

The park would construct a boundary fence for unfenced portions of the ʻŌlaʻa rainforest, consistent with the park's plan for protecting and restoring native ecosystems by managing nonnative ungulates.

ʻŌLAʻA SMALL TRACT— The small tract of ʻŌlaʻa is 356.13 (355.9) acres in size and is not designated wilderness (as opposed to the "large tract"). Currently, visitors accessing the small tract informally park along Wright Road in Volcano Village. Under the preferred alternative, the park would collaborate with the county to formalize a turnout for parking on Wright Road for two to three vehicles (current capacity).

In addition, to ensure resource protection and minimize impacts, the park would develop a boardwalk-style or weed-mat trail to provide visitors with on-site interpretation of the rainforest. Before implementation, the park would determine a route to avoid sensitive resources, develop and implement a monitoring and treatment plan to address the spread of nonnative plants and determine a group size limit for the trail. Once completed, the trail would be available for general self-guided public access.

To increase off-site interpretation opportunities and educational group use of the ʻŌlaʻa rainforest, the park would explore partnership opportunities to create joint interpretive media with adjacent land managers such as the Puʻu Makaʻala Natural Area Reserve managed by the Department of Lands and Natural Resources (DLNR) and a co-member with the park in the Three Mountain Alliance Watershed Partnership.

ʻŌLAʻA LARGE TRACT— The large tract of ʻŌlaʻa is 9,298.54 (9,329.5) acres of designated wilderness. Under the preferred alternative, the park would maintain custodial responsibility for the large tract of ʻŌlaʻa and would continue to manage it for its wilderness values without developing trails for day use. No improvements would be made to facilitate public access and no overnight camping would be allowed. Interpretation would occur off-site only for the wilderness portion of ʻŌlaʻa.

In the long-term, if trails and access provided in the small tract are successful in terms of providing visitor access with minimal resource damage, the park would consider additional public access in the large tract consistent with wilderness values and character. Any additional public access would be determined through minimum requirements analysis as directed by the Wilderness Act (1964).

KAHUKU UNIT

In 2003, Hawaiʻi Volcanoes National Park acquired 115,788 (150,867) acres of land that straddles the Southwest Rift Zone of Mauna Loa and extends across lava fields, pastures, forests, shrubland and mesic, subalpine, alpine, and desert environments towards the Kaʻū District in Hawaiʻi County. Referred to as the Kahuku Unit, this acquisition increased the size of the park by 38% and expanded opportunities for visitor use and resource protection. While the lower portion of Kahuku is a pastoral landscape resulting from years of cattle ranching, much of Kahuku is noted for its biological diversity, ecological integrity, and wild character. Existing park management activities in Kahuku concentrate on protecting and recovering native species, including special status species, and ecosystems, controlling invasive nonnative plants and animals, developing interpretive programs, and conducting surveys and inventories of cultural and natural resources. Restoration activities would continue to include installing construction of boundary and internal fences to exclude nonnative ungulates, consistent with the park's *Final Plan/EIS for Protecting and Restoring Native Ecosystems by Managing Nonnative Ungulates* (2013).

The Kahuku Unit is currently managed under an interim operating plan with limited day use visitation on weekends and for special events. Under the preferred alternative, over time and with adequate funding for staff and

infrastructure, the park would strive to open Kahuku for visitors beyond the weekends, and ultimately have operational capacity seven days a week. Recreational infrastructure, such as trails, small-scale campgrounds, and interpretive and educational programs and activities would be developed to optimize visitor access and provide a range of opportunities to experience Kahuku's unique natural and cultural resources and participate in the recovery of species and sites. The experience would be designed to fully immerse visitors and engage local communities in the restoration process and story throughout Kahuku. The park would offer opportunities for the community, visitors, and school groups to volunteer on restoration projects in Kahuku and participate in hands-on resources management activities.

KAHUKU ENTRANCE— The existing entrance to Kahuku is 43 miles to the southwest of the main park entrance on Highway 11 and poses safety concerns due to its location on a curve with limited line-of-sight. Under the preferred alternative, the park would maintain the existing entrance at Kahuku but address safety issues by clearing vegetation, improving signage, and possibly lowering existing berms to improve the line of sight for drivers. The park would also seek to collaborate with the state to evaluate and add turn lanes on Highway 11 and would work with the state and other partners to expand interpretive and scenic opportunities along Highway 11.

The park would also explore working with the state to develop a parking area for a few cars off the Old Mamalahoa Highway as a trailhead to the 1868 lava flow and rare native dryland forest, as well as a potential trail following the historic Kahuku-ʻAinapō Trail alignment to connect other trails in lower Kahuku.

LOWER KAHUKU— For the purposes of this GMP/WS/EIS, lower Kahuku is defined as the acreage below a line that is 100 meters above the upper-most road in the paddock system (see *Figure 1.5. Existing Conditions, Kahuku*). Lower Kahuku extends down the Southwest Rift Zone of Mauna Loa from this line to Highway 11.

The park would develop a DCP for the lower Kahuku area to create a design that provides visitors with a sense of arrival in Kahuku as well as general orientation and information. The DCP would provide detailed guidance on how best to implement the recommendations of the general management plan, including adaptively reusing existing buildings for specific uses, and would determine the numbers and locations of campgrounds, picnic areas, and trails consistent with the overall vision for this alternative.

DEVELOPED AREA AND USE OF EXISTING BUILDINGS

In lower Kahuku, some limited use of existing ranch buildings would continue. In addition, the park would adaptively reuse the existing ranch buildings and surrounding site for a mixture of visitor services and park operations, including administrative offices and maintenance space.

Under the preferred alternative, the park would rely primarily on self-guided infrastructure to convey a sense of arrival and tell interpretive stories of Kahuku. In order to welcome visitors to Kahuku, the park would maintain a visitor contact station past the current entrance gate and closer to the existing visitor contact area. This visitor contact station could be self-guided or staffed. The park would also maintain a small amphitheater in proximity to the visitor contact station that could be used for outdoor programs and organized activities.

In an effort to improve visitor circulation near the entrance, the park would explore opportunities to use existing interior roads in the developed area.

In addition, the park would provide a location in lower Kahuku to accommodate camping and staging for groups such as volunteers, researchers, students, and educational and service groups.

RECREATION ACTIVITIES AND VISITOR OPPORTUNITIES

In the preferred alternative, the park would encourage a rustic visitor experience in Kahuku. The focus would be on recreational activities such as hiking, camping, and nature-viewing, with some biking and scenic driving opportunities. A minimum amount of pavement and road infrastructure would be reconstructed and/or maintained to accommodate recreation and visitor circulation while preserving the natural surroundings.

An educational covered pavilion would be provided near the 1916 flows to support a range of visitor programs and volunteer groups.

The park would manage the amount of commercially guided recreation in lower Kahuku primarily through vehicle size limits and commercial use authorizations (CUAs). The road would be evaluated to determine final vehicle size limits; however, based on current knowledge it is likely that commercial services would be limited to vehicles no greater than 22 feet in length or 15,000 pounds maximum GVWR in lower Kahuku. The park would encourage commercial service groups to provide environmental or conservation-focused messages while sightseeing and/or recreating in lower Kahuku.

Road Access: No new roads would be developed in lower Kahuku, and access and circulation would focus on use of the existing road network. Large commercial vehicles would be restricted to the developed area around the existing visitor contact area due to the constraints of existing road infrastructure.

The park would upgrade and maintain the main road from the existing developed area to Upper Glover for two-wheel-drive access. This road would primarily be one-lane with turnouts, and the surface will be either gravel or paved surface, similar in character to the Hilina Pali or Mauna Loa Roads. The main road, from Upper Glover east to a designated location near the 1916 lava flows (approximately three miles), would be maintained for four-wheel-drive access. There would be no public vehicular access west from Upper Glover.

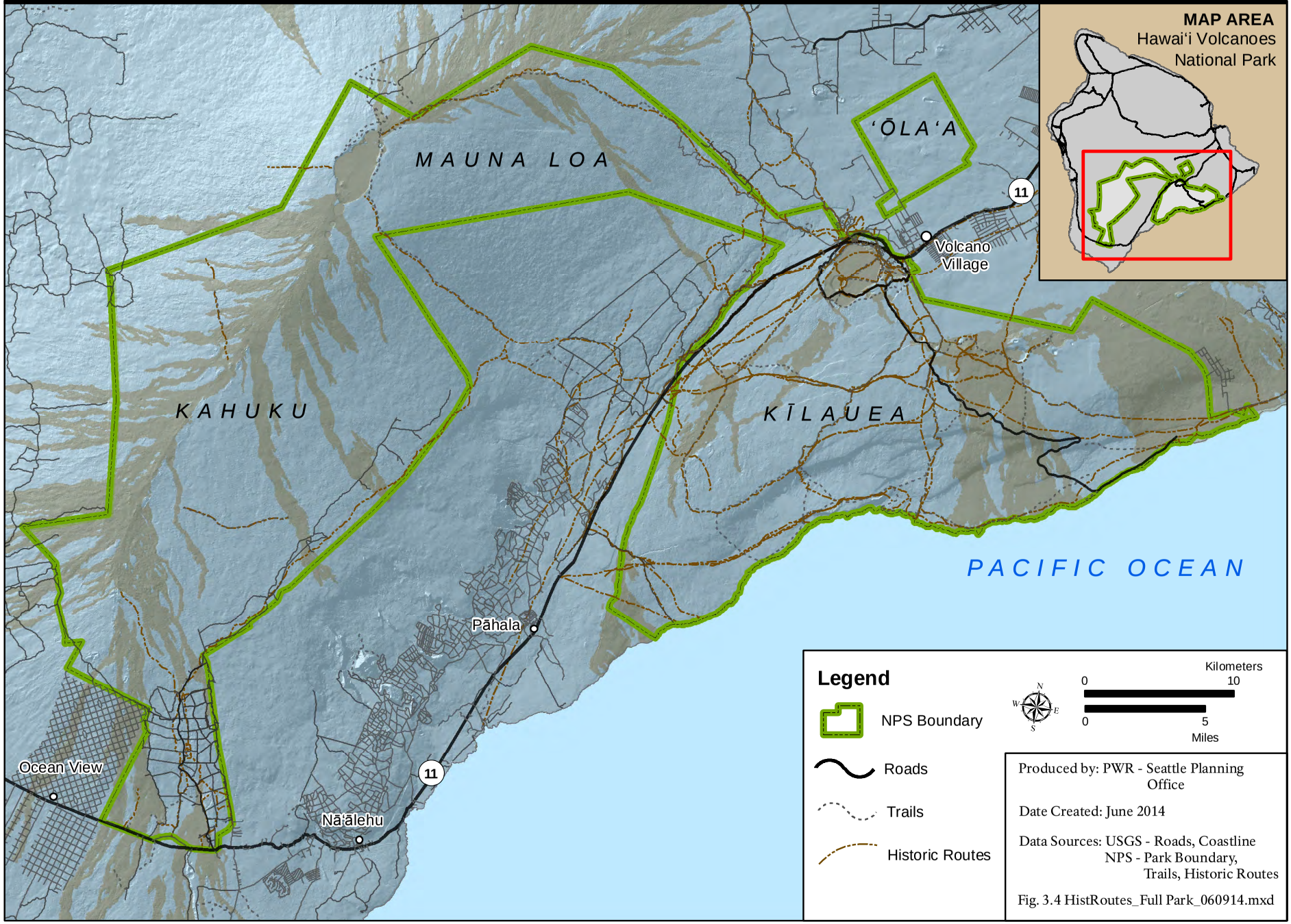
Any remaining roads not used for administrative purposes (including administrative or emergency vehicular access or use as a fuel break) or trail access would be restored to natural conditions and/or native communities. Prior to making a determination on converting roads to trails or restoring roads to natural conditions, the park will evaluate routes for any historic significance. Historic use of routes in Kahuku should help guide management decisions about future use of these roads and routes (see *Figure 3.4. Historic Routes, Full Park*). The park could consider allowing smaller capacity shuttles in response to increased demand (e.g., 15–20 passengers) as a transportation strategy in Kahuku.

Trails and Trailheads: The park would emphasize the use of trails and trailheads for nonmotorized access through Lower Kahuku as opposed to formalizing any additional road access.

Under the preferred alternative, as part of the DCP, the park would develop a trail network in lower Kahuku that would accommodate different visitor abilities across a series of loop trails and trail connections in an effort to promote hiking, bicycling, and equestrian use. In designing the trail network, the park would take existing and historic trails and routes into consideration for long-term use and preservation and would prioritize re-establishing these traditional and historic travel routes before any new trail construction (see *Figure 3.4. Historic Routes, Full Park*). However, new trails could also be constructed in order to create trail connections, such as connecting Kahuku to the Mauna Loa summit, or to the historic Kahuku-ʻAinapō Trail, or creating linkages between historic trails across lava flows. Trail alignments and uses would also be analyzed for identifying appropriate locations of picnic tables and trail signs. Trail management in the Kahuku Unit should also be evaluated and assessed as part of the trail management plan for the entire park.

Figure 3.4 Historic Routes, Full Park

Hawai'i Volcanoes National Park GMP/WS/EIS



Campgrounds: Under the preferred alternative, overnight camping in Kahuku would be allowed and supporting infrastructure developed. Development to support overnight camping in Kahuku would be focused on multiple small-scale designated campgrounds with a low level of infrastructure and minimal services, such as water and compost or vault toilets. Sites would be developed for both drive-in and walk-in campers, with some handicap-accessible campsites provided. Camping opportunities would be located close to trailheads and features of interest.

The park would also accommodate extended family or group camping by providing multiple tent sites in close proximity to one another in different locations. The park would ensure a separate group camping location for larger educational groups, such as school groups and volunteer groups, with a covered area for staging or programs. Some temporary and movable field camps could be established at designated sites for environmental study areas for staff, volunteers, or other science, research, and educational groups, but no permanent infrastructure would be associated with these sites.

Bicycling: Bicycling would be allowed on designated routes. Primary pasture roads would be assessed for their ability to serve as bicycle routes or trails. Some pasture roads could be maintained as multipurpose trails if they are wide enough and some of which could also be maintained for administrative vehicular road access. Unless new connector trails are necessary to manage the flow of bike traffic on these trails, no new bike trails would be developed on undisturbed ground.

Equestrian Use: Under the preferred alternative, the park would implement a small pilot program for equestrian use in lower Kahuku pastures. The goal of the pilot program is to explore allowing equestrian use in Kahuku while managing for resource concerns such as the spread of invasive nonnative species. Under the pilot program, limited equestrian use would be allowed by special permit and potentially through a CUA for guided trips. Best management practices, such as weed-free protocols, would be implemented for resource protection, and use would be authorized only on designated trails or in designated sites. The number of equestrian-accessible trails would also be limited as a way to manage use and monitor impacts. Separating equestrian and bicycle trails would be considered in the DCP.

Implementation of this pilot program would require park staff to research, monitor, and mitigate potential impacts of concern, such as the spread of invasive plants. A baseline vegetation assessment and monitoring plan would be needed in advance of the pilot program. If impacts to resources are found to be acceptable and manageable, limited equestrian use could be allowed in lower Kahuku pastures in the long-term under similar conditions of the pilot program. Any future increases in equestrian use would need to be slowly phased in to monitor and mitigate impacts. The extent of future equestrian use would depend on the success of the pilot program.

UPPER KAHUKU— For the purposes of this GMP/WS/EIS, upper Kahuku is defined as the acreage above a line that is 100 meters above the upper-most road in the paddock system. Upper Kahuku extends up the Southwest Rift Zone of Mauna Loa (see *Figure 1.5. Existing Conditions, Kahuku*).

Under the preferred alternative, the park would manage upper Kahuku for its wilderness characteristics based on its determination of eligibility for inclusion in the national wilderness preservation system. Management of upper Kahuku would emphasize restoring native ecosystems and recovering biological diversity of native species based on best available science. Recreational access in upper Kahuku would be permitted and visitor opportunities such as hiking and camping would be managed consistent with a wilderness experience.

NPS vehicular access for administrative use and emergencies would be allowed on existing roads outside of eligible wilderness. These roads would be maintained to the minimum standard required to support administrative and emergency use.

RECREATIONAL ACTIVITIES AND VISITOR OPPORTUNITIES

Recreation in upper Kahuku would consist of all recreational activities associated with foot travel such as hiking, bird-watching, and overnight backcountry travel. No public vehicular, biking, or equestrian use would be permitted beyond the 1916 lava flows. The park would consider NPS-guided vehicular and/or biking cost-recovery interpretive and recreational experiences above the 1916 lava flows if practical and feasible.

The park would implement a permit system for public hiking and backcountry use for access beyond the 1916 lava flows. Facilities, such as a trailhead and primitive campground in the vicinity of the 1916 flows, would be developed, and water tanks and catchments would be provided, as appropriate.

No commercial services or commercially guided recreation would be permitted in upper Kahuku.

NPS administrative vehicular access, such as use associated with protection of special status species, restoration, wildland fire suppression, and search and rescue would be allowed in upper Kahuku; however, the park would implement best management practices to minimize spread of invasives, such as sanitizing procedures for NPS vehicles and sanitation protocols for boots and gear.

Trails and Trailheads: Trails in upper Kahuku would provide the primary recreational experience for visitors. Trail design would be consistent with the undeveloped character of the area, emphasizing minimal development, and could be as simple as routes designated by cairns. The trail network, including any new routes, would emphasize connecting historic trails across lava flows.

Campgrounds: Under the preferred alternative, dispersed backcountry camping would also be permitted, consistent with wilderness recreation. Backcountry camping would not necessarily require camping in designated sites but would require a backcountry use permit.

The park would consider developing a system of shelters with water catchments for backcountry and wilderness camping. These shelters could simply be a covered water tank for rain catchment, with the cover providing enough shelter for a windbreak for a tent. Any development in eligible or designated wilderness in upper Kahuku would need to be analyzed through the minimum requirements analysis as required by the Wilderness Act (1964) and NPS *Management Policies 2006*.

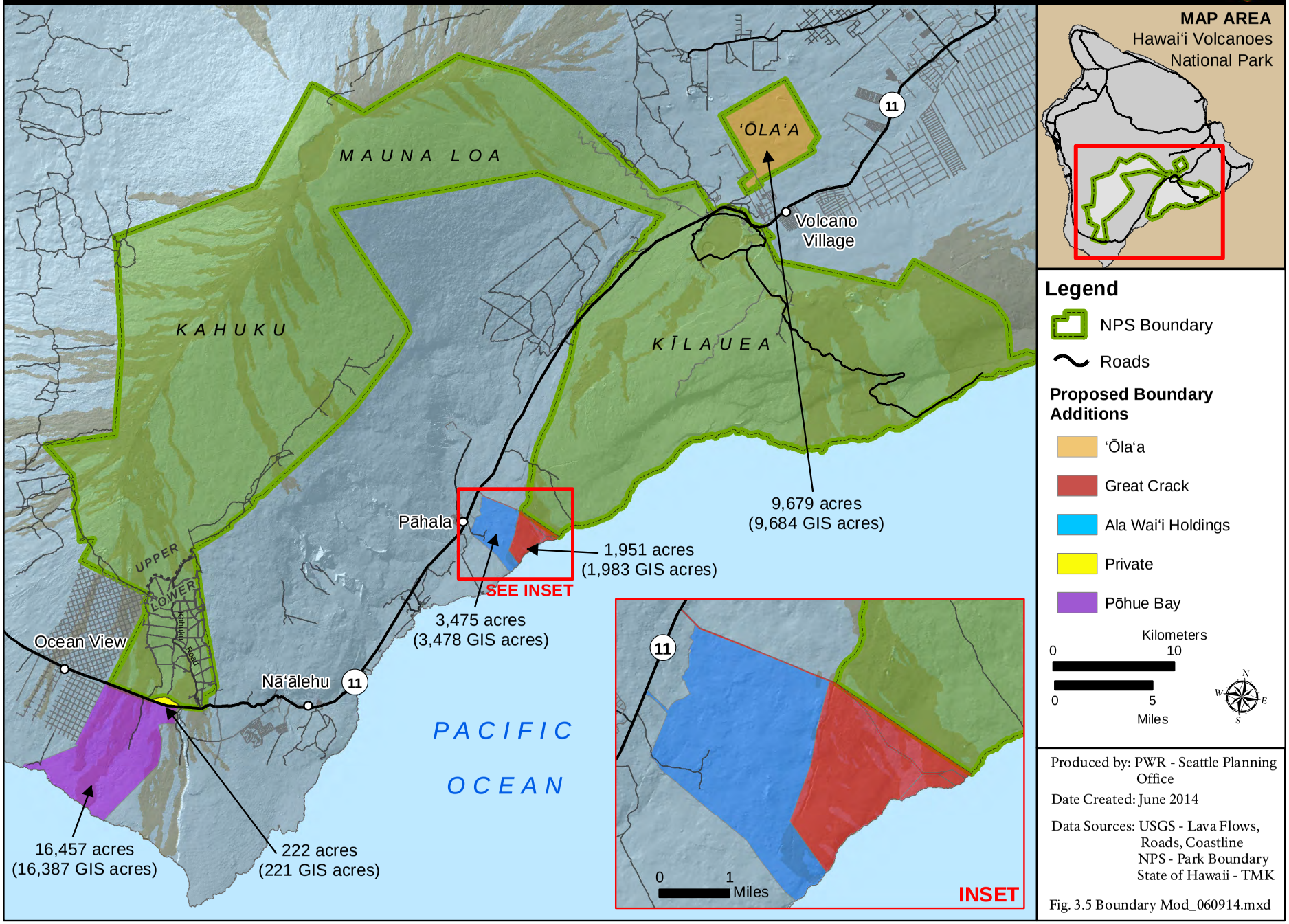
The park would also consider developing a small campground in the proximity of the existing cabins and out of nēnē habitat in nonwilderness for walk-in users. This campsite could also serve as a launching point for backcountry users. Water catchment/shelter could also be provided.

Boundary Modifications

NPS policies require park managers to evaluate the adequacy of boundaries for protecting resources and providing visitor opportunities in general management plans. Appendix E of this GMP/WS/EIS includes an *Analysis of Boundary Modification and Land Protection* that reviews the criteria for boundary adjustments as applied to Hawai‘i Volcanoes National Park. In accordance with this analysis, the preferred alternative proposes several parcels for inclusion within the boundary of Hawai‘i Volcanoes National Park, all of which meet the boundary adjustment criteria (see *Figure 3.5. Boundary Modifications*).

Figure 3.5 Boundary Modifications

Hawai'i Volcanoes National Park GMP/WS/EIS



Produced by: PWR - Seattle Planning Office

Date Created: June 2014

Data Sources: USGS - Lava Flows, Roads, Coastline
NPS - Park Boundary
State of Hawaii - TMK

Fig. 3.5 Boundary Mod_060914.mxd

Under the preferred alternative, Hawai‘i Volcanoes National Park would seek legislation to include ‘Ōla‘a within the official park boundary. Donated to the National Park Service in 1952 via the Hawai‘i Territorial Executive Order 1540, ‘Ōla‘a is geographically separated from the rest of the park by Volcano Village. Because language in the 1938 legislation for the park stated that Hawai‘i Volcanoes National Park could acquire lands only if "adjacent and contiguous" to park boundaries, ‘Ōla‘a has never been formally designated as part of Hawai‘i Volcanoes National Park, even though the unit is managed by park administrators for its valuable rainforest habitat and presence of endemic and/or rare and endangered species. This proposed legislation would adjust the boundary of Hawai‘i Volcanoes National Park to include ‘Ōla‘a's two noncontinguous parcels (Parcels 319001006 and 319001007).

The preferred alternative would also recommend that the following parcels are added to the park boundary.

The park would seek to acquire the Great Crack parcels (1,951 acres) and the Ala Wai‘i parcel (3,478 acres), which is located west of the Great Crack. Both properties are in private ownership and contain excellent geology and important archeological sites. Acquisition of the Great Crack parcels was proposed in the park's 1975 *Master Plan*.

The park would also pursue acquisition of a private parcel (222 acres) located along the southern edge of Kahuku (west of present entrance off Highway 11), which would essentially connect the entire Kahuku parcel with Highway 11. Acquisition of this property would protect lower Kahuku from incompatible development.

Finally, the park would pursue acquisition of a parcel at Pōhue Bay that has been proposed to the county as a development called Kahuku Village. This privately-owned parcel is 16,457 acres and extends from lower Kahuku on Highway 11 down to the coast. The local community, nonprofit organizations, elected officials, and the developers have approached the park to acquire it. The site is used by the endangered hawksbill turtle for nesting. The threatened green turtle and the endangered Hawaiian monk seal are both known to bask on the beaches during the day. The area also contains other endemic and endangered invertebrate, plant, and animal species. In addition, there are important archeological sites and coastal resources that are still used traditionally. Acquisition of this parcel would extend the park's portion of Kahuku from mauka to makai and give the park a wider range of options for recreation improvements in lower Kahuku.

No legislation would be needed for acquisition of these parcels contiguous to the boundary; however, acquisition by the National Park Service would be restricted to a willing seller purchase only. This means that the seller would be willing to sell and adequate funds would be available to support the purchase.

Rather than proposing boundary adjustments to enhance protection of coastal and marine resources, the park would engage partners, such as the DLNR and NOAA, to enhance protection of these resources. Park jurisdiction at the coast currently ends at the high water mark, so resources or activities that fall below that mark are outside of park jurisdiction and make protection of marine resources difficult. Increased emphasis on partnerships for coastal and marine resources could improve protection by engaging agencies with different authorities to work together in pursuit of common preservation goals. A number of tools and techniques would be available, including pursuing designation of the coastal area as a marine managed area or national marine sanctuary under the preferred alternative. Designation would ensure additional protection of these waters.

Program Specific Management Guidance

The following section presents an overview of the preferred management strategies for program areas at Hawai‘i Volcanoes National Park.

Although this plan separates resource protection into discrete categories of natural and cultural resources, park management recognizes that these resources are inextricably integrated, particularly within Native Hawaiian understanding. In Hawaiian culture, the land or ‘āina is sacred. The natural and cultural worlds are intricately bound together, and the spiritual world is not separate from the secular at Hawai‘i Volcanoes National Park. For example, volcanic activity is a part of geological processes and history, but Kīlauea volcano is also home to Pelehonuamea or Pele, the deity of the volcano, and her family. The literal meaning of Pelehonuamea is lava earth matter; hence, lava is a manifestation of the deity. Observed in the lava flows and other natural phenomena associated with volcanic activity, Pele and her family continue to be a presence in Native Hawaiians' lives both physically and spiritually. Management of Hawai‘i Volcanoes National Park will continue to recognize and embrace the interconnectedness of natural and cultural resources into the future.

NATURAL RESOURCES

Under the preferred alternative, the natural resources program would continue efforts to perpetuate and restore native ecosystems and recover populations of rare species (including threatened and endangered) and biological diversity of native species by using scientifically informed methods. In addition, the park would strive to increase current staffing levels to improve monitoring and control of nonnative plants and animals, reintroduction of historical species, protection and recovery of locally rare, threatened and endangered species, fire restoration, fuels reduction, and supporting research that informs natural resources management activities (e.g. climate change studies, fire ecology, vegetation mapping, wildlife monitoring etc.). The natural resources program would emphasize and expand research to identify new methods and optimize existing methods for habitat conservation, watershed protection, and restoration of native species, habitats, ecosystems, and habitat linkages, such as those provided in the *Fire Management Plan* (2007) and such as those being developed for the *Plan and Environmental Assessment for Facilitating Forest Recovery in Former Cattle Pastures, Kahuku Unit*. Concepts of traditional Native Hawaiian land management, such as ahupua‘a management that recognizes the interconnectedness between mauka and makai ecosystems and the natural and cultural environments, would be integrated into natural resource management activities. The park would also seek to enhance restoration techniques and practices with native Hawaiian traditional ecological knowledge.

The natural resources program would also seek to engage the visitor in the protection and restoration of native species and ecosystems by expanding opportunities to participate in restoration activities. Additional NPS-led volunteer stewardship, and service-learning opportunities (defined as a strategy that integrates meaningful community service with instruction and reflection to enrich the learning experience, teach civic responsibility, and strengthen community ties to the park) would be offered to the public to foster long-lasting connections to the park and enhance resource protection and education opportunities. Also, citizen science (defined as participation in a science-based approach to understanding the environment, such as collecting data) would be expanded for park visitors in focal areas.

The park would also work with interpretive and education programs to showcase specific areas, such as special ecological areas, as living laboratories for experimental restoration and research, such as the exclosures in the former cattle pastures at Kahuku and the exclosures on Mauna Loa, and strategically engage educational groups and service groups in restoration activities at

Kahuku. Students and general public would be provided opportunities to study and participate in restoration efforts in these areas as part of expanding service-learning and stewardship programs.

The park would continue to participate in existing partnerships for landscape-level restoration and conservation. Partnering opportunities would include coordinating activities with members of the Three Mountain Alliance (TMA) and other partners on research and restoration measures including reintroduction activities, such as the Hawaiian crow (ʻalalā). The park would continue to engage partners such as DLNR and NOAA for coastal and marine resource protection along the park boundary. The park would seek additional collaborations with appropriate agencies and surrounding communities to enhance protection of coastal and marine resources in addition to land resources.

CULTURAL RESOURCES

The cultural resources program would continue to provide cultural resource protection for park resources. Documentation, research, and stewardship of cultural resources, including natural and cultural history collections, would be strengthened. The park would strive to expand towards a full complement of preservation specialists on staff. The park would seek to enhance cultural resource preservation techniques and practices with Native Hawaiian traditional ecological knowledge. The park would also strive to expand understanding of cultural resources within the context of Native Hawaiian world view. Concepts of traditional Native Hawaiian land management, such as ahupuaʻa management, would be integrated into cultural resource management activities and emphasize the interconnectedness of the cultural and natural environments.

Under the preferred alternative, the cultural resource program would seek to strengthen the archeology program in the park by building and expanding the permanent staff of archeologists which would allow the park to better meet the needs of all the park's compliance projects. The larger staff will seek to expand the on-going documentation and inventory of park resources which formally began in 1994. Formal determinations of eligibility and national register nominations will be sought. Staff specialists would be hired to facilitate compliance with the National Historic Preservation Act and the NPS guidelines for the park's cultural resource management program.

A suite of preservation plans that would provide guidelines for interpreting and preserving cultural landscapes and historic structures would be developed and implemented. Natural and cultural museum collections would be researched and exhibited at a greater number of available and appropriate opportunities. The park would work toward permanent facilities to house and showcase locally and nationally significant collections as staff expand the preservation of park history through the care of objects and archives, and provide researchers access to those materials.

The park would seek to stabilize and maintain some significant ranching and World War II-era landscapes and their contributing elements, and work in a collaborative manner with the natural resources division to carry out the vision of an integrated restoration plan for Kahuku that will provide for protection of Kahuku's rich and diverse histories. The park would also continue to inventory Kahuku's resources and complete the National Register of Historic Places Determination of Eligibility, when appropriate. Some historically significant landscapes or contributing elements of landscapes in Kahuku would be identified and maintained for interpretation and education, highlighting different periods of occupation, such as early Hawaiian use, World War II, and ranching (if historic research shows ranching to be a significant theme).

RESEARCH

As in all alternatives, the park would continue park research efforts and collaboration with partners and would continue to support independent research under the NPS permitting system consistent with NPS management policies.

The preferred alternative would also strengthen the emphasis on disseminating research related to ecology, endemics, climate change, archeology, history, and traditional cultural properties to park visitors in a lay-person format.

WILDERNESS

Hawai'i Volcanoes National Park would continue to manage designated wilderness consistent with National Park Service management policies and the Wilderness Act and would develop a wilderness stewardship plan to guide wilderness use in the park after completion of this GMP/WS/EIS. Wilderness stewardship would emphasize preserving the qualities of wilderness character including undeveloped, untrammeled, natural, solitude, and primitive and unconfined recreation. Activities and uses that would continue to occur in wilderness under minimum requirements analysis based on previous environmental compliance include: (1) fences to protect native ecosystems from nonnative ungulates, (2) research instrumentation and telecommunication essential to continued volcanic studies and warnings, (3) the use of helicopters as a minimum tool in servicing research instrumentation and in the protecting and restoring of natural and cultural resources, and (4) water catchment shelters in remote waterless backcountry.

Under the preferred alternative, Hawai'i Volcanoes National Park Wilderness Study would also recommend wilderness designation for 121,015 acres (GIS) of the Kahuku Unit that met eligibility criteria and requirements necessary to qualify for the National Wilderness Preservation System. Consistent with NPS policy, the park would continue to manage these proposed eligible lands for their wilderness qualities prior to formal designation.

Approximately 13,795 acres (GIS) in upper Kahuku are not recommended for wilderness designation at this time due to incompatible uses in the area, particularly the presence of four-wheel-drive roads and the needed access along these roads for NPS management efforts to protect and restore natural conditions including the native plant and animal communities, ecological processes, and threatened and endangered species. If and when recovery and restoration are completed and successful in upper Kahuku, the National Park Service would consider conducting another eligibility and suitability study for these remaining 13,795 acres (GIS) in the upper Kahuku area.

The remaining 16,055 acres (GIS) in Kahuku (located in the lower pastures) are not eligible for wilderness designation due to the changes wrought by past cattle ranching activities and the presence of past developments including extensive cattle paddocks of exotic grasses, roads, corrals, water pipelines, a small runway, two water reservoirs, and a series of small ranch buildings. In addition, visitor services for Kahuku would be developed in this area, including campgrounds, picnic areas, interpretive exhibits, and a visitor contact station.

SOUNDSCAPES AND THE ACOUSTIC ENVIRONMENT

The National Park Service would continue to use a variety of methods to reduce human-caused noise and improve natural sounds.

The Federal Aviation Administration, National Park Service, and the Volpe National Transportation Systems Center are working together to develop the *Hawai'i Volcanoes National Park Air Tour Management Plan / Environmental Impact Statement*, whose objective, as outlined under the National Parks Air Tour Management Act of 2000, "shall be to develop acceptable and effective measures to mitigate or prevent the significant adverse impacts, if any, of commercial air tour operations upon the natural and cultural resources, visitor experiences, and tribal lands." The National Park Service, as a cooperator with the Federal Aviation

Administration, would complete an ATMP/EIS that would develop measures to limit or prevent any significant impacts that may be caused by commercial air tour operations upon the natural and cultural resources, or visitor experiences at the park. This plan would be consistent with the guiding principle of reducing noise/human sound in sensitive areas.

To improve soundscapes and the acoustic environment, the park would expand active management practices to include: (1) implementing best management practices to limit the duration of artificial noise, (2) maximize human-caused noise free periods, (3) create more opportunities for visitors to experience natural soundscapes, and (4) implement partial closures of air space in sensitive areas. In addition, park operations and projects would be implemented using best management practices to minimize noise impacts.

The park would strive to improve soundscapes and the acoustic environment by reducing artificial noise within wilderness; in and near critical habitat for threatened and endangered species; in traditional cultural areas such as volcano summits, active lava, or active volcanic features; and in high visitor use areas. The park would also provide commercial air tour operators with information and training on wilderness boundaries and the location of these sensitive areas, and provide guidance on best management practices to improve understanding of the importance of these resources and encourage greater protection.

Under the preferred alternative, the park would also recommend the implementation of a soundscape monitoring program and would consider developing a soundscape management plan, if additional guidance is needed.

VISITOR EXPERIENCE

Under the preferred alternative, Hawai‘i Volcanoes National Park would continue to provide visitors with safe access to volcanic features, active lava, cultural resources, and ecosystems from mauka to makai. The park would offer unique opportunities that provide visitors with an appreciation for the ways in which kama‘āina (local people of the land) view, understand, and connect with park landscapes and resources today.

Under this alternative, the park would deliberately manage different geographic areas of the park for different types of visitor experiences and levels of visitor services. The summit of Kīlauea would continue to be managed for the greatest concentration of park visitors and offer the most readily accessible services and amenities, such as visitor centers, restrooms, interpretive programming, etc. Along Chain of Craters Road and Mauna Loa Road, the park would maintain the driving and sightseeing experience by preserving the character of these park roads. The park would also strive to provide visitors with improved opportunities along these road corridors to experience and connect with park resources and values, including new opportunities at places like the 1974 flows.

The end of Chain of Craters Road would continue to be a destination for park visitors, offering a coastal experience and opportunities to experience recent lava flows. As the primary location to see the ocean in the park, this area would continue to be more congested than other locations along the road, however, replacement visitor contact facilities would improve the overall experience.

At Kahuku, infrastructure and development in Kahuku would be minimal, would be gradually phased in over time, and remain rustic in design to allow for a primitive visitor experience. Visitor access and recreation opportunities would be expanded from what is currently offered.

New visitor opportunities at ‘Ōla‘a would expand rainforest experiences in the park. While ‘Āinahou Ranch would be managed primarily as a core nēnē recovery area; however, guided access would be allowed for groups participating in habitat restoration or historic preservation and maintenance activities.

The park would also set the expectation for visitors in the park that eruptive events would likely be linked with congested areas in the park. Experience and research at Hawai'i Volcanoes National Park has shown that the public has tolerance for greater levels of congestion during these events.

The park would also develop an accessibility plan to identify and evaluate opportunities throughout the park to improve accessibility.

RANGE OF RECREATIONAL ACTIVITIES— Under the preferred alternative, the park would continue to allow for a range of recreational activities such as viewing lava and evidence of volcanic activity, camping, hiking, backpacking, biking, equestrian use, birding and wildlife viewing, picnicking, general sightseeing, and stargazing. Additional opportunities for existing activities could be provided in different geographic areas of the park. The park would focus on ranger-guided tours for access to new and particularly sensitive areas in the park. Expanded recreational activities would be authorized in Kahuku beyond current use.

TRAILS: HIKING, BIKING, AND EQUESTRIAN— Under the preferred alternative, a trail management plan would be created to comprehensively assess trail conditions and needs and to identify specific trail alignments and uses, such as hiking, biking, and equestrian use. Development of any new trail alignments would be primarily along historic alignments and traditional routes, or on existing roads, such as at Kahuku (see *Figure 3.4. Historic Routes, Full Park*). The park would strive to provide access to a variety of locations for different audiences and types of recreationists. The park would also strive to create loop trail experiences through new links between existing trails.

Rather than construct extensive new trails, the park would evaluate ways to use the existing road network for improved nonvehicular recreation opportunities. For example, in some areas of the park, such as Hilina Pali or Mauna Loa, roads could be closed to private day use vehicles during certain times of day or days of the week to provide a more enjoyable and less congested experience for recreationists such as hikers, backpackers, bikers, and equestrian users.

CAMPING—
FRONTCOUNTRY CAMPING
Nāmakanipaio Campground and Kūlanaokuaiki Campground would continue to serve as formal frontcountry campgrounds in the park with drive-in camping opportunities. Nāmakanipaio Campground would continue to be run as a concession/fee operation.

Any additional camping considered in the future would be more primitive and dispersed than current facilities and would most likely be in Kahuku due to the lack of current facilities in this unit. Any future frontcountry camp development would also be considered in relationship to outdoor education pavilions that have been sited based on ecological themes and would be targeted to educational groups but could also expand capacity for general public camping.

BACKCOUNTRY CAMPING
Under the preferred alternative, the park would maintain existing backcountry camping and would explore, with additional planning, formally designating backcountry campsites, primarily along the coast outside the tsunami evacuation zone and at Mauna Loa, but potentially in a range of environments. Additional backcountry camping opportunities would also be available in Kahuku. Any new campsites would require further planning.

Some sites could contain water catchments/ shelters, and any decisions about designating campsites in wilderness would be consistent with the minimum requirements decision guide.

INTERPRETATION AND EDUCATION— The park would develop a comprehensive interpretive plan which is a comprehensive interpretive strategy. This plan would be parkwide with an interpretive media plan and long-term direction for the park's front-

line interpretive programs and the park's education program. Some of the park themes that require additional, updated guidance in this plan include Kahuku; the park's special ecological areas as places to experience the park's most intact native ecosystems, learning about the special plants and animals and efforts to protect and restore them in these areas; and impacts from climate change to park resources.

PROGRAMS

The park would continue to provide the current range of interpretive programs, media, and techniques and would develop a comprehensive interpretive plan that would expand interpretive opportunities to introduce visitors to all of the park's interpretive themes through the use of interpretive standards and methods. Kahuku would also be integrated into the park's comprehensive interpretive plan, and key stories such as the Southwest Rift of Mauna Loa and the five recent eruptions, the story of refugia and restoration, ranching and the paniolo lifestyle, Pu'u Akihi - a Special Ecological Area, and how land affects people and people affect the land, Kahuku in the context of climate change, and the ahupua'a management (Native Hawaiian land management) system would be featured in this unit.

Under the preferred alternative, interpretation methods, while diverse in nature, would focus on ranger-led experiences and live programs to immerse visitors in the volcanic, biologic, and cultural resources at Hawai'i Volcanoes National Park. These live programs would also provide additional opportunities to learn from Native Hawaiians and/or other cultural practitioners. Self-guided interpretation opportunities such as waysides and interpretive trails would also be provided, particularly in lower Kahuku.

New, additional interpretive programs would also focus on providing hands-on educational experiences for school, volunteer, and other organized groups in the frontcountry. Stewardship and hands-on activities would be a key element in these programs engaging visitors in research, learning, science, restoration, and educational programs and facilities. In addition, park staff would engage visitors in research and citizen science.

Interpretive programming would also utilize new media and tools to provide inquiry-based learning through frontcountry self-guided interpretive and educational opportunities in order to meet the diverse needs of an increasingly international audience.

INTERPRETATION AND EDUCATIONAL FACILITIES

In the preferred alternative, the park would expand the uses of Jaggar Museum and Kīlauea Visitor Center as dramatic opportunities to introduce visitors to the volcanic, biologic, and cultural resources at Hawai'i Volcanoes National Park. Kahuku would also serve as an important location for visitor orientation.

The park would emphasize minimal new facilities. When needed, structures would be small, low-impact, potentially designed to be consistent with traditional Hawaiian design (such as thatched hale), and would provide flexibility during periods of eruptive activity.

The park would provide opportunities for outdoor education and inquiry-based learning that stretches from mauka to makai with a series of small, covered pavilions at key locations.

The park would also seek to engage visitors in resource management activities through developing combined interpretive and resource management features such as a mala (native and canoe plant garden), rare plant orchards, or a greenhouse, which would serve to interpret indigenous plants, provide plant material for stewardship restoration activities and demonstrate the park's role in protecting endemic plant species.

COMMERCIAL SERVICES

A Commercial Services Strategy has been produced as part of the general management plan that includes criteria for evaluating new commercial services, consistent with existing concession law and other statutes (see *Appendix F: Commercial Services Strategy for Hawai'i Volcanoes National Park*). This strategy would provide broad guidance for future decisions involving commercial services but would not apply retroactively to previously made decisions. The Commercial Services Strategy would not affect the terms of ongoing contracts or authorizations previously signed or issued prior to the completion of the final GMP/WS/EIS.

Under the preferred alternative, the park would continue to allow the range of commercial services that presently exist at Hawai'i Volcanoes National Park. Commercial services would continue to operate in the existing developed area around Crater Rim Drive and would extend to the end of Chain of Craters Road when necessary, such as to provide access to eruptive events in that area. Commercial use would also continue at current levels along Hilina Pali and Mauna Loa Roads. Commercial services would also be allowed in lower Kahuku, similar to access granted to the general public, but would be restricted from upper Kahuku, including all areas eligible for wilderness designation. Any proposed significant increases in use due to eruptive events, or even due to increased ecotourism or other type of tours not related to an eruptive event, would need to be evaluated due to safety concerns, natural and cultural resource concerns, and limited infrastructure in these areas. Any necessary environmental and/or cultural compliance would also need to be completed.

In managing commercial services, the park would continue to balance access to resources for commercial service providers and clients with access granted to the general public, ensuring that the public is not displaced from high use areas in the park. The park would also engage commercial service providers in managing visitor use and providing valuable information to the public, including general park visitor information, safety updates, and interpretation of the park's fundamental resources and values. Management strategies could include: infrastructure changes to accommodate commercial uses (such as additional parking, staging areas, and limiting tour buses to one-way traffic on Crater Rim Drive when fully opened), limits on numbers or size/capacity or times/dates of commercial activities, interpretive training for all commercial service employees, and ongoing communication with commercial service providers about changes in park conditions, etc.

ADMINISTRATIVE FACILITIES AND INFRASTRUCTURE

The park would continue to maintain and upgrade, when necessary, administrative infrastructure in the park such as offices, storage, and utilities and would improve provisions for accessibility. Under the preferred alternative, administrative functions would be relocated from Kīlauea Visitor Center to other buildings within the park so that interpretive and visitor use functions could be consolidated at the visitor center.

At Kahuku, the park would continue to maintain and upgrade when necessary, existing infrastructure in lower Kahuku and continue to use existing buildings for office space and storage. The park would also adaptively reuse the existing developed area in lower Kahuku for a mix of visitor services and administrative and operational use as needed. Any new development in Kahuku would occur in the existing developed footprint.

TRANSPORTATION AND ACCESS

All park roads are eligible for inclusion on the national register and would be maintained to provide for a safe driving experience, consistent with the park setting to ensure a park-like and scenic driving experience. Historic road alignments and built features that define the period of significance of the roads would be maintained to the extent

possible. A range of roads and road standards would continue, and the park would continue to work cooperatively with the state and other partners, particularly on Highway 11, in order to provide for visitor safety, signage, and information.

No construction of new roads and no major new parking areas would be anticipated, though the park would continue to maintain parking areas and turnouts with upgrades as needed. Existing parking areas could be expanded or new smaller parking areas could be developed to facilitate visitor access in keeping with the existing road history and character defining features. Some parking areas could also be reduced or removed out of concern for park resources.

In the preferred alternative, the park would strive to maintain and improve visitor access for both vehicles and bicycles. This improved access could involve exploring the use of utility corridors or other existing unpaved areas in the park, especially for bicycles.

The first focus for managing congestion and reducing private vehicle use would be guided by demand management, marketing strategies such as educating visitors about when to visit locations that may be crowded, and park policies to control cars and congestion. Intelligent transportation systems (ITS) would be another tool or element of this strategy. New restrictions or management of vehicles on some roads would be implemented, such as implementing size limits (no vehicles greater than 98 inches in width or over 38 feet in length) and testing one-way traffic for large commercial buses within a pilot program on part of Crater Rim Drive.

Some road connections previously lost to lava could be restored and the park would strive to reopen roads impacted by lava, seismic activity, eruptive events, or other acts of nature when feasible.

Continuation of a shuttle (nonmandatory) would be evaluated after completion of the pilot project.

PARTNERSHIPS

The park would continue to maintain existing partnerships with agencies and organizations that are key to the park's mission, such as Hawaiian Volcano Observatory, Kilauea Military Camp, the Three Mountain Alliance, park concessioners, and other entities that provide visitor services and support park operations.

The park would also foster and expand partnerships with local and regional communities, organizations, nonprofits, and businesses; Native Hawaiian communities (including families and Native Hawaiian organizations); adjacent landowners; local, state, and federal agencies; and other interested groups or organizations in efforts to support the purpose and significance of Hawai'i Volcanoes National Park.

As a way to involve local participation, the park would promote community and school involvement in traditional practices and environmental service projects.

CLIMATE CHANGE AND SUSTAINABILITY

As a leader in how parks and land managers are responding to threats from climate change, the park would continue to implement the climate action plan for Hawai'i Volcanoes National Park and participate in the Climate Friendly Parks program. The park would strive for increased energy efficiency, conservation, and sustainability in development of facilities and would give priority to green facility design for any new construction, retrofitting, and upgrading of facilities to the greatest extent possible. Increased reliance would be placed by the park on temporary and movable facilities to improve flexibility for both visitors and operations during periods of eruptive activity.

Contractors and concessioners would be encouraged to reduce their own greenhouse gas emissions, particularly during their operations in the park, by using sustainable practices, purchasing local products, and using vehicles with alternative fuels.

The park would also promote activities to get visitors out of cars such hiking, biking, and equestrian use, and employees would be encouraged to bicycle to decrease the park's carbon footprint.

The park would serve as a model for climate change adaptation by supporting climate change-related research, adapting management activities based on climate projections, and building resilience among populations of rare native species, communities, and ecosystems. Examples include long-term weather monitoring of park ecosystems, establishing wildlife corridors through restoration of forest fragments, and expanding populations of rare species throughout their former range.

Operations

ESTIMATED COSTS

Cost estimates for Alternative 2 are identified in *Table 3.5. Alternative 2: Summary of Costs*. Costs shown are not intended for budgeting purposes; instead they are used to show a relative comparison of costs among the alternatives. Implementation of the approved plan will depend on future funding, and approval of a general management plan does not guarantee that funding and staffing needed to implement the plan would be forthcoming. Full implementation of the plan may take many years. The National Park Service will also evaluate proposed facility investments prior to project approvals using the best scientific information available related to climate change and other possible scenarios to ensure the long-term sustainability of these investments. Due to potential vulnerabilities of some of the park's facilities, it is feasible that the National Park Service may conclude that such financial investments for facilities would be unwise and that other options would be considered or potentially the project would not be pursued or implemented.

These costs are in 2012 dollars and are based upon general "Class C" estimates for site development and construction and are referred to as conceptual estimates by the design and construction industry. They are general in nature and representative of a broad based vision rather than focused on specific details. Prior to submitting funding requests for the design and construction phases, "Class B" estimates are required, based upon detailed site and facility designs. "Class A" estimates would be prepared from completed construction documents.

ONE-TIME COSTS— One-time costs for Alternative 2 emphasize the rehabilitation of facilities and infrastructure and addressing critical resource management concerns. Almost half the one-time costs associated with Alternative 2 involve projects in the Kahuku Unit which is the newest addition to the park. At Kahuku, the majority of costs would be to rehabilitate the main road from the entrance to Upper Glover for two-wheel-drive access and to invest in the construction and maintenance of ungulate-proof fences that help control invasives and assist the natural recovery of native species. Additional new construction costs at Kahuku would include campsites and associated infrastructure, an educational pavilion, wayside exhibits, and a small amphitheater associated with the visitor contact station.

Overall, a large portion of the costs in the main part of the park would be to renovate the Ohia Wing, a historic structure, as a cultural museum/administrative offices. Additional facility rehabilitation costs include those necessary to accommodate the steady stream of visitors at the park's main visitor facilities such as Kīlauea Visitor Center, Jaggar Museum, and the Ohia Wing.

Resource management costs for Alternative 2 would be primarily for fencing for nonnative animal control. Invasive species are the overriding threat to natural resources in the park, degrading and simplifying native ecosystems and eroding biological diversity. The park's main strategy to control invasives and monitor the natural recovery of native species is through constructing and maintaining ungulate-proof fences. In addition to Kahuku, the park would invest in fencing to exclude ungulates from the wilderness area at ʻŌlaʻa.

Costs for new construction in Alternative 2 focus on installation of educational pavilions, waysides, and new trail segments or linkages in the main portion of the park. Transportation costs for Alternative 2 focus on continuing and expanding the shuttle system around the rim and evaluating the feasibility of a shuttle system at Kahuku.

Projects in the alternatives are identified as either Priority 1 or Priority 2. Priority 1 projects include projects that emphasize resource protection, threats, and visitor safety. Priority 2 projects which are less urgent include all other projects important to the full implementation of the alternative, including those that address visitor opportunities and experiences such as enhanced facilities, as funding allows and could be sustained. For the Priority 1 projects, the renovation of the Ohia Wing is expected to take many years so it may be completed after implementation of other Priority 1 projects. At Kahuku, the most pressing Priority 1 projects would be construction and rehabilitation of fencing for animal control. Though still a Priority 1 project, the rehabilitation of the main road at Kahuku from the entrance to Upper Glover for two-wheel-drive access may be phased after fencing projects are completed. The least important Priority 2 project would be the evaluation of the development of a shuttle system for visitor access at Kahuku.

Deferred maintenance, also presented in *Table 3.5. Alternative 2: Summary of Costs*, is maintenance and repair activities that were not performed when they should have been or were scheduled to be and which, therefore, are put off or delayed for a future period. Maintenance and repairs are activities directed toward keeping fixed assets in an acceptable condition. Many of the proposals in Alternative 2 address deferred maintenance issues; therefore, deferred maintenance costs would "offset" the total one-time costs. A fully staffed maintenance division as presented in this alternative would also assist the park in addressing the amount of deferred maintenance.

STAFFING

Implementation of Alternative 2 would require additional staffing for increased natural resources protection and restoration efforts, additional cultural resources program needs, new interpretive and educational programs, and additional maintenance, law enforcement, and administrative needs.

Proposed staffing in Alternative 2 would require 47 new FTE employees (one person working 40 hours per week for one year, or the equivalent): 11.5 FTE for additional natural and cultural resources management and restoration activities, eight positions for interpretation and education to address additional and new interpretation throughout the park, 12 positions for facilities and maintenance, five additional positions for visitor protection, nine positions for Kahuku operations seven days a week, and 1.5 new administrative and management positions.

The staffing table does not include seasonal staffing, which would vary depending on specific projects needs and funding allocations.

ANNUAL OPERATING COSTS— Annual operating costs are the total costs per year for maintenance and operations associated with Alternative 2, including utilities, supplies, staff salaries and benefits, leasing, and other materials. Costs and staffing estimates assume that the alternative is fully implemented as described in the narrative. The park's annual operating budget for fiscal year 2014 was $7,281,000. Full implementation of Alternative 2 would include filling vacant positions and filling an additional 47 FTE ($3,079,000). Additional operations and maintenance costs related to capital investments would be $379,000. Total operating costs for Alternative 2 would be $10,739,000. FTE salaries and benefits are included in the annual operating costs.

Table 3.4. Alternative 2: Staffing

Park Management Division	FTE
Administrative and Management (includes Kahuku staff)	27 + 10.5 new
Natural and Cultural Resource Management	29 + 11.5 new
Interpretation and Education	12 + 8 new
Facilities and Maintenance	28 + 12 new
Visitor Protection/Fire	26 + 5 new
Vacant positions	21
Total New Positions	**47**
Total Positions	**190 FTE**
Total Staffing Costs	**$10,739,000**

Table 3.5. Alternative 2: Summary of Costs

Description of Cost	Estimated Summary of Costs
ANNUAL OPERATIONAL COSTS	
Existing Annual Operational Costs	$7,281,000
Additional Staffing Costs (+47 FTE)*	$3,079,000
Additional Operations & Maintenance Costs Related to Capital Investments	$379,000
Total Annual Operational Costs	**$10,739,000**
ONE-TIME CAPITAL COSTS	
Program Support	
Priority 1 Projects**	$1,158,000
Priority 2 Projects	$0
Facility Rehabilitation	
Priority 1 Projects	$13,281,000
Priority 2 Projects	$1,312,000
Natural Resource Management	
Priority 1 Projects	$6,763,000
Priority 2 Projects	$0
Cultural Resource Management	
Priority 1 Projects	$10,494,000
Priority 2 Projects	$70,000
New Construction	
Priority 1 Projects	$1,006,000
Priority 2 Projects	$3,684,000
Transportation	
Priority 1 Projects	$150,000
Priority 2 Projects	$150,000
Total Priority 1 Projects	**$32,852,000** (Kahuku costs are $14,029,000 of this total)
Total Priority 2 Projects	**$5,216,000** (Kahuku costs are $2,452,000 of this total)
Total One-time Costs	**$38,068,000** (Kahuku costs are $16,481,000 of this total)
Deferred Maintenance Offset	**$22,841,000**

* The current staffing level is below the authorized level of 143 FTE; the additional staffing level would add 47 FTE to the authorized level of 143. The new staffing level would be 190 FTE.

** Priority 1 projects include projects that emphasize resource protection, threats, and visitor safety. Priority 2 projects include all other projects important to the full implementation of the alternative, including those that address visitor opportunities and experiences such as enhanced facilities as funding allows and could be sustained. Costs are in 2012 dollars.

ALTERNATIVE 3

Description of Alternative

This alternative emphasizes building new connections with the park primarily through expanded education and hands-on stewardship opportunities. Traditional visitor opportunities would continue and capacity could be expanded at some existing sites to allow for increased visitation, but new development would be very limited and a suite of management tools would be used to disperse visitors and manage congestion throughout the park. A greater focus would be placed on science and learning opportunities for visitors from mauka (mountains) to makai (sea). The park would immerse visitors in the protection and restoration of native species and ecosystems by maximizing opportunities to participate in restoration activities and additional emphasis would be placed on providing opportunities for visitors to engage in research, scientific investigation, and projects associated with natural and cultural resources management, notably in Kahuku.

Similar to the preferred alternative, natural and cultural resources would continue to be managed and protected with a high degree of integrity, consistent with direction provided by existing laws and policies. This alternative also emphasizes the park's role as a refuge and haven for native biota, people, and cultures in a world constantly adapting to volcanic activity and island building processes. This alternative would honor the Native Hawaiian people and culture, by recognizing Native Hawaiian values such as mālama ʻāina (nourishing or taking care of the land) and kuleana (responsibility) and perspectives from Native Hawaiian land management such as ahupuaʻa management (managing land from mauka to makai) as important concepts in park stewardship of resources. Native Hawaiian traditional ecological knowledge would be used to enhance current scientific understanding to protect park resources and provide additional interpretive and educational opportunities for visitors.

Management Zones Applied to Alternative 3

The management zones for Alternative 3 are geographically located to identify an area's predominant use and desired future conditions. The specific configurations of the management zones for Alternative 3 are provided in *Figure 3.6. Management Zones for Alternative 3, Full Park* and *Figure 3.7. Management Zones for Alternative 3, Crater Rim Drive and Kahuku*. The following description identifies the locations and details for the application of management zones in Alternative 3.

VISITOR SERVICES ZONE

In Alternative 3, the visitor services zone would include Nāmakanipaio Campground, the northeast section of Crater Rim Drive and some surrounding facilities, and the vicinity around existing development in lower Kahuku.

Around Crater Rim Drive, the visitor services zone would include 100 yards on either side of northeastern section of the road between Jaggar Museum and the junction with Chain of Craters Road and would extend around high visitor use facilities/locations including the campus around Kīlauea Visitor Center and the parking lots for Kīlauea Overlook, Kīlauea Iki, Devastation, and Puʻu Puaʻi.

In Kahuku, the Visitor Services Zone would encompass all of the existing ranch buildings in lower Kahuku and the Puʻu o Lokuana Trailhead, extending north to the far side of Puʻu o Lokuana and west to the eastern edge of the Old Mamalahoa Highway.

Figure 3.6 Management Zones for Alternative 3, Full Park

Hawai'i Volcanoes National Park GMP/WS/EIS

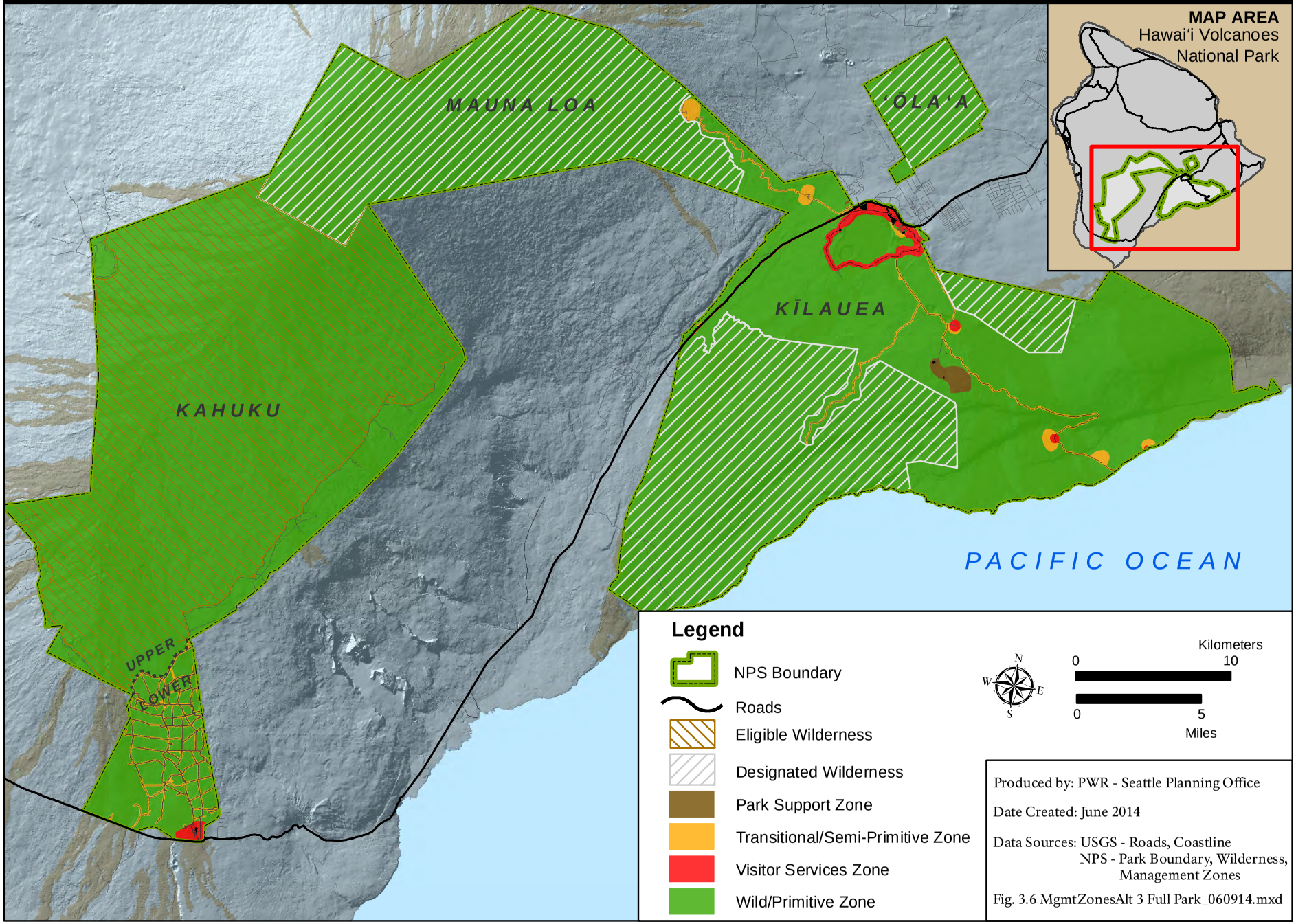
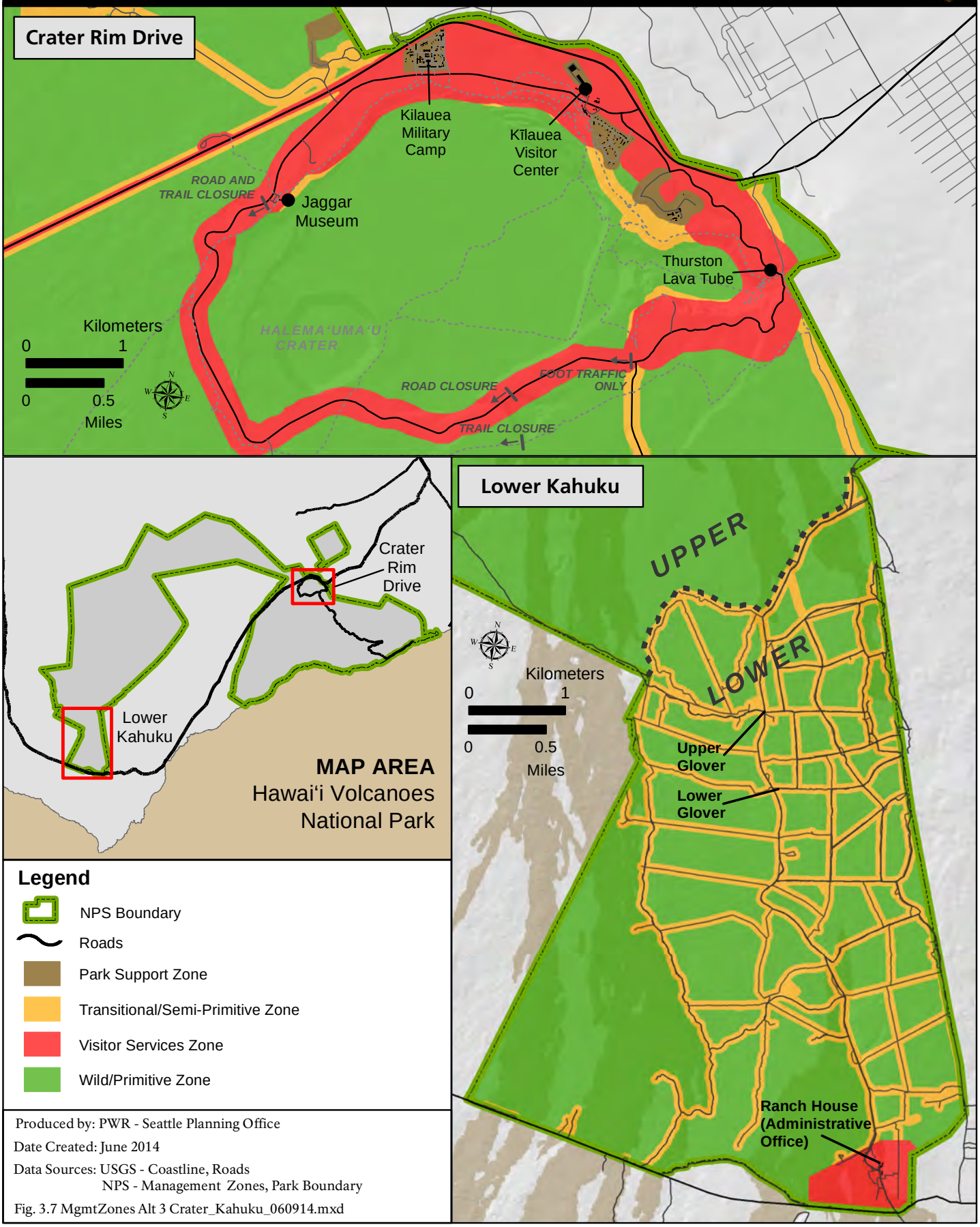


Figure 3.7 Management Zones for Alternative 3, Crater Rim Drive & Kahuku

Hawai'i Volcanoes National Park GMP/WS/EIS



Produced by: PWR - Seattle Planning Office

Date Created: June 2014

Data Sources: USGS - Coastline, Roads
NPS - Management Zones, Park Boundary

Fig. 3.7 MgmtZones Alt 3 Crater_Kahuku_060914.mxd

TRANSITIONAL/SEMI-PRIMITIVE ZONE

In Alternative 3, the transitional/semi-primitive zone would encompass all major road corridors in the park, including areas surrounding high use visitor turnoffs and trailheads. This includes the Highway 11 corridor through the park, the Mauna Loa Road (including the areas surrounding Kīpukapuaulu and Mauna Loa Lookout), the southern section of Crater Rim Drive between Jaggar Museum and junction with Chain of Craters Road, the Escape Road, Hilina Pali Road, Chain of Craters Road (including the areas surrounding Mauna Ulu, Kealakomowaena, Pu‘u Loa, and the end of the road), and the road corridors in lower Kahuku (100 yards on either side of the road corridors). This zone also encompasses the Tree Molds area off of Mauna Loa Road; and the area between Crater Rim Drive and the Crater Rim Trail, extending west and south to include room for a possible trail connection between Kīlauea Iki Overlook, Thurston Lava Tube, Pu‘u Pua‘i, and Devastation.

WILD/PRIMITIVE ZONE

The wild/primitive zone in Alternative 3 would include all areas designated wilderness or eligible wilderness within Hawai‘i Volcanoes National Park, including the East Rift, Ka‘ū Desert, ‘Ōla‘a, and Mauna Loa wilderness units within the Hawai‘i Volcanoes Wilderness. The zone would also include the small tract of ‘Ōla‘a and most of the nonwilderness areas of the Mauna Loa, Kīlauea, and Kahuku units, except for major road corridors, high use visitor and administrative facilities, and high visitor use turnouts along the road corridors (see “Visitor Services Zone,” “Transitional/ Semi-Primitive Zone,” and “Park Support Zone”).

All of upper Kahuku would be included within the Wild/Primitive zone, as would most of lower Kahuku except along the road corridors (see “Transitional/Semi-Primitive Zone”) and in the vicinity of the ranch buildings (see “Visitor Services Zone”).

PARK SUPPORT ZONE

The Park Support Zone in Alternative 3 includes those facilities and surrounding areas in the park used primarily for NPS administration, such as the research facilities, administration and housing area, the rainshed, and the NPS horse corral. Both ‘Āinahou and Kilauea Military Camp are zoned Park Support because they are not open to the general public under this alternative.

The greatest proportion of Hawai‘i Volcanoes National Park (about 98.8%) would be managed in the Wild/Primitive zone. The Transitional/Semi-Primitive Zone would cover about 1.0%, and the Visitor Services Zone would cover approximately 0.1%. The Park Support Zone would cover the smallest portion (less than 0.1%) of the park.

See *Table 3.1. Management Zones* for a comparison of the zone concept; desired natural and cultural resource conditions; shoreline and wilderness management practices; visitor opportunities; science, research, and learning opportunities; facility conditions; and access and transportation conditions of the proposed management zones.

Site-Specific Management Guidance

The following section presents an overview of the management strategies for Alternative 3 for specific areas of Hawai‘i Volcanoes National Park.

KĪLAUEA VISITOR CENTER AND SURROUNDING AREA

Same as Alternative 2.

KĪLAUEA VISITOR CENTER—Same as Alternative 2.

VOLCANO HOUSE℠— Same as Alternative 2. In addition, the park would articulate in the next concession contract a goal to retrofit and update Volcano House℠ to use solar energy to serve as a leader in sustainable design and adaptive reuse of historic structures. Costs to

construct and/or install solar infrastructure would be borne by the concession. The park would strive for environmentally sound and sustainable practices for the entire operation.

1877 VOLCANO HOUSE— Same as Alternative 2. In addition, the park would increase historic interpretation of 1877 Volcano House (current home of the Volcano Art Center) and the historic campus. Interpretation could be expanded inside the building by adding interior exhibits. These exhibits could include a period restored room and/or additional historic photos of the 1877 Volcano House in the appropriate rooms to highlight historic uses of the building. On the outside, interpretation could be expanded by adding an additional wayside.

OHIA WING (1932 ADMINISTRATION BUILDING)—Same as Alternative 1.

CRATER RIM DRIVE

Assuming no eruptive activity, the park would maintain the closure of the southern section of Crater Rim Drive to private vehicle traffic from Jaggar Museum to the Chain of Craters Road junction and explore the feasibility of implementing a mandatory shuttle system that would be owned by the National Park Service but operated by a concession, CUA, or partner. This shuttle would run, with two-way service, the length of Crater Rim Drive and would be mandatory from Jaggar Museum south and east to Chain of Craters Road junction. Locations for parking would be explored and would likely include expanding existing parking areas at Jaggar Museum and Devastation Trail. Large commercial buses would be allowed to run on Crater Rim Drive but would be limited to one-way traffic on the southern section of Crater Rim Drive from Jaggar Museum to the Chain of Craters Road junction. The historic character of the road would be preserved.

In addition, the park would continue to allow administrative use of the road for two-way vehicle traffic. The park also would encourage bicycle use of the road with improved signage for safety concerns.

HALEMAʻUMAʻU PARKING AND OVERLOOK—Same as Alternative 2.

KILAUEA MILITARY CAMP

Same as Alternative 2.

JAGGAR MUSEUM AND HAWAIIAN VOLCANO OBSERVATORY

Same as Alternative 1. In addition the park would rehabilitate and upgrade the outdated Jaggar Museum interpretive exhibits.

With the closure of part of Crater Rim Drive to private vehicles, Jaggar Museum could also serve as a staging area for the shuttle. Additional parking improvements may be needed.

THURSTON LAVA TUBE AND SURROUNDING AREA

THURSTON LAVA TUBE (NĀHUKU)— Under Alternative 3, the park would implement a more active management strategy at Thurston to address congestion and improve the visitor experience by increasing reliance on shuttle systems, reducing private vehicle parking, and continuing to allow commercial vehicles at Thurston. The park would strive to improve visitor information and outreach for trip planning and emphasize less busy times of the day to visit and expand use of intelligent transportation systems.

To circulate visitors and provide visitor access to Thurston Lava Tube, the park would rely on the Crater Rim Drive shuttle, if implemented, and redirect private vehicle parking to other parking areas such as Kīlauea Iki, Devastation, or Puʻu Puaʻi. Thurston Lava Tube would be maintained as a stop for large and small buses for commercial or educational groups around Crater Rim Drive as well as a shuttle stop. Except for ADA parking, private vehicle parking at Thurston would be removed. Reconstruction of some of the parking may be necessary to provide compliant ADA parking.

The park would continue ranger-guided tours of Pua Poʻo, as staffing and funding permits, similar to Alternative 1. As a way to disperse visitor use and take some of the demand off

Thurston Lava Tube, the park would explore the option of expanding public access to other lava tubes for ranger-guided tours that would be focused on science.

KĪLAUEA IKI, PU'U PUA'I, AND DEVASTATION— New or improved trail connections would be explored for pedestrians and bicycles from Kīlauea Iki and Devastation Trail parking areas to Thurston, but the existing footprint of those parking areas for private vehicles would be maintained.

ESCAPE ROAD— Same as Alternative 1.

CHAIN OF CRATERS ROAD

Same as Alternative 1. In addition, the park would use existing trails, historic trails, turnouts, and waysides to improve the visitor experience and limit new development along Chain of Craters Road. New connections between existing trails could create loop hiking opportunities along Chain of Craters Road.

To limit informal turnouts, the park would improve signage of features and viewpoints at existing road turnouts.

MAUNA ULU— Same as Alternative 1.

KEALAKOMO— Same as Alternative 2.

END OF CHAIN OF CRATERS ROAD— Same as Alternative 1. In addition, the park would provide a covered educational pavilion at a key location for visitor contact, interpretive programs, and outdoor educational use.

The park would strive to replace lost picnicking opportunities with a new picnic area along the coastal portion at the end of Chain of Craters Road.

HILINA PALI ROAD

Same as Alternative 2.

'ĀINAHOU RANCH HOUSE AND GROUNDS

Similar to Alternative 2, 'Āinahou Ranch would continue to provide a core nēnē management area for nēnē recovery. Park staff would continue to maintain the house and cultural landscape in good condition with very limited use of volunteers or other support groups. The water system would be maintained for house fire suppression, and the access road to 'Āinahou would be maintained as an unpaved road. Also, in the areas surrounding the formal gardens and where invasive faya tree (*Morella faya*) and European olive (*Olea europaea*) have taken over, habitat restoration to remove these invasives, and re-establish native plant communities would occur and improve forage for forest birds (e.g., amakihi, apapane, 'i'iwi). Within the formal gardens, the park would work with cultural resource staff to replace invasive nonnatives with native species, minimize any new plantings or cultivation, and prevent any inadvertent introduction of nonnatives.

Alternative 3 would provide greater emphasis on restoration for nēnē and minimize human presence in the ranch house and gardens only as directly related to the protection of the site. NPS staff would conduct the majority of the project work at 'Āinahou, with less use of volunteers or other groups, in order to minimize the amount of human presence at the site and emphasize nēnē recovery.

MAUNA LOA ROAD

Same as Alternative 2.

NĀMAKANIPAIO CAMPGROUND— Same as Alternative 2 except there would be no expansion of Nāmakanipaio Campground to include additional indoor lodging facilities.

KA'Ū FOOTPRINTS AREA AND KA'Ū DESERT

Similar to Alternative 2, a DCP would be developed to address issues and needs for interpretation of the Ka'ū Footprints and the Ka'ū Desert area; however, the park would focus on improvements within the current capacity of the area rather than expanding access.

'ŌLA'A

Same as Alternative 2.

ʻŌLAʻA SMALL TRACT— Similar to Alternative 2, the park would coordinate with the county to formalize a turnout for parking on Wright Road for two to three cars (current capacity) or for shuttle or guided access.

The park would provide additional public access by developing a trail that would be a flagged route for guided access only, and possibly fee interpretation. A flagged route could be moved as needed and limiting recreation to guided access only would help ensure hikers stay on the appropriate route. Group size limits for trail use would be determined similar to Alternative 2.

To increase off-site interpretation opportunities and educational group use of the ʻŌlaʻa rainforest, the park would explore partnership opportunities to create new joint interpretive media with adjacent land managers such as the Puʻu Makaʻala Natural Area Reserve managed by and co-member with the park in the Three Mountain Alliance watershed partnership.

Park staff would work to engage other partners in forest restoration and maintenance in ʻŌlaʻa.

ʻŌLAʻA LARGE TRACT— Same as Alternative 1.

KAHUKU UNIT

Similar to Alternative 2, park management activities in Kahuku would continue to concentrate on protecting and recovering native species, including special status species, and ecosystems, controlling invasive nonnative plants and animals, developing interpretive programs, and conducting surveys and inventories of cultural resources. Restoration activities would continue to include construction of boundary and internal fences to exclude nonnative ungulates, consistent with the park's *Final Plan / EIS for Protecting and Restoring Native Ecosystems by Managing Nonnative Ungulates* (2013).

Alternative 3 would also provide additional recreation opportunities in Kahuku, such as trails, camping, and interpretive and educational programs; however, the emphasis would be on a more primitive recreational experience with dispersed recreation and minimal facilities. Opportunities and programs would place additional emphasis on science, stewardship and service-learning and focus more heavily on coordinated group activities.

KAHUKU ENTRANCE— Same as Alternative 2, except the park would not create a parking area and trailhead off the Old Māmalahoa Highway.

LOWER KAHUKU— For the purposes of this GMP/WS/EIS, lower Kahuku is defined as the acreage below a line that is 100 meters above the upper-most road in the paddock system (see *Figure 1.5. Existing Conditions, Kahuku*). Lower Kahuku extends down the Southwest Rift Zone of Mauna Loa from this line to Highway 11.

The park would develop a DCP for the lower Kahuku area to create a design that provides visitors with a sense of arrival in Kahuku as well as general orientation and information. The DCP would provide detailed guidance on how best to implement the recommendations of the general management plan, including adaptively reusing existing buildings for specific uses, and would determine the numbers and locations of campgrounds, picnic areas, and trails consistent with the overall vision for this alternative.

DEVELOPED AREA AND USE OF EXISTING BUILDINGS

Adaptively reuse buildings and maintain visitor contact station with a small amphitheater in lower Kahuku, similar to Alternative 2.

RECREATION ACTIVITIES AND VISITOR OPPORTUNITIES

Same as Alternative 2, except there would be no commercially guided access for recreation in this alternative.

Road Access: Same as Alternative 2.

Trails and Trailheads: Same as Alternative 2.

Campgrounds: Facilities and infrastructure to support overnight camping would consist of primitive and dispersed campsites with minimal services rather than campgrounds.

Bicycling: Same as Alternative 2.

Equestrian Use: Same as Alternative 2, except no commercial use would be permitted.

UPPER KAHUKU— For the purposes of this GMP/WS/EIS, upper Kahuku is defined as the acreage above a line that is 100 meters above the upper-most road in the paddock system. Upper Kahuku extends up the Southwest Rift Zone of Mauna Loa (see *Figure 1.5. Existing Conditions, Kahuku*).

Upper Kahuku would be managed the same as Alternative 2. The park would manage upper Kahuku for its wilderness characteristics based on its determination of eligibility for inclusion in the national wilderness preservation system. Management of upper Kahuku would emphasize restoring native ecosystems and recovering biological diversity of native species based on best available science. Recreational access in upper Kahuku would be permitted and visitor opportunities such as hiking and camping would be managed consistent with a wilderness experience.

NPS vehicular access for administrative use and emergencies would be allowed on existing roads outside of eligible wilderness. These roads would be maintained to the minimum standard required to support administrative and emergency use.

RECREATIONAL ACTIVITIES AND VISITOR OPPORTUNITIES
Same as Alternative 2.

Campgrounds: Same as Alternative 2, except no campground would be developed in the proximity of the existing cabins.

Trails and Trailheads: Same as Alternative 2.

Boundary Modifications

Same as Alternative 2.

Program-Specific Management Guidance

The following section presents an overview of the management strategies for program areas at Hawai‘i Volcanoes National Park.

Although, for the sake of discussion, this plan separates resource protection into discrete categories of natural and cultural resources, these resources are inextricably integrated, particularly within Native Hawaiian understanding. In Hawaiian culture, the land or ‘āina is sacred. The natural and cultural worlds are intricately bound together and the spiritual world is not separate from the secular at Hawai‘i Volcanoes National Park. For example, volcanic activity is a part of geological processes and history, but Kīlauea is also home to Pelehonuamea or Pele, the volcano goddess, and her family. Observed in the lava flows and other natural phenomena associated with volcanic activity, Pele and her family continue to be a presence in Native Hawaiians’ lives both physically and spiritually.

NATURAL RESOURCES

Same as Alternative 2; however, the park would maximize opportunities for volunteerism, stewardship, service-learning, and citizen science as a major component of natural resources management.

Also, the park natural resources staff would maximize efforts to work with interpretive and education programs to showcase specific areas, such as special ecological areas, as living laboratories for experimental restoration and research and expand efforts to engage visitors in restoration activities and projects.

CULTURAL RESOURCES

Same as Alternative 1, plus the park would emphasize surveys (including oral history and interviews), research, and stewardship opportunities to foster long-lasting connections to the park’s cultural resources. Similar to Alternative 2, the park would also emphasize and expand research, scientific investigation, and learning opportunities to enhance cultural resources protection.

Additional emphasis would be placed on providing opportunities for visitors to engage in the research, scientific investigation, and projects associated with cultural resources management.

The park cultural resources staff would expand efforts to work with interpretation and education in order to broaden messages used in visitor programs about the sacredness of the park and aloha ʻāina (love of the land) to Native Hawaiians and emphasize the interconnectedness and interdependency between the natural and cultural environments. This expanded education and interpretation would enhance and strengthen cultural resources protection in the park.

Management of cultural resources including archeological resources, cultural landscapes, historic structures, and museum collections would be the same as Alternative 2.

RESEARCH

Same as Alternative 2, plus the park would expand opportunities for citizen science as part of the research program. Additional emphasis would be placed on finding new ways for visitors to participate in research activities, such as data collection, to improve understanding of the environment and engage in hands-on resource stewardship.

WILDERNESS

Same as Alternative 2.

SOUNDSCAPES AND ACOUSTIC ENVIRONMENT

Same as Alternative 2.

VISITOR EXPERIENCE

Same as Alternative 1. In addition, the park would enhance the visitor experience by expanding the capacity of existing sites (while limiting new development) and providing unique hands-on learning and stewardship opportunities for visitors that stretch from mauka to makai.

In addition to education, the park would consider managing general park congestion with a mandatory shuttle around Crater Rim Drive, in addition to a suite of other tools to disperse visitors and traffic. (See "Site-Specific Management Guidance" for more detailed guidance.)

The park would set the expectation for visitors in the park that eruptive events would likely be linked with congested areas in the park. Experience at Hawaiʻi Volcanoes National Park has proved that the public has tolerance for greater levels of congestion during these events, however management of congestion during eruption events could be improved with earlier messaging about conditions.

Same as Alternative 2, the park would also develop an accessibility plan to identify and evaluate opportunities throughout the park to improve accessibility.

RANGE OF RECREATIONAL ACTIVITIES— Similar to Alternative 2, however access to new and particularly sensitive areas would primarily focus on ranger-guided tours, and any expanded recreational uses would emphasize opportunities and amenities for larger educational and stewardship groups.

TRAILS: HIKING, BIKING AND EQUESTRIAN USE— Under Alternative 3, a trail management plan would be created to comprehensively assess trail conditions and needs and to identify specific trail alignments and uses, such as hiking, biking, and equestrian use. Development of any new trail alignments would be primarily along historic alignments and traditional routes, or on existing roads, such as at Kahuku. Any new trail development would work with existing trails, historic trails, turnouts, and waysides to connect key features or park sites, improve the visitor experience, and limit any new development.

In the main part of the park, hiking and biking opportunities would be enhanced in order to create a trail network to accommodate, within existing capacities, bicycle, equestrian, and pedestrian use and improve connection to other trails and other visitor facilities within and outside of park boundaries. Few new trails would be created, but existing trails would be upgraded.

In some areas of the park, such as Hilina Pali or Mauna Loa, roads could be closed to private day use vehicles during certain times of day/days of week to provide a more enjoyable and less congested experience for recreationists such as hikers, backpackers, bikers, and equestrian users.

CAMPING—
FRONTCOUNTRY CAMPING
Frontcountry camping in the main area of the park would be the same as Alternative 1. Additional general public camping would be provided at Kahuku. In addition, any additional, future frontcountry camping in the main park would be considered in relationship to outdoor education pavilions that have been sited based on ecological themes and would be targeted to educational groups rather than increased general public camping.

BACKCOUNTRY CAMPING
Same as Alternative 1, plus additional backcountry camping would be available at Kahuku.

Interpretation and Education— The park would develop a comprehensive interpretive plan, the same as Alternative 2.

PROGRAMS
Same as Alternative 1, plus interpretation methods, while diverse in nature, would focus on ranger-led experiences and live programs to immerse visitors in the volcanic, biologic, and cultural resources at Hawai'i Volcanoes National Park. These live programs would provide additional opportunities to learn from Native Hawaiians and/or cultural practitioners.

New, additional interpretive programs would also focus on providing hands-on educational experiences for school, volunteer, and other organized groups in the front country (in Kahuku). Stewardship activities would be a key element in these programs engaging visitors in research, learning, science and educational programs and facilities. In addition, park staff would engage visitors in research and citizen science.

Kahuku would be integrated into the park's comprehensive interpretive plan. The plan would address key stories that should be interpreted at Kahuku, such as the Southwest Rift of Mauna Loa and five recent eruptions, the story of refugia and restoration, ranching and the paniolo lifestyle, Pu'u Akihi - a Special Ecological Area, and how land affects people and people affect the land, Kahuku in the context of climate change, and the ahupua'a (Native Hawaiian land management) system. Instead of ranger-led, visitor interpretation in Kahuku would primarily be self-guided, independent, and full of discovery, with interpretive trails and waysides for the general public.

This alternative would emphasize hands-on stewardship where visitors can lend a hand to help restoration activities at the park. Additional emphasis would also be placed on engaging educational groups and service groups in Alternative 3 and the program would work with natural resources staff to showcase specific areas (such as special ecological areas) for restoration and research.

INTERPRETIVE AND EDUCATIONAL FACILITIES
Similar to Alternative 2 except the park would not expand the uses of Jaggar Museum and Kīlauea Visitor Center. The park would provide opportunities for outdoor education and inquiry-based learning that stretches from mauka to makai with a series of small, covered pavilions at key locations similar to Alternative 2.

COMMERCIAL SERVICES

Same as Alternative 2, except the concession operation at Nāmakanipaio campground would not be expanded to include additional indoor lodging facilities.

ADMINISTRATIVE FACILITIES AND INFRASTRUCTURE

Same as Alternative 2.

TRANSPORTATION AND ACCESS

Under Alternative 3, park roads would be maintained similar to Alternative 1.

Following the completion of the hydrogen shuttle pilot project, the park would explore the feasibility of implementing a mandatory shuttle system on Crater Rim Drive, and potentially to other locations in the park, to reduce private vehicle traffic and congestion.

The park would improve bicycle access on roads by considering limits on private vehicles (see "Site-Specific Management Guidance" above for examples).

Alternative 3 would minimize any expansion or development of new parking. Some parking areas could also be reduced or removed for resource concerns.

No construction of new roads is envisioned. Roads impacted by volcanic or seismic activity or other natural events would be reevaluated for reopening to vehicle traffic and could be converted to trails.

PARTNERSHIPS

Same as Alternative 2.

CLIMATE CHANGE AND SUSTAINABILITY

Same as Alternative 2.

Operations

ESTIMATED COSTS

Cost estimates for Alternative 3 are identified on *Table 3.7. Alternative 3: Summary of Costs*. Costs shown are not intended for budgeting purposes; instead they are used to show a relative comparison of costs among the alternatives. Implementation of the approved plan will depend on future funding, and approval of a general management plan does not guarantee that funding and staffing needed to implement the plan would be forthcoming. Full implementation of the plan may take many years. The National Park Service will also evaluate proposed facility investments prior to project approvals using the best scientific information available related to climate change and other possible scenarios to ensure the long-term sustainability of these investments. Due to potential vulnerabilities of some of the park's facilities, it is feasible that the National Park Service may conclude that such financial investments for facilities would be unwise and that other options would be considered or potentially the project would not be pursued or implemented.

These costs are in 2012 dollars and are based upon general "Class C" estimates for site development and construction and are referred to as conceptual estimates by the design and construction industry. They are general in nature and representative of a broad based vision rather than focused on specific details. Prior to submitting funding requests for the design and construction phases, "Class B" estimates are required, based upon detailed site and facility designs. "Class A" estimates would be prepared from completed construction documents.

ONE-TIME COSTS— Alternative 3 one-time costs would consist of the rehabilitation of facilities and infrastructure. Similar to Alternative 2, a large portion of the costs in the main part of the park would be to renovate the Ohia Wing as a cultural museum/administrative offices. At Kahuku, the majority of costs would be to rehabilitate the road from the entrance to Upper Glover for two-wheel-drive access at Kahuku.

Resource management costs for Alternative 3 would be primarily for fencing with significant investments to exclude ungulates from Kahuku and the wilderness area at ʻŌlaʻa.

Costs for new construction in Alternative 3 focus on installation of educational pavilions, waysides, and new trail segments or linkages in the main portion of the park. At Kahuku, new construction would include primitive campsites, an educational pavilion, wayside exhibits, and a small amphitheater associated with the visitor contact station.

Transportation costs for Alternative 3 focus on continuing and expanding the shuttle system around the rim and to evaluating the feasibility of a shuttle system at Kahuku.

Projects in the alternatives are identified as either Priority 1 or Priority 2. Priority 1 projects include projects that emphasize

resource protection, threats, and visitor safety. Priority 2 projects which are less urgent include all other projects important to the full implementation of the alternative, including those that address visitor opportunities and experiences such as enhanced facilities, as funding allows and could be sustained. For the Priority 1 projects, the renovation of the Ohia Wing is expected to take many years so it may be phased after implementation of other Priority 1 projects. At Kahuku, the most pressing Priority 1 projects would be construction and rehabilitation of fencing for animal control. The least important Priority 2 project would be the evaluation of the development of a shuttle system for visitor access at Kahuku.

Deferred maintenance is maintenance and repair activities that were not performed when they should have been or were scheduled to be and which, therefore, are put off or delayed for a future period. Maintenance and repairs are activities directed toward keeping fixed assets in an acceptable condition. Total costs for deferred maintenance offset in Alternative 3 are listed in Table 3.7. A fully staffed maintenance division as presented in this alternative would also assist the park in addressing the amount of deferred maintenance.

STAFFING

Implementation of Alternative 3 would require additional staffing for increased natural resources restoration efforts, additional cultural resources program needs, new interpretive and educational programs, and additional maintenance, law enforcement, and administrative needs.

Proposed staffing in Alternative 3 would require 46 new FTEs (one person working 40 hours per week for one year, or the equivalent). These new FTEs would include an additional 13 FTE for additional resources management and restoration activities, six positions for interpretation and education to address additional and new interpretation at Kahuku and expanded education throughout the park, 12 positions for facilities and maintenance, five additional positions for visitor protection, nine positions for Kahuku operations seven days a week, and one new administrative and management position.

The staffing table does not include seasonal staffing, which would vary depending on specific project

ANNUAL OPERATING COSTS— Annual operating costs are the total costs per year for maintenance and operations associated with Alternative 3, including utilities, supplies, staff salaries and benefits, leasing, and other materials. Costs and staffing estimates assume that the alternative is fully implemented as described in the narrative. The park's annual operating budget for fiscal year 2014 was $7,281,000. Full implementation of Alternative 3 would include filling vacant positions and filling an additional 46 FTE ($3,034,000). Additional operations and maintenance costs related to capital investments would be $372,000. Total operating costs for Alternative 3 would be $10,687,000.

FTE salaries and benefits are included in the annual operating costs.

Table 3.6. Alternative 3: Staffing

Park Management Division	FTE
Administrative and Management	27 + 10 new
Natural and Cultural Resource Management	29 + 13 new
Interpretation and Education	12 + 6 new
Facilities and Maintenance	28 + 12 new
Visitor Protection/Fire	26 + 5 new
Vacant positions	21
Total New Positions	**46**
Total Positions	**189**
Total Staffing Costs	**$10,687,000**

Table 3.7. Alternative 3: Summary of Costs

Description of Cost	Estimated Summary of Costs
ANNUAL OPERATIONAL COSTS	
Existing Annual Operational Costs	$7,281,000
Additional Staffing Costs (+46 FTE)*	$3,034,000
Additional Operations & Maintenance Costs Related to Capital Investments	$372,000
Total Annual Operational Costs	**$10,687,000**
ONE-TIME CAPITAL COSTS	
Program Support	
Priority 1 Projects**	$828,000
Priority 2 Projects	$0
Facility Rehabilitation	
Priority 1 Projects	$13,173,000
Priority 2 Projects	$1,010,000
Natural Resource Management	
Priority 1 Projects	$6,763,000
Priority 2 Projects	$0
Cultural Resource Management	
Priority 1 Projects	$10,474,000
Priority 2 Projects	$70,000
New Construction	
Priority 1 Projects	$856,000
Priority 2 Projects	$2,667,000
Transportation	
Priority 1 Projects	$590,000
Priority 2 Projects	$740,000
Total Priority 1 Projects	**$32,684,000** (Kahuku costs are $14,029,000 of this total)
Total Priority 2 Projects	**$4,487,000** (Kahuku costs are $2,452,000 of this total)
Total One-time Costs	**$37,171,000** (Kahuku costs are $16,481,000 of this total)
Deferred Maintenance Offset	**$21,823,000**

* The current staffing level is below the authorized level of 143 FTE; the additional staffing level would add 57.5 FTE to the authorized level of 143. The new staffing level would be 200.5 FTE.

** Priority 1 projects include projects that emphasize resource protection, threats, and visitor safety. Priority 2 projects include all other projects important to the full implementation of the alternative, including those that address visitor opportunities and experiences such as enhanced facilities as funding allows and could be sustained. Costs are in 2012 dollars.

USER CAPACITY

Overview of Visitor Use Management and Visitor Capacity

General management plans for national park system units, including Hawai‘i Volcanoes National Park, must address visitor use management and visitor capacity. Managing visitor use in national park units is inherently complex and depends not only on the number of visitors, but also on where the visitors go, what they do, and the "footprints" they leave behind. The National Park Service defines visitor use management as the proactive and adaptive process of planning for and managing characteristics of visitor use and the physical, social, and managerial setting through a variety of strategies and tools to sustain desired resource conditions and visitor experiences. Visitor use characteristics may include amount, type, timing, and distribution of visitor use, including activities and behaviors. In short, visitor use management strives to maximize the benefits of visitor use while meeting resource and experiential protection goals. This planning and management process provides the framework within which visitor capacity should be addressed. As part of the visitor use management process, visitor capacity is the maximum amount and type of visitor use that an area can accommodate while sustaining desired resource conditions and visitor experiences consistent with the values for which the area was established. In managing for visitor use, Hawai‘i Volcanoes National Park staff and partners rely on a variety of management tools and strategies rather than relying solely on regulating the number of people in the park. In addition, the ever-changing nature of visitor use requires a deliberate and adaptive approach to visitor use management.

The foundations for making visitor use management decisions in this general management plan are the purpose, significance, special mandates, and management zones associated with the park. The purpose, significance, and special mandates define why the park was established and identify the most important resources, values, and visitor opportunities that would be protected and provided. The management zones in each action alternative describe the desired resource conditions and visitor experiences, including appropriate types of activities and general use levels, for different locations throughout the park. The zones, as applied in the alternatives, are consistent with, and help the NPS achieve, its specific purpose, significance, and special mandates. As part of the NPS commitment to implement visitor use management, the park staff would abide by these directives for guiding the types and levels of visitor use that would be accommodated while sustaining the quality of park resources and visitor experiences consistent with the purposes of Hawai‘i Volcanoes National Park.

In addition to these important directives, this GMP/WS/EIS includes indicators and standards for Hawai‘i Volcanoes National Park. Indicators are measurable variables that would be monitored to track changes in resource conditions and visitor experiences. Standards represent the minimum acceptable conditions for those indicator variables. The indicators and standards are important feedback mechanisms that help the National Park Service make decisions about managing all aspects of visitor use to ensure that desired conditions are being attained and that the park's legislative and policy mandates are being fulfilled. The general management plan also identifies the types of management actions that would be taken to achieve desired conditions and related legislative and policy mandates.

Appendix G: User Capacity Indicators and Standards includes the indicators, standards, and potential future management and monitoring strategies, allocated by management zones, which would be implemented as a result of this planning effort. The planning team considered many potential issues and related indicators that would identify impacts of concern, but those described below were considered the most significant, given the importance

and vulnerability of the resource or visitor experience affected by visitor use. The planning team also reviewed the experiences of other parks with similar issues to help identify meaningful indicators. Standards that represent the minimum acceptable condition for each indicator were then assigned, taking into consideration the qualitative descriptions of the desired conditions, data on existing conditions, relevant research studies, staff management experience, and scoping on public preferences.

Some of the indicators and standards are more directly tied to helping NPS address visitor capacity. These indicators include crowding, parking issues, and traffic congestion. These indicators and standards directly inform management of the kinds and amounts of use that can be accommodated in different areas of the park while maintaining desired conditions. Further guidance for addressing visitor capacity would be found in subsequent implementation level plans that have a significant visitor use management component. These types of plans may be informed by the proposed/planned traffic study, which would provide baseline data for acceptable levels of traffic flow, and potentially would provide additional management strategies that could be implemented to achieve acceptable levels. Visitor use management is a form of adaptive management (see *Figure 3.8. User Capacity Framework*) in that it is an iterative process in which management decisions are continuously informed and improved. Indicators are monitored, and adjustments are made as appropriate. As monitoring of conditions continues, managers may decide to modify or add indicators if better ways are found to measure important changes in resource and social conditions. Monitoring indicators helps National Park Service determine the most effective way to manage kinds and amounts of visitor use in order to attain desired visitor experience and resource conditions. Frequency of monitoring may vary depending on the availability of funds. Information on the NPS monitoring efforts, related visitor use management actions, and any changes to the indicators and standards would be available to the public through the most appropriate and effective outreach method chosen by the park. It should be noted that revisions to indicators and standards would potentially be subject to compliance with NEPA, NHPA, and other laws, regulations, and policies.

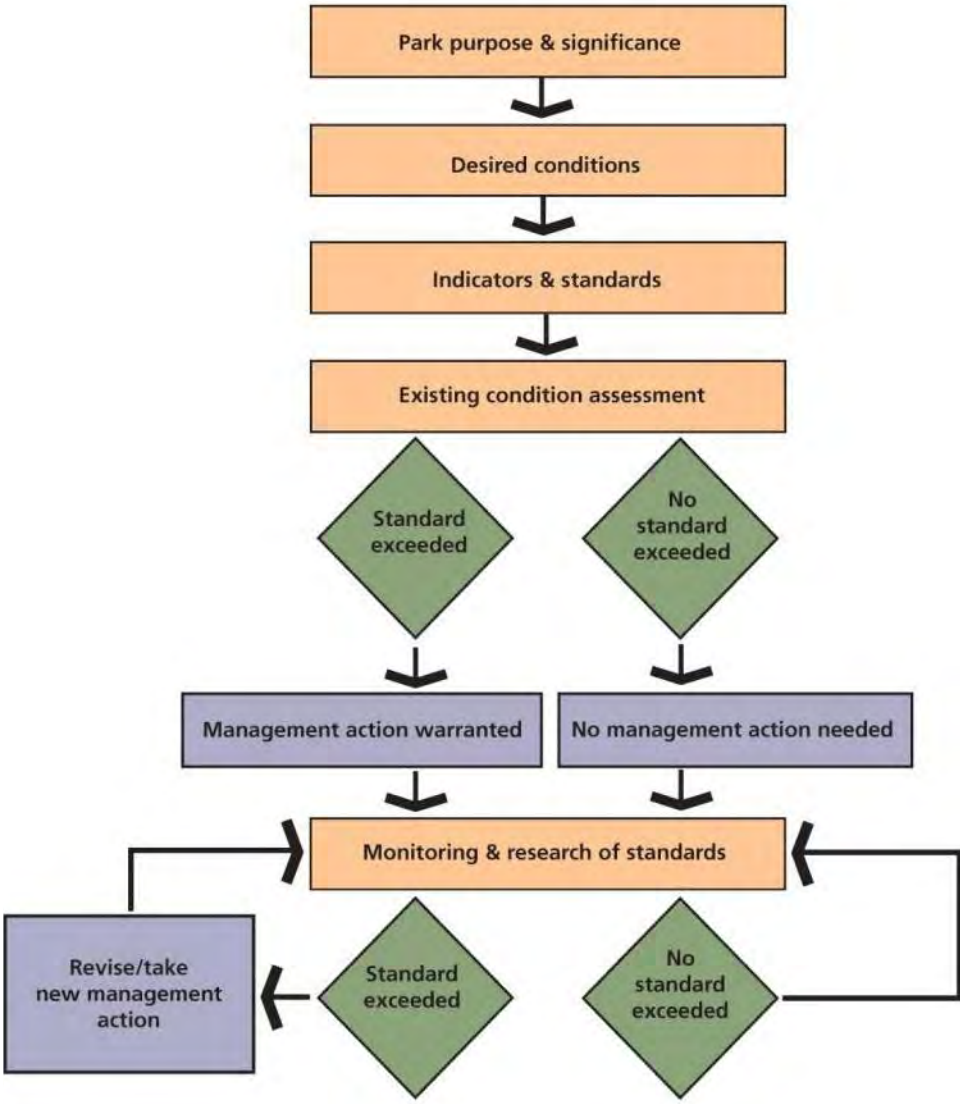
Indicators and Standards

The priority indicators for Hawai‘i Volcanoes National Park are associated with the following issues:

- informal trails
- invasive plant and animal species
- incidences of human-wildlife interactions (threatened or endangered species)
- damage or theft of threatened or endangered plant and animal species
- damage or loss of geologic resources
- campsite conditions
- fire risk
- artificial light
- damage to archeological sites
- lack of understanding of Native Hawaiian culture
- visitors impacting access for cultural practitioners
- soundscapes
- crowding
- trail-based user conflicts
- parking and traffic congestion

A table detailing the specific indicators, standards, management strategies and monitoring strategies appears in *Appendix G: User Capacity Indicators and Standards*.

Figure 3.8. User Capacity Framework



MITIGATION MEASURES COMMON TO ALL ALTERNATIVES

Mitigation measures are the practicable and appropriate methods that would be used under any alternative to avoid and/or minimize harm to natural and cultural resources, wilderness, visitors and the visitor experience, and socioeconomic resources when no other management alternative exists (such as avoidance). These mitigation measures have been developed using existing laws and regulations, best management practices, conservation measures, and other known techniques from past and present work in and around Hawai'i Volcanoes National Park.

This general management plan provides a management framework for Hawai'i Volcanoes National Park. Within this broad context, the alternatives include the following measures that may be used to minimize potential impacts from the implementation of the alternatives. These measures would be applied to all alternatives, subject to funding and staffing levels. Additional mitigation would be identified as part of implementation planning and for individual projects to further minimize resource impacts.

Cultural Resources

The National Park Service would preserve and protect, to the greatest extent possible, resources that reflect human occupation of Hawai'i Volcanoes National Park. Specific mitigation measures include the following:

- Adverse impacts on historic properties listed in, determined eligible for listing in, or not yet assessed for eligibility to the National Register of Historic Places would be avoided, if possible. If adverse impacts could not be avoided, an assessment of effect and a treatment plan, if necessary, would be developed through a consultation process with all interested parties. In accordance with NPS Management Policies 2006, proposed adverse effects would be assessed to determine whether the proposed actions constitute impairment of significant fundamental cultural resources.
- Continue to develop inventories for and oversee research about archeological, historic, and ethnographic resources to better understand and manage the resources, including historic cultural and ethnographic landscapes.
- Conduct any needed archeological or other resource-specific surveys, national register evaluations, and identify recommended treatments.
- Incorporate the results of these efforts into site-specific planning and compliance documents.
- Continue to manage cultural resources and collections following federal regulations and the National Park Service guidelines.
- Inventory the park's collection and keep in a manner that would meet NPS curatorial standards.
- In accordance with NPS Management Policies 2006, cultural resources that have been included in wilderness would be protected and maintained according to the pertinent laws and policies governing cultural resources, using management methods that are consistent with the preservation of wilderness character and values such as the Organic Act, the National Historic Preservation Act, the Archeological Resources Protection Act, the American Indian Religious Freedom Act, the Native American Graves Protection and Repatriation Act, and Executive Order 13007 that addresses government-to-government consultation.

ARCHEOLOGICAL RESOURCES

- Archeological surveys would precede ground disturbance required for new construction or removal of eligible historic properties.
- Known archeological resources would be avoided to the greatest extent possible. If national register listed, eligible, or unassessed archeological resources could not be avoided, an appropriate treatment plan would be developed in consultation with the Hawai'i State Historic Preservation Officer, Advisory Council on Historic Preservation, and associated Native Hawaiian groups.
- Conduct archeological site monitoring and routine protection.
- Conduct data recovery excavations at archeological sites threatened with destruction, where protection or site avoidance during design and construction is infeasible.
- If previously unknown archeological resources are discovered during project work, NPS cultural resources staff would be immediately informed, work in the immediate vicinity of the discovery would be halted and the location secured until the resources are identified, evaluated, and documented and an appropriate treatment plan is developed, if necessary, in consultation with the Hawai'i State Historic Preservation Officer and associated Native Hawaiian groups.
- Encourage visitors through the park's interpretive programs to respect and leave undisturbed any inadvertently encountered archeological resources and respect and leave undisturbed any offerings placed by Native Hawaiians.

HISTORIC BUILDINGS AND STRUCTURES

All project work relating to historic structures/buildings would be conducted in accordance with Director's Order 28 and the guidelines and recommendations of the *Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for Preserving, Rehabilitating, Restoring and Reconstructing Historic Buildings*. Typical mitigation measures for historic buildings include:

- Rehabilitate and adaptively reuse structures wherever feasible.
- Design any new development to be compatible with surrounding historic properties
- Screen new development from surrounding historic resources to minimize impacts on viewsheds, cultural landscapes, and ethnographic resources.
- Historic structures would be maintained or stabilized until appropriate preservation maintenance could be undertaken. Benign neglect would not be considered an appropriate management strategy.
- No national register listed or eligible structure would be removed or allowed to decay naturally without prior review by park and region cultural resource specialists, including approval by the NPS regional director and consultation with the Hawai'i State Historic Preservation Officer. Before a national register listed or eligible structure is removed, appropriate documentation recording the structure would be prepared in accordance with Section 110(b) of the National Historic Preservation Act, and the documentation would be submitted to the Historic American Buildings Survey (HABS)/Historic American Engineering Record (HAER) or Historic American Landscape Survey (HALS) program, if deemed appropriate.

- Historic structures that are within designated wilderness areas would be protected and maintained according to the pertinent laws and policies governing cultural resources using management methods that are consistent with the preservation of wilderness character and values. Laws pertaining to historic preservation remain applicable within wilderness but must generally be administered to preserve the area's wilderness character. Consultation of treatment would include appropriate consideration of the application of the provisions of the Wilderness Act in analyses and decision-making concerning cultural resources.

CULTURAL LANDSCAPES

All project work relating to cultural landscapes would be conducted in accordance with Director's Order 28 and the guidelines and recommendations of the *Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for the Treatment of Cultural Landscapes*. Typical mitigation measures for cultural landscapes include:

- Design new development to be compatible with surrounding historic properties.
- Screen new development from surrounding cultural landscapes to minimize impacts on those landscapes and viewsheds.

ETHNOGRAPHIC RESOURCES

The National Park Service would protect sensitive traditional use areas to the extent feasible by avoiding or mitigating impacts on ethnographic resources and continuing to provide access to traditional use and spiritual areas. Mitigation strategies include:

- Continue to consult with Native Hawaiian groups to identify ethnographic resources and develop appropriate strategies to mitigate impacts on these resources.
- Continue to provide access to traditional use or spiritual areas
- Screen new development from traditional use areas to minimize impacts on ethnographic resources.
- Consult with Native Hawaiians linked by ties of kinship, culture, or history to park lands to address any inadvertent discovery of human remains, funerary objects, sacred objects, or objects of cultural patrimony.
- Follow all provisions outlined in the Native American Graves Protection and Repatriation Act of 1990.

MUSEUM COLLECTIONS

- Conserve all collections through proper storage, handling, and exhibit of objects as specified in the NPS *Museum Handbook* and NPS Director's Order 24, "NPS Museum Collections Management". This would include artifacts used in exhibits in the visitor centers.

Natural Resources

AIR QUALITY

- Implement a dust abatement program including the following potential actions: water or otherwise stabilize soils, cover haul trucks, employ speed limits on unpaved roads, minimize vegetation clearing, and revegetate with native species.
- Minimize NPS vehicle emissions by using the best available technology whenever possible.
- Encourage the public and commercial tour companies to employ methods that reduce emissions.
- Employ sustainable designs that reduce energy demands, thus reducing pollutant production.

SOUNDSCAPES AND THE ACOUSTIC ENVIRONMENT

- Implement standard noise abatement measures during NPS operations, including: scheduling to minimize impacts in noise-sensitive areas, using the best available noise control techniques wherever feasible, using hand tools or hydraulically or electrically powered impact tools when feasible, and locating stationary noise sources as far from sensitive areas as possible.
- Site and design facilities to minimize objectionable noise.
- Minimize idling of motors when power tools, equipment, and vehicles are not in use.
- Muffle above ambient noise whenever possible to reduce noise impacts.

LIGHTSCAPES AND NIGHT SKIES

- Light only where and when it is needed.
- Shield lights and direct them downward.
- Use minimum amount of light necessary.
- Consider alternatives to the use of artificial lighting such as reflective surface walkways, reflective signage, or guidance to use hand held lighting devices.
- Replace existing outdoor lighting with fixtures that do not contribute to nighttime light pollution.
- Install energy-efficient lights equipped with timers and/or motion detectors so that light would only be provided when it is needed to move safely between locations.
- Use low-impact lighting, such as diffused light bulbs, and techniques such as downlighting in outdoor fixtures, to prevent light spill and preserve the natural lightscape and avoid light pollution. Select lamps with warmer colors (less blue light).
- Limit use of personal lighting (flashlights) when required for safe movement and work and/or modified (such as using red or blue light bulbs as opposed to white) to protect wildlife.

SOILS

- Build new facilities on soils suitable for development. Minimize soil erosion by limiting the time that soil is left exposed and by applying erosion control measures, such as erosion matting, silt fencing, and sedimentation basins in construction areas to reduce erosion, surface scouring, and discharge to water bodies. Once work was completed, revegetate construction areas with native plants in a timely period.
- Place construction equipment in previously disturbed areas.
- Locate trails on soils with low erosion hazards and small changes in slope and develop proper signs to minimize social trails to the extent possible.
- Ensure proper drainage of parking areas.

WATER RESOURCES

- To prevent water pollution during construction, use erosion control measures, minimize discharge to water bodies and washes, and regularly inspect construction equipment for leaks of petroleum and other chemicals.
- Build a runoff containment filtration system to minimize water pollution from larger parking areas.
- Parking area designs should include ways to minimize damage from runoff. Parking areas could include detention basins, runoff filtration, and/or could be sited away from drainage.

VEGETATION

- Monitor areas used by visitors (e.g., trails and campsites) for signs of native vegetation disturbance. Use public education, revegetation of disturbed areas with native plants,

erosion control measures, and barriers to control potential impacts on plants from erosion or social trails.

- Avoid impacts by relocating project sites when possible.
- Develop revegetation plans for disturbed areas and require the use of genetically appropriate native species. Revegetation plans should specify species to be used, seed/plant source, seed/plant mixes, site-specific restoration conditions, soil preparation, erosion control, and ongoing maintenance and monitoring requirements, etc. Salvaged vegetation should be used to the extent possible.
- Survey for rare plants prior to any ground-disturbing activities; disturbance to rare or unique vegetation would be avoided to the greatest extent possible. Consult with the USFWS for projects where listed species and their habitats occur.
- Implement an invasive, nonnative plant management program. Standard measures could include the following elements: use only weed-free materials for road and trail construction, repair, and maintenance; ensure equipment arrives on-site free of mud or seed-bearing material; certify all seeds and straw material as weed-free; identify areas of invasive plants pre-project; monitor and treat invasive plants or invasive plant topsoil before construction (e.g., topsoil segregation, storage, herbicide treatment); when depositing ditch spoils along the roads, limit the movement of material to as close as possible to the excavation-site; scrupulously and regularly monitor and clean areas that serve as introduction points for invasive plants (campgrounds, staging areas, maintenance areas, and corrals); revegetate with genetically appropriate native species; inspect rock and gravel sources to ensure these areas are free of invasive plant species; and monitor locations of ground-disturbing operations followed by appropriate invasive plant control actions for at least three years following the completion of projects.

WILDLIFE

- Employ techniques to reduce or avoid impacts to fish and wildlife, including visitor education programs, restrictions on visitor and NPS activities, and law enforcement patrols.
- Implement a wildlife protection program. Standard measures would include project scheduling (season and/or time-of-day), project monitoring, biological monitoring, erosion and sediment control, fencing or other means to protect sensitive resources adjacent to project areas, disposing of all food-related items or rubbish, salvaging topsoil, and revegetating. This could include specific construction monitoring by resource specialists as well as treatment and reporting procedures. Consider relocation of facilities to avoid impacts, temporary closures, and group size limits to mitigate impacts. Also include management of artificial light and sound to avoid adverse impacts to wildlife (since not discussed under those topics with regards to wildlife need to mention this here).

SPECIAL STATUS SPECIES

Mitigation actions would occur during normal park operations as well as before, during, and after construction to minimize immediate and long-term impacts on rare, threatened, and endangered species and their habitat. These actions would vary by specific project and area of the national park affected, and additional mitigations would be added depending on the specific action and location. Many of the measures listed above for vegetation and wildlife would also benefit rare, threatened,

and endangered species by helping to preserve habitat including designated critical habitat. Further mitigation efforts the National Park Service would perform include the following:

- Conduct surveys for rare, threatened, and endangered species as warranted.
- Locate and design facilities/actions to avoid adverse effects on rare, threatened, and endangered species and their habitat. If avoidance is infeasible, minimize and compensate for adverse effects on rare, threatened, and endangered species as appropriate and in consultation with the appropriate resource agencies. Conduct work outside of critical periods for the specific species.
- Develop and implement restoration and/or monitoring plans as warranted. Plans should include methods for implementation, performance standards, monitoring criteria, and adaptive management techniques.
- Implement measures to reduce adverse effects of nonnative plants and wildlife on rare, threatened, and endangered species and their habitat.
- Carry out surveys and monitoring for special status species.
- Protect and preserve critical habitat features, such as nest trees and key host plants, whenever possible.

Management and Protection of Wilderness Values

- Develop specific desired conditions in the park's future wilderness stewardship plan for wilderness resources, visitor experiences, and management protocols.
- Develop standards and guidelines establishing acceptable limits of change and mitigation measures for wilderness within a future wilderness stewardship plan.
- Conduct monitoring to ensure that conditions are meeting established standards and to determine if mitigation measures have been successful.
- Apply the minimum requirement process to all proposed management actions that might affect wilderness and potential wilderness in order to develop, evaluate, and select the actions that would be the least intrusive on wilderness character and values, while allowing necessary administration of the wilderness.

Scenic Resources

- Where appropriate, use facilities such as boardwalks and fences to route people away from sensitive natural and cultural resources while still permitting access to important viewpoints.
- Design, site, and construct facilities to minimize adverse effects on natural and cultural resources and visual intrusion.
- Provide vegetative screening, where appropriate.
- Implement vegetation management that could include selective clearing to manage or improve important viewpoints and viewsheds while minimizing impacts to native vegetation and wildlife habitat.

Socioeconomic Environment

- During the future planning and implementation of the approved management plan for Hawai'i Volcanoes National Park, the National Park Service would pursue partnerships with Native Hawaiian organizations, local communities, and county governments to further identify potential impacts and mitigating measures that would best serve the interests and concerns of both the National Park Service and the local communities.

Sustainable Design and Aesthetics

- Use sustainable practices in the selection of building materials and sources and building location and siting. Sustainable practices and resources would be used whenever practicable by recycling and reusing materials, by minimizing materials, by minimizing energy consumption during the project, and by minimizing energy consumption throughout the lifespan of the project.
- Develop design standards specific to the park in all repair, rehabilitation, and construction projects.

Visitor Safety and Experiences

- Consider accessibility in each project to understand barriers to programs and facilities. Provide the maximum level of accessibility.
- Implement adaptive visitor use management, as outlined in the user capacity section of this plan, when resource and visitor experience conditions are trending towards or violating a user capacity standard. Management strategies may include visitor education, site management, visitor use regulations, rationing or reallocation of visitor use, and enforcement.
- Consider visitor safety in all planning and projects.
- Consider using the principles of operational leadership in planning safe visitor access to park features.

Hazardous Materials

- Implement a spill prevention and pollution control program for hazardous materials. Standard measures could include hazardous materials storage and handling procedures; spill containment, cleanup, and reporting procedures; and limitation of refueling and other hazardous activities to upland/ nonsensitive sites.

ACTIONS AND ALTERNATIVES CONSIDERED BUT DISMISSED

Under NEPA and Council on Environmental Quality Forty Questions, alternatives may be eliminated from detailed study based on the following reasons [40 CFR 1502.14 (a)]:

- Technical or economic infeasibility.
- Inability to meet project objectives or resolve need for the project.
- Duplicate other less environmentally damaging alternatives.
- Conflict with an up-to-date valid plan, statement of purpose and significance, or other policy, and therefore would require a major change in that plan or policy to implement.
- Environmental impacts are too great.

The following alternatives or actions were considered during the initial alternatives development phase of the planning process, but were ultimately dismissed from further consideration in the general management plan because they met one or more of the above criteria.

Alternatives B and C

The planning team originally developed four preliminary alternatives for public review. These preliminary alternatives included a no-action alternative (Alternative A) to continue current management and three action alternatives (Alternatives B, C, and D).

During the process of comparing these preliminary alternatives to identify the preferred alternative, the planning team, using a value analysis methodology for comparison purposes, decided to combine the primary alternative actions from Alternatives B and C for the main part of the park and Alternative D for Kahuku in order to form the new preferred alternative, Alternative 2, as these actions best met the goals for the general management plan. Since many components of the former Alternatives B and C were included in the preferred alternative, the planning team felt that the original concepts

were strong enough to stand alone (many public comments suggested combining elements between alternatives and saw similarity in the alternative concepts), these separate alternatives (B and C) were ultimately dropped from further consideration in this GMP/WS/EIS. Alternative D was retained from the preliminary alternatives, and is now Alternative 3. Alternative A is now Alternative 1.

New Park Entrance

The park explored several proposals to add a second entrance to the park in order to alleviate traffic congestion. One proposal was to add an entirely new second entrance to the park along Highway 11 for the general public and administrative use. The second entrance would likely require infrastructure that could be staffed to manage entrance fees. The planning team also evaluated formalizing a second park entrance using the Mauna Loa Road connection for staff and administrative use (but not the general public), in order to help improve overall park access and minimize vehicle congestion at the main public entrance. This second entrance would likely require additional key card infrastructure, but there would be no staffed infrastructure.

Both these proposals were dismissed from further consideration due to potential impacts to cultural and natural resources. Such an entrance would expand the developed footprint within important habitat for endangered species such as the nēnē, potentially impact archeological sites, and would have greater impacts than other alternatives considered, without significant benefit.

Public Entrance at Kilauea Military Camp

To alleviate traffic congestion at the existing entrance station, a proposal was considered to use the service road in Kilauea Military Camp as an entrance station into the park. Establishing a turnoff on Highway 11 would require improvements on the highway, as well as within the KMC area. This alternative was dismissed due to engineering and security concerns and potential adverse effects to cultural resources, including the historic district.

Other Options for Managing the Emergency Access Route along Chain of Craters Road

The park considered several management options for the future use of the emergency access route along Chain of Craters Road, but ultimately considered but dismissed ideas that involved maintaining the route for future vehicular access from further evaluation in the action alternatives.

In general, keeping the road open to regular vehicular use will have potentially significant impacts due to invasive species introductions. Invasive species pose a serious risk to park resources from introduction of potentially ecosystem altering species such as little fire ants, coqui frogs, fountain grass, and many other invasive plant species. Many of these species were not on the island, or were not as widespread, when the road was open prior to 1989. The risk of inadvertent introductions is much greater with traffic directly from the Lower Puna region and would require extensive monitoring and control.

Significant impacts to endangered species would likely occur, particularly to nēnē (endangered). Long-term vehicular traffic is likely to disturb nēnē breeding, nesting, and rearing along a 1 to 1.5 mile stretch from the current end of the pavement to the west and along a stretch further up Chain of Crater Road and the risk of vehicular strikes in these areas is significantly greater.

Significant impacts would likely occur to visitor experience and park operations due to increased traffic on already congested park roads in certain areas, which would change the character of the visitor experience. There would be potentially significant long-term adverse impacts to park operations due to increased staffing needs and other potential new infrastructure requirements. Additional staff would be required to

manage the additional fee collection, provide visitor and resource protection including law enforcement over a broader area, and monitor and manage sensitive natural and cultural resources in the area. Infrastructure and equipment improvements would include communication upgrades (there is no radio or cell phone reception along the proposed route), additional law enforcement vehicles and equipment, a visitor contact station to replace the one was previously removed, a contact station on the Kalapana side, an additional ambulance for emergency response, among others. These long-term staffing and infrastructure additions and upgrades are due to the increased numbers of vehicles and people in the park and the fact that this area of the park does not currently have or support this level and type of visitor access.

The following specific ideas for the future use of the road beyond the emergency access were considered but dismissed:

CLOSING THE ROAD COMPLETELY

Closing the route completely and allowing no access was considered but dismissed. Visitors come to view more recent lava flows and this area provides easy access to recent flows. The alignment does potentially provide for an enhanced visitor opportunity consistent with the purpose of the park, and can be managed for an appropriate non-motorized recreational opportunity that also enables protection of sensitive resources. Therefore, closing the route completely to future public access was dismissed from consideration.

MAINTAINING THE UNPAVED ROUTE FOR FUTURE VEHICULAR ACCESS

The park considered maintaining the unpaved route for future vehicle access. Maintaining the unpaved route for future vehicular access would result in potentially significant, adverse impacts to park resources and operations mentioned above. In addition, maintaining the alignment as an unpaved route for vehicular access would cost an estimated $300,000 per year for road maintenance and an additional $1,275,000 per year for other park operations due to the anticipated heavy use of the road.

The park also considered maintaining the unpaved route for vehicular access until a major seismic, volcanic, or maintenance issue forced closure; however, all of the same impacts to resources and operations and concerns about the high cost of maintaining and operating the road would still apply under that situation. Therefore, maintaining the unpaved route for future vehicular access was dismissed from further consideration.

PAVING THE ROAD FOR FUTURE VEHICULAR ACCESS

Paving the alignment would lessen the long-term maintenance costs; however, the up-front costs would be more involved and costly than simply adding pavement to the current alignment. The current roadbed was not designed as a regular road and would not meet standards for a paved roadway.

Significant upgrades would be needed in order to pave the roadway and meet NPS park road standards. The roadway bench would have to be widened further to provide additional clear zone at cut slopes, similar to the open segment of the roadway between the current closure point and Crater Rim Drive, and the vertical profile would need to be smoothed out to safely accommodate the higher speeds motorists will drive on a paved surface. Additionally, before an investment in pavement could be made, upgrades to the quality of the subbase would be required - the subbase being built now is not as well graded or compacted as would be required for a permanent facility. Storm drainage improvements would also likely be necessary. Initial estimates indicate that it is likely that such improvements would cost about $2 million per mile of road, or about $11 million for the 5.5 miles total (NPS pers. comm., 2014).

Paving the road is not a sound long-term investment for the NPS given the volcanic activity in this area and funding agencies have indicated in the past that they will not fund repaving the road due to the area's high level of volcanic activity. Therefore, this alternative was dismissed from further consideration.

MAINTAINING THE ROUTE FOR A SHUTTLE OPERATION

Keeping the road open as a shuttle route was considered but dismissed. The park does not envision a shuttle route for this part of the park and running a shuttle on the emergency access route would not link specific destinations of public interest. Without a connection to a larger shuttle operation and without prominent visitor attractions at either end of the route, proposing a shuttle operation on this segment of road is not likely to be economically viable. Therefore, this alternative was dismissed from further consideration.

MAINTAINING THE ROUTE FOR LOCAL OR COMMUTER ACCESS ONLY

Keeping the route open to only locals as a commuter route for authorized access only was considered but dismissed. Maintaining any type of commuter route or limited access is not consistent with the purpose of the park. Therefore, this alternative was dismissed from further consideration.

One-way Circulation Along Crater Rim Drive

Instituting one-way traffic for all vehicles on the southern portion of Crater Rim Drive was dismissed from further analysis for several reasons. First, the length of the drive is approximately 11 miles. A missed stop by visitors would result in additional driving to return 11 miles to that location, which would have a significant adverse effect on the visitor experience. Emergency vehicles, researchers at HVO, and park administration would need to be exempt from the one-way requirement, which would pose a serious safety hazard and could confuse visitors traveling in the one-way direction. In addition, Crater Rim Drive has historically been a two-way drive and altering the traffic pattern would partially change the historic character of the driving experience. Public input during the planning process has also been opposed to this idea.

Eliminating Motorized Transportation on Crater Rim Drive

The planning team explored the idea of converting the southern portion of Crater Rim Drive to pedestrian and bicycle access only and maintaining the current closure to private vehicle traffic between Jaggar Museum and Chain of Craters Road. This alternative was dismissed from additional consideration due to the potential impacts to the visitor experience, the need to still maintain the road for administrative access, its historic significance, and the technical difficulties of managing visitation without vehicular access on this road. The planning team concluded that other alternatives were more successful in meeting the goals for balancing visitor opportunities with resource protection and dismissed this idea from further consideration.

Closure or Reduction of Halemaʻumaʻu Parking Area

The planning team explored the idea of closing or reducing the size of the parking area at Halemaʻumaʻu Overlook. The overlook and parking area are historic, so any reduction would be an adverse impact to the historic feature. In addition, when the road is open and there is an eruptive event, having this parking area would reduce the potential impacts to nearby cultural and natural resources that would otherwise be trampled or parked on.

Kīlauea Visitor Center Expansion

Adding a second story to the Kīlauea Visitor Center (KVC) was discussed as a way to allow for additional space for visitor interpretive services, as well as for park headquarters and administrative offices. Although a second story was featured in one of the several proposed 1938 sketches for Kīlauea Visitor Center, this idea was dismissed due to associated costs and impacts to cultural resources. While there were multiple proposed sketches for visitor facilities, the actual design drawing in the park records for Kīlauea Visitor Center represents a single-story building. While the decision to build a one-story facility could have been influenced by expediency in the face of World War II, no documentation for this final decision exists. Furthermore, the current building is consistent with the design drawing and the historic district. It is

anticipated that the addition of a second story would impact cultural resources by changing the viewshed; moreover, modifications would need to be made to the structure and interior, which currently align closely with the selected 1938 design of the building. Finally, the cost of improving the first story and constructing a second story addition are high compared with other options that could still improve the amount of space available for interpretation and visitor orientation in the area around Kīlauea Visitor Center. Therefore, this idea was dismissed from further consideration.

The planning team also explored the idea of converting an additional 500 square feet within Kīlauea Visitor Center from offices to general public space in order to accommodate existing visitation, and improve visitor services, orientation, and interpretive support. The remaining park headquarters and administrative functions would be relocated out of the visitor center to other buildings within the park. Due to concerns about the potential impacts associated with removing walls to allow for more general and open visitor space and the importance of maintaining the remaining historic integrity of Kīlauea Visitor Center, this idea was dismissed from further consideration.

Rainshed Road

The planning team evaluated the feasibility of relocating the entrance of the road that continues past the 1877 Volcano House to the rainshed area. Relocating the road would help separate administrative use from a primarily visitor use area, improving safety and visitor circulation for pedestrians crossing the road to access the Sulfur Banks Trail. The impacts to both natural and cultural resources from relocating the road, given its location and surrounding terrain, were considered too great, especially when compared with the minimal benefits to the visitor experience. Furthermore, the costs associated with constructing a new road, which would be significant given the terrain and numerous earth cracks in the area, were considered too high when compared with the relative benefits to the visitor experience. The planning team concluded that other, more cost-effective ideas like improved signage and crosswalks could achieve park goals; therefore this idea was dismissed from further consideration.

Park Administrative Area

The park administrative area is part of the Kīlauea Administration and Employee Housing Historic District and is eligible for listing in the National Register of Historic Places. Many facilities in this area, which traditionally all served as housing, have been converted to park offices and storage areas over time. A proposal to return the administrative area back to housing was considered by the planning team but dismissed due to current NPS policies about providing housing in parks. Although there continues to be housing needs at the park, especially for volunteers who come to work in the park, the demand for office space still exceeds that of housing.

Park Visitor Center in Hilo

A proposal to develop a park visitor center in Hilo and provide a shuttle bus to the park with visitor orientation was dismissed as economically not feasible.

Additional Lava Tube Experience

As a way to disperse visitor use and take some of the demand off Thurston Lava Tube, the planning team explored the option of adding an additional lava tube or lava tunnel experience within the park. This additional lava tube experience would be in a more remote location and at a smaller-scale than Thurston. In order to protect the resources within the lava tubes and offer a unique experience in the park, this additional experience would be a ranger-led or guided-only experience. Due to concerns about potential impacts to the sensitive natural and cultural resources associated with caves, as well as the feasibility of having adequate staff and funding to implement this idea on a consistent basis, the planning team dismissed this idea from further consideration. However, the park could re-evaluate this idea in subsequent updates to the cave management plan.

Kahuku Alternative Entrance and Loop Road

A new entrance for Kahuku was considered, further west using a section of the old Māmalahoa Highway and connected to a new road that would provide a scenic loop driving experience through lower Kahuku. This idea was dismissed due to the impacts associated with constructing a new road as well as the costs associated with constructing and maintaining the new road and entrance. Dismissing this idea in this general management plan does not preclude considering it in the future should travel patterns and demand for recreation in Kahuku change.

Kahuku Overnight Accommodations

The planning team considered establishing a traditional frontcountry, accessible campground (provided for a fee) with approximately 20 sites including a mix of group sites and small sites that would accommodate a wide range of users near the existing developed area in lower Kahuku. Some sites could offer structural shelters such as a lean-to or covered pavilion for cooking, while other sites could offer walk-in camping. Campground locations could include previously disturbed areas, such as the abandoned tree farm or the area adjacent to/across the road from the former ranch house infrastructure. The campground likely would not have provided water or electrical hookups due to the feasibility of providing those amenities. Given the limited resources available and unknown demand for overnight camping in lower Kahuku, as well as the impacts and costs associated with constructing and managing a large campground, the planning team dismissed this idea from further consideration in favor of smaller, more distributed camping in lower Kahuku. If demand changed in the future, other overnight accommodations in lower Kahuku could be considered.

The planning team also considered the idea of cabins or a lodge (potentially run by a concessioner) in lower Kahuku based on a few public comments received. This idea was dismissed from further consideration due to the availability of overnight lodging in adjoining communities and the desire expressed by many public comments to keep infrastructure development in Kahuku to a minimum.

Expanded Mountain Biking in Lower Kahuku

Constructing new mountain biking trails in Kahuku on previously undisturbed ground was considered but dismissed. An expansive network of pasture roads already exists in Kahuku and is adequate enough to accommodate a range of recreation including mountain biking. The potential resource impacts and costs associated with new trail construction and allowing off-trail mountain biking use were both concerns, as well as the additional staff that would be required to patrol and manage more expansive bicycling use.

Full, Unrestricted Equestrian Access in Kahuku

The proposal from the public to provide full, unrestricted equestrian access to Kahuku was considered but dismissed due to anticipated impacts to natural resources in this unit. Kahuku is recognized as an ecologically unique landscape, one that, to this date, has been largely unaffected by the introduction of some very detrimental invasive species, particularly within the upper reaches of the unit. In seeking to expand public access and facilities in this unit, park management has a unique opportunity and responsibility to carefully manage the introduction of development and recreational uses in Kahuku and to better understand the consequences and impacts of those uses. While all modes of transportation have the potential to spread invasive species, equestrian use has the increased potential of introducing and/or spreading invasive species through manure. Stock animals can potentially trample and damage plants if they were inadvertently allowed to wander, posing a particular issue for native plant communities that are not adapted to large herbivores. This concern would be particularly in areas in recovery

and under restoration. Therefore, out of concern for natural resources in Kahuku and a desire to respond to the public's request for access, the National Park Service believes that equestrian use, if introduced in Kahuku, needs to be done so gradually and within a monitored pilot program to research, monitor, and mitigate issues, such as the spread of invasive plants and damage to native vegetation through trampling and feeding (in areas where native vegetation and sensitive species occur).

Expanded Recreational Access in Upper Kahuku

The planning team considered allowing NPS and/or commercially guided vehicular four-wheel-drive access in upper Kahuku as well as implementing a permit system for public bicycling use in upper Kahuku. Concern for resource protection in upper Kahuku was paramount in dismissing this idea from further consideration, as well as the cost, staffing, and oversight that would be required for ensuring adequate resource protection. The National Park Service is gradually introducing low-impact recreation in Kahuku so as to better understand resource impacts and ensure the success of restoration efforts to the greatest extent possible. Should monitoring and other research, including techniques for prohibiting the spread of invasive species, demonstrate a greater ability of the resources to sustain potential impacts from increased recreation access, the park could reconsider providing additional recreation access in the future.

IDENTIFICATION OF THE ENVIRONMENTALLY PREFERABLE ALTERNATIVE

In accordance with NPS Director's Order 12: *Conservation Planning, Environmental Impact Analysis, and Decision-making*, the National Park Service is required to identify the environmentally preferable alternative in environmental documents. The environmentally preferable alternative is "the alternative that will promote the national environmental policy expressed in NEPA (Sec. 101(b))".

The environmentally preferable alternative is determined by applying the criteria suggested in the National Environmental Policy Act of 1969, which is guided by the CEQ. The criteria outlined in NEPA Sec. 101(b) considers:

1. Fulfilling the responsibilities of each generation as trustee of the environment for succeeding generations;
2. Assuring for all generations safe, healthful, productive, and aesthetically and culturally pleasing surroundings;
3. Attaining the widest range of beneficial uses of the environment without degradation, risk of health or safety, or other undesirable and unintended consequences;
4. Preserving important historic, cultural and natural aspects of our national heritage and maintaining, wherever possible, an environment that supports diversity and variety of individual choice;
5. Achieving a balance between population and resource use that will permit high standards of living and a wide sharing of life's amenities; and
6. Enhancing the quality of renewable resources and approaching the maximum attainable recycling of depletable resources.

The CEQ regulations state that the environmentally preferable alternative is "the alternative that causes the least damage to the biological and physical environment; it also means the alternative which best protects, preserves, and enhances historic, cultural, and natural resources (46 FR 18026 – 46 FR 18038)." According to NPS NEPA Handbook (Director's Order 12), through identification of the environmentally preferred alternative, the NPS decision-makers and the public are clearly faced with the relative merits of choices and must clearly state through the decision-making process the values and policies used in reaching final decisions.

The environmentally preferable alternative for Hawai'i Volcanoes National Park is Alternative 2, the NPS preferred alternative.

This alternative best satisfies the national environmental goals by providing the highest level of protection of natural and cultural resources while concurrently providing for a wide range of neutral and beneficial uses of the environment. This alternative maintains an environment that supports a diversity and variety of individual choices, and it integrates resource protection with an appropriate range of visitor uses and understanding.

Both of the action alternatives (the preferred alternative and Alternative 3) would provide a high level of protection of natural and cultural resources. In addition, the preferred alternative provides a wider range of visitor opportunities than Alternative 3, thus better fulfilling criteria 3. Alternative 3 would have a greater stewardship/volunteerism component related to research, but overall, the preferred alternative would provide the greatest educational and research opportunities to foster better understanding of the park's resources, therefore better equipping the park in fulfilling NEPA criteria 3, 4, and 5.

Alternative 1, no action, while accurately describing the current management direction and best efforts of the staff, fails to satisfy the NEPA requirements outlined above when compared to the action alternatives. A shortage of funding, staff, facilities, and services limits the park's effectiveness in achieving NEPA criteria 1, 4, and 6.

SECTION 106 SUMMARY

Section 106 of the National Historic Preservation Act (16 USC 470 e seq.) requires (1) that federal agencies consider the effect of their projects on historic properties (including archeological resources) eligible for the National Register of Historic Places, and (2) that agencies give the Advisory Council on Historic Preservation and the state historic preservation office an opportunity to comment on projects.

As required by Section 110 of the National Historic Preservation Act, federal land management agencies survey cultural resources on lands under their jurisdiction and evaluate these resources by applying criteria for the National Register of Historic Places. A number of surveys, inventories, and studies have been completed or are ongoing, and further resource evaluation and documentation will continue in Hawai'i Volcanoes National Park.

At this time, there is not enough information to identify an undertaking-determined area of potential effect or make a determination of effect consistent with section 106 of the National Historic Preservation Act of 1966 (as amended, 16 USC 470-470w-6) for the actions related to historic properties. Undertakings that have the potential to effect resources eligible for or listed on the National Register of Historic Places such as ground disturbing construction activities for developing visitor facilities at Kahuku or undertakings related to the implementation of the *Archeological Preservation Plan for Kealakomo Ahupua'a*, will fulfill all procedural requirements specified in 36 CFR 800 (as amended in August, 2004). As more information is available, NPS staff will continue to consult with the SHPO.

In the interim, no historic properties would be inalterably changed without consultation with the State Historic Preservation Office and the Advisory Council on Historic Preservation, as appropriate. Archeological sites would be protected in an undisturbed condition unless it is determined through formal processes that disturbance or natural deterioration is unavoidable and when disturbance is unavoidable appropriate treatment would follow in consultation with the Hawai'i State Historic Preservation Division and the park's Kupuna Consultation Group.

Copies of this draft GMP/WS/EIS have been distributed to affected/concerned Native Hawaiian Organizations, the park's Kupuna Consultation Group, the Hawai'i State Historic Preservation Division, and the Advisory Council on Historic Preservation for review and comment related to compliance with section 106 of the National Historic Preservation Act.

TABLE 3.8. SUMMARY OF ALTERNATIVES

Topic	Alternative 1: No Action	Alternative 2: Preferred Alternative	Alternative 3
Alternative Concept	Assume existing programming, facilities, staffing, and funding would generally continue at current levels. No major changes in current management or visitor use. Continue implementation of currently approved as funding allows. This alternative provides the baseline for evaluating actions and impacts in other alternatives.	Strengthen and broaden opportunities to connect people with the park and provide a wide range of high-quality visitor experiences based on different geographic areas. Provide concentrated visitor services and amenities on Kīlauea summit; a less congested experience with new opportunities to disperse use along Chain of Craters Road and Mauna Loa Road; additional visitor services that offer more primitive recreational opportunities at Kahuku. Natural and cultural resources would continue to be managed and protected with a high degree of integrity. Emphasis is on the park's role as a refuge and haven for native biota, people, and cultures in a world constantly adapting to volcanic activity and island building processes. Additional emphasis on Native Hawaiian values such as mālama ʻāina (nourishing or taking care of the land) and kuleana (responsibility) as important concepts in park stewardship.	Emphasize building new connections with the park primarily through expanded education and hands-on stewardship opportunities. Traditional visitor opportunities would continue, new development would be very limited and a suite of management tools would be used to disperse visitors and manage congestion throughout the park. Greater focus on science and learning opportunities and maximizing opportunities for visitors and groups to participate in restoration and resource management activities, research and scientific investigation, notably in Kahuku. Natural and cultural resources would continue to be managed and protected with a high degree of integrity. Emphasis is on the park's role as a refuge and haven for native biota, people, and cultures in a world constantly adapting to volcanic activity and island building processes. Additional emphasis on Native Hawaiian values such as mālama ʻāina (nourishing or taking care of the land) and kuleana (responsibility) as important concepts in park stewardship.
SITE-SPECIFIC MANAGEMENT GUIDANCE			
Kīlauea Visitor Center and Surrounding Area			
Actions Common to All Alternatives	Maintain the existing park entrance off Highway 11 for both public and administrative use.		
	Consider a range of options for adaptive reuse of facilities should conditions change such as the 1877 Volcano House and Kīlauea Military Camp (see "Common to all Alternatives")		
Kīlauea Visitor Center and Surrounding Area	Maintain the current use and function of buildings with no expansion of buildings proposed.	Produce a DCP and site-specific interpretive strategy to integrate visitor experiences among the complex of buildings on Kīlauea summit.	Same as Alternative 2.
Kīlauea Visitor Center	Retain current function as main park visitor center and headquarters and upgrade as needed.	Continue to use as one of two primary visitor facilities as well as park headquarters. Provide additional parking and upgrade HVAC system. Remove the current restroom and replace with a facility of similar capacity behind the visitor center and closer to the 1877 Volcano House. Construct a 2.5-mile pedestrian and bicycle trail from Kīlauea Visitor Center to Jaggar Museum.	Same as Alternative 2.

Table 3.8. Summary of Alternatives

Topic	Alternative 1: No Action	Alternative 2: Preferred Alternative	Alternative 3
Volcano House[SM]	Continue to operate as a concession operation for lodging, retail, and food services. Continue to provide educational programs and cultural demonstrations by park partners.	Continue as a concession operation, strive for environmentally sustainable practices, and work with the park to provide interpretive services. Adaptively reuse for other park visitation and/or administrative functions if it is no longer operating as commercial lodging.	Same as Alternative 2, plus update for solar energy in the next concession contract.
1877 Volcano House	Retain current function as a nonprofit educational arts center. Continue to interpret structure primarily through existing waysides.	Same as Alternative A plus evaluate accessibility improvements for the front entrance, lanai, and parking. Consider additional historic photos on the interior to highlight historic uses of the building.	Same as Alternative 2, plus increase historic interpretation by potentially adding interior exhibits such as a period restored room and/or additional historic photos. Expand outside interpretation with an additional wayside.
Ohia Wing (1932 Administration Building)	Adaptively reuse as a cultural museum to replace some of the functions provided by the Waha'ula Visitor Center.	Adaptively reuse as a cultural museum and administrative offices to replace some of the functions provided by the Waha'ula Visitor Center and complement functions of Kīlauea Visitor Center and Jaggar Museum.	Same as Alternative 1.
Crater Rim Drive			
Actions Common to All Alternatives	Continue to manage the 2.8 miles of Crater Rim Drive between the entrance station and Jaggar Museum, consistent with the *Crater Rim Drive Rehabilitation Environmental Assessment* (May 2010).		
Crater Rim Drive	Maintain as two-way road, keeping with historic character and reopening closed section when and if possible. Continue to evaluate the pilot hydrogen shuttle technology.	Reopen drive to the public for two-way traffic when the park determines through active monitoring that air quality and other hazards are at a level that is consistent with general visitor use. Allow a mix of private vehicles and smaller, non-mandatory shuttles. Preserve historic character and alignment of the road. Limit large commercial buses or vehicles to one-way traffic between Jaggar Museum and Chain of Craters Road junction along the southern portion of road. Continue to allow administrative use of the road for two-way vehicle traffic. Continue to evaluate the pilot hydrogen shuttle technology, which includes the performance of the shuttles that will service proposed stops along Crater Rim Drive. If this project proves successful, the shuttle operations could be extended to include other stops along Crater Rim Drive, such as Kīlauea Visitor Center, Steam Vents, Kīlauea Military Camp, and Jaggar Museum. Improve signage for bicycles along the road corridor. Provide adjacent bicycle trails when feasible, and consider vehicular traffic closures during specific times of day or days of the week to encourage bicycle use.	Maintain the closure (despite eruptive activity) of the southern section of Crater Rim Drive to private vehicle traffic from Jaggar Museum to the Chain of Craters Road junction. Explore feasibility of implementing a mandatory shuttle system that would be owned by the National Park Service but operated by a concession, commercial use authorization, or partner. Allow large commercial buses to run on Crater Rim Drive but limit to one-way traffic on the southern section of Crater Rim Drive from Jaggar Museum to the Chain of Craters Road junction. Preserve the historic character of the road. Continue to allow administrative use of the road for two-way vehicle traffic. Encourage bicycle use of the road and add signage to improve safety.

Table 3.8. Summary of Alternatives

Topic	Alternative 1: No Action	Alternative 2: Preferred Alternative	Alternative 3
Halemaʻumaʻu Parking and Overlook	Reopen when hazards associated with the volcanic plume are diminished and the park determines through active monitoring that air quality and other hazards are at a level that is consistent with general visitor use. Continue to use and maintain for visitor use.	Maintain parking lot once the overlook is reopened to visitation to accommodate the existing capacity, but evaluate site modifications to address sensitive cultural issues and values and improve resource protection.	Same as Alternative 2.
Kīlauea Military Camp			
Actions Common to All Alternatives	Continue to operate Kīlauea Military Camp as a military recreation facility for the duration of the existing special use permit. Continue to coordinate on natural and cultural resource protection and interpretation.		
	When the special use permit expires, review existing laws, policies, authorities, and park goals to 1) assess the appropriateness and/or necessity of the commercial services and their alignment with park goals, and 2) to determine or reaffirm the appropriate authority by which these commercial services should be authorized to operate (see "Common to All Alternatives").		
	If the permitted military recreation operations at Kīlauea Military Camp are discontinued, the National Park Service would prepare a plan and explore future options for the site (see "Common to All Alternatives").		
Kīlauea Military Camp	Work with Kīlauea Military Camp to develop and implement interpretive waysides at Kīlauea Military Camp that highlight important features and stories. Continue to provide parking/staging for park's special events.	Same as Alternative 1 plus expand interpretation of the park's military history and KMC history to include the placement of additional waysides and guided tours.	Same as Alternative 2.
Jaggar Museum			
Actions Common to All Alternatives	Hawaiian Volcano Observatory (HVO) would continue to operate out of its present location adjacent to Jaggar Museum.		
Jaggar Museum	Continue interpretation and upgrade visitor center as needed for building maintenance and interpretive exhibits.	Actively rehabilitate and upgrade the interpretive exhibits at Jaggar Museum. Consider adding an outdoor seating area (within existing footprint) for ranger demonstrations and programs. Consider other locations in the vicinity of the pā hula if an outdoor seating area is not feasible around Jaggar Museum.	Same as Alternative 1 plus rehabilitate and upgrade the outdated Jaggar Museum interpretive exhibits. Develop a shuttle staging area and add parking improvements as needed.

Table 3.8. Summary of Alternatives

Topic	Alternative 1: No Action	Alternative 2: Preferred Alternative	Alternative 3
Thurston Lava Tube and Surrounding Area			
Thurston Lava Tube (Nāhuku)	Continue to implement recommendations from Thurston Parking Area Improvement Project. Implement visitor-use planning to reduce congestion. Implement transportation congestion management strategies to improve the visitor experience and safety in this area. Continue ranger-guided tours of Pua Poʻo, as staffing and funding permits.	Maintain the current mix of parking for private and commercial vehicles and use a suite of tools to address congestion and improve the visitor experience. Restripe and reconfigure parking, if needed. Consider a more specific site plan or DCP to integrate trails and parking areas from Kīlauea Iki to Devastation. Large commercial buses would be able to load and unload at Thurston but may be required to park at nearby underutilized lots, which may need reconfiguration and other improvements. Continue to evaluate implications of implementing one-way traffic on Crater Rim Drive between Jaggar Museum and Chain of Craters Road junction for large commercial buses and requiring buses to only load and unload at Thurston as conditions change. Improve and increase interpretive opportunities, themes and signage while still protecting rainforest resources. Continue ranger-guided tours of Pua Poʻo, as staffing and funding permits.	Increase reliance on shuttle systems and reducing private vehicle parking, and other active management strategies to address congestion. Continue to allow large and small commercial vehicles to park at Thurston. Strive to improve visitor information and outreach for trip planning and emphasize less busy times of the day to visit. Expand use of intelligent transportation systems. Rely on shuttle to circulate visitors and redirect private vehicle parking to other parking areas. Maintain Thurston as a shuttle stop. Remove private vehicular parking at Thurston (except for ADA parking). Continue ranger-guided tours of Pua Poʻo, as staffing and funding permits, and to disperse visitor use, explore the option of expanding public access to other lava tubes for ranger-guided tours that would be focused on science.
Kīlauea Iki, Puʻu Puaʻi, and Devastation	Continue to maintain Kīlauea Iki as a parking lot and trailhead to Thurston Lava Tube. Continue to maintain Puʻu Puaʻi as a parking lot, overlook, and trail connection to Devastation Trail and parking lot. Maintain Devastation as a parking lot and trailhead for the Devastation Trail.	Explore new or improved trail connections for pedestrians and bicycles from these parking areas to Thurston. Consider creating a return trail from Thurston to Kīlauea Iki on the other side of the road to create a loop trail. Incorporate trail design features that protect rainforest resources and meet visitor capacity. Explore establishing an educational covered pavilion for student groups near Devastation Trail or the 1974 lava flow. Update the environmental education curriculum and waysides in the Devastation Trail area.	Explore new or improved trail connections for pedestrians and bicycles from these parking areas to Thurston, but maintain the existing footprint of those parking areas for private vehicles.
Escape Road	Maintain the historic road as an emergency egress route and trail for pedestrians, bicycles, and equestrians.	Same as Alternative 1, plus improve the trail surface on the road to accommodate increased bicycle, equestrian, and pedestrian use and improve connections from the park to the Volcano community. Consider linking the road with additional loop trail connections, but avoid wilderness and sensitive wildlife habitat.	Same as Alternative 1.

Table 3.8. Summary of Alternatives

Topic	Alternative 1: No Action	Alternative 2: Preferred Alternative	Alternative 3
Chain of Craters Road			
Actions Common to All Alternatives	Continue to improve interpretation and preservation of Kealakomowaena and its resources by implementing recommendations from the *Archeological Preservation Plan for Kealakomo Ahupua'a* (January 2011) in a phased approach, including primary messages and themes for interpretive trails and signage, sites to be interpreted, site preparation required to mitigate impacts to sensitive resources, and guidance for managing natural and cultural resources in the area.		
	Continue to consult with the Kalapana community about issues in the Kalapana Extension related to the community.		
Chain of Craters Road	Maintain character of road to NPS standards for a park-like driving experience and to immerse visitors in landscape and history. Identify and clear over-vegetated turnouts to restore views/vistas and to encourage stops along the road.	Continue to maintain character of road to NPS standards. Limit new development along the road and prioritize use and maintenance of existing trails, historic trails, turnouts, and waysides to improve the visitor experience, disperse use and provide a more tranquil experience. Identify and clear over-vegetated turnouts and improve signage of features and viewpoints. Explore option of locating an educational pavilion, in addition to a mobile visitor contact station, along Chain of Craters Road to orient visitors, communicate visitor safety information, and provide an alternative visitor experience when the summit is closed.	Same as Alternative 1, plus use existing trails, historic trails, turnouts, and waysides to improve visitor experience and limit new development along the road. Create loop hiking opportunities by connecting existing trails along Chain of Craters Road. Improve signage of features and viewpoints at existing road turnouts to limit informal turnouts.
Chain of Craters Road to Mauna Ulu	Continue to maintain as a day use area with parking for viewing lava fields and features and trailhead for Pu'u Huluhulu and Nāpau Crater and campground.	Continue to maintain Mauna Ulu as a day use area similar to Alternative 1, plus develop a site plan around the 1974 lava flows near the Lua Manu Crater to create a more comprehensive and organized visitor experience. Prioritize using existing and historic trails, but some new trail development would be needed. Explore an educational pavilion in the vicinity of Mauna Ulu or elsewhere along the 1974 flows.	Same as Alternative 1.
Kealakomo	Continue to maintain as a day use area and viewing location. Continue to improve interpretation and preservation of Kealakomowaena by implementing plan recommendations.	Same as Alternative 1, plus explore locating an educational pavilion at Kealakomowaena. Expand parking at the turnout for school bus parking. Install vault toilets near the pavilion. Interpret and protect archeological sites along the loop trail at Kealakomowaena.	Same as Alternative 2.
End of Chain of Craters Road	Continue to work with partners to provide a sustainable and movable visitor contact station for interpretation and safety to replace some of the functions provided by the Waha'ula Visitor Center. If this pilot project is successful, the park would retain the structure for visitor contact at the end of Chain of Craters Road.	Same as Alternative 1 except if pilot project is unsuccessful, develop a long-term replacement visitor contact station in the form of an open air pavilion or similar structure at the end of Chain of Craters Road. Under either scenario, remove temporary mobile infrastructure once a long-term contact station is finalized and evaluate any additional site requirements.	Same as Alternative 1, plus provide a covered educational pavilion at a key location for visitor contact, interpretive programs, and outdoor educational use. Strive to replace lost picnicking opportunities with a new picnic area along the coastal portion at the end of Chain of Craters Road.

Table 3.8. Summary of Alternatives

Topic	Alternative 1: No Action	Alternative 2: Preferred Alternative	Alternative 3
Hilina Pali Road			
Actions Common to All Alternatives	Continue to maintain the Kūlanaokuaiki Campground as it currently exists.		
Hilina Pali Road	Maintain the existing road width and historic alignment indicative of the architecture style. Continue to maintain Hilina Pali Lookout and adjacent trails.	Same as Alternative 1, plus consider expanding interpretive opportunities, such as waysides and turnouts for interpreting wilderness values. Consider an education pavilion in relationship to Kūlanaokuaiki Campground. Improve trailhead management at the end of the road by removing nonnative plants and restoring native species. Consider management strategies to provide safer access for hiking and bicycling such as identifying days or parts of days the road could be closed to day-use vehicles and become hike/bike only. Consider developing a bicycle loop to connect Escape Road with Hilina Pali Road outside designated wilderness and sensitive wildlife habitat.	Same as Alternative 2.
ʻĀinahou Ranch House and Grounds			
ʻĀinahou Ranch House and Grounds	Continue to provide management area for nēnē recovery. Continue to administer the ranch house and grounds under existing interim operating plan. Maintain water system and unpaved access road.	Same as Alternative 1, plus focus on restoration for nēnē but provide opportunities for public stewardship by using trained volunteers and small service groups under the direction of NPS staff in the field. Replace some ornamental nonnatives with native species, minimize any new plantings or cultivation, and prevent any inadvertent introduction of nonnatives. Remove invasive nonnatives and re-establish native plant communities in the areas surrounding the formal gardens to improve forage for native forest birds. Promote off-site public interpretation of ʻĀinahou Ranch and its significance as a cultural resource and important site for nēnē.	Similar to Alternative 2, but provide greater emphasis on restoration for nēnē and minimize human presence in the ranch house and gardens only as directly related to the protection of the site. Conduct majority of project work at ʻĀinahou by NPS staff, with less use of volunteers or other groups, in order to minimize the amount of human presence at the site and emphasize nēnē recovery.
Mauna Loa Road			
Mauna Loa Road	Maintain existing road width and historic alignment. Address safety issues by improving signage and adding turnouts.	Same as Alternative 1, plus consider developing a turnout at about the 6,000 feet elevation for birding. Consider adding interpretive waysides and 1 or 2 loop trails along the road for hiking and watching native birds. Provide opportunities for visitors to experience a wide range of mesic and dry montane habitats not found in the rest of the park. Explore providing trail linkages to other trails in the park. Provide 2 covered educational pavilions along Mauna Loa Road at different elevations to represent different types of habitat. Similar to Hilina Pali Road, consider identifying days or parts of days when Mauna Loa Road is closed to private day use vehicles and would become hike/bike only.	Same as Alternative 2.

Table 3.8. Summary of Alternatives

Topic	Alternative 1: No Action	Alternative 2: Preferred Alternative	Alternative 3
Nāmakanipaio Campground	Manage for fee camping as part of concession contract with Volcano House and include retail services.	Same as Alternative 1, plus consider expanding concession operations at Nāmakanipaio to include the construction and operation of an indoor lodging opportunity such as a dormitory style or hostel-like facility, cabins, or similar. Explore creation of a pedestrian and possibly a bicycle trail to link the Nāmakanipaio Campground with Kīpukapuaulu on Mauna Loa Road and key sites on Crater Rim Drive.	Same as Alternative 2, except no expansion of the campground to include additional indoor lodging facilities.
Ka'ū Footprints Area and Ka'ū Desert			
Ka'ū Footprints Area and Ka'ū Desert	Continue to maintain as a self-guided interpretive experience with limited visitation. No improvements to facilitate public access.	Develop a DCP to address issues and needs for interpretation of the area. Focus planning on expanding and promoting access, including accessible access; providing trail connections and interpretive opportunities; determining other visitor support facilities needed; and ensuring the protection and preservation of cultural and natural resources. Consider slightly expanding the development footprint to accommodate the goals of the DCP.	Similar to Alternative 2, except focus on improvements within the current capacity of the area rather than expanding access.
'Ōla'a			
Actions Common to All Alternatives	Seek legislation to include 'Ōla'a within the legislated park boundary.		
'Ōla'a –Small Tract	Visitors would continue to access the small tract by informally parking along Wright Road in Volcano Village.	Collaborate with county to formalize a turnout for parking on Wright Road. In addition, to ensure resource protection and minimize impacts, develop a boardwalk-style or weed-mat trail for visitors with self-guided on-site interpretation. Determine a route to avoid sensitive resources. Develop and implement a monitoring and treatment plan to address the spread of nonnative plants and determine a group size limit for the trail. Explore partnership opportunities to create joint interpretive media with adjacent land managers.	Coordinate with county to formalize a turnout for parking on Wright Road similar to Alternative 1. Develop a flagged trail for guided access only, and possibly fee interpretation. Develop group size limits similar to Alternative 2. Explore partnerships to create new joint interpretive media with adjacent land managers. Engage other partners in forest restoration and maintenance in 'Ōla'a.
'Ōla'a –Large Tract Wilderness	Continue to manage the large tract for its wilderness values without developing trails for day use. Continue to provide interpretation off-site. Do not provide on-site guided interpretation or overnight camping opportunities or make improvements to facilitate public access.	Continue to manage the large tract for its wilderness values without developing trails for day use, and continue to provide interpretation off-site. Prohibit improvements for public access and overnight camping. Consider additional public access if small tract can be managed with minimal resource damage. Access would be determined through minimum requirements analysis for wilderness.	Same as Alternative 1.

Table 3.8. Summary of Alternatives

Topic	Alternative 1: No Action	Alternative 2: Preferred Alternative	Alternative 3
Kahuku Unit			
Actions Common to All Alternatives	Strive to expand recreation opportunities for public access seven days a week, over time and with adequate funding for operations.		
General Concept	Concentrate on protecting and recovering native species and ecosystems, controlling invasive nonnative plants and animals, developing interpretive programs, and conducting surveys and inventories of cultural and natural resources. Continue to operate with limited day use visitation on weekends and special events.	Concentrate on protecting and recovering native species, including special status species, and ecosystems, controlling invasive nonnative plants and animals, developing interpretive programs, and conducting surveys and inventories of cultural and natural resources. Develop recreational infrastructure, such as trails, small-scale campgrounds, and interpretive and educational programs and activities to optimize visitor access and provide a range of opportunities. Immerse visitors and engage local communities in the restoration process and story throughout Kahuku. Offer opportunities for the community, visitors, and school groups to volunteer on restoration projects and participate in hands-on resource management activities.	Concentrate on protecting and recovering native species, including special status species, and ecosystems, controlling invasive nonnative plants and animals, developing interpretive programs, and conducting surveys and inventories of cultural and natural resources. Develop infrastructure such as trails and campsites to support primitive recreational experience and dispersed and minimal facilities. Opportunities and programs place additional emphasis on science, stewardship, and service learning. Focus more heavily on coordinated group opportunities.
Kahuku Entrance	Maintain the existing entrance but address safety issues by clearing vegetation, improving signage, and possibly lowering existing berms to improve the line of sight for drivers. Collaborate with state to add a turn lane(s).	Same as Alternative 1, plus work with the state and other partners to expand interpretive and scenic opportunities along Highway 11. Explore working with the state to develop a parking area for a few cars off Old Mamalahoa Highway as a trailhead.	Same as Alternative 2, except do not create a parking area and trailhead off Old Māmalahoa Highway.
Lower Kahuku			
General	Continue to adaptively reuse the site for a mix of visitor services, administrative, and operational use with limited use of existing ranch buildings. Develop an orientation/ interpretive strategy to site various media to interpret Mauna Loa geologic and natural history, native species and forest conservation, history of cattle ranching, Native Hawaiian presence in this area, and military history.	Same as Alternative 1, plus develop a DCP to create a design that provides visitors with a sense of arrival as well as general orientation and information, and provides detailed implementation guidance on adaptively reusing existing buildings for specific uses and determining the numbers and locations of campgrounds, picnic areas, and trails consistent with the overall vision for this alternative.	Same as Alternative 1, plus develop a DCP to create a design that provides visitors with a sense of arrival as well as general orientation and information, and provides detailed implementation guidance on adaptively reusing existing buildings for specific uses and determining the numbers and locations of campgrounds, picnic areas, and trails consistent with the overall vision for this alternative.

Table 3.8. Summary of Alternatives

Topic	Alternative 1: No Action	Alternative 2: Preferred Alternative	Alternative 3
Developed Area and Use of Existing Buildings	Maintain a single visitor contact station in lower Kahuku.	Continue some limited use of existing ranch buildings, and adaptively reuse the existing ranch buildings and surrounding site for a mixture of visitor services and park operations, including administrative offices and maintenance space. Rely primarily on self-guided infrastructure. Maintain an open air visitor contact station and a small amphitheater that could be used for outdoor programs and organized activities. Explore opportunities to use existing interior roads to improve circulation. Provide a location to accommodate camping and staging for groups such as volunteers, researchers, students, and educational and service groups.	Adaptively reuse buildings and maintain visitor contact station with a small amphitheater in lower Kahuku, similar to Alternative 2.
Recreation Activities and Visitor Opportunities	Strive to provide access for 7 days per week. Provide current range of recreational uses. Allow bicycle use on designated roads and trails and prohibit or restrict equestrian use and overnight camping.	Encourage a rustic visitor experience in Kahuku. Focus on recreational activities such as hiking, camping, and nature-viewing, with some biking and scenic driving opportunities. Reconstruct and/or maintain a minimal amount of pavement and road infrastructure. Provide an educational covered pavilion near the 1916 flows. Manage the amount of commercially guided recreation primarily through vehicle size limits and CUAs.	Same as Alternative 2, except do not provide commercially guided access for recreation.
Road Access	Maintain current road for vehicle access to Upper Glover. Maintain selected unimproved pasture roads for administrative use. Consider restoring roads, former paddock, and pasture areas not used for visitor or administrative use to natural conditions and/or native communities. Enhance interpretation along the current road system.	No new roads developed; focus on use of existing road network. Restrict large commercial vehicles to the developed area. Upgrade and maintain main road from the developed area to Upper Glover for two-wheel-drive access as a one-lane with turnouts. Maintain the main road from Upper Glover east to a designated location near the 1916 lava flows for four-wheel-drive access. Prohibit public access west from Upper Glover. Roads not used for administrative purposes or trail access are restored to natural conditions and/or native communities. Evaluate routes for historic significance/use to help guide management. Consider allowing smaller capacity shuttles in response to increased demand as a transportation strategy in Kahuku.	Same as Alternative 2.

Table 3.8. Summary of Alternatives

Topic	Alternative 1: No Action	Alternative 2: Preferred Alternative	Alternative 3
Trails and Trailheads	Continue to convert some pasture roads to trails.	Emphasize the use of trails and trailheads for nonmotorized access through Lower Kahuku as opposed to formalizing any additional road access. Develop a trail network as part of an overall trail management plan. Accommodate different visitor abilities across a series of loop trails and trail connections to promote hiking, bicycling, and equestrian use. Analyze trail alignments and uses to identify appropriate locations of picnic tables and trail signs. Evaluate and assess trail management in Kahuku as part of the trail management plan for the entire park.	Same as Alternative 2.
Campgrounds	N/A	Allow overnight camping in Kahuku. Develop multiple small-scale campgrounds with minimal services. Develop sites close to trailheads and features of interest for both drive-in and walk-in campers; provide some accessible campsites. Accommodate extended family or group camping by providing multiple tent sites in close proximity to one another. Ensure a separate group camping location for larger educational groups with a covered area for staging or programs. Establish some temporary and movable field camps at designated sites for researchers, volunteers and others.	Allow overnight camping similar to Alternative 2 but infrastructure would consist of primitive and dispersed campsites with minimal services rather than small-scale campgrounds.
Bicycling	Allow bicycles on designated routes.	Allow bicycles on designated routes by adaptively reusing pasture roads. Unless new connector trails are necessary to manage the flow of bike traffic on these trails, no new bike trails would be developed on undisturbed ground.	Same as Alternative 2.
Equestrian Use	N/A	Implement a small pilot program to explore allowing equestrian use while managing for resource concerns. Consider separate equestrian and bicycle trails in the DCP. Prepare a baseline vegetation assessment and monitoring plan in advance of the pilot program.	Same as Alternative 2, except do not allow commercial use.
Upper Kahuku			
Upper Kahuku	Manage area for its wilderness characteristics based on its determination of eligibility. Do not provide public access above Upper Glover, though allow vehicular access for administrative use and emergencies on existing roads.	Manage upper Kahuku for its wilderness characteristics based on its determination of eligibility. Emphasize restoring native ecosystems and recovering biological diversity of native species. Permit recreational access and visitor opportunities such as hiking and camping consistent with a wilderness experience. Allow NPS vehicular access on existing roads outside eligible wilderness for administrative use and emergencies.	Same as Alternative 2.

Table 3.8. Summary of Alternatives

Topic	Alternative 1: No Action	Alternative 2: Preferred Alternative	Alternative 3
Recreational Activities and Visitor Opportunities	Maintain closure above Upper Glover to public access. Do not provide opportunities for recreation and visitor use in upper Kahuku.	Allow recreation in upper Kahuku associated with foot travel such as hiking, birding, and overnight backcountry travel. Above the 1916 lava flows: do not allow public vehicular, biking, or equestrian activities; consider NPS-guided vehicular and/or biking cost-recovery interpretive and recreational experiences; implement a permit system for backcountry hiking. Develop facilities, such as a trailhead, water catchment and primitive campground in the vicinity of the 1916 flows. No commercial services or commercially guided recreation in upper Kahuku. Allow NPS vehicular access with implementation of best management practices.	Same as Alternative 2.
Campgrounds	N/A	Allow dispersed backcountry camping via backcountry use permit consistent with wilderness recreation. Consider developing a small walk-in campground near the existing cabins and out of nēnē habitat outside of wilderness. Consider developing a system of shelters with water catchments for backcountry and wilderness camping.	Same as Alternative 2, except no additional campground would be developed near the existing cabins.
Trails and Trailheads	N/A	Provide primary recreational experiences for visitors through use of trails. Design trails consistent with wilderness character and emphasize historic trail connections.	Same as Alternative 2.
Boundary Modifications			
Actions Common to All Alternatives	Seek legislation to include ʻŌlaʻa within the legislated park boundary.		
Boundary Modifications	Continue to seek acquisition of the Great Crack parcels (1,951 acres), located to the south of the Kīlauea Unit.	Add four contiguous parcels to the park boundary on a willing seller basis only: • Great Crack parcel (1,951 acres) as earlier proposed in the park's 1975 master plan. • Ala Waiʻi parcel (3,475 acres) adjacent to the Great Crack parcel. • Private parcel (222 acres) at the southern edge of Kahuku. • Pōhue Bay parcel (16,457 acres) from lower Kahuku down to the coast. No legislation would be needed for acquisition of these parcels contiguous to the boundary.	Same as Alternative 2.

Table 3.8. Summary of Alternatives

Topic	Alternative 1: No Action	Alternative 2: Preferred Alternative	Alternative 3
PROGRAM SPECIFIC MANAGEMENT GUIDANCE			
Natural and Cultural Resources			
Actions Common to All Alternatives	Emphasize the Hawaiian concept of mālama ʻāina (care of the land) and the idea that caring for park resources is the kuleana (responsibility) of us all.		
Natural Resources			
Actions Common to All Alternatives	Perpetuate and restore native species, communities, and ecological processes in as natural condition as possible. Rely on the best available science to guide management actions so as to minimize impacts to park resources and visitor experience and as required by policy and law.		
	Emphasize restoring native ecosystems and the recovery of biological diversity of native species, including special status species. Restoration activities would be implemented consistent with the park's *Final Plan/EIS for Protecting and Restoring Native Ecosystems by Managing Nonnative Ungulates* (2013), the Fire Management Plan (2007), *Kahuku Pasture Restoration Plan/Environmental Assessment* (currently in progress) and other planning documents.		
	Continue to provide opportunities for communities, visitors, and school groups to volunteer on restoration projects. Continue to coordinate activities with members of Three Mountain Alliance and other partners on research and restoration measures.		
General	Continue efforts to perpetuate and restore native ecosystems. Recover populations of rare species and biological diversity of native species by using scientifically informed methods.	Same as Alternative 1, plus expand research and recovery efforts on a range of issues including habitat conservation, watershed protection, restoration of native species and ecosystems. Native Hawaiian traditional ecological knowledge would be used to enhance current scientific understanding to protect park resources. Engage visitors with additional opportunities to participate in resource management and restoration activities. Work with interpretive and education programs to showcase specific areas, such as special ecological areas as living laboratories for experimental restoration and research.	Same as Alternative 2; however, the park would maximize opportunities for volunteerism, stewardship, service-learning, and citizen science as a major component of natural resources management. Also, the park natural resources staff would maximize efforts to work with interpretive and education programs to showcase specific areas, such as special ecological areas, as living laboratories for experimental restoration and research and expand efforts to engage visitors in restoration activities and projects.
Cultural Resources			
Actions Common to All Alternatives	Continue to provide cultural resource protection for cultural landscapes, historic buildings and structures, archeological and ethnographic resources, and museum collections for park-related projects as required by law.		
	Continue to recognize the sacredness of the park to many Native Hawaiians.		
	Facilitate traditional cultural practices as allowed by NPS policy and regulations.		
	Acknowledge that some ethnographic use of nonsensitive shoreline resources may be allowed above the high water mark.		

Table 3.8. Summary of Alternatives

Topic	Alternative 1: No Action	Alternative 2: Preferred Alternative	Alternative 3
General	Continue to provide cultural resources protection for park-related projects as required by law. Continue with documentation, research, and stewardship of cultural resources with limited opportunity to expand program capabilities. Continue to stabilize and maintain significant landscapes or national register-eligible properties or contributing elements, as able.	Strengthen and expand documentation, research, and stewardship of cultural resources. Expand toward a full complement of preservation specialists on staff. Integrate concepts of traditional Native Hawaiian land management and traditional ecological knowledge and strive to expand understanding of cultural resources within the context of Native Hawaiian world view. Expand the permanent staff or archeologists to meet the needs of all the park's compliance projects. Pursue a suite of preservation plans to provide guidelines for interpreting and preserving cultural landscapes and historic structures. Research and exhibit a greater number of museum collections. Work toward permanent facilities to house and showcase significant collections and provide researchers access to those materials.	Same as Alternative 2, plus emphasize surveys (including oral history and interviews), research, and stewardship opportunities to foster long-lasting connections to the park's cultural resources. Maximize opportunities for visitors to engage in the research, scientific investigation, and projects associated with cultural resources management. Expand efforts to work with interpretation and education in order to broaden messages used in visitor programs about the sacredness of the park and aloha ʻāina (love of the land) to Native Hawaiians and emphasize the interconnectedness and interdependency between the natural and cultural environments.
Historic Resources	Continue to inventory Kahuku's resources and update the National Register of Historic Places Determination of Eligibility.	Same as Alternative 1, plus continue to stabilize and maintain for interpretation some significant ranching and World War II-era landscapes or contributing elements at Kahuku.	Same as Alternative 2.
Research			
Actions Common to All Alternatives	Continue park research efforts and collaboration with partners; continue to support independent research under the NPS permitting system. Emphasize research related to ecology, endemics, climate change, archeology, history, and traditional cultural properties.		
	Continue to allow operations for Hawaiian Volcano Observatory in its present location adjacent to Jaggar Museum.		
Research	See "Common to All Alternatives"	Strengthen the emphasis on disseminating research related to ecology, invasive species, rare species, climate change, archeology, history, and traditional cultural properties to park visitors in a lay-person format.	Same as Alternative 2, plus expand opportunities for citizen science and new ways for visitors to participate in research activities.
Wilderness			
Actions Common to All Alternatives	Continue to manage designated wilderness consistent with NPS management policies and the Wilderness Act and to manage proposed eligible wilderness in upper Kahuku for its wilderness qualities.		
	Continue to complete the minimum requirements analysis as required for all management actions in designated and eligible wilderness.		

Table 3.8. Summary of Alternatives

Topic	Alternative 1: No Action	Alternative 2: Preferred Alternative	Alternative 3
General	See "Common to All Alternatives"	Recommend wilderness designation for 121,015 acres (GIS) at Kahuku that met eligibility criteria. Develop a wilderness stewardship plan to guide wilderness use in the park after completion of this GMP/WS/EIS. Emphasize preserving the qualities of wilderness character and continue activities and uses in wilderness under minimum tool analysis based on previous environmental compliance which include: (1) fences to protect native ecosystems from nonnative animals, (2) research instrumentation and telecommunication essential to continued volcanic studies and warnings, (3) the use of helicopters as a minimum tool in servicing research instrumentation and in the protecting and restoring of natural and cultural resources, and 4) water catchment shelters in remote waterless backcountry.	Same as Alternative 2.
Soundscapes and the Acoustic Environment			
Actions Common to All Alternatives	Aircraft use is allowed for administrative purposes throughout the park and minimum tool analysis is used when needed, as outlined in the *Mission Critical Administrative Aviation Plan/EA* (2014).		
General	Continue to use a variety of methods to reduce human-caused noise and improve natural sounds. Complete an air tour management plan/EIS that would develop measures to limit or prevent any significant impacts that may be caused by commercial air tour operations upon the natural and cultural resources, or visitor experiences at the park.	Same as Alternative 1, plus expand active management practices to improve soundscapes and the acoustic environment by: (1) implementing best management practices to limit the duration of artificial noise, (2) maximizing human-caused noise free periods, (3) creating more opportunities for visitors to experience natural soundscapes, and (4) implementing partial closures of air space in sensitive areas. Reduce artificial noise within wilderness; in and near critical habitat for threatened and endangered species; in traditional cultural areas such as volcano summits, active lava, or active volcanic features; and in high visitor use areas. Expand information and training to commercial air tour operators. Implement a soundscape monitoring program and consider developing a soundscape management plan, if additional guidance is needed.	Same as Alternative 2.

Table 3.8. Summary of Alternatives

Topic	Alternative 1: No Action	Alternative 2: Preferred Alternative	Alternative 3
Visitor Experience			
Actions Common to All Alternatives	Strive to provide high-quality visitor experiences and continue to offer visitors a menu of options depending on length of stay, interests and capabilities.		
	Continue to allow visitors to experience the park's world treasures, iconic landscapes, volcanic processes, and other significant highlights.		
	Continue existing recreation opportunities such as camping, picnicking, hiking, biking, equestrian use, and viewing lava, scenery, and wildlife.		
	Continue to maintain trails and provide visitor facility improvements as needed.		
	Continue to maintain the Kūlanaokuaiki Campground as a frontcountry campground with approximately eight sites and a vault toilet, i.e., no water.		
	Prioritize and locate accessibility improvements.		
	Continue to rehabilitate and interpret the historic Civilian Conservation Corps shelter and footprints in the Ka'ū area.		
	Work with Ala Kahakai National Historic Trail staff to sign and interpret those trail segments through the park.		
General	Continue to provide visitors with safe access to volcanic features, active lava, cultural resources, and ecosystems from sea to summit. Use a variety of methods to help manage visitor congestion such as educating the public and dispersing visitor use through information.	Continue to provide visitors with safe access to volcanic features, active lava, cultural resources, and ecosystems from mauka to makai. Manage different geographic areas of the park for different types of visitor experiences and levels of visitor services. Offer unique opportunities to understand the ways in which kama'āina (local people of the land) view, understand, and connect with park landscapes and resources today. Manage visitor expectations that eruptive events would likely be linked with congestion.	Same as Alternative 1, plus enhance and expand unique hands-on learning and stewardship opportunities for visitors that stretch from mauka to makai. Consider managing general park congestion with a mandatory shuttle around Crater Rim Drive, in addition to a suite of other tools to disperse visitors and traffic.
Range of Recreational Activities	Continue to allow for a range of recreational activities: camping, hiking, backpacking, biking, equestrian use, birding and other wildlife viewing, lava viewing, picnicking, general sightseeing, and stargazing. Opportunities at Kahuku would continue to be limited.	Continue recreational activities same as Alternative 1, plus provide additional opportunities for existing activities in different geographic areas and expand recreational activities in Kahuku beyond current use. Focus on ranger-guided tours for access to new and particularly sensitive areas in the park.	Similar to Alternative 2, however focus expanded recreational uses on providing opportunities and amenities for larger educational and stewardship groups.
Trails: Hiking, Biking, and Equestrian	Maintain the existing trail network within the main part of the park with emphasis on frontcountry trails. Continue to create safe trail corridors that link key features or park sites. Encourage bicycling, pedestrian, and equestrian use as recreational activities and as alternative transportation to park sites. Continue to seek solutions to provide safe pedestrian and bicycle access around Crater Rim Drive. Identify key needs for trail improvements. Work with Ala Kahakai National Historic Trail staff to sign and interpret those trail segments through the park.	Develop a trail management plan to comprehensively assess trail conditions and needs and to identify specific trail alignments and uses. Develop new trail alignments primarily along historic alignments and traditional routes, or on existing roads, such as at Kahuku. Strive to provide access to a variety of locations for different audiences and types of recreationists. Try to create loop trail experiences through new links between existing trails. Evaluate ways to use the road network for improved nonvehicular recreation opportunities rather than construct extensive new trails.	Create a trail management plan to comprehensively assess trail conditions and needs and to identify specific trail alignments and uses. Create few new trails, but upgrade existing trails, historic trails, turnouts, and waysides to connect key features or park sites. Focus on road closures in some areas to during certain times of day/days of week to provide a less congested experience for recreationists such as hikers, backpackers, bikers, and equestrian users.

Table 3.8. Summary of Alternatives

Topic	Alternative 1: No Action	Alternative 2: Preferred Alternative	Alternative 3
Frontcountry Camping	Maintain Nāmakanipaio Campground and Kūlanaokuaiki Campground as the only formal frontcountry campgrounds that offer drive-in camping facilities in the park. Maintain Nāmakanipaio Campground as a concession/fee operation.	Maintain Nāmakanipaio and Kūlanaokuaiki campgrounds as formal frontcountry campgrounds in the park with Nāmakanipaio similar to Alternative 1, plus consider developing additional primitive and dispersed campsites in the main park for general public camping. Additional camping opportunities would be provided in Kahuku. Consider future frontcountry camping development in relationship to outdoor education pavilions targeted to educational groups.	Similar to Alternative 2 except the only increased general public camping would be at Kahuku.
Backcountry Camping	Maintain the existing backcountry campsites and associated facilities, including water catchment systems, restrooms, shelters, etc.	Maintain existing backcountry camping. Explore formally designating some backcountry campsites (beginning with areas already in use), primarily along the coast. Additional backcountry camping opportunities would be available at Kahuku. Any new campsites would require further planning.	Same as Alternative 1, plus additional backcountry camping opportunities would be available at Kahuku.
Interpretation and Education			
Actions Common to All Alternatives	Continue to provide a variety of interpretive and educational programs, events, and guest speakers to engage park visitors and diverse audiences.		
Interpretation and Education Programs	Continue to offer a range of interpretive programs, media, and techniques. Integrate wayside and interpretive planning for Kahuku into the comprehensive interpretive plan currently under development. Focus interpretation at Kahuku on a range of themes and media for visitor immersion. Continue to promote environmental education, ranger-led programs and tours, and variety of curriculum-based activities.	Continue to provide the current range of interpretive programs, media, and techniques in Alternative 1. Finalize a comprehensive interpretive plan and include Kahuku. Focus interpretation methods on ranger-led experiences and live programs to immerse visitors in the volcanic, biologic, and cultural resources at the park. Provide hands-on educational experiences in the frontcountry and engage visitors in research and citizen science. Utilize new media and tools to provide inquiry-based learning through frontcountry self-guided interpretive and educational opportunities in order to meet the diverse needs of an increasingly international audience.	Same as Alternative 1 plus focus on ranger-led experiences and live programs to immerse visitors in the volcanic, biologic, and cultural resources. Provide additional opportunities to learn from Native Hawaiians and/or cultural practitioners. Focus on providing hands-on educational experiences for school, volunteer, and other organized groups and engage visitors in stewardship, research, and citizen science as a key element. Emphasize engaging educational groups and service groups. Work with natural resources staff to showcase specific areas (such as special ecological areas) for restoration and research.
Interpretation and Education Facilities	Continue to use Kīlauea Visitor Center and Jaggar Museum as primary locations for visitor orientation and in-depth exposure to the park's interpretive themes. Promote Kahuku as an important location for visitor orientation on days it is open for public access. Maintain the basic infrastructure for visitors and education groups and upgrade facilities as needed.	Expand the uses of Jaggar Museum and Kīlauea Visitor Center as dramatic opportunities to introduce visitors to the volcanic, biologic, and cultural resources at Hawai'i Volcanoes National Park and include Kahuku as an important location for visitor orientation. Emphasize minimal new facilities: structures would be small, low-impact, potentially designed to be consistent with traditional Hawaiian design (such as thatched hale), and provide flexibility during periods of eruptive activity. Provide opportunities for outdoor education and inquiry-based learning that stretches from mauka to makai with a series of small, covered pavilions at key locations.	Similar to Alternative 2 except do not expand the uses of Jaggar Museum and Kīlauea Visitor Center. Provide opportunities for outdoor education and inquiry-based learning that stretches from mauka to makai with a series of small, covered pavilions at key locations similar to Alternative 2.

Table 3.8. Summary of Alternatives

Topic	Alternative 1: No Action	Alternative 2: Preferred Alternative	Alternative 3
Transportation and Access			
General	Maintain park roads to provide for safety consistent with the park setting, ensuring a park-like and scenic driving experience. Maintain historic road alignments to the extent possible. Continue current range of roads and road standards. Continue to work cooperatively with the state and other partners, particularly on Highway 11 for visitor safety, signage, and information. Maintain parking areas and turnouts with upgrades as needed but provide no major new parking areas.	Same as Alternative 1 plus, provide some upgrades or expansion as needed to facilitate and improve visitor access for vehicles and bicycles. Could reduce or remove some parking areas out of concern for park resources. Manage congestion and private vehicle use using an intelligent transportation system, marketing strategies, and park policies to control cars and congestion. Implement new restrictions or management of vehicles on some roads, such as size limits and a pilot program for one-way traffic for large commercial buses on Crater Rim Drive. Possibly restore some road connections previously lost to lava and reopen roads impacted by lava, seismic activity, eruptive events, or other acts of nature, when feasible. Explore continuation of a nonmandatory shuttle system in the park after completion of the hydrogen shuttle pilot project.	Maintain park roads similar to Alternative 1. Explore the feasibility of implementing a mandatory shuttle system on Crater Rim Drive, and potentially to other locations in the park, to reduce private vehicle traffic and congestion, following the completion of the hydrogen shuttle pilot project. Maintain closure of Crater Rim Drive to private vehicles. Improve bicycle access on roads by considering limits on private vehicles. Minimize any expansion or development of new parking and potentially remove or reduce parking for resource concerns. Do not construct new roads. Reevaluate reopening of roads to vehicle traffic that are impacted by volcanic or seismic activity or other natural events and whether roads could be converted to trails.
Commercial Services			
General	Continue to authorize existing commercial services through a range of legal authorities using a variety of different permits, contracts, and other authorizations, depending on the type and location of the activity involved.	Continue to allow the range of commercial services that presently exist at existing levels and locations. Implement guidance in the Commercial Services Strategy (Appendix F) for future decisions and evaluating new requests. Consider expansion of Nāmakanipaio campground to include additional indoor lodging facilities. Allow commercial services in lower Kahuku, but restrict from upper Kahuku. Include management strategies such as infrastructure changes to accommodate commercial uses; limits on numbers or size/capacity or times/dates of commercial activities; engaging commercial service providers in communicating park information to the public.	Same as Alternative 2 except no expansion of Nāmakanipaio campground to include additional indoor lodging facilities.
Partnerships			
Actions Common to All Alternatives	Continue to collaborate with and engage other partners in monitoring and protecting of terrestrial, coastal and marine resources. Continue to maintain formal and informal partnerships in support of broader landscape protection, including Three Mountain Alliance, the largest land partnership in the state of Hawai'i.		

Table 3.8. Summary of Alternatives

Topic	Alternative 1: No Action	Alternative 2: Preferred Alternative	Alternative 3
General	Continue to maintain existing partnerships and relationships that are key to the park's mission.	Same as Alternative 1, plus foster and expand partnerships with local and regional communities, organizations, nonprofits, and businesses; Native Hawaiian communities; adjacent landowners; local, state, and federal agencies; and other interested groups or organizations to support the purpose and significance of the park. Promote community and school involvement in traditional practices and environmental service projects.	Same as Alternative 2.
Administrative Facilities and Infrastructure			
General	Continue to maintain, and upgrade when necessary, administrative infrastructure in the park such as offices, storage, and utilities and improve provisions for accessibility. Continue to maintain, and upgrade when necessary, existing infrastructure in lower Kahuku and continue to use existing buildings there for office space and storage.	Same as Alternative 1 plus, strive to relocate administrative functions from Kīlauea Visitor Center to other buildings consolidate interpretation and visitor use functions at the visitor center. At Kahuku, continue to maintain and upgrade when necessary existing infrastructure. Adaptively reuse the existing developed area in lower Kahuku for a mix of visitor services and administrative and operational use as needed. Locate any new development in Kahuku in the existing developed footprint.	Same as Alternative 2.
Climate Change and Sustainability			
General	Continue to implement the climate action plan for the park and participate in the Climate Friendly Parks program. Strive to reduce greenhouse gas emissions, continue monitoring and research, increase climate change education and outreach, and develop climate change adaptation strategies.	Continue to implement the climate action plan for Hawai'i Volcanoes National Park and participate in the Climate Friendly Parks program. Strive for increased energy efficiency, conservation, and sustainability of facilities and prioritize green facility design to the greatest extent possible. Encourage contractors and concessioners to reduce their own greenhouse gas emissions, use sustainable practices, and purchase local products. Promote hiking and biking to get visitors and employees out of cars and decrease the park's carbon footprint. Serve as a model for climate change adaption by supporting climate change-related research, adapting management activities based on climate projections, and building resilience among populations of rare native species, communities and ecosystems.	Same as Alternative 2.

SUMMARY OF COSTS ASSOCIATED WITH IMPLEMENTATION OF THE ALTERNATIVES

Table 3.9. Summary of Costs

	Alternative 1 (No Action)	Alternative 2 (Preferred)	Alternative 3
ANNUAL OPERATIONAL COSTS			
Total Annual Operational Costs	$7,990,000	$10,739,000	$10,689,000
Total Staffing (FTE)	153.5	190	189
ONE-TIME COSTS			
Priority 1 Projects Main Park	$5,260,000	$18,823,000	$18,655,000
Priority 2 Projects Main Park	$0	$2,674,000	$2,035,000
Total Main Park	**$5,260,000**	**$21,497,000**	**$20,690,000**
Priority 1 Projects Kahuku	$1,820,000	$14,029,000	$14,029,000
Priority 2 Projects Kahuku	$0	$2,452,000	$2,452,000
Total Kahuku	**$1,820,000**	**$16,571,000**	**$16,481,000**
Total One-time Costs	**$7,080,000**	**$38,068,000**	**$37,171,000**
Deferred Maintenance Offset	**$5,275,000**	**$22,841,000**	**$21,823,000**

SUMMARY OF IMPACTS

Table 3.10. Summary of Impacts

Alternative 1 (No Action)	Alternative 2 (Preferred)	Alternative 3
GEOLOGIC RESOURCES		
Negligible to moderate adverse impacts. Widespread minor to moderate beneficial impacts. Negligible to moderate adverse cumulative impacts.	Minor to moderate adverse impacts, all localized. Widespread minor to moderate beneficial impacts. Negligible to moderate adverse cumulative impacts.	Negligible to moderate adverse impacts, all localized. Widespread minor to moderate beneficial impacts. Negligible to moderate adverse cumulative impacts.
VEGETATION		
Negligible to moderate, long-term and adverse impacts. Long-term minor to major beneficial impacts. Cumulative impacts are moderate adverse and minor to major beneficial.	Negligible to moderate, long-term, localized, adverse impacts. Long-term minor to major beneficial impacts. Cumulative impacts are moderate adverse and minor to major beneficial.	Same as Alternative 1.
NATIVE WILDLIFE AND WILDLIFE HABITAT		
Negligible to minor long-term adverse impacts. Moderate to major long-term beneficial impacts. Moderate long-term adverse and moderate to major long-term beneficial cumulative impacts.	Negligible to moderate long-term localized adverse effects. Minor to major long-term and more widespread beneficial impacts. Moderate long-term adverse and moderate to major long-term beneficial cumulative impacts.	Same as Alternative 2.

Table 3.10. Summary of Impacts

Alternative 1 (No Action)	Alternative 2 (Preferred)	Alternative 3
SPECIAL STATUS SPECIES		
Negligible to minor short-term adverse impacts. Long-term moderate to major beneficial impacts. Cumulative impacts would be long-term moderate adverse and long-term moderate to major beneficial.	Similar to Alternative 1 with increased protection which will result in decreased adverse impacts.	Same as Alternative 2.
WILDERNESS		
Short- and long-term minor to moderate adverse impacts. Long-term minor to major beneficial impacts. Cumulative impacts would be minor to major and adverse.	Overall impact levels same as Alternative 1.	Overall impact levels same as Alternative 1.
SOUNDSCAPES AND THE ACOUSTIC ENVIRONMENT		
Short-term moderate and long-term negligible to moderate adverse impacts. Minor to major adverse cumulative impacts.	Short-term minor to moderate and long-term negligible to minor adverse impacts. Long-term minor to moderate beneficial impacts. Minor to major adverse cumulative impacts.	Same as Alternative 2.
ARCHEOLOGICAL RESOURCES		
Long-term negligible to minor adverse and beneficial impacts. Cumulative impacts would be adverse.	Long-term negligible to minor adverse impacts. Long-term moderate beneficial impacts. Cumulative impacts would be adverse.	Same as Alternative 2.
HISTORIC STRUCTURES/CULTURAL LANDSCAPES		
Long-term negligible to minor beneficial impacts. Cumulative impacts are long-term, minor to moderate, and both adverse and beneficial.	Both beneficial and adverse negligible to minor impacts. Cumulative impacts are long-term, minor to moderate, and both adverse and beneficial.	Same as Alternative 2.
ETHNOGRAPHIC RESOURCES		
Negligible to minor long-term adverse impacts. Cumulative impacts would be minor long-term and adverse.	Minor to moderate long-term beneficial impacts. Negligible to minor long-term adverse impacts. Cumulative impacts would be minor long-term and adverse.	Same as Alternative 2.
VISITOR USE AND EXPERIENCE		
Minor to moderate, long-term and both beneficial and adverse impacts. Moderate long-term beneficial cumulative impacts, both widespread and localized.	Minor to major, long-term beneficial impacts. Moderate adverse impacts. Moderate long-term beneficial cumulative impacts, both widespread and localized, with this alternative contributing a greater amount to these impacts compared to the no-action alternative.	Minor to major, long-term beneficial impacts. Moderate to major adverse impacts. Moderate long-term beneficial cumulative impacts, both widespread and localized, with this alternative contributing a greater amount to the adverse impacts compared to the preferred alternative.

Table 3.10. Summary of Impacts

Alternative 1 (No Action)	Alternative 2 (Preferred)	Alternative 3
TRANSPORTATION AND ACCESS		
Adverse, minor to moderate impacts parkwide, and localized negligible beneficial impacts. Negligible adverse cumulative impacts.	Long-term minor to moderate beneficial and adverse impacts. Negligible adverse cumulative impacts.	Long-term minor to moderate beneficial impacts. Long-term moderate adverse impacts. Negligible adverse cumulative impacts.
SOCIOECONOMICS		
Overall continuing impacts would be short- and long-term, moderate and beneficial. Long-term moderate and beneficial cumulative impacts.	Short- and long-term, moderate and beneficial. Long-term moderate and beneficial cumulative impacts, with the impacts greater than the no-action alternative.	Same as Alternative 2.
PARK OPERATIONS		
Long-term minor to moderate and adverse impacts. Moderate short-term adverse and moderate long-term beneficial cumulative impacts.	Overall long-term moderate and beneficial impacts, if funded, otherwise moderate to major adverse if implemented without additional funding. Moderate short-term adverse and moderate long-term beneficial cumulative impacts.	Same as Alternative 2.
GREENHOUSE GAS EMISSIONS, CLIMATE CHANGE, AND SUSTAINABILITY		
Negligible to minor, long-term beneficial impacts. Cumulative impacts would be beneficial and adverse.	Minor to moderate, long-term beneficial impacts. Cumulative impacts would be beneficial and adverse.	Same as Alternative 2.

IMPLEMENTATION OF THE GENERAL MANAGEMENT PLAN

Once the general management planning process is completed, the selected alternative would become the new management plan for the park and would be implemented in phases. The park's strategic plan, business plan, and annual work plans would help develop priorities that would determine how best to implement the general management plan.

Implementation of the actions and developments proposed within the management plan is dependent upon funding available at the time of need. The approval of this general management plan does not guarantee that the funding and staffing needed to implement the plan would be forthcoming.

In addition to funding, implementation of the preferred alternative also could be affected by other factors. More detailed planning and environmental documentation may be completed, as appropriate, before some of the actions would be carried out.

Implementation Plans, Studies,and Design Work

The following list includes some of the plans, studies and design work needed to implement the preferred alternative.

Plans and Designs

- development concept plan (summit of Kīlauea including visitor center improvements)
- adaptive reuse for Ohia Wing

- development concept plan (Kīlauea Iki to Devastation)
- site plan (Lua Manu Crater area)
- development concept plan (Kaʻū Footprints / Kaʻū Desert area)
- wilderness stewardship plan (parkwide)
- soundscape management plan (if additional guidance is needed)
- trail management plan (parkwide)
- accessibility plan (parkwide)
- comprehensive interpretive plan (parkwide)
- development concept plan (lower Kahuku)
- emergency operations plan (update to address changes to park as a result of implementing the general management plan)

Site Improvements

- trail design (Kīlauea Visitor Center to Jaggar Museum)
- design for outdoor seating area (Jaggar Museum)
- site plan improvements for groups (Kealakomowaena)
- interpretive waysides and trail development for bird-watching (Mauna Loa Road)
- trail design (Nāmakanipaio Campground to Mauna Loa Road)
- interpretive site design for boardwalk (ʻŌlaʻa-small tract)
- site improvements for entrance (Kahuku)

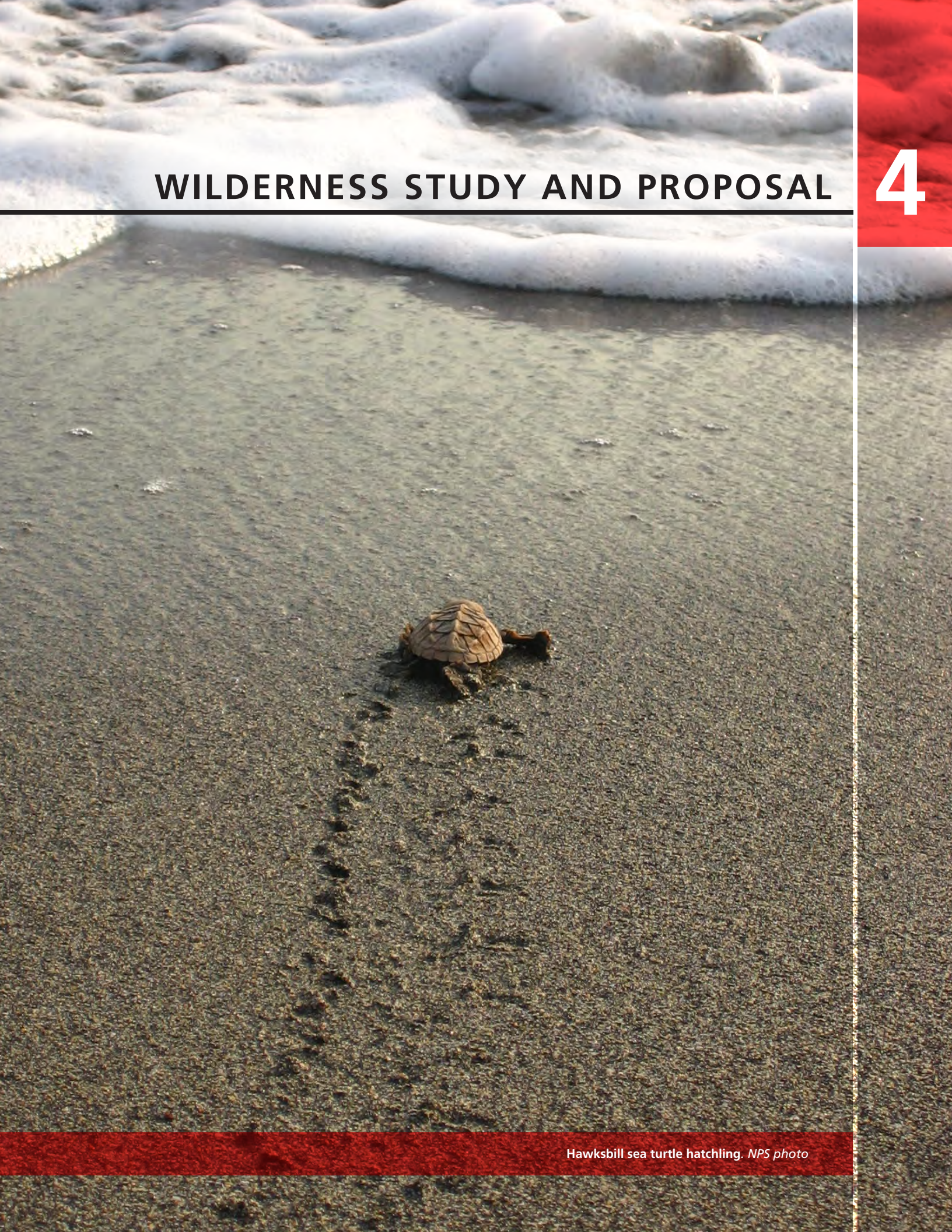
Studies and Data Needs

- environmental education curriculum and waysides updates (Devastation Trail area)
- soundscape monitoring program (parkwide)
- pilot program for testing one-way traffic for large commercial buses (Crater Rim Drive)
- monitoring and treatment plan to address spread of nonnative plants (ʻŌlaʻa rainforest)
- pilot program for equestrian use (lower Kahuku pastures)
- baseline vegetation assessment and monitoring plan (lower Kahuku pastures)
- National Register of Historic Places determination of eligibility (Kahuku)
- site-specific assessment of rare and listed species (all projects)

In addition, policy-required baseline studies and updates of existing plans such as the Fire Management Plan and Museum Management Plan would be completed when needed.

WILDERNESS STUDY AND PROPOSAL

4



Hawksbill sea turtle hatchling. *NPS photo*

Hawksbill sea turtle hatchlings leaving nest. *NPS photo*

CHAPTER 4: WILDERNESS STUDY AND PROPOSAL

INTRODUCTION

With the passage of the 1964 Wilderness Act, Congress declared a national policy to secure for present and future generations the benefits of enduring wilderness resources. NPS policy further directs that lands and waters within the national park system that are found to possess the characteristics and values of wilderness be formally studied for possible recommendation to Congress for wilderness designation. The purpose of wilderness designation is to preserve and protect wilderness characteristics and values in perpetuity. Wilderness can be officially designated only through congressional action.

In 1973, Hawai'i Volcanoes National Park initiated the first parkwide inventory to identify any wilderness-eligible lands, accompanied by a *Wilderness Study/Final Environmental Impact Statement*. The study resulted in the National Park Service formally proposing that 123,100 acres (130,950)[1] be designated as wilderness. In 1978, this acreage within Hawai'i Volcanoes National Park was formally designated by Congress (see *Figure 4.1. Wilderness and Backcountry Areas*). An additional 7,850 acres outside of park boundaries were also designated as potential wilderness by Congress, to be converted to wilderness upon acquisition. Since this land is outside the park boundary, it is not shown on the map.

In 2003, the park acquired 115,788 (150,865) acres in an area long known as Kahuku on the Southwest Rift Zone of Mauna Loa. NPS *Management Policies 2006* ("Chapter 6: Wilderness Preservation") direct the park to review roadless and undeveloped areas, including new areas or expanded boundaries within the national park system, to determine whether or not they are eligible for preserving as wilderness. The GMP/EIS process, which began in 2009, and the Kahuku acquisition presented the planning team with an opportunity to analyze the potential for additional wilderness designation within Hawai'i Volcanoes National Park since the 1974 Wilderness Study and the 1975 Final Environmental Statement.

Early in the planning process for the general management plan, the planning team conducted an assessment of wilderness eligibility for the Kahuku Unit and an assessment of the potential for wilderness suitability of all lands within park boundaries. In 2011 park staff determined that 121,015 (GIS) acres of the Kahuku Unit met eligibility criteria and requirements necessary to qualify for the National Wilderness Preservation System. Subsequently, in December 2011, the GMP/EIS planning process was amended to include a wilderness study and a notice was published in the *Federal Register* (volume 76, number 232, pages 75557-58). This draft GMP/Wilderness Study/EIS now evaluates any foreseeable effects associated with possible designation of additional wilderness within Hawai'i Volcanoes National Park.

WILDERNESS DEFINITION

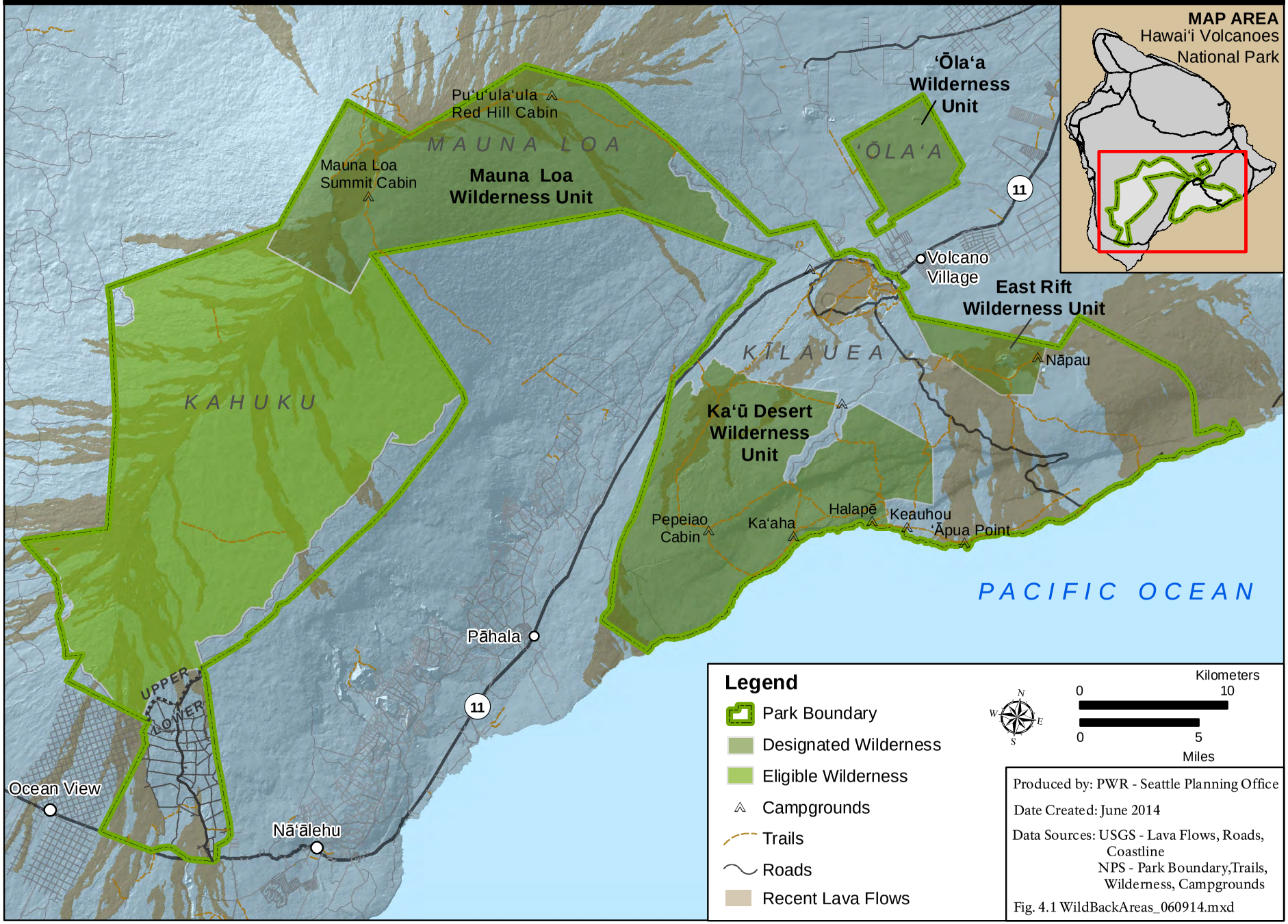
The Wilderness Act of 1964 (PL 88-577) is the guiding piece of legislation for all wilderness areas. This Act refers to wilderness as follows:

- lands designated for preservation and protection in their natural condition (Section 2[a])

[1] Determining acreage at Hawai'i Volcanoes National Park is a complex process by which varying sources provide different estimations of total acreage. Unless otherwise specified, acreage listed in this document includes two numbers: the first is the official acreage derived from deeds of conveyance to the United States and County/State tax assessor records, the sum total of which constitute the official NPS acreage for the park. (The official park acreage is maintained by the NPS Land Resource Division, WASO.) The second (listed in parentheses) is an estimation generated by GIS software that uses projections on the land to calculate acreage within geographically defined boundaries. When available and appropriate, both numbers are included in this GMP/WS/EIS because deed/tax assessor estimates, which are used in legislation and policy for the park, do not exist for some areas in the park, such as those acres analyzed for wilderness eligibility in the Kahuku Unit.

Figure 4.1 Wilderness and Backcountry Areas

Hawai‘i Volcanoes National Park GMP/WS/EIS



- an area where the earth and its community of life are untrammeled by man (Section 2[c])
- an area of "undeveloped Federal land retaining its primeval character and influence, without permanent improvement or human habitation" (Section 2[c])
- an area that "generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable" (Section 2[c})
- an area that "has outstanding opportunities for solitude or a primitive and unconfined type of recreation" (Section 2[c])
- an area that "shall be devoted to the public purposes of recreation, scenic, scientific, educational, conservation and historic use" (Section 4[b])

Based on these descriptions of wilderness, the Aldo Leopold Research Institute, an interagency group representing all four federal agencies that manage wilderness, prepared statutory language in *Keeping It Wild: An Interagency Strategy to Monitor Trends in Wilderness Character Across the National Wilderness Preservation System*. This document, along with the 1964 Wilderness Act definitions, specifically articulates the following five qualities of wilderness character:

- **Natural:** wilderness ecological systems are substantially free from the effects of modern civilization.
- **Untrammeled:** wilderness is essentially unhindered and free from modern human control or manipulation.
- **Solitude or a Primitive and Unconfined Type of Recreation:** wilderness provides outstanding opportunities for solitude or primitive and unconfined recreation.
- **Undeveloped:** wilderness retains its primeval character and influence, and is essentially without permanent improvements or modern human occupation.
- **Other Features of Value:** wilderness preserves other tangible features that are of scientific, educational, scenic, or historical value.

WILDERNESS ELIGIBILITY CRITERIA

NPS lands are considered eligible for wilderness if they are at least 5,000 acres or of sufficient size to make practicable their preservation and use in an unimpaired condition, and if they possess the following characteristics (as identified in the 1964 Wilderness Act):

- The earth and its community of life are untrammeled by humans, where humans are visitors and do not remain.
- The area is undeveloped and retains its primeval character and influence without permanent improvements or human habitation.
- The area generally appears to have been affected primarily by the forces of nature, with the imprint of humans' work substantially unnoticeable. The area is protected and managed so as to preserve its natural conditions.
- The area offers outstanding opportunities for solitude or a primitive and unconfined type of recreation.

BRIEF DESCRIPTION OF STUDY AREA

The wilderness study area consists of approximately 121,015 (GIS) acres within the legal boundaries of Hawai'i Volcanoes National Park at the Kahuku Unit. This area was determined wilderness-eligible in a 2012 Wilderness Eligibility Assessment (see *Figure 4.1. Wilderness and Backcountry Areas*).

The Kahuku Unit straddles dramatic lava flows and volcanic features along the Southwest Rift Zone of Mauna Loa, an active volcano and the largest mountain in the world. Over the past century, Mauna Loa has erupted frequently, often every two decades, and is known for its voluminous lava flows that extend down its Northeast Rift Zone (outside

the park) and its Southwest Rift Zone at Kahuku. The wilderness-eligible area stretches from alpine at 12,600 feet in elevation down to approximately 4,600 feet. Native montane ʻōhiʻa and koa forests are scattered between historic lava flows, providing habitat for several species of federally listed endangered plants and animals. Known in Native Hawaiian culture as the "realm of the gods," the only visible evidence of humans at the highest elevations are the stone remnants of Native Hawaiian archaeological sites and a few remaining segments of trails dating to the 18th and 19th centuries. The Southwest Rift Zone has experienced seven eruptions since 1843 and exhibits outstanding geologic features including high-elevation cinder and sulfur cones, cinder fields, and lava tubes. A colorful tephra deposit, called Hapaimamo, is located along the southern boundary of the area proposed as wilderness between 5,000 and 6,500 feet in elevation.

WILDERNESS ELIGIBILITY IN THE KAHUKU UNIT

In July 2003, 115,788 (150,865) acres (now known as the Kahuku Unit) were purchased from the estate of Samuel M. Damon and added to Hawaiʻi Volcanoes National Park. In accordance with NPS policy, park staff analyzed the Kahuku Unit for eligibility as wilderness based on the results of an inventory conducted in 2010. Of the 115,788 (150,865) acres assessed, approximately 121,015 (GIS) acres of the Kahuku Unit met the wilderness eligibility criteria and were proposed for further wilderness study and potential designation, as outlined in the 2012 Kahuku Unit Wilderness Eligibility Assessment (full text of analysis is available in Appendix D) (see *Figure 4.2. Eligible Wilderness, Kahuku*).

Other Park Lands Considered for Wilderness Eligibility

During the GMP process, staff also revisited two large roadless areas of the park previously excluded from the 1973 Wilderness Study. Park staff determined that the uses that resulted in their exclusion from the 1973 study are still continuing today; therefore, these areas do not meet the criteria necessary for wilderness.

One area analyzed is located immediately south of Kīlauea Crater, adjoining the Kaʻū Desert wilderness unit. This area of approximately 4,000 acres is heavily instrumented by the US Geological Survey for volcanic monitoring and research. The monitoring sites located there require routine maintenance and transport of heavy equipment. As a result, this site is excluded for eligibility as additional park wilderness.

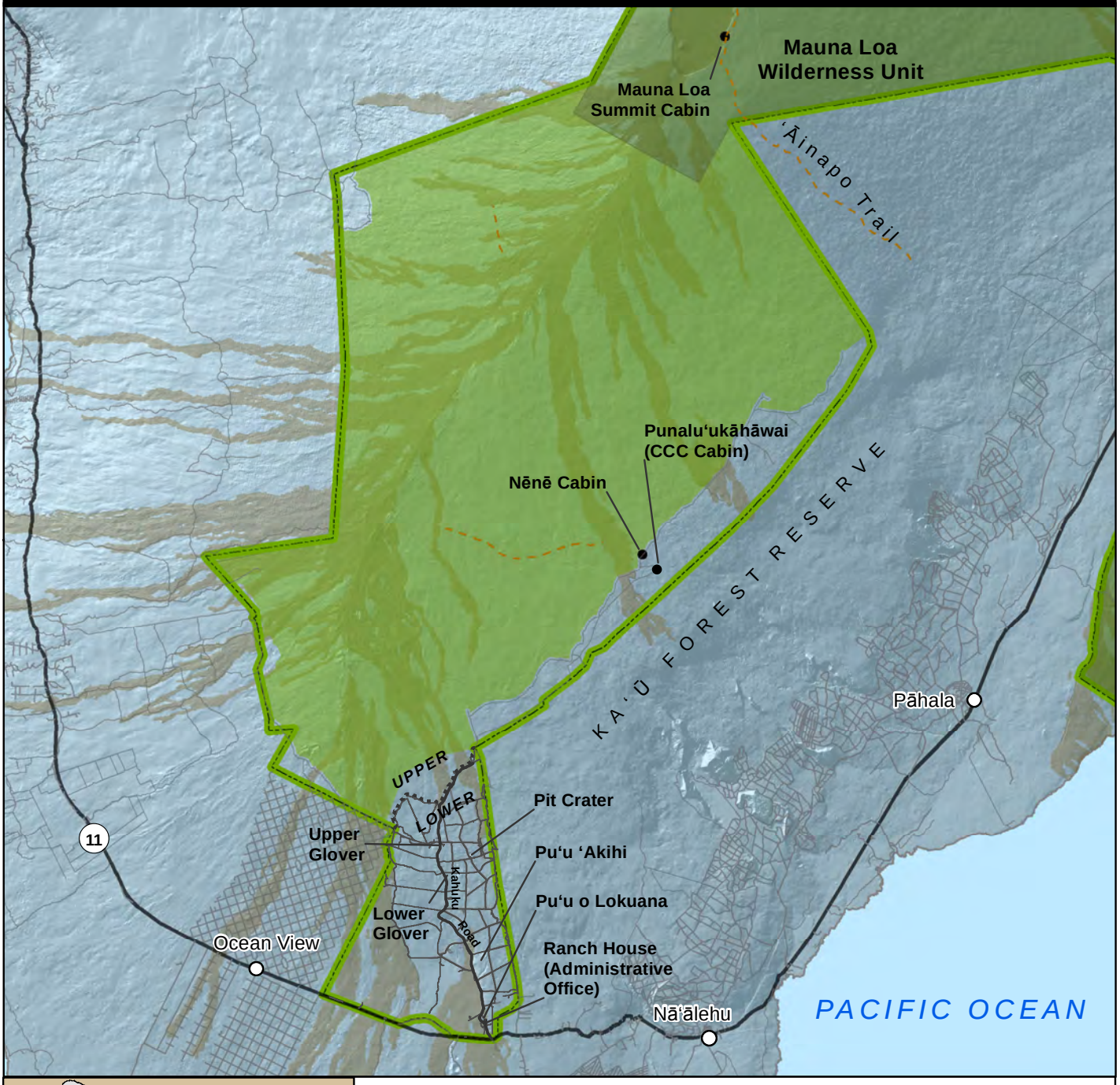
A second parcel is located on the southeast side of the park in a section known as the Kalapana Extension lands. The Kalapana Extension lands include 49,340 acres and are covered by provisions in Section 3 of the Act of June 20, 1938, titled "An Act to add certain lands on the island of Hawaiʻi to the Hawaiʻi National Park, and for other purposes" (HR 1995. 52 Stat. 781), which enables the Secretary of the Interior to lease home sites in the Kalapana Extension. This type of use is inconsistent with wilderness preservation and use, therefore none of the Kalapana extension lands are proposed as wilderness-eligible or considered for additional park wilderness.

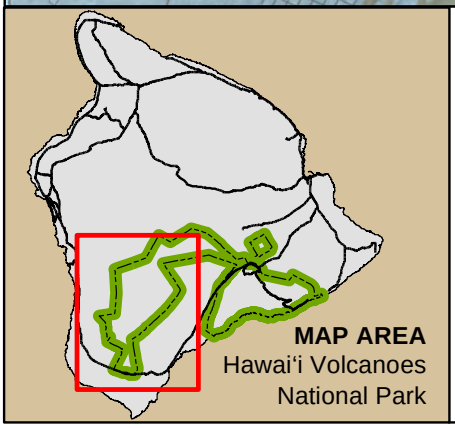
OPTIONS ANALYZED IN THIS WILDERNESS STUDY

Under all action alternatives in this GMP/WS/EIS, the National Park Service would propose wilderness designation of all 121,015 (GIS) acres found eligible for designation in the 2012 Wilderness Eligibility Assessment. These 121,015 (GIS) acres include an upper-elevation roadless parcel at Kahuku that is undeveloped and borders the park's previously designated wilderness atop Mauna Loa at 12,600 feet in elevation. A majority of the parcel descends to approximately 8,000 feet, with a small section on the west side dropping down to approximately 4,600 feet in elevation southeast of an area known as Hapaimamo. The National Park Service would propose that the wilderness-eligible lands to the north be demarcated from a point lying roughly 300 feet from the centerline of the northernmost roadways that run parallel to the park boundary both west and east of the upper Kahuku parcel. Lands in upper Kahuku adjacent to the east and west roads

Figure 4.2 Eligible Wilderness, Kahuku

Hawai'i Volcanoes National Park GMP/WS/EIS





Legend

- NPS Boundary
- Designated Wilderness
- Eligible Wilderness
- Cabins
- Roads
- Trails
- Recent Lava Flows

N W E S

Kilometers
0 10
0 5
Miles

Produced by: PWR - Seattle Planning Office

Date Created: June 2014

Data Sources: USGS - Lava Flows, Roads, Coastline
NPS - Park Boundary,Trails, Wilderness

Fig. 4.2 KahukuEligibleWild_060914.mxd

that lie between the park boundary and the roadways would be excluded. No developed roads would be included in this proposal for designation. See *Figure 4.1. Wilderness and Backcountry Areas*.

In order to maintain the ecological integrity of the Kahuku Unit, restore the native forest, and promote the recovery of endangered species, park staff will need to use and maintain the current road system for a number of decades in order to conduct activities such as fencing, ungulate removal, and restoration of exotic grass pastures. The need for ongoing administrative or operational access to existing roads restricts wilderness designation options at the Kahuku Unit as it is anticipated that both the historic and nonhistoric portions of the higher-elevation road system would need to remain open to administrative vehicles for these purposes. Upon completion of high-elevation forest and endangered species recovery projects, parts or all of the road system, as well as any restored native forest areas, could be reconsidered for wilderness and used as a hiking trail or restored to natural conditions.

In addition to the higher-elevation roadways, the 2012 Wilderness Eligibility Assessment also determined that 29,848 (GIS) acres at the Kahuku Unit are ineligible for designation due to the changes wrought by past cattle ranching activities and the presence of past ranching developments, including extensive paddocks of exotic grasses, roads, corrals, water pipelines, a small runway, two reservoirs of water, and a series of ranch buildings. Portions of the area are more heavily degraded due to extensive modification by bulldozers. Ongoing native forest and endangered species recovery activities in all excluded areas of the Kahuku Unit are needed in order to restore ecological integrity. These activities will require administrative use of the current road system and routine road maintenance for a number of decades. The presence of these activities and road uses preclude further options for wilderness proposals in Kahuku Unit at this time.

Under the no-action alternative in this draft GMP/Wilderness Study/EIS, the park would continue to manage the proposed eligible wilderness in upper Kahuku for its wilderness qualities, but there would be no proposal for wilderness designation. Recreational access at Kahuku would continue to be limited to day use only on weekends and for special events in the short-term, with the long-term goal of providing access seven days per week, and the current main road system would be maintained for vehicle access to Upper Glover. There would be no public vehicular access above Upper Glover.

SUMMARY OF PUBLIC INVOLVEMENT RELATED TO WILDERNESS

Hawai‘i Volcanoes National Park received public comments on wilderness during both the 2009 initial GMP public scoping process and during the 2011 public review of preliminary alternatives, which also served as the official scoping for this wilderness study. In 2011, the preparation of a wilderness study was added as part of the GMP process and was advertised via press releases. On December 2, 2011, a Notice of Intent was published in the *Federal Register* (Volume 76, Number 232, and Pages 75557–58) announcing the inclusion of the Wilderness Study. In addition, the mailing of Hawai‘i Volcanoes National Park GMP Newsletter 3 Preliminary Alternatives included a map of proposed eligible lands in Kahuku and a discussion of wilderness criteria (see "*Chapter 7: Public Involvement*").

During initial public scoping for the parkwide general management plan in 2009, 17 wilderness-related comments were received. Of the 17 respondents, 16 were supportive of park wilderness protection and promoted wilderness values. One respondent cautioned that the park should be careful with any new wilderness designation due to limits on access or increased costs it might incur in accomplishing native forest protection and restoration activities. No other opposition was expressed to further wilderness assessment or designation. Four individuals specifically

mentioned the importance of the wilderness experience in describing the future of Kahuku. One comment recommended that the upper slopes of Kahuku be officially designated as wilderness. One respondent thought that the public should have 4x4 road access to Kahuku's higher elevations. Overall comments on the Kahuku Unit emphasized the conservation values of this area and the importance of native forest protection and restoration.

In 2011, 21 respondents submitted 33 review comments on wilderness in Kahuku. A number of respondents specifically voiced support for the wilderness study and designation at Kahuku. Several comments focused on the need for backcountry facilities to support high-elevation access in rugged terrain, such as minimal shelters and water catchments. Another respondent emphasized that high-altitude historic trail remnants should be accessible to hikers. Several comments expressed concern that wilderness designation should not hamper the park's needs for intensive management related to removing ungulates, maintaining fencing, or administrative use of helicopters. Others were concerned about potential conflicts with wilderness designation due to the presence of air tours, administrative access needs for forest restoration and research, and the perceived need for backcountry shelters. One commenter stated that it made sense to exclude Kahuku roads from wilderness designation.

Several commenters voiced their support for the wilderness study and wilderness designation, and a few recommended including the Great Crack and the Kaʻū coastline, which are outside the park boundary. One commenter requested that the park reassess former wilderness designations, as some boundaries seem inappropriate and/or arbitrary, such as wilderness boundaries around ʻĀinahou Ranch and pit craters in the Kaʻū Desert. This commenter also suggested creating a buffer zone for wilderness in areas in Kahuku that are adjacent to other lands. There was no opposition to further wilderness assessment, study, or designation at Kahuku. All comments were received either in written form or orally at public meetings and "talk story sessions."

WILDERNESS PROPOSAL

After studying the various resources on the Southwest Rift Zone of Mauna Loa, the National Park Service proposes wilderness designation of the lands found eligible in the Kahuku Unit as a natural extension of the existing wilderness within the park. This designation of wilderness at Kahuku would further a conservation vision for high-elevation protection of natural and cultural resources and would create a link of connectivity for park wilderness that would span from the summit of Mauna Loa Volcano all the way down its massive Southwest Rift Zone. This rugged and remote environment offers outstanding opportunities for solitude and the potential for high-challenge recreational hiking. Nearly all of this mauka area of Kahuku is a place where the imprint of humans is scarcely noticeable, overpowered by the vast lava expanse and aura of wildness. The following figure illustrates the NPS wilderness review and management process.

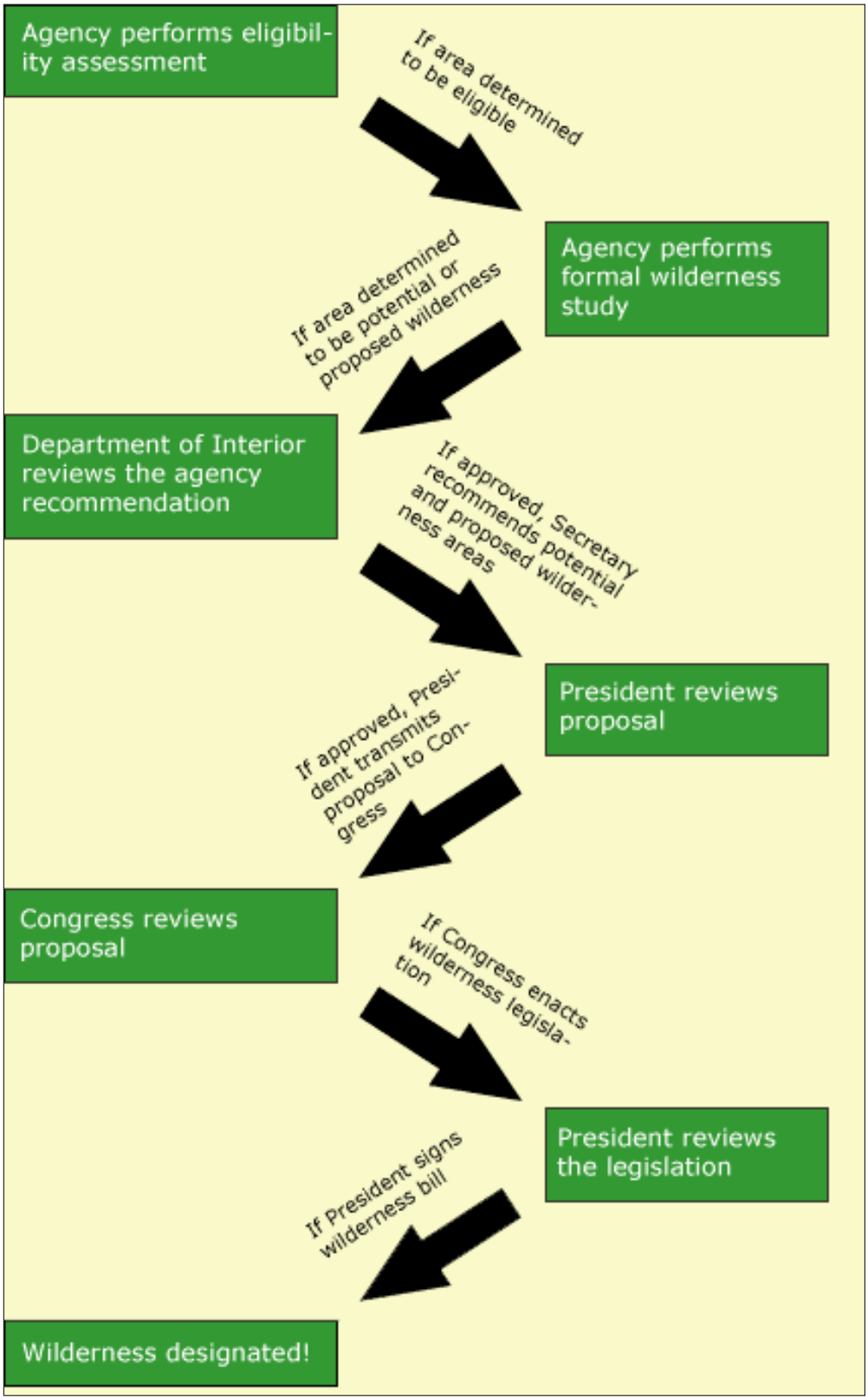
IMPLICATIONS OF MANAGING LANDS PROPOSED FOR WILDERNESS

General Guidance

Any NPS lands that are proposed for wilderness designation are to be managed as wilderness until such time as Congress specifically decides whether or not to include them in a formal wilderness designation (NPS *Management Policies 2006*). Management activities on lands proposed for wilderness cannot diminish the wilderness eligibility of those lands.

All management decisions affecting wilderness would be consistent with a "minimum requirements" analysis. Agencies responsible for administration of designated wilderness are required by law to preserve the wilderness character of the area. Managers at the park use a Minimum Requirement

Figure 4.3. NPS Wilderness Review and Management Process



Decision Guide (MRDG) to determine whether administrative activities affecting wilderness resources or visitor experiences are necessary in wilderness, and if so, how to minimize impacts from such activities. Parks are to complete an MRDG for administrative actions that have potential to affect wilderness character. Where practical alternatives do not exist, administrative actions (such as trail maintenance or forest restoration) may be accomplished through the use of otherwise prohibited uses in wilderness, if determined necessary through the minimum requirement analysis process. A detailed description of this process is outlined in Director's Order 41 reference manual, "Keeping it Wild in the National Park Service: A User Guide to Integrating Wilderness Character into Park Planning, Management, and Monitoring" and may also be obtained on-line at www.wilderness.net.

Planning and Management

Once wilderness is designated, a wilderness stewardship plan is typically developed to guide preservation, management, and use of NPS wilderness areas. Such a plan is developed with public involvement and contains specific, measurable objectives for preservation of wilderness values as specified in the Wilderness Act and NPS *Management Policies 2006*. Wilderness stewardship plans, which are often combined with backcountry management plans, articulate management actions such as regulations, monitoring, and permit systems similar to those currently in place for backcountry camping in other established park units. Since Congress officially designated 123,100 acres (130,950) of wilderness at Hawai'i Volcanoes National Park, the park has never developed a wilderness stewardship plan to guide the protection and management of wilderness resources and the wilderness visitor experience. It is anticipated that the park will begin work on a wilderness stewardship plan after completion of the general management plan, dependent on funding. The timing of any new designated wilderness would provide a seamless planning approach to the park's wilderness resources. A parkwide trail management plan is also anticipated for development after the general management plan is completed. As stated above, all management decisions affecting wilderness would be consistent with Director's Order 41: Wilderness Stewardship and reference manual, Wilderness Stewardship Plan Handbook 2014, and a "minimum requirements" analysis.

Recreational Uses

Recreational uses of NPS wilderness are to be of a type and nature that enable the areas to retain their undeveloped primeval character and influence, protect, and preserve natural conditions, leave the imprint of man's work substantially unnoticeable, provide outstanding opportunities for solitude or primitive and unconfined types of recreation, and preserve wilderness in an unimpaired condition. Public use of motorized equipment or any form of mechanical transport is prohibited, except as provided for in specific legislation. For example, using a bicycle in wilderness is prohibited. However, the use of a wheelchair, as defined by the Americans with Disabilities Act of 1990, is allowed in wilderness.

Due to a lack of surface water throughout Kahuku, it is assumed that a future wilderness stewardship plan would analyze the need for water catchment and shelters on any new high-elevation trails. This type of system is prohibited in wilderness but could be possible, after analysis through the wilderness planning process and MRDG analysis.

Emergency Services

In emergency situations involving the health and safety of people, the use of aircraft and other motorized or mechanical equipment would likely be allowed for administrative use. Wildfires would be controlled as necessary to prevent loss of life, damage to property, the spread of wildfire to lands outside wilderness, or unacceptable loss of wilderness values or degradation of wilderness character. The use of tool caches, aircraft, and motorized firefighting equipment

would possibly be permitted for such control. Prescribed fire and hazard fuel reduction programs could be implemented according to approved plans. Any actions involving motorized use and/or mechanized tools could be analyzed programmatically through the MRDG process.

Resource Management and Research

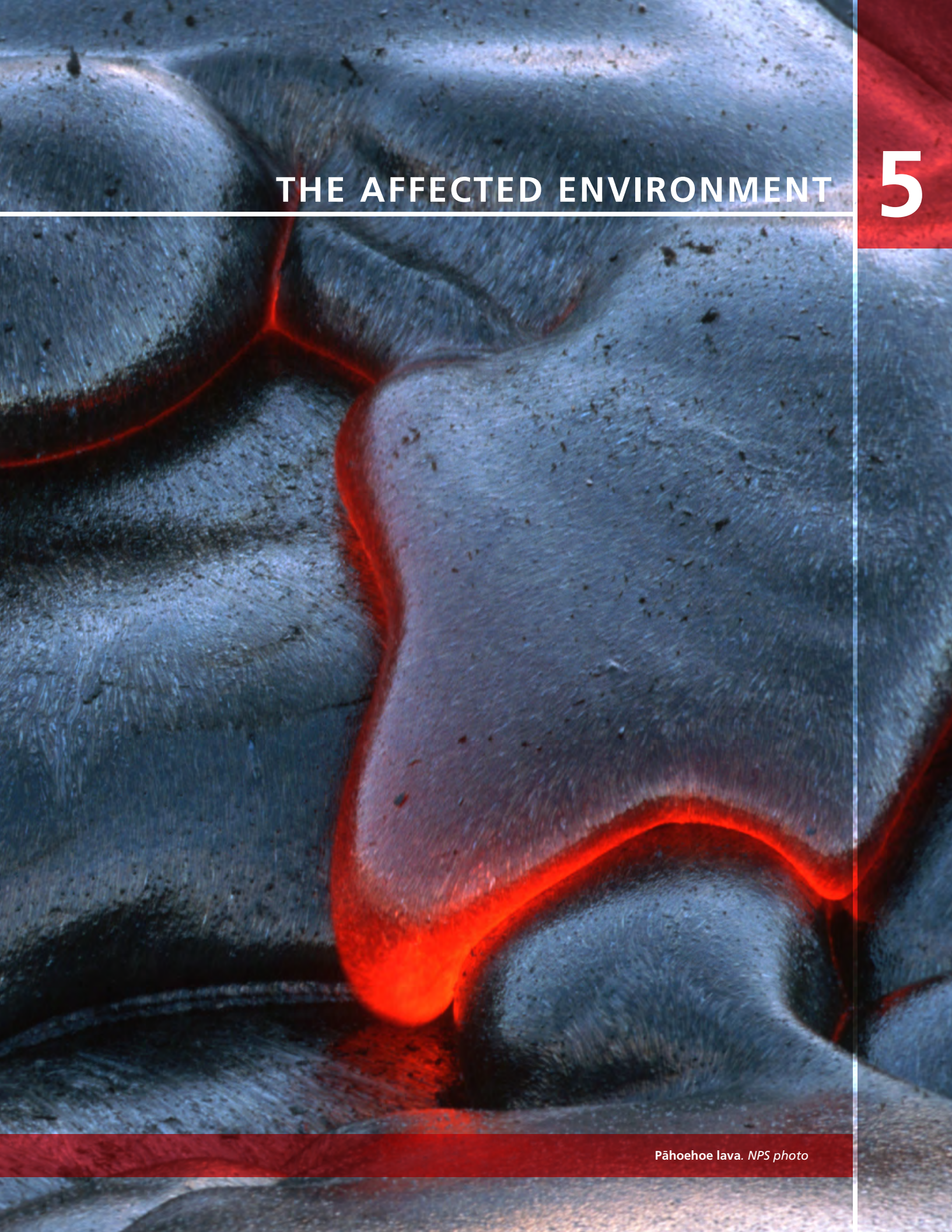
Natural resource management activities in wilderness are generally undertaken to address the impacts of past and current use on wilderness lands or remedy influences originating outside of wilderness boundaries. The use of tool caches, aircraft or mechanical equipment would be allowed only as consistent with the "minimum requirements" (MRDG) analysis. The park is actively engaged in long-term restoration activities to protect and restore special status species, natural conditions, and wilderness character throughout the park. Fencing, administrative use of helicopters, and nonnative species removal are currently permissible in wilderness as determined through the MRDG analysis.

Wilderness designation does not prevent the National Park Service from protecting and preserving historic and other cultural resources within wilderness areas. Using the minimum requirement concept, any cultural resources would be protected and preserved according to the pertinent laws and policies governing cultural resources.

A historic road and two cabins, one of which is thought to be eligible for listing on the national register, were excluded from wilderness-eligible lands in Kahuku. Although not included in wilderness eligibility, the road and cabins are anticipated to be used by hikers to access wilderness-eligible lands located at higher elevations.

Scientific research and geologic monitoring activities and equipment are allowed in wilderness. Even scientific activities (including inventory, monitoring, and research) that involve a potential impact to wilderness resources or values (including access, ground disturbance, use of equipment, etc.) are allowed when the benefits of what can be learned or benefits to health and safety of park visitors outweigh the impacts on wilderness resources or values. Volcanic research and monitoring within Hawai'i Volcanoes National Park provides information of major scientific importance and is essential to providing an effective early warning to the people of Hawai'i in the event of potentially destructive volcanic activity. Such monitoring is equally essential for management of park visitors and protection of park resources. In past years, the minimum tools and equipment necessary to accomplish this have included seismic instruments, SO_2 monitoring and GPS stations, webcams, and routine use of helicopters to remote monitoring stations. All such activities have been evaluated and approved in the past using the MRDG analysis. These activities have been and could continue to be accommodated in the future within the parameters of future wilderness planning as well as through the MRDG process.

THE AFFECTED ENVIRONMENT 5



Pāhoehoe lava. *NPS photo*

Halemaʻumaʻu Trail. *NPS photo by Stephen Geiger.*

CHAPTER 5: THE AFFECTED ENVIRONMENT

The "Affected Environment" describes the environment of Hawai'i Volcanoes National Park and surrounding lands. This section focuses on key park resources, uses, facilities, and socioeconomic characteristics that have the potential to be affected if any of the alternatives were implemented. Some characteristics of the park setting are also included because they provide context and/or must be considered for potential impacts in developing an environmental impact statement.

THE NATURAL ENVIRONMENT

Weather and Climate

In general, the park climate is characterized by a two-season year. The park exhibits mild, fairly uniform temperature conditions everywhere except at high elevations and is marked by varied geographic differences in rainfall. Climate data has been recorded at park headquarters (around 4,000 feet above sea level) since 1949 and shows that temperatures range from an average minimum of 59°F to a maximum of 67°F in winter, and from 63° to 71°F in summer. Average annual temperature from 1949 to 2006 was about 61°F. The highest recorded temperature was 89°F in December of 2000, while the lowest was 34°F in January of 1978 (WRCC n.d., 2006). From 2002 to 2007, annual average precipitation was 105 inches: the wettest months were December (twice), January (twice), March (once), and September (once). Temperature and precipitation vary by elevation, which ranges from sea level to 13,679 feet at the summit of Mauna Loa. For example, temperatures at the summit of Kīlauea can be 12 to 15° cooler than coastal lowlands, and mean temperatures in alpine areas on Mauna Loa—which include elevations of about 8,500 feet to the summit and can experience snowfall—range from 43° to 48°F. In addition, wet forests in the park average 90 to 140 inches of rain per year, while precipitation in coastal lowlands ranges from 20 to 60 inches (Park 2013a; NPCA 2008).

Air Quality

Hawai'i Volcanoes National Park is designated a Class I area under the Clean Air Act. Class I areas are afforded the highest degree of protection. The Clean Air Act states that managers have a responsibility to protect air quality-related values from adverse air pollution impacts.

NPS *Management Policies 2006* on air quality (NPS 2006a) also state that the National Park Service will seek to perpetuate the best possible air quality in parks to (1) preserve natural resources and systems; (2) preserve cultural resources; and (3) sustain visitor enjoyment, human health, and scenic vistas. Vegetation, visibility, water quality, wildlife, historic and prehistoric structures and objects, cultural landscapes, and most other elements of a park environment are sensitive to air pollution and are referred to as "air quality related values."

EMISSION SOURCES

Air quality in Hawai'i Volcanoes National Park is affected by a number of emission sources, primarily Kīlauea Volcano. Since 1983, records of eruption emissions from Kīlauea have recorded a range of 1,000 to 2,000 metric tons of sulfur dioxide (SO_2) each day, as well as other gases, including hydrogen sulfide, hydrogen chloride, hydrogen fluoride, and trace metals like mercury. The range of SO_2 emissions for Kīlauea (combined East Rift and summit eruption areas) for September 1, 2008 to May 7, 2010 is roughly between 950 to 7,300 metric tons per day. There has been an overall decline in total emissions since late 2008, but it is still approximately five times the historic levels.

Sulfur dioxide reacts with sunlight, oxygen, small particles, and water in the air to form a mixture known as volcanic smog or "vog." The vog not only creates a haze which obscures visibility, but it is very acidic, causing acid rain and affecting human health and natural and cultural resources. Adding

to the haze are marine aerosols, which can further diminish visibility. In addition, when hot lava reaches sea water, large clouds of mist are formed, often called "laze," which contain hydrochloric acid and other airborne contaminants harmful to human health. Although the volcano dominates total emissions, other emission sources within the park include motorized vehicles, generators, small mobile combustion engines, helicopters, and wildfires, which can also affect air quality and visibility, releasing nitrogen oxides, particulates, and other pollutants.

MONITORING

Hawai'i Volcanoes National Park is actively monitoring volcanic emissions within the park related to visitor and employee health and safety. This is discussed in more detail in the Visitor and Employee Health and Safety section of this chapter. In order to protect the park's other air quality values, a monitoring program was instituted in 1986. As part of the monitoring process, air quality related values were identified for Hawai'i Volcanoes National Park. These include park resources potentially sensitive to air pollution such as visibility, night skies, vegetation, wildlife, and cultural resources. In addition to the volcanic emissions monitoring, multiple methods are used to monitor air quality at the park, including atmospheric deposition, ultraviolet radiation, ozone, visibility, and haze. For further detail on the specifics of the air quality monitoring methods and how the data is used to protect visitor and employee safety, see "Visitor and Employee Health and Safety" later in this chapter.

Volcanoes and Volcanic Processes and Features

Hawai'i Volcanoes National Park is encompassed within portions of two active shield volcanoes, Mauna Loa and Kīlauea. Both volcanoes are world famous: Mauna Loa is one of the largest volcanoes in the World, while Kīlauea has sustained one of the world's longest continuous eruptions in recorded history. The processes that have formed and continue to sculpt these two Hawaiian Volcanoes are like none other in the world.

Mauna Loa Volcano, the elder of the two, has had its share of volcanic eruptions. Each eruption has contributed to its overall grandeur. Mauna Loa currently rises some 13,679 feet above sea level and encompasses more than half of the island of Hawai'i. Its most recent eruption occurred in 1984, which sent a lava flow within several miles of Hilo town. Of all the volcanoes in Hawai'i, Mauna Loa best exemplifies what geologists have termed a Hawaiian shield volcano. Hawaiian shield volcanoes have broad, gently sloping sides; with large sections stretching across the sea floor, Mauna Loa incorporates a base that extends some tens of thousands of feet to the seafloor. In total, Mauna Loa occupies a volume of approximately 19,000 cubic miles and if measured from the depths of its sea floor base, rises some 56,000 feet (Trusdell 2012). Its immense size is attributed to centuries of high-volume volcanic eruptions that occur approximately every 20 years on average. Typical of other Hawaiian volcanoes that are in their shield building stage, Mauna Loa features one caldera at its summit and two active rift zones. From Mauna Loa and its subsequent eruptions were born a diverse collection of volcanic products and features, like a caldera and craters, cones and fissures, and lava flows and faults.

Kīlauea has woven a similar yet younger history. Sporting a caldera and with two rift zones, Kīlauea is much like Mauna Loa in structure though not nearly as grand. Unlike Mauna Loa, Kīlauea is known for its plethora of eruptions, many of which have affected the lives of nearby communities. In the last 30 years, Kīlauea has erupted significant volumes of lava along its remote East Rift Zone, particularly from Pu'u 'Ō'ō and Kūpa'ianahā vents. This eruption, with few interruptions, has been ongoing since 1983 and has added approximately 500 acres of new land to Hawai'i Island's southern shore (Orr, Heliker, and Patrick 2013). Thanks to this nearly constant eruption—plus almost a dozen additional summit eruptions in recorded history—Kīlauea's lava flows are among the most watched and accessible in the world.

Hotspot volcanism, the source for Hawaiian volcanoes, was first theorized in the 1960s. This type of volcanism is actively occurring beneath Mauna Loa and Kīlauea and is believed to cause molten magma, which rises from a deep reservoir within the mantle layer of the earth (about 25–37 miles beneath the ocean floor) (Babb, Kauahikaua, and Tilling 2011). Hotspot volcanism fuels the nearly continuous eruptions of Mauna Loa and Kīlauea. This dynamic process began more than 70 million years ago and has since formed the entire Hawaiian archipelago, which extends 2,000 miles across the Pacific Ocean. As with many young Hawaiian Island volcanoes, Mauna Loa and Kīlauea erupt a basaltic-type lava: basaltic lavas are rich in silicon (SiO_2), aluminum (Al_2O_3), irons (FeO and Fe_2O_3), and calcium (CaO), as well as a cadre of other minerals (NPCA 2008). Although basaltic-type eruptions occur elsewhere in the world, there are few places on Earth that allow such intimate observation of ancient and current volcanism as the Hawaiian Islands and Hawai'i Volcanoes National Park in particular.

Native Hawaiian culture tells us that Kīlauea is the home of Pelehonuamea (Pele) and her 'ohana (family). Their ancient chants chronicle the voyage of Pele to Hawai'i and the great efforts they made in search of a new home. These ancient chants along with the generations of descendants who comprise this living culture have helped us understand the intimate relationship the Native Hawaiians have with both Mauna Loa and Kīlauea.

The numerous eruptions of Kīlauea Volcano have amazed residents and visitors for centuries. Since 1956, the average yearly volume of lava erupted from Kīlauea Volcano is between 110 and 130 million cubic yards. By comparison, this is more than four times the average rate of lava erupted along the Hawaiian-Emperor Chain during its 70-million-year life. (Tilling, Heliker, and Swanson 2010). Kīlauea Volcano is comprised of a caldera that is approximately 3 miles in length by 2 miles wide. Within the caldera is Halema'uma'u Crater, the sacred home of Pele, and the location of one of two ongoing eruptions. This summit eruption began in 2008 and has since continued to emit elevated levels of dangerous gases, resulting in the closure of the southern portion of Crater Rim Drive. The second actively erupting area is away from the summit, on the East Rift Zone at Pu'u 'Ō'ō and Kūpa'ianahā. This eruption has been ongoing since January 3, 1983. Approximately 1 cubic mile of lava was erupted from vents along the East Rift Zone of Kīlauea from the start of this eruption to December 2012. This is enough to bury a football field with about 560 miles of lava, or an amount twice the height of the orbiting International Space Station (Babb 2013).

Mauna Loa Volcano, with its gently sloping flanks, rises 13,679 feet. Punctuated by its caldera Moku'āweoweo, Mauna Loa is the world's largest volcano. Since 1843, Mauna Loa has erupted 33 times. The most recent eruption took place in 1984, threatening the town of Hilo and blanketing the state with volcanic smog or "vog." Of all the Hawaiian volcanoes, Mauna Loa is said to produce the largest, most voluminous flows, making it a "high priority" volcano for the monitoring staff of the Hawaiian Volcano Observatory. Like other Hawaiian volcanoes, Mauna Loa is composed of a single caldera, two rift zones, and numerous other volcanic structures, landforms, and products, many of which are underground or buried. Mauna Loa often receives little attention due to its seemingly benign nature. This is deceptive, however, as Mauna Loa poses an increased risk of inundation due to the fact that it has and can produce lava at much higher rates than Kīlauea over a shorter period of time, sending lava flows as far as the ocean in as little as three to four hours.

VOLCANIC STRUCTURES, LANDFORMS, AND PRODUCTS

A wide range of geologic features, including calderas and rift zones, and an unparalleled diversity of volcanic products are formed by Mauna Loa and Kīlauea volcanoes and can be found within Hawai'i Volcanoes National Park. Each is the result of a specific type of volcanic activity that gives volcanic

structures, landforms, and products a unique character—a story revealed (see *Figure 5.1. Volcanic Flows, Faults, and Cracks*).

Different volcanic eruptions have produced different volcanic landforms and products. Two of the most famous and frequently photographed eruptions in the park were the lava fountains produced during the 1959 eruption of Kīlauea Iki and the Puʻu ʻŌʻō eruption in the early 1980s. These explosive-type eruptions produced cinders and reticulite (a form of tephra), Pele's hair and tears, as well as volcanic cones and a crater. Also observed during these eruptions were lava flows in both pāhoehoe and ʻaʻā forms. Lava flows entered the ocean both in and outside of the park, forming new land, as well as littoral cones, black sand beaches, dangerous benches of varying size, and countless miles of sea cliffs, peppered with sea arches. Since the beginning of the Kīlauea summit eruption in late 2008, volcanic gases and numerous other products have amassed in many of the areas surrounding the summit. These eruptions, along with the elemental forces of wind, rain, water, and sun have continuously weathered, shaped, and reformed Kīlauea volcano into the feature it is today.

GEOLOGIC HAZARDS

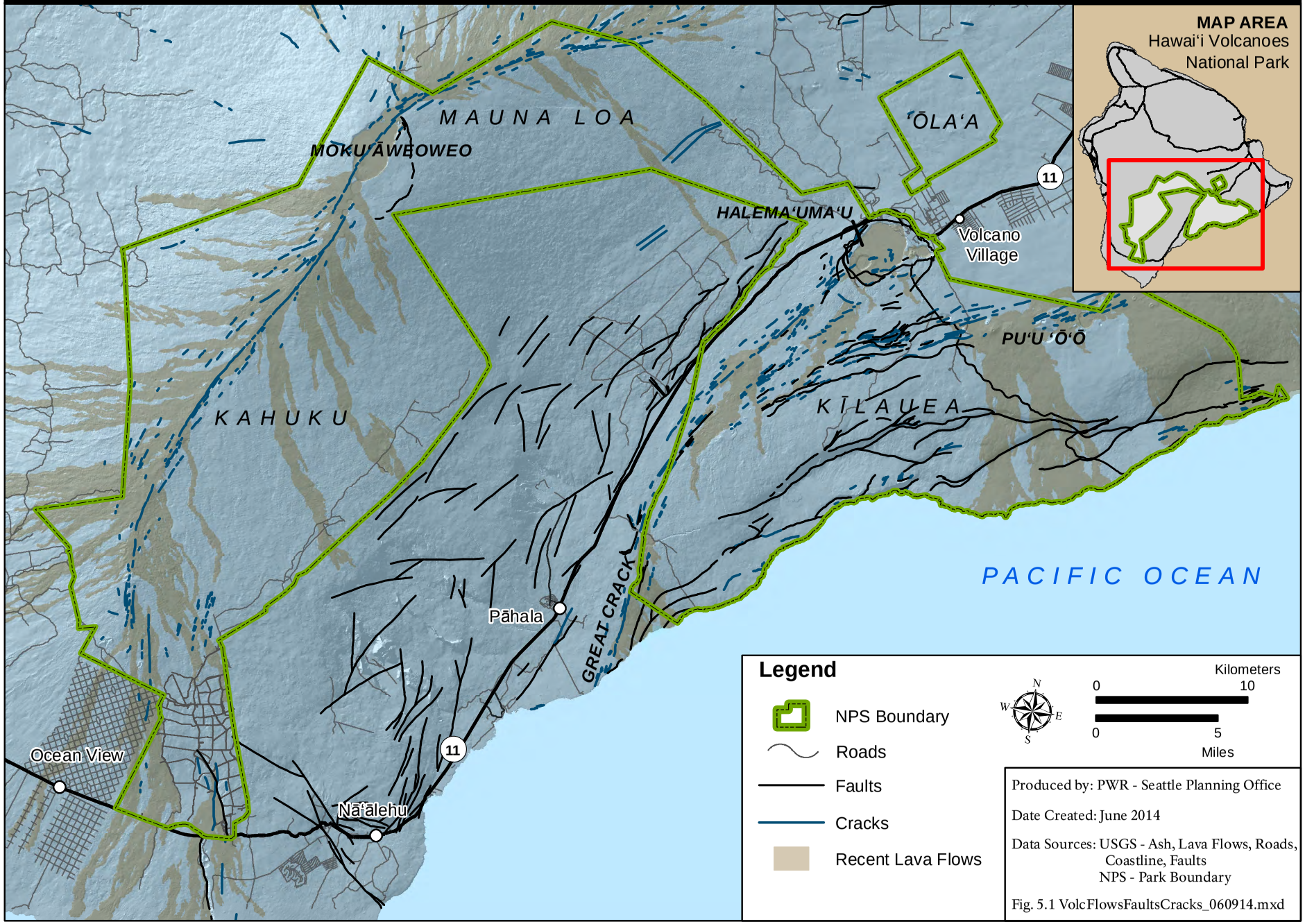
Much of the dynamic volcanic activity occurring in Hawaiʻi is monitored by the staff of the United States Geological Survey Hawaiian Volcano Observatory. HVO reports changes in volcanic activity that necessitate park closures and modification of staff and visitor activity in park areas. The National Park Service has an *Emergency Operations Plan—Eruption Response Plan* (Park 2008a) to address potential volcanic eruptions, including procedures for notifying staff and the public of the evacuation of an area.

VOLCANIC ERUPTIONS— For 30 years, Kīlauea Volcano has erupted large volumes of lava along its remote East Rift Zone. Over the past 150 years, lava flows have inundated the Southwest and East Rifts of Mauna Loa and Kīlauea. In the past 50 years, both Chain of Craters Road and Crater Rim Drive have been inundated by lava at various times and at various locations. Chain of Craters Road through the south section of the park remained closed by lava flows near Hōlei Sea Arch to the park boundary until 2014. In 2014, due to the lava threatening access in the lower Puna region, the previously lava-covered section was reopened utilizing the previous alignment as an unpaved emergency access route. Since March 2008, Kīlauea has also been erupting at Halemaʻumaʻu Crater. Because of this ongoing eruption, a nearly 5-mile portion of Crater Rim Drive beyond Jaggar Museum remains closed due air quality and safety concerns. The last eruption of Mauna Loa occurred in 1984 and resulted in lava fountains and lava flows that came within 4.5 miles of Hilo town.

FAULTS, CRACKS, LAVA TUBES, INFLATION, AND COLLAPSE FEATURES— Faults, cracks, lava tubes, inflation, and collapse features can be found all over Hawaiian shield volcanoes: they occur during the shield volcanoes' natural formation and evolution. Seismic activity associated with both Kīlauea and Mauna Loa volcanoes can trigger both extension and contraction, or inflation and deflation of these faults, cracks, and collapse features. In the case of lava tubes, any ground deformation could trigger a collapse of the interior wall and/or roof structure of the tube. Any number of these features may be visible on the ground, at shallow depth, or hidden deeply beneath the surface.

Figure 5.1 Volcanic Flows, Faults, and Cracks

Hawai'i Volcanoes National Park GMP/WS/EIS



VOLCANIC EMISSIONS (VOG)— The natural volcanic activity of Hawaiian volcanoes generates high levels of volcanic gases (vog), comprised primarily of carbon dioxide (CO_2), water vapor (H_2O), and sulfur dioxide (SO_2). Other smaller amounts of gases generated by volcanic activity include carbon monoxide (CO), hydrogen (H_2), hydrogen chloride (HCl), and hydrogen sulfide (H_2S). Volcanic activity and wind conditions affect volcanic gas emission levels at a specific site. Vog levels can vary rapidly in a given area, as well as between areas. The park has an air quality policy governing recommendations for restriction of outdoor activities or closure of areas due to excess poor air quality (Park 2009a). The park's air quality level is regularly monitored at the Kīlauea Visitor Center and Jaggar Museum, as well as at other locations in the park. The NPS air resources section, in partnership with HVO, operates an advisory program that informs the public of current sulfur dioxide levels in the park. A discussion of volcanic emissions can be found in the Air Quality and Visitor and Employee Safety sections of this chapter.

SEISMIC ACTIVITY— Earthquakes are commonly associated with actively growing volcanoes and are often a precursor to volcanic eruptions. They may indicate the movement of magma through a network of underground volcanic pipes. Earthquakes are actively monitored by a network of stations throughout the park. These stations detect near real-time ground motion across both Mauna Loa and Kīlauea. Since 1868, Hawai'i Island has experienced numerous large earthquakes above 6.0 magnitude. The largest was a 7.9 earthquake in 1868, when more than 100 homes were destroyed and a tsunami was generated (Babb, Kauahikaua, and Tilling 2011). Ground surface cracks or collapses can open up unexpectedly even during smaller earthquakes. In 2007, several quakes with a magnitude greater than 3.0 caused the closure of portions of Chain of Craters Road (Park 2007f).

GEOTHERMAL FEATURES— Active subsurface geologic formation generates continuous vapor emissions (steam) through cracks in the ground. The groundwater in these areas is hot, reaching as high as 135 degrees near the surface. Rainwater continually drains into cracks and is heated and released as steam: these cracks are referred to as steam vents. The greatest concentration of vapor emissions in the park is along Crater Rim Drive and includes the Steam Flats area and Steam Vents Interpretive Site. A second site is located at Puhimau along Chain of Craters Road. It is estimated that almost 90% of all visitors visit the Steam Flats area. At the Steam Vents parking area, two steam vents are easily accessible to visitors. Both vents are rimmed with railings.

TSUNAMIS— A tsunami is generated when a large mass of land is displaced in or near the ocean. Waves of water emanate from that source of disturbance and travel across the ocean as fast as 600 miles per hour. As these waves hit reefs or other shallow land masses, they grow to great heights and can cause massive destruction along shorelines. In 1975, a localized earthquake caused a locally generated tsunami with a wave 45 feet in height along the southeast coast of the island of Hawai'i, which killed two people and caused widespread damage along the Kalapana coast (USGS 1997).

VOLCANIC MONITORING—Volcanic monitoring is continuously carried out through a network of more than 100 permanent and temporary instrument stations deployed inside and outside the park. The instruments are mostly out of sight of park visitors and remote from roads. These important instruments include Global Positioning Station (GPS) receivers, seismic sensors, tilt meters, gas sensors, radio repeaters, and webcams. Many of the instruments are telemetered, with batteries, solar panels, and radio antennae to provide near real-time monitoring of all five volcanoes on Hawai'i Island and elsewhere.

Soils

In Hawai‘i Volcanoes National Park, soil does not dominate the land surface of the park. Only about 40% of the park has soils covering portions of the surface. The remaining 60% of the park is composed of various lava flows, cinderland, badlands, and some geothermal areas.

In Hawai‘i Volcanoes and on much of the rest of the island, volcanic ash and cinder deposits serve as the predominant parent material of the soils, which are generally very shallow. The underlying lava flow material appears to contribute little to soil formation, with the exception of sand and gravel fragments chipping from ‘a‘ā clinkers and minor weathering of surfaces in areas of high rainfall. Since Hawai‘i Volcanoes represents most of the youngest areas on the island, many of the soils in the park have not had enough time either for the formation of thick ash deposits or for weathering of the primary ash minerals into various secondary clays.

Accumulations of organic matter in the soil and ground litter are the most important factors in soil development on these relatively young sites. Pāhoehoe, ‘a‘ā, cinders, and weathered ash provide differing contributions of minerals and drainage characteristics, and soil age and composition have considerable influence over plant community composition and hydrology (TMA 2007).

On many of the younger landscapes, organic soils appear to be the first stage of soil formation as a result of fern and ‘ōhi‘a colonization in pāhoehoe fractures and between ‘a‘ā clinkers. In Hawai‘i Volcanoes, the Kahaluu, Kiloa, Lalaau, Malama, and Mawae soils are all classified as organic soils and are unique in that they are all well-drained and typically exhibit a very minor degree of decomposition of organic matter. In contrast, the more traditional organic soils found on the mainland tend to be poorly or very poorly drained soils with peat or muck textures. The organic soils in the park can also be hydrophobic, or water repellent, after a fire. This occurs when the waxy material created by the combustion of plants coats the sand and silt grains of the underlying mineral soil. The hydrophobicity can impede infiltration and increase runoff, especially on pāhoehoe landforms, and this characteristic is accentuated if vegetation is removed. These organic soils are found in the upper Kahuku area of the park, which are not being considered for development. Another soil that also displays some unique ecological characteristics is the Lithic Ustipsamment soil found in many areas in the Ka‘ū Desert (USDA-NRCS 2008). These soils have a thin cemented layer at the surface, which severely impedes water infiltration and results in excess runoff. This cementation is caused by the acidity of the rainfall (due to vog) which converts the silica in the basaltic rock into a solution which is then redeposited on the surface as a varnish-like substance (see photo, “Profile of Lithic Ustipsamments”).

Soil formation in the park is episodic. The ability of primary minerals to transform into secondary minerals (primarily in clay-size fractions) is affected by the amount and seasonality of rainfall. Puaulu soils are a good example of this. These soils have been leached of base cations and silica. They are a good example of soils that form and then are buried by subsequent deposits, which then form a new soil. This soil type is found predominantly in the ‘Ōla‘a Forest area (USDA-NRCS 2008).

The Heake soil series is an example of soils in which only a thin ash layer has accumulated thus far. Heake soils consist of very shallow and shallow well-drained soils that form in ash deposits over pāhoehoe lava. They are highly susceptible to erosion if vegetation is removed. This soil type is found in the area of Jaggar Museum.

Shallow and very shallow soil depth is a major issue, contributing to the severe limitation of the use of soils for building sites and recreational development in Hawai‘i Volcanoes National Park (USDA-NRCS 2008).

Profile of Lithic Ustipsamments, which have a thin cemented surface crust. On the tape, depth is marked in centimeters. *NPS Photo*

Vegetation

Vegetation in the park varies with the climates found at different elevations. The fire management plan for Hawai‘i Volcanoes National Park identifies seven ecological zones, each with differing plant communities: alpine/aeolian, subalpine, mesic/wet forest, montane seasonal, mid-elevation seasonal, coastal lowland, and Kahuku pasture/mesic forest. The plant communities supported in these zones are home to more than 400 native species of plants, as well as 600 nonnative plant species that threaten the native ecosystems in the park. These plant communities are described in the following sections, which include discussions of climatic and geographic factors that affect their composition, as well the nonnative species present (see *Figure 5.2. Ecological Zones*).

ALPINE/AEOLIAN

The upper portions of the Mauna Loa and Kahuku units are in this zone, which varies in elevation from 8,500 feet to the 13,679-foot summit of Mauna Loa (2,591 to 4,169 meters). This zone experiences average temperatures ranging from 43°F to 48°F and rainfall from 20 to 28 inches, with frequent nightly frost in the winter months. Most of the alpine zone is characterized by nearly barren lava flows with sparse, low, vegetation consisting of small patches of stunted native shrubs, mostly pūkiawe (*Leptecophylla tameiameiae*) and ‘ōhelo (*Vaccinium reticulatum*). Grasses, sedges, lichens, and mosses comprise the rest of the plant life (Park 2007a). This zone also contains isolated kīpuka, which are large and small areas untouched by recent lava flows that are “islands” of plant and animal life surrounded by a “sea” of lava (NPCA 2008; Park 2007a). There is very little or no vegetation in the areas above 11,000 feet.

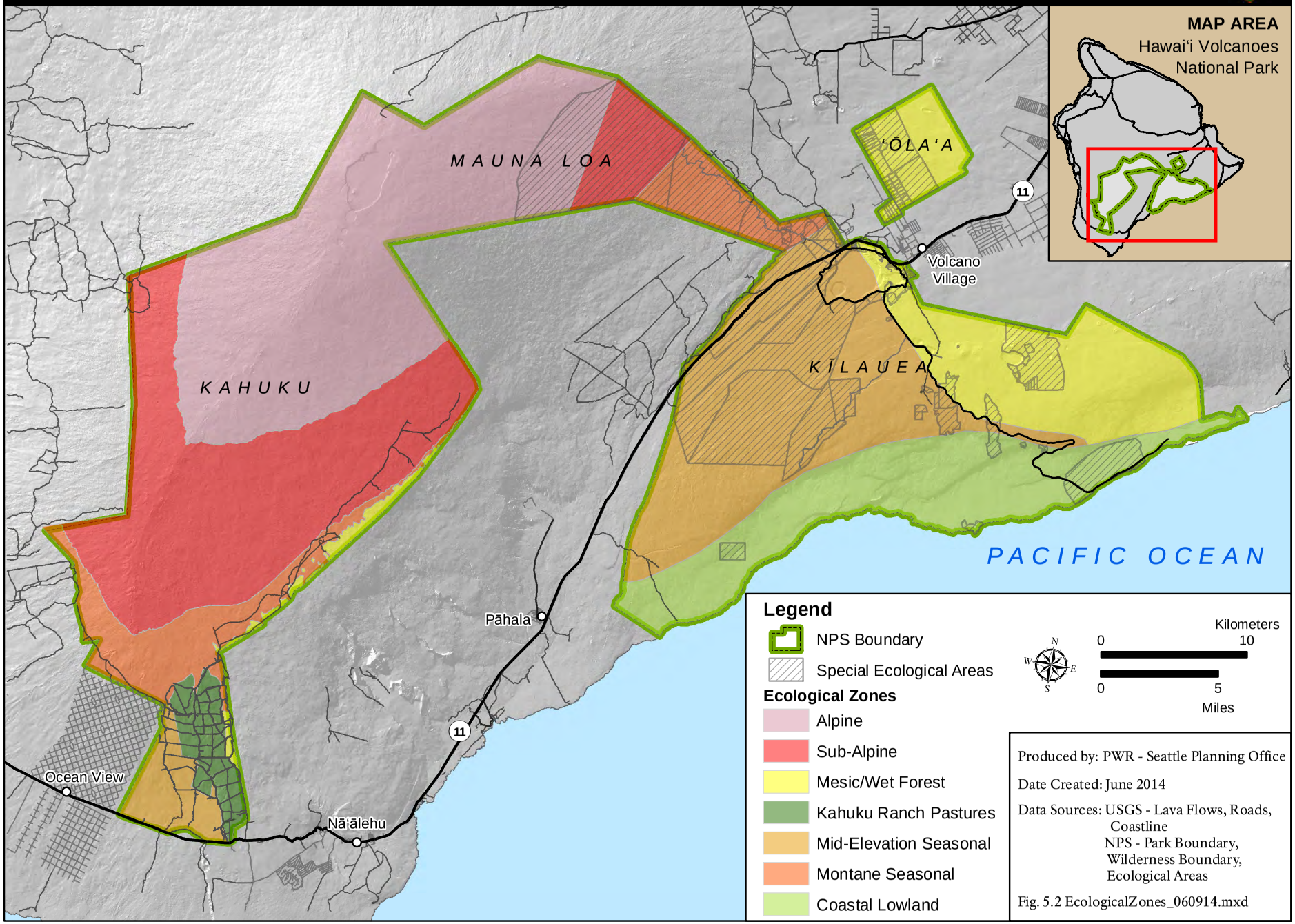
SUBALPINE

This zone extends from 6,500 to 8,500 feet (1,981 to 2,591 meters) and higher. The average annual temperature ranges from 49°F to 54°F, with occasional winter frost. In the Mauna Loa Unit, rainfall averages between 30 and 40 inches per year (summers are dry, and most precipitation occurs in the winter). Low-lying clouds cause fog-drip from trees and shrubs, which contributes to precipitation. The climate of the Kahuku subalpine environment is decidedly moister, with nearly daily cloud cover and light precipitation on the southeast slope, upslope of the Ka‘ū and Kapāpala forest reserves (Doty and Mueller-Dombois 1966).

In the Mauna Loa Unit, much of the subalpine vegetation is concentrated in two major kīpukas on older pāhoehoe lava flows. Sparsely vegetated lava flows dominate many areas of this zone. The most widespread plant community in the subalpine zone is ‘ōhi‘a (*Metrosideros polymorpha*) scrub, with an understory of open native shrubs and grasses. Scrub is characterized by scattered, short ‘ōhi‘a with native shrub and grasses. ‘Ōhelo, pūkiawe, and ‘a‘ali‘i (*Dodonaea viscosa*) are the most abundant native shrubs, while the most abundant grass is the native bunchgrass *Deschampsia nubigena*. Vegetation on the extensive, younger ‘a‘ā flows consists of scattered and very scattered native ‘ōhi‘a trees and native shrubs. In the Mauna Loa Unit, where ungulates have

Figure 5.2 Ecological Zones

Hawai'i Volcanoes National Park GMP/WS/EIS



been removed, native plants dominate the vegetation, māmane (*Sophora chrysophylla*) is regenerating, and recovery of rare plants (including the endangered Mauna Loa silversword [*Argyroxiphium kauense*]) through active restoration has begun (Park 2007a). Vegetation is similar in Kahuku, but four decades of browsing by nonnative mouflon sheep has reduced native species abundance and diversity (Benitez et al. 2008; Park 2007a).

MESIC/WET FOREST

Mesic and wet forests grade into each other along the sharp rainfall gradients that characterize the park. Almost all wet forests, which include areas with approximately 90 to 140 or more inches of rainfall per year, are found on the eastern edge of the park, which receives nearly daily trade-wind rains. These forests are found in four locations: on the eastern rim of the summit caldera of Kīlauea Volcano, along the East Rift of Kīlauea above approximately 2,300 feet (701 meters) in elevation, in ʻŌlaʻa Forest, and in Kahuku on the eastern edge of the pastures and upslope of Kaʻū and Kapāpala Forest Reserves between 3,000 and 5,000 feet (914 and 1,524 meters) in elevation (Park 2007a).

Wet forests at Hawaiʻi Volcanoes National Park are characterized by two major plant associations: tree fern and uluhe fern (*Dicranopteris linearis*) forests. Tree fern forests are multi-layered, dominated by ʻōhiʻa and tree ferns, and are best developed on the older, deep ash soils of ʻŌlaʻa Forest and some areas of the East Rift. Most of the wet forest in ʻŌlaʻa is dominated by a dense canopy of tree fern, often co-mingled or slightly overtopped by open stands of other native trees. The relatively young substrates of volcanically active areas at Kīlauea Summit and the East Rift support closed canopy stands of ʻōhiʻa, with a subcanopy of other native trees and tree ferns. Ground cover is dense and consists of a high diversity of native ferns, as well as native shrubs and herbaceous plants (Park 2007a).

Uluhe fern forests are found at the summit of Kīlauea and along the East Rift, and are characteristic of early successional communities that occur on younger lava flows and in secondary successional communities following ʻōhiʻa dieback. Uluhe is a dense matted fern that grows three to 20 feet tall and suppresses all vegetation, native and nonnative. As a result, species diversity is lower in uluhe forests when compared to tree fern forests (Park 2007a).

Mesic forests, which receive approximately 60 to 90 inches of rain per year, are found primarily east of Chain of Craters Road and west of wet forests, makai of wet forests in the southeastern section of the park, and upslope of Kaʻū and Kapāpala Forest Reserves in Kahuku. Mesic forests are dominated by closed to open stands of ʻōhiʻa and koa (*Acacia koa*) with highly variable understory vegetation. In Kahuku, the understory consists of tree ferns and native trees or shrubs. East of Chain of Craters Road, the understory is similar, but many areas have dense stands of introduced faya tree (*Morella faya*) or native uluhe fern. The understory of mesic forest in the lower East Rift of Kīlauea is dominated by continuous swards of introduced swordfern (*Nephrolepis* sp.) (Park 2007a).

MONTANE SEASONAL

In the Mauna Loa Unit, the montane seasonal zone occurs between 4,000 and 6,700 feet (1,219 to 2,042 meters) and is dry during the summer, with variations in annual rainfall depending on elevation (60 inches per year at 4,000 feet [1,219 meters] in elevation and 40 inches per year at 6,000 feet [1,829 meters] in elevation). In Kahuku, the area at 5,000 to 6,000 feet (1,524 to 1,829 meters) on the southwest-facing slope can also be characterized as montane seasonal. This zone in Kahuku is wet in the summer and is characterized by frequent afternoon cloud buildup and low-lying fog (Park 2007a).

In the Mauna Loa Unit, most of the montane seasonal environment is densely vegetated and found on 750- to 4,000-year-old lava flows, although several massive, more recent (late prehistoric or historic) ʻaʻā flows also penetrate this zone. The vegetation of this zone varies considerably with soil depth and substrate age. For example, the most diverse

and well-developed forests occur at Kīpuka Kī and Kīpukapuaulu—the most biologically rich site in the park—which are islands of ash soil more 1,500 to 3,000 years old on the lower east end of the Mauna Loa Unit (4,000 to 4,400 feet [1,219 to 1,341 meters] in elevation). Although included in the montane seasonal fire management unit, these kīpukas support a rare mesic forest community characterized by mānele (*Sapindus saponaria*)/koa (*Acacia koa*)/ʻōhiʻa , as well as several threatened, endangered, or candidate species, or species of concern (discussed later in this chapter) (Park 2007a).

Above 5,000 feet (1,524 meters) elevation, most soils are shallow, discontinuous ash deposits over weathered pāhoehoe. Where deeper soils occur, koa dominates the forest and contains an understory comprised of the native shrubs pūkiawe and ʻaʻaliʻi, sedges, and a mixture of alien meadowrice grass and native grasses. At lower elevations koa forest understory is dominated by alien pasture grasses, a legacy of 150 years of cattle grazing. Across elevations within this zone, small stands of shrubland and grassland persist on shallow soils. The shrublands are dominated by the native shrubs pūkiawe and ʻaʻaliʻi, with a continuous understory of mixed alien and native grasses at lower elevations and native bunchgrasses above 5,000 feet. Grasslands are generally small and are dominated by alien grasses at lower elevation and native bunchgrasses at upper elevation.

Vegetation in the montane seasonal zone in Kahuku is dominated by closed stands of ʻōhiʻa forest with a native shrub, fern, and mixed native-alien grass understory. Koa may or may not be a component in these forests. Koa is more prevalent on the west side of Kahuku (above The Nature Conservancy Kona Hema Preserve). This area was impacted by cattle and logging, and much of the native understory has been replaced by nonnative kikuyu and meadowrice grass. Since nonnative ungulate removal efforts were initiated, vigorous recruitment of young koa has occurred.

Across the Kahuku and Mauna Loa units, ʻaʻā flows are characterized by open to sparse ʻōhiʻa woodlands with a sparse native shrub understory in many areas. Other areas consist of very scattered native shrubs, and grass is never abundant (Park 2007a).

MID-ELEVATION SEASONAL

This zone is found between approximately 1,000 and 4,000 feet (305 and 1,219 meters) in elevation in the leeward part of the park. As a result, it is sheltered from daily trade wind rains, and precipitation varies from 20 to 60 inches per year. Vegetation of the mid-elevation seasonal environment varies with substrate and rainfall. For example, younger flows, or deep cinder with little ash-soil development, typically support sparse native shrubs, primarily pūkiawe and ʻaʻaliʻi and scattered, short ʻōhiʻa. Flows with deeper ash support dry ʻōhiʻa woodland. However, this plant community has been altered by the introduction of nonnative plants and fire. In many areas, the understory is dominated by nonnative bush beardgrass (*Schizachyrium condensatum*), broomsedge (*Andropogon virginicus*), and molasses grass (*Melinis minutiflora),* which form a nearly continuous matrix between the open layers of native shrubs. In Kahuku, where mouflon sheep and other nonnative ungulates remain on the landscape, a similar open to sparse woodland structure with an understory dominated by tall nonnative grasses such as, bush beardgrass, broomsedge and barbed wire grass (*Cymbopogon refractus*) prevails. The nonnative shrub Christmasberry (*Schinus terebinthifolius*) is also present and dominates portions of this zone. Other areas of the park (not including Kahuku) have been invaded by the nonnative faya tree, which has become codominant with ʻōhiʻa in some areas and displaced it in others. In addition, the majority of dry ʻōhiʻa woodlands on Kīlauea have burned in the last 40 years, creating savannas of scattered ʻōhiʻa and native shrubs with abundant nonnative grass (Park 2007a).

COASTAL LOWLAND

The coastal lowland environment lies below the mid-elevation seasonal environment and includes the immediate shoreline, the coastal plain upland of the large fault scarps or pali (cliffs/ridges), and the faces of the pali. Typically warm and dry, rainfall varies from less than 20 inches per year in the western part of the park to about 60 inches per year along the eastern boundary. These dry conditions, combined with the relatively young age of the substrate, limit the development of vegetation in this zone (Park 2007a).

A narrow band of coastal strand vegetation is found along parts of the immediate shoreline. Vegetation varies from naupaka (*Scaevola taccada*)-dominated scrub to sparse salt-tolerant herbs. The endangered grass *Ischaemum byrone*, the endangered loulu palm (*Pritchardia affinis*), and the species of concern, *Portulaca villosa,* grow in a number of locations where planted. The endangered shrub ʻōhai (*Sesbania tomentosa*) grows in some coastal strand sites. In the interior, the coastal lowlands are now largely dominated by grasses. The remains of a coastal shrubland persist in the wetter, eastern portions, modified by fire. Prior to fire this community was dominated by tall ʻākia (*Wikstroemia sandwicensis*) shrubs, along with other native shrubs including ʻa'ali'i and ʻūlei. Alien broomsedge and bush beardgrass, along with native pili grass (*Heteropogon contortus*), formed a matrix between the shrubs and permitted wildfires to spread. Most of the ʻākia shrublands burned in the Pu'u ʻŌ'ō eruptions that started in 1983 and only exist today in small pockets. The remainder has since been buried by lava or converted to low open shrubland with scattered ʻa'ali'i and ʻūlei, and with broomsedge, bush beardgrass, and pili grass growing between the shrubs. The drier, western portion of the coastal lowlands are dominated by alien grasslands with patches of alien shrubs. The dominant grasses are alien Natal redtop (*Melinis repens*), thatching grass (*Hyparrhenia rufa*), molasses grass (*Melinis minutiflora*), bush beardgrass, and broomsedge. Native pili grass, a fire-adapted species, is an important component of the grasslands in some areas. The coastal lowlands also contain small scattered stands of dry and mesic forests on the faces of the pali. Younger flows are dominated by open stands of ʻōhi'a, while older flows support stands of the native tree lama (*Diospyros sandwicensis*), with an understory of the shrub alahe'e (*Psydrax odorata*). A number of threatened, endangered, and candidate species, including kauila (*Alphitonia ponderosa*), hala pepe (*Pleomele Hawaiʻiensis*), ʻahakea (*Bobea timonioides*), and ʻohe makai (*Reynoldsia sandwicensis*) occur in lama forest. Lama forests in the park have been so greatly reduced by lava flows in the last 30 years that only a few patches remain (Park 2007a).

KAHUKU PASTURE/MESIC FOREST

This zone encompasses 7,200 acres of former cattle pasture containing remnants of mesic forest located on the lower east end of the Kahuku Unit on the south slope of Mauna Loa, extending from 2,500 feet to 5,000 feet in elevation (762 to 1,524 meters). The area stretches east to the mesic forest (where 60 to 80 inches of rainfall per year), and to the west it lies adjacent to seasonally dry ʻōhiʻa woodlands (40 to 60 inches of rain per year) (Park 2007a).

Vegetation is generally characterized by abundant alien grasses and an open canopy of ʻōhiʻa or ʻōhiʻa/koa. Fragments of native forest are scattered across this area and become increasingly abundant on the east end of the park boundary that lies adjacent to the state Kaʻū Forest Reserve. Vegetation surveys conducted in 2007 identified a number of rare plants remaining in forest fragments and as individuals in the pasture, including the only ʻohe (*Tetraplasandra hawaiensis*) and olonā (*Touchardia latifolia*) individuals found in the Kahuku Unit, and several endangered species discovered in a pit crater and ravine (Benitez et al. 2008). Until recently, domestic cattle, nonnative mouflon sheep, and pigs damaged remaining forest fragments and suppressed establishment of many native seedlings. Domestic cattle were removed in 2010. Experiments in four 10-acre fenced exclosure units are evaluating methods for restoring native forest following exclusion of all ungulates.

NONNATIVE PLANTS

Over half of the more than 900 vascular plant species found at Hawai‘i Volcanoes National Park are nonnative, and more than 100 species are considered highly disruptive to native ecosystems inside the park (Smith 1985; Benitez et al. 2012). The more disruptive species reduce native plant diversity and abundance and cause the local extinction of species. Some nonnative species such as faya tree (*Morella faya*), fountain grass (*Pennisetum setaceum*), and strawberry guava (*Psidium cattleianum*) are able to completely replace native plant communities and form monospecific stands.

Park staff has been monitoring and managing disruptive nonnative (invasive) plants found in the park (Park 1999). Based on surveys conducted between 2000 and 2010, the park detected on average two new plant invaders annually (Benitez et al. 2012). Since the 1980s, strategies for invasive plant control implemented at the park have included (1) minimizing disturbances to the native vegetation such as those caused by nonnative ungulates and wildfires, which facilitate the spread of invasive plants; (2) monitoring and mapping the distribution of invasive plants; (3) removing small or localized infestations parkwide; (4) focusing control of widespread weeds in high priority management units called special ecological areas; (5) working with other agencies and groups in nonnative plant management including development of treatment methods and biological control for some widespread weeds; (6) supporting research on the ecology, seed biology, and phenology of disruptive nonnative plant pest species; and (7) educating the public in disruptive nonnative plant impacts and the importance of nonnative plant control (Tunison 1991).

Disruptive weeds that are too widespread to be managed throughout the park are controlled in special ecological areas and surrounding buffer units. These high-priority areas are selected based on: (1) the biological communities representative of a particular ecological zone and/or rarity in the park or on the islands; (2) manageability and intactness so that areas are accessible and the potential for native species recovery is high; (3) concentrations of species diversity and rare species; and (4) value for research and interpretation to the public (Tunison and Stone 1992; Loh and Tunison 2009). Inside each special ecological area, periodic searches have been conducted by ground crews or by aerial surveys, and target weeds have been removed from the area. Methods have varied from manual uprooting to chemically treating individuals. In 2007, 27 SEAs and buffer units covered approximately 66,000 acres. Fountain grass is a fire-promoting invasive grass that has invaded portions of Kona and South Kohala on the island of Hawai‘i and is established in the park. Although initially widespread, over the last 15 years systematic search (helicopter and ground sweeps) and removal efforts for fountain grass have prevented the buildup of dense populations in the park. In the new Kahuku addition, fountain grass is beginning to invade young lava flows. Park staff have been removing all individuals found in the park, and since 2004 have been working with the adjacent Ocean View subdivision community to remove plants along roadsides of the subdivision.

Native Wildlife and Wildlife Habitat

Hawai‘i Volcanoes National Park protects a wide diversity of wildlife and habitat. Approximately 90% of all native wildlife in Hawai‘i is endemic (found nowhere else on earth) (NPCA 2008). This section focuses on the native terrestrial wildlife species, including mammals, birds, invertebrates, and reptiles in the park that could be affected by the proposed alternatives. Native wildlife species found in marine environments are described in the Marine and Estuarine Resources section later in this chapter.

MAMMALS

Although Hawai‘i Volcanoes National Park supports great biodiversity, the Hawaiian hoary bat (*Lasiurus cinereus semotus*) is the only native land mammal in the park and in the Hawaiian Islands. Known in Hawai‘i as ‘ōpe‘ape‘a, the nonmigrant Hawaiian hoary bat occurs over a wide range of elevations

(primarily from sea level to 7,500 feet [2,288 meters]). Data regarding the habitat and population status of this species are very limited, but available documentation suggests that the ʻōpeʻapeʻa appears to be most numerous in native dry to mesic forests, and is often associated with native forest edges (Pratt et al. 2011; USFWS 2009a). The Hawaiian hoary bat was first listed as federally endangered in 1970 and continues to hold that status (USFWS 2009a).

The only native marine mammal associated with Hawaiʻi Volcanoes National Park is the Hawaiian monk seal (*Monachus schauinslandi*), or ʻīlio-holo-i-ka-uaua. This mammal is also federally listed as endangered and can be observed occasionally swimming offshore or resting at remote beaches in the park.

More information regarding these two species is provided in *Appendix H: Special Status Species Descriptions*.

The other 12 mammals in Hawaiʻi Volcanoes National Park are all nonnative (NPCA 2008).

BIRDS

Many bird species survive in and depend on the habitat provided within the park boundaries, from the seacoast to the alpine/aeolian zone (Park 2006d). Of the 87 species of birds present in the park, 41 are nonnative (NPCA 2008).

Hawaiian forest birds are an important component in native Hawaiian rainforests, carrying out vital ecosystem processes such as seed dispersal, pollination, and nutrient cycling (USGS 2005a). Of the 23 surviving endemic Hawaiian songbird species, those living in the park include six Hawaiian honeycreepers: ʻapapane (*Himatione sanguinea*), ʻamakihi (*Hemignathus virens virens*), ʻiʻiwi (*Vestiaria coccinea*), ʻākepa (*Loxops coccineus*), ʻakiapōlāʻau (*Hemignathus munroi*), and the Hawaiʻi creeper (*Oreomystis mana*) (NPCA 2008; Park 2006c). In general, Hawaiian honeycreepers are now restricted to koa and ʻōhiʻa forests at high elevations, generally above 4,000 feet (1,219 meters), while some rare species of Hawaiian honeycreepers are restricted to forests above 5,000 feet (1,525 meters). ʻApapane, ʻamakihi, ʻiʻiwi, ʻakiapōlāʻau, and the Hawaiʻi creeper all rely on tall ʻōhiʻa trees for nesting habitat. The ʻākepa generally nest in tree hollows, rather than on tall branches like other Hawaiian honeycreepers (Pratt et al. 2011). The latter three species are all listed as federally endangered (ʻiʻiwi is a species of special concern) and are further addressed in the Rare, Unique, Threatened, or Endangered Species section of this chapter. Hawaiian honeycreepers, once abundant in the park and the Hawaiian Islands, have experienced drastic reductions in population size since the arrival of Europeans. Factors contributing to their demise include loss of forest habitat, introduction of small mammals and predators, and various avian diseases such as mosquito-transmitted diseases (USGS 2006b).

The pueo, or Hawaiian short-eared owl (*Asio flammeus sandwichensis*), is another bird species endemic to Hawaiʻi. This species can be found on the island from sea level to 8,000 feet (2,450 meters). While the pueo occupies a variety of habitats, including dry and wet forests, shrublands, grasslands, and montane parklands, many bird species in the park are dependent on food resources from the forest understory and midcanopy (Park 2009d; DLNR 2005). The native thrush ʻōmaʻo (*Mayadestes obscurus*) spends much time midcanopy eating fruits of subcanopy trees, including kāwaʻu (*Ilex anomala*), kōlea (*Myrsine* spp.), and ʻolapa (*Cheirodendron trigynum*) (Park 2009d; USGS 2006a). Ōmaʻo is the most common of the Hawaiian thrushes and occurs mainly in native ʻōhiʻa and koa forests above 3,280 feet (1,000 meters). This species prefers forests with a closed canopy 80 to 130 feet (25 to 40 meters) in height, with many fruiting trees in the understory (Audubon 2007). ʻŌmaʻo also occur and breed in alpine habitat on Mauna Loa. These birds may be a distinct population from forest ʻōmaʻo (Hawaiʻi Audubon Society 2005). The Hawaiʻi ʻelepaio (*Chasiempis sandwichensis*), or flycatcher, is an insect feeder that occurs

in a variety of forest habitat, including dry to mesic koa forest on Mauna Loa, and ʻōhiʻa wet forest in ʻŌlaʻa and Kīlauea (Stone and Pratt 2007).

Three additional endangered species of endemic Hawaiian birds found in the park include nēnē (Hawaiian goose, *Branta sandvicensis*), ʻuaʻu (Hawaiian petrel, *Pterodroma sandwichensis*), and ʻio (Hawaiian hawk, *Buteo solitarius*) (Park 2008b). Habitat for the nēnē is highly variable and ranges from sparsely vegetated lava flows to scrubland to open grasslands (Park 2009d). Hawaiʻi Volcanoes National Park's nēnē flock is the best monitored wild nēnē population in the world, and the park is considered a leader in nēnē restoration among biologists working on the species (Hu 2014). ʻUaʻu utilize land only during nesting season and their nesting habitat is quite variable statewide, ranging from heavily vegetated, forested slopes on Lānaʻi and Kauaʻi to subalpine and alpine environments on Maui and Hawaiʻi (Simons and Hodges 1998). In the park, the species nests in shallow pits, cracks and lava tubes within sparsely vegetated, weathered pāhoehoe lava flows on Mauna Loa (Hu et al. 2001). The ʻio utilizes native and nonnative forests, grasslands, and cane fields, and generally nests in native ʻōhiʻa trees (USFWS 1984). These species are described further in *Appendix H: Special Status Species Descriptions*.

There are 40 nonnative bird species documented in the park. These include introduced game birds such as the wild turkey (*Meleagris gallopavo*) and Kalij pheasant (*Lophura leucomelanos*), and many passerines such as the house sparrow (*Passer domesticus*) and Japanese white eye (*Zosterops japonicas*) (Park 2005).

INVERTEBRATES

Approximately 98% of the native invertebrates documented in the park are endemic to Hawaiʻi (NPS 2003b). The majority of these invertebrates are dependent on the health of the native plant populations, which they use for food and shelter (NPCA 2008).

Among the more than 1,100 documented native invertebrate species in the park, there are only two native butterflies: the Kamehameha butterfly (*Vanessa tameamea*), which is the state insect of Hawaiʻi, and the Blackburn's blue (*Udara blackburni*) (Park 2005). Other native invertebrates include 200 species of moths; over 150 beetles (order Coleoptera) that include the colorful koa bug (*Plagithmysius varians*); approximately 150 species of bees and wasps (order Hymenoptera); and a number of hoppers, scales, and insects (order Hemiptera); true bugs (order Heteroptera); nerve-winged insects (order Neuoptera); crickets and katydids (order Orthoptera); damselflies and dragonflies (order Odonata); spiders (order Araneae); thrips (order Thysanoptera); and book and bark lice (order Psocoptera). The endemic picture-wing fly (family Drosophilidae), of which there are approximately 90 species documented in the park, is among the most studied endemic invertebrate groups and an example of island-hopping speciation (Stone and Pratt 2007).

Other native invertebrates present in the park include the giant Hawaiian darner (*Anax strenuus*), the largest native Hawaiian insect and largest dragonfly in the United States; Hawaiian cave crickets (*Thaumatogryllus cavicola*), which live on the ceilings of lava tubes; several carnivorous caterpillars, including *Hyposmocoma molluscivora*, which was discovered in 2003 and is remarkable for its ability to spin webs similar to spiders; and the happy-face spider (*Theridion grallator*), which occurs under plant leaves awaiting its prey (NPCA 2008; Rubinoff and Haines 2006; UNEP-WCMC 2007). Among the terrestrial mollusks or pūpū, the small Hawaiian tree snails (subfamily Achatinellinae) are the most commonly encountered in the park.

Several invertebrate species, such as the hammerhead picture-wing (*Drosophila heteroneura*) and flying earwig Hawaiian damselfly (*Megalagrion nesiotes)* are federally listed or considered rare, respectively. These species are described further in *Appendix H: Special Status Species Descriptions*.

There are approximately 500 species of nonnative invertebrates, including species of mosquitos, ants, spiders, thrips and slugs documented in the park (Park 2005). Many of these compete with or prey upon native invertebrates. Introduced mosquitos transmit avian diseases to native forest birds.

REPTILES AND AMPHIBIANS

There are no land-dwelling reptiles native to the island of Hawai‘i, but certain species of sea turtle occasionally utilize the park's shore. Known as honu‘ea, the hawksbill sea turtle (*Eretmochelys imbricata*) is an endangered species that lives in the waters off Hawai‘i island (NPCA 2008). The hawksbill sea turtle's nesting season usually occurs between late May and December, when females crawl ashore at night to find a suitable nest site (Park 2009e). The green sea turtle or honu (*Chelonia mydas*) is also observed in nearby waters and occasionally onshore (NPCA 2008). These species are described further in *Appendix H: Special Status Species Descriptions*. Eleven nonnative reptiles, including five geckos and the Jackson's chameleon, have been documented in the park (Park 2005). No amphibians are native to the island of Hawai‘i, but several nonnative amphibians have been found in the park. These include three frog and one toad species (NPS 2005).

INFLUENCE OF NONNATIVE WILDLIFE

Endemic species face decimating threats from introduced ungulates such as goats, sheep, and pigs, as well as from nonnative feral cats, rats, mongoose, ants, wasps, mosquitoes, and coqui frogs. The presence of alien ungulate species are especially damaging to Hawaiian ecosystems. Since the 1970s, the natural resources management program at Hawai‘i Volcanoes National Park has effectively controlled nonnative ungulates in many areas of the park through a systematic approach of direct reduction and fencing. The control of alien ungulates is followed by control of key alien plant species, which, in turn, assists the recovery of native species and provides conditions for active restoration of native plant and animal communities. Further information can be found about ecosystem impacts and control of nonnative ungulates in the *Plan and Final EIS for Protecting and Restoring Native Ecosystems by Managing Nonnative Ungulates* (Park 2013b). Nonnative feral cats, rats, and mongoose have a significant impact on native birds, particularly endangered species, through the consumption of eggs, young, and adult birds. Nonnative ants and wasps have significant impacts on native plants and native invertebrates. The nonnative ants and wasps prey upon native pollinators, some of which only pollinate specific plant species, thereby contributing to the decline or loss of those plant species. Mosquitoes transmit avian malaria and other diseases to which Hawaiian birds are not adapted, which has decimated many bird populations at the lower altitudes where mosquitoes survive. Coqui frogs pose a threat to native ecosystems by devouring unique insects and spiders. They compete with endemic birds that rely on insects for food. They also reproduce at high rates and significantly impact soundscapes with their loud persistent calls.

Special Status Species (Rare, Unique, Threatened, or Endangered Species)

FEDERALLY LISTED SPECIES

Under the Endangered Species Act (ESA) of 1973, the National Park Service has the responsibility to address impacts to federally listed threatened, endangered, and candidate species. The terms "threatened" and "endangered" describe the official federal status of certain species in the park as defined by the ESA. The term "candidate" is used officially by the USFWS when describing those species for which the USFWS has sufficient information on biological vulnerability and threats to support issuance of a "proposed rule to list," but for which issuance of the proposed listing rule is precluded by higher listing priorities. While listing actions of higher priorities go forward, the USFWS works with several private and government agencies to carry out conservation actions for these species to possibly eliminate the need for listing.

The ESA also requires the designation of "critical habitat" for listed species when "prudent and determinable." Critical habitat

includes geographic areas that contain the physical or biological features that are essential to the conservation of the species and may need special management or protection, even if the area is not occupied by the species at the time of listing. Critical habitat designations affect only federal agency actions or federally funded or permitted activities. The ESA requires that such actions avoid "destruction" or "adverse modification" of designated critical habitat (USFWS 2009b).

As of 2013, 409 plant and animal taxa in Hawai'i were listed as endangered or threatened by the USFWS, or 29% of all such plants and animals listed for the entire United States. Based on a review of lists provided by the USFWS (Leonard 2008) and the National Park Service (Park 2009d) and subsequent species listings by USFWS (USFWS 2013d, 75 FR 35990), 41 plants are listed as threatened, endangered, or candidate species under the ESA within the park and its vicinity. The park is also home to 13 endangered, one threatened, and five candidate animal species, including birds, insects, crustaceans, mammals, and reptiles (see *Table 5.1. Endangered, Threatened, and Candidate Species Of Hawai'i Volcanoes National Park and its Surrounding Areas*). These include species historically found in the park (e.g., *Psittirostra psittacea* and *Zanthoxylum Hawai'iense*), nonresident species (e.g., *Monachus schauinslandi*), and outplanted individuals (e.g., *Kokia drynarioides*) (Park 2009d).

Descriptions of listed and candidate species and their status in the park are provided in Appendix H.

SPECIES OF SPECIAL CONCERN

NPS policy requires that state-listed species, and others identified as species of management concern by the park, are to be managed in parks in a manner similar to those that are federally listed. The National Park Service is cooperating in the protection and enhancement of species of concern listed by the states.

Within Hawai'i Volcanoes National Park, 13 animal species, including birds, insects, mammals, and reptiles, have been identified as rare or sensitive. The park is also home to 69 plant species considered species of concern (including former candidate taxa) or rare. See *Table 5.2. Species of Special Concern in Hawai'i Volcanoes National Park* for the list of species.

The status of species of concern are provided in Appendix H.

Table 5.1. Endangered, Threatened, and Candidate Species of Hawai'i Volcanoes National Park and Surrounding Areas

Common Name (if available)	Scientific	Federal Status
MAMMALS		
Hawaiian monk seal (nonresident)	*Monachus schauinslandi*	Endangered
Hawaiian hoary bat	*Lasiurus cinereus subsp. semotus*	Endangered
BIRDS		
nēnē, Hawaiian goose	*Branta sandvicensis*	Endangered
'io, Hawaiian hawk	*Buteo solitarius*	Endangered
'akiapōlā'au	*Hemignathus munroi*	Endangered
'akepa	*Loxops coccineus coccineus*	Endangered
Hawai'i creeper	*Oreomystis mana*	Endangered
'o'u	*Psittirostra psittacea*	Endangered
'ua'u, Hawaiian petrel	*Pterodroma sandwichensis*	Endangered
'a'o, Newell's shearwater	*Puffinus auriculari*	Threatened
'ake 'ake, band-rumped storm petrel	*Oceanodromo castro*	Candidate
REPTILES		
Honu'ea, hawksbill turtle (semiresident)	*Eretmochelys imbricate*	Endangered
honu, green sea turtle (nonresident)	*Chelonia mydas*	Threatened

Table 5.1. Endangered, Threatened, and Candidate Species of Hawai'i Volcanoes National Park and Surrounding Areas

Common Name (if available)	Scientific	Federal Status
CRUSTACEANS		
shrimp	*Metabeteus lohena*	Candidate
INSECTS		
pomace fly	*Drosophila digressa*	Endangered
pomace fly[a]	*Drosophila heteroneura*	Endangered
pomace fly	*Drosophila mulli*	Endangered
damselfly	*Megelagrion nesiotes*	Candidate
damselfly	*Megalagrion xanthomela*	Candidate
PLANTS		
pendant kihi fern	*Adenophorus periens*	Endangered
Ka'ū silversword[a]	*Argyroxiphium kauense*	Endangered
ahinahina[c]	*Argyroxiphium sandwicense subsp. sandwicense*	Endangered
	Asplenium peruvianum (A. fragile var. insulare)	Endangered
uhiuhi[c]	*Caesalpinia kavaiensis*	Endangered
'oha wai	*Clermontia lindseyana*	Endangered
'oha wai	*Clermontia peleana subsp. peleana*	Endangered
hāhā[b]	*Cyanea hamatiflora subsp. carlsonii*	Endangered
hāhā	*Cyanea shipmanii*	Endangered
hāhā[a]	*Cyanea stictophylla*	Endangered
'akū	*Cyanea tritomantha*	Endangered
ha'iwale[a]	*Cyrtandra giffardii*	Endangered
ha'iwale	*Cyrtandra tintinnabula*	Endangered
hau kuahiwi[a]	*Hibiscadelphus giffardianus*	Endangered
Hilo ischaemum[a]	*Ischaemum byrone*	Endangered
koki'o[c]	*Kokia drynarioides*	Endangered
Zahlbruckner's pelea[a]	*Melicope zahlbruckneri*	Endangered
ma'aloa	*Neraudia ovata*	Endangered
'aiea	*Nothocestrum breviflorum*	Endangered
holei	*Ochrosia kilaueaensis*	Endangered
many-flowered phyllostegia	*Phyllostegia floribunda*	Endangered
small flower phyllostegia	*Phyllostegia parviflora var. glabriuscula*	Endangered
kiponapona[d]	*Phyllostegia racemosa*	Endangered
hoaw[a]	*Pittosporum hawaiiense*	Endangered
laukahi kuahiwi[a]	*Plantago hawaiensis*	Endangered
Hawai'i hala pepe[a]	*Pleomele hawaiiensis*	Endangered
po'e[a]	*Portulaca sclerocarpa*	Endangered
loulu	*Pritchardia affinis*	Endangered
loulu[c]	*Pritchardia lanigera*	Endangered
	Schiedea diffusa subsp. macraei	Endangered
'ohai[a]	*Sesbania tomentosa*	Endangered
white-bur cucumber[a]	*Sicyos alba*	Endangered
	Spermolepis hawaiiensis	Endangered
	Stenogyne angustifolia	Endangered
Hawai'i pricklyash	*Zanthoxylum hawaiiense*	Endangered
'ahinahina[c]	*Argyroxiphium sandwicense subsp. macrocephalum*	Threatened
sheriff's catchfly[a]	*Silene hawaiiensis*	Threatened

Table 5.1. Endangered, Threatened, and Candidate Species of Hawai'i Volcanoes National Park and Surrounding Areas

Common Name (if available)	Scientific	Federal Status
'ohe	*Joinvillea ascendens subsp. ascendens*	Candidate
holei[c]	*Ochrosia haleakalae*	Candidate
large-flower native buttercup	*Ranunculus hawaiensis*	Candidate
largeleaf bur-cucumber	*Sicyos macrophyllus*	Candidate

Sources: Leonard 2008; Park 2009d, USFWS 2013d, 75 FR 35990.
Note: Critical habitat in table taken from USFWS list and the Federal Register final rule published December 4, 2008.
a. Species has designated critical habitat within and adjacent to Hawai'i Volcanoes National Park
b. Species has critical habitat within and adjacent to the park, but species is not known to occur there
c. Outplanted species
d. Not known to occur within Hawai'i Volcanoes National Park, but on USFWS list for the park.

Table 5.2. Species of Special Concern in Hawai'i Volcanoes National Park

Common Name (if available)	Scientific Name	Status
BIRDS		
'i'iwi	*Vestiaria coccinea*	Rare or Sensitive
noio, black noddy	*Anous minutus melanogenys*	Rare or Sensitive
'ou, Bulwer's petrel	*Bulweria bulwerii*	Rare or Sensitive
koa'e-kea,white-tailed tropicbird	*Phaethon lepturus dorotheae*	Rare or Sensitive
INSECTS		
	Drosophila engyochracea	Rare or Sensitive
	Drosophila hawaiiensis	Rare or Sensitive
	Drosophila silvestris	Rare or Sensitive
Koele mountain damselfly	*Megalagrion koelense*	Rare or Sensitive
PLANTS		
kaulia	*Alphitonia ponderosa*	Species of Concern
Hawai'i jewel orchid	*Anoectochilus sandvicensis*	Species of Concern
fringed spleenwort	*Asplenium schizophyllum*	Species of Concern
akakea	*Bobea timonioides*	Species of Concern
native caper	*Capparis sandwichiana*	Species of Concern
ha'iwale	*Cyrtandra menziesii*	Species of Concern
Pacific embelia	*Embelia pacifica*	Species of Concern
anini	*Eurya sandwicensis*	Species of Concern
Gaudichaud's exocarpus	*Exocarpos gaudichaudii*	Species of Concern
Hawai'i fimbry	*Fimbristylis hawaiiensis*	Species of Concern
Chilean strawberry	*Fragaria chiloensis ssp. sandwicensis*	Species of Concern
Hawaiian twayblade	*Liparis hawaiensis*	Species of Concern
manena	*Melicope hawaiensis*	Species of Concern
Maui phyllostegia	*Phyllostegia stachyoides*	Species of Concern
Hawaiian pittosporum	*Pittosporum hawaiiense*	Species of Concern
hairy purslane	*Portulaca villosa*	Species of Concern
ohe	*Reynoldsia sandwicensis*	Species of Concern
akala	*Rubus macraei*	Species of Concern
tall Hawaiian sanicle	*Sanicula sandwicensis*	Species of Concern
Kīlauea naupaka	*Scaevola kilaueae*	Species of Concern
	Schiedea diffusa ssp. macraei	Species of Concern

Table 5.2. Species of Special Concern in Hawai'i Volcanoes National Park

Common Name (if available)	Scientific Name	Status
Hawaiian blue-eyed grass	*Sisyrinchium acre*	Species of Concern
Hawaiian stenogyne	*Stenogyne macrantha*	Species of Concern
large-flower false lobelia	*Trematolobelia grandifolia*	Species of Concern
kawa'u	*Zanthoxylum dipetalum var. dipetalum*	Species of Concern
Hawai'i beggarticks	*Bidens hawaiensis (B. skottsbergii)*	Rare
island phyllostegia	*Phyllostegia vestita*	Rare
Hawai'i pokeweed	*Phytolacca sandwicensis*	Rare
scroph stenogyne	*Stenogyne scrophularioides*	Rare
ohe'ohe	*Tetraplasandra kavaiensis*	Rare
hame	*Antidesma pulvinatum*	Rare
Hawaiian jackbean	*Canavalia hawaiiensis*	Rare
ekoko	*Chamaesyce celastroides*	Rare
papala	*Charpentiera obovata*	Rare
oha kepau	*Clermontia hawaiiensis*	Rare
Mauna Loa clermontia	*Clermontia montis-loa*	Rare
Kauna'oa	*Cuscuta sandwichiana*	Rare
	Cyanea pilosa subsp. longipedunculata	Rare
wiliwili	*Erythrina sandwicensis*	Rare
Menzies' exocarpus	*Exocarpos menziesii*	Rare
	Gonocormus prolifer	Rare
	Jacquemontia ovalifolia subsp. sandwicensis	Rare
graceful necklace fern	*Lindsaea ensifolia*	Rare
Hawai'i marattia	*Marattia douglasii*	Rare
Lanai colicwood	*Myrsine lanaiensis*	Rare
olopua	*Nestegis sandwicensis*	Rare
longleaf nothecestrum	*Nothocestrum longifolium*	Rare
Hawaiian nototrichium	*Nototrichium sandwicense*	Rare
mountain phyllostegia	*Phyllostegia ambigua*	Rare
largeleaf phyllostegia	*Phyllostegia macrophylla*	Rare
Australian catchbird tree	*Pisonia brunoniana*	Rare
umbrella catchbird tree	*Pisonia umbellifera*	Rare
ho'wa	*Pittosporum confertiflorum*	Rare
Hosmer's pittosporum	*Pittosporum hosmeri*	Rare
	Pittosporum zeylanica	Rare
Hudson's maiden fern	*Pneumatopteris hudsoniana*	Rare
Kīlauea pritchardia	*Pritchardia beccariana*	Rare
hao	*Rauvolfia sandwicensis*	Rare
	Rhus sandwicensis	Rare
giant dock	*Rumex giganteus*	Rare
wingleaf soapberry	*Sapindus saponaria*	Rare
paha	*Sicyos pachycarpus*	Rare
sessile stenogyne	*Stenogyne sessilis*	Rare
Hawaiian tretraplasandra	*Tetraplasandra hawaiensis*	Rare
ohe mauka	*Tetraplasandra oahuensis*	Rare
olona	*Touchardia latifolia*	Rare
smooth urera	*Urera glabra*	Rare
maua	*Xylosma hawaiiense*	Rare
Kauai prickly-ash	*Zanthoxylum kauaense (Z. maviense)*	Rare

Water Resources

MARINE RESOURCES

The Hawaiian Islands are the most isolated island chain in the world, located more than 2,000 miles (3,200 kilometers) from the nearest continent. Because of Hawai'i's geographic isolation, rates of endemism are high for aquatic fauna, ranging typically from 15% to 20%. The estimated number of aquatic indigenous species is thought to include more than 100 freshwater and 6,400 marine animals (Meadows et al. 2005).

Because the landform of the Hawaiian Islands is actually a series of summits of steep volcanic peaks, waters off these islands become very deep within a short distance from the shoreline. Outside of the park, the shallower, nearshore waters are home to some of the most desirable game fishes in the Hawaiian Islands, including mahi-mahi (*Coryphaena hippurus*), 'ahi (tuna, *Thunnus* spp.), and marlin (*Makaira nigricans*) (Meadows et al. 2005). Many unique fish and invertebrate species inhabit these deepwater areas and provide important food sources for other marine animals.

Because the park's legislated boundary ends at the mean high tide, its important marine resources are limited to the coastal intertidal areas, particularly beaches that are used by threatened and endangered sea turtles and monk seals (Daniel and Minton 2006). Intertidal areas at the park include large stretches of high coastal basalt cliffs, as well as basalt benches, tide pools, and sand beaches. Endemic Hawaiian limpets (*Cellana* sp., locally known as 'opihi) occur in some intertidal areas. These and other intertidal organisms are important traditional foods for Native Hawaiian communities near the park (Daniel and Minton 2006).

ANCHIALINE POOLS

Brackish anchialine pools occur along the coast and represent the only fish habitat within park boundaries. Anchialine pools are exposed portions of the groundwater table that are found in porous lava areas. Because these pools are connected to the ocean, the water is measurably saline and fluctuates with the tides. Most anchialine pools support unique biotic communities, although they are poorly understood. An inventory of 19 anchialine pools was conducted in 1988, which identified seven species of fishes, nine crustacean species, and one mollusk (Chai, Cuddihy, and Stone 1989). Subsequent lava flows buried the pool at Waha'ula. More recently, a total of 28 pools were identified in Hawai'i Volcanoes National Park and nine are proposed for monitoring by the NPS Inventory and Monitoring Program (Brasher, et. al., in press). These pools provide unique habitat and niches, and they host a variety of endemic species such as the anchialine pool shrimp (*Metabetaeus lohena*), which is a candidate for protection under the ESA (NPCA 2008). Threats to the anchialine pools on Hawai'i Island include encroachment of development, the introduction of nonnative aquatic species (Chai, Cuddihy, and Stone 1989), and sea level rise. Not all of these threats are issues at Hawai'i Volcanoes National Park. Encroachment of development is not an issue within the park and introduction of nonnative aquatic species is not likely because the pools are mostly located in the backcountry and are small and hard to find. The anchialine pools in the park were found to be smaller in size, lower in biological diversity, and lower is species rarity than other pools on Hawai'i Island. However, the anchialine pools at Hawai'i Volcanoes National Park have a high natural value due to good structural diversity (caves, deep cracks, and shallow pools), excellent habitat for organisms (such as at Halapē), and great management and preservation potential (Chai, Cuddihy, and Stone 1989).

Within the park, impacts to the aquifer/groundwater are unlikely because the park is the primary watershed owner and does not extract any groundwater. The park's water supply is from a rainwater catchment system located by the park's headquarters. There are also small rainwater catchment systems for visitor use at the campgrounds near the coast. The park's buildings are on septic systems, not cesspools, to protect groundwater quality.

Past potential impacts on water quality and quantity were caused by large numbers of ungulates through soil erosion and vegetation loss, but were addressed through animal removal and fencing several decades ago. The park's developed areas are small and distant from these shoreline resources, so runoff and associated pollution is highly unlikely for the anchialine pools within the park.

Although the park does not contain true marine environments, it is recognized that the majority of stressors on the marine environment have terrestrial, mostly anthropogenic, origins. At Hawai'i Volcanoes, the main stressors identified were fishing, due to the harvesting of resources, and the potential impact of humans near the threatened and endangered turtles (Daniel and Minton 2006).

Night Skies

The extreme isolation of the Hawaiian Islands allows for excellent air quality at high elevations and results in clear night skies that provide outstanding opportunities to see the stars and constellations. The absence of artificial light allows native wildlife to navigate without becoming disoriented. The quality of the night sky is outstanding for the wilderness traveler. Native Hawaiians depend upon clear night skies for ocean navigation and traditionally celebrate the relationship between the summit of Mauna Loa Volcano and the moon and stars, which require unobstructed vistas and night sky clarity. The island of Hawai'i is home to an astronomy community that operates observatories on Mauna Kea, and clear night skies are important for researchers and serve as an economic resource for island residents.

Dark night skies are so important that Hawai'i County passed lighting ordinances to protect the dark night sky (Hawai'i County Outdoor Lighting Ordinance, 1988, Ord. No. 88-122, sec. 3; Chapter 14, Article 9). More recently, the state of Hawai'i recently passed an act to ensure that the rest of the state is protecting night skies (Act 287, Hawai'i Night Sky Protection Act, 2012; Chapter 201—Night Sky Protection Strategy, Hawai'i Revised Statutes revision; previously only Hawai'i and Maui counties had ordinances).

Increasingly, night sky values are described by the term "natural lightscape," referring to a place or environment characterized by the natural rhythm of the sun and moon cycles, clean air, and dark nights unperturbed by artificial light. Natural lightscapes, including dark night skies, are not only considered a natural resource unto themselves but are also an integral component of countless park experiences, in addition to inspiring myths, religions, and innumerable works of art and literature.

Park wildlife need food, water, shelter, and space, but they also need darkness. The high quality of the night sky at the park makes it particularly susceptible to artificial lighting choices: its natural lightscape is impacted by both direct light and glare, as well as by indirect scattered light. Certain meteorological patterns and poor air quality can further exacerbate the impact of artificial light upon nighttime scenery. Enhancing protection of nocturnal habitat is especially important in sensitive biomes (such as beaches and wetlands) or when listed species known to be sensitive to artificial light are present.

NPS *Management Policies 2006*, Section 4.10 on Lightscape Management states: "The Service will preserve, to the greatest extent possible, the natural lightscapes of parks, which are natural resources and values that exist in the absence of human-caused light…" The National Park Service recognizes that improper outdoor lighting can impede views and visitor enjoyment of the night sky.

Several special status species are known to be adversely impacted by artificial lighting, including the Hawaiian petrel, Newell's shearwater, hawksbill sea turtle, green sea turtle, and Blackburn's moth. In 2008, the grounding of a Hawaiian petrel at the exterior of Volcano House prompted the park to audit outdoor lighting conditions and develop internal draft guidance that is more stringent than the Hawai'i County lighting ordinance.

The park has adopted the following avoidance and minimization measures to reduce the risk of seabird light attraction due to lights and related activities. Avoidance measures are those which cease or suspend lighting activities posing threats to species. These include the following:

- minimize outside lights from dusk through dawn, particularly during the fledgling period for the night-flying seabirds (September 15 to December 15)
- permanently remove roof lights or other lights that direct light upward and horizontally

Hawai'i Volcanoes National Park is concerned about protecting natural lightscapes and nocturnal wildlife within the park and is incorporating new lighting techniques and technology in order to reduce light trespass and preserve the dark night sky, conserve energy, and maintain safety. The park minimizes night lighting in administrative buildings, on roadways, and within commercial concession operations. The park is transitioning all outdoor lighting to directional lighting and light bulbs that improve the quality of the night sky. Recent lighting changes to incorporate new night sky fixtures at Kīlauea Visitor Center and Jaggar Museum have greatly improved the lightscapes in those areas.

The park has restricted the use of artificial lighting to those areas where security, basic human safety, and specific cultural resource requirements must be met. Actions include:

- use of minimal-impact lighting techniques
- shielding of artificial lighting where necessary to prevent the disruption of the night sky, nocturnal cycles, and physiological processes of living organisms
- requiring park concession or other commercial services to minimize use of artificial lights; disconnecting lights in soda machines and gas pumps
- emphasizing outstanding night sky viewing in park interpretive programs and backcountry permits, educating visitors about their importance, and providing red flashlight filters with backcountry permits

Future threats could arise from increasing development and the proliferation of artificial light sources surrounding park boundaries and designated wilderness.

Climate Change

Climate change is defined by the United Nations Framework Convention on Climate Change (UNFCCC) as "a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods" (UNFCCC 1992). In recent years, scientific data have shown that human influence on climate systems is taking place, and evidence of climate change has already presented itself (Solomon et al. 2007).

CLIMATE FRIENDLY PARKS EMISSIONS INVENTORY

Climate change has already had noticeable impacts on both natural and cultural resources within NPS-managed lands nationwide. In response to the increasing need for understanding and action related to climate change impacts in the parks, the National Park Service launched the Climate Friendly Parks program in 2002. This program enables the National Park Service to educate its staff about climate change issues, assess each park's contribution to greenhouse gas emissions, create short- and long-term strategies for reducing emissions, determine potential effects of climate change on park resources, and develop skills and strategies for communicating these effects to the public. Hawai'i Volcanoes National Park is a participant in the Climate Friendly Parks program and developed a long-range Climate Action Plan in 2007.

As part of developing the 2007 Climate Action Plan, the carbon footprint of the park was analyzed using the Climate Leadership in Parks (CLIP) tool, a greenhouse gas emissions inventory model jointly developed by the Environmental Protection Agency and the National Park Service. Data used to perform the calculations included the amount of electricity purchased, waste sent to the landfill, and fuels consumed. The baseline findings show that transportation was the largest contributor to total greenhouse gas emissions for the park (73% of emissions). Energy was the next highest contributor, with 15% of emissions. Solid waste and other emission sources (such as stationary combustion and refrigeration) contributed to overall park emissions. These findings provide an initial overview of the carbon footprint of Hawai'i Volcanoes National Park. Further monitoring and analysis using the CLIP tool will track progress in reducing the park's carbon footprint into the future.

REGIONAL PROJECTIONS

Results of documented temperature changes in Hawai'i show a fairly rapid rise in surface temperature over the past 30 years, with more rapid warming occurring at higher elevations (Giambelluca et al. 2008). Current studies indicate that in the absence of factors such as adaptation and migration, tropical climates may hold the greatest extinction risks from global warming (Deutsch et al. 2008). Stronger warming trends, especially at higher elevations, can have severe ecological impacts in Hawai'i, including consequences on water resources and native biodiversity (Giambelluca et al. 2008). Temperatures are predicted to rise an average of 4°F in the Pacific Islands by 2090 (Schramm and Loehman 2011).

VEGETATION AND THE ROLE OF CLIMATE CHANGE

Two key climatic features of Hawaiian montane forests are the northeast trade winds and the associated trade wind inversion, which influence humidity and precipitation, and as a result influence the distribution of forest plant communities. Studies show that both local temperature and the elevation of the trade wind inversion, which averages 6,200 feet, have responded substantially to past climate changes (Benning et al. 2002). If the frequency or height of the trade wind inversion is affected by climate warming, precipitation throughout Hawai'i but especially on the upper mountain slopes will be substantially impacted. Trends in rainfall (lower rainfall) and recent changes in the trade wind inversion suggest warming may result in drier conditions, which would severely affect the highly vulnerable ecosystems found in areas above the mean inversion height (Giambelluca and Luke n.d.). Increased variability of rainfall coupled with potential for drought could have profound impacts on the cloud forest. For example, results from a study of successional vegetation on lava flows at Mauna Loa suggest that severe drought is a likely mechanism causing or reinforcing a shift from dominance by woody species to dominance by herbaceous species (Loope and Giambelluca 1998). For native plants and communities and the wildlife dependent on them, population and habitat ranges will shift, increase, decrease, or disappear completely in accordance with changes in moisture and temperature regimes.

As a result of global climate change, variability in the occurrence or height of the trade wind inversion, carbon dioxide, temperature, water availability, nutrient availability, and cloud cover can all affect the resistance of plants and trees to introduced herbivores. For example, increased carbon dioxide can reduce leaf nitrogen, and herbivores will respond with either decreased growth or increased consumption. Herbivores and pathogens can alter the species composition and size structure of forests, which can in turn affect ecosystem processes such as evapotranspiration (loss of water from the soil by evaporation and transpiration from plants), carbon dioxide flux (change in the output and intake of carbon dioxide), and heat transfer, thereby creating feedbacks to climate (Ayres and Lombardero 2000). Anthropogenic climate change and shifts in the trade wind inversion (changing patterns of cloud cover,

rainfall, and humidity) can both interact with past land use changes and biological invasions to drive several native species of Hawai‘i to extinction (Benning et al. 2002). In general, invasion by a single species combined with warming trends can alter the composition and dynamics of an entire ecosystem (Simberloff 2000; Vitousek et al. 1997).

WILDLIFE AND THE ROLE OF CLIMATE CHANGE

In addition to the factors associated with vegetation, which would also affect wildlife habitat, climate change has implications unique to wildlife in Hawai‘i. For example, the biogeographic ranges of species like mosquitoes are set by climate. Changes in climate, including seasonal changes in temperature and rainfall, could lead to a change in ranges and newly established populations of such species (Atkinson and LaPointe 2009; Giambelluca et al. 2008). Accelerated warming at higher elevations may have substantial impacts on Hawai‘i’s native endangered and threatened bird species by allowing disease-carrying mosquitoes to reach the high-elevation forests in which the birds find refuge (Giambelluca et al. 2008). Hawaiian honeycreepers, for example, have been eliminated from low- and mid-elevation forests largely due to introduced predators and diseases (Benning et al. 2002). The trade wind inversion is likely to have a substantial role in determining the upper extent of forest bird habitat in the Hawaiian Islands. If the trade wind inversion and its effects on rainfall prevent expansion of forest bird habitat into higher elevations, remaining high-elevation forest bird populations may be squeezed between expanding disease transmission from lower elevations and the upper limits of suitable habitat. These changes would likely drive remaining populations of honeycreepers to extinction (Atkinson and LaPointe 2009). This could be exacerbated by feral pigs and other nonnative ungulates, which can create depressions that allow water to pool, resulting in larval mosquito habitat in otherwise well-drained forests like those in the park, where there are few natural standing water sources (Atkinson and LaPointe 2009).

These conclusions are further supported by landscape analyses of three high-elevation forest refuges on Hawai‘i, Mau‘i, and Kaua‘i, which show that climate change is likely to combine with past land-use changes and biological invasions to drive several of the remaining Hawaiian honeycreepers to extinction, especially on the islands of Hawai‘i and Kaua‘i (Benning et al. 2002).

ADDITIONAL EFFECTS

Additional potential climate change effects identified as management issues for the park include increased frequency of wildfire, increased spread of nonnative plants and animals, rising sea level and inundation in coastal areas and increased storm-surge events impacting near-shore environments and coastal archeological sites, increased hurricane frequency, and reduced water for park operations. In addition, the aerial distribution of hazardous volcanic emissions from the summit eruption of Kīlauea and the vent at Pu‘u ‘Ō‘ō is influenced by the presence or absence of trade winds. A change in trade winds has the potential to affect air quality conditions at the park.

Wilderness

The Wilderness Act of 1964 defines wilderness as:

> *an area of undeveloped Federal land retaining its primeval character and influence, without permanent improvements or human habitation, which is protected and managed so as to preserve its natural conditions and which 1) generally appears to have been affected primarily by the forces of nature, with the imprint of man’s work substantially unnoticeable; 2) has outstanding opportunities for solitude or a primitive and unconfined type of recreation; 3) has at least five thousand acres of land or is of sufficient size as to make practicable its preservation and use in an unimpaired condition; and 4) may also contain ecological, geographical, or other features of scientific, educational, scenic, or historical value.*

Agencies responsible for administration of designated wilderness are required by law to preserve the wilderness character of the area. Managers at the park use a Minimum Requirement Analysis to determine if, when, and how administrative actions that might impact wilderness character can be implemented. There are four qualities derived from the statutory language of the 1964 Wilderness Act that are used to describe wilderness character:

Untrammeled: wilderness is essentially unhindered and free from modern human control or manipulation.

Natural: wilderness ecological systems are substantially free from the effects of modern civilization.

Undeveloped: wilderness is essentially without permanent improvements or modern human occupation.

Outstanding opportunities for solitude or a primitive and unconfined type of recreation: wilderness provides outstanding opportunities for people to experience natural sights and sounds, solitude, freedom, risk, and the physical and emotional challenges of self-discovery and self-reliance.

Other unique components that reflect the character of the wilderness: in addition to the four required qualities of wilderness listed above, the Wilderness Act says these areas "may also contain ecological, geological, or other features of scientific, educational, scenic, or historical use."

DESIGNATED WILDERNESS

As a requirement of the 1964 Wilderness Act, Hawai'i Volcanoes National Park conducted a study, held public hearings, and wrote an environmental impact statement for possible wilderness designation of roadless areas within the park. In 1978, under Title IV, Section 401(6) of Public Law 95-625 (92 Stat. 3467), approximately 123,100 acres were designated wilderness within the boundary of Hawai'i Volcanoes National Park (see *Figure 4.1. Wilderness and Backcountry Areas*).

As stated in the final EIS for the initial wilderness proposal, the designated wilderness area for Hawai'i Volcanoes National Park would:

> *preserve diverse segments of the island of Hawai'i in an undeveloped state—from the 13,680-foot summit of Mauna Loa to the Puna and Kau Coasts, and landscape[s] ranging from barren lava to dense tropical forests and dry coastal reaches with numerous archeological sites (Park 1975).*

Park areas that are formally designated as wilderness include the following:

- Mauna Loa wilderness unit
- Ka'ū Desert wilderness unit
- East Rift wilderness unit
- 'Ōla'a wilderness unit

The Mauna Loa wilderness unit preserves the upper reaches and summit of Mauna Loa Volcano, including the entire Moku'āweoweo Caldera. The forces of nature predominate within this wilderness area, affording visitors primitive wilderness solitude and scientists an undisturbed outdoor laboratory. Within this wilderness area are two historic cabins, Red Hill and Mauna Loa summit. These existing shelters provide protection from extreme weather conditions and have been deemed necessary for backcountry management and protection of park resources.

The Ka'ū Desert wilderness unit preserves shoreline and the lands between the ocean and the palis. The shoreline is dramatic, rugged, and the longest stretch of undeveloped coastline on Hawai'i Island. There are dramatic views of the Puna and Ka'ū coastline from the palis. Most of the park's backcountry use occurs in this wilderness area and primarily on the coastline. There are two historic shelters (Halapē and Footprints) and one historic cabin (Pepeiao) in this wilderness area. The shelters at Halapē and Pepeiao include a water catchment system to provide freshwater in a park where surface water is rare. Backcountry use is relatively light and greater use is discouraged by the lack of freshwater and shade along the severe coastline.

The East Rift wilderness unit includes a segment of the Chain of Craters and includes native ʻōhia and tree fern forest. This wilderness unit experiences frequent volcanic eruptions, which cover portions of forest, leaving bare lava on which immediate regeneration of rainforest vegetation often occurs. This area is known for its scenic lava landscapes and receives higher amounts of visitation due to the volcanic activity.

The ʻŌlaʻa Forest wilderness unit is one of the finest examples of native Hawaiian ʻōhiʻa/fern forest. This area has no development and is surrounded by similar state forest lands. Fences have been constructed in this area to control invasive animals, particularly feral pigs, and approximately half of the area is now ungulate free.

An additional two tracts of land bordering the park, totaling 7,850 acres, were also mentioned in the 1974 legislation as "potential" wilderness additions. These two tracts were destined to become designated wilderness if acquired by the park in the future (92-Stat.3467, P.L. 95-625, Sec.301). This includes an area known as Tract 22 on the park's east boundary, recently designated a new Natural Area Reserve (2009) administered by the state Department of Land and Natural Resources (DLNR), and an area on the lower Kaʻū boundary of the park, known as the Great Crack. Neither has been acquired by the park, and subsequently neither was designated wilderness.

Although not included in the final 1978 legislation language, special provisions were included in NPS recommendations for wilderness designation within Hawaiʻi Volcanoes National Park. These special provisions included allowing shelters with water collection systems; the continuation of geologic instrumentation (by US Geological Survey scientists) and the use of helicopters for resource management, research, and volcanic monitoring; and the use of fences, tools, and equipment necessary to accomplish feral animal control (Park 1974). These provisions were all consistent with the DOI guidelines for wilderness proposals promulgated in June 1972. There is a continued need for these special provisions due to the extremely rugged terrain, lack of surface water, need for volcanic research and monitoring for human health and safety, and need for nonnative invasive species control to restore and preserve native Hawaiian ecosystems. These needs are addressed through the application of the Minimum Requirement Analysis to ensure wilderness values are considered during management actions.

WILDERNESS ELIGIBILITY OF THE KAHUKU UNIT

Current NPS policy, as stated in *Management Policies 2006*, requires that any major additions to units of the national park system be assessed for their eligibility for inclusion in the national wilderness preservation system. In July 2003, an area of 150,865 acres (GIS), known as "Kahuku," was purchased from the estate of Samuel M. Damon and added to Hawaiʻi Volcanoes National Park. This parcel straddles dramatic lava flows and volcanic features along the Southwest Rift Zone of Mauna Loa, an active volcano and the largest mountain in the world. Over the past century, Mauna Loa has erupted frequently, roughly every 20 years, and is known for the voluminous lava flows. The Southwest Rift Zone of Mauna Loa is in Kahuku. The Kahuku area stretches from alpine, at 12,600 feet in elevation, down to 2,000 feet, into the lowland dry woodlands.

The *Kahuku Unit Wilderness Eligibility Assessment* addresses these requirements and criteria and is the result of an inventory conducted in 2010. Of the 150,865 acres (GIS) assessed, 121,015 acres (GIS) of the Kahuku Unit meet the eligibility criteria (see *Figure 4-2. Eligible Wilderness Kahuku*) and requirements necessary to qualify for the congressionally designated National Wilderness Preservation System. The remaining 29,848 acres (GIS) are not recommended for eligibility at this time, because of the need for long-term intensive restoration activities to restore natural conditions. These activities include fencing and the extensive use of helicopter, motorized vehicles, mechanical tools, and

heavy construction equipment to restore areas altered by bulldozers, ranching, roads, feral ungulates, and other harmful invasive nonnative plants and animals. It is anticipated that eligibility would be possible after forest restoration activities are completed. Management of Kahuku will be managed in accordance with the GMP/WS/EIS (see "Chapter 3: Alternatives"). A detailed description of the eligibility analysis can be found in Appendix D of this document.

Soundscapes and the Acoustic Environment

The acoustic environment, defined as the combination of all the acoustic resources (physical sound sources, including both natural sounds and cultural and historic sounds) within a given area, is an inherent component of "the scenery and the natural and historic objects and the wild life" protected by the Organic Act of 1916. While the acoustic environment includes sound vibrations made by geological processes, biological activity, and even sounds that are inaudible to most humans, such as bat echolocation calls, the soundscape is the component of the acoustical environment that can be perceived and comprehended by humans. NPS *Management Policies 2006* require the National Park Service to preserve the park's soundscape and acoustic environment which refer to the combination of all of the natural sounds occurring within the park, absent the human-caused sounds, as well as the physical capacity for transmitting those natural sounds and the interrelationships among park natural sounds of different frequencies and volumes (NPS 2006a). The National Park Service will preserve soundscapes and the acoustic environment to the greatest extent possible and will restore these resources to their natural condition wherever they have become degraded by noise (unwanted sounds which either effect humans and wildlife or interfere with the perception or detection of other sounds).

The soundscape and acoustic environment at Hawai'i Volcanoes National Park includes both natural and human components. Some common acoustic resources in Hawai'i Volcanoes are surf action at the shoreline, winds spilling across volcanic flows or rustling leaves, native Hawaiian birds calling and singing, rain falling on tree and tree fern canopies, and crickets vocalizing in the rain forest. Some of the park's most notable acoustic resources include those related to volcanic activity such as the hissing and crackling of new lava flows, clinking of glass-like surfaces of active lava flows, booming methane explosions or, more rarely, the roar of fountaining events. These sounds may be heard as a composite of sound, or individually.

Human components of the soundscape and acoustic environment in Hawai'i Volcanoes are Native Hawaiian ceremonies and chants, park maintenance activities, visitors talking, vehicles on roads, helicopter overflights, etc.

Noise is generally defined as unwanted sounds which either effect humans and wildlife or interfere with the perception or detection of other sounds. Noise can adversely affect park resources or values, including but not limited to the soundscape and acoustic environment, wildlife, wilderness, traditional cultural uses, and visitor experience. It can directly impact them by modifying or intruding upon soundscapes and the acoustic environment, masking the natural sounds that are an intrinsic part of the environment. Sounds can also be perceived as noise because of loudness, pitch, duration, or occurrence at unwanted times or from an unwanted source. Sound that is consistent with the purpose of a particular region of the park, such as that caused by ocean surf, is less likely to be perceived as unwanted noise. The presence of loud noises—such as motorized sounds—where visitors expect to experience the tranquility and serenity of the natural environment would detract from the visitor's park experience.

In addition to its effect on humans, noise can adversely affect wildlife communities within parks by interrupting important communication networks for survival and reproduction between insects, birds, and mammals. For example, certain wildlife communications may signify a desire to mate, danger from predators, and territorial claims (NPS 2009d).

CHARACTERISTICS OF SOUND

The magnitude of sound is usually described by its sound pressure level. The A-weighted decibel scale is commonly used to describe sound levels because it reflects the frequency range to which the human ear is most sensitive. Sound levels measured using an A-weighted decibel scale are generally expressed as dBA. Throughout this section, all sound levels are expressed in dBA. Several examples of sound pressure levels in the A-weighted (dBA) scale are listed in *Table 5.3. Common Sound Levels and their Effects on the Human Ear*. Normal speech has a sound level of approximately 60 dBA.

ACOUSTICAL CONDITIONS IN THE PARK

The commercial air tour industry has greatly increased on Hawai‘i Island since the start of Kīlauea Volcano’s East Rift eruption at Pu‘u ‘Ō‘ō. Dozens of flights took to the air and buzzed at low elevations across the park. Since the start of the eruption in 1983 and continuing today, air tours at park eruption-sites can routinely exceed over 60 flights per day. Due to a growing number of air tours and subsequent air tour crashes nationwide, congressional legislation was passed to minimize the impacts of air tours over national parks. An initial report to Congress, *Effects of Aircraft Overflights on the National Park System*, included documentation of the impacts of air tours on park resources at Hawai‘i Volcanoes National Park. In 2000 congressional legislation known as the National Parks Air Tour Management Act (Public Law 106-181) created a partnership between the Federal Aviation Administration and the National Park Service to create an air tour management plan/environmental impact statement (ATMP/EIS) related to the impacts of air tour overflights on park resources. Hawai‘i Volcanoes National Park was one of the first in a handful of parks to begin development of an air tour management plan. Since 2000, the FAA has granted air tour companies authority to fly up to 28,441 flights annually over the park.

In 2002–03, baseline acoustic data was collected throughout the park as part of the early ATMP/EIS planning process and will help to inform soundscape management activities in various areas of the park (USDOT-FAA 2006). Sound level

Table 5.3. Common Sound Levels and their Effects on the Human Ear

Sources	Decibel Level (dBA)	Qualitative Perception
Normal breathing	10	Very low
Leaves rustling	20	Very low
Soft whisper, quiet library (at 15 feet)	30	Low
Crickets (at 15 feet)	40	Low
Light auto traffic (at 100 feet)	50	Medium
Hughes 500D helicopter overflight (at 500 feet)	54	Medium
Conversational speech (at 3 feet)	60	Medium
Vacuum cleaner	70	High
Off-road vehicles	70–90	High
Heavy truck or motorcycle (at 25 feet)	90	High
Military jet (at 330 feet)	120	High

Sources: Park 2013b and Lee 2012

measurements were conducted at 22 site locations from October 23, 2002 to June 1, 2003. Ultimately, ten "acoustic zones" were identified to represent regions of the park with similar acoustic conditions (see *Figure 5.3. Acoustic Sites and Sampling Areas*). The baseline data representative of the various acoustic zones and acoustic modeling of aircraft overflights will be used to further characterize soundscapes and determine potential impacts to park soundscapes from overflights as the ATMP/EIS planning process progresses. The results of these data are shown in *Table 5.4. Ambient Sound Levels in Park Acoustic Sampling Areas*. Sound measurements have not been collected in the Kahuku Unit or in the Mauna Loa Alpine. Information collected from other sections of the park was used to extrapolate the natural ambient sound levels in Kahuku based on similarity of vegetation and terrain. Sound measurements were completed in the Kahuku Unit in fall 2013 and the data is being analyzed. Additional sound measurements for the Mauna Loa Forest zone were collected in April 2008 (NPS 2008). *Appendix I: Acoustic Sampling Areas* contains further information regarding the ten acoustic zones.

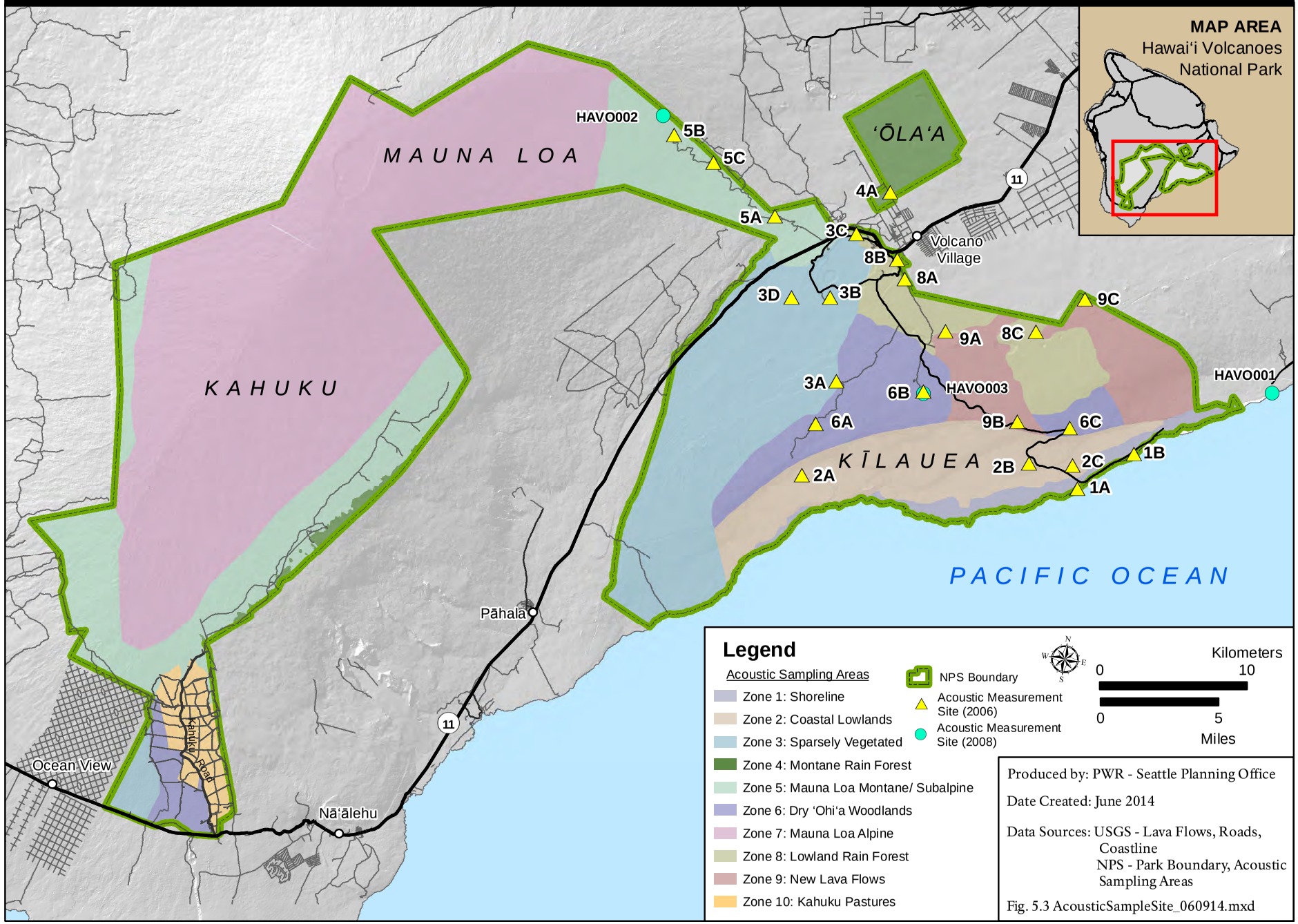
Table 5.4. Ambient Sound Levels (dBA) In Park Acoustic Sampling Areas

Acoustic Sampling Area	Measurement Sites	L_{50}[a] Natural Ambient Sound Level (dBA)
Zone 1 (Shoreline)b	1A	54.2
	1B	46.6
Zone 2 (Coastal Lowlands)	2A	28.3
	2B	32.7
	2C	29.1
Zone 3 (Kaʻū Desert/Kīlauea Summit)	3A	31.4
	3B	29.1
	3C	32.7
	3D	20.4
Zone 4 (ʻŌlaʻa Rainforest)	4A	33.5
Zone 5 (Mauna Loa Forest)	5A	35.0
	5B	22.1
	5C	27.5
	HAVO002c	18.1c
Zone 6 (Dry ʻŌhiʻa Woodlands)	6A	28.0
	6B	28.0
	6C	32.7
Zone 7 (Mauna Loa Alpine)	no data	no data
Zone 8 (Young Rain forest)	8A	42.6
	8B	38.2
	8C	29.7
Zone 9 (New Lava Flows)	9A	28.6
	9B	28.6
	9C	25.4
Zone 10 (Kahuku Pastures)	no data	no data

a. L50 refers to the sound level exceeded for 50% of a specific time period (6 a.m. to 6 p.m./7 a.m. to 7 p.m.). L50 data and time periods are from USDOT-FAA 2006 and NPS 2008, respectively.
b. Due to strong trade winds, the data for Zone 1 is contaminated with some wind noise and should be used with caution.
c. A single station was deployed in the subalpine zone on Mauna Loa at the 7,300-foot elevation for 41 days in 2008 (NPS 2008).

Figure 5.3 Acoustic Sites and Sampling Areas

Hawai'i Volcanoes National Park GMP/WS/EIS



THE CULTURAL ENVIRONMENT

Initial settlement of Hawai‘i is likely to have originated from the Marquesas, Society, and Cook islands in Central East Polynesia (Kirch 1985). Superb sailors, these Polynesians migrated to Hawai‘i by navigating with the sun and stars and by reading the winds, currents, and the flight of seabirds. Sailing across 2,400 miles of open ocean in large double-hulled canoes, they brought with them items to ensure their survival: pua’a (pigs), ‘ilio (dogs), and moa (chickens); the roots of kalo (taro) and ‘uala (sweet potato); and the seeds and saplings of niu (coconut), mai‘a (banana), ko (sugar cane), and other edible and medicinal plants (Park 2009b). The time of colonization may have occurred in the centuries around AD 500, although this is still a topic of debate amongst scholars (Kirch 1985; Hunt and Holsen 1991; Graves and Addison 1995). Having carried with them a cultural template from their Polynesian homeland, they established a religious and sociopolitical system that was soon to evolve into a uniquely Hawaiian culture (Kirch 1985).

The 1778 arrival of sailing explorer Captain James Cook and his crew opened Hawai‘i to the western world through their accounts and stories. In the next century great change came to the island peoples and landscapes with the influx of sailors, merchants, missionaries, and businessmen, whose alteration of the islands’ social and political structure resulted in permanent impacts. The islands were already environmentally changed from Polynesian introductions (plants and animals) and land use practices, but the environmental changes were even greater with the influx of the sailors, merchants, missionaries, and businessman.

There were two classes of people at the time of contact in 1778—the chiefly class and the commoners. Within the chiefly class on Hawai‘i Island was the Kamehameha line. Kamehameha’s rise to power was through conquest of other island chiefs. Ultimately, Kamehameha united the islands in 1810. Once Kamehameha had established himself as the ruler of the islands, he ruled for nine years until his death in 1819; the traditional social and political rules of behavior remained. After his death, his favorite wife Kaahumanu and Kamehameha’s son Liholiho (who ruled as Kamehameha II) dismantled the traditions. The practice of communal eating between men and women— the breaking of the ‘ai kapu was the first of these traditions to be discarded. Other changes included the acceptance of western religious practice by some and wearing of western clothing. Once westerners were living among Hawaiians in greater numbers by the 1830’s, the further assimilation of western ideas, dress, and attitudes flooded the islands.

For centuries prior to European contact with Hawai‘i, the park lands were cared for and occupied by Native Hawaiians. There are a variety of radiocarbon dates that suggest that Hawaiians settled in this region of Puna and Ka‘ū by the early 14th century; however, earlier dates for the establishment of Waha‘ula heiau falls within the 13th century, when the landscape—or actual terrain surrounding the heiau—was being created from the lava (Kane Nui o Hamo flow). Some of the earliest evidence of life within the Puna and Ka‘ū ahupua‘a have been buried by more recent lava activity, since 1983. Archeological reports of life on the lava landscape are documented through the remnants of house platforms with associated living surfaces. Caves were often used as water sources and shelter. Discovery of more recent animal enclosures and excavated pits and rock mulch mounds suggest that animal husbandry and widespread farming took place on what today appears to be barren lava.

The Native Hawaiians who lived in this region were linked together by trail systems which connected families who lived and fished along the coast with families who farmed, lived, and worked further inland. The trail systems were laid out specifically to provide people with access to resources such as volcanic glass and basalt used to make their cutting or chopping tools, nests where seabirds were caught for food, shrines where they worshiped their gods, plants collected for medicine and dyes, and wood for canoes and houses.

The first Europeans to travel near the area now known as Hawai‘i Volcanoes National Park arrived in 1794 with Captain George Vancouver on the ship *Discovery*. While moored off Hawai‘i Island, Archibald Menzies (the ship's naturalist) ascended Hualālai and then Mauna Loa to Moku‘āweoweo Crater. Descriptions of Mauna Loa and the adjacent lands are provided in Menzies' journal printed in 1920: *Hawai‘i Nei 128 Years Ago* was a recap of his three trips to Hawai‘i. From the vantage point of the *Discovery*, Menzies described the erupting Kīlauea Volcano to their east. The next written account of Kīlauea does not appear until nearly three decades after Menzies' visit, when the missionary Reverend William Ellis and his companions walked through the districts of Ka‘ū and Puna over a period of two months in 1823. Ellis gives detailed accounts of the geology, fauna, flora, and cultural history of the area in a personal journal. Ellis also recorded the eruptive activity visible at Kīlauea Volcano. Between 1823 and the early 1900s, various reports detailed the presence of the lava lake and eruptive activity from the summit of Kīlauea Volcano (Ellis 2004).

The relative safety and ease of reaching an active volcano such as Kīlauea made the advantage of establishing a permanent place for scientific study in Hawai'i appealing. As researchers from Massachusetts Institute of Technology (MIT) became interested in establishing an observatory at Kīlauea, they lent their support for securing lands under the control of the federal government. By doing so, they would secure rights to access the site. In 1912, Dr. Thomas Jaggar, a highly respected geologist from MIT, left MIT to become the first director of the Hawaiian Volcano Observatory, which had been founded in 1909. Jaggar became a great proponent of establishing Kīlauea as a national park and lobbied through speeches and written articles for its creation.

The establishment of a national park in 1916 in what was then the Territory of Hawai‘i stemmed from an increasing trend of American tourism to scenic and health-enhancing areas. Between 1872 (establishment of Yellowstone National Park) and 1916 (establishment of the National Park Service), the priority within the new federal parks was for their use and enjoyment through recreational tourism. Thus across the United States the creation of parks was undertaken to enhance the development of resorts near favored health spots or scenic areas. Hawai‘i did not escape the influence of this national movement; the trend in Hawai‘i, and specifically in the volcano area, was to focus development around the scenic beauty of the setting and the volcanic activity. Although early European American interest in the Kīlauea region came from naturalists, adventurers, and scientists seeking to understand and explain the geologically active area, later visitors were primarily tourists interested in seeing the spectacular volcanic activity and enjoying the natural steam baths.

In the 1930s, Franklin D. Roosevelt's Civilian Conservation Corps played a major role in the early development of park infrastructure, including rock walls and road features that visitors can still see and use today (Park 2007c). The historic Kilauea Military Camp was developed as a rest and relaxation camp in 1916 for military personnel and that use continues today. During World War II, it served various roles including a temporary Japanese internment camp and, later, a prisoner of war camp (Park 2009f, 2012a).

The boundaries of the park have been modified through the years to add culturally rich areas (see "*Chapter 1: Introduction and Background*" for a full description of these changes). Specifically related to cultural resources, the park acquired the Footprints and Ka‘ū Desert areas in 1922, which contain significant archeological resources. In addition, in 1938 a proposal for the park to acquire lands near Kalapana originated with several citizens of the Hawaiian Territory and was eventually passed in legislation, authorizing the addition of 42,000 acres to the park. It includes provisions for Native Hawaiian fishing access and short-term leases for homesites for Native Hawaiians.

Description of the Park's Cultural Resources

NATIONAL REGISTER OF HISTORIC PLACES AND PROPERTIES ELIGIBLE FOR INCLUSION IN THE NATIONAL REGISTER AT HAWAIʻI VOLCANOES NATIONAL PARK

Cultural resources within Hawai'i Volcanoes National Park are varied and reflect 500 to 600 years of history through to the present. Properties at the park that are listed or found eligible for listing in the National Register of Historic Places and that may be affected by potential actions in the general management plan include districts, sites, buildings, structures, and objects, the categories defined in 36 CFR Part 60 (National Register of Historic Places). Many of the historic resources that are within the protection of the park are not listed on the register but are treated as if they would be listed. Many properties have been determined eligible (36CFR 63) for inclusion on the national register but are not yet listed.

Eight properties (sites, structures, and buildings) and one historic district in the park are listed on the National Register of Historic Places (see *Figure 5.4. Listed Properties on the National Register of Historic Places*). The Puna-Kaʻū Historic District includes eleven site complexes and one general category for eligible sites within the district. These national register listings were part of an effort to identify properties that were locally, state, or nationally significant in accordance with the National Historic Preservation Act of 1966 as amended. Sites identified with the district may be added to the district as contributing features. A number of sites in the park ASMIS (Archeological Sites Management Information System) files are identified as "listed/documented" in the NRHP as contributing members to the district, but many more exist that are eligible for listing.

PUNA-KAʻŪ HISTORIC DISTRICT (NRHP# 74000294)— This nationally significant district covers about 127,000 acres and constitutes primarily the lowland portion of the park, extending beyond both its southeastern and southwestern boundaries. Included in this district are hundreds of sites and thousands of subfeatures including several petroglyph fields, village complexes, historic trails, and caves. Most of this historic district is in designated wilderness. Several sites are described on the nomination, but the nomination included all known and unknown (unrecorded) archeohistorical resources (Ladd 1973).

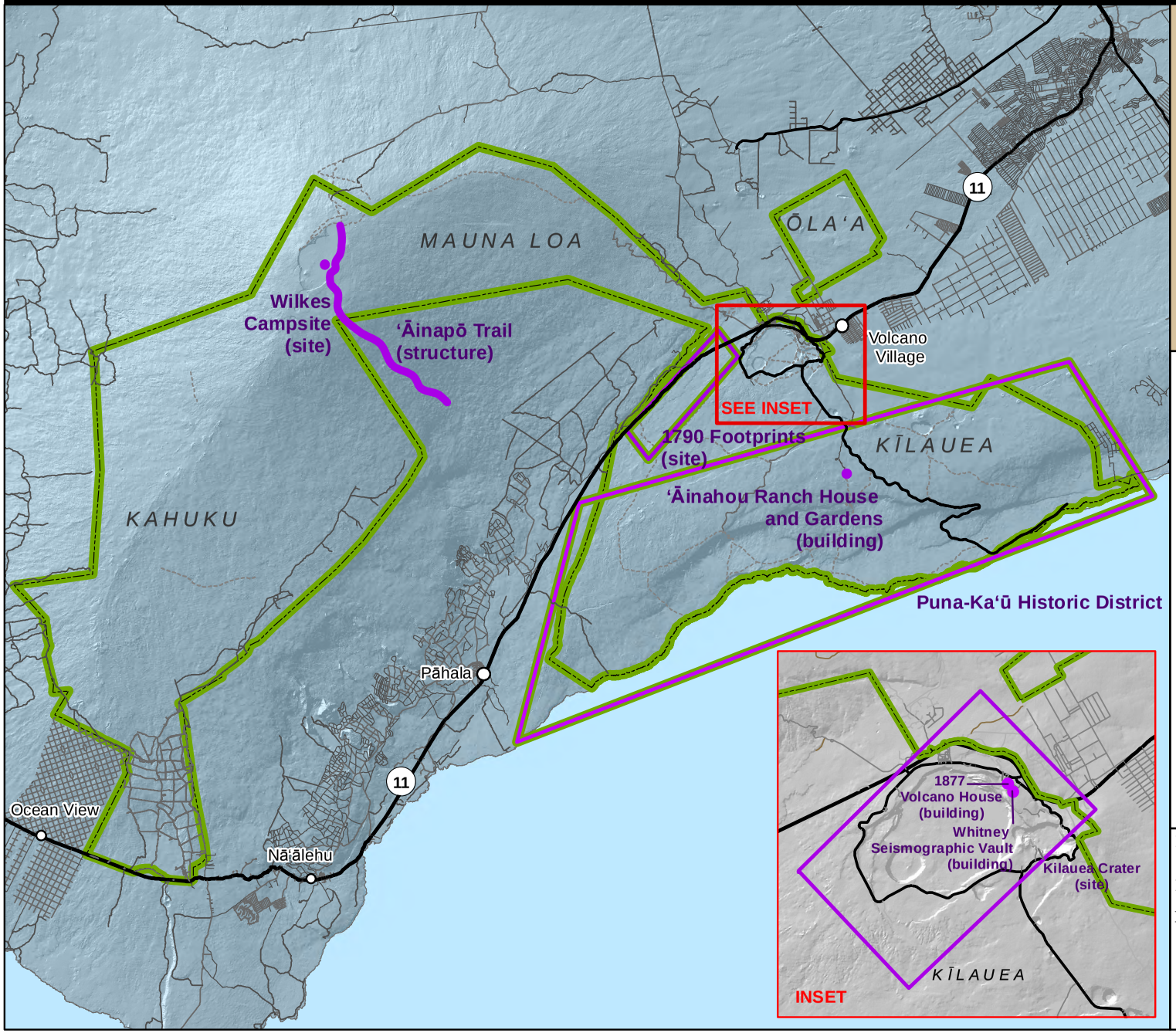
ʻAINAPŌ TRAIL (NRHP# 74000290)— This nationally significant trail is also known as the Menzies Trail, approximately five miles of which exist within the park, from 12,560 to 13,240 feet in elevation, with an additional mile of trail going down to 11,650 feet elevation after which point the trail is no longer visible and was not included in the nomination. The original trail continued down to 2,000 feet elevation, according to the NRHP nomination of 1973. Boundaries of the NRHP extend 200 feet on either side of the trail of the nominated length. (Note: the original nomination listed a total of 11 miles, but recent mapping shows that it is actually only 6 miles). This is a prehistoric trail that gained further significance when it became the route used by visiting westerners who wished to explore Mauna Loa.

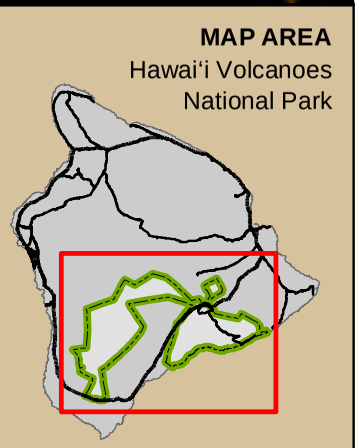
WILKES CAMPSITE (NRHP# 74000295)— This is the only remaining campsite within the Pacific Islands region attributed to the first US Exploration Expedition to the South Seas, which set out to map the Pacific in 1841. The site is at 13,240 feet at the edge of Moku'āweoweo Crater on Mauna Loa. It has been determined to have national significance.

1790 FOOTPRINTS (NRHP# 74000351)— This area in the Kaʻū Desert wilderness unit includes 3,500 individual fossil footprints within 8,000 acres. It is anticipated that approximately 711 archeological features will be added to amend its original listing. This property has state significance.

Figure 5.4 Listed Properties on the National Register of Historic Places

Hawai'i Volcanoes National Park GMP/WS/EIS





Legend

- NPS Boundary
- Historic Districts
- Roads

NOTE: This map does not depict individual objects, structures, sites or landscapes that are eligible and not yet listed, or that contribute to the significance of historic districts.

N W E S

Kilometers
0 10

0 5
Miles

Produced by: PWR - Seattle Planning Office

Date Created: June 2014

Data Sources: USGS - Roads, Coastline
NPS - Park Boundary, Footprints and Ka'ū Historic District boundaries

Fig. 5.4 HistProp_060914.mxd

KĪLAUEA CRATER (NRHP# 74000291)— The caldera (a.k.a. Ka Lua o Pele) is listed for its cultural and scientific values, and has been determined to have national significance. The frequent, almost continual centering of volcanic activity at Kīlauea Crater in prehistoric and historic times has affected human life, cultures, religions, and undertakings in the area. In historic times it has also attracted local and worldwide governmental, tourist, and scientific interests. Kīlauea Crater is and has been both worshipped and studied (Apple 1973a). It remains a focal point for many Hawaiians and within the larger context of the Hawaiian culture—Pelehonuamea, more widely known as Pele, is the deity of the volcano and is a central figure in the explanation of volcanic activity. The literal meaning of Pelehonuamea is 'lava earth matter'; hence lava is a manifestation of the deity. She is the creative force that provides the land that we need to live.

'ĀINAHOU RANCH (NRHP# 94001619)— 'Āinahou Ranch is a locally significant historic vernacular landscape with a craftsman/bungalow style of architecture. Its period of significance is 1941 to 1971, based on its association with Herbert C. Shipman and what remains of its vernacular landscape. The 'Āinahou Ranch House and the surrounding one-acre area are significant for the architecture and for agriculture, including raising cattle and nēnē (Park 2004).

OLD VOLCANO HOUSE NO. 42 (NRHP# 74000293) (A.K.A. 1877 VOLCANO HOUSE)— This nationally significant property is the first western structure to provide shelter and visitor accommodations at the edge of Kīlauea Crater. The 1877 building is significant as a representation of early 19th century architecture in Hawai'i and because it served as a hotel for visitors to the volcano. It remains very much in keeping with the original design (Apple 1973b).

WHITNEY SEISMOGRAPH VAULT NO. 29 (NRHP# 74000292)— Built in 1912, the vault represents the beginnings of the continuous and resident study by American scientists of the earth's volcanic and seismic activity at Kīlauea and Mauna Loa volcanoes. The Hawaiian Volcano Observatory, a US government facility since 1917, used the vault from 1912 through 1961, when more sophisticated instrumentation made the seismometers and tiltmeters it was designed to house obsolete (Apple 1973c).

NATIONAL REGISTER-ELIGIBLE HILINA PALI ROAD— The Hilina Pali Road is a paved one-lane spur road measuring approximately 12 feet wide and dating from the early 1930s. It extends southwest from the Chain of Craters Road for 8.54 miles to a historic shelter that provides a view of the Pacific Ocean and Ka'ū Desert wilderness unit . The Hilina Pali Road is significant for its association with NPS road design and construction principles, as well as NPS Rustic Architecture (1916–42). Its period of significance is 1928 to 1950, which encompasses the design, construction, and alteration of the road (Park 2007d).

Hilina Pali Overlook shelter depicting NPS Rustic Architecture. *NPS photo*

NATIONAL REGISTER-ELIGIBLE MAUNA LOA ROAD— The Mauna Loa Road, completed in 1936, extends northwest from Highway 11 (Mamalahoa Highway), a distance of approximately 11.2 miles, partially up the side of Mauna Loa to 6,662 feet in elevation. Mauna Loa Road is a secondary road providing backcountry access to Mauna Loa and is part of the road system planned by NPS officials for Hawai'i Volcanoes National Park. The road is significant for its association with the history of NPS road design and construction principles as well as NPS Rustic

Architecture. It is also significant for its association with volcanology. The period of significance is from 1915 to 1937 (Park 2007e). There is also a historic shelter at the end of Mauna Loa Road that overlooks the East Rift of Kīlauea.

NATIONAL REGISTER-ELIGIBLE CRATER RIM ROAD— Crater Rim Drive is the primary park road. The 10.6-mile, two lane, paved loop road circles the rim of Kīlauea Caldera, providing views and access not only to Kīlauea but also to smaller craters, spectacular lava flows, the Jaggar Museum, the Southwest Rift, steam vents, native vegetation, and Thurston Lava Tube. The road's design and construction spans a considerable period of time (1916–83): in the 1930s and early 1940s, park personnel incorporated already existing roads into a loop road around Kīlauea Crater as outlined in the 1931 and 1939 general development plans for the park. By 1942, Crater Rim Drive and its associated structures were in place, but they were periodically reconstructed and rerouted in response to natural disasters like volcanic eruptions and earthquakes, notably from 1959–62, 1975–76, and 1982–83 (Park 2007c).

NATIONAL REGISTER-ELIGIBLE KAHUKU RANCH BASE CAMP— This historic site is approximately 5-6 acres and is part of the larger Kahuku Ranch. The US military leased part of the ranch from 1939-1947 and utilized a portion of Kahuku Ranch for strategic operations during World War II. It is this particular use and legacy, as part of the World War II era of military building design and advancing radar communications technology that are of primary significance for this historic site. Current research indicates the radar installation at the Kahuku Ranch was constructed and active from 1942–44, the current period of significance, but continued research may provide information that extends the period of significance (Park 2012b).

NATIONAL REGISTER-ELIGIBLE TRADITIONAL CULTURAL PROPERTY— Pelehonuamea and family – This traditional cultural property would include the identification of landscape features that are revealed in traditional songs, dances, and chants that relate to Pele and her family. Through the existing documentation of specific locations, place names within the park boundaries will be identified. Although the complexities of this story of Pelehonuamea's life go beyond the park boundaries, her home is here at Kīlauea, and more specifically at Halema'uma'u, which is already a property in the national register of Historic Properties. The continued association of current Native Hawaiians to the landscapes within the park boundary provided the basis for the TCP (Park 2013c).

NATIONAL REGISTER-ELIGIBLE KILAUEA MILITARY CAMP HISTORIC DISTRICT— The historic Kilauea Military Camp was developed as a rest and relaxation camp in 1916 for military personnel. During World War II, it served various roles including a temporary Japanese internment camp and, later, a prisoner of war camp.

ARCHEOLOGICAL RESOURCES

Archeological resources in the park document the Native Hawaiian way of life (ka noho 'ana) in traditional land divisions, or ahupua'a, extending from the uplands to the sea. Sites and features associated with day-to-day activities are essential to understanding the rich and living Hawaiian heritage.

Archeological resources are the physical evidence of past human activity, including evidence of the effects of that activity on the environment (NPS 1998). An archeological overview and assessment of the park was prepared in 2008 (Tuggle and Tomonari-Tuggle 2008). Although only 13% of the acreage at Hawai'i Volcanoes National Park has been surveyed for cultural resources, the coverage has been such that samples of most of the regions of the park have been obtained, and a general understanding of occupational patterns has been developed. However, there is no doubt that cultural resources exist within undocumented or unsurveyed areas.

The archeological resources at Hawai'i Volcanoes National Park encompass a range of prehistoric Native Hawaiian and

Euro-American historic sites. Ruins extend from the coast to the upland alpine regions. Radiocarbon data suggest that Hawaiians settled in this region by the early 15th century.

Across the entire park, more than 300 archeological sites and more than 14,000 features have been identified, evaluated, and recorded in the Archeological Sites Management Information System (ASMIS), the NPS database of archeological information (NPS 2009b). The recent addition of the Kahuku region has contributed to the park database of sites. More archeological sites are expected to be found, as only a portion of the Kahuku Unit has been systematically surveyed (Quiseng 2008).

While Hawai‘i Volcanoes National Park contains a vast number of archeological sites, only a few areas are actively interpreted to the public by the park, or have been in the recent past. One of the highest-profile and most heavily visited archeological sites in the park is the Pu‘u Loa Petroglyph Field, part of the Puna-Ka‘ū Historic District. This site contains more than 23,000 petroglyphs that depict people, canoes, geometric shapes, and cupules (also referred to as a puka or a hole carved in the volcanic rock)—where babies' umbilical cords were placed in a hope of long life (NPCA 2008). While petroglyphs are found throughout the Hawaiian Islands, the Pu‘u Loa Petroglyph Field is the largest concentration of petroglyphs in the state.

A second interpreted site within the park boundary is the "1790 Footprints Area," which is listed in the National Register of Historic Places. "Footprints" is located within the Ka'ū Desert and is one of the most unique sites in the park. It is a field of fossilized human footprints, impressed in layers of hardened desert ash that were deposited by explosive eruptions over the course of several centuries. A major trail system crosses through the footprints area, connecting the villages of Ka‘ū with Kīlauea Crater, upper Puna, and Hilo. Along the trail are hundreds of temporary shelter sites, presumably used by travelers who accessed the area during or after the large volcanic ash explosion of 1790 or later (Moniz-Nakamura 2003).

In addition to these two important sites, the park contains several religious sites such as shrines, and it once possessed at least two prominent visible heiau. Archeological surveys have evaluated some of these heiau, specifically detailing the Waha'ula Heiau (Masse et al. 1991). This heiau was covered by the Pu‘u ‘Ō‘ō lava flows in the late 1990s, but prior to that it was the premier location for interpretation of cultural resources in the park. Waha'ula Heiau was built in the 13th century and is significant for its connection to Pa'ao, a priest who appeared on the island, ushering in the second massive migration wave of Polynesians (NPCA 2008). The beginning of heiau luakini—human sacrifice—and ceremonial worship of Hawaiian gods is traced to this temple.

A portion of the Ala Kahakai National Historic Trail, a 175-mile trail corridor with cultural and historical significance, is located within the park. The trail skirts the southern and western perimeters of the island. The Ala Kahakai National Historic Trail was established in 2000 for the preservation, protection, and interpretation of traditional Native Hawaiian culture and natural resources (NPS 2009a). It can be accessed through four national park units, including Hawai‘i Volcanoes National Park, and traverses through hundreds of ancient Hawaiian settlement sites and over 200 ahupua‘a, or traditional sea-to-mountain land divisions. Much of the designated alignment within the park has no trail. It is in the very remote southwestern area of the park in designated wilderness. The existing coastal trail within this route extends from Elemakule to the end of the pavement at Chain of Craters Road. Beyond that the historic trail and road (about five to 7 miles of the trail) is now under lava flows from the current Pu‘u ‘Ō‘ō eruption. Although the trail segment through Hawai‘i Volcanoes National Park is not yet actively interpreted, it is expected that it will be in the future.

Many archeological sites can also be found throughout the park, associated with such events as World War II and ranching. World War II features include physical landscape features (access road at Kahuku, bulldozed areas created to deter Japanese landings, strafed buildings and lava flows, unexploded ordnance) and buildings (radar installation at Kahuku, buildings at Kilauea Military Camp that housed internees, buildings in the park that were used by the military). Ranching features include houses, ranch walls, animal enclosures, and trails, including the Kahuku-ʻAinapō Trail that was used to drive cattle across the island from as early as 1918 into the 1930s (Quiseng 2008). Families once used lands in Kaʼū and Puna to tend goats and cattle. These lands are now included in the park boundary and only the Puna sections were part of the Kalapana Extension. Most of the physical remains of these activities were covered by lava after the 1983 eruption of Puʻu ʻŌʻō. The park also contains the first airfield ever built on the island (1923) and the only physical remnant in the Pacific region of the 1841 US Exploring Expedition, led by Lieutenant Charles Wilkes from the Smithsonian Institution and the National Museum of Natural History (Dougherty 2004). The only archeological remains of the Wilkes campsite are located at the summit of Mauna Loa and were listed in the National Register of Historic Places in 1974. Another site frequented by visitors is an impressive example of an early Hawaiʻi industry: the site of a factory for processing pulu for export. Pulu is the soft, glossy, yellow wool on the base of tree-fern leaf stalks. It was used to stuff mattresses and pillows and in the mid-1800s was exported to California.

The numerous archeological sites located within Hawaiʻi Volcanoes National Park are threatened by a number of natural and human-induced elements. These include lava flows, fire, earthquakes, tsunamis, inappropriate visitor uses, nonnative ungulates, and time. The threat is greatest from lava flows, earthquakes, and tsunamis.

CULTURAL LANDSCAPES

Cultural landscapes are geographic areas associated with specific cultures or historical events, and they help illustrate how humans have adapted to and altered their surroundings (NPS 1998). The National Park Service recognizes four cultural landscape categories: historic designed landscapes, historic vernacular landscapes, historic sites, and ethnographic landscapes. Polynesian colonizers employed their own traditional fishing and agricultural techniques where possible, and they adapted new techniques to fit the unique conditions of Hawaiʻi. They used local resources, including a wide range of indigenous plants and animals, and shaped their surroundings (NPCA 2008). Although not specifically identified within the current list of cultural landscapes, several ethnographic landscapes that relate to the origin myth, or Kumulipo, have been considered for the park.

Hawaiʻi Volcanoes National Park has an abundance of cultural resource sites distributed across the larger geographic landscape, a characteristic that is fairly typical of Hawaiian cultural landscapes: for example, villages are usually scattered along the coastline, and their density is generally correlated with inland agricultural intensity, with agricultural fields sited according to average rainfall. Cultural boundaries (districts, ahupuaʻa, and ʻili, or political subdivisions) segregate these villages and fields, and transportation infrastructure (trails and canoe landings) integrates them (Tuggle and Tomonari-Tuggle 2008).

Hawaiʻi Volcanoes National Park has identified 19 individual cultural landscapes within its boundaries, including trails, ranches, roads, historic districts, landing strips, and a military camp. The list of landscapes is not exhaustive. To date, 113 landscapes have been identified that include specific landscapes presented in table 5.5.

Table 5.5. Cultural Landscapes at Hawai'i Volcanoes National Park

Primary Landscape	Cultural Landscape Inventory Name	NRHP Status	Documentation Status
ʻĀinahou Ranch and Gardens	ʻĀinahou Ranch	Listed	Yes
ʻĀinahou Ranch	ʻĀinahou Ranch	Listed	Yes
Chain of Craters Road	Hilina Pali Road and Shelter	Eligible	Yes
Crater Rim Historic District	Crater Rim Historic District Halemaʻumaʻu Overlook Hawaiian Volcano Observatory and Jaggar Museum Kīlauea Iki Overlook Sulphur Banks Thurston Lava Tube	All Eligible	Yes
Chain of Craters Road	Chain of Ca	Eligible	No
Crater Rim Trail	Crater Rim Trail	Eligible	No
Kahuku Ranch	Kahuku Ranch	Eligible (portions)	No
Kaʻū Desert Trail	Kaʻū Desert Trail	Eligible	No
Kīlauea Administration and Employee Housing Historic District (a.k.a. Kīlauea Historic District)	Kīlauea Administration and Employee Housing Historic District (a.k.a. Kīlauea Historic District)	Eligible	Yes
Kilauea Military Camp	Kilauea Military Camp	Eligible	Yes
Landing Fields	Landing Fields	Eligible	No
Mauna Loa Road	Kīpukapuaulu (Bird Park)	Eligible	Yes
Wilkes Campsite and ʻAinapō Trail	Wilkes Campsite and ʻAinapō Trail	Listed (Nationally Significant)	No

Three of the park's identified cultural landscapes—Crater Rim Historic District, Kīlauea Historic District (formally the Kīlauea Administration and Employee Housing Historic District), and ʻĀinahou Ranch and Gardens—have been documented through cultural landscape inventories (Park 2004, 2006a, 2006b) and have been determined eligible for listing in the National Register of Historic Places. ʻĀinahou Ranch House and Gardens is on the national register. The Crater Rim Historic District is approximately 5,000 acres in size, located in and around the Kīlauea Caldera, and is significant for its association with the CCC program and for its distinctive design, which represents the predominant NPS architectural style between the two world wars (known as the NPS rustic style). The cultural landscape inventory for Crater Rim Historic District, a traditional scenic auto tour area that provides visitor access to Kīlauea Volcano, notes that the landscape is in "good" condition because it retains the integrity of its original design and aesthetic properties, with no immediate action required to maintain it at this level (Park 2006a).

The cultural landscape inventory for the Kīlauea Historic District—the administration and employee housing district—retains integrity relating to the original plan and is in "good" condition. The period of significance for the Kīlauea Historic District extends from 1927 to 1942, and it is significant for its association with the development of the park and the original designed landscape for the park, referred to as "Early Park Planning," and its association with the Civilian Conservation Corps (CCC) and other public work groups, and because it embodies distinctive characteristics of the NPS rustic style as expressed during the early development of the park (Park 2006b).

ʻĀinahou Ranch is associated with Herbert C. Shipman, who leased land from Bishop Estate in the late 1930s to establish the ranch

before it was acquired by the park. Shipman maintained a captive flock of nēnē at the ranch, and in 1949 and 1950 he donated several birds to territorial government and British captive breeding programs thus contributing to efforts to conserve the species. Shipman's captive nēnē were not left behind to live in the wild when he left Ainahou. The 13.3-acre site of the ranch house and gardens (a small portion of the ranch's approximately 6,324 acres) is located within a native, seasonally dry woodland at an elevation of 3,000 feet. The period of significance begins in 1941, when Shipman first constructed his house as a safe haven from a possible Japanese invasion during World War II, and it ends in 1944, however subsequent research has expanded the date for the period of significance to 1971. Shipman's lease agreement was purchased by the federal government based on the appraised value of the structures and infrastructure on the ranch. The cultural landscape inventory for the ʻĀinahou Ranch states that it is in "fair" condition, with structural repairs needed (Park 2004). The Ranch was purchased by the National Park Service from the B. P. Bishop Estate under the authority of the Endangered Species Conservation Act of 1969 for the purpose of protecting, restoring, and propagating endangered bird species. Since then, the greater ʻĀinahou area has served an important role in the conservation and reestablishment of endangered nēnē on the island.

Additional cultural landscapes that focus on Polynesian or Hawaiian land use patterns have been identified through archeological inventory and analysis (Tuggle and Tomonari-Tuggle 2008) but have not been added to the current park list. The list will be finalized through consultation with individuals and organizations from the community. Such studies also routinely include extensive cultural history studies. Examples of other potential cultural landscapes within the park associated with historic activities and alteration of the environment could include CCC programs, Mission 66, and the use of the island during World War I and World War II.

ETHNOGRAPHIC RESOURCES

Ethnographic resources are variations of natural resources and standard cultural resource types. They include subsistence and ceremonial sites, structures, objects, and rural and urban landscapes assigned cultural significance by traditional users in the present day. The decision to call resources "ethnographic" depends on whether associated peoples perceive them as traditionally meaningful to their identity as a group and the survival of their lifeways (NPS 1998). A broader group of people may also have a connection to the park for its scientific, historic, and scenic values.

Ethnographic resources abound in Hawaiʻi Volcanoes National Park. The volcanic landscape, the summits, and the vegetation connect the Hawaiian people to the park. Volcanic landscapes and all active flows and products of eruptive events such as steam and vog are believed to be the representation of Pelehonuamea. The word Pelehonuamea literally means "lava earth matter." Native Hawaiians understand that the function of Pelehonuamea is to build land, land that is essential for all life. The active volcanism demonstrates the presence of Pelehonuamea. Kīlauea Volcano is currently the only place where you can find active lava flows in the Hawaiian Islands, hence the sacredness of this place for many Native Hawaiians.

A Native Hawaiian elder discusses the significance of the kanawai (laws) that are present in the vicinity of an active volcano:

> *These are the basic natural laws we expect when living near and around a live volcano. The energy of growth, whether it is volcanism or vegetation, is the process of gods, those natural forces that create life. These kanawai are laws of protection and expectations for us, for the land and for the volcano. These are old, traditional, simple, sensible, yet substantial kanawai. These are determined from centuries of wisdom and experiences. 1) He ki hoʻihoʻi kanawai or a law of quick restoration. This means that*

when there is destruction of land by volcano, that this land must also have the nurturing factors for vegetation to begin growing very soon after. It was known that the natural movement for growth is as dynamic as that of a volcano. Restoration must happen quickly, this is what we expect. 2) He kua a kanawai or a burning, hot back law. When the land is hot it is part of that process of developing, sulphur indicates that this is the threshold of a live volcano, steam is also an indicator of a live volcano, and magma is the live volcano. Unlike volcanoes on continents, our volcano here is the primary source for our land. It is sacred to us because land is limited and acknowledging the indicators is respecting the process of growth or acknowledging the gods of land building (Kanahele 2010).

Pelehonuamea is given a very high degree of respect because the land that is created by lava flows becomes the foundation for all natural cycles, including those of fresh water, plants, animals, and human life. Native Hawaiians, like other native people, have a very close familial relationship to the natural world. This relationship requires reciprocity: for example they share the belief that if they take care of the land then the land will take care of them, and that if they keep the forest healthy the forest will attract rain, which will fill aquifers and provide fresh water. Traditional hoʻokupu (offerings) are often left at the edge of the crater, illustrating the reciprocal relationship that exists between the Native Hawaiians and Pelehonuamea. Native Hawaiians, as cultural practitioners, recognize the interconnection of their environment and appreciate the value of their elemental deities. Kīlauea and Mauna Loa Volcanoes are especially sacred because they are the birthplaces of new land.

Native Hawaiian practitioners continue to perpetuate traditional practices and knowledge related to these sacred lands. This is an integral part of the lifeways of many Hawaiians. Sacred or religious sites within the park include natural features such as active lava flows, Kīlauea Caldera and Summit areas, and constructed features such as shrines, heiau, or burial sites. Kīlauea is used for rituals to Pelehonuamea, or to her relatives (Kamohoaliʻi, Hiʻiakaikapoliopele, and others). Of these, the sites dedicated to Pelehonuamea are by far the most important (Langlas 2003a). Native Hawaiians from the entire island, and even from off-island, go to Kīlauea Caldera periodically to give hoʻokupu (offerings) to Pelehonuamea and to ask for her help with their lives. Those religious activities have their roots in the Hawaiian past, from well before the time of European contact. Other subsistence or traditionally used resources include marine resources such as fish, crab, shellfish, and others.

The Puna coastline located in the park is another important resource for Native Hawaiians who live in the Kalapana extension area and continue to practice their fishing rights along the coastal areas of the park. The extension area extends from Kupapa'u Point on the east to Keauhou on the west. According to 36 CFR 7.25(3):

Kalapana extension area; special fishing privileges. (i) Pursuant to the act of June 20, 1938 (52 Stat. 781; 16 U.S.C. 391b and 396a) Native Hawaiian residents of the villages adjacent to the Kalapana extension area added to the park by the above act and visitors under their guidance are granted the exclusive privileges of fishing or gathering seafood from parklands (above the high waterline) along the coastline of such extension area. These persons may engage in commercial fishing under proper State permit.

This special regulation was written to assure that Hawaiians living in adjacent villages could continue their subsistence lifestyle. Also mentioned in the Hawai'i National Park Act of June 20, 1938 is the following:

SEC. 3. (a) That the Secretary of the Interior is authorized to lease, under such rules and regulations as he may

deem proper, land ascertained by him to be suitable for home site purposes in the Kalapana extension as described herein, to Native Hawaiians when such occupancy does not encroach on or prevent free access to any points of historic, scientific, or scenic interest or in any manner obstruct or interfere with protection and preservation of said area as a part of the Hawai'i National Park: Provided, however, That occupants of home sites shall reside on the land not less than six months in any one year: And provided further. That fishing shall be permitted in said area only by native Hawaiian residents of said area or of adjacent villages and by visitors under their guidance.

A wide group of Native Hawaiians use the sacred sites and plant resources of the park today (Langlas 2003a). Many of the Hawaiians who visit Kīlauea are there to make offerings to Pelehonuamea as many are associated with various hālau hula (dance schools) that focus on Kīlauea and Pele chants or mele (Langlas 2003b). This ancient form of Hawaiian hula is directly related to the forest and other elements in nature. The beauty of nature is mimicked in hula. The park makes accommodations for many hālau hula by temporarily restricting public access in specific areas so that hālau may make offerings undisturbed by others.

Ongoing ethnographic work continues at the Kahuku Unit of the park. Interviews with retired cowboys are conducted to learn about the cattle ranching operation that once occupied the land. Kahuku has over a hundred years of ranching history. Kahuku also has a military history. During World War II, Pu'u o Lokuana was chosen as the site for the secret Kahuku radar station. There is no record of any archeological work done in Kahuku prior to the park's acquisition of the unit in 2003. The park has since begun archeological investigations on the 'Ainapō Trail and other places.

Hawai'i Volcanoes has a strong commitment to include native voices in park planning and interpretive materials. The park acknowledges its "living culture" and embraces the sacredness of the summit areas of Kīlauea and Mauna Loa volcanoes. Additionally, the park maintains a good relationship with a number of elders, or kupuna, from the adjacent communities of Puna and Ka'ū. Native Hawaiian Organizations such as the Office of Hawaiian Affairs and the Edith Kanaka'ole Foundation are also included in ongoing consultation for the protection of cultural resources within the park.

Examples of recent ethnographic studies can be found in Native Hawaiian Use of Hawai'i Volcanoes National Park: A Historical and Ethnographic Overview (Langlas 2003a) and Ethnographic Studies at Hawai'i Volcanoes National Park (2003b). Other work continues with research on the greater cultural landscapes found within the park lands.

OTHER POTENTIAL CULTURAL LANDSCAPES

Today considered a traditional Hawaiian activity, ranching began in the islands in the 1830s, first on Maui and then on Hawai'i at the Parker Ranch near Waimea (Avery 2009). The Kahuku Unit of the park has a long tradition of cattle ranching. Starting in the 1860s, ranching activities on the island were dispersed, with most cattle descending from the remnant population brought to Kealakekua Bay for Kamehameha by George Vancouver in 1793 (Bergin 2004). The idyllic open pasturelands that currently define cattle ranching in Hawai'i, particularly at Kahuku, developed initially between 1912 and 1947, when Parker Ranch owned Kahuku. Although fencing in the form of dry-laid walls was typical, wire fences were also introduced to this landscape in 1912.

Hawai'i Volcanoes National Park is host to many other important human stories, relating to such subjects as contact, conflict, and integration of Hawaiians with foreigners; the scientific exploration and investigation of volcanoes, earthquakes, and adaptation to a changing landscape;

the impact of feral animals on the island ecosystem; the significance of ranching in Hawai'i; and military history, including the establishment of the Kilauea Military Camp, the occupation of the park during World War II at both the Kīlauea and the Kahuku units, buffalo soldiers, and the Japanese-American internment (NPCA 2008). Each of these histories is linked to at least one group of people who could connect its cultural significance to their present way of life.

MUSEUM COLLECTIONS

The park collection houses a repository of many irreplaceable items that can be studied and used for research, interpretation, and education. These items provide critical evidence of a chronology of events, actions, and decisions, and contribute to a critical understanding and appreciation of human activity and interaction in the park. The park is currently managing over 1.9 million objects, including cultural collections (archives, archeology, art, history) and natural history collections (geology, paleontology, biology).

The Hawai'i Volcanoes National Park museum collections are composed of both natural and cultural artifacts. The cultural collection currently includes 518,765 catalogued objects and is likely to expand in the foreseeable future. The purpose of the cultural collection is to increase knowledge and inspiration in present and future generations through exhibits, research, and interpretive programs; support research, resource management, and education; provide baseline data of park natural and cultural resources; document changes these resources are undergoing because of internal park conditions and external effects; and guarantee the protection of important cultural objects whose in situ preservation cannot be assured.

The majority of the museum collection is stored in the basement of the park headquarters building. Currently 0.04% of the park's museum collection is stored off-island in one NPS and two non-NPS facilities. Due to limited facilities and space, only eight items from the park's collection are currently on display in the park. There are other buildings with museum storage, including the Kīlauea Field Station and Magma House. None of these facilities was built to accommodate the special needs of museum collections in regards to security, access, or preservation. The park museum program has been able to correct many storage and preservation deficiencies over the years, however there are many deficiencies that will never be able to be corrected due to the nature of the facilities. There is also a critical shortage of collections work and storage space, although there is significant potential for collections growth, especially in the archival and biological collections. The proper administration, preservation, and utilization of the existing collections are hampered due to this lack of adequate work, storage, and study space. As a result, these primary park resources are not contributing to park operations at their full potential. The park maintains emergency response plans for the collections, including evacuation and mitigation plans.

There are many types of collections within the museum collection, including natural history, biology, geology, paleontology, archeology, ethnology, history, archives, and art. The park also has a resource library for staff and public use that is managed by the Cultural Resources Division.

THREATS TO CULTURAL RESOURCES

Cultural resources are the nonrenewable legacy of the human experience and a people's adaptation to their landscape. Hawai'i Volcanoes National Park contains some of the last remaining vestiges of the adaptation of native people to their environment. For centuries Pacific Islanders have lived and worked from the mountains to the sea, building their house sites, their temples, and accessing the abundant resources that were available to them. The coming of Westerners changed their culture dramatically—disease killed off large numbers and continues to disproportionately affect them. Many of the native island people who are left are slowly being cut off from their traditional lands, access to the sea, mountains, and former

farming sites, and the resources within and around the ocean. The park is very important because it preserves the entire landscape.

Today, Hawai'i Volcanoes National Park lands are virtual refuges, housing the last vestiges of a traditional lifestyle. Overlaying this story of colonization, adaptation, and survival is the history of contact with European adventurers, whalers, sailors, and scientists. All of these stories are worthy of noting, understanding, preserving, and sharing, however it is also the mandate of the National Park Service to preserve and perpetuate them.

Climate change poses a threat to cultural resources (see the Climate Change section earlier in this chapter for a description of the impacts of climate change on natural resources). One of the known threats of climate change is a rise in sea level. Along with sea level rise will come an increase in high waves, seasonal increases in storm intensity, and increased frequency of hurricanes and severe tsunamis. For the coastal area within Hawai'i Volcanoes National Park these threats are of great concern. Cultural resources within the park will be disproportionately impacted, as the ocean will be able to penetrate further inland with the ever-rising tide. Impairment of these cultural resources will be severe and permanent. Sites along the coast and cliffs will become inundated, damaged, and in some cases completely destroyed. The onset of global climate change threatens to wash away what remains of these cultural resources, many of which will not even be documented for future generations.

Climate change poses another threat to all cultural resources, including landscapes and buildings, with the potential for increased flooding in areas that are already susceptible to erosion, such as the Footprints area and Hilina Pali. Climate change will also dramatically affect the forest and its birds, both of which are crucial to traditional Hawaiian practices and cultural practitioners to connect with the land.

VISITOR USE AND EXPERIENCE

Visitation

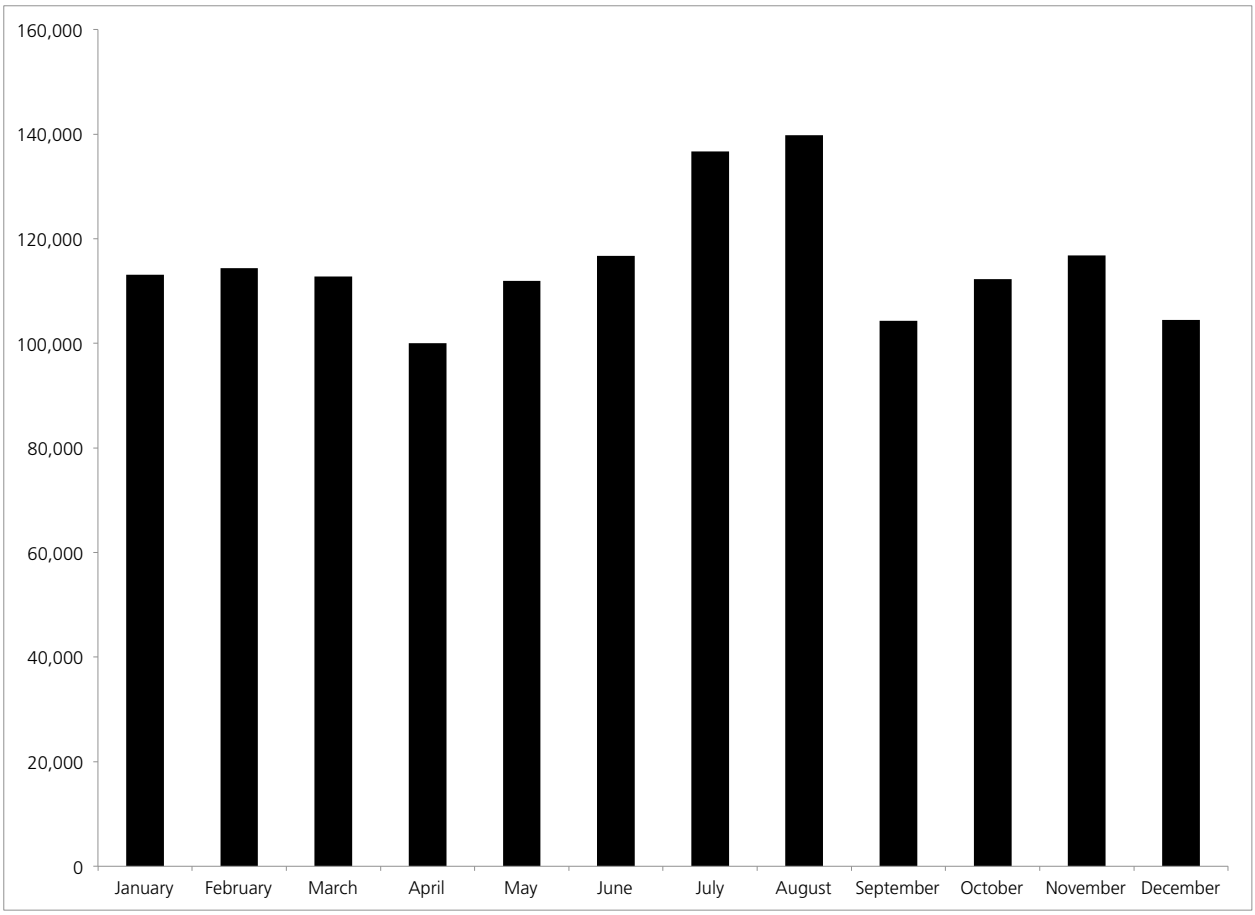
Visitors to Hawai'i Volcanoes National Park have the opportunity to visit two of the world's most active volcanoes, take in views of volcanic landscapes, and learn about the geologic origins of the Hawaiian Islands and the distinct Native Hawaiian culture (Park 2009b). Between 1998 and 2012, an average of 1,367,266 people visited the park annually. Over this period, the largest decline in visitation was experienced from 2001 to 2002, when the annual number of visitors decreased by approximately 17%. By contrast, the largest increase in visitation was experienced from 2003 to 2004, when the annual number of visitors increased by approximately 32%. From 1998 to 2012, an average of approximately 114,000 people visited the park per month (see *Table 5.6. Visitor Use Statistics for Hawai'I Volcanoes National Park, 1998–2012*). July and August represent slightly busier months overall, with approximately 140,000 visitors. April and December are, on average, the lightest months in terms of park visitation with roughly 99,000 visitors to the park.

Table 5.6. Visitor Use Statistics for Hawai'i Volcanoes National Park, 1998–2012

Year	Visitation	% Change from Previous Year
1998	1,352,373	—
1999	1,502,855	+11%
2000	1,514,636	+< 1%
2001	1,343,286	–11%
2002	1,110,998	–17%
2003	991,875	–11%
2004	1,307,391	+32%
2005	1,661,196	+27%
2006	1,612,246	–3%
2007	1,467,779	–9%
2008	1,270,538	–13%
2009	1,233,104	-3%
2010	1,304,666	+6%
2011	1,352,122	+4%
2012	1,483,930	+10%
Average	1,367,266	—

Source: Park 2012a

Figure 5.5. Average Monthly Visitation For Hawai'i Volcanoes National Park, 2000–13



Source: NPS 2013

Hawai'i Volcanoes National Park is a year-round park with little seasonal variation in visitation. There are slight fluctuations, but overall the park sees steady levels of visitation. The park has a high commercial to recreational visitation ratio. Most recreational vehicle traffic enters the park between 10:00 a.m. and 2:00 p.m. each day. Between 2006 and 2008, 23% of paying visitors entered the park as passengers of a commercial tour vehicle. The average length of stay in the park for commercial tour passengers is less than one day (Miskimins 2010).

Historically, visitation numbers and visitor length of stay can change dramatically in response to the presence of volcanic activity. In the months following the Mother's Day Eruption of 2002, for example, visitation to the eruption-site on the East Rift at the end of pavement on Chain of Craters Road—where visitors can hike out to view lava spilling into the ocean—increased from an average of 650 visitors per day to between 2,000 and 6,000 per day. A large portion of visits to view any lava activity present in the park occur during the evening, outside of the park's normal operating hours. In 2007, lava flows shifted outside park boundaries and became a popular destination operated by Hawai'i County on lands adjacent to the park. This shift in lava flows caused a decrease in the length of stay as park visitors shortened their visit to incorporate lava viewing opportunities outside the park. Since the summit eruption of Kīlauea in March 2008, a growing number of visitors are now drawn to Jaggar Museum during the evening to witness the glow from lava rising within Halema'uma'u Crater.

While visitor activities are generally available at all times of the year, the park superintendent may restrict use of any area or trail in order to protect visitors and the

park's resources. Volcanic eruptions and high levels of volcanic gases occasionally warrant closing an area of the park for short periods of time. Elevated SO_2 emissions from the March 2008 summit eruption of Kīlauea Volcano have caused the indefinite closure of a section of Crater Rim Drive and trails near the caldera. Short-term closures of Jaggar Museum have also occurred when needed to protect park visitors and staff. Visitation is expected to continue to vary over time in response to opportunities for lava viewing or other eruptive activity and in response to the presence of elevated levels of SO_2 emissions.

VISITOR USE DEMOGRAPHICS, PATTERNS, AND TRENDS

The NPS Cooperative Park Studies Unit at the University of Idaho routinely conducts visitor use surveys for the National Park Service to obtain information about park visitors and visitation patterns. A visitor use study was last conducted at Hawai'i Volcanoes National Park from March 11–17, 2007 (Holmes and Hollenhorst 2008). At the time of this visitor survey, lava flows from Kīlauea were entering the ocean, offering spectacular lava-viewing opportunities for visitors able to hike approximately 0.5 mile over rough terrain.

The study profiled a random sample of visitors, and results indicated that visitors were often in family groups (68%). Groups often consisted of two people (44%) or four or more people (40%). Most visitors were between the ages of 41 and 65 years (51%), and 10% were aged 15 years or younger—72% were first-time visitors. United States visitors comprised a majority of total respondents (85%), and significant numbers were from California (12%), Hawai'i (9%), and Texas (9%), though the other 47 states were also represented. International visitors were predominantly from Canada (40%), Japan (36%), and Germany (7%).

A majority of visitor groups (57%) indicated that viewing active lava flows at the eruption-site on Chain of Craters Road was a primary reason for visiting the park. Park sites that received the most visitation also included the Kīlauea Visitor Center (84%), Steam Vents (76%), Thurston Lava Tube (68%), and Kīlauea Overlook (66%). The park's most popular trail is Kīlauea Iki. Most visitors learned about the park through travel guides or tour books (57%), friends or relatives (46%), other printed materials (34%), and previous visits (30%).

The average length of stay among visitor groups spending fewer than 24 hours in the park was 6.1 hours. Of those visitor groups who were in the park for more than 24 hours, the average length of stay was 3.7 days. The average length of stay for all visitors was 22.5 hours.

Visitors said that the most common activities that they expected to experience were viewing active lava flow sites (80%), driving Crater Rim Drive (75%), and visiting Kīlauea Visitor Center (65%). The most common activities included driving Crater Rim Drive (83%), visiting Kīlauea Visitor Center (76%), driving Chain of Craters Road (66%), viewing lava (54%), day hiking (41%), and shopping in the bookstore (37%) and gift shops (33%).

VISITOR USE AT THE KAHUKU UNIT

In the years immediately following the 2003 acquisition of the Kahuku Unit, public access was initially restricted to open houses, special events, and service-based resource management programs (collection of seeds, sowing of native plants, removal of nonnative weeds, and cleaning up of trash and other debris). Increased public entry to the Kahuku Unit began in 2010 with fee-free access for weekend day-use by visitors who picnic, hike, or participate in ranger-led hikes or service projects for invasive species removal and planting of native plants. In 2013, visitor use of Kahuku averaged 48 visitors per day (Saturday and Sunday only). To date, no commercial uses have been allowed.

Visitor Opportunities and Experiences

The park is open to visitors at all times of the year, however the presence of active volcanoes and numerous endangered species

can cause periodic closures or restrictions. Volcanic eruptions and high levels of volcanic emissions may warrant closing an area or the entire park. The presence of endangered species, such as the nēnē, can also limit visitor use in certain areas. The park superintendent may restrict use of any area or trail in order to protect visitors and park resources.

LAVA/ERUPTION-RELATED

The varied landscape within the park contains the active caldera of Kīlauea Volcano, fragile lava features, craters, and rift zones. Exceptional landscape experiences are created by the interplay of natural forces including volcanism, weather, exotic endangered birds, native rainforests, vistas, smells, color and shape of landform, air quality, and changing light. The opportunity to witness volcanic activity is a once-in-a-lifetime experience for park visitors. Visitor surveys and GMP public scoping comments continue to echo the importance of the park's volcanic landscapes to visitors (Park 2010). In 2007, a majority of visitor groups (80%) indicated that the expectation of viewing active lava flows at the eruption-site on Chain of Craters Road was one of the primary reasons for visiting the park (Holmes and Hollenhorst 2008). In this setting, visitors engage in a wide spectrum of activities including hikes, nature walks, photography, scenic driving, interpretive trails, and ranger-led talks and walks.

SCENIC DRIVING

Sixty-five miles of scenic roadway in the park offer outstanding views and opportunities to explore active volcanic landscapes, particularly via the two popular main roads, Crater Rim Drive and Chain of Craters Road. Interpretive media for scenic roads and views include wayside exhibits, interpretive guides, and educational books. There are several picnic areas that can be utilized driving the park roads. Those visitors with more time or who wish to get off the beaten path can choose to drive Mauna Loa Road, Hilina Pali Road, or Kahuku Road.

HIKING AND CAMPING

FRONTCOUNTRY HIKING— A majority of visitors utilize many segments of the park's 63 miles of frontcountry hiking/interpretive trails in order to experience the park's key features, which include sites such as Thurston Lava Tube, Steam Vents, Sulphur Banks Interpretive Trail, Kīlauea Iki Interpretive Trail, Pu'u Loa Petroglyphs, and the Footprints Trail.

WILDERNESS/BACKCOUNTRY HIKING— Over 92 miles of backcountry trails wind across every park ecosystem from coastal beaches to the summit of Mauna Loa. Few places on Earth offer such an outstanding diversity of hiking experiences, from coastal lowland to mid-elevation rainforests to the alpine environment on Mauna Loa. Most of the trails are historic and were in use prior to the park's existence, both prehistoric and historic. The condition of the trails varies, with constant maintenance required due to plant overgrowth, weathering, erosion, and seismic damages. Several of the trails were constructed, repaired, or improved during the Civilian Conservation Corps (CCC) era. Several historic trails in the park have been partially covered by lava and segments have not been reestablished.

DEVELOPED/FRONTCOUNTRY CAMPING—
NĀMAKANIPAIO CAMPGROUND

This campground is located off Highway 11, to the northwest of park headquarters, and includes ten cabins and 18 designated campsites, six of which are walk-in sites. This is a developed site with running water and flush toilets. The campground is managed by the park's concession, Hawai'i Volcanoes Lodge Company (see "Commercial Visitor Services" for more details).

KŪLANAOKUAIKI CAMPGROUND

This NPS-managed campground is located off Chain of Craters Road along the Hilina Pali Road. It offers free camping at designated campsites, some of which are along a paved path and some are further away from the developed area. This is a less-developed site with no potable water and vault toilets. This campground experiences temporary closures

due to high fire danger and the presence of nēnē (endangered Hawaiian goose).

BACKCOUNTRY AND WILDERNESS CAMPING

Primitive camping opportunities are available for free at small designated backcountry campsites along the coast at ʻĀpua Point, Keauhou, Halapē, Kaʻaha, and Pepeiao Cabin; on Mauna Loa at the Mauna Loa Summit Cabin and Red Hill Cabin; and near Puʻu ʻŌʻō at Nāpau Crater. Kaʻaha, Halapē, and Keauhou have composting toilets, small shelters, and a limited supply of water that requires treatment. There are three cabins for camping at the Mauna Loa Summit, Red Hill, and Pepeiao. Cabin sites have a composting toilet and a limited supply of water that requires treatment. All campsites are available on a first-come, first -served basis. Backcountry permits are required for all overnight stays in the park's backcountry campgrounds and cabins.

BICYCLING

Park roads are considered shared roadways. This means bicycles use the same roads that are open to cars. In some places pedestrians also share the road with bicyclists, due to a lack of connecting trails. Park roads do not have designated bike lanes or pedestrian walkways to separate uses on park roads, and bicyclists are subject to the same laws and restrictions that govern vehicles. Bicyclists are allowed on some dirt and gravel administrative roads, including the Escape Road and along the main road in Kahuku from the park entrance and up to the Upper Palm Trailhead (approximately 3 miles). At Kahuku, bicycles are also allowed on Palm Trail (approximately 2 miles), which is an administrative access road.

Bicycle users in the park are comprised primarily of individual riders with some commercial tour groups. Commercial bicycle tours operate in the park via a commercial use authorization. They ride in groups of no more than 14, led by a bicycle tour guide and followed by a support van. Commercial bicycle groups are required to submit a typical tour route to the park (but are allowed to deviate), must ride single-file while bicycling, and are not allowed to tour at night or when visibility in the park is limited. Commercial bicycle tours are not allowed on Chain of Craters Road below Kealakomo due to safety concerns with the shared roadway. Like most tours in the park, cyclists stop at overlooks and parking lots to view park resources. An average of one bike tour visits the park per day. Congestion on park roads due to large groups of bicycles blocking vehicle lanes is a problem on narrow historic roadways. Riders are known to leave the road and use nearby walking paths due to lack of a defined bike lane and the congestion of cars, buses, and pedestrians.

Cyclists using park roads may ride in groups comprised of families and friends. A few riders choose to use trails illegally or may choose to ride in the park early in the morning or late in the day, when there is less traffic. Others are content to ride on park roads. Some park employees and nearby residents cycle regularly in the Kīlauea Unit of the park. Prior to the closure of part of Crater Rim Drive in March 2008, a ride around Halemaʻumaʻu Crater was a popular riding loop for bicyclists.

FISHING

Fishing is popular along the park's coastal shores. In the park's coastal wilderness, fishing is open to all park visitors with no restrictions except those specific to season, size, and method of take. Fishing in the nonwilderness coastal areas of the park is restricted to Native Hawaiian residents of Kalapana. Cross-country hikers enter the park from the east in lower Puna to fish along the coastal edge near Kalapana.

NATURE APPRECIATION, EXPLORATION, AND BIRD-WATCHING

The park's seven ecological zones harbor distinct plant and animal communities, sheltering an array of Hawaiian native species including birds, carnivorous caterpillars, the largest dragonfly in the United States, crickets that inhabit new lava flows, endangered sea turtles, and the Hawaiian hoary bat.

The Hawaiian Islands are renowned in the scientific world for evolving the most spectacular land bird assemblage on a remote oceanic archipelago (Park 2009c). Birdwatchers are drawn to the park's most frequently seen seven native bird species along the Mauna Loa Road and in the rainforest trails that rim Halemaʻumaʻu Crater.

Interpretation, Education, and Outreach

This section provides information on the park's methods for providing information, orientation, and education to a variety of audiences.

Hawai'i Volcanoes National Park is open to visitors 24 hours a day, 365 days a year. Due to a lack of significant seasonal variation in visitation levels, the park maintains a constant level of visitor services throughout the year. The changing nature of the park's active lava flows and landscape requires flexibility and continuous adaptation of programs and media by park staff to ensure visitors have a safe, educational, and enjoyable experience.

VISITOR CENTERS

The park has two small visitor centers, Kīlauea Visitor Center and the Jaggar Museum. A third portable visitor contact station is open during periods of lava viewing at the end of Chain of Craters Road. Another small visitor center, Waha'ula Visitor Center, housed Native Hawaiian cultural exhibits and was located on lower Chain of Craters Road. It was covered by lava flows during eruptions in June 1989.

KĪLAUEA VISITOR CENTER— Kīlauea Visitor Center is the main park visitor center in Hawai'i Volcanoes National Park and is one of the most heavily visited locations in the park. This visitor center was remodeled in 2005 and offers visitors a staffed information desk, small exhibit space, daily air quality monitoring stations, a Hawai'i Pacific Parks Association sales area and a 193-seat auditorium for ongoing interpretive films and special programs. A lighted outdoor lanai offers 24-hour trip planning information and a 3D map of the park and Hawai'i Island. It is an essential spillover space for crowds when visitor capacity is exceeded in the 1,700-square-foot visitor center. A nearby hula platform is used for hula performances, which can attract crowds of 200 people or more.

This facility is designed primarily for orientation and trip planning and briefly introduces the park's significant natural stories through a rich pallet of original art, wood carvings, custom photographs, dioramas, sound sticks, and touchable tactile displays related to natural and cultural resources. These exhibits are intended to serve as a "spring board" to launch the visitor out into the park. The in-depth displays are linked to sales items and books in the bookstore. Exhibits indoors and on the lanai emphasize safe lava viewing and the current status of volcanic smog (vog) in the park. The park film, "Born of Fire . . . Born of the Sea," shown regularly throughout the day, conveys a holistic story of life on the island and documents the arrival of ungulates and other nonnative species. The film also addresses the NPS role as guardian of the park. Exhibits share the story of generations of park employees who have fought to remove nonnative species. The conservation of park resources is an integral topic in most of the park's interpretive programs, such as ranger walks and stewardship walks with the public (Gale 2009).

The visitor center can only accommodate moderate visitation loads. In times of peak visitation (typically 10:00 a.m. to 2:00 p.m.) and during periods of elevated SO_2 emissions when visitors are forced indoors, the parking lot as well as the interior of the building fills to capacity and becomes overcrowded. The visitor center does not have any heating, cooling, or ventilation, so on most days even moderate visitation loads result in a hot and stuffy environment. Park visitation levels also exceed visitor center capacity, resulting in crowding on a daily basis.

The parking lot that adjoins park headquarters and the Kīlauea Visitor Center is the only parking location for visitors accessing multiple

activities in this area. It is used by visitors participating in daily scheduled interpretive walks and programs and by those using the Sulphur Banks Interpretive Trail or any of the trails which lead off the rim. Visitors accessing food and beverage services at the Volcano House[SM]Hotel or retail and program offerings at the Volcano Art Center park in this location as well. Visitor length of stay at Kīlauea Visitor Center averages 31 minutes (Prevedouros and Abrishamkar 2010).

JAGGAR MUSEUM— Jaggar Museum was the first park museum and is located on the rim of Kīlauea Caldera overlooking Halemaʻumaʻu Crater. The Jaggar Museum is operated by the National Park Service and the Hawaiʻi Pacific Parks Association and shares a place on the rim with a second facility, the Hawaiian Volcano Observatory, which is operated by the US Geological Survey and houses scientists, laboratories, offices, and monitoring equipment. A small uncovered observation deck offer views of Halemaʻumaʻu Crater and outdoor exhibits. The summit eruption has increased the number of evening visitors to the site, which is a designated historic property as part of the Crater Rim Historic District. There are public restrooms in a separate structure constructed in 1986.

Jaggar Museum is one of the premiere locations for visitors to learn about past volcanic eruptions and experience current volcanic activity, and it is one of the most heavily visited locations in the park. Almost all commercial tour buses stop at Jaggar Museum. The 3,000-square-foot building houses geologic and cultural exhibits including rock samples, a series of visible seismographs that record seismic signatures in various locations of the park, and paintings by the late Herb Kane illustrating the Native Hawaiian deity Pelehonuamea and her interaction with her brothers and sisters. These exhibits were designed and installed during the initial stages of the 1980 Puʻu ʻOʻō–Kūpaʻianahā eruption. Additional displays at Jaggar Museum exhibit the volcanoes of Kīlauea and Mauna Loa, including the eruptions on the East Rift and summit of Kīlauea.

Interaction with millions of visitors has taken its toll on the initial 1986 displays and all subsequent exhibits. Annual repairs are made to a varying combination of exhibits. The interpretive infrastructure has a dated and worn appearance and does not reflect a unified design or communicate the park's interpretive themes. The Native Hawaiian images and text are inaccurate and inadequate to portray the culture. There are many public comments and complaints about the current state of interpretation at the museum.

LOWER CHAIN OF CRATERS ROAD PORTABLE CONTACT STATION— A portable visitor contact station at the end of Chain of Craters Road serves as a visitor orientation-site during periods when lava from East Rift eruptions of Kīlauea Volcano is visible. Exhibits in this location are focused on safe lava viewing with some interpretation of lava flows; additional facilities include a law enforcement station and restroom. A new replacement structure is anticipated that would remain a moveable building but would generate all its power from the sun. It would house exhibits to interpret the Puʻu ʻŌʻō eruption, the coastal life of Hawaiians, ocean stewardship, and sustainable building construction.

ORIENTATION INFORMATION/WAYSIDE EXHIBITS/BROCHURES

In the 1970s, approximately 60 to 70 waysides were posted throughout the park. Kīlauea Volcano's episodic and continuous eruptions over 40 years have impacted many of these, creating a weathered or absent interpretive infrastructure. In 2000, projects funded by entrance fees included the replacement of waysides. Many of the signs had become illegible due to acidic etching of the volcanic gases. Four self-guided trail brochures and two interpretive trails are enjoyed by visitors. These represent some of the key themes of the park but do not fully depict the breadth of rich cultural and natural features that could spark the curiosity of visitors. Site bulletins are translated into over 13 languages and are available in large print and Braille. Orientation/information signage throughout

the park is updated quarterly with current volcanic conditions.

GUIDED INTERPRETIVE PROGRAM

The role of guided interpretation is to inspire and inform visitors through formal programs and informal ranger interaction. Formal interpretation includes talks, walks or hikes, evening programs, cultural demonstrations, Junior Ranger programs, and special events. At Hawai'i Volcanoes National Park, interpretive staff is also actively engaged in communicating volcanic hazards and air quality information to ensure safe and successful park visits. The Interpretive Division depends upon the Volunteers in Parks program to meet the staffing needs of park programs.

GUIDED EDUCATIONAL PROGRAMS AND PUBLIC OUTREACH

Educational programs are very popular with local residents and students, as well as general park visitors who participate in family programs or Junior Ranger activities. The programs are targeted for grades K through ten and are designed to meet state and federal Department of Education standards. The dissemination of educational programs connecting students with nature is currently limited by a lack of funding for staff and curriculum materials.

The park is also host to a diversity of web-based virtual education programs related to Native Hawaiian culture, biology, and geology. Students of all ages participate in electronic field trips offered on the park website. The park also hosts service-based learning trips for groups, which has provided students with hands-on experience in projects such as endangered silversword planting and invasive plant removal.

Many visitors consult the park's official website prior to visiting the park. The website serves national and international audiences, including people who may never have the opportunity to visit. The park also posts information using social media (such as Facebook) to provide additional avenues for visitors and the general public to learn about Hawai'i Volcanoes.

Commercial Visitor Services

Commercial visitor services are an important aspect of daily operations. The park welcomes an average of 1.4 million visitors annually, and an estimated 23% of those visit with tour-based commercial services providers. Commercial services for visitors to Kīlauea Volcano and the present-day park evolved in step with changing modes of travel to Hawai'i Island. Prior to 1877, most people reached the volcano after sailing into the town of Hilo and then riding on horseback over a very rugged trail for 30 miles, through forest and barren lava fields. Very early on there was a need for lodging at the caldera, and early travelers stayed at a grass hut constructed in 1846 on the northeast side of the crater which became the first Volcano House. At $1.00 per person for lodging, visitors could also purchase foods such as fowl for $0.37 and a small calabash of potatoes for $0.25. Thus began a succession of visitor accommodations, with various iterations of Volcano Houses built over time. A more modern hotel was built in 1877 (the existing relocated 1877 Volcano House) and by the mid-1880s two steamship companies began providing other routes to the volcano (Moniz-Nakamura 2010). Although visitation counts were not kept, records from the early Volcano House registry, as well as testimonials and articles written in local newspapers and popular magazines, show that scientists, researchers, politicians, businessmen, artists, and the general public were all willing to take the long, arduous, expensive trip to the brink of the caldera in hopes of viewing a once in a lifetime event—an active eruption. It is this popularity of Kīlauea that eventually spurred citizens familiar with the volcano to lobby Congress in the early 1900s for the establishment of a national park in Hawai'i (Moniz-Nakamura 2009).

Over the past several decades, visitor needs for food and overnight lodging within the park have been provided by a single park concession, which operates the Volcano House[SM]. The historic hotel, snack bar, and dining room offer overnight accommodations, meals, and services for park visitors. Retail sales operations within the park are available

at several venues: souvenirs and gifts at the Volcano House gift shop, operated by the park concessioner; books and educational items at the Kīlauea Visitor Center and Jaggar Museum, operated by the Hawai'i Natural History Association; and fine art and handmade items at the Volcano Art Gallery. The park's neighboring communities are easily accessed by State Highway 11 and include Volcano, Pāhala, Nā'ālehu, and Ocean View, all of which offer a more extensive array of services including grocery stores, gas stations, restaurants, and overnight lodging in small hotels or bed and breakfasts.

EXISTING CONDITIONS FOR COMMERCIAL SERVICES

As of spring 2013, Hawai'i Volcanoes National Park offers a variety of commercial services through two concession contracts (lodging, campground, food and beverage, and retail), approximately 143 CUAs (primarily tours), and two cooperating association agreements. The park also issues a number of special use permits for commercial services; however, none of the permittees provide visitor services. There are no commercial services in the park that operate under a lease.

LODGING, CAMPGROUND, AND FOOD AND BEVERAGE SERVICE— In 2012, approximately 1.48 million people visited Hawai'i Volcanoes National Park (Park 2012a). While the majority of park visitors are day-use only, according to a 2009 visitor use survey, approximately 20% of visitors choose to spend the night in the park (averaging two nights per visitor) (NPS 2009c). While some of these overnight visitors camp at one of the backcountry campgrounds, commercial services also provide lodging at the following facilities.

VOLCANO HOUSE℠

Located on the rim of Kīlauea Caldera, the historic 1941 Volcano House℠ provides overnight accommodations, food and beverage service, and retail to park visitors. Since 1969, the services provided in this location have been authorized under a concession contract with the Secretary of the Interior. Between 2010 and 2012, a number of renovations were made by the National Park Service to the Volcano House concession facilities, including deferred maintenance projects, seismic and fire suppression retrofits, and other upgrades related to life, health, and safety. Due to the extensive nature of this work as well as a concession facility improvement program implemented by a new concessioner, the National Park Service closed the Volcano House concession facilities to the visiting public beginning January 1, 2010 and did not re-open it until August 2012.[1] The Volcano House℠ now has 33 hotel rooms, an approximate 219-seat dining room with additional outdoor seating, an approximate 58-seat snack bar, a cocktail lounge, and a retail sales operation. In 2012, the CC-HAVO001-12 concession contract for operations at the Volcano House℠ was awarded to Hawai'i Volcanoes Lodge Company, LLC. That concession contract will expire in 2025.

The Volcano House℠ is also the only location for visitors to obtain food and beverage service within the park. Under the concession contract with Hawai'i Volcanoes Lodge Company, LLC, visitors can purchase breakfast, lunch, and dinner at the restaurant in the Volcano House℠, as well as grab and go food during the day. In a survey conducted in 2007, 20% of all park visitors ate at the concession-operated restaurant during their stay at the park, 53% of whom valued the Volcano House℠ as extremely important to their visit (Park 2007b).Under CC-HAVO001-12, Hawai'i Volcanoes Lodge Company, LLC also operates a retail shop in the Volcano House℠ and at Nāmakanipaio Campground and is able to provide an occasional mobile retail enterprise during eruptive events. These retail services are authorized to sell convenience items (such as bottled water, raincoats, and sunscreen), interpretive items, and souvenirs tied to park themes to visitors. See the "Volcano

[1] Reopening occurred in phases. The retail store reopened on August 18, 2012. The Annex reopened on March 22, 2013, and the full hotel operations, along with the restaurant, bar, and gift shops reopened on May 23, 2013.

House℠ and Nāmakanipaio Campground" subheading under the next section, "Retail," for more information.

NĀMAKANIPAIO CAMPGROUND

Nāmakanipaio is a developed campground located off Highway 11, to the northwest of park headquarters. It includes ten cabins and 18 designated campsites and provides running water and flush toilets to visitors, as well as showers in a separate restroom building located in the cabin area. In 2007, the cabins were filled to an occupancy rate of 65%, while the campground ran at a 51% occupancy rate (NPS 2009c). The CC-HAVO001-12 concession contract awarded to Hawai'i Volcanoes Lodge Company, LLC also authorizes concession operations at Nāmakanipaio consisting of lodging and retail services for visitors. See the "Volcano House℠" subheading above and the "Volcano House℠ and Nāmakanipaio Campground" subheading under the next section, "Retail," for more information about the retail services provided.

KILAUEA MILITARY CAMP

The United States Army operates this 54-acre historic recreational complex under a special use permit with Hawai'i Volcanoes National Park that will expire in 2021. The Special Use Permit, among other things, states that Kilauea Military Camp is not open to the general public; its use is restricted to certain categories of users including Department of Defense personnel by Morale, Welfare, and Recreation patronage authority and eligibility published in Army Regulation 215-1. The KMC complex includes 90 rooms for overnight accommodations, a cafeteria, bar, grocery store, gas station, bowling alley, recreation room, exercise facility, conference rooms, and bus and van tours, as well as other support programs and facilities.

RETAIL— There are three general types of retail service in Hawai'i Volcanoes National Park: (1) visitor convenience items, (2) interpretive items that have the potential to enhance a visitor's understanding of the park and its resources, and (3) souvenirs tied to park themes. Convenience items include bottled water and sunscreen. Interpretive items include field guides and books about the history of the park, and souvenirs include items like coffee mugs that feature the name of the park or a recognized resource in the park. In a NPS survey conducted in 2007, 21% of visitors to the park spent a portion of their visit in one of the following retail outlets in the park (Park 2007b).

VOLCANO HOUSE℠ AND NĀMAKANIPAIO CAMPGROUND

Hawai'i Volcanoes Lodge Company, LLC is authorized by the CC-HAVO001-12 concession contract to operate a retail shop in the Volcano House℠ and Nāmakanipaio Campground and an occasional mobile retail enterprise during eruptive events. These retail services are authorized to sell convenience items (such as bottled water, raincoats, and sunscreen), interpretive items, and souvenirs tied to park themes, which includes a broader scope of items in comparison to other retail services in the park. See the "Volcano House℠" subheading under the previous section, "Lodging and Food and Beverage Service," for additional information.

KĪLAUEA VISITOR CENTER AND JAGGAR MUSEUM BOOKSTORES

Hawai'i Pacific Parks Association (HPPA) operates the bookstores at Kīlauea Visitor Center and Jaggar Museum under the authority of a cooperating association agreement (for interpretive items) and concession contract CC-HAVO002-06 (for convenience items) which both expire in 2015. HPPA is a nonprofit organization dedicated to supporting the interpretive, educational, scientific, and historic mission of the National Park Service through the sale of educational items.

VOLCANO ART CENTER GALLERY

The Volcano Art Center Gallery is operated under a cooperating association agreement by the Volcano Art Center (VAC), a 501(c)3 nonprofit organization dedicated to environmental education and art that perpetuates the artistic and cultural heritage of the people and environment of Hawai'i

through activities in the visual, literary, and performing arts. The gallery occupies an 1877 historic building (called 1877 Volcano House) that was the first Volcano House℠ Hotel on the rim of Kīlauea and now sits adjacent to the Kīlauea Visitor Center. In accordance with their cooperative agreement, VAC interprets the park through the sales of handmade art and crafts that are inspired by and pertain to, or reflect, Hawai'i Volcanoes National Park or the traditional Hawaiian culture. The VAC also sponsors and/or produces park educational activities, demonstrations, and exhibits on the park's behalf, such as dance presentations at the nearby Pa Hula platform and Hale. VAC's cooperative agreement with Hawai'i Volcanoes National Park will expire in 2014.

TOURS AND GUIDED EXCURSIONS— In addition to the above visitor facilities within Hawai'i Volcanoes National Park, approximately 143 private businesses are currently authorized under CUAs to provide small-scale, recreational services to visitors within the park every year (see *Table 5.7. Total Commercial Use Authorizations in Hawai'i Volcanoes National Park, 2012*). These businesses provide a range of services to the public, such as bus and auto-based tours, guided bike tours, hiking tours, and other guided excursions including birding and lava viewing.

AUTO-BASED TOURS

Approximately 4% of the 429,327 recreation-based vehicles that entered the main part of the park in 2011 were commercial tour vehicles, 20% of which were motor coaches carrying, on average, 39 passengers and, at maximum, up to 81 passengers in one vehicle. Although representing a small percentage of the park's total traffic, these tour buses and the smaller cars and vans associated with these CUAs transported approximately 19% (259,354 people) of all paying visitors to Hawai'i Volcanoes National Park in 2011. This was up from 250,560 people in 2010. Of the 17,583 CUA vehicles that entered the park in 2011, 54% entered the park within a span of three hours, between 12:00 p.m. and 2:59 p.m. (see *Figure 5.6. Timing of Daily CUA Visitation to Hawai'i Volcanoes National Park, 2011*). Due to traffic restrictions on Chain of Craters Road, motor coaches with the capacity of more than 26 passengers can only go as far as Kealakomo Overlook on Chain of Craters Road.

BICYCLE TOURS

In 2012, commercial service providers guided approximately 8,400 visitors on 660 bike tours in Hawai'i Volcanoes National Park, averaging roughly 13 people per tour and 13 tours a week (up from 11 per week in 2011). Most of these tours now stage at the Kīlauea Overlook and Picnic Area. Due to resource and safety concerns, the park places a number of restrictions on bicycle tours. For example, all bike tours are limited to 14 bicycles, including the guide, and must provide an escort vehicle for each trip. Similarly, bike tours in the park must stay on a park road and are not allowed below Muliwai a Pele on Chain of Craters Road or above Kīpukapuaulu on Mauna Loa Road.

HIKING TOURS AND OTHER GUIDED EXCURSIONS

In 2012, approximately 60,000 visitors to Hawai'i Volcanoes National Park (4.5% of the park's annual visitation) participated in a guided tour with a commercial service, including hiking tours and tours associated with birding and lava viewing. Due to natural and cultural resource concerns, the park places some restrictions on CUA operators that provide hikes within the park. For example, while all CUAs adhere to a standard set of park-specific conditions, all CUA operations in Mauna Ulu are additionally restricted to a group size of 15, and only one tour is allowed in the area at one time. In addition, all guides that take visitors to Mauna Ulu must go through a certification course before guiding tours in the area.

EQUESTRIAN TOURS

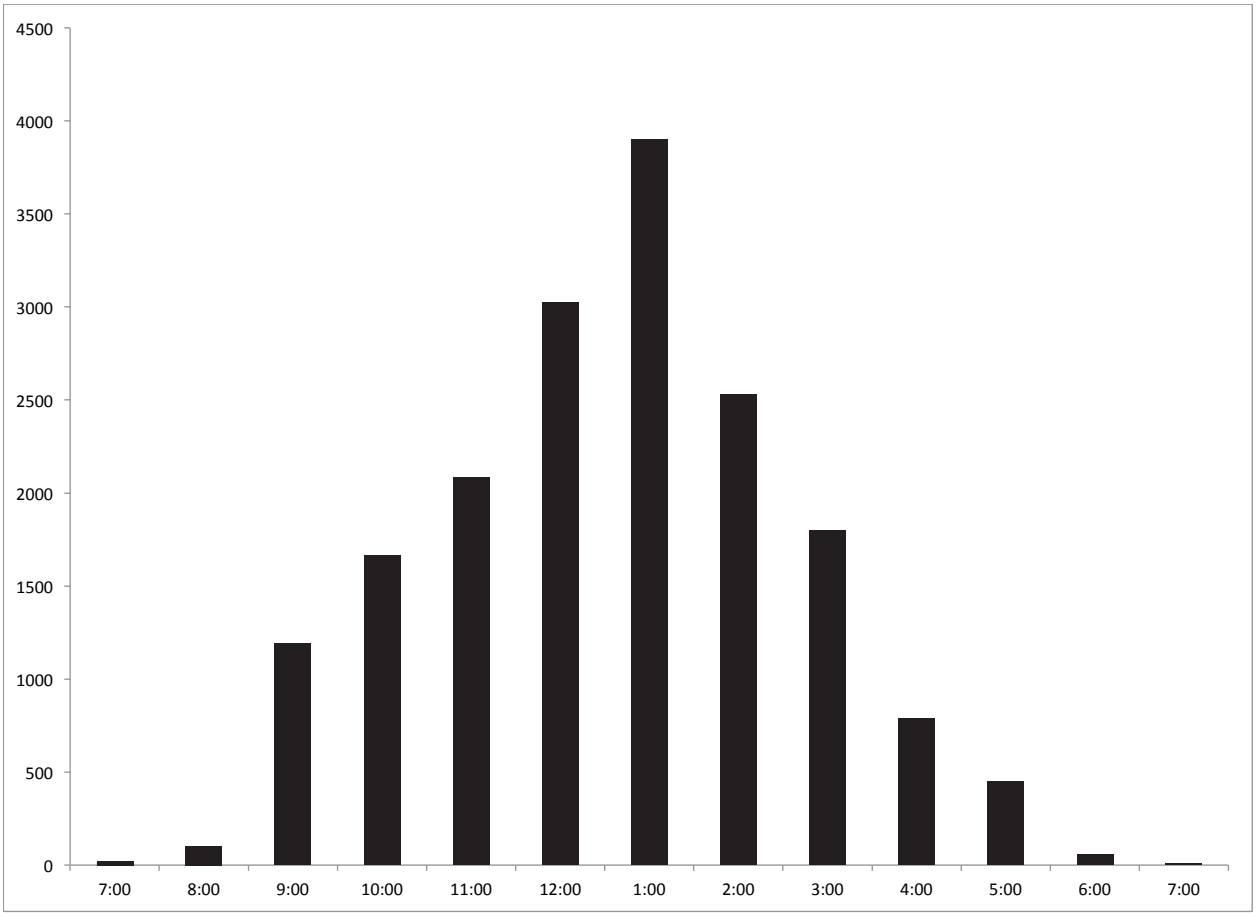
As of spring 2013, there are no equestrian tours authorized to operate in Hawai'i Volcanoes National Park.

Table 5.7. Total Commercial Use Authorizations in Hawai'i Volcanoes National Park, 2012

Recreational Service	Number of CUAs
Road-based Scenic Tours (Motorized vehicle use for transport of passengers on guided tours)	77
Nonroad-based tours (Tours of the park that are not on the park roads such as hiking, birding, and tours on bicycles)	43
Combination road and nonroad based permits	23
TOTAL CUAs	**143**

Source: NPS files

Figure 5.6. Timing of Daily CUA Visitation to Hawai'i Volcanoes National Park, 2011



INTERPRETATION AND EDUCATION— In addition to the lodging/campground, food and beverage, retail, and guided services described above, commercial visitor service entities in the park also provide interpretive and education services to the public, both through the primary service they offer (such as a guided tour in the park) and through the provision of additional programs, as in the case of the concession operation at the Volcano House[SM] and Nāmakanipaio Campground These interpretive services include, among others, presentations, printed materials, and guided services that are primarily educational in nature.

OTHER USES— In 2012, the park issued 71 Special Use Permits for activities such as filming, ash scattering, and weddings. As these permits are issued on a case by case basis, are of relatively short duration, and have minimal impacts on resources and visitor use, this CSS

does not address SUPs associated with these types of activities.

VISITOR SERVICES PROVIDED OUTSIDE OF HAWAI'I VOLCANOES NATIONAL PARK

There are three small communities that are surrounded by Hawai'i Volcanoes National Park: Volcano Village (which borders the east entrance to the park), Pāhala (which is near the west entrance to the park), and Nā'ālehu (which is close to the Kahuku Unit). The populations of these communities range from 1,000 to 4,500 residents, and each offers lodging at hotels, vacation rentals, and bed and breakfast accommodations. The Volcano Community alone has at least one hotel and nearly 100 bed and breakfast facilities. These include studios, cabins and single bedroom rentals, plantation cottages, and traditional bed and breakfasts. The community also has a diversity of small restaurants that serve American, Asian/Pacific Rim, pizza and deli food. Each community has at least one gas station and a grocery store/market.

COMMERCIAL SERVICES PLANNING

The purpose of a commercial services strategy is to develop implementation guidance for managing commercial services at Hawai'i Volcanoes National Park. Under the guidance of NPS *Management Policies 2006*, this CSS is both an analytical document that identifies the necessary and appropriate commercial services within Hawai'i Volcanoes National Park and articulates the park's goals associated with such services. The CSS prepared in conjunction with this general management plan can be found in *Appendix F: Commercial Services Strategy for Hawai'i Volcanoes National Park*.

VISITOR AND EMPLOYEE HEALTH AND SAFETY

A diversity of federal laws, NPS management policies, and park-level protocols exist to protect visitor and employee safety. These policies and regulations contain specific guidelines to ensure public health and safety within areas of NPS jurisdiction, and specify when appropriate certifications related to public health and safety are required.

Volcanic Emissions

The natural volcanic activity of Kīlauea Volcano generates high levels of volcanic gases and small particles (locally referred to as volcanic smog, or vog) comprised primarily of carbon dioxide (CO_2), water vapor (H_2O), and sulfur dioxide (SO_2). Other gases generated in smaller amounts include carbon monoxide (CO), hydrogen (H_2), hydrogen chloride (HCl), and hydrogen sulfide (H_2S). Volcanic activity and trade wind conditions affect volcanic gas emission levels on a site-by-site basis, and areas downwind of the activity are the most susceptible to volcanic gases. Vog levels can vary rapidly within a specific area as well as between areas. The park has an *Air Quality Policy* that governs when the park recommends limiting outdoor activities or closing areas because of poor air quality (Park 2009a).

Monitoring for SO_2 began in the park in 1986. In 2008, Kīlauea Volcano began to emit more SO_2, particularly from the Halema'uma'u Crater vent, going from about 150 tonnes/day of SO_2 to over 2,000 tonnes/day. The park's air quality level is regularly monitored at two primary monitoring stations that meet EPA protocols (at Kīlauea Visitor Center and Jaggar Museum), plus a network of low-resolution SO_2 sensors that serve the visitor SO_2 alert system. As of 2013, emissions are five times higher than historic average levels. At times, the SO_2 concentrations are measured at levels that may affect even healthy individuals. The presence of sulfur dioxide from volcanic emissions is a significant health concern for visitors and employees working within Hawai'i Volcanoes National Park as well as for downwind communities.

The National Park Service, in partnership with USGS HVO, operates an advisory program that informs the public of current sulfur dioxide levels in the park. In addition, since 2008 park visitors, employees, and island residents have been able to access a website of current sulfur dioxide concentrations within the park that is updated every 15 minutes. The park has instituted an air quality protocol to guide employee response during temporary periods of poor air quality. Field

staff members wear gas badges to monitor SO_2. Ranger protection staff members carry and use respirators for emergency outdoor activities during poor air quality, such as directing traffic during site closures.

TRANSPORTATION AND ACCESS (TO AND WITHIN THE PARK)

Hawai'i Volcanoes National Park is on the southern portion of Hawai'i Island. Access to the island is almost entirely by air. Most park visitors fly into the island's two major airports, on the east side of the island in Hilo or on the west side in Kailua-Kona. Both Hilo and Kailua-Kona airports are served by several interisland air carriers that make numerous daily flights from Honolulu and Maui, and by international and mainland United States air carriers. A smaller number of visitors arrive on Hawai'i Island as cruise ship passengers, docking at Hilo Bay or at the harbor in Kailua-Kona. There is no interisland auto ferry system.

Approximately 1.4 million visitors enter the park by bicycle, rental car, private vehicle, or via commercial tour vehicles. Vehicles travel from Hilo, 30 miles to the southeast of the park on Highway 11, or from the Kailua-Kona area, located approximately 96 miles southwest of the park on Highway 11, as well as from other island communities. In 2011, 78% of park visitors entered the park in private vehicles with 23% entering as passengers on commercial tour buses, vans, and taxis.

Road Users/Travel Patterns

In 2011, approximately 45,000 vehicles entered the park via Crater Rim Drive. Vehicles are classified as either recreation-based (carrying park visitors) or non-recreation-based (e.g., employees working in the park, vendors, and post office traffic). In 2011, 80% of these vehicles were recreation-based. Approximately 96% of recreation-based traffic consisted of personal vehicles (cars, trucks, and SUVs), and 4% of the recreation-based vehicles were commercial tour vehicles (taxis, 12–15-passenger vans, and tour buses). Bicyclists and pedestrians also use Crater Rim Drive.

HIGHWAY 11

Road access to the main entrance of Hawai'i Volcanoes National Park is reached via Highway 11, a state highway that circumnavigates the island, connecting with Highway 19 to make a long loop. This route traverses through towns and smaller communities, providing access for commercial and visitor services. A 12-mile stretch of this highway passes through park boundaries and receives about three million travelers annually. Approximately half of those visitors actually pay to come into the park.

CRATER RIM DRIVE

Crater Rim Drive is an historic two-lane road that circles Kīlauea Caldera, offering spectacular views of volcanic craters and lava flows and features. The road begins at the junction with State Highway 11 and extends for 10.6 miles, through the park entrance gate, past the developed area surrounding the Kīlauea Visitor Center and Volcano House[SM] Hotel, and continuing on to Jaggar Museum, Halema'uma'u Crater, and Thurston Lava Tube to circle back to the park entrance gate. Most visitors tour Crater Rim Drive and also drive down Chain of Craters Road, especially when hot lava is visible.

Since March 2008, the summit eruption of Kīlauea Volcano has resulted in the closure of 4.72 miles of road or approximately 40% of Crater Rim Drive, which is the road section from Jaggar Museum to the junction with Chain of Craters Road.

The Crater Rim Drive corridor and the majority of its associated features remain intact and still convey its heritage as the "rim road" from which visitors historically and currently view the vast Kīlauea Caldera and associated volcanic features. In 2006 the Hawai'i State Historic Preservation Division concurred with documentation of Crater Rim Drive's eligibility for listing on the National Register of Historic Places (national register) as a contributing feature within a broader historic district. Since the end of its construction in 1942, segments of the road have been realigned and modified to repair damage from weathering, lava

flows, and earthquakes. Crater Rim Drive is a Class 1 Public Use Park Road (NPS 1984), a road "which constitute[s] the main access route, circulatory tour or thoroughfare for park visitors."

CHAIN OF CRATERS ROAD

Chain of Craters Road descends 18.65 miles, dropping nearly 4,000 feet in elevation from its junction with the south end of Crater Rim Drive to its lava-forced terminus at the coast. The road winds through miles of lava flows, offering visitors access to pit craters, tree molds, and native Hawaiian petroglyphs. Chain of Craters Road provides access to the East Rift Zone of Kīlauea Volcano, site of the most recent lava flows in the park (ongoing since 1983). The road pavement ends at a temporary visitor information facility along the coast. Lava flows routinely inundate this area, occasionally forcing the park to move its temporary interpretive and operational facilities in response. Visitors to the recent lava flows park along the southbound lane and walk one-quarter mile past the portable visitor contact site, along the closed section of road to the lava field. The park has proposed various plans to construct a parking area in this location but have not been able to implement any of the plans due to advancing lava. Plans to improve the visitor contact station include methods to allow easy movement of the building if and when lava advances again.

Due to its location on the East Rift of Kīlauea Volcano, lower Chain of Craters Road has been inundated by numerous lava flows over several decades. Prior to closure by the Pu‘u ‘Ō’ō flows, Chain of Craters Road was a popular scenic drive, known as the Golden Triangle, which linked Hilo to Kalapana and Kīlauea Volcano in a driving loop. This road is designated a National Scenic Byway.

Eruptive flows during the 1969–74 Mauna Ulu eruption closed the road from the Mauna Ulu parking area for a distance of about ten miles. In 1979, the park reopened a rerouted section of this road reconnecting the upper and lower portions of Chain of Craters Road. Flows in 1986 closed the Chain of Craters Road just outside the park and subsequent flows covered approximately 5.5 miles of this road west from the eastern park boundary. In 2014, due to the lava threatening access in the lower Puna region, the previously lava-covered section was reopened utilizing the previous alignment as an unpaved emergency access route. This route will only be used when other viable access routes are cut off in the Lower Puna region. When not needed for emergency access, the route will be used as a non-motorized multi-purpose trail.

HILINA PALI ROAD

In 1931, the road from Devil's Throat on upper Chain of Craters Road to the Hilina Pali Overlook was improved and made passable for "large cars with a reasonable load" (Park 2007d). This 8.5-mile section of road is often closed during dry spells when fire hazards are high. Four miles into the Hilina Pali Road is the Kūlanaokuaiki Campground. At the end of the road is a historic rock shelter/lookout designed by early NPS landscape architect Thomas Vint.

MAUNA LOA ROAD

Mauna Loa Road extends 11.42 miles from Crater Rim Drive, across Highway 11 and to an elevation of nearly 6,700 feet. The segment between Crater Rim Drive and Highway 11 is only used for administrative purposes due to sensitive resources in the area. From Highway 11 north, a two-lane road leads 1.59 miles to a large cul-de-sac at the Kīpukapuaulu (Bird Park) Nature Trail. Two historic stone pillars mark the entrance to the upper section of road. The first 2.16 miles of the upper section is a narrow two-lane segment, approximately 16 to 17 feet wide. For the next 7.67 miles, the road narrows to one lane, approximately ten to 11 feet wide, and continues to the Mauna Loa Lookout parking area. The original concept was documented in 1916 and the actual alignment of loose gravel was completed in 1936.

Along the lower section of Mauna Loa Road are several spur roads to the Tree Molds Area, Kīpukapuaulu Picnic Area, Kīpukapuaulu

Nature Trail, and the park gravel storage area. The road ends at a historic Thomas Vint-designed stone lookout shelter, the Mauna Loa Observatory Building. The road is closed at times due to high fire hazard.

ESCAPE ROAD

The Escape Road is popular with off-road bicyclists, hikers, and horseback riders, offering a dirt/gravel route from Highway 11 near the junction with Old Volcano Highway, past Thurston Lava Tube and down to Mauna Ulu on Chain of Craters Road. This gated unpaved road is approximately 6 miles in length and is made up of two historic routes, the upper section of Keauhou Trail/Road and Lee's Short Cut, and has primarily been used as a multi-purpose trail for nonmotorized use. It has been maintained as an escape route in the event that road access on Chain of Craters Road is cut off due to volcanic, seismic, or other natural disaster. It is used routinely by educational groups and local residents who walk, bicycle, or ride horseback.

KAHUKU ROADS

The entrance to Kahuku Unit is just west of milepost 70 on State Route 11 (43 miles past the main entrance to the park at milepost 28). The existing entrance is a safety concern due to its location on a curve with limited line-of-sight, so a study was completed by the Federal Highway Administration in 2007 to examine alternatives (USDOT-FHWA 2007). Information from this study was taken into consideration in the development of the alternatives in this GMP/WS/EIS.

The lower 3 miles of the main road in the Kahuku Unit is an unimproved gravel surface, typically passable for two-wheel-drive vehicles, from the park entrance to Upper Palm parking area. The road beyond Upper Glover is very rough with four-wheel-drive access only. The road splits at Upper Glover, with the west branch continuing for an additional 7 miles along the western boundary and above the Hawaiian Ocean View Estates subdivision. The eastern branch parallels the eastern boundary and continues an additional 11 miles until its terminus at the Nēnē Cabin. The main Kahuku road and the eastern branch of the road appear to follow the historic Kahuku-ʻAinapō Trail alignment in many places.

Public Transit

Hawaiʻi County Mass Transit Agency provides public transportation around the island on the Hele-On bus. The Hele-On bus stops several times a day at the Kīlauea Visitor Center on the route between Ocean View and Hilo. Public transportation to the park is primarily utilized by park employees and park partners' employees, but a small number of visitors also arrive at the park on the Hele-On bus. Data is not collected for the number of visitors arriving specifically by public transportation, but it is estimated to be between zero to five visitors a day.

Alternative Transportation

HYDROGEN SHUTTLE PROGRAM

A project to test two electric battery/hydrogen fuel cell hybrid shuttles within the park is scheduled for 2014–15. The project is a multiagency partnership including the National Park Service, the University of Hawaiʻi– Hawai'i Natural Energy Institute, the US Department of Energy, the Office of Naval Research, the Hawaiʻi Center for Advanced Transportation Technologies, and Kilauea Military Camp. With many partners, there are multiple objectives for the project. Hawaiʻi Volcanoes National Park will serve as an NPS test center for hydrogen technology over a wide range of climate zones, elevations, and grades. The shuttles will allow the park to test small-scale shuttle service and visitor response. The shuttles will also help alleviate traffic congestion on Crater Rim Drive and provide service between Kīlauea Iki, Thurston Lava Tube, Puʻu Puaʻi, and Devastation Trail. If this project proves successful, the shuttle operations could be extended under the preferred alternative to include other stops along Crater Rim Drive, such as Kīlauea Visitor Center, Steam Vents, Kilauea Military Camp, and Jaggar Museum.

The shuttle operation could also extend to the end of Chain of Craters Road to provide service mauka to makai. Routes and schedules would be flexible, and shuttle buses would primarily be used for scheduled interpretive tours and small circular routes. All tours and visitor stops would be located within existing visitor areas only. No new trailheads, routes, or locations would be opened or promoted in conjunction with this pilot project.

For user comfort, safety, and ease of driving on the park's narrow, historic roads, the vehicles purchased do not exceed 35 feet in length and 8 feet in width and can carry 19 passengers, including up to two wheelchairs.

The hydrogen is expected to be produced off-site and delivered to the fueling station at Kilauea Military Camp. In addition to hosting the hydrogen fueling station, it is anticipated that Kilauea Military Camp will provide shuttle drivers and the electric charging station, storage, and maintenance space at KMC base yard.

IDENTIFIED ISSUES—The cost of electricity in Hawai'i is very high, at least four times more than on the mainland; therefore the cost of hydrogen, produced with electricity, is extreme in comparison to a gallon of gasoline or diesel. Hydrogen technology has yet to emerge in the Hawai'i or US economies, but state and federal governments are currently working to reduce cost and technological hurdles by promoting a hydrogen economy in Hawai'i that utilizes local geothermal energy. Additionally, the sulphur dioxide (SO_2) present in volcanic emissions poses a challenge for hydrogen fuel cells, which it can disable immediately. The volcanic plume, which usually blows south into the desert, can turn toward the visitor areas in the park when the trade winds stop blowing. This can happen for a few minutes, a day, or a week or more on occasion. The University of Hawai'i is currently researching the development of SO_2 filters for fuel cells, funded in part by the Office of Naval Research.

SOCIOECONOMIC CONDITIONS AND TRENDS

Hawai'i County, Hawai'i is the primary area of influence for economic and social considerations associated with this GMP/WS/EIS. Hawai'i County shares its borders with the island of Hawai'i, a 4,028-square-mile island on the southern end of the Hawaiian Archipelago. In comparison to the four other counties in the state, Hawai'i County is by far the largest in area, surpassing the total area of the four other counties combined.

Located on the southeastern half of the island of Hawai'i, the closest communities to Hawai'i Volcanoes National Park are Volcano Village (3 miles to the east of the main entrance) and Na'alehu (approximately 7 miles to the east of the entrance to Kahuku). The communities of Kea'au, Mountain View, Pāhala, and Ocean View are also near the park along State Route 11, and the two largest cities on the island, Hilo and Kailua-Kona, are within a 30- and 94-mile drive of the park's main entrance, respectively. Another community, Kalapana, is just east of park along the coast but is no longer directly accessible from the park due to the 1986 and subsequent lava flows that covered the connecting scenic byway.

Demographic Conditions and Trends

POPULATION

According to last two dicentennial censuses, Hawai'i County's population grew twice as fast as that of the state between 2000 and 2010, averaging a 2.4% annual growth rate over the course of those 10 years. As of 2010, the county has a population of approximately 185,079 people, making it the second-most populous county in the state (see *Table 5.8. Population Growth and 2010 Urban and Rural Demographics, Hawai'i State Counties, 2010*) (US Census Bureau 2000a, 2010). That same year, based on census county divisions (CCDs), Hilo and its surrounding area had a population of approximately 45,714 people; the Kona area had a population of 37,875; the Kea'au and Mountain View communities

had a combined population of 34,266; Pahoa and Kalapana had a combined population of 11,060; and the Kaʻū District (including Pāhala, Naʻalehu, and Ocean View) had a population of 8,451 (US Census Bureau 2010).

Despite its relatively large population (the county has the highest population in the state), Hawaiʻi County is the most rural county in the state, with approximately 50 persons per square mile.[2] While 38% of Hawaiʻi County's residents live in a rural community, only 8.1% of the statewide population is rural. In comparison, less than 15% of residents in Maui, Kauaʻi, and Honolulu counties are rural (US Census Bureau 2010). See *Table 5.8. Population Growth and 2010 Urban and Rural Demographics, Hawaiʻi State Counties, 2010*.

AGE

Figure 5.7. Age Demographics in Hawaiʻi County by Age Group, 2010, shows Hawaiʻi County's age distribution across gender. As shown in this figure, the county's population is evenly distributed between males and females (approximately 50% for both genders) and is weighted toward a large middle-aged adult population (ages 45–64; 31% of the total population) (US Census Bureau 2010). The median age of Hawaiʻi County's 2010 population was 41, up from 39 in 2000, and it is higher than that of the state of Hawaiʻi (39) and the nation (37) (US Census Bureau 2000a, 2010).

As of 2010, approximately 15% of Hawaiʻi County's population is 65 or older, and 38% of the workforce (ages 18–64) is within 15 years of retirement, compared to 30% nationwide (US Census Bureau 2010).

[2] According to the US Census Bureau, 100% of Kalawao County's residents live rurally, making it factually, the most rural county in the state. However, with a population of only 90 residents, this county does not have a county government (with the exception of a sheriff) and is administered by the State Department of Health. The county is on Molokaʻi Island, and is administered by Maui County for most functions (e.g., elections, state representation), but not for others (e.g., sheriff, Department of Health), Kalawao is usually not shown as a separate county on maps.

RACE

The racial composition of Hawaiʻi County is predominantly non-white. More than a third of the population is of Asian, Native Hawaiian, or Other Pacific Islander descent (34.3%), and another 29.5% of the population is of two of more races. The 2010 census records 33.7% of the county's population as white, compared to 24.7% in the state and 72.4% in the nation; 11.6% of the county is Hispanic or Latino (US Census Bureau 2010). See *Table 5.9. Demographic in the Nation, State, and County, 2010*.

HOUSING

At the time of the 2010 Census, Hawaiʻi County reported a total of 82,324 housing units, a 31.4% increase from 2000. In comparison, with a reported 519,508 housing units in 2010, housing in the state of Hawaiʻi experienced a much slower growth rate of 12.8% during the same time period (US Census Bureau 2000a, 2010).

Perhaps due to this fast growth rate in housing, Hawaiʻi County's 2010 vacancy rate is slightly higher, at 18.5%, than the state's 12.4% vacancy rate. Of these vacant units, almost half are used for seasonal, recreational, or occasional use (46.9%), and almost a fifth are for rent (19.7%); the remaining 33.4% are for sale or sold but not occupied or are otherwise deemed vacant (US Census Bureau 2010). Similarly, while the occupancy and vacancy rates in the state of Hawaiʻi remained stable between 2000 and 2010, Hawaiʻi County experienced a 3% increase in the vacancy rate during this time frame (US Census Bureau 2000a, 2010). See *Figure 5.8. Occupancy in Housing Units in Hawaiʻi County, 2000–10*.

Table 5.8. Population Growth and 2010 Urban and Rural Demographics, Hawai'i State Counties, 2010

Area	Total Population			2010 Urban		2010 Rural	
	2000	2010	ANNUAL % CHANGE	POPULATION	PERCENT	POPULATION	PERCENT
Hawai'i	1,211,537	1,360,301	1.2%	1,250,489	91.9%	109,812	8.1%
Hawai'i County	148,677	185,079	2.4%	114,766	62.0%	70,313	38.0%
Honolulu County	876,156	953,207	4.4%	944,982	99.1%	8,225	0.9%
Kalawao County	147	90	(3.9%)	0	0.00%	90	100.00%
Kaua'i County	58,463	67,091	1.5%	58,463	87.1%	8,628	12.9%
Maui County	128,094	154,834	2.1%	132,278	85.4%	22,556	14.6%

Source: US Census Bureau 2000a, 2010

Figure 5.7. Age Demographics in Hawai'i County by Age Group, 2010

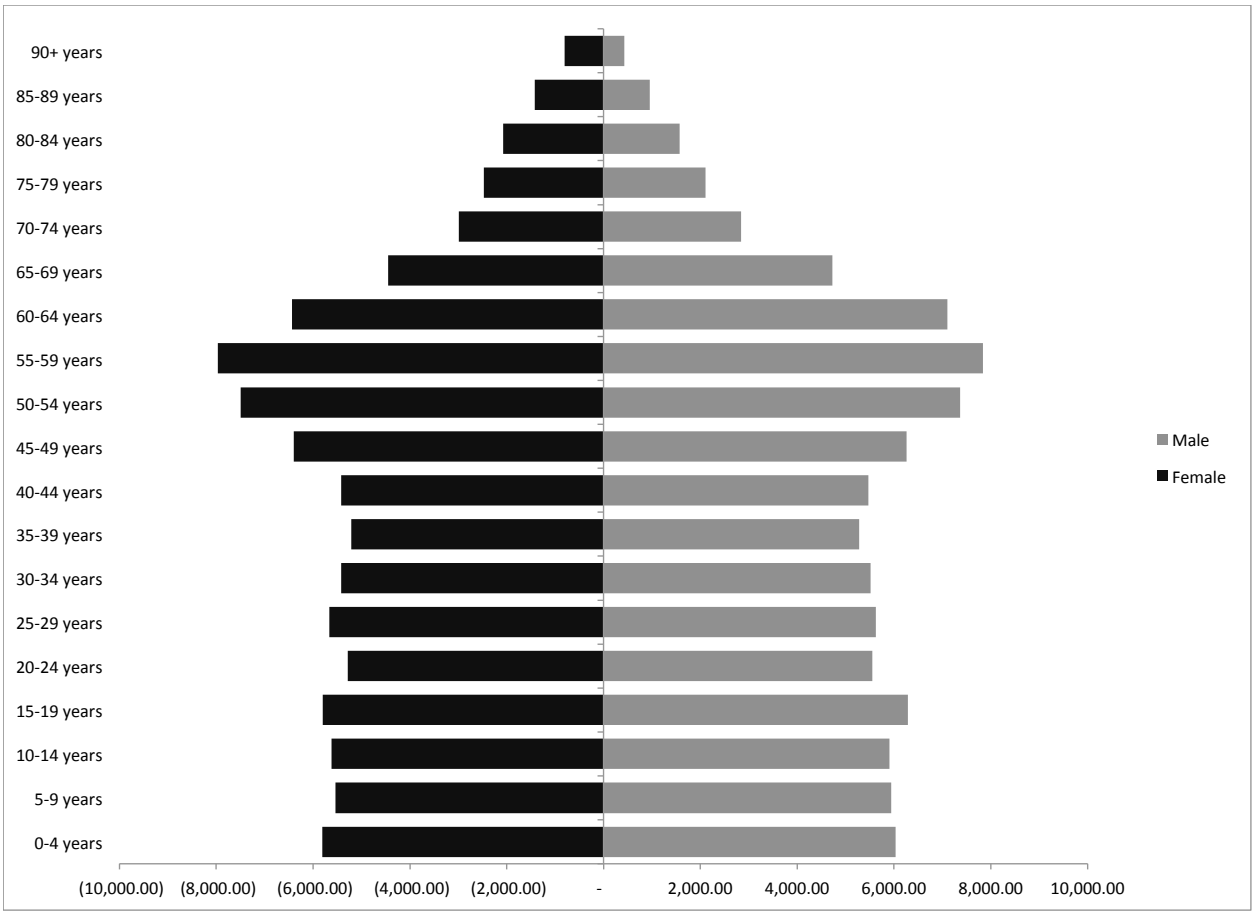
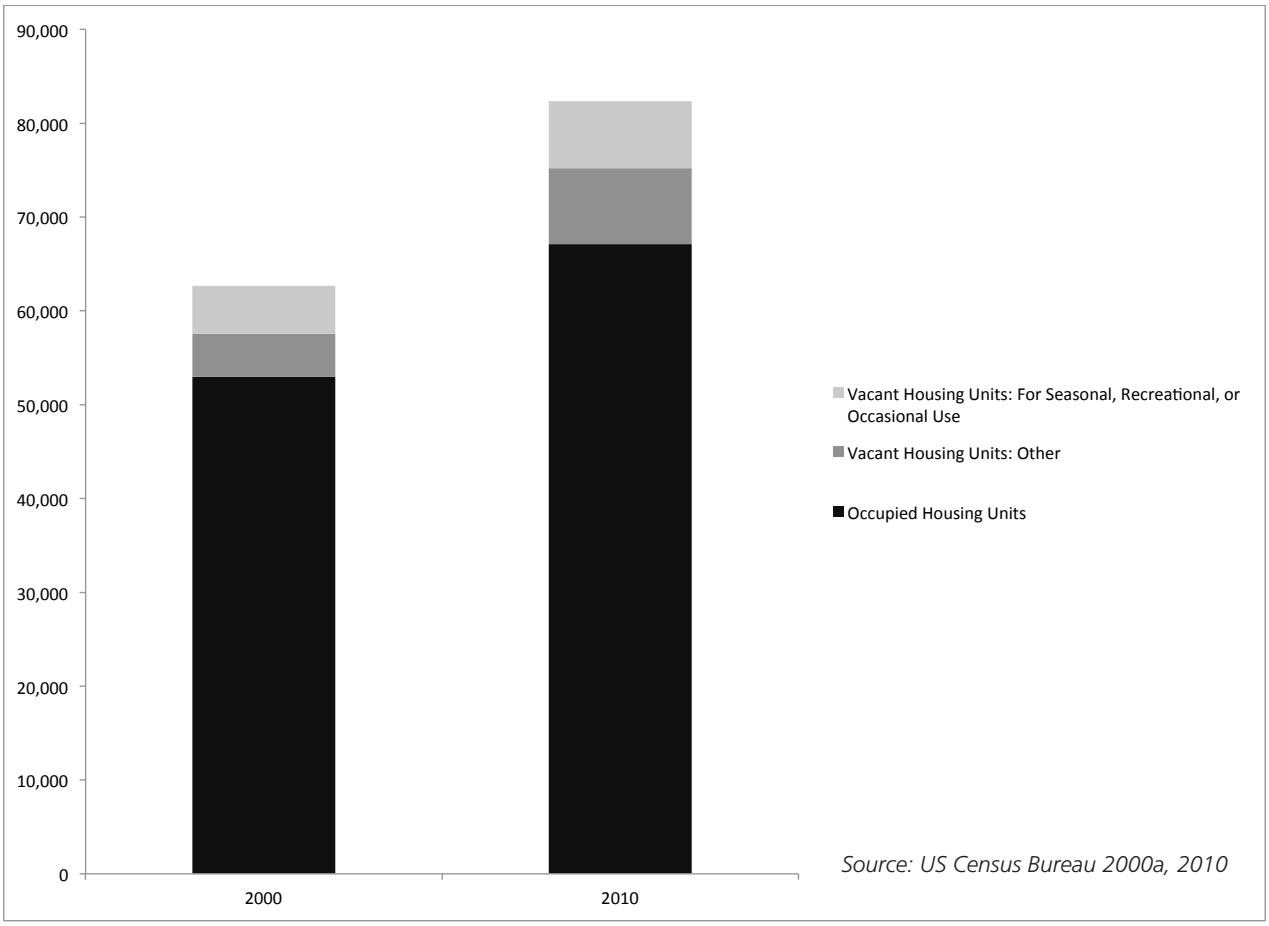


Table 5.9. Demographic in the Nation, State, and County, 2010

One Race Alone									
AREA	TOTAL	WHITE	BLACK & AFRICAN AMERICAN	AMERICAN INDIAN & ALASKA NATIVE	ASIAN	NATIVE HAWAIIAN & PACIFIC ISLANDER	OTHER	TWO OR MORE RACES	HISPANIC OR LATINO (OF ANY RACE)
USA	97.1%	72.4%	12.6%	0.9%	4.8%	0.2%	6.2%	2.9%	16.3%
Hawai'i	76.4%	24.7%	1.6%	0.3%	38.6%	10.0%	1.2%	23.6%	8.9%
Hawai'i County	70.5%	33.7%	0.6%	0.5%	22.2%	12.1%	1.5%	29.5%	11.6%

Source: US Census Bureau 2010

Figure 5.8. Occupancy in Housing Units in Hawai'i County, 2000–10



Of the occupied units in Hawai‘i County, 66% are owned by the occupant and 34% are rented. In comparison, the state of Hawai‘i had an owner-occupancy rate of 57.7% in the 2010 census and a renter-occupancy rate of 42.3%. Between 2000 and 2010, the owner-occupancy rate in the state and county both increased, by 1.2% and 1.5% respectively (US Census Bureau 2000a, 2010).

According to the 2011 American Community Survey (one-year estimates), median housing values in the state of Hawai‘i and Hawai‘i County are estimated at almost twice that of the national average. While only 9% of the housing units in Hawai‘i County are valued at less than $100,000, 14.6% of the housing units are valued at $500,000 or more. In the state, 48.3% of the units are valued at more than $500,000 (see *Table 5.10. Value of Owner-Occupied Units, 2011*). For those who rent, the median rent in the state of Hawai‘i[3], at $1,308/month, is 50% higher than the national average of $871/month, while Hawai‘i County’s median gross rent is only $920/month in comparison. Despite the lower cost in the county, renters are more likely to spend a higher percentage of their income on rent in Hawai‘i County than those elsewhere in the state or nation. An estimated 62.6% of Hawai‘i County renters spend more than 30.0% of their household income on housing, compared to 58.9% of renters in the state and 53.4% of renters in the nation (US Census Bureau 2011a).

[3] The American Community Survey defines gross rent as “the [monthly] contract rent plus the estimated average monthly cost of utilities (electricity, gas, and water and sewer) and fuels (oil, coal, kerosene, wood, etc.) if these are paid by the renter (or paid for the renter by someone else). Gross rent is intended to eliminate differentials that result from varying practices with respect to the inclusion of utilities and fuels as part of the rental payment.” The median gross rent “divides the gross rent distribution into two equal parts: one-half of the cases falling below the median gross rent and one-half above the median” (US Census Bureau 2011b).

Economic Conditions and Trends

EMPLOYMENT

According to the US Bureau of Economic Analysis (BEA), Hawai‘i County experienced a 16.3% job growth rate between 2001 and 2011, increasing from 81,611 jobs in 2001 to 94,907 jobs within 10 years. In comparison, the state job growth rate was lower, at 10.1%, or a 1% annual growth, during this same time period. Despite positive growth over the past decade, the number of jobs in both the county and state reached their high in 2007, dipping below 2006 levels in 2009 and 2010 due to the national recession. Neither region has regained this job loss, despite job growth between 2010 and 2011 in both the state and county (see *Figure 5.9. Employment Growth by Area, 2001–11)* (BEA 2011).

Table 5.10. Value of Owner-Occupied Units, 2011

Value	United States		Hawai‘i		Hawai‘i County	
	NUMBER	PERCENT	NUMBER	PERCENT	NUMBER	PERCENT
Less than $50,000	6,538,986	8.8%	2,818	1.1%	1,138	2.7%
$50,000 to $99,999	11,916,860	16.0%	5,140	2.0%	2,689	6.3%
$100,000 to $149,999	12,230,945	16.5%	6,632	2.6%	4,029	9.5%
$150,000 to $199,999	11,437,518	15.4%	8,734	3.4%	4,035	9.5%
$200,000 to $299,999	13,511,178	18.2%	29,500	11.6%	10,230	24.1%
$300,000 to $499,999	11,306,069	15.2%	79,071	31.0%	14,119	33.3%
$500,000 to $999,999	5,850,178	7.9%	102,778	40.4%	5,151	12.1%
$1,000,000 or more	1,472,701	2.0%	20,027	7.9%	1,071	2.5%
Total	74,264,435	(X)	254,700	(X)	42,462	(X)
Median (dollars)	$173,600	(X)	$487,400	(X)	$290,400	(X)

Source: US Census Bureau 2011a

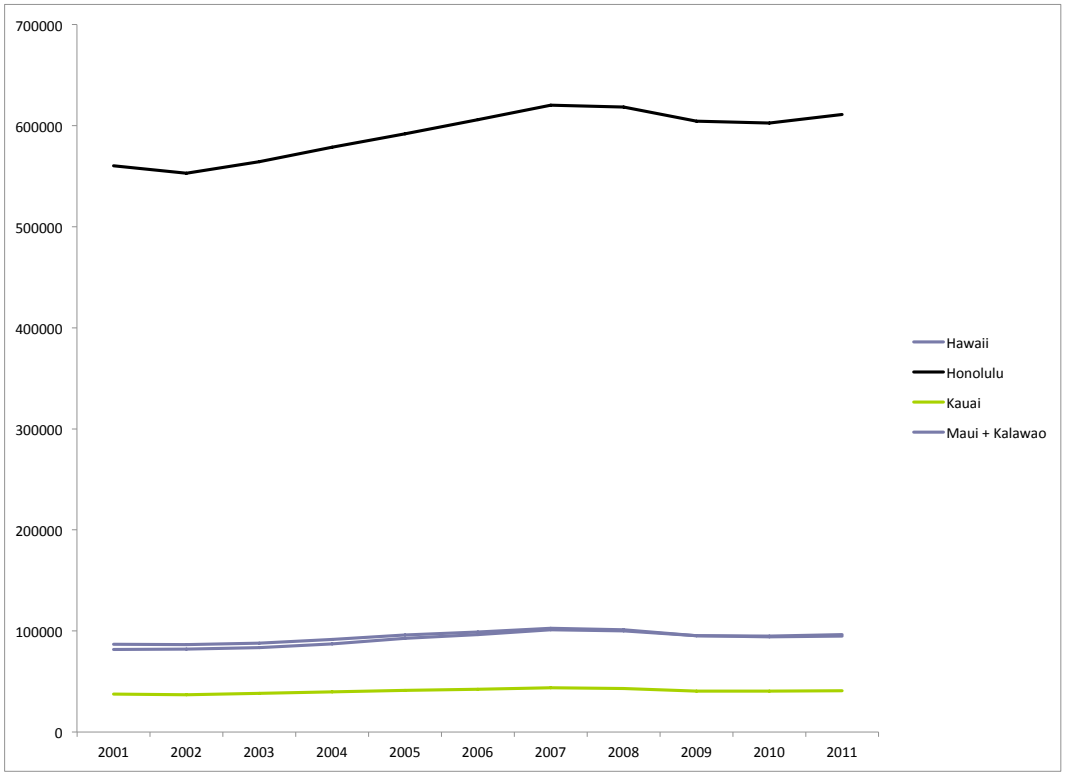
Due in part to the national recession and drop in number of jobs in 2009, employment rates in the county and state also decreased between 2007 and 2011. While 2007 unemployment rates in the state and county were 4.5% and 5.4% respectively, they jumped to 7.7% and 11.2% in 2011. As of 2011, the US Census Bureau estimates that Hawai'i County has an unemployment rate that is nearly 1% higher than that of the nation (US Census Bureau 2011a).

Table 5.11 Growth in Median Household Income, 1999–2011

Area	1999	2011	Percent Change
Hawai'i County	$39,805	$46,479	16.8%
Honolulu County	$51,914	$66,146	27.4%
Kaua'i County	$45,020	$60,751	34.9%
Maui County	$49,489	$60,147	21.5%
Hawai'i	$49,820	$61,821	24.1%
USA	$41,994	$50,502	20.3%

Source: US Census Bureau 2000b, 2011a

Figure 5.9. Employment Growth by County, 2001-11



INCOME

Between 1999 and 2011, the US Census Bureau estimates that Hawai'i County's median household income grew by 16.8% or 1.4% annually, yet remained the lowest in the state. While the 2011 median household income in Hawai'i County was estimated at $46,479 in 2011, both the state median income ($61,821) and national median income ($50,502) were higher (US Census Bureau 2000b, 2011a).

INDUSTRIES

As the most rural county in Hawai'i, Hawai'i County accounts for 62.6% of the farm employment in the state (BEA 2011). Fruits, nuts, and coffee are the island's principal agricultural products. The Kona district in the western part of Hawai'i is the coffee belt of the United States and is also known for its health resorts and offshore deep-sea fishing (Columbia Encyclopedia 2003).

Despite the importance of agriculture in the county and its national prominence, this industry accounts for only 4% of the total jobs in Hawai'i County (BEA 2011). According to the state of Hawai'i Department of Business and Economic Development and Tourism, the largest sources of employment in the county are in service-based industries (retail trade, 13.6%, and health care and social assistance, 10.5%) and with the government (20.3%). In fact, while employment in manufacturing decreased by 50% between 1990 and 2010, employment in education services; arts, entertainment, and recreation; and healthcare and social assistance grew by over 160% during the same time period, averaging at least an 8.0% annual growth rate over the past two decades. Jobs in professional and business services, information services, and other services have also grown significantly (State of Hawai'i Department of Business and Economic Development and Tourism n.d.).

Economic Benefits from Hawai'i Volcanoes National Park

Based on analysis from Michigan State University using the Money Generation Model (MGM2)[4] and analysis from the National Park Service using a more recently developed visitor spending effects (VSE) model, Hawai'i Volcanoes National Park plays an important role in Hawai'i County's local economy.

First, as an employer the park provides jobs to park employees, including seasonal, term, and permanent full- or part-time positions. Park employees spend their income and wages in the local communities, which in turn create other opportunities for work in the county. In 2010 Hawai'i Volcanoes National Park employed 148 employees, who supported an additional 46 jobs in the local economy based on MGM2 estimates. This payroll spending resulted in added value[5] of over $12.1 million to the local economy (Stynes 2011). In

[4] The money generation model study is based on recreational visits and overnight stays as reported by the NPS. Visitors are broken down into local day-trip visitors, nonlocal day-trip visitors, and visitors on overnight trips staying in motels or campgrounds inside or outside the recreation area based on previous visitor surveys. Visitor spending is estimated based on visitor-use survey data from selected parks where studies have occurred and extrapolated to parks without studies. Spending does not include expenditures on durable goods that cannot be attributed to a single trip (Stynes 2008). Payroll information (wages and salaries plus benefits) was also obtained from the National Park Service.
To account for different park settings, there are different multipliers for large urban, small urban, and rural areas. The multipliers are derived from IMPLAN, a federal land management agency standard used to evaluate economic impacts. IMPLAN was developed by the US Forest Service to calculate economic impacts generated by national forests. The multipliers are for the following activities: construction sand and gravel, industrial and commercial construction, maintenance and repair of facilities, local transportation services, water transportation, air transportation, hotels and lodging places, eating and drinking places, automobile repair and services, recreation-related retail trade, amusement and recreation services, and government-federal.
The model does not include park operations expenses or construction activities, only base annual salaries. It also does not include the impacts of employees in regional offices or other administrative divisions, where visitation is not reported. Commercial service providers are also not included in the model

[5] "Value added is the sum of labor income, profits and rents, and indirect business taxes. It can also be defined as total sales net of the costs of all nonlabor inputs. Value added is the preferred economic measure of the contribution of an industry or activity to the economy" (Stynes 2011).

addition to these expenditures and benefits, the park also supports the local economy when utilizing local vendors or awarding contracts to local businesses; for example, through contracted lawn maintenance services or purchases of office supplies. This economic activity is not included in this analysis.

Second, over the past 40 years Hawai'i Volcanoes National Park has attracted, on average, 1.38 million visitors to the area every year who contribute to the local economy through tourism spending (Park 2012a). Traveling from around the globe to visit this World Heritage Site and International Biosphere Reserve, visitors spend money on transportation (including gas and public transit), lodging, food (restaurants and grocery stores), retail, and recreation (Stynes 2011). Based on the almost 1.5 million recreational visitors to the park in 2012, the VSE model estimates that total spending associated with Hawai'i Volcanoes National Park amounted to over $140.5 million in 2012, most ($138.6 million; 98.6%) of which was spent by nonlocal visitors. Considering this impact, the total labor income generated by this spending was over $53.2 million, which supported 1,353 jobs and added a value of approximately $91.8 million to the local economy (Cullinane et al 2014).

PARTNERSHIPS AND AGREEMENTS

In working to preserve and restore the park's resources unimpaired for future generations, the park will continue to build on the legacy of the many partnerships that have extended its ability to protect resources and serve the public since the park was established. Park managers will establish and maintain cooperative relationships with managers of adjacent public and private lands; state and local governments; Native Hawaiians and community organizations. The park will collaborate to ensure that watersheds, ecosystems, endangered species, cultural resources, viewsheds, and trail and transportation systems that extend beyond park boundaries are considered holistically. Through mutual collaboration, shared, values and learning, partnerships create outcomes beyond any one organization's individual capacity. Partnerships will continue to be an important way to accomplish the park's mission.

The park participates in partnerships and agreements through a variety of methods, such as concession contracts, interagency agreements, cooperative agreements, memorandums of understanding, and rights of way. A wide range of organizations and agencies partner with the park, such as the Three Mountain Alliance, USGS-HVO, Big Island Invasive Species Council, Volcano Art Center, and many others. Hawai'i County Fire Services operates a small fire station at Kilauea Military Camp under a mutual aid agreement with the park, to provide 24-hour fire and paramedic level emergency medical services to the park and surrounding communities. The park also maintains two sister park agreements between the National Park Service and Jeju Volcanic Island and Lava Tubes, World Natural Heritage Site, Republic of Korea and Wudalianchi National Park, People's Republic of China to promote international cooperation and collaboration for mutual benefit of the common ideals of stewardship and preservation of resources.

ADJACENT LAND MANAGEMENT

Hawai'i Volcanoes National Park is surrounded by federal, state, and privately held lands. The large agencies and organizations that own or manage these lands include the state of Hawai'i, Kamehameha Schools, and The Nature Conservancy. These entities are also part of a consortium of partner organizations and land management agencies known as the Three Mountain Alliance (TMA). The TMA is the largest of the eleven Hawai'i Association of Watershed Partnerships (HAWP) in the State of Hawai`i. The purpose of the HAWPs is to promote coordination among private and public landowners and land managers to maintain healthy forested watersheds. Lands owned or administered by other alliance partners have

the potential to be affected by any potential actions proposed in the general management plan, especially as they relate to removal of nonnative species as well as species recovery at Hawai‘i Volcanoes National Park.

State of Hawai‘i

The state manages natural area reserves, forest reserves, and game management areas on the island of Hawai‘i, several of which share boundaries with or are located near Hawai‘i Volcanoes National Park. Areas within the state system have different management objectives. Protection of native ecosystems is the primary objective of natural area reserves, while game management is the primary objective in game management areas. Forest reserves balance several objectives that include providing mixed recreational use (including hunting) and protecting native plant communities and watersheds.

Kamehameha Schools

Kamehameha Schools (Bishop Estate) is the largest private landowner in the state of Hawai‘i. These lands were inherited by Princess Bernice Pauahi Bishop as the last royal descendant of the Kamehameha line and today total 365,800 acres of land across the state. In her will, she left her estate to Kamehameha Schools and mandated that her real estate be leased, sold, or managed to help generate revenue that would support the schools' educational programs and services (Kamehameha Schools n.d.). Today these lands are managed to derive an overall balance of economic, educational, cultural, environmental, and community returns as well as to protect and enhance native ecosystems (TMA 2007). As part of their involvement with the Three Mountain Alliance, Kamehameha Schools is involved in protection of the watershed through fencing and nonnative ungulate removal on portions of their lands. They have recently ceased cattle operations and removed feral nonnative ungulates from portions of the Keauhou Ranch designated for native forest restoration. The Keauhou Ranch is adjacent to the Mauna Loa area of the park.

The Nature Conservancy

The Nature Conservancy mission is to preserve the plants, animals, and natural communities that represent the diversity of life on Earth by protecting the lands and waters they need to survive (TMA 2007). The Nature Conservancy of Hawai‘i partners with indigenous communities, businesses, governments, multilateral institutions, and other nonprofits to address threats to conservation including those concerning climate change, fire, freshwater, forests, nonnative species, and marine ecosystems (TNC 2009).

On the island of Hawai‘i, The Nature Conservancy owns and manages two preserves: the Kona Hema Preserve (8,061 acres in three contiguous units) and the Ka‘ū Preserve (3,548 acres in four noncontiguous units) (TNC 2006). The Nature Conservancy is involved with fencing and nonnative ungulate removal on their lands. For example, the Kona Hema units are fenced and are free of nonnative ungulate species. Within the Ka'ū Preserve, The Nature Conservancy is managing the land to reduce populations of nonnative animals and prevent new weed invasions. They are also working with neighboring landowners, local communities, state agencies, the National Park Service, and neighboring private landowners to protect the larger Ka'ū Forest (TNC 2009)

PARK MANAGEMENT AND OPERATIONS

Hawai‘i Volcanoes National Park is divided into two management units – Kīlauea and Kahuku. The park is administered by a superintendent and the park headquarters is in the Kīlauea Unit near Volcano. Management of the park is organized into the following divisions: Administration, Cultural Resources, Interpretation, Maintenance and Facilities Management, Natural Resources, Visitor and Resource Protection, Kahuku Unit staff, Planning and Compliance, and Fire Management. The total number of full-time employees was 139 in fiscal year 2012.

Administrative Division

The Administrative Division oversees all human resources, budget operations, contracting, concessions, information technology, telecommunications, property, and cost of collections within the park. The division is responsible for the park's revenues, which are collected from the entrance station, air tour fees, special use permits, CUAs, and donations. Additionally, the Administrative Division provides support to other NPS units on Hawai'i Island. This includes a newly developed Servicing Human Resources Office (SHRO) at Hawai'i Volcanoes National Park, which will assist all of the Pacific Island Network (NPS) parks in staffing.

Cultural Resources Management Division

The Cultural Resources Management Division is responsible for compliance with sections 106 and 110 of the National Historic Preservation Act. This includes surveying park property for archeological and cultural resources. The division also manages the park's museum, which contains approximately 300 library, archeological, natural, and artistic items. The division additionally manages contracts with individuals who enter into the park to work on resource inventory documentation projects.

Interpretation Division

The Interpretation Division is responsible for public communication, outreach, publications, and permits related to films or other communications. Interpretation and outreach activities are conducted to convey key park messages to the visiting public, to school groups, and to the surrounding community. This division utilizes ranger-led interpretive hikes, walks, and talks; cultural demonstrations; environmental education programs for school groups; and service-based learning projects; as well as informal contacts with visitors. The Interpretive Division annually initiates new or existing outreach programs that are relevant and meaningful to the underserved communities surrounding the park.

Maintenance and Facilities Management Division

The Maintenance and Facilities Management Division is responsible for the maintenance of buildings and facilities within the park; fleet vehicles and equipment; utilities; and all roads and trails, including front- and backcountry trails. They are also responsible for maintenance of the park's front- and backcountry campgrounds, four cabins, three shelters, and custodial services for all park facilities. The park livestock program (horse and mule pack animals) is the responsibility of the maintenance division. The park's fencing program is managed by the Natural Resources Management Division, and not by the Maintenance and Facilities Management Division, as would be typical in most national parks.

Hawai'i Volcanoes National Park has 492 maintained locations (sites) that are composed of a variety of man-made features and include buildings, roads, trails, landscapes, and archeological sites. These maintained facilities extend in elevation from the Hōlei Sea Arch at sea level to the Summit Cabin on Mauna Loa.

Natural Resources Management Division

The Natural Resources Management Division is responsible for the protection of native ecosystems and native species to ensure their continued existence. This includes restoration activities pertaining to native species and the preservation of biological diversity. Many of the division's programs focus on nonnative species management, preservation of rare species, and habitat generation for extirpated or at-risk (threatened and endangered) species. This division does not do any work directly related to coastal marine resources.

This Division includes programs related to endangered species monitoring and recovery, habitat restoration, nonnative plant and animal management, fire ecology, and air quality monitoring. This division is also responsible for implementing the park's wilderness program and has an assigned

wilderness coordinator. The division also coordinates all research conducted in the park through the web-based NPS Research Permit and Reporting System.

This division has several formal and informal partnerships with external institutions. These include the local universities (through the Cooperative Ecosystem Studies Unit), USGS Pacific Ecosystem Research Center (PIERC), the USDA quarantine facility, all with offices based at the park that provide valuable monitoring and research services. Other partnerships are maintained with the Big Island Invasive Species Council, a partnership among federal, state, and county agencies to coordinate nonnative species management activities on Hawai'i Island; and the Three Mountain Alliance, which coordinates conservation and watershed management activities among several federal and state agencies and private landowners (e.g., Kamehameha Schools and The Nature Conservancy) and with offices based at the park.

Visitor and Resource Protection Division

The Visitor and Resource Protection Division's responsibility is to ensure protection of the visiting public and the park resources. This division has exclusive jurisdiction for all law enforcement within the park. As a result, local, county, or state law enforcement agencies are unable to enter the park and enforce any laws unless they are invited by the Protection Division or are in pursuit of or investigating a crime that occurred within their own jurisdiction.

This division's responsibilities include front- and backcountry patrols to enforce criminal codes, traffic codes, state and federal laws, conducting search-and-rescue operations, and assisting with wildland firefighting. Additionally, the division is responsible for managing public safety and education as it relates to the unique volcanic hazards in the park, structural fire protection, emergency medical services, and security; and managing the Pacific Islands Network Pacific Area Communications Center for routine, law enforcement, and emergency dispatching and communications.

Kahuku Unit Work Group

The Kahuku Unit work group is responsible for the management of the Kahuku Unit, particularly with respect to visitor services and facilities maintenance. This work group consists of the site manager / management assistant, as well as administrative, maintenance, and visitor services staff. The staff coordinates activities within the unit to provide basic visitor services for weekend visitation, as well as maintenance of facilities, trails, and grounds. They also coordinate with other park work groups and park partners for natural and cultural resources management, and on an as needed basis for implementation of projects.

Fire Management Division

The Fire Management Division is responsible for fire management at all of the ten Pacific Island park units. This includes responding to wildland fires, preparing fire management plans, conducting fire management activities, managing hazardous fuels projects, and maintaining the qualifications and certification program for wildland firefighters. The division also oversees the park's aviation program, which is a certification and qualification program for aviation personnel and which uses contract helicopters to conduct administrative operations. The division also maintains seven remote weather stations. The Fire Management Division spends approximately 70% of its time in Hawai'i Volcanoes National Park.

Planning and Compliance Division

This division is responsible for all planning and compliance activities within Hawai'i Volcanoes National Park and assists other parks within the Pacific Island NPS units as time and funding allow. Activities include ensuring park compliance with the National Environmental Protection Act, as well as with ESA and NHPA for all projects, as well as developing and/or assisting with park planning documents.

Lava trees on the Mauna Ulu flow. *NPS photo*

ENVIRONMENTAL CONSEQUENCES 6

Kamehameha butterfly on ama'u fiddlehead. *NPS photo by Jay Robinson*

Endangered native hāhā flowers. *NPS photo*

CHAPTER 6: ENVIRONMENTAL CONSEQUENCES

INTRODUCTION

The National Environmental Policy Act requires that environmental assessments disclose the environmental impacts of a proposed federal action and feasible alternatives to that action. In addition, compliance with NEPA is also based on other federal laws, including effects on historic properties considered in accordance with the National Historic Preservation Act. In this case, the proposed federal action is the adoption of a general management plan for Hawai'i Volcanoes National Park.

The alternatives in this general management plan provide broad management direction. Thus, this environmental impact statement should be considered a programmatic document. If and when specific developments or actions are proposed for implementation subsequent to this general management plan, appropriate detailed environmental and cultural compliance documentation would be prepared in accord with NEPA and NHPA requirements. Those actions that implement guidance provided in the general management plan may tier from this EIS.

This chapter begins with a discussion on terms and definitions used for determining environmental consequences, followed by a discussion on policy related to cumulative impacts, a description of the projects that make up the cumulative impact scenario, and finally a discussion on impairment. The second part of this chapter describes the methods and assumptions used for analyzing each impact topic. The impacts of each alternative are then analyzed by impact topic. Each impact topic includes a description of the impact of the alternative, a discussion of cumulative effects, and a conclusion for each alternative. Where data are limited, professional judgment has been used to project environmental impacts. Professional judgment was based, in part, on observation, analysis of conditions, and responses in similar areas.

At the end of the impact analysis of the alternatives, there is a brief discussion of unavoidable adverse impacts, irreversible and irretrievable commitments of resources, and the relationship of short-term uses of the environment and the maintenance and enhancement of long-term productivity. The impacts of each alternative are also briefly summarized in the "Summary of Impacts" chart at the end of "*Chapter 3: Alternatives*."

TERMS AND DEFINITIONS

The following section defines the terms used for determining the environmental consequences of the actions in the alternatives. The environmental consequences to each impact topic are defined based on impact type, intensity, and duration, and whether the impact would be direct or indirect. Cumulative effects are also identified.

Impact Type

The effects that an alternative would have on an impact topic could be either adverse or beneficial. Adverse impacts involve a change that moves the resource away from a desired condition or detracts from its appearance or condition. Beneficial effects are those that involve a positive change in the condition or appearance of a resource or a change that moves the resource toward a desired condition. In some cases, the action could result in both adverse and beneficial effects for the same impact topic.

Intensity

Defining the intensity or magnitude on an impact is taken directly from Director's Order 12: *Conservation Planning, Environmental Impact Analysis and Decision-making* (NPS 2001). Impact intensity is the magnitude or degree to which a resource would be beneficially or adversely affected. Each impact was identified as negligible, minor, moderate, or major. Because definitions of intensity vary by topic, separate intensity definitions

are provided for each impact topic in the methodology section. Due to the broad nature of actions called for in this general management plan, most intensity findings were expressed qualitatively.

Duration

Duration refers to how long an impact would last. The planning horizon for the general management plan is approximately 15 to 20 years. Unless otherwise stated, in this document the following terms are used to describe the duration of the impacts:

Short-term: The impact would be temporary in nature, such as the impacts associated with construction.

Long-term: The impact would last more than one year and could be permanent in nature, such as the loss of soil due to construction of a new facility. Although an impact may only occur for a short duration at one time, if it occurs regularly over a longer period of time the impact may be considered to be a long-term impact. For example, the noise from a vehicle driving on a road would be heard for a short time and intermittently, but because vehicles would be driving the same road throughout the 20-year life of the plan, the impact on the soundscape and acoustic environment would be considered to be long term.

Direct versus Indirect Impacts

Direct effects would be caused by an action and would occur at the same time and place as the action. Indirect effects would be caused by the action and would be reasonably foreseeable but would occur later in time, at another place, or to another resource.

CUMULATIVE IMPACTS

Cumulative impacts result from the incremental impact of an action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes such other action. Cumulative impacts can result from individually minor, but collectively significant actions taking place over a period of time.

Cumulative impacts are considered for all impact topics and alternatives. The National Park Service assumes the types of use that are occurring now would continue, but there may be new or different future uses. These actions are evaluated in conjunction with the impacts of each alternative to determine if they have any cumulative effects on a particular resource. For most of the impact topics, the geographic area defined for the analysis was Hawai‘i Volcanoes National Park. In some cases, the area of consideration was Hawai‘i Island.

To determine potential cumulative impacts, projects in the area surrounding the park were identified. Projects included in this analysis were identified by examining other existing plans. Projects identified for the purposes of cumulative impact analyses are past actions, plans or actions that are currently being implemented, and reasonably foreseeable future plans or actions. These projects were considered regardless of what agency, organization, or person undertakes them. Projects included in the cumulative impact analysis do not affect all resources equally.

The following land uses, operations and management actions make up the cumulative impact scenario:

- Past development of infrastructure, roads, trails, and facilities in the park
- Implementation of park plans, such as Protecting and Restoring Native Ecosystems by Managing Nonnative Ungulates Plan/EIS, Mission Critical Administrative Aviation Plan / EA, Fire Management Plan, Crater Rim Drive Rehabilitation EA, Land Protection Plan, etc.
- Routine park management activities, such as facilities maintenance, natural resources management, cultural resources management, etc.
- Commercial air tour overflights
- Air Tour Management Plan/EIS (future)

- Implementation of the management and implementation plans outside park boundaries, such as the Kaʻū Forest Reserve Management Plan, Ala Kahakai National Historic Trail Final Comprehensive Management Plan/EIS, Puʻu Makaʻala Natural Area Reserve Management Plan, Three Mountain Alliance Management Plans, USFWS Recovery Plans, Hawaiʻi 2014 Statewide Comprehensive Outdoor Recreation Plan, etc.
- Kaʻū Community Development Plan (in progress)
- Puna Community Development Plan (amended 2010)
- Volcano Long Range Plan 2012
- Development and population growth in surrounding communities
- Human-caused climate change scenarios

METHODS AND ASSUMPTIONS FOR ANALYZING IMPACTS

The planning team based the impact analysis and the conclusions in this chapter largely on the review of existing literature and studies, information provided by experts in the National Park Service and other agencies, and park staff insights and professional judgment. The team's method of analyzing impacts is further explained below. Impacts have been assessed assuming that mitigation measures, as described in Chapter 3, would be implemented. If mitigation measures were not applied, the potential for resource impacts and the magnitude of those impacts would increase.

The impact analyses for the no-action alternative compare resource conditions throughout the life of the plan to existing conditions, based on the continuation of current management. The impact analysis for the action alternatives (Alternatives 2 and 3) compare the action alternative to the no-action. In other words, the impacts of the action alternatives describe the difference between no action and implementing the action alternatives. To understand a complete "picture" of the impacts of implementation any of the action alternatives, the reader must also take into consideration that impacts would occur under the no-action alternative.

Natural Resources

The natural resource impact topics analyzed in this document are geologic resources, vegetation, wildlife and wildlife habitat, special status species (which include both federally listed species and those listed by the state as threatened and endangered), wilderness, and soundscapes and the acoustic environment. Information about known resources was compiled and compared with the locations of proposed developments and other actions. The impact analysis was based on the knowledge and best professional judgment of planners, and biologists; data from park records; and studies of similar actions and effects, when applicable. The planning team qualitatively evaluated the intensities of effects on all the natural resource impact topics.

GEOLOGIC RESOURCES, INCLUDING SOILS

The area of consideration for this topic is Hawaiʻi Volcanoes National Park. Available information on surface geologic resources and processes, including soils and volcanic products, in Hawaiʻi Volcanoes National Park was compiled. This impact topic includes soils, volcanic landforms and products, and geologic processes that would continue to be adversely affected by NPS management and operations and visitor use of the area. Potential impacts from management actions are based on professional judgment and experience with similar actions. The thresholds of change for the intensity of an impact are as follows.

Negligible: Actions could change aspects of a geologic feature or process but the change would not be detectable. Effects to soils would be generally undetectable. Any effects to soil productivity or fertility would be slight.

Minor: Actions would change a geologic feature or process, with the change measurable but localized. Effects to soils

would be detectable and could include loss of organic surface horizons. Effects to soil productivity or fertility and the area affected would be small.

Moderate: Actions would change a geologic feature or process, with the change measurable and localized or widespread. The effect on soils would be readily apparent and likely long-term and could include loss of subsurface soil horizons. Impacts would result in a change to the character of the resources over a relatively wide area or in changes to a rare or sensitive soil.

Major: Actions would change a key geologic feature or process, with the change measurable and widespread. The effect on soils would be readily apparent, affecting size, continuity, productivity, and/or fertility. Soil erosion would be affected over a large area (or over small areas if a sensitive soil is affected).

ALTERNATIVE 1 (NO ACTION)— New facilities and infrastructure changes would be limited, primarily occur in previously disturbed areas, and focused on increasing visitor services at Kahuku and Kealakomowaena under the no-action alternative. There would also be impacts to geologic resources from the maintenance of existing facilities and minor changes to those facilities as necessary to respond to periodic damages from natural events such as earthquakes and severe weather. This could result in long-term negligible to minor adverse impacts to geologic resources and soils.

Routine maintenance and park operations would have a negligible impact on surficial geologic resources because the facilities would generally remain in the same locations. Some additional localized short-term negligible impacts to geologic resources and soils may occur from restoration and fencing activities, with long-term moderate beneficial impacts from the restoration and protection of geologic resources and soils from nonnative invasive species.

Visitor use of the park would likely lead to further social trail development in certain areas. Expansion of social trails would cause negligible to minor adverse impacts to soils. Unintentional and/or incidental disturbance of geologic features from off-trail hiking, particularly to view volcanic landforms and products would cause negligible to moderate damage to geologic resources and soils. Intentional removal of geologic features or specimens could adversely impact the geological story of that area. Parking in non-designated areas would impact soils and potentially volcanic landforms or products, resulting in negligible to minor impacts.

CUMULATIVE IMPACTS

A variety of past, present, and reasonably foreseeable actions have affected and will continue to affect geologic resources and soils in Hawai‘i Volcanoes National Park. The soils and geologic resources of Hawai‘i Volcanoes National Park have been variously modified over the past century by human activities such as highway construction and construction of various facilities within the park. In more recent times, best management practices and mitigations have been implemented to minimize impacts to resources, resulting in negligible to moderate adverse impacts, depending on the project scope and location. The implementation of the various plans and projects, such as the Fire Management Plan and the Crater Rim Drive Rehabilitation Environmental Assessment has had and will continue to have negligible to moderate adverse impacts on soils and geologic resources, but also long-term beneficial impacts such as through closure of unauthorized turnouts during the Crater Rim Drive rehabilitation.

CONCLUSION

The no-action alternative would result in long-term negligible to moderate adverse impacts to geologic resources and soils locally within the park, primarily from the maintenance of the existing infrastructure of roads, trails, campgrounds, and facilities, as well as from visitor use in areas without formal trails and turnouts. Cumulative impacts would remain negligible to moderate and long-

term. Beneficial impacts would be long-term and be minor to moderate in intensity from restoration activities.

ALTERNATIVE 2 (PREFERRED)— Under the preferred alternative, there would be some new facilities, such as education pavilions in various locations throughout the park, campgrounds and picnic areas at Kahuku, etc., as well as expansion of parking in some areas and formalizing roadside turnouts in other areas. These changes would have localized but moderate adverse impacts to geologic resources. There would also be impacts to geologic resources from the routine maintenance of existing facilities and minor changes to those facilities as necessary to respond to periodic damages from natural events such as earthquakes and severe weather. This could result in long-term negligible to minor adverse impacts to geologic resources and soils, as well as long-term beneficial impacts to geological resources due to the reduction of unauthorized parking by improving and expanding formalized areas in strategic locations. Various best management practices would be employed to minimize soil erosion during construction and maintenance. New or expanded facilities would be sited when possible in areas that have been previously disturbed and/or are not located near geologically unstable areas.

New trails would be constructed in a few locations, such as connector trails and the shared trail between Kīlauea Visitor Center and Jaggar Museum; however, most of the new trails would be following historic routes or existing unpaved roads. The increase in trail connections and loop trails would reduce further social trail development in those areas which will be beneficial for geologic resources.

Routine maintenance and park operations would have a negligible impact on surficial geologic resources. Some additional localized short-term negligible adverse impacts to geologic resources and soils may occur from restoration and fencing activities, however there would be long-term beneficial impacts from the restoration and protection of geologic resources and soils from nonnative invasive species.

The proposed boundary modifications could have beneficial and adverse impacts on geologic resources and soils, depending on level of development and use that is determined during future planning, as well as potential restoration activities that could occur. Any proposed uses and development would need to consider mitigations to ensure geologic resources and soils are protected, to the extent feasible.

CUMULATIVE IMPACTS

The cumulative impacts would be the same as those identified for the no-action alternative.

CONCLUSION

The preferred alternative would result in long-term minor to moderate adverse impacts to geologic resources and soils locally within the park, primarily from the new facilities and trails in some areas. Cumulative impacts would remain negligible to moderate and long-term. Beneficial impacts from restoration activities, as well as from management of visitor traffic through enhanced parking and trails, would be long-term and minor to moderate in intensity.

ALTERNATIVE 3— The impacts from Alternative 3 would be similar to those described for the preferred alternative with the following exceptions.

Alternative 3 would not expand parking areas and would develop less new trails and trail connections. In addition, turnouts would be formalized on Mauna Loa and Hilina Pali Roads, but not on Chain of Craters Road; therefore, the impacts would be slightly less than Alternative 2 from disturbance related to development, but would be slightly higher due to disturbance from visitors where turnouts and trail connections are not created.

CUMULATIVE IMPACTS

The cumulative impacts would be the same as those identified for the no-action alternative.

CONCLUSION

Alternative 3 would result in long-term negligible to moderate adverse impacts to geologic resources and soils locally within the park, primarily from the new facilities and trails in some areas, but the impacts would

be less than under the preferred alternative due to reduced facilities, infrastructure, and trails. Cumulative impacts would remain negligible to moderate and long term. Adverse impacts to soils and geologic resources from the general management plan would be short and long term and range from negligible to moderate in intensity. Beneficial impacts from restoration activities, as well as from management of visitor traffic through increased turnouts and some new trails/trail connections, would be long-term and minor to moderate in intensity.

VEGETATION

The area of consideration for this topic is Hawai'i Volcanoes National Park. Available information on vegetation in Hawai'i Volcanoes National Park was compiled. Potential impacts from management actions are based on professional judgment and experience with similar actions. The thresholds of change for the intensity of an impact are as follows.

> **Negligible:** The impact of vegetation (individuals or communities) would not be measurable. The abundance or distribution of individuals would not be affected or would be slightly affected. Ecological processes and biological productivity would not be affected.
>
> **Minor:** An action would not necessarily decrease or increase an area's overall biological productivity. An action would affect the abundance or distribution of individuals in a localized area but would not affect the viability of local or regional populations or communities.
>
> **Moderate:** An action would result in a change in overall biological productivity in a small area. An action would affect a local population sufficiently to cause a change in abundance or distribution, but it would not affect the viability of the regional population or communities. Changes to ecological processes would be of limited extent.
>
> **Major:** An action would result in a change in overall biological productivity in a relatively large area. An action would affect a regional or local population of a species sufficiently to cause a change in abundance or in distribution to the extent that the population or communities would not be likely to return to its/their formal level (adverse), or would return to a sustainable level (beneficial). Key ecological processes would be altered.

ALTERNATIVE 1 (NO ACTION)— Impacts to vegetation from continued current management would result from management actions that directly or indirectly disturb vegetation communities. These management actions would generally include maintenance of roads, trails, campgrounds, vegetation management such as invasive plant management, site rehabilitation/restoration, fencing, and wildland fire management.

Adverse impacts to vegetation would vary according to location and activity, with minor impacts expected in the visitor use and park support zones with concentrated development and human use, particularly the visitor use zone. Negligible to minor adverse impacts to vegetation would be expected in the less developed areas of the park, such as the transitional/semi-primitive zone, as well as the wild/primitive zone because management actions would be limited to trail and backcountry facility maintenance, and fence installation and maintenance.

Human impacts from recreation and visitor use of these areas would continue to be correlated most closely with the quantity and intensity of recreation and visitor use of a given area. Adverse impacts from visitor use would primarily include social trail development, trampling, and soil compaction, and inadvertent introduction of weeds.

New facilities and infrastructure changes would be limited and focused on increasing visitor services, interpretation, and education over time at Kahuku and Kealakomowaena under the no-action alternative. These

changes would be primarily in previously disturbed areas and surveys would be completed to minimize impacts on native vegetation so the impact would be negligible to minor, long-term, and adverse.

Beneficial impacts from restoration activities would include native revegetation projects, planting of locally extirpated species, monitoring and control of detrimental nonnative plants and animals. Impacts to vegetation from these activities would generally range from minor to major and long-term, depending on location and type of restoration.

Impacts to vegetation from alternative 1 would generally range from negligible to moderate, long-term and adverse with long-term minor to moderate, beneficial impacts from restoration activities.

CUMULATIVE IMPACTS

Vegetation within Hawai'i Volcanoes National Park has been cumulatively and adversely affected from many different types of human activity, such as development over time of visitor services and park operations facilities and infrastructure, and from the introduction of nonnative species. Vegetation has also been adversely affected from sources outside the park through introduction of nonnative plants and animals that then become established in the park. Development adjacent to the park can impact native vegetation through loss of native seed sources and also by an increased risk of colonization by invasive nonnative plants. Any development would involve soil disturbance and movement of vehicles, materials, and people. Thus the conditions for establishment of nonnative plants would be created, and the seeds or plant fragments of nonnative plants would be likely to be transported into the park from adjacent lands. Many invasive nonnative plants have been or continue to be popular ornamental plants which results in a greater chance of spread of invasive nonnative plant species into the park.

Implementation of management plans by adjoining public landowners will result in long-term beneficial impacts to vegetation. Partnerships with groups such as Three Mountain Alliance has resulted in long-term moderate to major beneficial impacts to vegetation through invasive nonnative plant management, fencing to exclude nonnative ungulates, and planting native species.

Removal of nonnative species and restoration of native plant species and communities would help to counteract the potential pressures of global climate change on vegetation. Changes in temperature and moisture regimes may result in dramatic shifts in habitat range for a number of native plant and animal species and vegetation types and the movement of invasive species. Management of nonnative species would remove a key stressor on native ecosystems, thereby increasing the capacity of native species to adapt to changes in climate. Restoration of fragmented communities would restore habitat continuity and allow for the local migration of species in response to climate change.

The overall effect of the cumulative actions would be moderate and adverse from impacts related to development adjacent to park and potential spread of invasive nonnative species, and will have moderate to major beneficial impacts from the implementation of management plans and on the ground management through partnerships.

CONCLUSION

Alternative 1 would continue to result in negligible to moderate direct and indirect impacts to vegetation, primarily from maintenance-related activities associated with roads, trails, and campgrounds and impacts from visitor use. Beneficial impacts would continue from restoration activities and would be minor to major, depending on location and action.

ALTERNATIVE 2 (PREFERRED)— Activities such as the maintenance of roads, trails, and campgrounds, vegetation management such as invasive plant management, site rehabilitation/restoration, fencing, and wildland fire management would continue to impact vegetation under the preferred

alternative. Adverse impacts to vegetation would vary according to location and activity, with minor impacts expected in the visitor use and park support zones with concentrated development and human use, particularly the visitor use zone. Negligible to minor impacts to vegetation would be expected in the less developed areas of the park, such as the transitional/semi-primitive zone, as well as the wild/primitive zone because management actions would be limited to trail and backcountry facility maintenance, and fence installation and maintenance.

Human impacts from recreation and visitor use of these areas would continue to be correlated most closely with the quantity and intensity of recreation and visitor use of a given area. Adverse impacts from visitor use would primarily include social trail development, trampling, and soil compaction, and inadvertent introduction of weeds. Due to management strategies proposed in the preferred alternative, it is anticipated that these impacts would be less than in the no-action alternative.

New facilities would be developed in the preferred alternative, particularly at Kahuku Unit (campgrounds, picnic areas, trails, etc.), but also to a lesser extent in the rest of the park (education pavilions, trails, expanded parking, etc.). Most of the new development would be primarily in previously disturbed areas and surveys would be completed to minimize impacts on native vegetation so the impact in those areas would be negligible to moderate, long-term, and adverse, depending on location and type of improvements. New development in previously undisturbed areas could have a greater impact on native vegetation, depending on location and species present. Site-specific planning and compliance would need to be completed to ensure the impacts are minimized, particularly with the new development and additional recreational access (e.g., equestrian) at the Kahuku Unit.

Beneficial impacts from restoration activities would include native revegetation projects, planting of locally extirpated species, monitoring and control of detrimental nonnative plants and animals. Impacts to vegetation from these activities would generally range from minor to major and long-term, depending on location and type of restoration.

The proposed boundary modifications could have beneficial and adverse impacts on vegetation, depending on level of development and use that is determined during future planning, as well as potential restoration activities that could occur. Any proposed uses and development would need to incorporate best management practices and mitigations to ensure native vegetation is protected and invasive species are prevented, to the extent feasible.

Impacts to vegetation from the preferred alternative would generally range from negligible to moderate, long-term and adverse, depending on location and action, with long-term minor to moderate, beneficial impacts from restoration activities. Future site-specific planning and compliance would be necessary to minimize impacts from development in some areas, such as the proposed trail from KVC to Jaggar.

CUMULATIVE IMPACTS

The cumulative impacts would be the same as those identified for the no-action alternative.

CONCLUSION

The preferred alternative would result in negligible to moderate direct and indirect impacts to vegetation, primarily from development of new facilities and maintenance-related activities associated with roads, trails, and campgrounds and visitor use. Beneficial impacts would continue from restoration activities would be minor to major, depending on location and action.

ALTERNATIVE 3— The impacts from Alternative 3 would be similar to those described for the preferred alternative with the following exceptions.

Under Alternative 3, parking at Jaggar Museum would be expanded for increased

shuttle operations, which may result in greater adverse impacts due to sensitive vegetation found in the area, depending on where the expansion occurs. The proposed trail at ʻŌlaʻa small tract would be a flagged route in Alternative 3, which has the potential to result in greater adverse impacts to vegetation due to trampling and social trails. The proposed conversion of Volcano House to energy independence may have impacts on vegetation if, for example, the photovoltaic system needs to be installed off-site. Site-specific planning and mitigations would need to be conducted to ensure potential impacts are minimized.

Alternative 3 has less new facility and trails development as compared to the preferred alternative which would result in decrease in adverse impact to vegetation; however some areas may receive more impact to vegetation from visitor use because of the decrease in visitor facilities and trails, therefore the overall impact level is similar to the preferred alternative.

Overall, the impacts to vegetation from Alternative 3 would generally range from negligible to moderate, long-term and adverse with long-term minor to moderate, beneficial impacts from restoration activities. Future site-specific planning and compliance would be necessary to minimize impacts from development in some areas, such as the proposed expansion of parking at Jaggar Museum.

CUMULATIVE IMPACTS

The cumulative impacts would be the same as those identified for the no-action alternative.

CONCLUSION

Alternative 3 would result in negligible to moderate direct and indirect adverse impacts to vegetation, primarily from development of new facilities and maintenance-related activities associated with roads, trails, and campgrounds and visitor use. Beneficial impacts would continue from restoration activities and would be minor to major, depending on location and action.

NATIVE WILDLIFE AND NATIVE WILDLIFE HABITAT

The area of consideration for this topic is Hawaiʻi Volcanoes National Park. This impact topic addresses only native wildlife and native wildlife habitat. The impacts of nonnative wildlife on native wildlife species and their habitat has been addressed thoroughly by other management and planning documents, such as the Final Plan/EIS for Restoring and Protecting Native Ecosystems by Managing Nonnative Ungulates (Park 2013b), so is not addressed in depth in this document.

Impacts on native wildlife are closely related to the impacts on habitat. The evaluation considered whether actions would be likely to displace some or all individuals of a species in the park or would result in loss or creation of habitat conditions needed for the viability of local or regional populations. Available information on wildlife and wildlife populations was considered. Predictions about short- and long-term impacts were based on previous studies of impacts to natural resources and recent monitoring data from the park. The thresholds of change for the intensity of an impact are as follows.

Negligible: Effects on wildlife would be at or below the level of detection, would be short-term, and the changes would be so slight that they would not be of any measurable or perceptible consequence to the species' population.

Minor: Effects on wildlife would be detectable, but localized, small, and of little consequence to the species' population. Mitigation measures, if needed to offset adverse effects, would be simple and successful.

Moderate: Effects on wildlife would be readily detectable but localized, with consequences at the population level. Mitigating measures, if needed to offset adverse effects, would be extensive and likely successful.

Major: Effects on wildlife would be obvious and would result in substantial consequences to the wildlife populations at the regional level. The change would result in a severely adverse or major beneficial impact, and possible permanent consequence on the species. Extensive mitigating measures would be needed to offset any adverse effects and their success would not be guaranteed.

ALTERNATIVE 1 (NO ACTION)— Few of the actions of implementing the no-action alternative would further affect the park's wildlife populations or habitats. Wildlife populations and habitat already have been altered by development and nonnative species, and wildlife habits and movement may be altered by visitors and employees particularly in high visitor use areas. The use of the park by visitors is concentrated mostly in developed areas and in areas near lava activity and in some areas is not well managed, which has a negligible to minor impact on native wildlife and wildlife habitat. The presence of hikers and park staff in the wilderness threshold and backcountry zones would continue to disturb some sensitive wildlife occasionally, but this disturbance would be temporary and would not affect the health or viability of the park's wildlife populations. The primary impact to wildlife would be the continued fragmentation of habitat within and outside the park boundaries.

Continued restoration activities, including revegetation of degraded wildlife habitat, monitoring and control of detrimental nonnative plants and animals, light- and soundscape management, as well as specific actions for population recovery, would have short-term negligible to minor adverse impacts due to disruption of wildlife, but long-term moderate to major beneficial impacts on wildlife populations and habitats.

CUMULATIVE IMPACTS

Native wildlife and wildlife habitat within Hawai'i Volcanoes National Park has been cumulatively and adversely affected from many different types of human activity, such as development over time of visitor services and park operations facilities and infrastructure, and from the introduction and/or colonization of nonnative species.

Development surrounding the park would continue to alter the types and distribution of habitat available to wildlife. The impacts from development can be due to direct impacts causing loss or change of habitat, impacts through fragmentation of habitat, and from the introduction of nonnative plant and animal species that escape cultivation and colonize the park. These impacts would cause long-term adverse moderate impacts to the area's native wildlife and wildlife habitat.

Implementation of management plans by adjoining public landowners would result in long-term beneficial impacts to native wildlife and wildlife habitat. Partnerships with groups such as Three Mountain Alliance has resulted in long-term moderate to major beneficial impacts to native wildlife and wildlife habitat through invasive nonnative plant and animal management, and planting native vegetation to restore wildlife habitat.

Removal of nonnative species and restoration of native species would help to counteract the potential pressures of global climate change on native wildlife and wildlife habitat. Changes in temperature and moisture regimes may result in dramatic shifts in habitat range for a number of native plant and animal species and vegetation types and the movement of invasive species. Management of nonnative species would remove a key stressor on native ecosystems, thereby increasing the capacity of native species to adapt to changes in climate. Restoration of fragmented communities would restore habitat continuity and allow for the local migration of species in response to climate change.

CONCLUSION

The no-action alternative would have negligible to minor long-term adverse effects on wildlife and wildlife habitat near and within developed areas, including roads and trails. Moderate to major long-term beneficial impacts would result from mitigation measures and restoration activities. Moderate

long-term adverse cumulative effects would be expected on the area's wildlife and wildlife habitat from development and nonnative species colonizing from nearby developed areas, with beneficial impacts from restoration activities by neighboring public landowners. The portion of this impact from Alternative 1 would be relatively small.

ALTERNATIVE 2 (PREFERRED)— A few of the actions implementing the preferred alternative may affect the park's wildlife populations or habitats. Of the actions proposed, the actions most likely to impact native wildlife or wildlife habitat are the new trails proposed at the Kīlauea Unit, trail connections, and parking lot expansions, in addition to the proposed development at the Kahuku Unit. These actions would have localized negligible to moderate impacts on native wildlife or wildlife habitat with appropriate site-specific planning and mitigations to minimize potential impacts.

Improved management of visitor traffic and impacts, particularly in high visitor use areas such as Thurston Lava Tube and the 1974 flows by Lua Manu Crater, would have minor beneficial impacts to native wildlife and wildlife habitat.

Wildlife populations and habitat have already been altered by development and nonnative species, and wildlife habits and movement may be altered in the future by visitors and employees, particularly in high visitor use areas. The use of the park by visitors is concentrated mostly in developed areas and in areas near lava activity. The presence of hikers and park staff would continue to disturb some sensitive wildlife occasionally, but this disturbance would be temporary and would not affect the health or viability of the park's native wildlife populations. The primary impact to wildlife would be the continued fragmentation of habitat within and outside the park boundaries.

Continued restoration activities, including revegetation of degraded wildlife habitat, monitoring and control of detrimental nonnative plants and animals, light- and soundscape management, as well as specific actions for population recovery, would have short-term negligible to minor adverse impacts due to disruption of wildlife, but long-term moderate to major beneficial impacts on wildlife populations and habitats.

The proposed boundary modifications could have beneficial and adverse impacts on native wildlife and wildlife habitat, depending on level of development and use that is determined during future planning, as well as potential restoration activities that could occur. Any proposed uses and development would need to incorporate best management practices and mitigations to ensure native wildlife and wildlife habitat is protected and invasive species are prevented, to the extent feasible.

CUMULATIVE IMPACTS

The cumulative impacts would be the same as those identified for the no-action alternative.

CONCLUSION

The preferred alternative would have negligible to moderate long-term adverse effects on wildlife and wildlife habitat near and within developed areas, including roads and trails, with proper planning and mitigations. Minor to major long-term beneficial impacts would result from mitigation measures and restoration activities. Moderate long-term adverse cumulative effects would be expected on the area's wildlife and wildlife habitat from development and nonnative species colonizing from nearby developed areas, with long-term moderate to major beneficial impacts from restoration activities by neighboring public landowners. The portion of this impact from Alternative 2 would be relatively small

ALTERNATIVE 3 — The impacts from Alternative 3 would be similar to those described for the preferred alternative with the following exceptions.

The proposed conversion of Volcano House to energy independence may have adverse impacts on native wildlife and wildlife habitat if, for example, the photovoltaic system needs to be installed off-site. Site-specific planning

and mitigations would need to be conducted to ensure potential impacts are minimized.

The proposed flagged route-style trail for ʻŌlaʻa small tract may have greater impacts on native wildlife and wildlife habitat due to the greater potential for trampling and social trails, which would disturb the wildlife and impact the wildlife habitat.

Alternative 3 has less new facility and trails development as compared to the preferred alternative which would result in decrease in adverse impact to wildlife and wildlife habitat; however some areas may receive more impact to wildlife and wildlife habitat from visitor use because of the decrease in visitor facilities and trails. Therefore the overall impact level is similar to the preferred alternative.

CUMULATIVE IMPACTS

The cumulative impacts would be the same as those identified for the no-action alternative.

CONCLUSION

Alternative 3 would have negligible to moderate long-term adverse effects on wildlife and wildlife habitat near and within developed areas, including roads and trails, with proper planning and mitigations. Minor to major long-term beneficial impacts would result from mitigation measures and restoration activities. Moderate long-term adverse cumulative effects would be expected on the area's wildlife and wildlife habitat from development and nonnative species colonizing from nearby developed areas, with long-term moderate to major beneficial impacts from restoration activities by neighboring public landowners. The portion of this impact from Alternative 3 would be relatively small.

SPECIAL STATUS SPECIES

The area of consideration for this topic is suitable and known occupied habitat in Hawaiʻi Volcanoes National Park. Information on threatened, endangered, candidate species, and species of general concern was gathered from responsible agencies, research, and specialists. Known locations of habitat associated with threatened, endangered, candidate species, and species of special concern were compared with locations of development and facilities, and modifications of existing facilities. In accordance with standard terminology used to describe effects on threatened and endangered species under the federal Endangered Species Act (USFWS and NMFS 1998), potential effects on special status species are categorized as follows:

> **No effect:** The proposed actions would not affect special status species or critical habitat.
>
> **May affect / not likely to adversely affect:** The effects on special status species would be extremely unlikely to occur and could not be meaningfully measured, detected, or evaluated or they would be completely beneficial.
>
> **May affect / likely to adversely affect:** Any adverse effect to listed species that might occur as a direct or indirect result of proposed actions, and the effect would not be discountable.
>
> **Is likely to jeopardize proposed species / adversely modify proposed critical habitat:** The appropriate conclusion when the National Park Service or the USFWS identifies situations in which an action could jeopardize the continued existence of a proposed species or adversely modify critical habitat to a species within or outside park boundaries.

The thresholds of change for the intensity of an impact are defined as follows.

> **Negligible:** The action would have no measurable effect to a listed species, suitable, potential, or critical habitat, resulting in a no effect determination.
>
> **Minor:** The effects of the alternative would be discountable (extremely unlikely to occur), insignificant (not able to be meaningfully measured, detected, or evaluated), or completely beneficial. Any change would be small

and localized and of little consequence, and result in a "not likely to adversely affect" determination.

Moderate: An action that would result in some change to a population or individuals of a species or designated critical habitat. The change would be measurable and of consequence but would most likely result in a "not likely to adversely affect" determination. Insignificant effects would not result in take.

Major: An action that would result in a noticeable change to a population or individuals of a species or designated critical habitat. Any adverse effect to the species that may occur as a direct or indirect result of the alternative and the effect is not discountable, insignificant, or completely beneficial. Incidental take is anticipated to occur as a result of the action. The change would result in a "likely to adversely affect" determination.

ALTERNATIVE 1 (NO ACTION)—The no-action alternative would continue the current management of the park's special status species, such as monitoring, mitigating disturbance from visitors and park operations, and cooperating with various agencies and organizations to improve recovery efforts. The beneficial impacts from the protection of sensitive species and their habitat within the park would continue under the no-action alternative, primarily through invasive species management, revegetation of altered plant communities, and individual species recovery actions.

Impacts of ongoing park operations and recreational use would continue to be monitored and appropriate mitigation measures would be implemented along with continued restoration activities. Mitigation measures could include items such as, minimizing incompatible human activities near sensitive wildlife, rerouting trails or restoring social paths to restore and protect plant communities and sensitive species, or conforming to Dark Sky Policy to protect nocturnal wildlife. To mitigate potential impacts, the National Park Service would continue to conduct plant and wildlife surveys in advance of taking management actions. Should species be present, the timing and location of management activities would be adjusted to eliminate or minimize disturbance. Impacts from the no-action alternative would be negligible to minor and adverse.

Seasonal closure of certain areas would also be implemented as necessary to prevent disturbance. For example, to prevent disturbance to breeding nēnē, Devastation or Pu'u Pua'i parking areas may be closed, or sections of beach at 'Āpua, Keauhou, and Halapē may be closed during hawksbill turtle nesting season.

Special status species within Hawai'i Volcanoes National Park would continue to benefit from continued restoration of habitat through fencing and removal of detrimental nonnative plants and animals, ongoing recovery actions and by virtue of the area's protected status as a unit of the National Park Service, including the large quantity of relatively undisturbed habitat within and surrounding the unit. These beneficial impacts to special status species and their habitats would be moderate to major and long-term.

The no-action alternative "may affect, but is not likely to adversely affect" the park's 60 federally listed plant and animal species. This "may affect, but is not likely to adversely affect" determination is based upon the conclusion that effects would be limited to inadvertent, short-term, and insignificant disturbance to listed species, the wide variety of undisturbed habitats available throughout Hawai'i Volcanoes National Park, and no anticipated changes in current management and operations.

CUMULATIVE IMPACTS

Development surrounding the park would continue to alter the types and distribution of habitat available to special status species. The impacts from development can be due to direct impacts causing loss or change of habitat, impacts through fragmentation

of habitat, and from the introduction of nonnative plant and animal species that escape cultivation and colonize the park. These impacts would cause long-term adverse moderate impacts to special status species, but are occurring outside the park.

Implementation of management plans, including USFWS Recovery Plans, by adjoining public landowners will result in long-term moderate to major beneficial impacts to special status species. Partnerships with groups such as Three Mountain Alliance has resulted in long-term moderate to major beneficial impacts to special status species through invasive nonnative plant and animal management and planting native vegetation to restore habitat.

Removal of nonnative species and restoration of native species would help to counteract the potential pressures of global climate change on special status species. Changes in temperature and moisture regimes may result in dramatic shifts in habitat range for a number of native plant and animal species, as well as vegetation types and the movement of invasive species. Management of nonnative species would remove a key stressor on native ecosystems, thereby increasing the capacity of native species to adapt to changes in climate. Restoration of fragmented communities would restore habitat continuity and allow for the local migration of species in response to climate change.

CONCLUSION

The continuing actions under the no-action alternative would have negligible to minor adverse impacts on special status species, which is equivalent to a determination of "may affect, but are not likely to adversely affect". There would also be long-term moderate to major beneficial impacts to special status species from activities such as restoration of habitat and individuals species recovery actions. Cumulative effects would be long-term moderate adverse and long-term moderate to major beneficial. The portion of this impact from Alternative 1 would be relatively small.

ALTERNATIVE 2 (PREFERRED)—Under the preferred alternative, the park would continue to manage the park's special status species, including monitoring, mitigating disturbance from visitors and park operations, and cooperating with various agencies and organizations to improve recovery efforts. The beneficial impacts from the protection of sensitive species and their habitat within the park would continue under the preferred alternative, primarily through continued invasive species management, revegetation of altered plant communities, and individual species actions.

Impacts of ongoing park operations and recreational use would continue to be monitored and appropriate mitigation measures would be implemented along with continued restoration activities. Mitigation measures could include items such as, minimizing incompatible human activities near sensitive wildlife, rerouting trails or restoring social paths to restore and protect plant communities and sensitive species, or conforming to Dark Sky Policy to protect nocturnal wildlife. To mitigate potential impacts, the National Park Service would continue to conduct plant and wildlife surveys in advance of taking management actions. Should species be present, the timing and location of management activities would be adjusted to eliminate or minimize disturbance. The impacts of the ongoing park operations and recreational use would be negligible to minor and adverse.

Seasonal closure of certain areas would also be implemented as necessary to prevent disturbance. For example, to prevent disturbance to breeding nēnē, Devastation or Pu'u Pua'i parking areas may be closed, or sections of beach at 'Āpua, Keauhou, and Halapē may be closed during hawksbill turtle nesting season.

Special status species within Hawai'i Volcanoes National Park would continue to benefit from continued restoration of habitat, management of detrimental nonnative species, and by virtue of the area's protected status as

a unit of the National Park Service, including the large quantity of relatively undisturbed habitat within and surrounding the unit. These beneficial impacts to special status species and their habitats would be moderate to major and long term.

New facility proposals, including trails, are conceptual in nature and illustrate the desired condition for visitor services and facilities in particular areas. New construction described in the preferred alternative would require site-specific planning, siting, and design, including further environmental analysis, to ensure any potential impacts to listed species are minimized, such as the shared trail between Kīlauea Visitor Center and Jaggar Museum, the boardwalk in ʻŌlaʻa, or visitor development in the Kahuku Unit.

The proposed boundary modifications could have beneficial and adverse impacts on special status species and their habitat, depending on level of development and use that is determined during future planning, as well as potential restoration activities that could occur. Any proposed uses and development would need to consider mitigations to ensure special status species are protected and invasive species are prevented, to the extent feasible.

If during future planning it was determined that impacts cannot be kept to negligible to minor, the National Park Service would consult with the USFWS to ensure that potential impacts were identified, avoided where feasible, and mitigation measures developed.

Enhanced management of nēnē and associated habitat at ʻĀinahou would have short-term and long-term moderate beneficial impacts on the species. The boardwalk at ʻŌlaʻa small tract would have long-term beneficial impacts for listed species due to visitors staying on the trail, experiencing the mature rain forest, and the potential for enhanced protection and support as a result of the visitors' experience.

CUMULATIVE IMPACTS

The cumulative impacts would be the same as those identified for the no-action alternative.

CONCLUSION

The preferred alternative "may affect, but is not likely to adversely affect" the park's 60 federally listed plant and animal species. This "may affect, but is not likely to adversely affect" determination is based upon the conclusion that effects would be limited to inadvertent, short-term, and insignificant disturbance to listed species, the wide variety of undisturbed habitats available throughout Hawaiʻi Volcanoes National Park, and the changes proposed for management and operations are designed to better protect resources. There would also be long-term moderate to major beneficial impacts to special status species from activities such as restoration and nonnative species control. Site-specific planning would be conducted for projects to ensure that the adverse impacts of proposed projects would be negligible to minor.

ALTERNATIVE 3— The impacts from Alternative 3 would be similar to those described for the preferred alternative with the following exceptions.
If an off-site location is needed to make the Volcano House energy independent, the site selected would have to be a location that would not adversely affect special status species. Certain actions, such as the expansion of the parking at Jaggar Museum, picnic opportunities at the end of Chain of Craters Road, flagged route-style trail at ʻŌlaʻa, and visitor development at the Kahuku Unit, may need to include mitigations and best management practices to ensure the actions would not impact special status species. Actions in alternative 3 would require site-specific planning, siting, and design, including further environmental analysis, to ensure any potential impacts to listed species are minimized. If during future planning it was determined that impacts cannot be minimized, the National Park Service would consult with the USFWS to ensure that potential impacts were identified,

avoided where feasible, and mitigation measures developed.

CUMULATIVE IMPACTS

The cumulative impacts would be the same as those identified for the no-action alternative.

CONCLUSION

Alternative 3 "may affect, but is not likely to adversely affect" the park's 60 federally listed plant and animal species. This "may affect, but is not likely to adversely affect" determination is based upon the conclusion that effects would be limited to inadvertent, short-term, and insignificant disturbance to listed species, the wide variety of undisturbed habitats available throughout Hawai'i Volcanoes National Park, and the changes proposed for management and operations are designed to better protect resources. Site-specific planning would be conducted for projects to ensure that the adverse impacts of proposed projects would be negligible to minor.

WILDERNESS

Working from definitions included in the Wilderness Act, and included in NPS *Management Policies 2006*, and the tradition of wilderness preservation and management at Hawai'i Volcanoes National Park, the following wilderness characteristics have been identified for consideration in this analysis.

- The earth and its community of life are untrammeled by humans, where humans are visitors and do not remain.
- The area is undeveloped and retains its primeval character and influence without permanent improvements or human habitation.
- The area generally appears to have been affected primarily by the forces of nature, with the imprint of humans' work substantially unnoticeable.
- The area is protected and managed so as to preserve its natural conditions.
- The area offers outstanding opportunities for solitude or a primitive and unconfined type of recreation.

Impacts on natural and cultural resources, visitor access, soundscapes and the acoustic environment, night sky, and other resources are evaluated elsewhere in the environmental consequences section. The analysis for this topic focuses on wilderness character and wilderness experience, which are integrally related because much of wilderness character can only be subjectively determined by the visitor's experience (for example, solitude or freedom of movement).

The thresholds of change for the intensity of an impact are as follows:

Negligible: Impacts would not be detectable to most wilderness visitors and would have no discernible effect on wilderness character or experience.

Minor: Impacts would be slightly detectable to some wilderness visitors but would not be expected to have an overall effect on wilderness character or experience.

Moderate: Impacts would be clearly detectable by many wilderness visitors and could have an appreciable effect on wilderness character or experience.

Major: Impacts would have a substantial and noticeable effect for most wilderness visitors on wilderness character or experience and could permanently alter various aspects of the visitor experience.

ALTERNATIVE 1 (NO ACTION)—

Under Alternative 1, the park's designated wilderness would continue to be managed as it is now. In accordance with NPS *Management Policies 2006*, eligible lands in the park would continue to be managed to preserve its wilderness character and maintain its potential eligibility for wilderness designation, however eligible lands within the park would not be proposed for designation. The minimum requirement analysis would continue to be used to determine if, when, and how actions that might impact wilderness character could be implemented. The backcountry permit system would remain

in place and would continue to be used to manage overnight use. Opportunities for visitors to experience wilderness character would continue to be abundant.

Current management actions that manipulate wilderness include removal of invasive plants and animals, restoration of native species, and fire suppression. Since these actions would only be slightly detectable (after the action is taken) to some visitors and would not have an overall effect on wilderness values or recreational opportunities, the impact of these actions to the untrammeled character of wilderness would be adverse and minor.

There are a number of natural resource issues that currently have an impact on the natural quality of wilderness character. These issues include invasive species issues, habitat loss, and climate change impacts. Although most of these impacts would only be slightly detectable to most visitors, the potential for landscape-scale changes could occur, especially as a result of vegetation changes due to invasive species, wildfires, and climate change. However, through restoration of native species and control of nonnative species, there would be long-term beneficial effects to the natural quality of wilderness. Therefore impacts to the natural quality of wilderness character would be short-term minor to moderate adverse (unintentional impacts to plants or animals during restoration or invasive control activities) and long-term beneficial and minor to major due to restoration activities.

Infrastructure and facilities within wilderness include the historic shelters and cabins on the coast and on Mauna Loa, volcanic and seismic monitoring equipment at locations throughout the park, and the internal fencing required to protect areas from nonnative ungulates. Motorized equipment, including helicopters and chainsaws, is used by park employees for emergency activities and non-emergency administrative purposes throughout the wilderness. Examples of emergency operations include volcanic and seismic activity response, fire suppression, and search and rescue operations while examples of non-emergency operations include trail maintenance, resource management projects, volcanic and seismic monitoring, and some fire management activities. The non-emergency work that uses motorized equipment is evaluated using the minimum requirement analysis, and, when appropriate, found to be the minimum tool necessary to administer the area. However, these features impact the undeveloped quality of wilderness as well as opportunities for solitude. Although trails and other developments would be clearly detectable by most visitors, the use of motorized equipment would be more locally noticeable and of a short-term duration. Therefore, adverse impacts to the undeveloped quality of wilderness character would range from minor to moderate and would be both short-term (for activities) and long term (for infrastructure and facilities).

Opportunities for solitude become more abundant with distance from the roads, as the majority of visitors are here for a short duration and do not venture far from the roads and developed areas. For visitor safety and resource reasons, permits are required for all backcountry camping, however campers are not required to stay in a designated campground, which provides opportunities for unconfined recreation. Campgrounds and cabins have use limits, but there are no restrictions on where campers stay within those areas, which may provide campers more opportunity for achieving solitude. As described above, the occasional administrative use of helicopters and motorized equipment would also impact the opportunities for solitude and primitive and unconfined recreation. Since these conditions would only be slightly detectable to some visitors and clearly detectable to others, adverse impacts on opportunities for solitude or primitive and unconfined recreation would range from minor to moderate.

CUMULATIVE IMPACTS

Development along the park boundary would be visible from eligible wilderness at Kahuku and would cause adverse impacts to the wilderness character. The wilderness units in the Kīlauea Unit of the park are

mostly adjacent to state owned lands, so are not likely to be developed for residential or commercial use, but some of these areas are subject to landscape manipulation for grazing and agricultural purposes. This landscape manipulation would be visible from the park's designated wilderness and would be an adverse impact to the natural and undeveloped character of the wilderness. The potential for landscape-scale changes, especially from invasive species, fire suppression, and climate change would continue to exist.

In some places in the wilderness, vehicles can be heard, such as the upper part of the Kaʻū Desert wilderness unit. This would have a minor to moderate adverse impact on wilderness character and experience.

Noise intrusions occur from aircraft throughout the wilderness and commercial air tour overflights would continue to have moderate to major impacts to the wilderness character in the park. The Air Tour Management Plan/EIS, when completed, will provide guidelines and mitigations to reduce the impacts to the wilderness character and experience in the park.

The cumulative impacts described would result in minor to major adverse impacts to the wilderness character and experience.

CONCLUSION

The no-action alternative would not change the current conditions related to wilderness character and experience. Adverse impacts would be short- and long-term and range from minor to moderate, resulting from natural resource issues, maintenance of infrastructure and facilities, and administrative aviation noise. Long-term minor to major beneficial impacts would result from restoration of native species and control of invasive species. Cumulative adverse impacts would range from minor to major, this alternative would not contribute significantly to those impacts.

ALTERNATIVE 2 (PREFERRED)—

Under the preferred alternative, the park's designated wilderness would continue to be managed as it is now. In addition, the portion of upper Kahuku that was determined eligible in June 2012 would be recommended for wilderness designation. The minimum requirement analysis would continue to be used to determine if, when, and how actions that might impact wilderness character could be implemented. The backcountry permit system would remain in place and would continue to be used to manage overnight use. Opportunities for visitors to experience wilderness character would be expanded under the preferred alternative with the opening of upper Kahuku to foot travel by visitors.

Current management actions that manipulate wilderness include removal of invasive plants and animals, restoration of native species, and fire suppression. Since these actions would only be slightly detectable (after the action is taken) to some visitors and would not have an overall effect on wilderness values or recreational opportunities, the impact of these actions to the untrammeled character of wilderness would be adverse and minor to moderate.

There are a number of natural resource issues that currently have an impact on the natural quality of wilderness character. These issues include invasive species issues, habitat loss, and climate change impacts. Although most of these impacts would only be slightly detectable to most visitors, the potential for landscape-scale changes could occur, especially as a result of vegetation changes due to invasive species, wildfires, and climate change. However, through restoration of native species and control of nonnative species, there would be long-term beneficial effects to the natural quality of wilderness. Therefore, impacts to the natural quality of wilderness character would be short-term minor to moderate adverse (unintentional impacts to plants or animals during restoration or invasive control activities) and long-term beneficial and minor to major due to restoration activities.

Infrastructure and facilities within wilderness include the historic shelters and cabins located

on the coast and on Mauna Loa, volcanic and seismic monitoring equipment at locations throughout the park, and the internal fencing required to protect areas from nonnative invasive animals. These would continue to be maintained under the preferred alternative. In addition, small primitive campgrounds would be considered for upper Kahuku, which may also include a small water catchment system to provide water in an otherwise waterless expanse. This would be highly beneficial for visitor use and experience of the area, but would be a moderate adverse impact to the undeveloped quality of wilderness character.

Motorized equipment, including helicopters and chainsaws, is used by park employees for emergency activities and non-emergency administrative purposes throughout the wilderness. Examples of emergency operations include volcanic and seismic activity response, wind damage, fire suppression, and search and rescue operations while examples of non-emergency operations include trail maintenance, resource management projects, volcanic and seismic monitoring, and some fire management activities. The non-emergency work that uses motorized equipment is evaluated using the minimum requirement analysis, and, when appropriate, found to be the minimum tool necessary to administer the area. However, these features impact the undeveloped quality of wilderness as well as opportunities for solitude. Although trails and other developments would be clearly detectable by most visitors, the use of motorized equipment would be more locally noticeable, and of a short-term duration. Therefore, adverse impacts to the undeveloped quality of wilderness character would range from minor to moderate and would be both short term (for activities) and long term (for infrastructure and facilities).

Opportunities for solitude become more abundant with distance from the roads, as the majority of visitors are here for a short duration and do not venture far from the roads and developed areas. Under the preferred alternative, there will be increased opportunities for solitude and primitive and unconfined recreation. Backcountry permits would still be required for all overnight use and for day use in some areas; however, visitors are not restricted to camping or hiking in specific areas which provides more opportunity for achieving solitude. As described above, the occasional administrative use of helicopters and motorized equipment would also impact the opportunities for solitude and primitive and unconfined recreation. Since these conditions would only be slightly detectable to some visitors and clearly detectable to others, adverse impacts on opportunities for solitude or primitive and unconfined recreation would range from minor to moderate.

The proposed boundary modifications could have beneficial impacts to the park's wilderness character and experience. One of the proposed parcels is designated wilderness already (ʻŌlaʻa). Another parcel is adjacent to the Kāʻu Desert wilderness unit (Great Crack) and was designated as potential wilderness in the 1978 wilderness legislation. Any lands acquired would be analyzed for their wilderness eligibility as required by NPS policy.

CUMULATIVE IMPACTS

The cumulative impacts would be the same as those identified for the no-action alternative.

CONCLUSION

This alternative would expand opportunities for visitors to experience wilderness character. Adverse impacts would be short- and long-term and range from minor to moderate, resulting from natural resource issues, maintenance of infrastructure and facilities, development of primitive campground(s) in upper Kahuku, and administrative aviation noise. Long-term minor to major beneficial impacts would result from restoration of native species and control of invasive species. Cumulative adverse impacts would range from minor to major, however, the preferred alternative would not contribute significantly to those impacts.

ALTERNATIVE 3— The impacts from Alternative 3 would be similar to those

described for the preferred alternative with the following exception. There would be no primitive campgrounds in upper Kahuku under Alternative 3, so there would be no additional impact to the undeveloped character. However, there could be additional impacts to the natural character due to more dispersed use over the landscape.

CUMULATIVE IMPACTS

The cumulative impacts would be the same as those identified for the no-action alternative.

CONCLUSION

Alternative 3 would expand opportunities for visitors to experience wilderness character. Adverse impacts would be short- and long-term and range from minor to moderate, resulting from natural resource issues, maintenance of infrastructure and facilities, and administrative aviation noise. Long-term minor to major beneficial impacts would result from restoration of native species and control of invasive species. Cumulative adverse impacts would range from minor to major, however, the preferred alternative would not contribute significantly to those impacts.

SOUNDSCAPES AND THE ACOUSTIC ENVIRONMENT

The area of consideration for this topic is Hawai'i Volcanoes National Park. Context, time, and intensity together determine the level of impact for an action or activity. Noise for a certain period and intensity would be a greater impact in a highly sensitive context, and a given intensity would be a greater impact if it occurred more often, or for longer duration. For example, in very low level ambient soundscapes, like the wilderness, noises can be much more audible, thereby having greater impact intensities. It is usually necessary to evaluate all three factors together to determine the level of noise impact.

> **Negligible:** Noise would rarely be greater than natural ambient sound levels, and/or there would usually be lengthy periods of time each day between noise events. Noise in a specific area would rarely result in a value for any noise metric that is more than a very small increment above the value for natural ambient sounds in the same area. Natural sounds would predominate.
>
> **Minor:** Noise would be greater than natural ambient sound levels for a small portion of the day, and/or there would often be substantial periods of time each day between noise events. Noise in a specific area would rarely result in a value for any noise metric that is more than a small increment above the value for natural ambient sounds in the same area.
>
> **Moderate:** Noise would be greater than natural ambient sound levels for an intermediate portion of the day, and/or there would rarely be more than intermediate periods of time each day between noise events. Noise in a specific area would rarely result in a value for any noise metric that is more than an intermediate increment above the value for natural ambient sounds in the same area.
>
> **Major:** Noise would be greater than natural ambient sound levels for a large portion of the day, and/or there would rarely be more than short periods of time each day between noise events. Noise in a specific area would often result in a value for a noise metric that is more than an intermediate increment above the value for natural ambient sounds in the same area.

ALTERNATIVE 1 (NO ACTION)— Under the no-action alternative, human-caused sounds associated with park operations would be sporadically mitigated on a case-by-case basis. No additional restrictions or enforcement of noise associated with visitor use would be anticipated. Soundscapes in primary use and wilderness threshold zones would continue to be affected by human-caused noise from park operations, vehicular traffic, and visitor use. Even though there would be some noise in these areas, the adverse impacts would be short- and long-term and negligible to minor, because some noise is expected and accepted in developed areas.

Soundscapes in wilderness threshold and backcountry zones would continue to be impacted in specific areas from human-related noise from park maintenance and operational activities and visitor use. These include activities that use mechanized tools and helicopters as the minimum tool, such as backcountry facilities maintenance, radio repeater maintenance and repairs, cultural and natural resources management projects, and trail maintenance. These functions occur periodically in the park, resulting in localized, short-term, moderate adverse impacts to the park's soundscape and acoustic environment. In very low-level ambient soundscapes, like the wild/primitive zones, noises are much more audible, and have greater impacts on the soundscape.

The level of human-related noise in some areas of the park might change from existing levels as a result of anticipated slight increases in park visitation under the no-action alternative. The expanded visitor services at Kahuku and Kealakomowaena under the no-action alternative may increase impacts from human-caused noise in those areas. These conditions would result in long-term negligible to moderate adverse impacts to the soundscape in the park's frontcountry areas, since some level of noise is expected, and natural sounds can still be heard depending on location and time-of-day.

CUMULATIVE IMPACTS

Other past, present, or future actions could impact the soundscapes and acoustic environment including ongoing highway and road traffic. Potential increases in visitation to lands surrounding the park could further impact the soundscape and acoustic environment. Depending on the action, the duration of each activity, and the location of the activity, these actions could result in minor to moderate adverse impacts.

There would be adverse impacts from commercial air tour overflights in the primary use and wilderness threshold and backcountry zones, which would result in minor to major adverse impacts, depending on location. Within the primary use and wilderness threshold zones, short- and long-term impacts would occur in areas with high concentrations of air tours, such as the East Rift wilderness unit. In those areas, the impacts to the soundscapes and acoustic environment would be moderate to major and adverse. The Air Tour Management Plan/EIS, when completed, would provide guidelines and mitigations to reduce the impacts to the soundscapes and acoustic environment in the park across all management zones.

The cumulative impacts to the soundscape and acoustic environment would be short- and long- term, minor to major, and adverse.

CONCLUSION

The existing conditions and activities included under the no-action alternative would result in short-term moderate and long-term negligible to moderate adverse impacts on the park's soundscapes and acoustic environment. The level of impact is dependent on the action/noise, the duration of each activity, and the location of the activity. Cumulative impacts would be minor to major and adverse. This alternative's contribution to these effects would be small.

ALTERNATIVE 2 (PREFERRED)— Under the preferred alternative, the park would expand active management practices to reduce human-caused sounds associated with park operations and visitor use. Soundscapes in the visitor services and transitional/semi-primitive zones would continue to be affected by human-caused noise from park operations, vehicular traffic, and visitor use, consistent with the desired conditions described for these zones. The expanded visitor services and visitation levels at Kahuku under the preferred alternative would increase impacts from human-caused noise, but the park would implement best management practices and educational tools to reduce the noise associated with park operations and visitor use. These conditions would result in negligible to minor adverse impacts to the soundscape in the park's frontcountry areas, since some level of noise is expected and accepted in developed areas, best management practices and educational tools

would reduce human-caused noise, and natural sounds could still be heard regularly.

Soundscapes in wild/primitive zones would continue to be impacted in specific areas by park maintenance and operational activities and by visitor use. As in the visitor services and transitional/semi-primitive zones, mitigations and educational tools would be used to reduce the human-caused sounds. The human-caused sounds include visitor-caused noise as well as activities that use mechanized tools and helicopters as the minimum tool, such as backcountry facilities maintenance, radio repeater maintenance and repairs, cultural and natural resources management projects, and trail maintenance. These sources of human-caused noise result in localized, short-term, minor to moderate adverse impacts to the park's soundscapes and acoustic environment. In very low-level ambient soundscapes, like the wild/primitive zones, noises are much more audible, and have greater impacts on the soundscape. The best management practices and educational tools would help reduce the amount of human-caused noise and allow natural sounds to dominate.

Under the preferred alternative, the park would implement a soundscape monitoring program and subsequently develop a soundscape management plan. This would have long-term minor to moderate beneficial impacts to the park's soundscapes and acoustic environment.

If lands are acquired as described under the proposed boundary modifications, future planning would determine what, if any, impacts there would be on the park's soundscapes and acoustic environment.

CUMULATIVE IMPACTS

The cumulative impacts would be the same as those identified for the no-action alternative.

CONCLUSION

The actions included under the preferred alternative would result in short-term minor to moderate and long-term negligible to minor adverse impacts, and long-term minor to moderate beneficial impacts on the park's soundscapes and acoustic environment. The level of impact is dependent on the action, the duration of each activity, and the location of the activity. Cumulative adverse impacts would be minor to major and adverse. This alternative's contribution to these effects would be very small.

ALTERNATIVE 3— The impacts from Alternative 3 would be similar to those described for the preferred alternative.

CUMULATIVE IMPACTS

The cumulative impacts would be the same as those identified for the no-action alternative.

CONCLUSION

The activities and conditions included under Alternative 3 would result in short-term minor to moderate and long-term negligible to minor adverse impacts, and long-term minor to moderate beneficial impacts on the park's soundscapes and acoustic environment. The level of impact is dependent on the action, the duration of each activity, and the location of the activity. Cumulative impacts would be minor to major and adverse. This alternative's contribution to these effects would be very small.

Cultural Resources

ARCHEOLOGICAL RESOURCES / HISTORIC STRUCTURES / CULTURAL LANDSCAPES

Potential impacts to those resources listed or eligible for listing in the National Register of Historic Places (NRHP) were identified and evaluated. The cultural resources considered include archeological resources, cultural landscapes, traditional cultural properties, museum collections, and historic structures. Evaluation was done in accordance with the Advisory Council on Historic Preservation's regulations implementing Section 106 of the National Historic Preservation Act of 1966, as amended (36 CFR 800, Protection of Historic Properties). This evaluation was done by (1) determining the area of potential effects; (2) identifying cultural resources in the area of potential effects that are listed in or eligible for listing in the national register; (3) applying the

criteria of adverse effect to affected resources; and (4) considering ways to avoid, minimize or mitigate adverse effects. Information used in this assessment was obtained from relevant literature and documentation, maps, and consultation with cultural resource professionals, as well as from interdisciplinary team meetings, field trips, and site visits.

Under the regulations of the Advisory Council on Historic Preservation, a determination of *adverse effect* or *no adverse effect* must be made for affected national register-listed or national register-eligible cultural resources. An adverse effect occurs whenever an action alters, directly or indirectly, any of the characteristics of a cultural resource that qualify it for inclusion in the national register; that is, the action diminishes the integrity of the resource's location, design, setting, materials, workmanship, feeling, or association. Adverse effects also include reasonably foreseeable effects caused by the alternative that would occur later in time, be farther removed in distance, or be cumulative (36 CRF 800.5(a)(1)). A determination of no adverse effect means there is an effect, but the effect would not meet the criteria of adverse effect (36 CFR 800.5(b)).

The thresholds of change for the intensity of an impact are defined as follows.

Negligible: The effects on cultural resources would be at the lowest levels of detection, barely measurable without any perceptible consequences, either beneficial or adverse to cultural landscape resources, traditional cultural properties, historic structures, or archeological resources. For the purposes of Section 106 and the National Historic Preservation Act, the determination of effect would be no adverse effect.

Minor: The effects on cultural resources would be perceptible or measurable, but would be slight and localized within a relatively small area. The action would not affect the character or diminish the character-defining features of a national register-eligible or listed cultural landscape, historic structure, or archeological site, and it would not have a permanent effect on the integrity of any such resources. For the purposes of Section 106 and the National Historic Preservation Act, the determination of effect would be no adverse effect.

Moderate: The effects would be perceptible and measurable. The action would change one or more character-defining features of a cultural resource, but would not diminish the integrity of the resource to the extent that its NRHP eligibility would be entirely lost. For the purposes of Section 106 and the National Historic Preservation Act, the cultural resources' NRHP eligibility would be threatened and the determination of effect would be adverse effect.

Major: The effects on cultural resources would be substantial, discernible, measurable, and permanent. For NRHP eligible or listed cultural landscapes, traditional cultural properties, historic structures, or archeological sites, the action would change one or more character-defining features, diminishing the integrity of the resource to the extent that it would no longer be eligible for listing in the national register. For purposes of Section 106, national register eligibility would be lost and the determination of effect would be adverse effect. If an adverse effect was anticipated, an appropriate mitigation strategy would be developed in consultation with the park's Kūpuna Consultation Group and Hawai'i State Historic Preservation Division. In addition, a memorandum of agreement, in accordance with 36 CFR Part 800.6 Resolution of Adverse Effects, would be negotiated between Hawai'i Volcanoes National Park and the Hawai'i State Historic Preservation Division (and/or the Advisory Council on Historic Preservation, if necessary). The memorandum of agreement would stipulate how the adverse effects would be mitigated.

The relationships between definitions of effects, including beneficial effects, and treatments of cultural resources, are analyzed in the impact analysis for each of the alternatives. Levels of beneficial effect are not directly linked to specific types of treatments; rather they depend on the particular treatment of given cultural resources. All treatments proposed under all of the alternatives would be in accordance with the *Secretary of the Interior's Standards for the Treatment of Historic Properties*. All treatments proposed under all of the alternatives would have no adverse effect on known cultural resources.

ALTERNATIVE 1 (NO ACTION)— The no-action alternative is required by the National Environmental Policy Act and provides the baseline from which to compare the other alternatives. Under Alternative 1, current management practices would continue, as funding allows. The emphasis in the no-action alternative would be to protect the values of the park without substantially increasing staff, programs, funding support, or facilities.

ARCHEOLOGICAL RESOURCES

Under the no-action alternative new archeological surveys would continue to be completed primarily in response to specific actions which trigger Section 106 (NHPA) compliance. Ongoing assessment of known and recorded sites would continue to meet legal requirements by park staff as time permits, but the backlog of condition assessment documentation would continue to grow.

Resources adjacent to or easily accessible from trails, roads, campgrounds, and picnic areas would continue to be vulnerable to surface disturbance, inadvertent damage, and vandalism. Loss of surface archeological materials, alteration of artifact distribution, and a reduction of contextual evidence could result in loss of site integrity. However, continued ranger patrol and staff presence in the park would discourage inadvertent destruction of cultural remains and vandalism, and no adverse effects would be anticipated. The greatest threat to cultural resources is lava flows. If documentation of sites is not completed prior to lava flows, the information will be lost forever. Active volcanism also threatens the park's ability to document resources due to earth cracks, hazardous fumes, and dangerous terrain.

The implementation of the *Archeological Preservation Plan for Kealakomo Ahupua'a* would improve the interpretation and preservation of the archeological resources found there. The plan includes sites to be interpreted, site preparation to mitigate impacts to sensitive resources, and guidance for managing the natural and cultural resources in the area. The implementation of this plan would have long-term negligible to minor beneficial impacts to archeological resources.

As appropriate, additional archeological surveys and/or monitoring would precede any ground disturbing activities, such as road and trail maintenance, consistent with the mitigation measures outlined in this plan as well as any project specific measures necessary. National register-eligible or listed archeological resources would be avoided to the greatest extent possible and no adverse effects would be anticipated.

CUMULATIVE IMPACTS

Because much of the park has not been surveyed and inventoried, it is possible that archeological sites have been disturbed by past development, construction, management actions, and natural processes. Past, present, and future actions and processes include past grazing and land clearing, the construction of facilities, prescribed burns, trail rehabilitation and relocation, rehabilitation of park roads, effects of climatic conditions, visitor use, unintentional disturbance, vandalism, and artifact hunting.

Land clearing, grazing, and the development and expansion of communities near the park have also disturbed archeological resources outside the park boundaries. Lava flows have resulted in the loss of archeological and historic resources, such as the cultural resources covered by the Pu'u 'Ō'ō flows

since 1983. In addition, changing climate patterns, such as projected sea-level rise and increased storm surges could impact archeological resources near the coast. The above factors have had and may continue to have adverse effects on archeological resources. Implementation of the no-action alternative would contribute very little to the overall adverse cumulative effects on archeological resources.

CONCLUSION

Under the no-action alternative, the continuation of current management to preserve and document archeological resources in keeping with NPS responsibilities as they pertain to NHPA, would result in beneficial impacts. There would be negligible to minor adverse impacts due to limited understanding of the extent of archeological resources and current planned actions, resulting in a determination of no adverse effect under Section 106. The implementation of the *Archeological Preservation Plan for Kealakomo Ahupua'a* would result in negligible to minor beneficial impacts. The overall cumulative impacts would be adverse; however, the actions proposed in this alternative would be a very small component of that cumulative impact.

HISTORIC STRUCTURES AND CULTURAL LANDSCAPES

Historic structures and cultural landscapes would continue to be surveyed, inventoried, and evaluated under National Register of Historic Places criteria to determine their eligibility for listing in the national register, as funding is available. Current preservation maintenance would continue on historic structures and cultural landscapes within the park. Designed park landscapes including park road systems, developed areas, park trail systems, and associated features would be stabilized and preserved consistent with the *Secretary of the Interior's Standards for the Treatment of Historic Properties* (1995).

The no-action alternative would be expected to have no adverse effects on historic structures and cultural landscapes. The continued program of cultural resources management in the park, including preservation and maintenance activities, would have negligible to minor beneficial impacts on these resources. Volcanic and seismic activity would continue to threaten historic structures and cultural landscapes in the park.

The park would continue to develop baseline inventories for historic buildings, structures, and cultural landscapes. The completion of these baseline inventories would directly benefit the public by providing new information to supplement the interpretive program at the park, resulting in long-term, beneficial impacts on historic buildings, structures, and cultural landscapes.

The park would carry out preservation maintenance on historic structures. Those historic structures and cultural landscapes located in wilderness would be stabilized and preserved according to the pertinent laws and policies governing cultural resources and wilderness, using management methods that are consistent with the preservation of wilderness character and values and with the *Secretary of the Interior's Standards for the Treatment of Historic Properties* (1995).

CUMULATIVE IMPACTS

In the no-action alternative, the park would continue to follow current management objectives, preserving and maintaining cultural resources in the park. To appropriately preserve and protect historic buildings, structures, and cultural landscapes that are listed or eligible for listing on the National Register of Historic Places, all stabilization, preservation, and rehabilitation efforts, as well as daily, cyclical, and seasonal maintenance, would be undertaken in accordance with the *Secretary of Interior's Standards for the Treatment of Historic Properties* (1995). Stabilization, preservation, and rehabilitation would have negligible to minor beneficial impacts on historic buildings, structures, or cultural landscapes which would be equivalent to no adverse effect.

Over the years historic structures and cultural landscapes in the park have been adversely

affected by natural processes, volcanic events, and wear and tear associated with visitor access, administrative use, and deferred maintenance. In some instances placement and location of campgrounds, trails, parking lots, and other visitor use and administrative facilities have also adversely affected historic structures and cultural landscapes resulting in moderate cumulative adverse effects. In addition, some structures were removed or modified in the past that may have been considered historic today. Under climate change projections, these resources will also likely be affected by changes in vegetation that could impact the integrity of historic buildings and surrounding cultural landscapes.

Overall, the cumulative effects would be long-term, minor to moderate, adverse, and beneficial. Alternative 1 would provide beneficial effects to historic structures and cultural landscapes and would not contribute to the adverse cumulative effects.

CONCLUSION

The implementation of the no-action alternative would have no adverse effect on the historic structures and cultural landscapes of Hawai'i Volcanoes National Park. The continued program of cultural resources management in the park, including preservation and maintenance activities, would have negligible to minor beneficial impacts on these resources. The cumulative effects from past activities could have adversely affected these resources. Ongoing cultural resource management, such as the identification, preservation, and maintenance of historic structures and cultural landscapes, has resulted in minor beneficial cumulative effects, resulting in no adverse effect. This alternative would contribute modestly to the overall beneficial cumulative effects, and would not contribute to the adverse cumulative effects. There would be no impairment to this resource or value as a result of implementing this alternative.

ALTERNATIVE 2 (PREFERRED)—ARCHEOLOGICAL RESOURCES

Under the preferred alternative, the park would expand the cultural resource program to include a permanent archeology program which would result in long-term moderate beneficial impacts due to the enhanced ability to document, monitor, and protect resources overall and not just for specific projects.

Under this alternative most of the park roads, trails, and facilities would be kept in their current locations. In the Kīlauea Unit, some new trails would be developed, some facilities would be relocated, and some parking areas would be expanded. In the Kahuku Unit, new trails and visitor facilities would be developed following a future DCP. Known archeological resources would be avoided to the greatest extent possible, and as appropriate, archeological surveys, monitoring, and/or mitigations would precede any ground disturbance associated with construction or demolition.

The implementation of the *Archeological Preservation Plan for Kealakomo Ahupua'a* would improve the interpretation and preservation of the archeological resources found there. The plan includes sites to be interpreted, site preparation to mitigate impacts to sensitive resources, and guidance for managing the natural and cultural resources in the area. The implementation of this plan would have long-term beneficial impacts to archeological resources.

The proposed boundary adjustments under the preferred alternative would have long-term beneficial impacts on archeological resources due of the protection of significant archeological resources in the proposed lands.

CUMULATIVE IMPACTS

The cumulative impacts would be the same as those identified for the no-action alternative.

CONCLUSION

Under the preferred alternative, there would be long-term moderate beneficial impacts from the enhanced ability to document and protect archeological resources. Through proper planning and mitigations, the proposed actions, such as new trails and visitor facilities, would have negligible to minor adverse impacts on archeological resources.

HISTORIC STRUCTURES AND CULTURAL LANDSCAPES

Keeping historic road alignments and associated corridors would ensure the preservation of elements of the road that are historic, which would have beneficial impacts on historic structures and landscapes.

The improvement proposed for Hilina Pali and Mauna Loa Roads could change the character of these historic roads if the turnouts and interpretive improvements are not carefully designed. Similarly, planning and mitigation would be necessary for other improvements proposed such as at the Footprints area, Kahuku, sites along Chain of Craters Road, and so on, to ensure historic structures and cultural landscapes were protected. Prior to implementing the preferred alternative, proper site-specific planning would be conducted to ensure any improvements do not impact the integrity of the historic roads, trails, and other cultural resources found in these areas.

Reuse of cultural resources, like historic trails and routes, such as the Kahuku-ʻAinapō Trail or the Kalapana Trail, Native Hawaiian agricultural fields in lower Kahuku, and the historic water system at Kahuku would be a beneficial impact through the preservation and maintenance of the historic resources.

Historic structures and cultural landscapes would continue to be surveyed, inventoried, and evaluated under National Register of Historic Places criteria to determine their eligibility for listing in the national register as funding is available. Current preservation maintenance would continue on historic structures and cultural landscapes within the park. Preservation and maintenance of historic structures and cultural landscapes would follow Historic Structure Reports and Cultural Landscape Reports, when available. Designed park landscapes including park road systems, developed areas, park trail systems, and associated features would be stabilized and preserved consistent with the *Secretary of the Interior's Standards for the Treatment of Historic Properties* (1995).

The park would carry out preservation maintenance on historic structures. Those historic structures and cultural landscapes located in wilderness would be stabilized and preserved according to the pertinent laws and policies governing cultural resources and wilderness, using management methods that are consistent with the preservation of wilderness character and values, consistent with the *Secretary of the Interior's Standards for the Treatment of Historic Properties* (1995).

CUMULATIVE IMPACTS

The cumulative impacts would be the same as those identified for the no-action alternative.

CONCLUSION

Upon implementation of the preferred alternative, additional site-specific planning would be conducted to ensure any improvements do not impact the integrity of the historic roads, trails, and other cultural resources found in these areas. Impacts from the preferred alternative would be both beneficial and adverse, and negligible to minor impacts to historic resources and cultural landscapes, with proper site-specific planning and implementation of mitigations where necessary. This alternative would contribute modestly to the overall beneficial cumulative effects, and would contribute very little to the adverse cumulative effects.

ALTERNATIVE 3—ARCHEOLOGICAL RESOURCES

Alternative 3 proposes less development of visitor facilities, therefore the potential to impact archeological resources would be less than under the preferred alternative. However, the same strategies for avoidance and mitigation would apply to Alternative 3, resulting in similar impact levels to those described under Alternative 2.

CUMULATIVE IMPACTS

The cumulative impacts would be the same as those identified for the no-action alternative.

CONCLUSION

Under Alternative 3, there would be long-term negligible to minor beneficial impacts from the enhanced ability to document and protect

archeological resources. Through proper planning and mitigations, the proposed actions, such as new trails and visitor facilities, would have negligible to minor adverse impacts on archeological resources. This alternative would contribute modestly to the overall beneficial cumulative effects, and would contribute very little to the adverse cumulative effects.

HISTORIC STRUCTURES AND CULTURAL LANDSCAPES

The impacts to the historic structures and cultural landscapes are the same as described under Alternative 2, except for the following.

To make the Volcano House energy independent through a photovoltaic system, an off-site location may need to be selected to avoid an adverse effect to the historic structure or the cultural landscape. However, this may depend on what technology is available when the conversion is completed; therefore further planning and compliance would need to be completed in the future to ensure the impacts are minimized.

CUMULATIVE IMPACTS

The cumulative impacts would be the same as those identified for the no-action alternative.

CONCLUSION

Prior to implementing Alternative 3, proper site-specific planning would be conducted to ensure any improvements do not impact the integrity of the historic roads, trails, and other cultural resources found in these areas. Impacts from Alternative 3 would be beneficial and adverse. With proper site-specific planning and implementation of mitigations where necessary, the adverse impacts from Alternative 3 would be negligible to minor. This alternative would contribute modestly to the overall beneficial cumulative effects, and would contribute very little to the adverse cumulative effects. There would be no impairment to this resource or value as a result of implementing this alternative.

ETHNOGRAPHIC RESOURCES

The intensity of potential impacts on ethnographic resources is described below:

Negligible: Impacts would be at the lowest levels of detection and would neither alter resource conditions, such as traditional access or site preservation, nor the relationship between the resource and the affiliated group's body of practices and beliefs. For the purposes of Section 106 of the National Historic Preservation Act, the determination of effect would be no adverse effect.

Minor: Impacts would be perceptible or measurable, but would be slight and localized within a relatively small area and would neither appreciably alter resource conditions, such as traditional access or site preservation, nor the relationship between the resource and the affiliated group's body of practices and beliefs. For the purposes of Section 106 of the National Historic Preservation Act, the determination of effect would be no adverse effect.

Moderate: Impacts would be apparent and would alter resource conditions. Something would interfere with traditional access, site preservation, or the relationship between the resource and the affiliated group's practices and beliefs, even though the group's practices and beliefs would survive. For the purposes of Section 106 of the National Historic Preservation Act, the determination of effect would be adverse effect.

Major: Impacts would alter resource conditions. Something would block or greatly affect traditional access, site preservation, or the relationship between the resource and the affiliated group's body of practices and beliefs, to the extent that the survival of a group's practices and/or beliefs would be jeopardized. For the purposes of Section 106 of the National Historic Preservation Act, the determination of effect would be adverse effect. A memorandum of agreement, in accordance with 36 CFR Part 800.6 Resolution of Adverse Effects, would be negotiated between Hawai'i Volcanoes National Park and the Hawai'i State Historic Preservation Division (and/or the Advisory Council

on Historic Preservation, if necessary). The memorandum of agreement would stipulate how the adverse effects would be mitigated.

Beneficial impact: Would allow access to and/or accommodate a group's traditional practices or beliefs. For the purposes of Section 106 of the National Historic Preservation Act, the determination of effect would be no adverse effect.

ALTERNATIVE 1 (NO ACTION)—
The park would continue to promote and encourage Native Hawaiians to participate in the development and/or execution of interpretive programs and the development of exhibits.

Inadvertent visitor use and park-related actions could potentially impact ethnographic resources resulting in negligible to minor long-term adverse impacts. However, the National Park Service would continue ongoing consultation and coordination with affiliated Native Hawaiians (such as through the Kūpuna Consultation Group) to address matters of mutual concern on parklands.

The National Park Service would continue to allow Native Hawaiian access to culturally important sites to promote traditional practices and beliefs. Under provisions of the Native American Graves Protection and Repatriation Act, the National Park Service would facilitate repatriation of cultural materials and remains to Native Hawaiians. Although there are some beneficial effects associated with this alternative, overall, actions under this alternative would have negligible to minor long-term adverse impacts on ethnographic resources in the park.

CUMULATIVE IMPACTS

Park development and administrative/maintenance operations, as well as increasing visitor use of the national park since its establishment, have had and are continuing to have cumulative minor long-term adverse impacts on ethnographic resources. Under climate change projections, these resources may be affected by changes in vegetation that could impact the integrity of ethnographic resources.

There would be a continuing loss of ethnographic resources outside of the park due to development of private lands. As the sacred sites outside the park are lost over time, those remaining in the park have become more important to Native Hawaiians.

The no-action alternative's contribution to these minor long-term cumulative adverse impacts on ethnographic resources would be small. NPS staff would continue consultation with affiliated Native Hawaiians (such as through the Kūpuna Consultation Group) to address matters of mutual concern.

CONCLUSION

Actions under the no-action alternative would generally have negligible to minor long-term adverse impacts on ethnographic resources in the national park. The no-action alternative would also contribute a small and adverse increment to the minor long-term adverse cumulative impacts on ethnographic resources.

ALTERNATIVE 2 (PREFERRED)—In addition to the actions discussed under the no-action alternative, the following would apply to Alternative 2. Under the preferred alternative, the park would enhance knowledge, management, and protection of ethnographic resources, resulting in a minor to moderate beneficial long-term impact to those resources.

New trails would need to carefully consider ethnographic resources when determining alignment, width, and tread to avoid impacting resources. Even with proper alignment, there could be negligible to minor adverse impacts on ethnographic resources in some areas.

The proposed boundary adjustments under the preferred alternative would have long-term beneficial impacts on ethnographic resources due to the protection of significant

ethnographic resources in the proposed land acquisition.

CUMULATIVE IMPACTS
The cumulative impacts would be the same as those identified for the no-action alternative.

CONCLUSION
Actions under the preferred alternative would have minor to moderate long-term beneficial impacts and negligible to minor long-term adverse impacts on ethnographic resources in the park. The preferred alternative would also contribute very little to the minor long-term adverse cumulative impacts on ethnographic resources.

ALTERNATIVE 3— The impacts would be similar as those described under the preferred alternative with the following differences. To make the Volcano House energy independent through a photovoltaic system, an off-site location may need to be selected to avoid an adverse effect to the historic structure or the cultural landscape. Any off-site location would need to be evaluated for ethnographic resources to ensure any impacts are minimized.

CUMULATIVE IMPACTS
The cumulative impacts would be the same as those identified for the no-action alternative.

CONCLUSION
Actions under Alternative 3 would have minor to moderate long-term beneficial impacts and negligible to minor long-term adverse impacts on ethnographic resources in the park. Alternative 3 would also contribute very little to the minor long-term adverse cumulative impacts on ethnographic resources.

Visitor Use and Experience

This impact analysis considers various aspects of visitor use and experience at Hawai'i Volcanoes National Park, including the effects on the range of recreational opportunities and opportunities for orientation, education, and interpretation.

Impacts on visitor use and experience were determined considering the best available information regarding visitor use and experience. Information on visitor use and visitor opinions was taken from a survey of visitors conducted by the University of Idaho in March 2007 and compiled by Holmes and Hollenhorst (2008). This information was supplemented by data gathered during the planning process for this management plan, including opinions from national park visitors and neighbors and information provided by park staff.

The analysis is primarily qualitative rather than quantitative due to the conceptual nature of the alternatives. Professional judgment was used to reach reasonable conclusions regarding the intensity, duration, and type of potential impact.

The thresholds of change for the intensity of an impact are defined as follows.

Negligible: Visitors would likely be unaware of any effects associated with implementation of the alternative.

Minor: Changes in visitor use and/or experience would be slight but detectable, would affect few visitors, and would not appreciably limit or enhance experiences identified as fundamental to the park's purpose and significance.

Moderate: Some characteristics of visitor use and/or experience would change, and many visitors would likely be aware of the effects associated with implementation of the alternative; some changes to experiences identified as fundamental to the park's purpose and significance would be apparent.

Major: Multiple characteristics of visitor experience would change, including experiences identified as fundamental to park purpose and significance; most visitors would be aware of the effects associated with implementation of the alternative.

ALTERNATIVE 1 (NO ACTION)—
RANGE OF RECREATIONAL OPPORTUNITIES
In the no-action alternative, visitor experiences of the park's resources would continue to be mostly positive. Visitors would continue to have access to high-quality recreational opportunities, including

experiencing the park's world treasures, iconic landscapes, and wide range of ecosystems. Visitors would continue to have a menu of options for experiencing the park depending on the length of stay, interests, and capabilities. Therefore, continuing to provide these high-quality opportunities would result in a continued long-term moderate beneficial impact for visitors.

During scoping, most respondents acknowledged their enjoyment of the park's recreational opportunities and suggested that the amount of opportunities should be maintained close to current levels. This alternative would increase the opportunities slightly, with the increase in visitor opportunities at Kahuku and Kealakomowaena, resulting in long-term moderate beneficial impacts. However, during scoping, some respondents mentioned the need for increased opportunities for bicyclists and additional picnic areas. Bicycling opportunities and picnic sites would remain the same in this alternative, resulting in a continuing long-term minor, adverse impact for visitors seeking these types of recreational opportunities.

OPPORTUNITIES FOR ORIENTATION, EDUCATION, AND INTERPRETATION

The visitor survey in 2007 (Holmes and Hollenhorst 2008) indicated the most important services related to orientation and interpretation were the ranger-led walks and talks, exhibits and signs along roads and trails, active lava flow staff, and information desk staff. There are two visitor centers in the park that provide numerous programs and services for visitor orientation, education, and interpretation. The Kīlauea Visitor Center is small for the visitation it receives (2,500 visitors per day average in 2012) and has poor ventilation, which can result in moderate adverse impacts to visitors. Jaggar Museum is larger and receives more visitors (4,000 visitors per day average in 2012), but the exhibits are outdated and worn resulting in a minor adverse impact to visitors. The park would continue to provide a variety of interpretive and educational programs, events, and guest speakers to engage park visitors and diverse audiences resulting in a moderate beneficial impact to visitors.

Under the no-action alternative, opportunities for orientation, education, and interpretation would continue to be offered throughout the park via wayside exhibits, signs, interpretive trails and trail guides, and visitor contact stations, such as at the end of Chain of Craters Road. In general these would provide moderate beneficial impacts, but in the case of areas that are overcapacity during peak periods (such as Thurston Lava Tube), the impacts to opportunities for orientation, education and interpretation would be moderate and adverse during peak periods. Off-site orientation, education, and interpretation would continue to be provided through the park's website and publications. Curriculum-based programs would help educate students about Native Hawaiian ecosystems and history, resulting in a moderate beneficial impact to visitor experience as they generate curiosity, passion, and respect for park resources among students. However, the park would continue to not meet the demand for on-site educational program requests, as well as the on-site requests for in-person orientation and interpretation, so the impacts of the no-action alternative would also be adverse and moderate for those visitors that could not access orientation, interpretation, or educational programs.

The continuing use of partnerships to help interpretive messages reach a broader audience through programs, additional interpretive displays, and distribution of interpretive material and media, including retail, would have a minor beneficial impact on visitor experience through expanded stewardship.

During scoping, the most frequently mentioned education and interpretation need was a place or facility dedicated to interpreting Native Hawaiian culture and other cultural resources. Under the no-action alternative, the park would improve

the interpretation and preservation of Kealakomowaena and its resources, as funding allows, including primary messages and themes for interpretive trails and signage. Also dependent on adequate funding, visitor opportunities would expand at Kahuku to include a visitor contact station with interpretive exhibits and educational material, as well as providing public access seven days a week. The improvements at Kealakomowaena and Kahuku would result in a long-term moderate beneficial impact to visitors upon implementation.

COMMERCIAL SERVICES AND FACILITIES

Under the no-action alternative, commercial services and facilities would continue at present levels. The concession operation would continue to operate as authorized under the existing contract. Commercial use authorizations would continue to be given to tour companies (such as bus, automobile, and biking tours) on a case-by-case basis but not by following a formal commercial services strategy.

Impacts under the no-action alternative would be long-term, minor to moderate, and beneficial for those uses that would continue at present levels, or minor to moderate adverse where there is more demand than capacity in the existing facilities. Impacts to services provided by CUAs would be beneficial to those who use the services but potentially adverse if these services grow to the point that public use is displaced.

CUMULATIVE IMPACTS

Ample recreational opportunities, visitor services, and recreation facilities would continue to be available both across the island and in areas adjacent to or in close proximity to the park that complement those available in the park.

Commercial services and facilities, including lodging, food services, and additional types of recreation, cultural, and educational opportunities would continue to be provided in the area, complementing what is available in Hawai‘i Volcanoes National Park.

Climate change may influence park visitation and associated needs over the next two decades. Extreme heat events or storm events could also pose elevated risks to visitors and require adjustments in park operations and infrastructure (e.g. installation of shade structures along trails or increases in emergency response).

Taken as a whole, the reasonably foreseeable past, present and future cumulative actions would continue to provide diverse and expansive visitor experiences, recreational opportunities, and visitor services and facilities within the region, resulting in long-term moderate benefits to visitors, although some adverse effects would be experienced due to the effects of global climate change. The impacts above, in combination with the impacts of implementing the no-action alternative, would result in moderate long-term beneficial cumulative impacts with localized adverse impacts at the visitor centers and other high visitation areas during peak periods.

CONCLUSION

The full spectrum of visitor opportunities would continue to provide for visitor enjoyment and recreation activities. Continuing current management practices under the no-action alternative, little would change in the array of opportunities in the area or in Hawai‘i Volcanoes National Park and impacts would be minor to moderate, long-term, and both beneficial and adverse. Beneficial impacts would be from the continuation of existing opportunities to serve the needs of most visitors, as well as the expansion of opportunities at Kahuku and Kealakomowaena. Adverse impacts could occur from insufficient visitor orientation and interpretation facilities in the park, overcrowding in at some locations, as well as from limited opportunities for some modes of recreation (e.g., bicycling).

There would be moderate long-term beneficial cumulative impacts and localized adverse cumulative impacts on visitors in the park and surrounding areas.

Implementation of the no-action alternative would have a modest contribution to these cumulative effects.

ALTERNATIVE 2 (PREFERRED)—RANGE OF RECREATIONAL OPPORTUNITIES

The preferred alternative would increase opportunities for bicyclists and picnicking, which were identified as needs during scoping. However, some of the strategies that may be used to increase bicycling opportunities, including day-of-week or time-of-day road closures to vehicles, may result in an adverse impact to the visitors traveling only in vehicles and not able to access those areas. Most visitors to the park are here for a short duration, but education and outreach could reduce the adverse impact of road closures by enabling visitors to be prepared and plan for their trip accordingly. Overall, the impact to visitors from enhanced bicycling opportunities would be minor beneficial for those participating in bicycling opportunities, and potentially moderate adverse to visitors in vehicles, due to potential temporary road closures as described earlier.

There would be increased hiking opportunities through trail connections and some new trails throughout the park which will result in moderate beneficial impacts to visitors. Visitor experience would be enhanced through new waysides, informational signage, and turnouts in different areas.
The improvements in visitor opportunities at Kahuku such as campgrounds, picnic areas, trails, and interpretive signage would have moderate to major beneficial impacts on visitor use and experience.

Under the preferred alternative, ABA/ADA access to visitor facilities (including overlooks and viewpoints) would be improved, where feasible. If ABA/ADA access cannot be accommodated for an area, other opportunities will be considered, such as large print brochures and virtual tours. The enhanced access would result in moderate beneficial impact to visitors.

The proposed boundary modifications would likely be beneficial for visitor use and experience, however the extent of the impacts would be determined through subsequent planning for use of those lands, if the lands are acquired.

OPPORTUNITIES FOR ORIENTATION, EDUCATION, AND INTERPRETATION

Under the preferred alternative, the two visitor centers in the park would undergo improvements that would enhance the programs, services, and conditions for visitor orientation, education, and interpretation. Rehabilitation and conversion of the Ohia Wing to a cultural museum would be beneficial for visitors because this type of facility and service has not been available to visitors since the Waha‘ula Visitor Center was taken by lava. There would be beneficial impacts from the addition of educational pavilions, enhancement of ranger-led and live programs, as well as increased self-guided opportunities. The park would also engage visitors in resource management activities for hands-on interpretation and stewardship. The improvements to visitor facilities and increase in opportunities for visitor orientation, interpretation, and education would result in a moderate to major beneficial impact to opportunities for orientation, education, and interpretation.

The increase in opportunities for orientation, education, and interpretation at the Kahuku Unit would have moderate to major beneficial impacts on visitor use and experience.

COMMERCIAL SERVICES AND FACILITIES

Under the preferred alternative, any new commercial services would be evaluated under the commercial services strategy before authorizing any new activities or significant changes to existing activities. The strategy would prevent commercial activities or use levels from impacting the general public’s enjoyment of the park resources, which would result in no adverse impact to visitors use or experience. The concession operation would continue to operate as authorized under the existing contract, with any potential changes occurring under the next contract.

CUMULATIVE IMPACTS

The cumulative impacts would be the same as those identified for the no-action alternative.

CONCLUSION

The full spectrum of visitor opportunities would provide for visitor enjoyment and recreational activities. Under the preferred alternative, there would be an increase in opportunities to serve the needs of visitors, as well as the expansion of opportunities, such as at the Kahuku Unit, which would have minor to major, long-term beneficial impacts. Moderate adverse impacts could occur from time-of-day/day-of-week restrictions on vehicles in the Kīlauea Unit of the park.

There would be moderate long-term beneficial cumulative impacts and localized adverse cumulative impacts on visitors in the park and surrounding areas. Implementation of the preferred alternative would have a greater contribution to these cumulative effects when compared to the no-action alternative.

ALTERNATIVE 3—

RANGE OF RECREATIONAL OPPORTUNITIES

The range of recreational opportunities would be similar to those described under the preferred alternative, therefore the impact levels would also be similar with the following differences.

Under Alternative 3, no private vehicles would be allowed on Crater Rim between Jaggar Museum and Chain of Craters Road. However, shuttles and commercial vehicles would be allowed, so visitor access would be provided if future conditions allow the road to be reopened. Similarly, at Thurston Lava Tube, private vehicle parking would be prohibited, but other parking areas and shuttles would be available. Therefore, all visitors will still be able to experience these areas, but would need to access them without a private vehicle. Since the majority of the park visitors come in a private vehicle, the impact would be moderate to major and adverse. This impact may be lessened with extensive outreach and education to assist visitors in appropriate trip planning.

A similar range of recreational opportunities would also be found at Kahuku except there would be less developed areas (smaller and fewer campgrounds, no trailhead off Old Mamalahoa Highway), therefore the reduced recreational opportunities would be less beneficial than the preferred alternative.

OPPORTUNITIES FOR ORIENTATION, EDUCATION, AND INTERPRETATION

The opportunities for orientation, education, and interpretation would be similar to those described under the preferred alternative; therefore the impact levels would also be similar.

COMMERCIAL SERVICES AND FACILITIES

Any new commercial services would be evaluated under the commercial services strategy before authorizing any new activities or significant changes to existing activities. The strategy would prevent commercial activities or use levels from impacting the general public's enjoyment of the park resources. The concession operation would continue to operate as authorized under the existing contract, with any potential changes occurring under the next contract.

Under Alternative 3, there would be no commercial services at Kahuku which would result in minor to moderate adverse impact for those visitors that would have otherwise visited Kahuku with a commercial service, such as an auto or hiking tour.

CUMULATIVE IMPACTS

The cumulative impacts would be the same as those identified for the no-action alternative.

CONCLUSION

The full spectrum of visitor opportunities would provide for visitor enjoyment and recreational activities. Under Alternative 3, there would be an increase in opportunities to serve the needs of visitors, as well as the expansion of opportunities, such as at the Kahuku Unit which would result in minor to major, long-term beneficial impacts. Moderate to major adverse impacts could occur from restrictions on private vehicles on a section of Crater Rim Drive and time-of-day/day-

of-week restrictions for vehicles on Mauna Loa and Hilina Pali Roads, as well as the prohibition of commercial services at the Kahuku Unit of the park.

There would be moderate long-term beneficial cumulative impacts and localized adverse cumulative impacts on visitors in the park and surrounding areas. Alternative 3 would have a greater contribution to the cumulative effects, particularly the adverse impacts, when compared to the preferred alternative.

Transportation and Access

The impact analysis evaluates how each alternative would change access and visitation and the capacity of roads and facilities in Hawai'i Volcanoes National Park to accommodate that change. Access addresses the distribution of visitors in Hawai'i Volcanoes National Park as well as access points and access options (motorized and non-motorized) to areas in Hawai'i Volcanoes National Park. Beneficial impacts would be associated with a decrease in the level of visitor congestion. Adverse impacts would be associated with the actions that reduce access to an area or increase the level of congestion.

The thresholds of change for the intensity of an impact are as follows:

Negligible: The effects would not be detectable and would have no discernible effect on the condition of roads and trails and/or traffic flow.

Minor: The effect would be slightly detectable, but there would not be an overall effect on the condition of roads and trails and/or traffic flow.

Moderate: Impacts would be clearly detectable, and the action could have an appreciable effect on the condition of roads and trails and/or traffic flow.

Major: Impacts would be substantial, with a highly noticeable influence, and the condition of roads and trails and/or traffic flow could be permanently altered.

ALTERNATIVE 1 (NO ACTION)— Under this alternative, access to the park for visitors would not change from current levels or conditions; however, based upon continuation of existing trends in the annual visitation, the number of visitors to the park is expected to increase slightly over the long term.

The increase in annual visitation is likely to result in more visitors during peak use period (between 10:00 a.m. and 2:00 p.m.). Most of the additional visitors are expected to travel to the most popular destinations such as the two visitor centers, Thurston Lava Tube, and the end of Chain of Craters Road. The pilot project for the hydrogen shuttle would be implemented in the no-action alternative. This may result in a slight decrease in crowding and congestion at Thurston Lava Tube. The potential increase in crowding and congestion due to the increase in visitation would result in minor to moderate adverse impacts, depending on time-of-day and location. Overall, the transportation system would be affected by increased annual visitation and its influence on access to the park, roadway capacity, parking capacity, alternative transportation, and health and safety.

The park roads and parking lots would be maintained with no major new or expanded parking areas. The park would continue to provide safe access to the volcanic features, as well as natural and cultural resources, and would continue to rely on education of the visitors to manage congestion. There would continue to be disturbance from visitors' parking in undesignated areas on road shoulders and natural areas. This situation creates safety and access problems for visitors, and resource protection issues for park resources.

At Kahuku, there would be no change to the transportation system, except for safety improvements at the park entrance. Vehicle access to Upper Glover would continue, but the road would be most suitable for high clearance vehicles beyond the upper Palm Trailhead. There would continue to be no public access beyond Upper Glover. Due to the limited access at Kahuku, the

impact would be long-term, minor to moderate, and adverse.

CUMULATIVE IMPACTS

Potential on-going and future actions could include general road, trail, or parking lot maintenance and various types of work on Highway 11 by Hawai‘i Department of Transportation. Although traffic delays may occur during road projects, there is no planned expansion of roadway capacity, and visitors would not likely alter their travel destinations. Occasional road, trail, or parking lot closures due to fire, lava flows, air quality, or seismic activity may occur. Overall impacts to access due to these cumulative impacts would be negligible.

CONCLUSION

The impacts on continuing current management on access and transportation would result in adverse, minor to moderate impacts parkwide and negligible beneficial impacts for the Thurston Lava Tube area due to the shuttle pilot program. Access would be most impacted during the peak period of visitation (mid-day) at popular destinations. The cumulative impacts would contribute a small amount to the impacts of the no-action alternative.

ALTERNATIVE 2 (PREFERRED)— Under the preferred alternative, there would be improved access to the park for visitors, including compliance with ADA/ABA standards, where feasible. The pilot project for the hydrogen shuttle would be implemented and expanded in the preferred alternative. This may result in a decrease in crowding and congestion at Thurston Lava Tube. In addition, a pilot program may be tested to further reduce congestion by restricting access for large commercial vehicles on the southern portion of Crater Rim Drive to one-way traffic.

Overall, the transportation system would be affected by potential increased annual visitation and its influence on access to the park, roadway capacity, parking capacity, alternative transportation, and health and safety. To further reduce crowding and congestion, demand management strategies would be implemented, which would reduce the adverse impacts of crowding and congestion.

There would be expansion of some of the parking areas, such as at Kīlauea Visitor Center, and reconfiguration of other parking areas, such as Kīlauea Iki. There would be no major new parking areas. There would be fewer disturbances from visitors' parking in undesignated areas on road shoulders and natural areas due to the creation and/or formalizing of turnouts in key locations.

At Kahuku, there would be changes to the transportation system, including increased safety improvements at the park entrance, two-wheel-drive access to Upper Glover, and four-wheel-drive access northeast to the 1916 flows. Access beyond the 1916 flows and west of Upper Glover would be for foot traffic only. The improved transportation and access at Kahuku would be long-term, moderate and beneficial.

Pedestrian and bicycle access in the park would be improved in the preferred alternative. New trails would be created in some areas, such as at Kahuku and ‘Ōla‘a. New trails to link key visitor areas would be developed, such as between Nāmakanipaio and Kīpukapuaulu. Shared trails to allow bicycle access off the roadways would be created, such as between Kīlauea Visitor Center and Jaggar Museum. Connections between trails would be developed to provide loop trail opportunities. Time-of-day or day-of-week restrictions for vehicles would be considered on roads such as Hilina Pali or Mauna Loa to provide better access for bicycles and pedestrians. These restrictions would increase safe access for pedestrians and bicyclists resulting in a long-term minor to moderate beneficial impact, but may have a moderate adverse impact on those visitors traveling only by vehicle.

The proposed acquisitions, particularly the Pōhue Bay parcel, would increase access

to natural and cultural resources but the magnitude of the beneficial impact would depend on what is determined in future planning should the areas be acquired.

CUMULATIVE IMPACTS
The cumulative impacts would be the same as those identified for the no-action alternative.

CONCLUSION
Overall, implementing the preferred alternative would have long-term minor to moderate, beneficial impacts to access for park visitors. Some visitors may consider some changes as minor to moderate and adverse impacts, such as restrictions on private vehicles if time-of-day or day-of-week restrictions are implemented. The cumulative impacts would contribute a small amount to the impacts of the preferred alternative.

ALTERNATIVE 3— Impacts to access and transportation would be similar to Alternative 2, with the following differences. Under Alternative 3, there are restrictions on where private vehicles can drive and park, such as no private vehicles parking at Thurston Lava Tube and no private vehicles driving on Crater Rim Drive from Jaggar Museum to Chain of Craters Road. There are also differences in level of access at the Kahuku Unit, such as no commercial guided access. The restriction of parking for private vehicles and the consideration of a mandatory shuttle in the future would be both beneficial and adverse. Reduced congestion and increased safety due to the changes in access for private vehicles would be beneficial and moderate. The visitors in private vehicles may consider the restrictions a moderate adverse impact to their access, but there would be a shuttle for access to areas where private vehicles are restricted and visitor outreach and education to assist them in trip planning which may alleviate some of the impact. The other impacts described under the preferred alternative would be similar for this alternative.

CUMULATIVE IMPACTS
The cumulative impacts would be the same as those identified for the no-action alternative.

CONCLUSION
Overall, implementing Alternative 3 would have long-term minor to moderate, beneficial impacts to access for park visitors. Some visitors, particularly those in private vehicles, may consider some changes as a moderate adverse impact, such as restrictions on private vehicles at Thurston Lava Tube and for a section of Crater Rim Drive, and the limits on pedestrian access only for upper Kahuku. The cumulative impacts would contribute a small amount to the impacts of Alternative 3.

Socioeconomics

Economic effects are commonly expressed in terms of the number and types of jobs supported, changes in income, the number of visitors to the park, and the resulting changes in local tourism spending. Less well-defined economic effects include the indirect effects from ongoing NPS operations and the effects on local government fiscal conditions. Examples of social impacts include effects on regional population growth and land use.

Socioeconomic impacts were determined based on applied logic, professional expertise, and professional judgment. The approach to these issues was based on the following factors directly related to implementation of the general management plan:

- estimated costs of building new facilities and infrastructure;
- changes in the number of NPS staff and federal spending to operate the park;
- changes in the number of visitors to the park; and
- changes in park boundaries.

Indirect consequences of these four factors, such as impacts on traffic, were also considered.

Costs were estimated using the best available tools for this level of detail, including estimates based on comparable projects and cost estimating calculators using RS Means data. Future staffing levels and operating costs were estimated by the project team.

Actual future costs could be different than the estimates in this analysis because they would be based on future NPS policies, operations and maintenance policies adopted at the park, and budgets approved by Congress for the National Park Service in general, or Hawai'i Volcanoes National Park specifically.

Projected visitor use was generally estimated as increasing or decreasing based on proposed visitor opportunities for each alternative.

Economic impacts associated with the general management plan alternatives are assessed in terms of type/character of impact, duration, and scale/intensity. These three parameters are defined below.

This analysis relies on qualitative analysis of the impacts of each alternative, as actual visitor numbers are not estimated, spending values are for comparison only, and influence area data was mainly available at the broader county and state level. Hawai'i County and the State of Hawai'i were defined as the influence area for this analysis.

Beneficial impacts result in generally recognized improvements to established social and economic environment, or can be recognized as improvements to specific sectors and stated as such. Adverse impacts are those effects that are generally recognized to diminish the established social and economic environment, or diminish the environment for particular sectors and stated as such.

Indeterminate effects are those for which the size, timing, location, or individuals or groups that would be impacted cannot be determined, or those that include both beneficial and negative effects—in some instances affecting different communities—such that the net effect is indeterminate.

Short-term effects are those that occur during and in response to the planning, design, construction, and major maintenance of buildings, trails, parking lots, and other improvements associated with federal spending. These effects diminish or disappear after the project is completed. "Short-term" may also describe the first or early response in social or economic conditions to more fundamental changes in park management and operations and to changes in visitor use, but which give way to broader changes over time. Generally, "short-term" describes those effects that may last up to five years.

Long-term effects are those that last longer than five years, including some that may not begin until after completion of direct activities associated with the initial federal government spending or changes in management.

The thresholds of change for the intensity of an impact are defined as follows:

Negligible: Negligible effects would be below detectable levels or detectable only through indirect means and would have no discernible effect on the character of the social and economic environment.

Minor: Minor effects would be detectable, but localized in geographic extent or size of population affected and would not be expected to alter the character of the established social and economic environment.

Moderate: Moderate effects would be readily detectable across a broad geographic area or segment of the community and could have an appreciable effect on the social and economic environment.

Major: Major effects would be readily apparent, affect a large segment of the population, extend across an entire community or influence area and likely would have a substantial effect on the social and economic environment.

ALTERNATIVE 1 (NO ACTION)— The economic impacts related to park visitors vary from year to year and depend on the number of visitors, their participation in various activities, particularly day-use versus overnight activities, their expenditure patterns, prices of goods and services,

and changes in the park and surrounding communities that may affect visitor use of the park.

The facilities, park operations, and recreational uses of the park would remain essentially unchanged, unless there is a significant change in volcanic activity. Without a long-term, comprehensive management plan, park managers would accommodate changing visitor use patterns, uses, and volumes, and changes in resource conditions, as they occur, in response to pressure from various interest groups, or in response to future budget availability. Although visitation can and does fluctuate from year to year, modest long-term growth in annual visitor use is assumed over the life of this plan, primarily in response to continued increased visitor growth in the state and in particular, on the island.

Hawai'i Volcanoes National Park would continue to be an important contributor to the regional economy and gateway communities because of employee jobs and wages supported and operational expenditures by the National Park Service. In addition, the park would continue as the primary local and regional tourism attraction. The visiting public would generate tourism-related spending within the regional economy, benefiting local businesses and individuals by generating income and providing employment opportunities.

Based upon 1.35 million recreation visits per year (2011), the economic contributions of the park within the region include $96.99 million spending by nonlocal visitors, which generated $40.2 million in direct personal income (wages and salaries) for area residents and supported approximately 1,177 jobs in tourism and related service-sector businesses (Stynes 2011). The economic contributions of the park are anticipated to increase modestly over time due to increases in visitation linked to continued population growth on the island and in the state, as well as increased tourism to the region.

Under the no-action alternative, there would be about $7.1 million in additional expenditures for specific improvements as described in the alternative, such as the Ohia Wing renovation and fencing park boundaries. Many of these projects are funded from park entrance fees. These projects would not occur all at the same time but rather over a number of years. The impacts of these projects, including increases in business volume and support for jobs and incomes, on individual firms and employees would be short-term, minor, and beneficial for individuals and affected firms. However, impacts on the regional economy as measured by economic indicators such as changes in unemployment or poverty would be negligible due to the size and diversity of the regional economy.

LOCAL ECONOMIES

Continuing visitor use at the park, as well as the amenity value of the park and other public lands in the area, would provide continued impetus for development in adjacent communities. Private sector tourism and outdoor recreation development would be attracted to travel corridors leading to the park. Individual gateway communities might be affected by specific projects occurring in the park. Because this alternative continues current policies and programs, no changes in the types or amounts of impacts would be anticipated to occur as the result of this alternative.

STAFFING AND BUDGET

In fiscal year 2013, the park had an authorized employment level of 143 full-time equivalent employees (FTEs). If the park were able to fund additional authorized FTEs, a slight change in the local population would occur. However, the staffing levels of the park over the past few years have been experiencing reductions and it is anticipated that reductions or no increase will continue for an unknown period of time, dependent on the economy and government fiscal climate.

Beneficial impacts of population increases include increased demand for housing, which can cause an increase in home values and

rental rates; and increased government tax revenues. Adverse socioeconomic impacts of population increases include potential for more crowding on roads and in public areas and greater demands on government services, including schools, sanitation, and water.

Population increases due to the no-action alternative would be very small compared to the total population of the island, which is about 185,000 people; therefore the impact would be negligible, long-term, and of indeterminate effect since there are both adverse and beneficial impacts to population growth.

IMPACTS TO SOCIAL CHARACTERISTICS

Increases in the number of visitors would impact the traffic in the local area, but since increases could be small, the impact to traffic would be negligible, long-term, and adverse. The pilot shuttle program would improve the traffic a small amount, but that improvement would be within the park, not within the gateway communities.

The presence of a national park is a beneficial social impact to the influence area, allowing residents and visitors to experience beauty and solitude in the outdoors. This benefit would continue under the no-action alternative and therefore would result in no new impact to the social character of the influence area.

Because the no-action alternative would continue existing trends in the influence area, the current baseline socioeconomic effects to the influence area economy would continue. While there is a mix of beneficial and adverse impacts, the overall continuing impact of Hawai‘i Volcanoes National Park to the social characteristics in the influence area would be short- and long-term, moderate, and beneficial.

CUMULATIVE IMPACTS

Hawai‘i Volcanoes National Park is a primary visitor attraction on Hawai‘i Island. As such, it is a cornerstone of the regional tourism and hospitality industry. Over time, the park, the visitors it attracts, and the economic contributions of its staff, have supported local commerce and community development across the island. Many of the secondary social and economic effects are spread across the island. This symbiotic relationship would remain. Local and regional economic activity and the no-action alternative would continue to interact to have moderate long-term beneficial impact on socioeconomic conditions within the gateway communities and broader region, with short-term added stimulus due to ongoing maintenance of facilities and programs and some limited development projects. However, the influences may become less significant over time as the economy of the island continues to grow and become more economically and socially diverse.

CONCLUSION

Current approved projects to be funded under the no-action alternative would amount to about $7.1 million (FY 2013). These projects would be phased over a number of years, so impacts on individual firms and employees could be minor to moderate, short-term, and beneficial, but the beneficial impacts on the regional economy would be negligible to minor.

Visitors (1.38 million in 2010) would continue to support the local tourism industry. This level of impacts from tourism spending on adjacent communities and concessioners would continue to be beneficial, providing income, employment, and business opportunities within the gateway communities and regional economies, with minor changes over time.

Under this alternative the park’s staffing level would remain relatively constant or decline slightly.

The cumulative impacts would be long-term, moderate and beneficial; this alternative’s contribution to these effects would be modest.

ALTERNATIVE 2 (PREFERRED)—In the preferred alternative, impacts to the socioeconomic environment would result

from changes in operational spending, changes in visitor spending, and changes in visitor patterns. The impact of the preferred alternative is evaluated in comparison with the no-action alternative.

Implementation of the preferred alternative would occur against the same backdrop of economic, demographic, and social changes across the influence area described under the no-action alternative. The economic and social effects of the preferred alternative would add to those changes, but would not fundamentally change the area's economic or demographic outlook.

The preferred alternative calls for the maintenance and expansion of various facilities and infrastructure in the park, particularly at the Kahuku Unit. Within the Kīlauea Unit, only modest facility changes are proposed under the preferred alternative. At Kahuku, increased visitation would be expected due to increased access as well as increased visitor facilities and services. Moreover, the visitor experience could improve because of less crowding through implementation of the preferred alternative throughout the park. Although visitation can and does fluctuate from year to year, modest long-term growth in annual visitor use is assumed over the life of this plan, primarily in response to continued increased visitor growth in the state and in particular, on the island.

Under the preferred alternative, there would be about $38.1 million in additional expenditures for specific improvements in the park, provided all were completed as described in the alternatives chapter, with about $16.4 million of this amount for the improvements at the Kahuku Unit. These projects would be subject to availability of funding and would not occur all at the same time but rather over a number of years. Many of these projects could be funded over time from park entrance fees. The impacts of these projects, including increases in business volume and support for jobs and incomes, on individual firms and employees would be short-term, minor to moderate, and beneficial for individuals and affected firms. However, impacts on the regional economy as measured by economic indicators such as changes in unemployment or poverty would be negligible to minor due to the size and diversity of the regional economy.

LOCAL ECONOMIES

Continuing visitor use at the park, as well as the amenity value of the park and other public lands in the area, would provide continued impetus for development in adjacent communities. Private sector tourism and outdoor recreation development would be attracted to travel corridors leading to the park. Individual gateway communities might be affected by specific projects occurring in the park. The increased access and visitor facilities at the Kahuku Unit would likely result in greater visitation, which could have a minor to possibly moderate beneficial impact on the economies of the neighboring communities by the Kahuku Unit.

STAFFING AND BUDGET

The preferred alternative would have little direct impact on the local area's population growth. It is likely that individuals already residing in the area would fill many of the construction and related jobs. However, new staff proposed in the preferred alternative likely would come from outside as well as from within the local area. Additional employees proposed in the preferred alternative include 47 permanent full-time equivalent positions. Beneficial and adverse impacts associated with population increases are similar to the no-action alternative.

Population increases due to the preferred alternative would be very small compared to the total population of the island, which is about 185,000 people; therefore the impact would be negligible, long-term, and of indeterminate effect since there are both adverse and beneficial impacts to population growth.

IMPACTS TO SOCIAL CHARACTERISTICS

The proposed changes to the entrance at Kahuku would cause short-term adverse

impacts to traffic during construction if turn lanes are added to the highway at the entrance. In the long-term, the changes would have beneficial impacts on the traffic in that area. No other projects are anticipated to affect traffic in the park or at the park entrances; therefore, there would be short-term minor, adverse, and long-term minor, beneficial impact to traffic.

The presence of a national park is a beneficial social impact to the influence area, allowing residents and visitors to experience beauty and solitude in the outdoors. This benefit would increase in the communities near Kahuku under the preferred alternative due to increased access and visitation.

While there is a mix of beneficial and adverse impacts, the overall impact of the preferred alternative to the influence area socioeconomics would be short- and long-term, moderate, and beneficial.

CUMULATIVE IMPACTS

The cumulative impacts would be the same as those identified for the no-action alternative.

CONCLUSION

Under the preferred alternative, there would be about $38.1 million in additional expenditures for specific improvements in the park, provided all were completed as described. These projects would be phased over a number of years, so impacts on individual firms and employees could be minor to moderate, short-term, and beneficial, but the beneficial impacts on the regional economy would be negligible to minor.

Visitors (1.38 million in 2010) would continue to support the local tourism industry. The level of impacts from tourism spending on adjacent communities and concessioners would continue to be beneficial, providing income, employment, and business opportunities within the gateway communities and regional economies, with minor changes over time.

Full implementation of the preferred alternative would involve the restoration to past staffing reductions and increasing staffing levels by the equivalent to 47 FTEs. Increases in park staff and payroll would result in additional secondary jobs and income in the region.

The cumulative impacts would be long-term, moderate and beneficial; this alternative's contribution to these effects would be greater than in the no-action alternative.

ALTERNATIVE 3

— Impacts to socioeconomics, including local economy, staffing and budget, and impacts to social characteristics, would be similar to Alternative 2, with the following differences.
Under Alternative 3, there would be about $37.1 million in additional expenditures for specific improvements in the park, provided all were completed as described in the alternatives chapter, with about $16.4 million of this amount for the improvements at the Kahuku Unit. These projects would be subject to availability of funding and would not occur all at the same time but rather over a number of years. Many of these projects could be funded over time from park entrance fees. The impacts to these projects, including increases in business volume and support for jobs and incomes, on individual firms and employees would be short-term, minor to moderate, and beneficial for individuals and affected firms.

Additional employees proposed in Alternative 3 include the equivalent to 46 FTEs.

CUMULATIVE IMPACTS

The cumulative impacts would be the same as those identified for the no-action alternative.

CONCLUSION

Under Alternative 3, there would be about $37.1 million in additional expenditures for specific improvements in the park, provided all were completed as described. These projects would be phased over a number of years, so impacts on individual firms and employees could be minor to moderate, short-term, and beneficial, but the beneficial impacts on the regional economy would be negligible to minor.

Visitors (1.38 million in 2010) would continue to support the local tourism industry. The level of impacts from tourism spending on adjacent communities and concessioners would continue to be beneficial, providing income, employment, and business opportunities within the gateway communities and regional economies, with minor changes over time.

Full implementation of the preferred alternative would involve the restoration of past staffing reductions and increasing staffing levels by the equivalent to 46 FTEs. Increases in park staff and payroll would result in additional secondary jobs and income in the region.

The cumulative impacts would be long-term, moderate and beneficial; this alternative's contribution to these effects would be similar to the preferred alternative.

Park Operations

Park management and operations refers to the current management structure of the park to provide policy direction for the protection, public use, and appreciation of the park, and the ability of the current staff to adequately protect and preserve vital resources and provide for an effective visitor experience. The discussion of impacts on park management, operations, and staffing focuses on the type of management structure, the amount of staff available to ensure public safety, and the ability of the staff to protect and preserve resources given current funding and staffing levels. Staff that are knowledgeable about the management of the park were consulted to evaluate the impacts of implementing each alternative.

The thresholds of change for the intensity of an impact are defined as follows:

Negligible: The effect would be at or below the lower levels of detection, and would not have an appreciable effect on park management and operations.

Minor: The effects would be detectable, but would be of a magnitude that would not have an appreciable adverse or beneficial effect on park management and operations.

Moderate: The effects would be readily apparent and would result in substantial adverse or beneficial changes in park management and operations in a manner noticeable to staff and the public.

Major: The effects would be readily apparent and would result in substantial adverse or beneficial changes in park management and operations in a manner noticeable to staff and the public, and would be markedly different from existing operation.

ALTERNATIVE 1 (NO ACTION)—FACILITIES AND SUSTAINABILITY

Under the no-action alternative, infrastructure and development, including operational facilities would increase slightly with the addition of the Kahuku visitor contact station and the improvements at Kealakomowaena. The ongoing routine maintenance of park facilities would continue under current management and there would be little overall change to park operations. Incremental changes in green facility design, continued maintenance of hybrid vehicles in the park's vehicle fleet, and the continued implementation of photovoltaic systems at select facilities would have minor long-term benefits to the sustainability of park operations.

OPERATIONAL EFFICIENCY

Maintenance of the current infrastructure in the no-action alternative would result in a slight change to the distribution of staff and work areas in Hawai'i Volcanoes National Park due to the improvements at Kahuku and Kealakomowaena.

STAFFING

Funding for staff levels would continue to be inadequate to meet the increased resource management, interpretation, visitor protection and safety, maintenance, and administrative

needs of Hawai‘i Volcanoes National Park, resulting in long-term minor to moderate adverse impacts to park operations.

Implementation of Alternative 1 would overall result in minor to moderate adverse impacts on park operations, with some minor beneficial impacts as facilities are maintained and upgraded to improve sustainability and efficiency.

CUMULATIVE IMPACTS

Past and ongoing projects, including road, trail, and facility maintenance and repairs have had long-term minor beneficial impacts on some aspects of park operations. Aging facilities and infrastructure, including utilities and systems, would continue to be repaired, upgraded, or replaced as needed on a case-by-case basis, subject to available funding. Over time, more sustainable and efficient facilities and infrastructure would replace those that are aging or no longer meet the needs of Hawai‘i Volcanoes National Park, resulting in moderate long-term benefits to the park by reducing maintenance needs. However, projected changes in climate conditions in Hawai‘i would likely impact park operations, exacerbating any delayed upgrades, lack of adequate staffing, and deferred maintenance in the park. For example, reliable clean water to meet the range of park operational and visitor service needs may become an increasing challenge as the climate warms and as projected reduced rainfall would impact the ability of the park to provide enough water for park operations solely through rainwater catchment. While advances in technology may mitigate some of the impacts to park operations from global climate change, the cumulative impacts to park operation from past, ongoing, and future events would be moderate and adverse.

CONCLUSION

Under the no-action alternative, there would be little overall change to facilities, and sustainability of the facilities. Sustainability and operations would improve incrementally as funding allows, resulting in minor long-term benefits for those facilities that have been upgraded. Staffing levels would continue to be inadequate to meet the future needs of park operations, resulting in moderate long-term adverse impacts to park operations. As more projects are completed that repair, upgrade, and replace aging facilities and infrastructure, and more sustainable systems are installed, maintenance needs would be reduced, resulting in moderate, long-term benefits. However, until those facilities are replaced, periodic and extensive maintenance would be required. The overall effects of implementing the no-action alternative on park operations would be long-term, minor to moderate and adverse due to the backlog of deferred maintenance.

ALTERNATIVE 2 (PREFERRED)—FACILITIES AND SUSTAINABILITY

Under the preferred alternative, major visitor and operational buildings and infrastructure, including staff offices and visitor centers, would continue to be concentrated in the same general areas of Hawai‘i Volcanoes National Park as the no-action alternative; however, some facilities may be rehabilitated, others would be expanded in size or services, and new facilities would be added, particularly at Kahuku. New facilities would include campgrounds and picnic areas at Kahuku, new trails and trail connections, and educational pavilions at various sites throughout the park.

New trails and trail connections would be constructed under Alternative 2, resulting in short-term moderate adverse impacts to park operations while the trails are being constructed and moderate long-term adverse impacts to park operations if additional funding is not obtained for maintenance of new trails. Some areas would also require additional invasive species monitoring after construction of trails, such as the proposed trail in ‘Ōla‘a, which could adversely impact park operations if additional funding is not obtained.

The improvements to the Kahuku Road, particularly if the 2WD section is converted to a paved road, would have long-term minor beneficial impacts on park operations due to a decrease in maintenance needs.

The rehabilitation of the Ohia Wing would have both beneficial and adverse impacts to park operations. Planned improvements would decrease the deferred maintenance backlog by $3.6 million, but as the building is currently unoccupied, there would be a slight increase in staff time needed for custodial duties once it is occupied again. Actions such as the development of educational pavilions throughout the park and the campgrounds and picnic areas at Kahuku would all increase the recurring maintenance and custodial needs over what is needed under the no-action alternative.

Overall, the increase in trails, facilities, and infrastructure would result in moderate adverse impacts to park operations if additional funding/staffing is not acquired and the preferred alternative is fully implemented.

The impact of the proposed land acquisitions on park operations is unknown at this time. If the lands were acquired, future planning would be completed to determine the type and level of visitor services and related park operations that would be needed.

OPERATIONAL EFFICIENCY

The rehabilitation of facilities that are deteriorating would have long-term minor to moderate benefits on operational efficiency by reducing the needs for maintenance.

STAFFING

In the short-term, impacts from staffing are the same as Alternative 1 with funding for staffing levels continuing to be inadequate to meet the increased needs of Hawai‘i Volcanoes National Park, resulting in minor adverse impacts to park operations. In the long-term, staffing increases in resource management, interpretation, visitor protection, facilities maintenance, and administration coupled with expanded emphasis on partnerships could have long-term moderate benefits to operations by increasing the capacity of Hawai‘i Volcanoes National Park to meet the needs of the operation and the visitors, if the park receives additional long-term funding for the increased staffing. If no additional funding is acquired for staffing, the impacts of the full implementation of the preferred alternative to park operations would be long-term moderate to major and adverse.

CUMULATIVE IMPACTS

Cumulative impacts are similar to those in the no-action alternative.

CONCLUSION

Under the preferred alternative, there would be some noticeable changes to facilities, such as the rehabilitation of the Ohia Wing, other actions such as the expansion of parking for Kīlauea Visitor Center, and the addition of new facilities such as trails, campgrounds, and education pavilions would result in both moderate benefits and adverse effects. Additional changes to improve the environmental sustainability in all aspects of facility and infrastructure management could have long-term moderate benefits to park operations. Changes in staffing and operational efficiency would have long-term moderate benefits to park operations (provided additional funding is acquired for the staffing). As more projects are completed that repair and upgrade aging facilities and infrastructure, and more sustainable systems are installed, maintenance needs would be reduced, resulting in moderate, long-term benefits. However, until those facilities are rehabilitated, periodic and extensive maintenance would be required. The overall effects of implementing Alternative 2 on park operations would be long-term, moderate, and beneficial, if additional funding is acquired, and long-term moderate to major adverse impacts if no additional funding is acquired and the alternative is fully implemented.

ALTERNATIVE 3—Impacts to park operations would be similar to Alternative 2, with the following differences.

The Volcano House would be retrofitted to be energy independent, which would have minor beneficial impacts to sustainability. There would be less new trails and less campgrounds developed under Alternative 3, resulting in reduced adverse impacts to park operations when compared to the preferred alternative.

CUMULATIVE IMPACTS
Cumulative impacts are similar to those in the no-action alternative.

CONCLUSION
Under Alternative 3, there would be some noticeable changes to facilities, such as the conversion of Volcano House to energy independence, and new facilities such campgrounds and education pavilions could be added, but the overall new development would be less than under the preferred alternative, resulting in minor to moderate beneficial and adverse effects. Additional changes to improve the environmental sustainability in all aspects of facility and infrastructure management could have long-term moderate benefits to park operations. Changes in staffing and operational efficiency would have long-term moderate benefits to park operations (provided additional funding is acquired for the staffing). As more projects are completed that repair and upgrade aging facilities and infrastructure, and more sustainable systems are installed, maintenance needs would be reduced, resulting in moderate, long-term benefits. However, until those facilities are rehabilitated, periodic and extensive maintenance would be required. The overall effects of implementing Alternative 3 on park operations would be long-term, moderate, and beneficial, if additional funding is acquired, and long-term moderate to major adverse impacts if not additional funding is acquired and the alternative is fully implemented.

Greenhouse Gas Emissions, Climate Change, and Sustainability

The area of consideration for this topic is Hawai'i Volcanoes National Park. Potential impacts from management actions are based on professional judgment. The thresholds of change for the intensity of an impact are as follows.

Negligible: The proposed actions would have no detectable effect on energy use, sustainability, or the park's response to climate change.

Minor: Changes in energy use, sustainability, or the park's response to climate change would be slightly detectable or localized within a small area of the park.

Moderate: Impacts would be readily apparent and would affect the park's energy use and operations.

Major: Impacts would be substantial and highly noticeable for the park's energy use, sustainability, and responses to climate change.

ALTERNATIVE 1 (NO ACTION)—Under the no-action alternative, existing emissions of greenhouse gases from man-made sources would initially continue more or less in their current form. There would be no increase in development under the no-action alternative. The pilot program for the shuttle would be implemented, but due to the small size and limited range, the shuttles would have negligible beneficial impacts on greenhouse gas emissions.

The park would continue to implement the climate action plan and participate in the Climate Friendly Parks program developed jointly by the National Park Service and the US Environmental Protection Agency. This program plans to lower emissions and reduce the park's overall carbon footprint. Under the no-action alternative, the park would strive to reduce greenhouse gas emissions, would continue monitoring and research, increase climate change education and outreach, and develop climate change adaptation strategies. In themselves, impacts from these activities would be negligible to minor, direct and indirect, long-term and beneficial.

CUMULATIVE IMPACTS
Actions taken by others in the region, such as increased development on Hawai'i Island and in the state of Hawai'i, the continued reliance on fossil fuels for power generation, as well as the move toward energy production from renewable energy sources, would all contribute to both adverse and beneficial

impacts to sustainable practices and responses to climate change in Hawai'i. NPS actions at Hawai'i Volcanoes National Park would be negligible in the context of Hawai'i Island and the state of Hawai'i. The no-action alternative would contribute a negligible amount to the adverse and beneficial impacts.

CONCLUSION

Impacts to greenhouse gas emissions, climate change, and sustainability from the no-action alternative would be negligible to minor, long-term, direct and indirect and beneficial. The cumulative impacts from actions in the region would be both beneficial and adverse, depending on the action. The no-action alternative would contribute a negligible amount to this adverse impact.

ALTERNATIVE 2 (PREFERRED)—Under the preferred alternative, the National Park Service would continue to implement the climate action plan and participate in the Climate Friendly Parks program. The park would increase energy efficiency, conservation, and sustainability in the development of facilities and would give priority to green facility design for any new construction, retrofitting, and upgrading of facilities to the greatest extent possible.

Sustainable practices would be used in the selection of building materials and sources and building location and siting. Projects would use sustainable practices and resources whenever practicable by recycling and reusing materials, by minimizing materials, by minimizing energy consumption during the project, and by minimizing energy consumption throughout the lifespan of the facility produced. As required by NPS *Management Polices 2006*, new buildings would be designed to meet a minimum silver standard for LEED (Leadership in Energy and Environmental Design).

The park would promote activities to get visitors out of cars, such as hiking, biking, and equestrian use, as well as using the pilot shuttle program. Employees would be encouraged to bicycle to decrease the park's carbon footprint. The park would also encourage contractors, partners, and concessioners to reduce their own greenhouse gas emissions during their operations in the park.

There would continue to be emissions from commercial vehicle traffic, such as bus and auto tours, but implementing the demand management system may increase their efficiency, which could reduce their overall emissions.

The park would support climate change-related research, adapt management activities based on climate forecasts, and build resilience among populations of rare native species, communities, and ecosystems.

Overall, the impacts from these activities would be minor to moderate, direct and indirect, long-term and beneficial.

CUMULATIVE IMPACTS

The cumulative impacts would be the same as those identified for the no-action alternative.

CONCLUSION

Impacts to greenhouse gas emissions, climate change, and sustainability from the preferred alternative would be minor to moderate, long-term, direct and indirect and beneficial. The cumulative impacts from actions in the region would be both beneficial and adverse, depending on the action. The preferred alternative would contribute a negligible amount to this adverse impact.

ALTERNATIVE 3—The impacts from Alternative 3 would be similar to those described for the preferred alternative with the following exception.

Converting the Volcano House to energy independence would have a moderate beneficial impact on energy use and sustainability.

CUMULATIVE IMPACTS

The cumulative impacts would be the same as those identified for the no-action alternative.

CONCLUSION

Impacts to greenhouse gas emissions, climate change, and sustainability from Alternative 3 would be minor to moderate, long-term, direct and indirect and beneficial. The cumulative impacts from actions in the region would be both beneficial and adverse, depending on the action. Alternative 3 would contribute a negligible amount to this adverse impact.

UNAVOIDABLE ADVERSE IMPACTS

The following paragraphs describe the more important (moderate and major intensity) adverse impacts that would result from implementing the alternatives. These are residual impacts that would remain after mitigation was implemented. The negligible and minor impacts are described in the foregoing analysis.

Alternative 1

Under the no-action alternative, there would be moderate adverse impacts to visitor use and experience due to overcrowding, existing visitor center conditions, limited opportunities for bicycling and picnicking, and limited availability of staff to provide orientation, interpretation, and education.

There would continue to be moderate adverse impacts to wilderness from the presence of structures and monitoring equipment in the wilderness. The existing structures in the wilderness are historic and also provide water to visitors in the waterless expanse of the park. The volcanic and seismic monitoring equipment is essential to the safety of visitors and island residents due to the active volcanoes in the park.

Under the no-action alternative, there would be greater adverse impacts to the soundscapes and acoustic environment from park operations and visitor use. This impact would be less under Alternatives 2 and 3 because the park would follow best management practices, develop educational tools to reduce visitor-caused noise, and develop a soundscape monitoring plan.

Under all alternatives, proposed actions would strictly avoid known archeological sites. Any such sites that could not be avoided because of ground-disturbing activities would be mitigated in concurrence with the Hawai‘i State Historic Preservation Division. Mitigation such as data recovery would constitute an unavoidable adverse impact on the archeological sites involved.

There will also be moderate to major adverse impacts to park operations over time due to declining funding, unless additional funding is acquired.

Alternative 2

Under the preferred alternative, there would likely be moderate localized adverse impacts to geologic features, soils, vegetation, and native wildlife and wildlife habitat from the construction of new facilities, infrastructure, and trails. These impacts may be lessened through site planning and best management practices, but the possibility exists that not all impacts could be mitigated.

There would be moderate adverse impacts to wilderness from the presence of structures and monitoring equipment in the wilderness. The existing structures in the wilderness are historic and also provide water to visitors in the waterless expanses of the park. If small primitive campgrounds or structures for water catchment are considered for upper Kahuku, it would be evaluated through a minimum requirement analysis to determine what is appropriate. The volcanic and seismic monitoring equipment is essential to the safety of visitors and island residents due to the active volcanoes in the park.

Under all alternatives, proposed actions would strictly avoid known archeological sites. Any such sites that could not be avoided because of ground-disturbing activities would be mitigated in concurrence with the Hawai‘i State Historic Preservation Division. Mitigation such as data recovery would constitute an unavoidable adverse impact on the archeological sites involved.

Moderate adverse impacts to visitor use and experience could occur from the potential time-of-day/day-of-week restrictions on vehicles on the southern portion of Crater Rim Drive, Hilina Pali Road, and Mauna Loa Road. Prior to implementation of closures, the park would conduct outreach and education through various methods, such as commercial tour operators, websites, and brochures, to reduce the potential impact on visitors.

There would also be moderate to major adverse impacts to park operations over time due to declining funding, unless additional funding is acquired.

Alternative 3

Under Alternative 3, there would likely be short-term moderate adverse impacts to geologic features, soils, vegetation, and native wildlife and wildlife habitat from the construction of new facilities, infrastructure, and trails. These impacts would be minimized to the extent possible through site planning, best management practices, and mitigations, but the possibility exists that not all impacts could be mitigated.

There would continue to be moderate adverse impacts to wilderness from the presence of structures and monitoring equipment in the wilderness. The existing structures in the wilderness are historic and also provide water to visitors in the waterless expanses of the park. The volcanic and seismic monitoring equipment is essential to the safety of visitors and island residents due to the active volcanoes in the park.

Under all alternatives, proposed actions would strictly avoid known archeological sites. Any such sites that could not be avoided because of ground-disturbing activities would be mitigated in concurrence with the Hawai‘i State Historic Preservation Division. Mitigation such as data recovery would constitute an unavoidable adverse impact on the archeological sites involved.

Moderate adverse impacts to visitor use and experience could occur from the potential time-of-day/day-of-week restrictions on vehicles on Hilina Pali Road, and Mauna Loa Road. Adverse impacts would occur from the closure to private vehicles along the southern portion of Crater Rim Drive. Prior to implementation of closures, the park would conduct outreach and education through various methods, such as commercial tour operators, websites, and brochures, to reduce the potential impact on the visitors. Additional adverse impacts could occur from prohibiting commercial use in the Kahuku Unit under Alternative 3, however currently there is no commercial use allowed in the Kahuku Unit.

There will also be moderate to major adverse impacts to park operations over time due to declining funding, unless additional funding is acquired.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

Alternative 1

Irreversible commitments of resources are actions that result in the loss of resources that cannot be reversed. Irretrievable commitments are actions that result in the loss of resources, but only for a period of time. No actions would be taken as a result of the no-action alternative that would result in the consumption of nonrenewable resources that would preclude other uses for a period of time. Thus, there would be no irreversible or irretrievable commitments of resources in Hawai‘i Volcanoes National Park by the National Park Service.

No actions would be taken that would result in irreversible or irretrievable effects on historic properties. NPS staff would continue to conduct appropriate cultural resources management in accordance with the Secretary of Interior’s Standards and Policies.

Alternative 2

Irreversible commitments of resources are actions that result in the loss of resources that cannot be reversed. Irretrievable commitments are actions that result in the loss of resources, but only for a period of time. No actions would be taken as a result of the preferred alternative that would result in

the consumption of nonrenewable resources that would preclude other uses for a period of time. Thus, there would be no irreversible or irretrievable commitments of resources in Hawai'i Volcanoes National Park by the National Park Service.

No actions would be taken that would result in irreversible or irretrievable effects on historic properties. NPS staff would continue to conduct appropriate cultural resources management in accordance with the Secretary of Interior's Standards and Policies.

Alternative 3

Irreversible commitments of resources are actions that result in the loss of resources that cannot be reversed. Irretrievable commitments are actions that result in the loss of resources, but only for a period of time. No actions would be taken as a result of Alternative 3 that would result in the consumption of nonrenewable resources that would preclude other uses for a period of time. Thus, there would be no irreversible or irretrievable commitments of resources in Hawai'i Volcanoes National Park by the National Park Service.

No actions would be taken that would result in irreversible or irretrievable effects on historic properties. NPS staff would continue to conduct appropriate cultural resources management in accordance with the Secretary of Interior's Standards and Policies.

RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES AND LONG-TERM PRODUCTIVITY

Alternative 1

Under all of the alternatives, most of Hawai'i Volcanoes National Park would be protected in a natural state and would continue to be used by the public. Under all the alternatives, the National Park Service would continue to manage Hawai'i Volcanoes National Park to maintain ecological processes and native and biological communities, and to provide for appropriate recreational activities consistent with the preservation of natural and cultural resources.

Any actions the National Park Service takes in Hawai'i Volcanoes National Park would be taken with consideration to ensure that uses do not adversely affect the productivity of biotic communities. Under the no-action alternative, there would be no appreciable loss of ecological productivity because there would be little new development. Existing developed areas and infrastructure within Hawai'i Volcanoes National Park would remain.

Alternative 2

Under all of the alternatives, most of Hawai'i Volcanoes National Park would be protected in a natural state and would continue to be used by the public. Under all the alternatives, the National Park Service would continue to manage Hawai'i Volcanoes National Park to maintain ecological processes and native and biological communities, and to provide for appropriate recreational activities consistent with the preservation of natural and cultural resources.

Any actions the National Park Service takes in Hawai'i Volcanoes National Park would be taken with consideration to ensure that uses do not adversely affect the productivity of biotic communities. Under the preferred alternative, there would be no appreciable loss of productivity because the proposed development would largely occur in previously disturbed areas. Existing developed areas and infrastructure within Hawai'i Volcanoes National Park would remain. Some previously disturbed areas would be rehabilitated to return these areas to productivity.

Alternative 3

Under all of the alternatives, most of Hawai'i Volcanoes National Park would be protected in a natural state and would continue to be used by the public. Under all the alternatives, the National Park Service would continue to manage Hawai'i Volcanoes National Park to maintain ecological processes and native and biological communities, and to provide for appropriate recreational activities consistent with the preservation of natural and cultural resources.

Any actions the National Park Service takes in Hawai‘i Volcanoes National Park would be taken with consideration to ensure that uses do not adversely affect the productivity of biotic communities. Under Alternative 3, there would be no appreciable loss of productivity because the proposed development would largely occur in previously disturbed areas. Existing developed areas and infrastructure within Hawai‘i Volcanoes National Park would remain. Some previously disturbed areas would be rehabilitated to return these areas to productivity.

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PUBLIC INVOLVEMENT

7

Monitoring endangered plants with park partners and volunteers. *NPS photo*

Koa bug on heau plant. *Photo by Thomas Bellfield courtesy of USGS-BRD*

CHAPTER 7: PUBLIC INVOLVEMENT

Public involvement and consultation efforts were ongoing throughout the process of preparing this draft GMP/EIS. Public involvement included outreach to Hawai'i Volcanoes National Park visitors, Native Hawaiian groups, Hawaiian communities, federal, state, and local agencies, organizations, and businesses. Methods to reach the public included Federal Register notices, news releases, public meetings and workshops, newsletter mailings, and website postings. This chapter provides information about each public involvement period and summarizes public comments received by the National Park Service during each phase.

PUBLIC SCOPING

The planning process for the *Hawai'i Volcanoes General Management Plan / Environmental Impact Statement* was formally launched to the public in the spring of 2009. The National Park Service initiated an official scoping period for submittal of public comments on March 30, 2009 and closed the first phase of public involvement on July 30, 2009. A broad scoping effort solicited early public comment regarding issues and concerns, the nature and extent of potential environmental impacts and overall public sentiments and priorities regarding the future management of the park. Through a diverse range of public outreach activities, the National Park Service extended an invitation to the general public to participate in the planning process and welcomed suggestions regarding a future park vision for resource protection, visitor use, and overall park management.

The National Park Service formally announced the public scoping period by issuing a notice of intent to prepare a general management plan and environmental impact statement for Hawai'i Volcanoes National Park in the *Federal Register* (74 FR 16888-9) that was published on April 13, 2009.

A GMP page on the park website (www.nps.gov/havo/parkmgmt/plan.htm) and the NPS Planning, Environment, and Public Comment (PEPC) website (http://parkplanning.nps.gov/havo) went live on the first day of public scoping to provide public information about the general management plan, the timeline for completing the plan, and a forum for accepting comments from the public.

Public Outreach

NPS staff produced and mailed the first GMP Newsletter, *Hawai`i Volcanoes National Park GMP Newsletter 1: Public Scoping*, to approximately 710 names on the park mailing list. The list consisted of private individuals, organizations, federal, state and local government agencies, businesses, representatives of the natural and cultural science community, Native Hawaiian groups and individuals, and legislators.

More than 8,500 newsletters were mailed or distributed during initial scoping. Newsletters were distributed at 12 Hawai'i Island libraries; three community centers at Pahoa, Volcano, and Oceanview; the Hawai'i Civil Defense Office; and the Kīlauea General Store; as well as park locations including Kīlauea Visitor Center, Jaggar Museum, Kilauea Military Camp, Volcano House, Volcano Art Center, and individually to visitors entering the Kahuku Unit during week-end hours. Newsletters were also made available in Honolulu, Oahu at the NPS Regional Office and the East-West Cultural Center and on Maui at Haleakala National Park and Maui Community College. The public was invited to submit comments by regular mail, email, online on PEPC, or in person at public open house meetings.

Additional communication methods to solicit public involvement and comment included press releases that were sent to an island- and nationwide media list, news articles printed in West Hawai'i Today, Hawai'i Tribune Herald, and the Ka'u Calendar, as well as

public service announcements on local radio broadcasts. In addition, park staff gave poster presentations at local membership meetings of the Kaʻu Chamber of Commerce, Volcano Community Association, and the 2009 annual meeting of the Friends of Hawai'i Volcanoes National Park. Park staff also staffed GMP information tables at the 2009 Kaʻū Coffee Festival and Oceanview Community Pancake Breakfast.

NPS staff specifically targeted outreach to off-island park visitors by staffing information tables at park venues including the Kīlauea Visitor Center, Jaggar Museum, and the 2009 Kīlauea Cultural Festival at the Kahuku Unit. A park planner made weekly introductory announcements to audiences at the Tuesday night "After Dark In the Park" lecture series given at the Kīlauea Visitor Center, and staffed a table-top display of GMP posters set up in the lobby. A short announcement was also given several times at the Kahuku Unit as an introduction to ranger-led Kahuku hikes to generate interest in the upcoming GMP planning process. Colorful flyers that advertised the GMP public meeting schedule were posted on Hawaiʻi Island business, community center, and library bulletin boards, as well as at all public meeting locations on outer islands.

Open House Events and Stakeholder Meetings

OPEN HOUSE EVENTS

During the week of April 26 to May 1, 2009, the National Park Service held seven public open house meetings on the islands of Hawaiʻi, Oahu, and Maui to provide the public with an opportunity to learn about the GMP process, to discuss their ideas about the future of the park, and to meet members of the planning team. The meeting venues on Hawaiʻi Island included Kīlauea Visitor Center and community and recreation centers in Volcano, Kailua-Kona, Naalehu, and Hilo. Meetings on Oahu were held at the East-West Cultural Center in Honolulu and at Maui Community College in Kahului on Maui.

The meetings began with a brief welcome and introduction to the GMP process, which transitioned into an open format in which attendees could visit six stations featuring tabletop poster displays on the following topics: Transportation; Visitor Experience; Sustainable Operations and Facilities; the Vision for Kahuku; Natural Resource Preservation, Restoration and Research; Partnerships; Cultural Resources Management and Preservation; Native Hawaiian Significance; the GMP Process and Schedule; and Park Foundation Elements. An easel flip-chart was set up at each station where park staff recorded public comments on the various topics.

During this initial scoping phase, the park also conducted several stakeholder meetings. Invitations to attend stakeholder meetings were also extended by letter and e-mail to representatives of city, county, and federal agencies; business and community organizations; and all research permit holders to attend one of two different meetings held at the federal office building on Oahu and at Kilauea Military Camp on Hawaiʻi Island. During the 2009 initial scoping period, the park planning team spoke with approximately 400 people at public and stakeholder meetings and approximately 1,500 people at park and community tabling events.

TABLE 7.1. PUBLIC SCOPING OPEN HOUSES 2009

Location	Date	Attendance
Volcano, HI	April 26, 2009	23
Hawai'i Volcanoes National Park	April 26, 2009	24
Hilo, HI	April 27, 2009	7
Naalehu, HI	April 28, 2009	12
Kailua-Kona, HI	April 29, 2009	18
Honolulu, Oahu	April 30, 2009	9
Kahului, Maui	June 1, 2009	2
TOTAL		**95**

STAKEHOLDER MEETINGS

The planning team held the following stakeholder meetings (numbers noted are total participants at each meeting):

- USGS Hawaiian Volcanoes Observatory (13)
- Hawai'i Volcanoes National Park Science Community (15)
- Oahu Science Community (10)
- Kalapana Fishing Council (24)
- Hawai'i Volcanoes National Park Business Community (15)
- Ka'u Chamber of Commerce (25)
- Volcano Community Association (20)
- Hawai'i County Planning Department (3)
- Friends of Hawai'i Volcanoes National Park Annual Meeting/ Retreat (120)
- Hawai'i Volcanoes National Park Kupuna Group Meeting (7)

Written Comments

During public scoping, the public was asked to respond to a series of questions including:

- What do you value most about Hawai'i Volcanoes National Park?
- What do you think are the important issues facing the park?
- Imagine you are visiting Hawai'i Volcanoes National Park 20 years from now. Describe what you would like to experience.
- Do you feel the purpose and significance statements capture the essence of Hawai'i Volcanoes National Park?

Respondents submitted a wide range of statements about the future of the park. To honor the depth of thought that was put forward, a narrative was developed to summarize both public meeting and written comments received by the National Park Service. The National Park Service received correspondence from more than 130 individuals and organizations, including comment forms, letters, and e-mails that, combined with public meeting comments, totaled 1,251 specific responses. These comments helped shape the park's foundation statement, park purpose and significance statements, and guiding principles, and further articulated the issues to be addressed in the preliminary alternatives for park management. The comments covered a diverse breadth of topics, ideas, and preferences. Many statements or ideas were echoed by multiple individuals and were grouped under the following categories:

- What people value most about the park
- Preservation and protection of the park's natural and cultural resources
- Significance of park resources to Native Hawaiian culture
- Research in the park
- Visitor experiences (activities, programs, and facilities)
- Commercial services and special park uses
- Transportation, roads, and parking
- Park operations
- Boundary
- Partnerships and collaboration
- Future of the Kahuku Unit

A postcard update on the GMP progress was mailed to the park mailing list in December 2009. A second newsletter, Hawai`i Volcanoes National Park GMP Newsletter 2: Results of Scoping, was distributed in the winter of 2010. This newsletter summarized publics scoping comments in narrative format. The summary of the public response was also made available online at the park GMP webpage and on the NPS PEPC site.

PUBLIC REVIEW OF PRELIMINARY ALTERNATIVES

In August 2011 the National Park Service solicited public review and comment on preliminary alternatives for the Hawai'i Volcanoes National Park GMP/WS/EIS. The goal of this review was to receive feedback and encourage public participation in the development of preliminary alternatives. Another objective of the review was to assist the planning team in defining alternatives and

selecting a preferred alternative for the draft plan. This comment period also served as official scoping for the wilderness study, which was added to the scope of the GMP/EIS in 2011. A Federal Register Notice of Intent (76 FR 5557-58), published on December 2, 2011, formally extended the preliminary alternatives comment period to January 2, 2012 in order to gain additional input on wilderness including the recently evaluated wilderness eligible lands within Kahuku.

Public Outreach

On August 1, 2011, Hawai`i Volcanoes National Park GMP Newsletter 3: Preliminary Alternatives was published and mailed to a GMP mailing list of approximately 955 names. The newsletter requested public review and comment and was also distributed to 13 Hawai'i Island libraries; community centers in Pahoa, Volcano, and Oceanview; and within the park at Jaggar Museum, Kīlauea Visitor Center, the Kahuku Unit, and Kilauea Military Camp. The park also staffed an information table at the 2011 Kīlauea Cultural Festival using GMP posters to advertise upcoming public "talk story" sessions.

The public was invited to attend a series of three gatherings or "talk-story" sessions between August 22 and August 24, 2011, at Kīlauea Visitor Center, Naalehu Community Center, and Pahoa Community Center. The public meetings were announced through the GMP newsletter, a park press release sent to the park media list, and on the park and PEPC websites. A news article was printed in three local papers: the Hawai'i Tribune Herald, West Hawai'i Today, and the Ka'u Calendar. A local Ka'ū news blog also advertised the Naalehu meeting locally.

Two stakeholder meetings were additionally organized by the planning team. One meeting was organized for park partners, agency representatives, and research permit holders, and a second meeting was devoted to the park's commercial use authorizations (CUAs), and included commercial drivers and guides, and anyone engaged in commercial activities in the park. A total of 66 people attended the talk story sessions held in Pahoa, Naalehu, and at the Kīlauea Visitor Center, and 280 individual comments were received. All five sessions were organized as open forums with a series of "stations" that the public could visit. The stations focused on the proposed alternatives and the wilderness study for Kahuku, and each included a poster about the preliminary alternative or wilderness study, a large notepad for recording responses, and a planning team representative who answered questions and transcribed comments. Additional stations discussed the GMP process and timeline.

Further public outreach was also conducted on preliminary alternatives during August and September 2011, when the park's GMP planner gave presentations upon request to the Three Mountain Alliance, the park's kupuna group, and one University of Hawai'i environmental planning class. The park GMP planner also led a short "planner's walk" for 21 elementary school students to discuss park issues and the role of the GMP. Tabling was conducted during this period for outreach to park visitors at the Kīlauea Visitor Center and Jaggar Museum.

Table 7.2. Public "Talk Story" on Preliminary Alternatives

Location	Date	Attendance
Kīlauea Visitor Center	August 22, 2011	26
Pahoa, HI	August 23, 2011	7
Naalehu, HI	August 24, 2011	21
Stakeholders	August 24, 2011	12
TOTAL		**66**

Public Response

The park received 72 written letters, emails, and comment forms from individuals, businesses, and organizations. One petition was received that was signed by 39 individuals. All correspondence was reviewed and analyzed by the planning team through the NPS PEPC system. Written and "talk story" meeting comments provided a total of 709 specific responses during the public review

period for preliminary alternatives. The topics that received the most comment during the 155-day review period included the following subject areas, listed in alphabetical order:

- ʻĀinahou
- Air tours
- All alternatives
- Alternative concepts
- Bikes
- Boundaries
- Campgrounds
- Climate change
- Chain of Craters Road
- Commercial services
- Crater Rim Drive
- Cultural resources
- Facilities
- Hilina Pali
- Interpretation
- Jaggar Museum and Hawaiian Volcano Observatory
- Kahuku
- Kilauea Military Camp
- Kīlauea Visitor Center
- Mauna Loa
- Natural resources
- Ohia Wing
- ʻŌlaʻa
- Park entrance
- Partners and neighbors
- Planning process
- Research
- Thurston Lava Tube (Nāhuku)
- Trails
- Transportation and access
- Visitor experience
- 1877 Volcano House
- Volcano House
- Wilderness

A summary of public comments on the preliminary alternatives was created and made available to the public in February 2012 through the GMP park website (http://www.nps.gov/havo/index.htm) and PEPC website (http://parkplanning.nps.gov/havogmp). A postcard announcing the availability of this summary was mailed on February 27, 2012, to approximately 830 names on the park mailing list, including private individuals and organizations; federal, state, and local government agencies; businesses; representatives of the natural and cultural science community; Native Hawaiian groups and individuals; and legislators.

LIST OF DRAFT GMP/ WS/EIS RECIPIENTS

Copies of the draft GMP/WS/EIS (paper or CD-ROM) and/or newsletter of the Executive Summary were sent to the following recipients. Additionally, newsletters were sent to private individuals on the mailing list.

Federal Agencies and Officials:

- Advisory Council on Historic Preservation, Washington, DC
- ʻAla Kahakai National Historic Trail, Kailua-Kona, HI
- Environmental Planning Element, Hickam Air Force Base, HI
- Federal Aviation Administration, Honolulu, HI
- Federal Aviation Administration, Los Angeles, CA
- Haleakalā National Park, Makawao, HI
- Humane Society of the United States, Washington, DC
- Kalaupapa National Park, Kalaupapa, HI
- Kilauea Military Camp, Hawaiʻi National Park, HI
- National Marine Fisheries Service, Honolulu, HI
- National Park Service, Inventory and Monitoring Program, Hawaiʻi National Park, HI
- National Park Service, Kona Parks, Kailua-Kona, HI
- National Park Service, Pacific West Region-Honolulu Office, Honolulu, HI
- National Park Service, Washington, DC
- Pu'ukoholā Heiau National Historic Site, Kawaihae, HI
- US Army Garrison Hawai'i, Hilo, HI

- US Department of Transportation, Federal Highways Administration, Lakewood, CO
- USDA Forest Service, Institute of Pacific Islands Forestry, Hilo, HI
- USDA Natural Resources Conservation Service, Honolulu, HI
- USFWS Hakalau Forest National Wildlife Refuge, Hilo, HI
- USFWS Pacific Islands Ecoregion, Honolulu, HI
- USGS Biological Resources Division - PIERC, Hawai'i National Park, HI
- USGS Hawaiian Volcano Observatory, Hawai'i National Park, HI
- USGS Pacific Island Ecosystems Research Center, Honolulu, HI
- USGS Pacific Island Ecosystems Research Center, Makawao, HI
- USGS Volcano Hazards Program, Reston, VA

State and Local Agencies and Officials:

- Bishop Museum, Honolulu, HI
- Ron Whitmore, County of Hawai'i, Ka'ū Community Planner, Hilo, HI
- County of Hawai'i Department of Parks and Recreation, Hilo, HI
- County of Hawai'i Mayor, The Honorable Billy Kenoi, Hilo, HI
- County of Hawai'i Planning Department, Hilo, HI
- County Parks and Recreation, Hilo, HI
- County Public Works Department, Hilo, HI
- County Wastewater Division, Hilo, HI
- Department of Health, Honolulu, HI
- Department of Land and Natural Resources, Hilo, HI
- Department of Hawaiian Home Lands, Kamuela, HI
- Department of Hawaiian Home Lands, Honolulu, HI
- Department of Land and Natural Resources, Division of Conservation and Resources Enforcement, Honolulu, HI
- Department of Land and Natural Resources, Division of Forestry and Wildlife, Hilo, HI
- Department of Land and Natural Resources, Division of Forestry and Wildlife, Honolulu, HI
- Department of Land and Natural Resources, Hawai'i Watershed Partnerships Program, Honolulu, HI
- Department of Land and Natural Resources, Hilo, HI
- Department of Land and Natural Resources, Honolulu, HI
- Department of Land and Natural Resources, Kailua-Kona, HI
- Department of Land and Natural Resources, Kapolei, HI
- Department of Land and Natural Resources, Natural Area Reserves System, Hilo, HI
- Department of Land and Natural Resources, Office of Conservation and Coastal Lands, Honolulu, HI
- Department of Land and Natural Resources, Olinda Endangered Species Facility, Kahului, HI
- Department of Land and Natural Resources, State Parks, Honolulu, HI
- Division of Forestry and Wildlife - DOE-CARE, Captain Cook, HI
- East Hawai'i Governor's Representative, Hilo, HI
- Hawai'i County Council, 1st District, Councilman Dominic Yagong, Hilo, HI
- Hawai'i County Council, 2nd District, Councilman Donald Ikeda, Hilo, HI
- Hawai'i County Council, 3rd District, Councilman J. Yoshimoto, Hilo, HI
- Hawai'i County Council, 4th District, Councilman Dennis Onishi, Hilo, HI
- Hawai'i County Council, 5th District, Councilwoman Wendy Cortez - Botelho, Pahoa, HI

- Hawai'i County Council, 6th District, Councilwoman Brittany Smart, Hilo, HI
- Hawai'i County Council, 7th District, Councilwoman Brenda Ford, Kailua-Kona, HI
- Hawai'i County Council, 8th District, Councilman Angel Pilago, Kailua-Kona, HI
- Hawai'i County Council, 9th District, Councilman Pete Hoffman, Kamuela, HI
- Hawai'i County Fire Department, Hilo, HI
- Hawai'i Island Burial Council, Keaau, HI
- Hawai'i State Legislature, 1st District, Representative Mark Nakashima, Honolulu, HI
- Hawai'i State Legislature, 1st District, Senator Malama Solomon, Honolulu, HI
- Hawai'i State Legislature, 2nd District, Representative Jerry Chang, Honolulu, HI
- Hawai'i State Legislature, 2nd District, Senator Gilbert Kahele, Honolulu, HI
- Hawai'i State Legislature, 3rd District, Representative Clifton Tsuji, Honolulu, HI
- Hawai'i State Legislature, 3rd District, Senator Josh Green M.D., Honolulu, HI
- Hawai'i State Legislature, 4th District, Representative Faye Hanohano, Honolulu, HI
- Hawai'i State Legislature, 5th District, Representative Robert Herkes, Honolulu, HI
- Hawai'i State Legislature, 6th District, Representative Denny Coffman, Honolulu, HI
- Hawai'i State Legislature, 7th District, Representative Cindy Evans, Honolulu, HI
- Hawai'i State Parks, Hilo, HI
- Natural Area Reserve Commission, Honolulu, HI
- Office of Environmental Quality Control, Honolulu, HI
- Office of Hawaiian Affairs, Honolulu, HI
- Office of Planning, Honolulu, HI
- State Highways Division, Hilo, HI
- State of Hawai'i Lieutenant Governor, Honorable Brian Schatz, Honolulu, HI
- State of Hawai'i Governor, Honorable Neil Abercrombie, Hilo, HI
- State Plant Extinction Prevention Program, Hilo, HI
- United States Senate, The Honorable Daniel K. Akaka, Honolulu, HI
- United States Senate, The Honorable Daniel K. Inouye, Honolulu, HI
- United States House of Representatives, The Honorable Mazie Hirono, Honolulu, HI

Organizations:

- 'Ahahui Ka'ahumanu O Kona, Kailua-Kona, HI
- 39 Taxi and Tours, Kailua Kona, HI
- AA Hawai'i Tours, Honolulu, HI
- Aa Tours/Paradise Christian, Kailua Kona, HI
- Above It All dba Island Hoppers dba Iolani Air, Kailua-Kona, HI
- AECOS, Kaneohe, HI
- Aina Ihi Ecotours/Volcano Discovery, Volcano, HI
- Alakai Taxi & Tours, Hilo, HI
- Alii Hilo Tours / Elms Taxi, Hilo, HI
- All Hawai'i Adventure Tours, Hilo, HI
- Alpengirl, Inc, Manhattan, MT
- America's Adventure, Inc, Golden, CO
- Amy B. H. Greenwell Ethnobotanical Garden, Captain Cook, HI
- Arnott's Lodge, Hilo, HI
- Audubon Naturalist Society - Woodend Sanctuary Headquarters, Chevy Chase, MD
- Aunty Moana Taxi, Hilo, HI
- Azusa - 4 - U, Kailua Kona, HI
- Backroads, Berkeley, CA
- Bays Deaver Lung Rose Holma, Honolulu, HI

- Bechart Expeditions, Inc., Cupertino, CA
- Best Tours of Hawai'i, Kailua Kona, HI
- Bicycle Adventures, Inc., Issaquah, WA
- Big Island Air, Kailua-Kona, HI
- Big Island Bow Hunters, Keaau, HI
- Big Island Crest Co, Inc., Kailua Kona, HI
- Big Island Field Trial Association, Kamuela, HI
- Big Island Gun Club, Hilo, HI
- Big Island Sight Seeing, Hilo, HI
- Big Island Trap Club, Hilo, HI
- Big Island Visitors and Convention Bureau, Hilo, HI
- BIISC, Hilo, HI
- Bike Volcano.com, Hilo, HI
- Bishop Museum, Honolulu, HI
- Blue Hawaiian, Kahului, HI
- Call Air, Inc., Honolulu, Hi
- C-Big Island, Kailua-Kona, HI
- City Cab, Hilo, HI
- Conservation Council of Hawai'i, Honolulu, HI
- D&K Taxi, Keaau, HI
- Da Best Taxi, Hilo, HI
- Daniel's Taxi, Keaau, HI
- Discover Hawai'i Tours, Honolulu, Hi
- Ducks Unlimited, Honolulu, HI
- Edith Kanaka'ole Foundation, Hilo, HI
- Environment Hawai'i Inc., Hilo, HI
- Field Guides, Inc, Austin, TX
- Forest Solutions Inc., Paauilo, HI
- Friends of Hawai'i Volcanoes National Park, Honolulu, HI
- Friends of Hawai'i Volcanoes National Park, Volcano, HI
- Friends of Hawai'i Volcanoes National Park, Hilo, HI
- Friends of Puna's Future, Pahoa, HI
- Fuku Travel, Hilo, HI
- Fun Tours Hawai'i, Hilo, HI
- Gene's Taxi, Hilo, HI
- Gold Coast Town Car Service, Kailua-Kona, HI
- Green Travel & Tours, Inc., Hilo, HI
- Hawai'i Community College, Kamuela, HI
- Hawai'i Audubon Society, Kailua-Kona, HI
- Hawai'i Audubon Society, Honolulu, HI
- Hawai'i Eco Safari, Keaau, HI
- Hawai'i Forest & Trail, Kailua Kona, HI
- Hawai'i Helicopters, Kahului, HI
- Hawai'i Hunting Advisory Council, Kurtistown, HI
- Hawai'i Hunting Tours, Honokaa, HI
- Hawai'i Island Archery Club, Keaau, HI
- Hawai'i Island Burial Council, Kapolei, HI
- Hawai'i Island Chamber of Commerce, Hilo, HI
- Hawai'i Kanko, Kailua Kona, HI
- Hawai'i Loco Tours/Taniwa, Kailua Kona, HI
- Hawai'i Nature Explorers / Taxi, Hilo, HI
- Hawai'i Outdoor Guides, Hilo, HI
- Hawai'i Pacific Parks Association, Hawai'i National Park, HI
- Hawai'i Pacific Parks Association Board, Ewa Beach, HI
- Hawai'i Pacific Parks Association Board, Kailua, HI
- Hawai'i Pacific Parks Association Board, Kailua-Kona , HI
- Hawai'i Pacific Parks Association Board, Hawai'i National Park, HI
- Hawai'i Pacific Parks Association Board, Hilo, HI
- Hawai'i Pacific Parks Association Board, Kihei, HI
- Hawai'i Pacific Parks Association Board, Volcano, HI
- Hawai'i Pacific Parks Association Board, Wailuku, HI
- Hawai'i Polonia Tours, Honolulu, HI
- Hawaiian Adventure Tours, Kapaau, HI
- Hawaiian Ecosystems at Risk, Puunene, HI
- Hawaiian Silversword Foundation, Tucson, AZ

- Hawaiian Silversword Foundation, Volcano, HI
- Hawaiian Walkways, Honokaa, HI
- HELCO, Hilo, HI
- Helen's Taxi, Hilo, HI
- Hilo Bay Tours, Hilo, HI
- Historic Hawai`i Foundation, Honolulu, HI
- Hokukano Ranch, Ocean View, HI
- Hot Lava Taxi & Tours, Hilo, HI
- Hualalai Archery Club, Holualoa, HI
- Hulihe'e Palace, Kailua-Kona, HI
- Island Dreams, Waikoloa, HI
- Island R.V., Kailua Kona, HI
- Island Wide Tours, Keaau, HI
- Jack's Tours, Hilo, HI
- Japanese Chamber of Commerce, Hilo, HI
- K & S Helicopters dba Paradise and Tropical Helicopters, Kailua-Kona, HI
- Ka 'Ohana O Honu'apo, Naalehu, HI
- Kahauloa Hunt Club, Kailua-Kona, HI
- KAHEA, The Hawaiian Environmental Alliance, Honolulu, HI
- Kahua Ranch LTD, Kailua-Kona, HI
- Kahua Ranch LTD, Kamuela, HI
- Kai Malino Ranch, Holualoa, HI
- Kai Malino Ranch, Ocean View, HI
- Kalapana Community Organization, Pahoa, HI
- Kalapana Community Organization, Hilo, HI
- Kalapana Fishing Council, Pahoa, HI
- Kalauonaone O Puna Association, Pahoa, HI
- Kapohokine Advance Tours, Pepeekeo, HI
- Ka'u Preservation, Naalehu, HI
- Kawaihae Boaters Association, Kamuela, HI
- KC's Taxi, Hilo, HI
- Keahole Airport, Kailua-Kona, HI
- Keahou Beach Resort, Kailua-Kona, HI
- Kealia Ranch, Captain Cook, HI
- Keauhou Bird Conservation Center, Volcano, HI
- Kīlauea Sporting Skeet Club, Volcano, HI
- Kona Crime Prevention Comm, Kailua-Kona, HI
- Kona Hawaiian Civic Club, Kailua-Kona, HI
- Kona Historical Society, Captain Cook, HI
- Kona Limousine Service, Kailua Kona, HI
- Kona Outdoor Circle, Kailua-Kona, HI
- Kool Feva Taxi, Hilo, HI
- Kuakini Hawaiian Civic Club of Kona, Holualoa, HI
- La Moda / Tor Tours, Kailua Kona, HI
- Laiopia 2020, Captain Cook, HI
- Lanihau Partners / Palani Ranch, Honolulu, HI
- Leolani / Hawai'i Scenic Tours and Travel, Hilo, HI
- Luana Limo / Laura's Taxi, Kailua-Kona, HI
- Mabuhay Tours, Hilo, HI
- Mahealani Ranch , Kealakekua, HI
- Makani Kai Helicopters, Honolulu, HI
- Manuiwa Airways, Inc. dba Volcano Helicopters, Hilo, HI
- Marek's Taxi & Tours, Hilo, HI
- Marine and Coastal Solutions Intl, Inc., Hawai'i National Park, HI
- Marine and Coastal Solutions Intl, Inc., Kamuela, HI
- Marine Science Institute, Port Arkansas, TX
- Mario's Taxi, Mountain View, HI
- Marylous Big Island Tours, Keaau, HI
- Maui Island Air dba Volcano Air Tours, Kahului, HI
- Mauna Kea Properties, Kamuela, HI
- Maunaloa Outfitters, Holualoa, HI
- McCandless Ranch & Cattle Company, Captain Cook, HI
- Meridian HRT, Kailua Kona, HI
- Miranda's Taxi & Tours, Ookala, HI
- Mokulele Flight Service, Inc., Holualoa, HI

- Mountain Travel, Inc, Emeryville, CA
- My Big Island Tours, Waikoloa, HI
- National Parks Conservation Association, Washington, DC
- National Wild Turkey Federation, Volcano Chapter, Captain Cook, HI
- National Wildlife Federation, Reston, VA
- Native Guide Hawai'i, Keaau, HI
- Natural Resources Defense Council, New York, NY
- Naturalist Journeys, Portal, AZ
- Nature Schools, Kailua Kona, HI
- New England Hiking Holidays, North Conway, NH
- Nippon Taxi, Kailua Kona, HI
- Noel Taxi, Keaau, HI
- Nui Pohaku, LLC, Pahoa, HI
- & M Taxi, Honokaa, HI
- Ka'u Kakou, Pahala, HI
- Ocean View Chamber of Commerce, Ocean View, HI
- Oceanit, Honolulu, HI
- Office of Hawaiian Affairs, Hilo CRC, Hilo, HI
- Office of Mauna Kea Management, Hilo, HI
- Na Ohana O Kalapana, Pahoa, HI
- Palika Ranch, Kailua-Kona, HI
- Palika Ranch, Kealakekua, HI
- Paradise Helicopters, Hilo, HI
- Photo Safari Hawai'i, Kula, HI
- Pig Hunters of Hawai'i, Keaau, HI
- Pig Hunters of Hawai'i, Papaikou, HI
- Polynesian Adventure Tours, Honolulu, HI
- Queen Liliuokalani Trust, Honolulu, HI
- R & A Taxi, Papaikou, HI
- R & M Taxi, Keaau, HI
- Rainbow Pacific Helicopters,LTD, Honolulu, HI
- Resorts Limousine Service, Kailua-Kona, HI
- Ricky's Tours, Pepeekeo, HI
- Roberts Hawai'i, Honolulu, HI
- Rue Mauverney 28, Gland, Switzerland
- Rutter Development, Irvine, CA
- Safari Aviation, Inc., Lihue, Kauai, HI
- Shaka! Taxi + Tours, LLC, Hilo, HI
- Shark's Tours, Papaikou, HI
- Sierra Club, Volcano, HI
- Sierra Club, Moku Loa group, Hilo, HI
- Sunshine Helicopters, Inc., Kahului, HI
- Taikobo Hawai'i, Kailua Kona, HI
- The Great Wall Inter. Tour, Hilo, HI
- The Mountain Institute, Berkeley, CA
- The Nature Conservancy of Hawai`i, Honolulu, HI
- The Nature Conservancy of Hawai'i, Honolulu, HI
- The Oakland Museum of California, Oakland, CA
- The Queen Emma Land Co, Honolulu, HI
- The World Outdoors, Boulder, CO
- Three Mountain Alliance, Hawai'i National Park, HI
- Timberline Adventures, Denver, CO
- TREE Hawai'i, Honolulu, HI
- Vavoom Volcano Tours, Hilo, HI
- VCA, Volcano, HI
- Volcano Community Association, Volcano, HI
- Volcano Art Center, Hilo, HI
- Volcano Art Center, Volcano, HI
- Waikiki Beach Mariott Hotel, Honolulu, HI
- Wigwam/Naturreisen, Waltenhofen, GM
- Wild Orchid Tours, Hilo, HI
- Wilderness Inquiry, Minneapolis, MN
- Wilderness Watch, Missoula, MT
- Wildlife Conservation Association of Hawai'i, Kamuela, HI
- Yee Hop Enterprises, Honolulu, HI
- YYY Enterprises Inc., Kailua Kona, HI

Native Hawaiian Organizations:

- Hui Malama I Na Kupuna O Hawai'i Nei, Hilo, HI
- Ho'oulu Lahui, Pahoa, HI

- Kalapana Community Organization, Pahoa, HI
- Naki'I Ke Aho, Hilo, HI
- Hale O Na'ali'i, Hilo, HI
- Council for Native Hawaiian Advancement, Honolulu, HI

Schools Libraries and Institutions:

- 72 University Pl, 501 Williams Hall, VT, 05405
- CA State University, Pomona, CA
- Carnegie Institute Department of Global Ecology, Stanford, CA
- Dept. of Zoology, University of Hawai'i, Manoa, Honolulu, HI
- Environmental Policy and Culture, Northwestern University, Evanston, IL
- Hawai'i Community College, Hilo, HI
- Hawai'i State Library, Honolulu, HI
- Hilo Public Library, Hilo, HI
- Honoka'a Public Library, Honokaa, HI
- Kailua-Kona Public Library, Kailua-Kona, HI
- Kamehameha Schools, Keaau, HI
- Kamehameha Schools, Kailua-Kona, HI
- Kamehameha Schools, Paauilo, HI
- Kamehameha Schools, Honolulu, HI
- Kanu o ka 'Aina Charter School, Kamuela, HI
- Kea'au Public Library, Keaau, HI
- Kealakekua Public Library, Kealakekua, HI
- Kua o Ka La Public Charter School, Pahoa, HI
- Laupahoehoe Public Library, Laupahoehoe, HI
- Mountain View Public Library, Mountain View, HI
- Naalehu Public Library, Naalehu, HI
- Pacific CESU, University of Hawai'i at Manoa, Botany Department, Honolulu, HI
- Pahala Public Library, Pahala, HI
- Pahoa Public Library, Pahoa, HI
- Thelma Parker Public Library, Kamuela, HI
- University of Hawai'i at Mānoa, Honolulu, HI
- University of Hawai'i, Honolulu, HI
- University of Hawai'i Institute for Astronomy, Hilo, HI
- University of Hawai'i at Hilo, Hilo, HI
- University of Hawai'i at Mānoa, Honolulu, HI
- University of Hawai'i at Mānoa, Botany Department, Ocean View, HI
- University of Vermont, Burlington, VT

Consultants

- John and Kathleen Dawson, Hilo, HI
- Allan Deear, Keaau, HI

Media

- Hawai'i TribuneHerald, Hilo, HI
- Ho'akea Public Relations LLC, Honolulu, HI
- West Hawai'i Today, Kailua-Kona, HI

Individuals

- 367 private individuals on the mailing list

CONSULTATION

National Historic Preservation Act - Section 106

In accordance with the National Historic Preservation Act of 1966 and the Advisory Council on Historic Preservation regulations, the park must consult the Hawai'i State Historic Preservation Office and related organizations regarding any resource management proposal that might affect a cultural property listed on or found eligible for the National Register of Historic Places. Formal consultation for Section 106 was initiated in 2009 during the initial scoping period for the GMP. A certified letter was sent to 40 names on the park's Section 106 mailing list of agencies, organizations, and

individuals. The letter included an invitation to attend stakeholder and public meetings and was accompanied by the first GMP newsletter. Two Section 106 meetings were held during the 2009 initial scoping; one for kupuna at the park and one in Pahoa with the Kalapana Fishing Council. During the public scoping period, the park received four response letters from Section 106-related organizations and individuals that were incorporated into the alternative development process.

In 2010, GMP Newsletter 2 was mailed to the Section 106 mailing list, providing a summary of public comments. During 2011, letters and copies of Newsletter 3 were sent to the Section 106 mailing list, soliciting review and attendance at public "talk-story" meetings on Hawai'i Island. A presentation was also given for park kupuna to discuss GMP preliminary alternatives in September 2011. During the 2011 review of preliminary alternatives, the park received one response from an individual relating to Section 106.

Endangered Species Act - Section 7

Formal consultation for Section 7 was initiated in 2009 with the US Fish and Wildlife Service and the National Marine Fisheries Service. Each agency was sent a letter and a GMP newsletter soliciting comment and extending an invitation to attend stakeholder or public meetings on Oahu or Hawai'i islands. A formal response was received from each agency that identified individual species concerns and expressed interest in remaining informed as the project progressed. A second letter was sent to both agencies in 2011, advising them of the review of preliminary alternatives, and issuing an invitation to attend a science stakeholder meeting at the park on August 24, 2011. There were no written responses from either agency during this informal public review period.

APPENDIXES

ʻĀkala berry and flower. *NPS photo by Jay Robinson*

Flowers of the endangered Mauna Loa silversword. *NPS Photo*

APPENDIX A: HAWAIʻI VOLCANOES NATIONAL PARK LEGISLATION

HAWAIʻI NATIONAL PARK, ACT OF AUGUST 1, 1916

An Act To establish a national park in the Territory of Hawaiʻi, approved August 1, 1916 (39 Stat. 432)

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the tracts of land on the island of Hawaiʻi and on the island of Maui, in the Territory of Hawaiʻi, hereinafter described. Shall be perpetually dedicated and set apart as a public park or pleasure ground for the benefit and enjoyment of the people of the United States, to be known as Hawaiʻi National Park. Said tracts of land are described as follows:

First. All that tract of land comprising portions of the lands of Kapapala and Keauhou, in the district of Kau, and Kahaualea, Panaunui, and Apua, in the district of Puna, on the island of Hawaiʻi, containing approximately thirty-five thousand eight hundred and sixty-five acres, bounded as follows: Beginning at a point on the west edge of the Keamoku Aa Flow (lava flow of eighteen hundred and twenty-three) from which point the true azimuth and distance to Government survey trigonometrical station Ohaikea is one hundred and sixty-six degrees twenty minutes, six thousand three hundred and fifty feet, and running by true azimuths: (First) Along the west edge of the Keamoku lava flow in a northeasterly and northwesterly direction, the direct azimuth and distance being one hundred and ninety-eight degrees ten minutes, fourteen thousand seven hundred feet; (second) two hundred and fifty-six degrees, eleven thousand four hundred feet, more or less, across the land of Kapapala and Keauhou to a marked point on the Humuula trail; (third) three hundred and twenty-eight degrees fifteen minutes, eight thousand seven hundred and twenty-five feet, across the land of Keauhou to the top of the fault north of the Kau road; (fourth) along the fault in a northeasterly direction, the direction azimuth and distance being two hundred and fifty-one degrees and thirty minutes, four thousand three hundred and thirty feet; (fifth) two hundred and forty-five degrees, six thousand feet, to a point near the southwest boundary of the land of Olaa; (sixth) three hundred and thirty-seven degrees ten minutes, eight thousand six hundred and fifty feet, more or less, to the junction of the Hilo and Keauhou roads: (seventh) three hundred and thirty-three degrees and twenty minutes, three thousand three hundred feet, more or less to the southwest corner of the land of Keaau; (eighth) three hundred and thirty-two degrees and ten minutes seven thousand feet, along the land of Kahaualea; (ninth) two hundred and eighty-one degrees, thirty thousand three hundred and seventy-five feet, more or less, across the land of Kahaualea, passing through the north corner of the land of Panaunui. to the north corner of the land of Laeapuki; (tenth) thirty-one degrees thirty minutes, thirteen thousand two hundred feet, more or less along the land of Laeapuki and across the land of Panaunui; (eleventh) eighty-nine degrees and ten minutes, thirty-two thousand nine hundred feet, more or less, across the land of Panaunui, Apua, and Keanhou to "Palilele-o-Kalihipaa", the boundary point of the Keauhou-Kapapala boundary; (twelfth) fifty-one degrees and thirty minutes, five thousand and five hundred feet, across the land of Kapapala: (thirteenth) one hundred and two degrees and fifty minutes, nineteen thousand one hundred and fifty feet, across the land of Kapapala to a small cone about one thousand five hundred feet southwest of Puu Koae trigonometrical station; (fourteenth) one hundred and sixty-six degrees twenty minutes, twenty-one thousand feet, across the land of Kapapala to the point of beginning.

Second. All that tract of land comprising portions of the lands of Kapapala and Kahuku in the district of Kau, island of Hawaiʻi; Keauhou second, in the district of North Kona; and Kaohe, in the district of Hamakua, containing seventeen thousand nine hundred and twenty acres, bounded as follows: Beginning at Pohaku Hanalei of Humuula, a small cone on the brow of Mauna Loa, and at the common boundary points of the lands of Humuula, Kapapala, and Kaohe, from which the true azimuth and

distance to Government survey trigonometrica1 station Omaokoili is one hundred and ninety-five degrees twelve minutes eighteen seconds, seventy-eight thousand two hundred and eighty-six feet, and running by true azimuths: First, two hundred and ninety-eight degrees, five thousand two hundred and forty feet; second, twenty-eight degrees, thirty-six thousand nine hundred and sixty feet; third, one hundred and eighteen degrees, twenty-one thousand one hundred and twenty feet; fourth two hundred and eight degrees, thirty-six thousand nine hundred and sixty feet; fifth, two hundred and ninety-eight degrees, fifteen thousand eight hundred and eighty feet, to the point of beginning.

Third. A strip of land of sufficient width for a road to connect the two tracts of land on the island of Hawai'i above described, the width and location of which strip shall be determined by the Secretary of the Interior.

Fourth. All that tract of land comprising portions of the lands of Honuaula and Kula in the district of Makawao, and Kipahulu Kaupo, and Kahikinui in the district of Hana, on the island of Maui, containing approximately twenty-one thousand one hundred and fifty acres, bounded as follows: Beginning at a Point called Kolekole, on the summit near the most western point of the rim of the crater of Haleakala, and running by approximate azimuths and distances: First, hundred and ninety-three degrees forty-five minutes nineteen thousand three hundred and fifty feet along the west slope of the crater of Haleakala to a point called Puu-o-Ili; second, two hundred and sixty-eight degrees twenty-three thousand feet up the western slope and across Koolau Gap to the point where the southwest boundary of Koolau Forest Reserve crosses the east rim of Koolau Gap; third, three hundred and six degrees thirty minutes seventeen thousand one hundred and fifty feet along the southwest boundary of Koolau Forest Reserve to a point called Palalia, on the east rim of the crater of Haleakala; fourth, along the east rim of the crater of Haleakala, the direct azimuth and distance being three hundred and fifty-four degrees fifteen minutes eighteen thousand three hundred feet to a point on the east rim of Kaupo Gap, shown on Hawaiian Government survey maps at an elevation of four thousand two hundred and eight feet: fifth, eighty-eight degrees forty-five minutes three thousand three hundred feet across Kaupo Gap to a point called Kaumikaohu, on the boundary line between the lands of Kipahulu and Kahilanui; sixth, one hundred and two degrees and thirty minutes forty thousand seven hundred and fifty feet along the south slope of the crater of Haleakala to the point of beginning. (U.S. C., title 16. sec. 391.)

SEC. 2. That nothing herein contained shall affect any valid existing claim, location or entry under the land laws of the United States, whether for homestead, mineral, right of way, or any other purpose whatsoever, or shall affect the rights of any such claimant, locater, or entryman to the full use and enjoyment of his land. Whenever consistent with the primary purposes of the park the Act of February fifteenth, nineteen hundred and one, applicable to the location of rights of way in certain national parks and the national forests for irrigation and other purposes, shall be and remain applicable to the lands included within the park. The Secretary of the Interior may, in his discretion and upon such conditions as he may deem wise, grant easements or rights of way for steam, electric, or similar transportation upon or across the park. (U.S. C., title 16, sec. 393.)

SEC. 3. That no lands located within the park boundaries now held in private or municipal ownership shall be affected by or subject to the provisions of this Act. (U.S.C. title 16. sec. 393.)

Sec. 4. That the said park shall be under the executive control of the Secretary of the Interior whose duty it shall be, as soon as practicable, to make and publish such rules and regulations as he may deem necessary or proper for the care and management of the same. Such regulations shall provide for the preservation from injury of all timber, birds mineral deposits, and natural curiosities or wonders within said park, and their retention in their natural condition as nearly as possible. The Secretary may in his discretion grant leases for terms not exceeding twenty years, at such annual rental as he may determine, of parcels of land in said park of not more than twenty acres in all to

any one person, corporation, or company for the erection and maintenance of buildings for the accommodation of visitors; but no such lease shall include any of the objects of curiosity or interest in said park or exclude the public from free and convenient approach thereto or convey, either expressly or by implication, any exclusive privilege within the park except upon the premises held thereunder and for the time granted therein; and every such lease shall require the lessee to observe and obey each and every provision in any Act of Congress and every rule, order, or regulation of the Secretary of the Interior concerning the use, care, management or government of the park, or any object or property therein, under penalty of forfeiture of such lease. The Secretary may in his discretion grant to persons or corporations now holding leases of land in the park, upon surrender thereof, new leases hereunder, upon the terms and stipulations contained in their present leases, with such modifications, restrictions, and reservations as he may prescribe. All of the proceeds of said leases and other revenues that may be derived from any source connected with the park shall be expended under the direction of the Secretary, in the management and protection of the same and the construction of roads and paths therein. The Secretary may also, in his discretion permit the erection and maintenance of buildings in said park for scientific purposes: Provided, That no appropriation for the maintenance, supervision, and improvement of said park in excess of $10,000 annually shall be made unless the same shall have first been expressly authorized by law: And provided further, That no appropriation shall be made for the improvement or maintenance of said park until proper conveyances shall be made to the United States of such perpetual easements and rights of way over private lands within the exterior boundaries of said park as the Secretary of the Interior shall find necessary to make said park reasonably accessible in a1l its parts, and said Secretary shall when such easements and rights of way have been conveyed to the United States report the same to Congress. (U.S.C., title 16, sec. 394.)

HAWAIʻI NATIONAL PARK, ACT OF 1920

An Act To authorize the governor of the Territory of Hawaiʻi to acquire privately owned lands and rights of way within the boundaries of the Hawaiʻi National Park, approved February 27, 1920 (41 Stat. 452)

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the governor of the Territory of Hawaiʻi is hereby authorized to acquire at the expense of the Territory of Hawaiʻi, by exchange or otherwise, all privately owned lands lying within the boundaries of the Hawaiʻi National Park as defined by "An Act to establish a national park in the Territory of Hawaiʻi." approved August 1, 1916, and all necessary perpetual easements and rights of way, or roadways, in fee simple, over or to said land or any part thereof.

SEC. 2. That the provisions of Section 73 of an Act entitled, "An Act to provide a government for the Territory of Hawaiʻi," approved April 30, 1900, as amended by an Act approved May 27, 1910, relating to exchanges of public lands, shall not apply in the acquisition, by exchange, of the privately owned lands herein referred to. (U.S.C., title 16, sec. 392.)

HAWAIʻI NATIONAL PARK, ACT OF 1922 ADDITION

An Act To add a certain tract of land on the island of Hawaiʻi to the Hawaiʻi National Park, approved May 1, 1922 (42 Stat. 503)

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the tract of land on the island of Hawaiʻi, in the Territory of Hawaiʻi, set aside for park purposes on the 29th day of October, 1920, by executive order numbered eighty-one of the governor of the Territory of Hawaiʻi, and hereinafter described, is hereby added to and made a part of the Hawaiʻi National Park. Said tract of land is described as follows, to wit:

All that tract of land comprising a portion of the Kau Desert, Kapapala, in the district of Kau, on the island of Hawai‘i, containing forty-three thousand four hundred acres, more or less, bounded as follows:

Beginning at a galvanized iron nail driven into the pahoehoe at the northeast corner of this tract of land, at a place called Palilele-o-Kalihipaa, and on the boundary between the lands of Kapapala and Keauhou, the coordinates of said point of beginning referred to Government survey trigonometrical station Uwekahuna, being twenty-six thousand and ten and four tenths feet south and nine thousand nine hundred and thirty-two and four tenths feet east as shown on Government survey registered map numbered twenty-three hundred and eighty-eight and running by true azimuths: First, three hundred and fifty degrees forty-three minutes, thirty thousand and twenty-three feet along the land of Kapapala to a point at seacoast; second, thence in a west and southwesterly direction along the seacoast to a station on a large flat stone, at a place called Na-Puu-o-na-Elemakule, at the seacoast boundary point of the lands of Kapapala and Kaalaala, the direct azimuth and distance being sixty-nine degrees thirty-four minutes thirty seconds, thirty-two thousand and forty-three feet; third, eighty-nine degrees twenty-seven minutes thirty seconds, thirty thousand six hundred and ninety feet along the land of Kaalaala to the main eighteen hundred and sixty-eight lava crack, said point being by true azimuth and distance two hundred and ninety-six degrees twenty-seven minutes thirty seconds, twenty-one hundred feet from Government survey trigonometrical station Puu Nahala; fourth, thence up along the main eighteen hundred and sixty-eight lava crack, along the Kapapala pastoral lands to a small outbreak of lava from the eighteen hundred and sixty-eight lava crack, opposite the Halfway House, the direct azimuth and distance being one hundred and ninety-eight degrees, thirty-two thousand five hundred and fifty feet; fifth, two hundred and thirty degrees twenty-five minutes, twenty-seven thousand six hundred and fifteen feet along the Kapapala pastoral lands to the west boundary of the Kīlauea section, Hawai‘i National Park; sixth, three hundred and forty-six degrees twenty minutes, six thousand seven hundred and forty-two feet along said west boundary to a small cone; seventh, two hundred and eighty-two degrees fifty minutes, nineteen thousand one hundred and fifty feet along the south boundary of said Kalauea section, Hawai‘i National Park; eighth, two hundred and thirty-one degrees fifty minutes thirty seconds, five thousand four hundred and thirty feet along said south boundary to the point of beginning.

SEC. 2. That the provisions of the Act of August 1, 1916, entitled “An Act to establish a national park in the Territory of Hawai‘i”: the Act of August 25, 1916, entitled “An Act to establish a national park service, and for other purposes,” and all Acts supplementary to and amendatory of said Acts are made applicable to and extended over the lands hereby added to the park: Provided, That the provisions of the Act of June 10, 1920, entitled “An Act to create a Federal power commission; to provide for the improvement of navigation; the development of water power; the use of the public lands in relation thereto; and to repeal Section 18 of the River and Harbor appropriation Act; approved August 8, 1917, and for other purposes,” shall not apply to or extend over such lands. (U.S.C., title 16, sec. 391.)

HAWAI‘I NATIONAL PARK, ACT OF 1928 BOUNDARY REVISION

An Act To revise the boundary of a portion of the Hawai‘i National Park on the island of Hawai‘i in the Territory of Hawai‘i, approved April 11, l928 (45 Stat. 424)

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the boundary of that portion of the Hawai‘i National Park on the island of Hawai‘i firstly described in the Act of Congress approved August 1, 1916 (Thirty-ninth Statutes, page 432, Section 391, title 16. United States Code), entitled “An Act to establish a national park in the Territory of Hawai‘i,” be, and the same is hereby, amended to read as follows:

"All that tract of land comprising portion of the lands of Kapapala and Keauhou, in the District of Kau, and portions of the lands of Keaau, Kahaualea, Panaunui, and Apua in the District of Puna, containing approximately thirty-four thousand five hundred and thirty-one acres, bounded as follows:

"Beginning at a point on the west edge of the Keamoku Aa Flow (lava Flow of 1823), the coordinates of said point of beginning referred to Government Survey Trigonometry Station 'Uwekahuna,' being four thousand seven hundred and six and six-tenths feet south and seventeen thousand nine hundred and seventy and three-tenths feet west, and the true azimuth and distance from said point of beginning to Government Survey Trigonometry Station 'Ohaikea,' being one hundred and sixty-six degrees and twenty minutes, six thousand three hundred and fifty feet, and running by true azimuths—

"1. Along the west edge of the Keamoku Aa Flow in a northeasterly and northwesterly direction, the direct azimuth and distance being one hundred and ninety-eight degrees and ten minutes fourteen thousand seven hundred feet;

"2. Two hundred and fifty-six degrees, eleven thousand four hundred feet across the land of Kapapala and Keauhou to a marked point on the Humuula Trail;

"3. Three hundred and twenty-eight degrees and fifteen minutes eight thousand seven hundred and twenty-five feet across the land of Keauhou to the top of the fault north and the Kau Road;

"4. Thence along the fault in a northeasterly direction along the remainder of Keauhou to a pipe, the direct azimuth and distance being two hundred and fifty-one degrees and thirty minutes four thousand three hundred and thirty feet;

"5. Two hundred and eighty-six degrees five hundred and thirty feet along the remainder of Keanhou;

"6. Two hundred and ninety-eight degrees nine hundred and sixty feet along same;

"7. Two hundred and eighty-three degrees and forty-eight minutes one thousand one hundred and forty-six and five-tenths feet along same to a pipe;

"8. Two hundred and sixty-seven degrees and twenty minutes one thousand and twenty-seven and five-tenths feet along same;

"9. Two hundred and ninety-three degrees and ten minutes one thousand and fifty feet along same to a pipe;

"10. Three hundred and twenty-one degrees and forty-six minutes one thousand one hundred and eleven and three-tenths feet along same;

"11. Three hundred and thirty-three degrees and fifty minutes one thousand one hundred feet along same;

"12. Three hundred and twenty-seven degrees and twenty minutes one thousand nine hundred and forty feet along same;

"13. Two hundred and eighty-three degrees and thirty-nine minutes two thousand and fifty-seven and four-tenths feet along same to a pipe;

"14. Three hundred and thirty-three degrees and twenty minutes two hundred and fifty feet along same to a pipe on the north side of Government Main Road at junction with the Keauhou Road, said pipe being by true azimuth and distance two hundred and ninety-five degrees and twelve minutes six thousand one hundred and sixty-seven and one-tenth feet from Government Survey Trigonometry Station 'Volcano House Flag';

"15. Three hundred and thirty-three degrees and twenty minutes three thousand two hundred and eighty-three and two tenths feet along the remainder of Keauhou to a pipe;

"16. Three hundred and fifty-four degrees and fifty four minutes sixty feet along the remainder of Keaau;

"17. Two hundred and thirty-one degrees and thirty-one minutes one thousand six hundred and seventy-eight and eight tenths feet along same;

"18. Three hundred and eighteen degrees eight hundred and sixteen and four-tenths feet along same to the boundary between the lands of Keaau and Kahaualea;

"19. Seventy-two degrees and forty-five minutes one thousand two hundred and thirty-three and three-tenths feet along the land of Kahaualea to a pipe;

"20. Forty-eight degrees six hundred and thirty-four feet along the remainder of Kahaualea to a pipe on the Kahaualea- Keauhou boundary;

"21. Three hundred and thirty-two degrees and ten minutes six thousand five hundred and fifty-one and four-tenths feet along the Kahaualea-Keaau boundary to a pipe;

"22. Two hundred and eighty-one degrees thirty thousand three hundred and one and seven-tenths feet along the remainder of Kahaualea to a pipe;

"23. Thirty-one degrees and thirty minutes thirteen thousand and seventy-four and seven-tenths feet along the remainder of Kahaualea and Panaunui to a pipe, passing over a pipe at five thousand nine hundred and twenty-two and two-tenths feet on the Kahaualea-Panaunui boundary;

"24. Eighty-nine degrees and ten minutes thirty-two thousand nine hundred feet along the remainder of Panaunui, across the lands of Apua and Keauhou to 'Palilele-o-Kalihipaa,' at an angle in the Keauhou-Kapapala boundary marked by a pile of stones, passing over pipes at three thousand five hundred and seventy-two and eight-tenths feet on the Panaunui- Apua boundary and eight thousand four hundred and thirty-five and three-tenths feet;

"25. Fifty-one degrees fifty minutes and thirty seconds five thousand four hundred and thirty feet across the land of Kapapala;

"26. One hundred and two degrees and fifty minutes nineteen thousand one hundred and fifty feet across same to a small cone about one thousand five hundred feet southwest of 'Puu Koai';

"27. One hundred and sixty-six degrees and twenty minutes twenty-one thousand feet across the land of Kapapala to the point beginning;" and all of those lands lying within the boundary above described are hereby included in and made a part of the Hawai'i National Park subject to all laws and regulations pertaining to said mark. (U.S.C., 6th supp., title 16, sec. 391.)

of Hawai'i to acquire privately owned lands and rights of way within the boundaries of the Hawai'i National Park," are hereby extended over and made applicable to the lands added to the park and included within the boundary established by the preceding section of this Act. (U.S.C., 6th supp., title 16, sec. 392a.)

HAWAI'I NATIONAL PARK, ACT OF 1930 JURISDICTION

An Act To provide for the exercise of sole and exclusive jurisdiction by the United States over the Hawai'i National Park in the Territory of Hawai'i, and for other purposes, approved April 18, 1930 (46 Stat. 227)

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That hereafter sole and exclusive jurisdiction shall be exercised by the United States over the territory which is now or may hereafter be included in the Hawai'i National Park in the Territory of Hawai'i, saving, however, to the Territory of Hawai'i the right to serve civil or criminal process within the limits of the aforesaid park in suits or prosecutions for or on account of rights acquired, obligations incurred, or crimes committed outside of said park, and saving further to the Territory of Hawai'i the right to tax persons and corporations, their franchises and property on the lands included in said park. All the 1aws applicable to places under the sole and exclusive jurisdiction of the United States shall have force and effect in said park. All fugitives from justice taking refuge in said park shall be subject to the same laws as refugees from justice found in the Territory of Hawai'i. (U.S.C., 6th supp., title 16. sec. 395.)

SEC. 2. That the District Court of the United States in and for the Territory of Hawai'i shall have jurisdiction of all offenses committed within the boundaries of said park. (U.S.C., 6th supp., title 16. sec. 395a.)

Sec. 3. That if any offense shall be committed in the Hawai'i National Park, which offense is not prohibited or the punishment for which is not specifically provided for by any law of the United States, the offender shall be subject to the same punishment as the laws of the Territory of Hawai'i in force at the time of the commission of the offense may provide for a like offense in said Territory and no subsequent repeal of any such law of the Territory of Hawai'i shall affect any prosecution for said offense committed within said park: (U.S.C., 6th supp., title 16, sec. 395b.)

SEC. 4. That all hunting or the killing, wounding, or capturing at any time of any wild bird or animal, except dangerous animals when it is necessary to prevent them from destroying human lives or inflicting personal injury, is prohibited within the limits of said park; nor shall any fish be taken out of the waters of the park in any other way than by hook and line, and then only at such seasons and in such times and manner as may be directed by the Secretary of the Interior. That the Secretary of the Interior shall make and publish such general rules and regulations as he may deem necessary and proper for the management and care of the park and for the protection of the property therein, especially for the preservation from injury or spoliation of all timber, natural curiosities, or wonderful objects within said park, and for the protection of the animals and birds in the park from capture or destruction, and to prevent their being frightened or driven from the park; and he shall make rules and regulations governing the taking of fish from the streams or lakes in the park. Possession within said park of the dead bodies, or any part thereof, of any wild bird or animal shall be prima facie

evidence that the person or persons having the same are guilty of violating this Act. Any person or persons, or stage or express company, or railway company, who knows or has reason to believe that they were taken or killed contrary to the provisions of this Act and who receives for transportation any of said animals, birds, or fish so killed, caught, or taken, or who shall violate any of the provisions of this Act or any rule or regulation that may be promulgated by the Secretary of the Interior with reference to the management and care of the park or for the protection of the property therein, for the preservation from injury or spoliation of timber, natural curiosities. or wonderful objects within said park, or for the protection of the animals, birds, or fish in the park, or who shall within said park willfully commit any damage, injury, or spoliation to or upon any building, fence, hedge, gate, guidepost, tree, wood, underwood, timber, garden, crops, vegetables, plants, land, springs, natural curiosities, or other matter or thing growing or being thereon or situated therein, shall be deemed guilty of a misdemeanor and shall be subject to a fine of not more than $500 or imprisonment not exceeding six months, or both, and be adjudged to pay all costs of the proceedings. (U.S.C., 6th supp., title 16, sec. 395c.)

SEC. 5. That all guns, traps, teams, horses, or means of transportation of every nature or description used by any person or persons within said park limits when engaged in killing, trapping, ensnaring, or capturing such wild beasts, birds or animals shall be forfeited to the United States and may be seized by the officers in said park and heId pending the prosecution of any person or persons arrested under charge of violating the provisions of this Act, and upon conviction under this Act of such person or persons using said guns, traps, teams, horses, or other means of transportation, such forfeiture shall be adjudicated as a penalty in addition to the other punishment provided in this Act. Such forfeited property shall be disposed of and accounted for by and under the authority of the Secretary of the Interior. (U.S.C., 6th supp., title 16, sec. 395d.)

SEC. 6. That upon the recommendation and approval of the Secretary of the Interior of a qualified candidate the United States District Court for the Territory of Hawai‘i shall appoint a commissioner who shall reside in the park and who shall have jurisdiction to hear and act upon all complaints made of any violations of law or of the rules and regulations made by the Secretary of the Interior for the government of the park and for the protection of the animals, birds, and fish, and objects of interest therein, and for other purposes, authorized by this Act. (U.S.C., 6th supp., title 16, sec. 395e.)

Such commissioner shall have power, upon sworn information, to issue process in the name of the United States for the arrest of any person charged with the commission of any misdemeanor, or charged with a violation of the rules and regulations, or with a violation of any of the provisions of this Act prescribed for the government of said park and for the protection of the animals, birds, and fish in said park, and to try the person so charged, and, if found guilty, to impose punishment and to adjudge the forfeiture prescribed. (U.S.C., 6th supp., title 16, sec. 395e.)

In all cases of conviction an appeal shall lie from the judgment of said commissioner to the United States District Court for the Territory of Hawai‘i, and the United States district court in said district shall prescribe the rules of procedure and practice for said commissioner in the trial of cases and for appeal to said United States district court. (U.S.C., 6th Supp., title 16, sec. 395e.)

SEC. 7. That such commissioner shall also have power to issue process as hereinbefore provided for the arrest of any person charged with the commission within said boundaries of any criminal offense not covered by the provisions of Section 4 of this Act to hear the evidence introduced, and if he is of opinion that probable cause is shown for holding the person so charged for trial shall cause such person to be safely conveyed to a secure place of internment within the jurisdiction of the United States District Court for the Territory of Hawai‘i, and certify a transcript of the record of his proceedings and the testimony in the case to said court, which court shall have jurisdiction of the case: Provided, That the said commissioner shall grant bail in all cases bailable under the laws of the United States or of said Territory. (U.S.C., 6th supp., title 16, sec. 395f.)

SEC. 8. That all process issued by the commissioner shall be directed to the marshal of the United States for the district of Hawai‘i, but nothing herein contained shall be so construed as to prevent the arrest by any officer or employee of the Government or any person employed by the United States in the policing of said reservation within said boundaries without process of any person taken in the act of violating the law or this Act or the regulations prescribed by the said Secretary as aforesaid. (U.S.C., 6th supp., title 16. sec. 395g.)

SEC. 9. That the commissioner provided for in this Act shall be paid an annual salary as appropriated for by Congress, payable quarterly: Provided, That the said commissioner shall reside within exterior boundaries of said Hawai‘i National Park at a place to be designated by the Secretary of the Interior: And provided further, That all fees, costs, and expenses collected by the commissioner shall be disposed of as provided in Section 11 of this Act (U.S.C., 6th supp., title 16., sec. 395h.)

SEC. 10. That all fees, costs, and expenses arising in cases under this Act and properly chargeable to the United States shall be certified, approved and paid as are like fees, costs, and expenses in the courts of the United States (U.S.C., 6th supp., title 16. sec. 395i.)

SEC. 11. That all fines and costs imposed and collected shall be deposited by said commissioner of the United States, or the marshall of the United States collecting the same, with the clerk of the United States District court for the Territory of Hawai‘i. (U.S.C., 6th supp., title 16, sec. 395j)

SEC. 12. That the Secretary of the Interior shall notify, in writing, the Governor of the Territory of Hawai‘i of the passage and approval of this Act and of the fact that the United States assumes police jurisdiction over said park.

HAWAI‘I NATIONAL PARK, ACT OF 1930 JURISDICTION AMENDMENT

To amend an Act entitled "An Act to provide for the exercise of sole and exclusive jurisdiction by the United States over the Hawai‘i National Park in the Territory of Hawai‘i, and for other purposes," approved April 19, 1930.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That Section 6 of the Act entitled "An Act providing for the exercise of sole and exclusive jurisdiction by the United States over Hawai‘i National Park in the Territory of Hawai‘i, and for other purposes", approved April 19, 1930 (46 Stat. 228; U. S. C., title 16, sec. 395e), be amended by adding at the end thereof the following:

"That during such time or times as the office of the Commissioner for the Hawai‘i National Park shall be or remain unfilled, or when the presence of such Commissioner cannot be conveniently procured, any United States commissioner duly appointed by the United States District Court for the Territory of Hawai‘i and residing in such district shall have full power, authority, and jurisdiction to hear and act upon all complaints made with respect to offenses or violations of law or regulations occurring within the limits of the Hawai‘i National Park, as the United States Commissioner for the Hawai‘i National Park may now act with respect to offenses or violations of law or regulations occurring within the limits of said park."

SEC. 2. That Section 9 of the said Act of April 19, 1930 (46 Stat. 229; U. S. C., title 16, sec. 395h), be amended by adding at the end thereof the following:

"That any United States commissioner in and for the Territory of Hawai‘i, while acting in such capacity as United States Commissioner for the Hawai‘i National Park as authorized by Section 6 hereof, shall be allowed the fees prescribed by Section 21 of the Act of May 28, 1896 (29 Stat. 184), upon the rendition of an itemized account."

SEC. 3. All laws or parts of laws, either Federal or Territorial, in conflict herewith are hereby repealed.

Approved June 25, 1938.

HAWAIʻI NATIONAL PARK, ACT OF 1938 ADDITION

An Act To add certain lands on the island of Hawaiʻi to the Hawaiʻi National Park, and for other purposes. H.R. 1995. June 20, 1938

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That when title to all or any of the following-described lands on the island of Hawaiʻi, in the Territory of Hawaiʻi, shall be vested in the United States, such lands shall be, and the same are hereby, added to and made a part of the Hawaiʻi National Park: Kalapana extension (being portions of the lands of Kahaualea, Panaunui, and Apua and all of the lands of Poupou, Pulama, Kamoamoa, Laeapuki, Panauiki, Kealakomo, and Kahue, in the district of Puna, and portion of the land of Keauhou, in the district of Kau): Beginning at the United States Coast and Geodetic Survey triangulation station Kupapau (marked by a survey tablet set in large rock), the true azimuth and distance from said point of beginning to the United States Coast and Geodetic Survey triangulation station Hakuma (marked by a United States Coast and Geodetic Survey tablet set in smooth lava outcrop and surrounded by a circular patch of cement near edge of sea pali) being two hundred and forty-four degrees forty minutes and fifty seconds exactly fourteen thousand four hundred and thirteen feet and running as follows, all azimuths being measured clockwise from true south (note azimuths of courses 1 to 4, inclusive, are referred to Hakuma meridian):

Along the seacoast at high-water mark, in a general southwesterly direction for the first five courses, the true azimuths and distances between points on said seacoast being-

1. Exactly sixty-six degrees and fifteen minutes twenty-six thousand three hundred and thirty-six and six-tenths feet to United States Coast and Geodetic Survey station Laeapuki, marked by a survey tablet set in mound and covered by a small cairn;

2. Exactly sixty degrees and ten minutes eighteen thousand seven hundred feet to Kaena Point;

3. Exactly seventy-one degrees and fifty-six minutes, twenty-one thousand three hundred and fifty feet to Apua Point;

4. Exactly ninety-eight degrees and forty-five minutes seven thousand four hundred feet to a pipe in concrete at a place called Okiokiahu (note: azimuths of courses 5 to 1l, inclusive, are referred to Uwekahuna meridian);

5. One hundred and nine degrees fifty-seven minutes and twenty-two seconds ten thousand seven hundred and seventeen and nine tenths feet to a pipe in concrete at a place called Makaloa; thence

6. One hundred and seventy degrees four minutes and thirty-nine seconds exactly six thousand eight hundred feet along Hawaiʻi National Park, Kīlauea section, to the foot of the Puueo pali;

7. Two hundred and forty-three degrees five minutes and thirty seconds exactly one thousand nine hundred and seventy-three feet along the foot of Puueo pali along portion of the land of Keauhou;

8. Exactly two hundred and eighty-six degrees fifty minutes exactly nine thousand seven hundred feet along portion of the land of Keauhou;

9. One hundred and seventy-eight degrees thirty-eight minutes and twenty-five seconds exactly

twelve thousand five hundred feet along portion of the land of Keauhou to a pipe in concrete at top of the Poliokeawe pali;

10. One hundred and sixty-six degrees twenty-two minutes and twenty-four seconds twelve thousand four hundred and sixty-seven and nine-tenths feet along portion of the land of Keauhou to a pipe in concrete on the south boundary of Hawai‘i National Park, Kīlauea section;

11. Exactly two hundred and sixty-nine degrees and ten minutes twenty-one thousand one hundred forty-six and five-tenths feet along Hawai‘i National Park, Kīlauea section, to a pipe (note: azimuths of courses 12 and 13 are referred to Puu Huluhulu meridian);

12. Exactly two hundred and eleven degrees and thirty minutes thirteen thousand seventy-four and seven-tenths feet along Hawai‘i National Park, Kīlauea section, to a pipe;

13. Exactly two hundred and eighty-one degrees exactly two thousand nine hundred and thirty-one feet along portion of the land of Kahaualea (note: azimuths of courses 14 to 24, inclusive, are referred to Hakuma meridian);

14. Exactly two hundred and twelve degrees and thirty minutes exactly eight thousand and fifteen feet along the land of Kahaualea;

15. Exactly two hundred and ninety-seven degrees and fifteen minutes exactly twenty-four thousand five hundred and fifty-two feet along the land of Kahaualea;

16. Exactly two hundred and forty-five degrees and fifty-eight minutes exactly six thousand one hundred and sixty-eight feet along the land of Kahaualea;

17. Exactly three hundred and twenty-six degrees and thirty-one minutes exactly five thousand two hundred and forty-eight feet along the land of Kahaualea;

18. Exactly three hundred and fifty-nine degrees and fifteen minutes exactly four hundred and forty-five feet along the land of Kahaualea;

19. Exactly three hundred and twenty-nine degrees exactly two thousand two hundred and eleven feet along the land of Kahaualea

20. Two hundred and thirty-four degrees thirty-nine minutes and forty seconds exactly three thousand two hundred and eighty-three feet across portion of the land of Kahaualea;

21. Exactly three hundred and thirty-eight degrees and twelve minutes three thousand nine hundred and twenty-seven and five-tenths feet along the land of Kapaahu;

22. Exactly three hundred and thirty-four degrees and thirty minutes exactly one thousand seven hundred and eighty feet along the land of Kapaahu to the south corner of grant 3208 to West Kaloi;

23. Exactly three hundred and thirty-one degrees and thirty minutes five thousand and ninety-seven and eight-tenths feet along the land of Kapaahu to a point near seacoast; thence

24. To and along the seacoast at high-water mark to the point of beginning, the true azimuth and distance being: Exactly fifty-three degrees and eighteen minutes three thousand three hundred and sixty-four feet.

Area, forty-nine thousand three hundred and forty acres.

Footprint extension: Beginning at the northeast corner of this tract of land, at a point on the west edge of the Keamoku Aa Flow (lava flow of 1893), and on the westerly boundary of Hawai'i National Park, Kīlauea section, as described in Governor's Executive Order 86, the coordinates of said point of beginning referred to Government survey triangulation station Uwekahuna, being four thousand seven hundred and six and six-tenths feet south and seventeen thousand nine hundred and seventy and three-tenths feet west, and the true azimuth and distance from said point of beginning to Government survey triangulation station Ohaikea being one hundred and sixty-six degrees and twenty minutes exactly six thousand three hundred and fifty feet, as shown on Government survey registered map 2388, and running by azimuths measured clockwise from true south—

1. Three hundred and forty-six degrees and twenty minutes exactly fourteen thousand two hundred and fifty-eight feet along Hawai'i National Park, Kīlauea section, as described in Governor's Executive Order 86;

2. Fifty degrees and twenty-five minutes exactly twenty-seven thousand six hundred and fifteen feet along Hawai'i National Park, Kīlauea section, as described in Governor's Executive Order 81, thence along the remainder of the Government land of Kapapala to the point of beginning as follows:

3. One hundred and ninety-one degrees no minutes and twenty seconds thirteen thousand five hundred and forty-four and five-tenths feet to a pipe at fence corner a little southwest of the old halfway house and about twenty feet southeast of the edge of the Government main road;

4. Two hundred and thirty-four degrees and twenty-five minutes one thousand three hundred and seventy-seven and five tenths feet to a pipe on a mound of pahoehoe about ninety feet southeast of the Government main road;

5. Two hundred and twenty degrees and forty minutes exactly one thousand seven hundred and eighty-seven feet crossing the Government main road to a spike in large boulder in stone wall about one hundred and twenty-five feet north of the Government main road; thence

6. Along stone wall over the lava flows, the boundary following the wall in its turns and windings the direct azimuth and distance being: two hundred and nineteen degrees twenty-two minutes and forty-five seconds exactly eighteen thousand one hundred and twenty-one feet to a point in said stone wall;

7. Two hundred and thirty-eight degrees and seven minutes exactly two hundred and fifty feet partly along stone wall to a pipe in the middle of a corral;

8. Two hundred and thirty-four degrees and two minutes exactly two hundred feet, across corral and along stone wall to a point in said wall;

9. Two hundred and thirty-nine degrees and thirty minutes exactly three hundred and fifteen feet along stone wall to a pipe at end of wall and on the south side of the old Peter Lee Road;

10. One hundred and eighty-five degrees and thirty minutes exactly three hundred and eighty feet crossing old Peter Lee Road and along fence to a pipe at fence corner on the west bank of a ravine; thence

11. Following along the west bank of ravine, the direct azimuth and distance being: two hundred and three degrees and twenty-three minutes four hundred seventy-five and seven-tenths feet to a pipe on the west bank of the ravine;

12. Two hundred and twenty degrees and fifty-four minutes exactly two hundred and forty-five feet across ravine and along fence to a spike in stone pile;

13. Two hundred and twelve degrees and forty-four minutes exactly two hundred feet along fence to a spike in stone pile;

14. Two hundred and twenty-two degrees and fifty-three minutes exactly two hundred and forty feet along fence to a spike in stone pile;

15. Two hundred and twenty-five degrees and forty-six minutes three hundred and forty and six-tenths feet to the point of beginning and containing an area of five thousand seven hundred and thirty acres, more or less; and, in addition, any lands adjacent or contiguous to the Hawai‘i National Park as hereby extended which, in the discretion of the Secretary of the Interior, are necessary for the proper rounding out of the boundaries of the park: Provided, That the United States shall not purchase, by appropriation of public moneys, any land within the aforesaid area, but such lands shall be secured by the United States only by public and private donations.

SEC.2. The Secretary of the Interior is hereby authorized, in his discretion and upon submission of evidence of satisfactory title to him, to accept, on behalf of the United States, title to the lands referred to in the previous section hereof as may be deemed by him necessary or desirable for national-park purposes.

SEC. 3. (a) That the Secretary of the Interior is authorized to lease, under such rules and regulations as he may deem proper, land ascertained by him to be suitable for home site purposes in the Kalapana extension as described herein, to Native Hawaiians when such occupancy does not encroach on or prevent free access to any points of historic, scientific, or scenic interest or in any manner obstruct or interfere with protection and preservation of said area as a part of the Hawai‘i National Park: Provided, however, That occupants of homesites shall reside on the land not less than six months in any one year: And provided further, That fishing, shall be permitted in said area only by native Hawaiian residents of said area or of adjacent villages and by visitors under their guidance.

(b) The term “native Hawaiian”, as used in this section, means any descendant of not less than one-half part of the blood of the races inhabiting the Hawaiian Islands previous to 1778.

SEC. 4. That the provisions of the Act of August 1, 1916 (39 Stat. 432), entitled “An Act to establish a national park in the Territory of Hawai‘i”; the Act of August 25, 1916 (39 Stat. 535). entitled “An Act to establish a. National Park Service, and for other purposes”; the Act of February 27, 1920 (41 Stat. 452), entitled “An Act to authorize the Governor of the Territory of Hawai‘i to acquire privately owned lands and rights-of-way within the boundaries of the Hawai‘i National Park”; and all Acts supplementary to and amendatory of said Acts are made applicable to and extended over the lands hereby added to the park: Provided, That the provisions of the Act of June 10, 1920 as amended, entitled “An Act to create a Federal Power Commission; to provide for the improvement of navigation; the development of water power; the use of the public lands in relation thereto; and to repeal Section 18 of the River and Harbor Appropriations Act, approved August 8, 1917, and for other purposes,” shall not apply to or extend over such lands (U. S. C., title 16, sec. 391): And provided further, That the Governor of the Territory of Hawai‘i is authorized to convey to the United States any and all lands and interests in lands acquired by the Territorial Government under the provisions of this Act.

HAWAIʻI NATIONAL PARK, ACT OF 1948

An Act To provide that appointments of United States commissioners for the Isle Royale, Hawaiʻi, Mammoth Cave, and Olympic National Parks shall be made by the United States district courts without the recommendation and approval of the Secretary of the Interior, approved April 21, 1948 (62 Stat. 196)

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the first sentence of Section 5 of the Act entitled "An Act to accept the cession by the State of Michigan of exclusive jurisdiction over the lands embraced within the Isle Royale National Park, and for other purposes", approved March 6, 1942 (U.S.C., 1940 edition, Supp. V, title 16, sec. 408m), is amended by striking out "upon the recommendation and approval of the Secretary of the Interior of a qualified candidate".

SEC. 2. The first paragraph of Section 6 of the Act entitled "An Act to provide for the exercise of sole and exclusive jurisdiction by the United States over the Hawaiʻi National Park in the Territory of Hawaiʻi, and for other purposes," approved April 19,1930, as amended (U.S.C., 1940 edition, title 16, sec. 395e), is amended by striking out "upon the recommendation and approval of the Secretary of the Interior of a qualified candidate".

SEC. 3. The first sentence of Section 5 of the Act entitled "An Act to accept the cession by the Commonwealth of Kentucky of exclusive jurisdiction over the lands embraced within the Mammoth Cave National Park; to authorize the acquisition of additional lands for the park in accordance with the Act of May 25, 1926 (44 Stat. 635); to authorize the acceptance of donations of land for the development of a proper entrance road to the park; and for other purposes," approved June 5,

1942 (U.S.C., 1940 edition, Supp. V, title 16, sec. 404c-5), is amended by striking out "Upon the recommendation and approval of the Secretary of the Interior of a qualified candidate, the" and inserting in lieu thereof "The".

SEC. 4. The first sentence of Section 5 of the Act entitled "An Act to accept the cession by the State of Washington of exclusive jurisdiction over the lands embraced within the Olympic National Park, and for other purposes", approved March 6, 1942 (U.S.C., 1940 edition, Supp. V, title a6 sec 256d), is amended by striking out "upon the recommendation and approval of the Secretary of the Interior of a qualified candidate". (See 28 U.S.C. § 631 note.)

HAWAIʻI NATIONAL PARK, ACT OF 1959

Excerpt from "An Act To provide for the admission of the State of Hawaiʻi into the Union" approved March 18, 1959 (73 Stat. 4, 11)

SEC. 16. (a) Notwithstanding the admission of the State of Hawaiʻi into the Union, the United States shall continue to have sole and exclusive jurisdiction over the area which may then or thereafter be included in Hawaiʻi National Park, saving, however, to the State of Hawaiʻi the same rights as are reserved to the Territory of Hawaiʻi by Section 1 of the Act of April 19,1930 (46 Stat. 227), and saving, further, to persons then or thereafter residing within such area the right to vote at all elections held within the political subdivisions where they respectively reside. Upon the admission of said State all references to the Territory of Hawaiʻi in said Act or in other laws relating to Hawaiʻi National Park shall be deemed to refer to the State of Hawaiʻi. Nothing contained in this Act shall be construed to affect the ownership and control by the United States of any lands or other property within Hawaiʻi National Park which may now belong to, or which may hereafter be acquired by, the United States. (48 U.S.C. prec. § 491 note.)

HAWAIʻI NATIONAL PARK, ACT OF 1960

An Act To designate and establish that portion of the Hawaiʻi National Park on the island of Maui, in the State of Hawaiʻi, as the Haleakala National Park, and for other purposes, approved September 13, 1960 (74 Stat. 881)

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That, effective July 1, 1961, the detached portion of the Hawaiʻi National Park which lies on the island of Maui is hereby established as a separate unit of the national park system to be known as Haleakala National Park. The park so established shall be administered in accordance with the Act entitled "An Act to establish a National Park Service, and for other purposes", approved August 25, 1916 (39 Stat. 535), as amended and supplemented, and in accordance with any other applicable provision of law relating to the Maui portion of Hawaiʻi National Park. (16 U.S.C. § 396b [Supp. II].)

HAWAIʻI NATIONAL PARK, ACT OF 1961

An Act To change the designation of that portion of the Hawaiʻi National Park on the island of Hawaiʻi, in the State of Hawaiʻi, to the Hawaiʻi Volcanoes National Park, and for other purposes, approved September 22, 1961 (75 Stat. 577)

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That, effective upon the enactment of this Act, the portion of the Hawaiʻi National Park situated on the island of Hawaiʻi, established and administered pursuant to the Act of August 1, 1916 (39 Stat. 432), as amended and supplemented, shall be known as the Hawaiʻi Volcanoes National Park. (16 U.S.C. § 391d.)

HAWAIʻI NATIONAL PARK, ACT OF 1978

An Act to authorize additional appropriations for the acquisition of lands and interests in lands within the Sawtooth National Recreation Area in Idaho. (92 Stat. 3467) (P.L. 95-625)

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

Title III – Boundary Changes

SEC. 301. The boundaries of the following units of the National Park System, are revised as follows, and there are authorized to be appropriated such sums as may be necessary, but not exceed the amounts specified in the following paragraphs for acquisitions of lands and interests in lands within areas added by reason of such revisions:

(10) Hawaiʻi Volcanoes National Park, Hawaiʻi: To add approximately two hundred-sixty-nine-acres as generally depicted on the map entitled "Boundary Map, Hawaiʻi Volcanoes National Park, Hawaiʻi", numbered 80,000, and dated August 1975: $562,000.

SEC. 302. Within twelve months after the date of the enactment of this Act, the Secretary shall publish in the *Federal Register* a detailed map or other detailed description of the lands added or excluded from any area pursuant to Section 301.

SEC. 303. (a) Within the boundaries of the areas as revised in accordance with Section 301, the Secretary is authorized to acquire lands and interests therein by donation, purchase with donated or appropriated funds, exchange, or transfer from any other Federal agency. Lands and interests therein so acquired shall become part of the area to which they are added, and shall be subjected to all laws, rules, and regulations applicable thereto. When acquiring any land pursuant to this title, the Secretary

may acquire any such land subject to the retention of a right of use and occupancy for a term not to exceed twenty-five years or for the life of the owner or owners. Lands owned by a State or political subdivision thereof may be acquired only by donation.

(b)(l) Lands and interests therein deleted from any area pursuant to Section 301 may be exchanged for non-Federal lands within the revised boundaries of such area, or transferred to the jurisdiction of any other Federal agency or to a State or political subdivision thereof, without monetary consideration, or be administered as public lands by the Secretary, as the Secretary may deem appropriate.

(2) In exercising the authority contained in this section with respect to lands and interests therein deleted from any such area which were acquired from a State, the Secretary may, on behalf of the United States, transfer to such State exclusive or concurrent legislative jurisdiction over such lands, subject to such terms and conditions as he may deem appropriate, to be effective upon acceptance thereof by the State.

(c) It is the established policy of Congress that wilderness, wildlife conservation, and park and recreation values of real property owned by the United States be conserved, enhanced, and developed. It is further declared to be the policy of Congress that unutilized, underutilized, or excess Federal real property be timely studied as to suitability for wilderness, wildlife conservation, or park and recreation purposes. To implement this policy, the Secretary, the Administrator of General Services, and the Director of the Office of Management and Budget shall establish a system with appropriate procedures to permit the Secretary full and early opportunity to make - such studies and propose appropriate recommendations to disposing agencies for consideration in connection with determinations of further utilization or disposal of such property under existing law. Each affected executive agency is authorized and directed to provide to the Secretary such advice and information relating to such studies as the Secretary may request.

SEC. 304. The authorities in this title are supplementary to any other authorities available to the Secretary with respect to the acquisition, development, and administration of the areas referred to in Section 301.

Title IV – Wilderness

(6) Hawai‘i Volcanoes National Park, Hawai‘i, wilderness comprising approximately one hundred and twenty-three thousand one hundred acres and potential wilderness additions comprising approximately seven thousand eight-hundred and fifty acres, depicted on a map entitled “Wilderness Plan, Hawai‘i Volcanoes National Park, Hawai‘i,” numbered 124- 20,020 and dated April 1974, to be known as the Hawai‘i Volcanoes Wilderness.

SEC. 402. A map and description of the boundaries of the areas designated in this title shall be on file and available for public inspection in the office of the Director of the National Park Service, Department of the Interior, and in the Office of the Superintendent of each area designated in this title. As soon as practicable after this Act takes effect, maps of the wilderness areas and descriptions of their boundaries shall be filed with the Committee on Interior and Insular Affairs of the House of Representatives arid the Committee on Energy and Natural Resources of the United States Senate, and such maps and descriptions shall have the same force and effect as if included in this Act: Provided, That correction of clerical and typographical errors in such maps and descriptions may be made.

SEC. 403. Any lands which represent potential wilderness additions in this title, upon publication in the *Federal Register* of a notice by the Secretary that all uses thereon prohibited by the Wilderness Act have ceased, shall thereby be designated wilderness. Lands designated as potential wilderness

additions shall be managed by the Secretary insofar as practicable as wilderness until such time as said lands are designated as wilderness.

SEC. 404. The areas designated by this Act as wilderness shall be administered by the Secretary of the Interior in accordance with the applicable provisions of the Wilderness Act governing areas designated by that Act as wilderness, except that any reference in such provisions to the effective date of the Wilderness Act shall be deemed to be a reference to the effective date of this Act, and, where appropriate, any reference to the Secretary of Agriculture shall be deemed to be a reference to the Secretary of the Interior.

Approved November 10, 1978.

HAWAIʻI VOLCANOES NATIONAL PARK ADJUSTMENT ACT OF 2000 (P.L. 10-510)

An Act To eliminate restrictions on the acquisition of certain Land contiguous to Hawaiʻi Volcanoes National Park, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

SECTION 1. SHORT TITLE.

This Act may be cited as the "Hawaiʻi Volcanoes National Park Adjustment Act of 2000".

SEC. 2. ELIMINATION OF RESTRICTIONS ON LAND ACQUISITION.

The first section of the Act entitled "An Act to add certain lands on the island of Hawaiʻi to the Hawaiʻi National Park, and for other purposes", approved June 20, 1938 (16 U S.C. 391b), is amended by striking "park: Provided," and all that follows and inserting "park Land (including the land depicted on the map entitled 'NPS-PAC 1997HW') may be acquired by the Secretary through donation, exchange, or purchase with donated or appropriated funds.".

SEC. 3. CORRECTIONS IN DESIGNATIONS OF Hawaiian NATIONAL PARKS.

(a) HAWAI'I VOLCANOES NATIONAL PARK

(1) IN GENERAL.-Public Law 87-278 (75 Stat. 577) is amended by striking "Hawaiʻi Volcanoes National Park" each place it appears and inserting "Hawai'i Volcanoes National Park."

(2) REFERENCES.-Any reference in any law (other than this Act), regulation, document, record, map, or other paper of the United States to "Hawaiʻi Volcanoes National Park" shall be considered a reference to "Hawai'i Volcanoes National Park"

(b) HALEAKALĀ NATIONAL PARK

(1) IN GENERAL.-Public Law 86-744 (74 Stat. 881) is amended by striking "Haleakala National Park" and inserting "Haleakalā National Park".

(2) REFERENCES.-Any reference in any law (other than this Act), regulation, document, record, map, or other paper of the United States to "Haleakala National Park" shall be considered a reference to "Haleakalā National Park."

(c) KALOKO-HONOKŌHAU

(1) IN GENERAL.--Section 505 of the National Parks and Recreation Act of 1978 (16 U.S.C. 396d) is amended-

(A) in the section heading, by striking "KALOKO-HONOKOHAU" and inserting "KALOKO-HONOKŌHAU"; and

(B) by striking "Kaloko-Honokohau" each place it appears and inserting "Kaloko-Honokōhau."

(2) REFERENCES.-Any reference in any law (other than this Act), regulation, document, record, map, or other paper of the United States to "Kaloko-Honokohau National Historical Park" shall be considered a reference to Kaloko-Honokōhau National Historical Park."

(d) PUUHONUA O HONAUNAU NATIONAL HISTORICAL PARK

(1) IN GENERAL.-The Act of July 21, 1955 (chapter 385; 69 Stat. 376), as amended by Section 305 of the National Parks and Recreation Act of 1978 (92 Stat. 3477), is amended by striking "Puuhonua o Honaunau National Historical Park" each place it appears and inserting "Pu'uhonua o Hōnaunau National Historical Park."

(2) REFERENCES.--Any reference in any law (other than this Act), regulation, document, record, map, or other paper of the United States to "Puuhonua o Honaunau National Historical Park" shall be considered a reference to "Pu'uhonua o Hōnaunau National Historical Park."

(e) PU'UKOHOLA HEIAU NATIONAL HISTORIC SITE

(1) IN GENERAL.-Public Law 92-88 (86 Stat. 562) is amended by striking "Puukohola Heiau National Historic Site" each place it appears and inserting "Pu'ukoholā Heiau National Historic Site."

(2) REFERENCES.-Any reference in any law (other than this Act), regulation, document, record, map, or other paper of the United States to "Puukohola Heiau National Historic Site" shall be considered a reference to " Pu'ukoholā Heiau National Historic Site."

SEC. 4. CONFORMING AMENDMENTS.

(a) Section 401(8) of the National Parks and Recreation Act of 1978 (Public Law 96~25; 92 Stat. 3489) is amended by striking "Hawai'i Volcanoes" each place it appears and inserting "Hawai'i Volcanoes".

(b) The first section of Public Law 94?667 (90 Stat. 2692) is amended in subsection (e) by striking "Haleakala" each place it appears and inserting "Haleakalā."

Approved November 13, 2000.

APPENDIX B: ACQUISITION OF ʻŌLAʻA – HAWAIʻI TERRITORIAL EXECUTIVE ORDER 1540

COPY

Executive Order No. 1540

Setting Aside Land for Public Purposes

By this Executive Order, I, the undersigned, Governor of the Territory of Hawaii, by virtue of the authority in me vested by Section 91 of the Hawaiian Organic Act, and every other authority me hereunto enabling, do hereby order that the public land hereinafter described be, and the same is, hereby set aside for the uses and purposes of the United States of America.

ADDITION TO THE HAWAII NATIONAL PARK for a national wilderness area to be under the control and management of the National Park Service, Department of the Interior of the United States of America.

Being portion of the Government land of Olaa included in the Upper Olaa Forest Reserve, set aside by Governor's Proclamation dated October 13, 1913.
Olaa, Puna, Hawaii

PARCEL 5 Beginning at the south corner of this parcel of land, the west corner of Lot I, Kilauea Settlement Association Lots (Grant 5362 to Albert J. W. Mackenzie), and on the boundary between the lands of Olaa and Keauhou, the coordinates of said point of beginning referred to Government Survey Triangulation Station "VOLCANO HOUSE FLAG" being 6583.98 feet North and 1724.16 feet East, as shown on Government Survey Registered Map 2514, and running by azimuths measured clockwise from True South:-

1.	149°	31'	3194.00 feet	along the land of Keauhou (L.C.Aw. 7713 Apana 11 to V. Kamamalu);
2.	230°	01'	4419.71 feet	along the remainder of the Government land of Olaa included in the Upper Olaa Forest Reserve;
3.	329°	31'	3923.46 feet	partly along same and partly along the southwest side of Wright Road (50 feet wide);
4.	59°	31'	4359.10 feet	along Lot XXII, Kilauea Settlement Association Lots (Grant 10069 to Hisashi Takaki), along the westerly end of Haunani Road (40 feet wide), along Lot 11, Kilauea Settlement Association Lots (Grant 5418 to Martin Porter) and along Lot I, Kilauea Settlement Association Lots (Grant 5362 to Albert J.W. Mackenzie)

OLAA WILDERNESS AREA
Olaa, Puna, Hawaii

Being portion of the Government (Crown) Land of Olaa included in the Upper Olaa and Olaa Forest Reserves set aside by Governor's Proclamations dated October 13, 1913 and December 31, 1918, respectively.

PARCEL 6 Beginning at the south corner of this parcel, the northwest corner of Grant 11132 to William Emil Wehrsig and on the northeast side of Wright Road, the coordinates of said point of beginning referred to Government Survey Triangulation Station "KULANI" being 23244.23 feet South and 18799.07 feet East, and running by azimuths measured clockwise from True South:-

1. 149° 31' 3591.62 feet along the northeast side of Wright Road Extension (50 feet wide, Executive Order 1403);

2. 59° 31' 50.00 feet along the northwest end of said Wright Road Extension (Executive Order 1403);

3. 149° 31' 16976.25 feet along Volcano Farm Lots (Executive Order 1403) and remainder of Upper Olaa Forest Reserve (Governor's Proclamation dated October 13, 1912);

4. 239° 31' 20000.00 feet along the remainders of Upper Olaa and Olaa Forest Reserves (Governor's Proclamations dated October 13, 1913 and December 31, 1918, respectively);

5. 329° 31' 17853.54 feet along the remainder of Olaa Forest Reserve (Governor's Proclamation dated December 31, 19

S

6.	34°	08'	30"	3554.40 feet	along Olaa New Tract Lots (90-A, end of Cross Road No. 7, 50 feet wide, 89, 88, 87, 86 and 85);
7.	318°	32'	30"	1213.30 feet	along Lot 85, Olaa New Tract Lots;
8.	59°	31'		16969.51 feet	along remainder of Olaa Forest Reserve (Governor's Proclamation dated December 31, 1918) and along Grant 11132 to William Emil Wehrsig, to the point of beginning and containing an Area of 9298.54 Acres.

Extract / Area Eq 0. 2615 F.D.

In Witness Whereof, I have hereunto set my hand and caused the Great Seal of the Territory of Hawaii to be affixed. Done at the Capitol at Honolulu this 28th day of November, Nineteen Hundred and Fifty-two

Territory of Hawaii

Office of the Secretary

This is to Certify That the within is a true copy of Executive Order No. 1540 setting aside land for public purposes, the original of which is on file in this office.

In Testimony Whereof, the Secretary of the Territory of Hawaii, has hereunto subscribed his name and caused the Great Seal of the Territory to be affixed.

(S) FRANK G. SERRAO

(SEAL)

DONE in Honolulu, this 28th day of November, A. D. 1952.

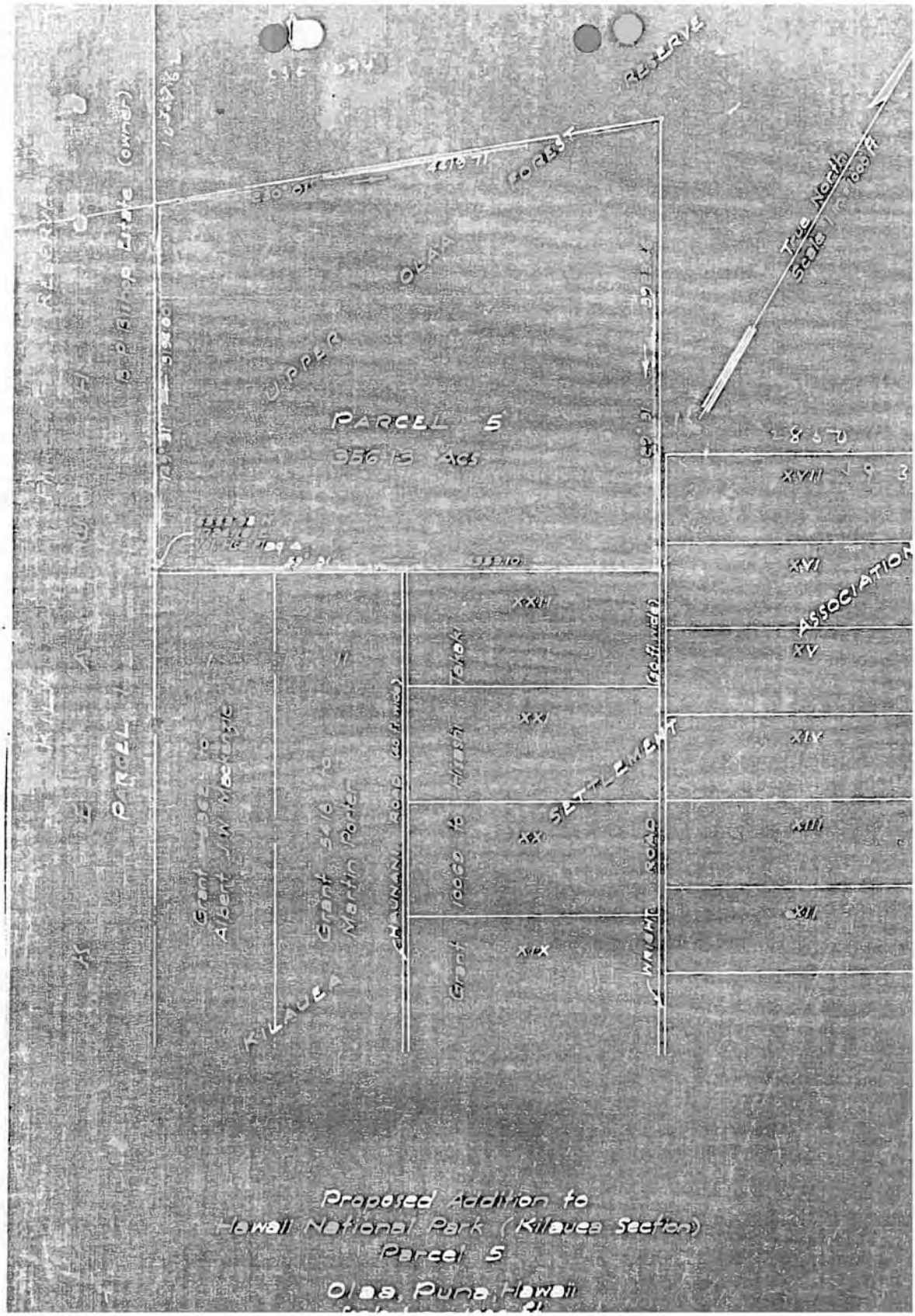
Executive Order No. 1540

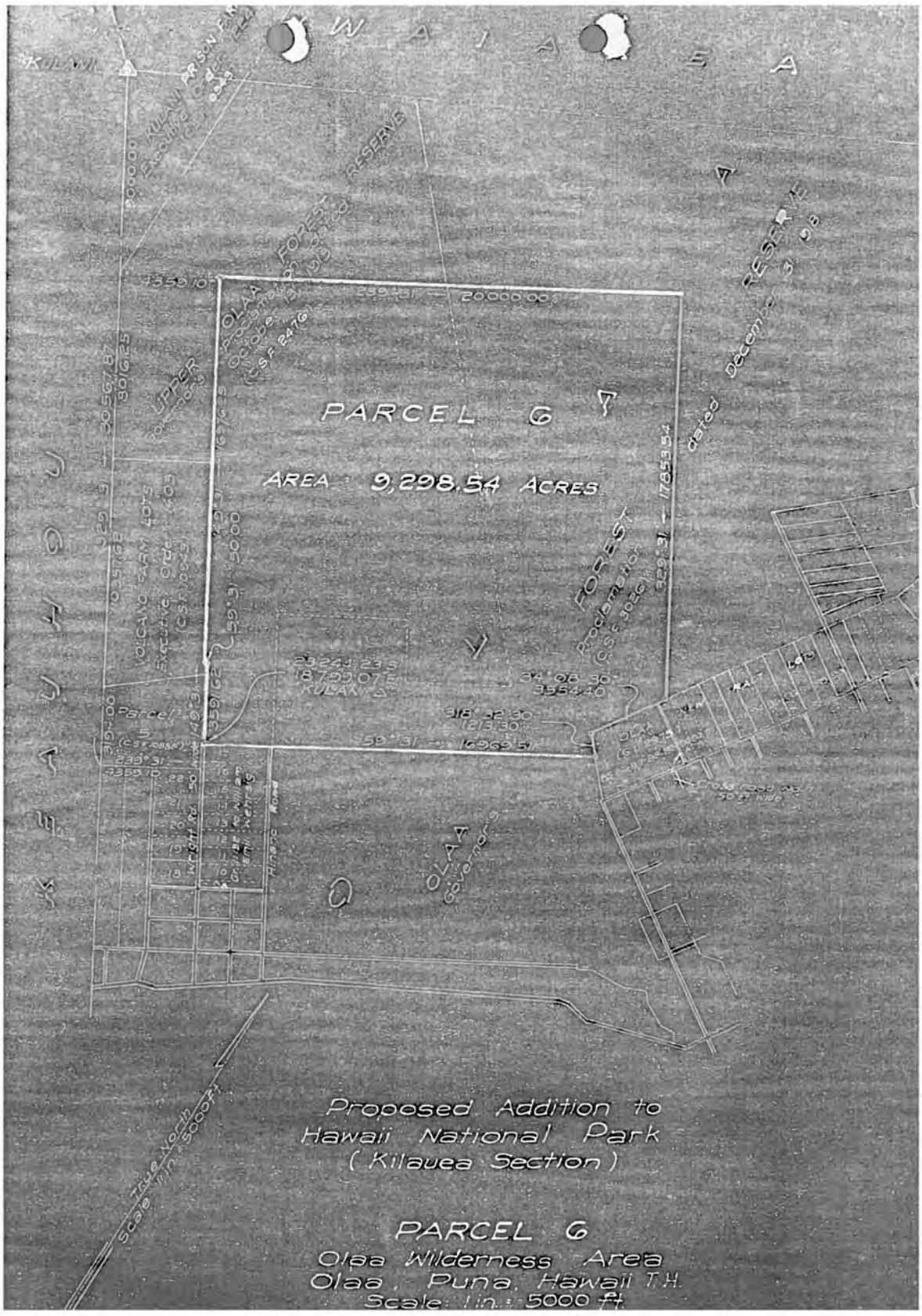
Setting Aside Land for Public Purposes

Land.....

Purpose.....

Date.....


PARCEL 5
Grant 10069 to Albert J.W. MacNamie
Grant 5410 to Martin Porter
KILAUEA
Grant 10069 to
Grant
SEATTLE-EMBRY
WRIGHT ROAD
Taylor
Hirsh
(Gaskill)
ASSOCIATION
True North
XXII
XXI
XX
XVIII
XVI
XV
XIV
XIII
XII
Proposed Addition to
Hawaii National Park (Kilauea Section)
Parcel 5
Olaa, Puna, Hawaii


PARCEL G
AREA 9,298.54 ACRES
Proposed Addition to
Hawaii National Park
(Kilauea Section)
PARCEL 6
Olaa Wilderness Area
Olaa, Puna, Hawaii T.H.
Scale: 1 in. = 5000 ft.

APPENDIX C: PERTINENT LAWS, POLICIES, AND PROCEDURES

The federal laws, executive orders, and policies and procedures applicable to the National Park System and preparation of this general management plan are listed in the following table.

FEDERAL LAWS APPLICABLE TO THE NATIONAL PARK SYSTEM

Abandoned Shipwreck Act of 1987
Acid Precipitation Act of 1980
Act amending the act of October 2, 1968 (commonly called the Redwoods Act)
Act of August 8, 1953
Act of February 21, 1925
Act of June 30, 1864
Act of June 5, 1920
Act of March 1, 1872
Act of May 26, 1930
Administrative Dispute Resolution Act
Administrative Procedures Act
Airport and Airway Development Act of 1970
Airports In or Near National Parks Act
Alaska National Interest Lands Conservation Act of 1980
Alternative Dispute Resolution Act
American Battlefield Protection Act of 1996
American Folklife Preservation Act of 1976
American Indian Religious Freedom Act
Americans with Disabilities Act of 1990
Antiquities Act of 1906
Archeological and Historic Preservation Act of 1974
Archeological Resources Protection Act of 1979
Architectural Barriers Act of 1968
Arizona Desert Wilderness Act (contains NPS boundary study provisions)
Bald and Golden Eagles Protection Act
Clean Air Act
Coastal Barrier Resources Act
Coastal Zone Management Act of 1972
Comprehensive Environmental Response Compensation and Liability Act (commonly referred to as CERCLA or the Superfund Act)
Department of Transportation Act of 1966
Disposal of Materials on Public Lands (Material Act of 1947)
Emergency Planning and Community Right-to-Know Act of 1986
Endangered Species Act of 1973
Endangered Species Conservation Act of 1969
Energy Independence and Security Act of 2007
Energy Supply and Environmental Coordination Act of 1974
Estuary Protection Act
Farmland Protection Policy Act
Federal Advisory Committee Act
Federal Aviation Act of 1958
Federal Cave Resources Protection Act of 1988
Federal Coal Leasing Amendments Act of 1976
Federal Insecticide, Fungicide, and Rodenticide Act
Federal Land Policy and Management Act
Federal Power Act of 1920
Federal Water Pollution Control Act (commonly referred to as Clean Water Act)
Federal Water Power Act
Federal Water Project Recreation Act
Fish and Wildlife Coordination Act
Flood Disaster Protection Act of 1973
Food Security Act of 1985 (Sodbuster Law)
Forest and Rangeland Renewable Resources Planning Act of 1974
Freedom of Information Act
General Authorities Act, October 7, 1976
General Mining Act of 1872
Geothermal Steam Act Amendments
Geothermal Steam Act of 1970
Grand Canyon National Park Enlargement Act
Historic Sites Act of 1935
Intergovernmental Cooperation Act of 1968

Lacey Act of 1900

Land and Water Conservation Fund Act of 1965

Magnuson-Stevens Fishery Conservation and Management Act

Management of Museum Properties Act of 1955

Marine Mammal Protection Act of 1972

Marine Protection, Research, and Sanctuaries Act of 1972 (commonly known as Ocean Dumping Act

Migratory Bird Conservation Act

Migratory Bird Treaty Act

Mineral Leasing Act for Acquired Lands

Mineral Leasing Act of 1920 (commonly referred to as Mineral Leasing Act or Mineral Lands Leasing Act)

Mining in the Parks Act

National Environmental Policy Act of 1969

National Flood Insurance Act of 1968

National Historic Preservation Act

National Park Service Concession Management Improvement Act of 1998

National Park Service Omnibus Management Act of 1998

National Park System Concessions Policy Act

National Park System General Authorities Act (Act to Improve the administration of the national park system), August 18, 1970

National Park System New Areas Studies Act

National Parks Air Tour Management Act of 2000

National Parks and Recreation Act, 1978

National Parks Overflights Act of 1987

National Trails System Act

National Trust Act of 1949

National Wildlife Refuge System Administration Act of 1966

Native American Grave Protection and Repatriation Act of 1990

Negotiated Rulemaking Act of 1990

Noise Control Act of 1972

NPS Organic Act, 1916

Outdoor Recreation Coordination Act of 1963

Outer Continental Shelf Lands Act

Park System Resource Protection Act

Parks, Parkways, and Recreational Programs Act

Payment in Lieu of Taxes Act

Public Buildings Cooperative Use Act of 1976

Rehabilitation Act of 1973

Reorganization Act of March 3, 1933

Reservoir Salvage Act of 1960

Resource Conservation and Recovery Act of 1976

Revised Statute 2477, Right-of-Way across Public Lands

Rivers and Harbors Appropriation Act of 1899

Safe Drinking Water Act

Soil and Water Resources Conservation Act of 1977

Surface Mining Control and Reclamation Act of 1977

Surface Resources Use Act of 1955

Surface Transportation Assistance Act of 1982

Tax Reform Act of 1976

Toxic Substances Control Act

Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970

Urban Park and Recreation Recovery Act of 1978

Water Resources Planning Act of 1965

Watershed Protection and Flood Prevention Act

Wild and Scenic Rivers Act

Wilderness Act

Wildfire Disaster Recovery Act of 1989

EXECUTIVE ORDERS APPLICABLE TO THE NATIONAL PARK SYSTEM

Executive Order 11514, "Protection and Enhancement of Environmental Quality"

Executive Order 11593, "Protection and Enhancement of the Cultural Environment"

Executive Order 11644

Executive Order 11987, "Exotic Organisms," 42 FR 26949, Revoked by Executive Order 13112

Executive Order 11988, "Floodplain Management"

Executive Order 11990, "Protection of Wetlands"

Executive Order 12003, "Energy Policy and Conservation"

Executive Order 12088, "Federal Compliance with Pollution Control Standards"

Executive Order 12372, "Intergovernmental Review of Federal Programs"

Executive Order 12898, "General Actions to Address Environmental Justice in Minority Populations and Low-Income Populations"

Executive Order 13006, "Locating Federal Facilities on Historic Properties in our Nation's Central Cities"

Executive Order 13007, "Indian Sacred Sites"

Executive Order 13089, "Coral Reef Protection"

Executive Order 13112, "Invasive Species"

Executive Order 13158, "Marine Protected Areas"

Executive Order 13175, Consultation and Coordination with Indian Tribal Governments"

Executive Order 13186, "Responsibilities of Federal Agencies to Protect Migratory Birds"

Executive Order 13352, "Facilitation of Cooperative Conservation"

Executive Orders 11989 (42 FR 26959) and 11644 (37 FR 2877), "Offroad Vehicles on Public Lands"

Executive Order 13514, "Federal Leadership in Environmental, Energy, and Economic Performance"

POLICIES AND PROCEDURES APPLICABLE TO THE NATIONAL PARK SYSTEM

Analysis of Impacts on Prime or Unique Agricultural Lands in Implementing the National Environmental Policy Act

Historic Preservation Certifications Pursuant to the Tax Reform Act of 1976, the Revenue Act of 1978, the Tax Treatment Extension Act of 1980, and the Economic Recovery Tax Act of 1981

National Park Service Management Policies 2006

Policies on Construction of Family Housing for Government Personnel

Procedures for Interagency Consultation to Avoid or Mitigate Adverse Effects on Rivers in the Nationwide Inventory

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APPENDIX D: 2011 KAHUKU UNIT WILDERNESS ELIGIBILITY ASSESSMENT

United States Department of the Interior

NATIONAL PARK SERVICE
Hawai'i Volcanoes National Park
Post Office Box 52
Hawaii National Park, Hawai'i 96718

IN REPLY REFER TO
HAVO I.A.2 (N1623)

April 26, 2012

Memorandum

TO: Director, National Park Service

THROUGH: Regional Director, Pacific West Region Patricia Neubacher
Attention: Deputy Regional Director, Resources Management & Planning PJN 5/1/12

FROM: Superintendent, Hawaii Volcanoes National Park Cindy Orlando

SUBJECT: Wilderness Eligibility Assessment for Kahuku

The staff at Hawaii Volcanoes National Park has reviewed an area of 150,865 acres (GIS), known as "Kahuku" or the "Kahuku Unit" to determine its eligibility for preservation as wilderness. These actions are in accordance with long standing policy and law. The Wilderness Act of 1964, regulations in the Code of Federal Regulations (Title 43 Public Lands: Interior, Part 19 Wilderness Preservation), Secretarial Order 2920, and NPS Management Policies (2001; Chapter 6, Wilderness Preservation) require that the National Park Service review roadless and undeveloped areas, including new areas or expanded boundaries within the National Park system to determine whether they are eligible or not eligible for preserving as wilderness. This also is in support of the updating of the General Management Plan.

Overview of Kahuku Parcel (See attached map)

In July 2003, an area of 150,865 acres (GIS), known as "Kahuku", was purchased from the estate of Samuel M. Damon and added to Hawaii Volcanoes National Park. This parcel straddles dramatic lava flows and volcanic features along the southwest rift zone of Mauna Loa, an active volcano and the largest mountain in the world. Over the past century, Mauna Loa has erupted frequently, often every decade, and is known for its voluminous lava flows that extend down its southwest rift zone at Kahuku. The Kahuku area stretches from alpine at 12,600' elevation down to 2,000' into the lowland dry woodlands. At the 7,000 to 8,000-foot middle elevations, Kahuku's landscape transitions into alpine and shrublands. Between the 6,000-7,000 foot elevations, shrublands transition to native montane 'ohi'a and koa forest interspersed by historic lava flows that are sparsely vegetated. Native forests descend to approximately the 3,000 foot elevation, providing habitat for several species of federally listed endangered birds and plants.

Known in Native Hawaiian culture as the "realm of the gods", the only visible evidence of humans at Kahuku's highest elevations are the stone remnants of Native Hawaiian archaeological sites and a few remaining segments of historic trails dating to the 18th and 19th century.

TAKE PRIDE IN AMERICA

An historic road and cabin believed to have been built by the CCC exists between the 6,000 and 7,000 foot elevation. It is anticipated that this road and cabin are most likely eligible for listing on the national register and would be utilized by hikers accessing wilderness eligible lands above.

The greatest human-caused changes occurred below 5,000' at Kahuku. Modifications associated with cattle ranching included construction of a network of dirt or gravel roads, creation of an extensive paddock system, bulldozing of large tracts of forest for cattle grazing, as well as commercial logging. Additional significant changes to the natural landscape occurred with the introduction of non-native goats, European pigs, mouflon sheep and other invasive animals and plants, and the use of ATVs.

Park visitors currently access Kahuku for day-use on week-ends for interpretive programs, sight-seeing, hiking and picnicking up to an elevation of about 4200'. Pit craters, lava tubes and other geologic features are scattered throughout the lower elevations at Kahuku offering great attraction for visitors to explore the geologic history of Mauna Loa Volcano as well as cultural stories which are not available elsewhere in the park. Administrative vehicular access above 4200' is only allowed by park staff working on resource protection, forest restoration and species recovery activities.

Wilderness Eligibility Criteria

NPS lands will be considered eligible for wilderness if they are at least 5,000 acres or of sufficient size to make practicable their preservation and use in an unimpaired condition, and if they possess the following characteristics (as identified in the Wilderness Act):

- The earth and its community of life are untrammeled by humans, where humans are visitors and do not remain.
- The area is undeveloped and retains its primeval character and influence without permanent improvements or human habitation.
- The area generally appears to have been affected primarily by the forces of nature, with the imprint of humans' work substantially unnoticeable. The area is protected and managed so as to preserve its natural conditions.
- The area offers outstanding opportunities for solitude or a primitive and unconfined type of recreation.

The Kahuku Unit Wilderness Eligibility Assessment addresses these requirements and criteria and is the result of an inventory conducted in 2010. The assessment also includes the following assumptions:

> Whether the imprint of human's work is substantially unnoticeable was reviewed from the perspective of a park resource manager and not an average visitor. The work of humans may not be noticeable to a visitor but would be substantially noticeable by a park resource manager.
>
> The wilderness eligibility criteria were only applied to the recently acquired Kahuku Unit; areas in the rest of the park were not included as part of this analysis. It is anticipated that any other potential parcels will be assessed as part of the 2014 General Management Plan.

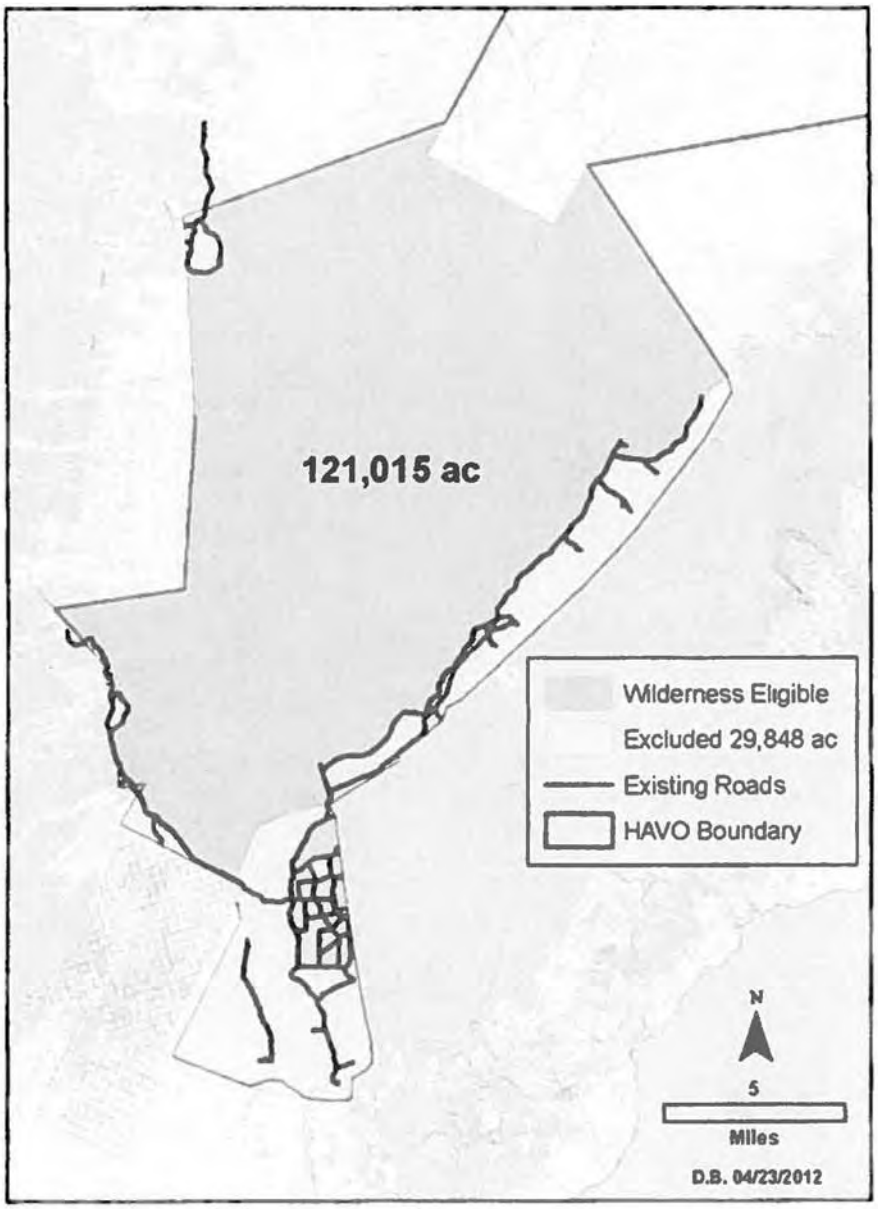
Description of Ineligible Lands (29,848 acres)

The area eliminated from wilderness eligibility recommendation is considered ineligible due to the changes wrought by past cattle ranching activities and the presence of past development including roads, cattle paddocks of exotic grasses, catchments, corrals, water pipeline, a 0.4 mile runway once used by small aircraft, two reservoirs of water, and a series of small ranch buildings. The excluded areas are also marked by the presence of large numbers of invasive non-native mouflon, pigs, goats, and sheep that are significantly degrading native vegetation, contributing to soil erosion, and present a major threat to a number of rare and listed endangered species and their habitat. Left unchecked, these animals will continue to erode the natural vegetation structure and biological diversity of remaining native forests, woodlands, and shrublands. Portions of these areas are more degraded due to extensive modification by bull dozers, introductions of alien grasses, establishment of cattle paddocks, and more intensive use by domestic cattle. The park is constructing boundary fencing and exclosures to protect native species, and searching and removing ungulates using helicopters and motorized vehicles. Areas more heavily modified may require use of heavy construction equipment to assist with forest restoration. Native forest and endangered species recovery activities to maintain ecological integrity and to protect and restore wilderness character require utilization of the current road system and routine road maintenance for a number of years. It is anticipated that both the historic and non-historic portions of the higher elevation road system need to remain for vehicular access throughout these areas.

It is recommended that wilderness eligible lands to the north be demarcated from a point lying roughly 100 meters from the centerline of the northernmost roadways that run parallel to the park boundary on both the west and east of the upper Kahuku parcel. Lands in upper Kahuku adjacent to the east and west roads that lie between the park boundary and the roadways are also recommended to be excluded from wilderness eligibility at this time. A disjunct three mile road segment in the far northwest corner is also excluded. Upon completion of high elevation forest and endangered species recovery projects, parts or all of the road system as well as any restored native forest areas could be reconsidered for wilderness and restored to natural conditions or used as a hiking trail.

A detailed description of the eligibility analysis and map is given on the following pages:

Kahuku Wilderness Eligibility



Kahuku Wilderness Eligibility Assessment

1. The earth and its community of life are untrammeled by humans, where humans are visitors who do not remain.

The 121,015 acres recommended for eligibility exemplifies an untrammeled character due to the presence of an ecological environment that has not been intentionally manipulated by humans. Human use has been greatly restricted by the natural expanse of massive lava flows on Mauna Loa and the lack of water or existing roads and trails. Since park acquisition, there has been only administrative access to this area for cultural and natural resource inventories, and forest and endangered species recovery projects. In addition, the upper mauka section bounded above by designated park wilderness encompasses the summit of Mauna Loa,representing a vast, wild expanse that receives infrequent human visitors who are temporary and do not remain. Its inaccessibility due to rugged lava flows, lack of water or defined trails has created a challenging setting for human access by foot or stock. There is no human habitation. This area is presently closed to the public. Visitation is comprised of park staff, and partners or volunteers engaged in forest restoration activities, and for administrative patrols and emergency actions to protect resources from wildfire and illegal activities in the park and adjacent lands. Access to the area is by motorized vehicle using the existing 4x4 road system or by helicopter (for areas not near roads).

The excluded area of 29,848 acres does not qualify for eligibility because of past human manipulations and the need for restoration of natural conditions that will require intensive management using vehicles, helicopter, fencing and power tools over an extended period of time.

2. The area is undeveloped and retains its primeval character and influence, without permanent improvements or human habitation.

The 121,015 acres recommended for eligibility possesses a windswept, misty terrain that stretches for more than 121,015 acres across the highest slopes of Mauna Loa, cloaking intact native forests and possessing a "primeval character". The upper elevation parcel is roadless and undeveloped bordering the park's previously designated Wilderness atop Mauna Loa at the 12, 600' elevation and descends to about 8,000 foot elevation. Known in Native Hawaiian culture as the "realm of the gods", the only visible evidence of humans at its highest elevations are the stone remnants of Native Hawaiian archaeological sites and a few remaining segments of historic cattle trails dating to the 19th century.

The excluded area of 29, 848 acres does not qualify due to the need for on-going vehicular use of roads and the need for administrative activities in these areas associated with native forest and endangered species recovery in order to maintain ecological integrity and to protect and restore wilderness character. Vehicular access throughout these areas will require utilization of the current road system and routine road maintenance for a number of years. Permanent improvements related to past cattle ranching activities also exist.

3. The area generally appears to have been affected primarily by the forces of nature, with the imprint of human's work substantially unnoticeable. The area is protected and managed so as to preserve its natural conditions.

The 121,015 eligible acres have been affected primarily by the forces of nature. It's vast expanse of huge lava flows dwarf human presence. Known evidence of humans are limited to Native Hawaiian

archaeological sites and a few remnant stretches of historic cattle trails. With only a few exceptions, the uplands of Kahuku are also remarkably free of non-native vegetation which contrasts sharply with the rest of the park's lower elevations. Nearly all of this upper mauka area, on Mauna Loa's massive SW Rift zone is a place where the imprint of humans is unnoticeable, overpowered by the vast lava expanse and aura of wildness.

The excluded 29,848 acres has seen the forces of nature altered by humans and their deliberate introductions of non-native species, especially prominent in the lower elevations. In addition to the road system and buildings described previously, large sections of native forest were cleared and replaced by alien grass pastures to accommodate commercial cattle ranching. Although domestic cattle ranching has ceased, feral ungulates on the landscape prevents the recovery of native forest in former ranched areas and jeopardizes the persistence of remaining native ecosystems. Besides removing these animals, other actions needed to assist recovery of natural conditions include management of introduced weeds and small predatory non-native mammals that endanger rare wildlife and significantly alter natural processes (e.g. trophic structure, fire regimes, nutrient cycles), and extensive planting to connect forest fragments and restore species movement and ecosystem processes across the landscape. Mitigation measures will require use of the road system, helicopters, construction of boundary fencing and motorized equipment, including the possible use of heavy equipment to restore the more heavily modified ranched areas. Administrative uses of these excluded areas are critical for protection of the higher elevation wilderness eligible lands from encroachment by invasive species and potential degradation of wilderness character.

4: The area offers outstanding opportunities for solitude or a primitive and unconfined type of freedom.

The 121,015 acres of eligible lands offers excellent and outstanding opportunities for solitude due its remote, primitive environment. Opportunities for high challenge dispersed recreational hiking on rough terrain and exploration of intact native forests amid fantastic geologic features will be unsurpassed.

The 29,848 acres of ineligible lands also offer opportunities for solitude and dispersed recreational hiking. However, because of its close proximity to Highway 11, the main access road through this area will most likely serve as the main access point for all visitors to the Kahuku Unit. It is anticipated that there will be greater numbers of visitor contacts and recreational activities in this area. This will most likely include more developed areas such as campgrounds, interpretive facilities and physically accessible picnic areas. Activities will also potentially be more directed including ranger-led or guided programs. Administrative activities related to forest restoration and native species recovery will also be necessary and may require closures or restrictions on visitor use and experience.

Other considerations: A wilderness area may also contain significant ecological, geological, or other features of scientific, educational, scenic or historical value.

Ecological: Kahuku eligible lands encompasses alpine, subalpine and portions of the montane seasonal life zones. Vegetation is primarily native dominated and becomes increasingly sparse at higher elevations. The upper area contains habitat for the federally listed endangered Hawaiian petrel ('u'au) the Hawaiian goose (nene), and the candidate endangered band-rumped storm petrel ('ake'ake). The upper northeastern boundary area of this Kahuku is the only park nesting location of three species of endangered Hawaiian forest birds, the 'akepa, 'akiapola'au and the

Hawaii creeper, as well as home to the endangered Hawaiian hoary bat ('ope'ape'a) and one endangered insect. Kahuku also has five species of globally rare Hawaiian forest birds; the 'elepaio, 'i'iwi, 'amakihi, 'oma'o and 'apapane and several native open-country birds including the federally listed endangered Hawaiian hawk ('io) and the globally rare Hawaiian owl (pueo). The upland forests are also identified in the 'Alala (Hawaiian crow) Interagency Recovery Plan as potential habitat for future reintroduction of this endangered species that are currently extinct in the wild. Rare plants in this area include the federally listed endangered Mauna Loa silversword, several endangered lobeliad species, halapepe, and lau kāhi.

Geological: The Kahuku Unit straddles the SW Rift Zone of Mauna Loa Volcano, the largest mountain in the world. The SW Rift zone comprises massive lava flows and has experienced seven eruptions since 1843. Other outstanding geologic features include high elevation cinder and sulfur cones, cinder fields and lava tubes. The colorful tephra deposits of Hapai Mamo, located between 5,000 and 6,500 foot elevation on the west side of the unit, are attributed to earthquakes and eruptions created by the Native Hawaiian deity, Pelehonuameha. Over the past century, Mauna Loa has erupted every one or two decades.

Historical: Remnant stretches of historic cattle trails exist in relic segments between lava flows offering opportunity for new primitive rock cairn wilderness trails to connect and restore historic travel paths. An historic road and cabin built by the CCC for conservation work exists between the 6,000 and 7,000 foot elevation. It is anticipated that this road and cabin are most likely eligible for listing on the national register. Although not included in the eligibility recomendation at this time, these cultural resources may be utilized by hikers accessing wilderness eligible lands above.

Native Hawaiian Cultural: The summit of Mauna Loa has great cultural significance to Native Hawaiians. Ancient Hawaiian archeological sites have been found at high elevations and it is most likely that others exist. A short segment of trail inundated by lava is believed to have been used by early Native Hawaiians. According to Hawaiian land divisions, the upper elevation plant communities and mountain summits (Wao Akua, Waokele, Kualono and Kuahiwi) were sacred and reserved for the spirits. Native Hawaiians seldom penetrated these upper elevation areas. Native Hawaiians consider the native forests to be sacred and the home of their amakua or a place where their ancestors dwell.

Summary of Public Involvement

The park received multiple comments specific to wilderness eligibility at Kahuku during the fall, 2011 public review of preliminary alternatives for the General Management Plan/Wilderness Study EIS. This comment period also served as official scoping for the Wilderness Study which was added to the scope of the GMP and advertised via press releases and an official *Notice of Intent* to include the Wilderness Study which was published in the *Federal Register* (vol. 76, n.232, pp. 75557-58). The third GMP newsletter, including a map of proposed Kahuku eligible lands and a discussion of wilderness criteria, was mailed to the park mailing list of approximately 800 individuals, businesses and organizations. Overall, the park received a total of 280 review comments at public open houses and stakeholder meetings, as well as responses from 65 respondents who commented electronically on PEPC or through written correspondence sent directly to the park.

There were 21 respondents who submitted 33 review comments on Kahuku wilderness eligibility. A number of respondents specifically voiced support for the wilderness study and wilderness designation as being appropriate for Kahuku.

Several comments focused on the need for backcountry facilities to support high elevation access in rugged terrain such as a minimal hut system and water catchment. Another emphasized that the high altitude historic trail remnants should be accessible to hikers. Several comments expressed concern that wilderness designation should not hamper the park's needs for intensive management related to removing ungulates and related needs for fencing or administrative use of helicopters. Others were concerned about potential conflicts with wilderness designation unless administrative access for forest restoration and research, limiting noise from air tours, and the presence of backcountry shelters is possible. One commenter stated that it made sense to exclude Kahuku roads from wilderness designation. There was no opposition to further wilderness assessment, study or designation at Kahuku. Continued public involvement on wilderness at Kahuku and park-wide will be done concurrently with public review of alternatives and the DEIS scheduled for completion in 2014.

Findings

Of the 150, 865 acres assessed, 121,015 acres of the Kahuku Unit meet the eligibility criteria and requirements necessary to qualify for the Congressional designated National Wilderness Preservation System. The remaining 29,848 acres are not recommended for eligibility at this time, because they do not meet eligibility criteria and due to the need for long-term intensive restoration activities to restore natural conditions. These activities include fencing and the extensive use of helicopters, motorized vehicles, mechanical tools, and heavy construction equipment to restore areas altered by bull dozers, ranching, roads, feral ungulates, and other harmful invasive non-native plants and animals. It is anticipated that eligibility would be possible in portions of these areas after forest restoration activities are completed. Management of Kahuku will be managed in accordance with the new General Management Plan/Wilderness Study.

Cindy Orlando, Superintendent — 4/26/12 Date

Patricia L. Neubacher — 5/29/12 Date

Christine S. Lehnertz
Regional Director, Pacific West Region — Concurred: ✓ Not Concurred: ____

acting

Jonathan B. Jarvis — 6/18/2012 Date

Jonathan B. Jarvis
Director, National Park Service — Concurred: X Not Concurred: ____

APPENDIX E: ANALYSIS OF BOUNDARY MODIFICATION AND LAND PROTECTION

NPS *Management Policies 2006* state that the National Park Service will conduct studies of potential boundary adjustments and may make boundary revisions:

- that include significant resources or opportunities for public enjoyment related to the purposes of the park
- that address operational and management issues such as boundary identification by topographic or other natural features
- that protect park resources critical to fulfilling park purposes

NPS policies also instruct that any recommendation to expand park boundaries be preceded by determinations that the added lands will be feasible to administer considering size, configuration, ownership, cost and other factors, and that other alternatives for management and resource protection have been considered and are not adequate.

The following is a review of the criteria for boundary adjustments as applied to Hawai‘i Volcanoes National Park. This analysis is included as supporting documentation for Alternative 2 (Preferred Alternative), which proposes several boundary changes to the park. In addition to seeking legislation to include ‘Ōla‘a (which is already owned by the federal government and managed under the National Park Service) within the official park boundary, Hawai‘i Volcanoes National Park would also propose that the following three areas be acquired and added to the park boundary (see *Figure E.1. Boundary Adjustments*):

- Great Crack parcels (1,951 acres) and Ala Wai‘i Holdings property (2,750 acres) located west of the Great Crack
- a private parcel (223 acres) at the southern tip of Kahuku (west of present entrance off Highway 11)
- Pōhue Bay parcel (16,457 acres) that extends from lower Kahuku on Highway 11 south to the coast

No legislation would be needed for acquisition of these parcels contiguous to the boundary as the Act of June 20, 1938 (Public Law 75-680, 52 Stat. 781) authorizes the acquisition, by public or private donations, of lands adjacent or contiguous to Hawai‘i National Park and determined to be necessary for proper rounding out of the park boundary. However, acquisition by the National Park Service would be restricted to a willing seller purchase only. This means that the seller would be willing to sell and adequate funds would be available to support the purchase.

‘ŌLA‘A

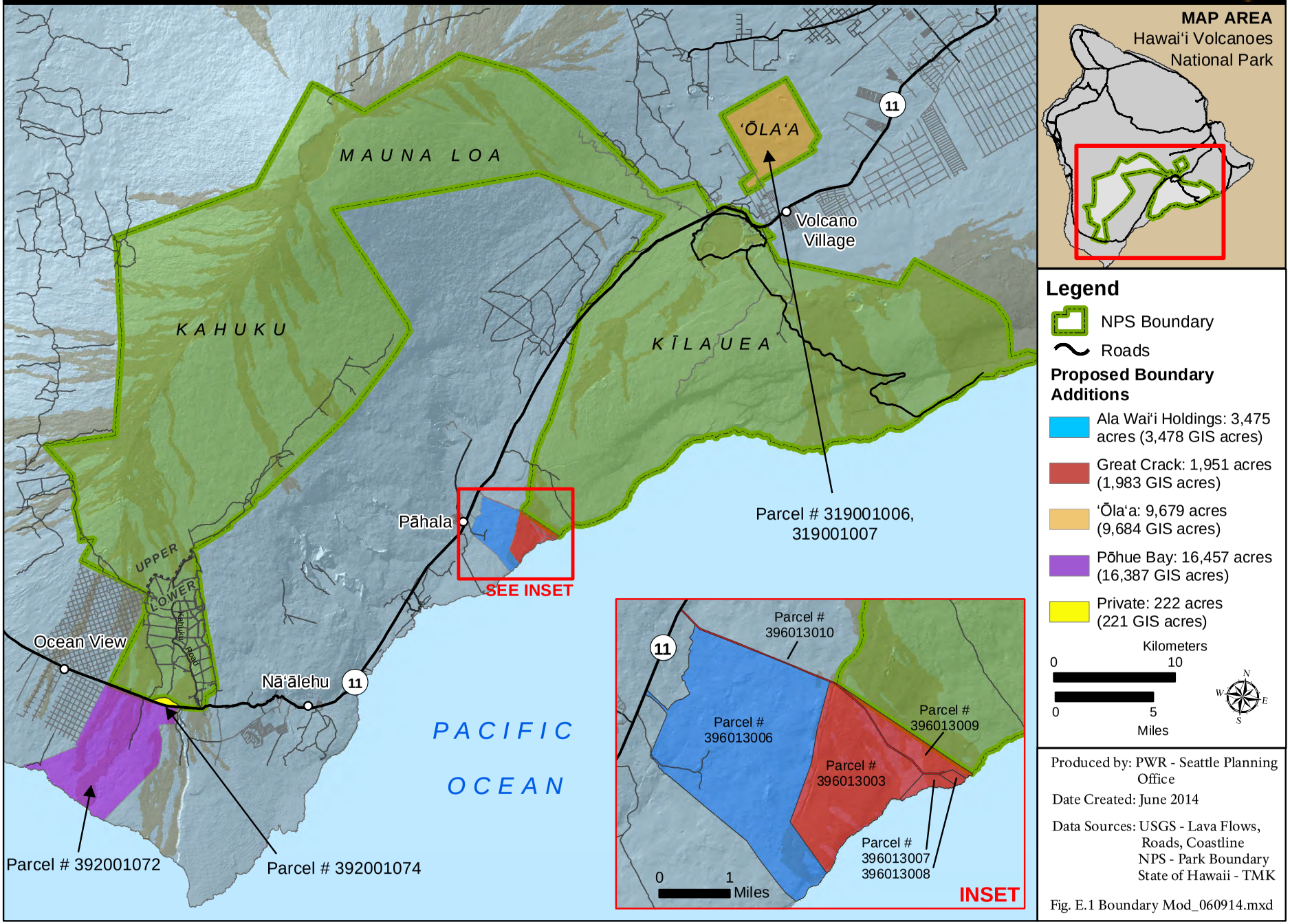
Significant Resources or Opportunities for Public Enjoyment Related to the Purposes of Hawai‘i Volcanoes National Park

‘Ōla‘a is composed of two tracts of land totaling 9,679 acres that are noncontiguous to the park boundary. Donated to the National Park Service in 1952 via Hawai‘i Territorial Executive Order 1540, this area, though not officially within the boundary of Hawai‘i Volcanoes National Park, is managed by the park’s administration for its wilderness character, valuable old growth rainforest habitat, and presence of endemic rare and endangered species. The larger of the two tracts of land (“large tract”) was designated by Congress as part of the Hawai‘i Volcanoes Wilderness in 1978.

Since assuming management of the area, the park has taken measures to remove nonnative ungulates from a large portion of the tract by fencing and excluding animals from approximately half of it. This has resulted in regeneration of native understory species and tree seedlings and has allowed managers to begin recovery efforts for rare, threatened, and endangered species (Loh and Tunison 1999;

Figure E.1 Boundary Modifications

Hawai'i Volcanoes National Park GMP/WS/EIS



Produced by: PWR - Seattle Planning Office

Date Created: June 2014

Data Sources: USGS - Lava Flows, Roads, Coastline
NPS - Park Boundary
State of Hawaii - TMK

Fig. E.1 Boundary Mod_060914.mxd

Pratt et. al. 1999). Over time, the remainder of the area will be fenced to allow removal of ungulates so that recovery actions can be completed throughout the tract.

Although the National Park Service does not currently provide formal public access to ʻŌlaʻa in order to protect the area's fragile plant communities, visitors can access the small tract via an informal turnout along Wright Road in Volcano Village.

The formal inclusion of ʻŌlaʻa within the park boundary would provide permanent protection for these lands as part of a unit of the national park system. This boundary adjustment would also substantiate the park's efforts to restore the unique fern and ʻōhiʻa forest within these tracts and provide more structured and substantial public access to and interpretation of the area's valuable rainforest habitat. The location of ʻŌlaʻa and its proximity to Volcano Village also presents a unique opportunity for the National Park Service to explore partnership opportunities with adjacent land managers such as the Puʻu Makaʻala Natural Area Reserve managed by the Department of Lands and Natural Resources (DLNR).

Operational and Management Issues related to Access and Boundary Identification by Topographic or other Natural Features

Puʻu Makaʻala Natural Area Reserve and ʻŌlaʻa Forest Reserve, owned and managed by the State of Hawaiʻi, border the ʻŌlaʻa large tract to the north, west, and southeast, and the State Department of Hawaiian Home Lands owns property that abuts the large tract at its most eastern corner. A number of private parcels, located within Volcano Village, border the large tract to the southwest and southeast and surround the small tract to the north, southwest, and southeast. The small tract's northeastern boundary is separated from the large tract by the only public access road to ʻŌlaʻa: Wright Road.

Currently, a small, informal turnout provides vehicular access to the small tract along Wright Road, but there are no official trails in ʻŌlaʻa. Public access to the large tract, which is physically limited due to the lack of infrastructure and abundance of protected lands surrounding this tract, is discouraged at this time to protect the area's fragile plant communities. However, this parcel can be accessed from the main road across from small tract and from a trail in Puʻu Makaʻala NAR (along the north/mauka side of large tract) which is accessible at the end of Amaumau Road.

Fencing has been completed around all of small tract and half of large tract. The park is planning to continue fencing and cross-fencing to remove the ungulates found in the currently unfenced section.

Protection of Park Resources and Fulfillment of Park Purposes

As one of the finest and most intact tree-fern and ʻōhiʻa rainforests in Hawaiʻi, ʻŌlaʻa provides vital habitat for species endemic to the Hawaiian archipelago, and therefore its official protection as a part of a unit of the national park system would complement and enhance the park's purpose and significance in protecting, restoring, and studying "unique and diverse ecosystems and endemic species that are the result of over 30 million years of evolution in an isolated environment characterized by its active volcanic landscape and wide climatic variation." Inclusion of the large tract, specifically, in the park boundary would also substantiate the protection of designated wilderness within ʻŌlaʻa as a valuable resource on the Hawaiian Islands that exhibits the natural, untrammeled, undeveloped qualities of wilderness character.

Due to the area's proximity to Volcano Village, ʻŌlaʻa also provides the park with unique opportunities to interpret rainforest ecosystems and the role they play in supporting endemic species on the Hawaiian Islands. Although access may remain limited in the future in order to protect this fragile ecosystem, this GMP calls for development of

a trail to provide visitors on-site interpretation of the rainforest within the small tract and encourages partnering with adjacent land managers to create interpretive media off-site as well.

Feasibility to Administer the Lands Added through Boundary Adjustment

ʻŌlaʻa was donated to the National Park Service in 1952 via Hawaiʻi Territorial Executive Order 1540 with the intent of including the two ʻŌlaʻa tracts within the park. Both parcels were formally accepted by the Secretary of Interior at that time, stating to the Governor of the Territory that the National Park Service would "assume protective custody ... pending their inclusion in the park." Although the National Park Service has managed these lands since acquisition, ʻŌlaʻa has never been included within the official boundary of Hawaiʻi Volcanoes National Park. Congress has never officially modified the park's boundary to include these tracts, and while the Hawaiʻi National Park Act of June 20, 1938 allows "any [acquired] lands adjacent or contiguous" to Hawaiʻi Volcanoes National Park to be added to the park, ʻŌlaʻa has never met the test of this "adjacent or contiguous" clause as it is separated from the park by Volcano Village and other private lands. The boundary adjustment for ʻŌlaʻa would be feasible for the National Park Service to manage and would not substantially add to NPS workloads because park administrators are already managing the 9,679 acres within the small and large tract of ʻŌlaʻa.

Summary

Given the above discussion, ʻŌlaʻa meets the boundary adjustment criteria for official incorporation within Hawaiʻi Volcanoes National Park:

1. ʻŌlaʻa protects one of the finest and most intact tree-fern and ʻōhiʻa rainforests in Hawaiʻi, providing vital habitat for species endemic to the Hawaiian archipelago. The unit also contains designated wilderness.
2. ʻŌlaʻa is already owned and managed by the National Park Service and is accessible to visitors from a public road. There are no operational and management issues related to access and boundary identification.
3. ʻŌlaʻa's official protection as a part of a unit of the national park system would complement and enhance the park's purpose and significance in protecting, restoring, and studying "unique and diverse ecosystems and endemic species that are the result of over 30 million years of evolution in an isolated environment characterized by its active volcanic landscape and wide climatic variation." Inclusion of the large tract, specifically, in the park boundary would also substantiate the protection of designated wilderness within ʻŌlaʻa as a valuable resource on the Hawaiian Islands that exhibits the natural, untrammeled, undeveloped qualities of wilderness character.
4. ʻŌlaʻa is already owned and managed by the National Park Service. As demonstrated by over 50 years of management, the National Park Service has the capacity to administer ʻŌlaʻa if officially included within the park boundary.

GREAT CRACK PARCELS AND ALA WAIʻI HOLDINGS PROPERTY

Significant Resources or Opportunities for Public Enjoyment Related to the Purposes of Hawaiʻi Volcanoes National Park

The Great Crack parcels (tracts 26 and 27) and Ala Waiʻi Holdings property, totaling approximately 4,701 acres, encompass the lower end of the southwest rift zone of Kīlauea Volcano, an area rich in geological and archeological resources. The Great Crack, stretching up to 49 feet (15 meters) wide and 66 feet (20 meters) deep in places, is a superb example of the geologic dynamism of Kīlauea and is one of a series of cracks, eruptive

fissures, and cones that outline the southwest rift zone of Kīlauea in this area. Acquisition of these parcels and inclusion within the park boundary would prevent the possibility of future development, including residential and an "energy park" for geothermal, solar, and wind power generation (Park 2013d) in this area, protect these valuable geologic resources, and provide public access to and interpretation of the resources. The park's 1975 Master Plan recommended acquisition of these parcels, as did the 1986 Land Protection Plan. In addition, the legislation authorizing the park's wilderness (1978) included the Great Crack parcels as potential wilderness that would become wilderness upon acquisition. Acquisition of these parcels would provide access to park lands that are currently not accessible except with private landowner permission. As this boundary adjustment would also extend the park boundary further along the coast, these parcels would also provide linkage to the Ala Kahakai National Historic Trail, existing park trails, and foot access to nearly three and a half miles of shoreline.

The lands included in the Ala Waiʻi Holdings property, adjacent to the Great Crack parcels, provide a critical link to the past and contain irreplaceable archaeological and cultural resources that are currently threatened by uncontrolled access and use, vandalism, and looting. Little is known about the cultural and natural history of this site since the lands have been in private ownership. However, the site is believed to contain extensive archeological resources that include early Polynesian/ Hawaiian features. These resources reflect the significance and sacredness of the site and provide an opportunity to expand our knowledge of how the land was used, what the resources were, and how early inhabitants of this expanse of lava survived.

Operational and Management Issues related to Access and Boundary Identification by Topographic or other Natural Features

The Great Crack parcels were recently officially subdivided into four developable lots at which time the County may have required official surveys.

The Great Crack parcels are located adjacent to the southwest corner of the park and makai of the Great Crack, a major geologic feature lying along the park's western boundary. These parcels were formerly identified for acquisition by the park service (Park 1975, Park 1986). Bordered by the park to the north, these parcels abut the Pacific Ocean to the east and the Ala Waiʻi Holdings property to the south and west.

The Ala Waiʻi Holdings property, which is adjacent to public lands to the north (state-owned) and the Great Crack parcels to the east, is primarily surrounded by private lands to the south and west, separated from the Mamalahoa Highway by only a sliver of private land. While hikers and cavers regularly trek to the Great Crack from neighboring lands, including the park, the only vehicular access to these parcels is off of the Mamalahoa Highway near Pāhala, utilizing a road that requires private landowner permission. This road is part of the proposed acquisition.

If acquired, resources would need to be inventoried and managed to protect natural and cultural resources found in the area.

Protection of Park Resources and Fulfillment of Park Purposes

Evaluated for inclusion within the national park system in the 2006 NPS Reconnaissance Survey for the Kaʻū Coast and proposed for additional evaluation through a NPS Special Resource Study under the Kaʻū Coast Preservation Act (S.1432), the relatively undisturbed Great Crack parcels and Ala Waiʻi Holdings property include significant geologic and archeological resources that illustrate the

violent geologic forces that formed the island and the human response and adaptation to these forces. Because of these resources, these lands are also of exceptional interpretive and educational value—affording a "visual and physical experience of the inextricable link between landscape and culture for the native people of Hawai'i" and "[enriching our] understanding of our country's complex natural and cultural heritage" (NPS 2006b). These lands also provide options for active and passive recreation, nature study, and cultural experiences, and "the native vegetation, geologic. . .features, and archeological sites and complexes offer untapped opportunities for scientific study" (NPS 2006b).

All of these elements align with the purposes for which Hawai'i Volcanoes National Park was established and contribute to the park's significance. Furthermore, this proposal to protect the remaining portions of the Kīlauea southwest rift zone is consistent with the park's international designation as a World Heritage Site and incorporation into the Man and the Biosphere (MAB) program, an element of the park's guiding principles.

Feasibility to Administer the Lands Added through Boundary Adjustment

As contiguous tracts on the southwest corner of the park, the Great Crack parcels and Ala Wai'i Holdings property represent logical and important additions to Hawai'i Volcanoes National Park and have previously been determined to meet the NPS standards for feasibility for inclusion in the national park system (NPS 2006b).

The Great Crack parcels, currently in private ownership, have previously been identified for acquisition and inclusion within the park boundary through the park's Master Plan (1975) and Land Protection Plan (1986) and were initially identified in the Master Plan and again in 1978 (PL 95-625) for potential wilderness designation (PL 95-625 allows for administrative wilderness designation through a notice published in the *Federal Register*).

Although the Ala Wai'i Holdings property has not previously been considered for legislation, Congress has already authorized acquisition of one of the Great Crack parcels, and the National Park Service previously sought to buy this property in 1998. Both parcels are also being considered for NPS designation through a special resource study. Contiguous to the park boundary and with no existing through roads to other destinations, these parcels could be readily delineated as part of Hawai'i Volcanoes National Park and, following acquisition and designation, could be managed with relative ease.

Summary

Given the above discussion, the Great Crack parcels and Ala Wai'i Holdings property meet the boundary adjustment criteria for acquisition and incorporation within Hawai'i Volcanoes National Park:

1. The Great Crack and Ala Wai'i holdings contain rich geological and irreplaceable archeological and cultural resources. Acquisition of these parcels and inclusion within the park boundary would prevent the possibility of future development, including residential and an "energy park" for geothermal, solar, and wind power generation (Park 2013d) in this area, protect these valuable geologic resources, and provide public access to and interpretation of the resources.
2. Official surveys have recently been completed for the Great Crack Parcels. Considering that the private road accessing these parcels is included within this boundary adjustment proposal, there are no operational and management issues related to access and boundary identification.
3. The resources within the Great Crack and Ala Wai'i holdings align with the purposes for which Hawai'i Volcanoes National Park was established and contribute to the park's significance. Furthermore, this

proposal to protect the remaining portions of the Kīlauea southwest rift zone is consistent with the park's international designation as a World Heritage Site and incorporation into the Man and the Biosphere (MAB) program, an element of the park's guiding principles.

4. As contiguous tracts located on the southwest corner of the park, the Great Crack parcels and Ala Wai'i Holdings property represent logical and important additions to Hawai'i Volcanoes National Park and have previously been determined to meet the NPS standards for feasibility for inclusion in the national park system (NPS 2006b).

PRIVATE PARCEL OFF MAMALAHOA HIGHWAY

Significant Resources or Opportunities for Public Enjoyment Related to the Purposes of Hawai'i Volcanoes National Park

A private parcel (223 acres) located at the southern tip of Kahuku (west of present entrance off Highway 11) currently separates Kahuku from the Mamalahoa Highway and limits NPS management of visitor use and access to this unit. Acquisition of this property would essentially connect the entire Kahuku parcel with Highway 11 and protect a section of lower Kahuku from incompatible development on its boundary, as well as provide access to a historic trail.

Operational and Management Issues related to Access and Boundary Identification by Topographic or other Natural Features

The boundary of the parcel off the Mamalahoa Highway is clearly delineated by Highway 11, which runs along the southern border of this parcel, and the Old Mamalahoa Highway (now a mostly abandoned roadway), which surrounds the northern section of this parcel and connects with Highway 11 to the east and west of the parcel. Due to its proximity to these major roads and Kahuku, this parcel is easily accessible by the public. Safety and traffic concerns, however, would dictate the design of this access and would likely need to be provided through close coordination with the State of Hawai'i Department of Transportation.

If acquired, the area may need to be fenced to allow ungulate removal and prevent future ingress, to protect natural and cultural resources found in the area.

Protection of Park Resources and Fulfillment of Park Purposes

As the parcel off the Old Mamalahoa Highway is privately owned and is physically the only barrier between a portion of Kahuku and Highway 11, acquisition of this property would protect the area from incompatible development, protect rare dryland forest habitat, provide access to a historic trail, and expand the interpretive opportunities and information provided in this location.

Feasibility to Administer the Lands Added through Boundary Adjustment

As a relatively small parcel of land, located between a highway and an abandoned roadway, the private parcel off the Old Mamalahoa Highway would likely decrease NPS administrative burdens as it would eliminate any threat of incompatible uses near this entry point. Managing this parcel could also provide the park with greater flexibility in providing a safe and scenic access to this unit of the park.

Summary

Given the above discussion, the Private Parcel off Mamalahoa Highway meets the boundary adjustment criteria for acquisition and incorporation within Hawai'i Volcanoes National Park:

1. Acquisition of this property would connect the entire Kahuku parcel with Highway 11 and protect a

section of lower Kahuku from incompatible development on its boundary, as well as provide access to a historic trail.
2. The boundaries of the parcel are clearly delineated by public roads; therefore, there are no operational and management issues related to access and boundary identification.
3. Acquisition of this property would protect the area from incompatible development along the park boundary, protect rare dryland forest habitat, provide access to a historic trail, and expand the interpretive opportunities and information provided in this location.
4. As a relatively small parcel of land, located between a highway and an abandoned roadway, acquiring this small parcel would likely decrease NPS administrative burdens and provide the park with greater flexibility in providing a safe and scenic access to the Kahuku unit.

PŌHUE BAY PARCEL

Significant Resources or Opportunities for Public Enjoyment Related to the Purposes of Hawai‘i Volcanoes National Park

The addition of the 16,457 acre Pōhue Bay parcel to Hawai‘i Volcanoes National Park would protect and preserve important resources related to the natural, archeological, cultural, and scenic resources of the park and would provide a significantly new range of opportunities for public use and enjoyment by extending the public lands along the southwest rift zone of Mauna Loa mauka to makai.

This parcel extends from lower Kahuku on Highway 11 south to the Ka‘ū Coast at Pōhue Bay. This bay is among the most productive nesting sites for the endangered hawksbill turtle, the rarest sea turtle in the Pacific Ocean. The area is also used by the threatened green sea turtle and endangered Hawaiian monk seal. Rare anchialine ponds that host endemic and native shrimp species and insects, and intertidal pool complexes that provide nursery habitat for marine invertebrates and fish are present as well. Many other endemic and/or threatened and endangered invertebrate plant and animal species, such as the Hawaiian hoary bat, the Halapepe tree, and endemic cave crickets are located on these lands. In addition to this abundance of natural resources, the Pōhue Bay property is the location of the original Polynesian landing over 1,500 years ago and contains important archeological sites, petroglyphs, ancient Hawaiian mauka-makai and lateral trails, and other coastal resources that are still used traditionally, including the Ala Kahakai National Historic Trail. Pōhue Bay is the only white sand beach in Ka‘ū (within a 40 mile radius), the coastline along this parcel (from Miloli‘i to Hawai‘i Volcanoes National Park) represents “the largest area of natural and undeveloped shoreline in the State of Hawai‘i” and “is largely pristine, unspoiled, uninhabited and undeveloped” (DNLR 2007).

In addition to protecting these natural, archeological, and cultural resources from private development, acquisition of this parcel would expand the recreational opportunities in lower Kahuku to include access to the ocean and would diversify the interpretation and educational opportunities in this area of the park.

Due to the abundance and importance of these resources, Sen. Mazie Hirono introduced the Ka‘ū Coast Preservation Act of 2013 on August 1, 2013, directing the National Park Service to assess the feasibility of designating certain coastal lands on the Ka‘ū Coast as units of the National Park System (S. 1432). According to the Library of Congress, the bill has been assigned to the Senate committee on Energy and Natural Resources to consider before sending it to the House or Senate (Library of Congress, n.d.). Sen. Brian Schatz introduced the Pacific Islands Parks Act of 2013 (S.618) to conduct resource studies on the Ka‘ū Coast and several other Hawaiian Islands, which could to acquisition of this parcel. Hawai‘i County

passed a resolution to enter into negotiations to acquire the parcel either in its entirety, portions thereof, or a conservation easement for this parcel (Resolution 265-12, 2012), therefore it may also be possible to protect this land through partnerships.

Operational and Management Issues related to Access and Boundary Identification by Topographic or other Natural Features

The Pōhue Bay parcel is located directly makai of the western half of Kahuku and is separated from the park by the Mamalahoa Highway. Although primarily surrounded by private lands to the east and west, a Hawai'i County parcel that is zoned for open space is located adjacent to the parcel. Privately owned, public access to this parcel is currently limited despite the 250-350 foot wide conservation corridor along the parcel's coastline. There are a few roads that access Pōhue Bay from the north (off the Mamalahoa Highway) and the west. The Ala Kahakai National Historic Trail also runs through this parcel.

If acquired, the area would need to be resources would need to be inventoried and managed to protect natural and cultural resources found in the area.

Protection of Park Resources and Fulfillment of Park Purposes

The acquisition of the Pōhue Bay parcel for Hawai'i Volcanoes National Park would protect and preserve important resources related to the natural, archeological, cultural, and scenic resources of the park and would provide a significantly new range of opportunities for public use and enjoyment by extending the park's portion of Kahuku mauka to makai, thereby completing the connection between the coast and the summit of Mauna Loa along the volcano's southwest rift zone. As mentioned previously, this land is used by several threatened and endangered species, contains rare anchialine ponds and intertidal pool complexes, and includes numerous archeological sites and other cultural resources, all of which complement the purpose of the park to perpetuate endemic Hawaiian ecosystems and the traditional Hawaiian culture connected to these landscapes. While acquisition and designation as part of Hawai'i Volcanoes National Park would protect these natural, archeological, and cultural resources from private development, it would also expand the recreational opportunities in lower Kahuku to include access to the ocean and the Ala Kahakai National Historic Trail and would diversify the interpretation and educational opportunities in this area of the park.

Feasibility to Administer the Lands Added through Boundary Adjustment

The acquisition of the Pōhue Bay parcel would also represent a logical and important addition to Hawai'i Volcanoes National Park and could be feasibly managed by staff overseeing operations in Kahuku, particularly in the interim until planning for the protection of resources and developing visitor access is completed.

Summary

Given the above discussion, the Pōhue Bay Parcel meets the boundary adjustment criteria for acquisition and incorporation within Hawai'i Volcanoes National Park:

1. The addition of the 16,457 acre Pōhue Bay parcel to Hawai'i Volcanoes National Park would protect and preserve important resources related to the natural, archeological, cultural, and scenic resources of the park and would provide a significantly new range of opportunities for public use and enjoyment by extending the public lands along the southwest rift zone of Mauna Loa mauka to makai.
2. Pōhue Bay is accessible from the Mamalahoa Highway and the Ala Kahakai National Historic Trail. The parcel is privately owned, and there are no known operational and

management issues related to access and boundary identification.

3. Pōhue Bay is used by several threatened and endangered species, contains rare anchialine ponds and intertidal pool complexes, and includes numerous archeological sites and other cultural resources, all of which complement the purpose of the park to perpetuate endemic Hawaiian ecosystems and the traditional Hawaiian culture connected to these landscapes.
4. If acquired and included within Hawai‘i Volcanoes National Park, the Pōhue Bay Parcel could be feasibly managed by staff overseeing operations in Kahuku.

PROTECTION ALTERNATIVES CONSIDERED

All of the action alternatives considered in this general management plan propose legislation to include ‘Ōla‘a in the park boundary as consistent with previous plans; however, Alternative 1, the no-action alternative, proposes no other boundary modifications to Hawai‘i Volcanoes National Park.

Without acquisition and protection by the National Park Service, the Great Crack parcels, the Ala Wai‘i Holdings property, the private parcel off Mamalahoa Highway, and the Pōhue Bay property, and the resources therein, are threatened by proposed subdivisions and development. In 1998, the owner of the Great Crack parcels proposed to subdivide approximately 2,000 acres into 90 parcels of 20-31 acres, which would have impacted the 8-mile long volcanic fissure known as the Great Crack, numerous archeological sites, pockets of endangered plant communities, and two miles of oceanfront. The Ala Wai‘i Holdings property has also been subdivided recently, and Hawai‘i County has received a proposal to rezone the Pōhue Bay property (that was previously called Nani Kahuku Aina) from conservation to medium density urban and resort development, including golf course and airport, for a master-planned community called Kahuku Village. At least for Pōhue Bay, the local community, nonprofit organizations, and elected officials joined forces to propose acquisition of the property “in its entirety, certain portions thereof, or a conservation easement” in 2012 (Resolution 265-12) to protect this parcel and the valuable natural and cultural resources therein, and the NPS currently works with these partners to monitor threatened and endangered species on this land. Partnerships with organizations such as the Trust for Public Lands or The Nature Conservancy could be used to assist the NPS with acquisition, as was done for the Kahuku Unit.

Due to the land’s valuable resources, the Great Crack parcels, the Ala Wai‘i Holdings property, and the Pōhue Bay property are also being considered for NPS designation through a special resource study.

PROPOSED ADDITIONS TO THE PARK BOUNDARY AND OTHER ADJUSTMENTS

Under the preferred alternative, Hawai‘i Volcanoes National Park would seek legislation to include ‘Ōla‘a within the official park boundary. Donated to the NPS in 1952 via the Hawai‘i Territorial Executive Order 1540, ‘Ōla‘a is geographically separated from the rest of the park by Volcano Village and has therefore never been formally designated as part of Hawai‘i Volcanoes National Park. Language in the 1938 legislation for the park stated that Hawai‘i Volcanoes National Park could acquire lands only if “adjacent and contiguous” to park boundaries. Early plans had been to acquire lands between the park and ‘Ōla‘a to make it contiguous, but that was not completed. However, the unit is managed by the park for its valuable rainforest habitat and presence of endemic and/or rare and endangered species.

The preferred alternative also proposes to add the following three contiguous parcels to the park boundary.

The park would seek to acquire the Great Crack parcels (1,951 acres) and the Ala Waiʻi Holdings parcel (2,750 acres), which is west of the Great Crack. Both properties are in private ownership and contain excellent geology and important archeological sites. Acquisition of the Great Crack parcels was proposed in the park's 1975 master plan, the 1986 Land Protection Plan, and was also referred to in the 1974 wilderness recommendation and subsequent legislation (1978).

The park would also pursue acquisition of a private parcel (223 acres) at the southern boundary of Kahuku (west of present entrance off Highway 11), which would essentially connect the entire south boundary of the Kahuku parcel with Highway 11. Acquisition of this property would protect lower Kahuku from incompatible development and protect rare dryland forest habitat.

Finally, the park would pursue acquisition of a parcel at Pōhue Bay that has been proposed to the county as a development called Kahuku Village. This privately owned parcel is 16,457 acres and extends from lower Kahuku on Highway 11 down to the coast. The local community, nonprofit organizations, elected officials, and the developers have approached the park to acquire it. The site is used by the endangered hawksbill turtle for nesting. The threatened green sea turtle and the endangered Hawaiian monk seal are both known to bask on the beaches during the day. The area also contains many other endemic and endangered invertebrate plant and animal species. In addition, there are important archeological sites and coastal resources that are still used traditionally. Acquisition of this parcel would extend the park's portion of Kahuku from mauka to makai and give the park a wider range of options for recreation improvements, interpretation, and environmental education in lower Kahuku. Community partnerships have proven to be effective thus far and could assist with long-term protection of these lands.

No legislation would be needed for acquisition of these parcels contiguous to the boundary; however, acquisition by the National Park Service would be restricted to a willing seller purchase only. This means that the seller would be willing to sell and adequate funds would be available to support the purchase.

There would be no significant property tax implications for Hawaiʻi County as a result of the proposed boundary change to Hawaiʻi Volcanoes National Park. Additionally, the payment in-lieu of taxes or PILT program would provide property tax income to Hawaiʻi County for a five-year period following the willing seller acquisition of the private land parcels by the United States of America.

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APPENDIX F: COMMERCIAL SERVICES STRATEGY FOR HAWAIʻI VOLCANOES NATIONAL PARK

INTRODUCTION

This commercial services strategy (CSS) has been prepared in conjunction with the Hawaiʻi Volcanoes National Park General Management Plan/Wilderness Study/ Environmental Impact Statement (GMP/WS/ EIS) in order to provide additional guidance for managing commercial services in the park. This document is intended to stand alone, independent of the GMP/WS/EIS, as a commercial services strategy required by Section 10.2.2 of NPS *Management Policies 2006* and provides the following types of information within five related sections.

1. "Purpose and Scope" identifies the goals and scope of this strategy and includes a discussion of why this CSS is needed for Hawaiʻi Volcanoes National Park.
2. "Introduction to Commercial Services" explains the purpose of and management concerns related to commercial service operations of the National Park Service, provides a definition of the various types of commercial services in the park service, and outlines the laws and policies that govern this use within the National Park Service.
3. "Background of Commercial Services in Hawaiʻi Volcanoes National Park" outlines the history and existing conditions of commercial services specific to the park and describes previous planning efforts at the park related to this use.
4. "Commercial Services Strategy for Hawaiʻi Volcanoes National Park" contains the primary substance of this document. It defines the necessary and appropriate criteria for commercial services in the park, identifies the goals and provides management guidance for these services, and outlines the process for addressing future requests for commercial services at Hawaiʻi Volcanoes.
5. "Next Steps / Future Planning Needs" describes how this strategy will be implemented.

PURPOSE AND SCOPE

The purpose of this CSS is to develop implementation guidance for managing commercial services at Hawaiʻi Volcanoes National Park. Under the guidance of NPS *Management Policies 2006*, this CSS is an analytical document that identifies the necessary and appropriate commercial services within Hawaiʻi Volcanoes National Park and articulates the park's goals associated with these services. This CSS additionally serves as a guidance document associated with the Hawaiʻi Volcanoes National Park General Management Plan / Wilderness Study/Environmental Impact Statement and will assist park decision-makers in responding to future inquiries related to commercial services. This document also contains descriptions of commercial services and their associated authorities, a description of existing conditions of commercial services at Hawaiʻi Volcanoes National Park, and a summary of previous planning efforts for commercial services at the park.

For the purposes of this CSS, a service is generally considered commercial if it involves the selling of goods or services or the granting of a right to use government land or facilities other than for governmental purposes. Commercial services may take place within a unit of the national park system only under certain defined and limited circumstances. Examples of commercial services addressed in this CSS include lodging, campground operations, food and beverage service, retail, road-based tours (auto and bike), equestrian tours, and hiking and other guided excursions.

Among other issues, this strategy addresses entities that the NPS has the discretion to authorize to provide commercial services, including concessioners, commercial use authorization (CUA) holders, cooperative associations, lease holders, and special use permittees. This CSS applies only to those areas of Hawai'i Volcanoes National Park that are not designated as wilderness or potential wilderness. Any determinations about commercial services in wilderness will be addressed in a future wilderness stewardship plan.[1] Also excluded from the CSS are air tour services, which will be addressed in a separate air tour management plan.[2]

A CSS is not a compliance document in that it does not evaluate alternatives or assess environmental impacts, and it alone does not result in any actionable decisions. Rather, this CSS provides general guidance for future decisions involving commercial services at Hawai'i Volcanoes National Park. Any future decisions that require additional analysis and compliance with the National Environmental Policy Act, National Historic Preservation Act, Wilderness Act, and/or other laws and policies will be analyzed and documented as necessary.

Once finalized through the Record of Decision for the associated *Hawai'i Volcanoes National Park General Management Plan / Wilderness Study/Environmental Impact Statement*, this strategy will provide broad guidance for future decisions associated with commercial services at the park; in the meantime, previous plans and other NPS and park policy documents allow for continuing commercial services, as well as other actions necessary for the management of the park. This CSS, when complete, will influence future decisions but will not apply retroactively to previously made decisions. Thus it will not affect the terms and conditions of existing concessions contracts, cooperative agreements, CUAs, or special use permits that have been issued prior to the completion of this document.

This CSS is intended to provide management guidance to Hawai'i Volcanoes National Park, and it should be reviewed periodically to ensure it is providing effective, relevant, and meaningful direction for park managers.

Need for Commercial Services Strategy

This strategy is needed to provide general guidance for establishing the types of commercial activities that are appropriate and meet the eligibility criteria for authorizations under available legal authorities (for example, whether "necessary and appropriate" if a concession contract) for Hawai'i Volcanoes National Park, including recommendations for any commercial services in Kahuku. Criteria for evaluating the appropriateness of commercial services needs to be developed and applied to commercial services in the park; goals for future commercial services need to be identified; and a process for evaluating future commercial services needs to be outlined. This guidance for the future management of commercial services within the park will help to ensure the protection of park resources and provision of a quality visitor experience within Hawai'i Volcanoes National Park.

In light of the 2008 closure of a portion of Crater Rim Drive (which was closed because of increased sulfur dioxide levels and hazardous conditions and hazardous conditions near Halema'uma'u Crater), Hawai'i Volcanoes National Park has experienced a dramatic increase in congestion around the sections of Crater Rim Drive remaining open, particularly at the park's two visitor centers (Kīlauea Visitor Center and Jaggar Museum) and Thurston Lava Tube (Nāhuku). The combination of private vehicular traffic, large commercial buses

[1] While a wilderness study is included in this document as part of the GMP/EIS, a wilderness stewardship plan for Hawai'i Volcanoes National Park will need to be completed subsequent to this GMP/WS/EIS. A wilderness study formally studies the feasibility and effects of recommending to Congress for wilderness designation NPS lands that have been found to possess the characteristics and values of wilderness. In comparison, a wilderness stewardship plan identifies a plan for managing a specific wilderness unit once it has been designated as wilderness.

[2] Consequently, all references in the CSS to tour services are to ground services, alone.

(which require infrastructure to turn around), and an increasing number of bicycle tours on this narrow road prism has not only led to more congestion in what were already congested areas, but has also created safety hazards in particularly tight areas. This additional congestion has increased the likelihood of user conflicts, and has contributed to adverse impacts to the visitor experience and to the park's natural and cultural resources. Increased impacts to a significant archeological site (eligible for the national register) have been documented. Soil degradation, excessive erosion, trampling of vegetation, and disturbance of endemic and sensitive species and sites have occurred in localized areas; and crowding and inappropriate behavior have contributed to a loss of sense of place, interference with traditional cultural uses, and increased negative perceptions of the park by Native Hawaiians and the general visiting public.

While the congestion and documented impacts are attributable to general high visitor use and limited capacity, they are also compounded and complicated by commercial visitor services in the area. An estimated 23% of visitors to Hawai'i Volcanoes National Park visit through a tour-based commercial service provider, and another large contingent of visitors utilize the retail, food and beverage, and lodging services provided by commercial service providers in the park. Thus, the types and levels of commercial uses in the park affect visitor experiences, natural and cultural resources, and park operations at Hawai'i Volcanoes. A commercial services strategy, with the accompanying general management plan, is needed to address adverse effects that may be occurring due to commercial services and provide guidance for the future management of commercial services to ensure the protection of both natural and cultural resources and to provide for a quality visitor experience.

A variety of legal authorities and NPS policies apply to commercial services depending upon the type and kind of specific service involved (e.g., concessions are regulated under different authorities than are special use permits). This strategy was prepared in accordance with and is consistent with the following laws and policies as applicable to specific services addressed within the CSS: park-specific legislation, including 16 USC 394; the National Park Service Concessions Management Improvement Act of 1998, 16 USC 5951 et seq.; various provisions of 16 USC pertaining to the National Park Service, including 16 USC §§1-5, 79, 460l-6d, and 470h-3; various implementing regulations, including 36 CFR Parts 1–7, 14, 18, and 51; Chapters 8 and 10 of NPS *Management Policies 2006*; and Director's Orders 32, 38, 48A, and 53.

INTRODUCTION TO COMMERCIAL SERVICES

Commercial Services and the National Park Service

National parks are special places, saved by the American people so that all may experience the country's natural and cultural heritage. The national parks movement of the mid-19th century was fueled by a determination to save beautiful and historic spots in America, in part to keep them from being populated with hotels, curio shops, and amusements. Over-commercialization and development can spoil the very character of the places visitors come to see. Yet some kinds of commercial activities are appropriate in national parks and sometimes necessary. These services may help visitors enjoy natural and cultural wonders to which they might not otherwise have access, and they often help protect park resources as well.

Commercial services involve the selling of goods or services or the granting of a right to use government land or facilities other than for governmental purposes. They are a business activity. Within the national park system, there are two general categories of commercial services: (1) those offered to the public (as visitor services); and (2) those that provide a specific benefit to an identifiable beneficiary and to the government but not to the public at large. There are different legal prerequisites for and different legal conditions that apply to commercial services depending

on the purpose and type of the activity involved. However, all commercial service legal authorizations share one common attribute—a fee or charge is assessed for the services involved.

Commercial services are authorized by law and policy within units of the national park system; however, they may take place only under certain defined and limited circumstances. The national park system has been established and is preserved and managed for the benefit and inspiration of the people of the United States. The NPS Organic Act and the NPS General Authorities Act of 1970, as amended (16 USC 1, 1a-1), mandate that park resources and values be conserved and provided for in such manner and means as will leave them unimpaired for the enjoyment of future generations (unless a particular law directly and specifically provides otherwise).

Consistent with these fundamental principles regarding management of the national park system, it is unlawful to engage in or to solicit any business in an area of the national park system, except in accordance with the provisions of a permit, contract, or other written agreement with the United States (unless specifically authorized under special regulations applicable to a park area) (36 CFR 5.3).

Authorization for Commercial Services

Commercial activities may be authorized through a range of legal authorities using a variety of different permits, contracts, and other authorizations, depending on the type and location of the activity involved. Examples of authorizations used for visitor services (that is, accommodations, facilities, and services for public use and enjoyment of units of the national park system) include concession contracts, CUAs, and cooperative agreements.

Concession contracts may be used to authorize concessioners to provide accommodations, facilities, and services that the National Park Service has determined are necessary and appropriate for public use and enjoyment of a park unit and are consistent to the highest practicable degree with the preservation and conservation of the resources and values of that unit. Authorized accommodations, facilities, and services are provided for a fee or charge to the visitor by the concessioner, and the concessioner's rates and charges to the public are subject to approval by the National Park Service. The contracts must provide a reasonable opportunity for profit for concession operators. The concessioner pays the government, through the vehicle of a franchise fee, for the privilege of operating the concession business. In addition, the concessioner is required to maintain, as an expense of its business, the government-owned facilities, land, and equipment that have been assigned to it for use in providing services to the visiting public. Under very limited circumstances, a concessioner may be authorized to construct capital improvements. A public solicitation process is used to award concession contracts, generally for terms of 10 years or less. Lodges and restaurants within parks are examples of commercial services that typically operate under concession contracts. Pertinent laws and regulations and NPS policies (discussed in more detail below) include the National Park Service Concessions Management Improvement Act of 1998, 16 USC 5951 et seq.; 50 CFR Part 51; and NPS Director's Order 48A.[3]

Commercial use authorizations may be used to authorize visitor services under somewhat different criteria than a concession contract. For a CUA, the visitor service must be determined by the National Park Service to have minimal impact on resources and values of the park unit and be consistent with the purpose for which the unit was

[3] All laws and regulations cited in this CSS are available at http://www.gpo.gov/fdsys/. NPS policies and Director's Orders are available at http://www.nps.gov/policy.

established and with all applicable management plans and park policies and regulations. Additionally, the National Park Service is prohibited by law from issuing more CUAs than are consistent with the preservation and proper management of park resources and values.

Only three types of operations are eligible for CUAs: (1) commercial operations generating not more than $25,000 annually from services originating and provided solely within the national park system unit; or (2) commercial operations originating or terminating outside of the boundaries of the national park system unit; or (3) uses by an appropriate children's camp, an outdoor club, or a nonprofit institution not deriving taxable income from the authorized use. A fee must be paid to the government for issuance of a CUA, at a minimum to cover associated management and administrative costs. The term of a CUA may not be more than two years in duration. Under no circumstances may a CUA holder construct any real property improvements within a park unit. Examples of CUAs include bus, bicycling, and birding tours in the park. Pertinent laws and regulations and NPS Policies (discussed in more detail below) include 16 USC 5966 and 50 CFR 51.1.

Cooperating Association Agreements may be used to authorize private, nonprofit organizations to sell interpretive materials and conduct interpretive programs (including incidental visitor services necessary for the conduct of that interpretive program) for a fee or charge in park areas. Cooperating associations also may be authorized separately to sell convenience items for the benefit of the visitor.

Cooperating associations are mission-driven nonprofit organizations that help connect individuals to the nation's parks by selling educational and interpretive materials, providing information services, and conducting educational programs and field institutes. A nonprofit organization may perform other functions to support the National Park Service, such as raising contributions to support the interpretive and educational mission of the parks, when authorized by a legal instrument other than a Cooperating Association Agreement. An example of a cooperating association would be a nonprofit that sells books and other educational and interpretive materials in the park. Pertinent laws and regulations and NPS Policies (discussed in more detail below) include 16 USC 1a-2(g); 50 CFR 51.1; and NPS Director's Order 32.

Services providing a specific benefit to an identifiable beneficiary and to the government but not to the public at large may be authorized, for example, by leases and special use permits.

Leases may be granted by the National Park Service for the use of buildings, lands associated with such buildings, and historic land located within the boundaries of units of the national park system under certain conditions. A lease may be used only for activities consistent with the purposes of the park area; may not result in degradation of the purposes and values of that park area; and must be compatible with NPS programs. Leases may not authorize activities subject to authorization through a concession contract, CUA, or similar instrument. A public solicitation process is used to award leases other than for certain nonprofit or governmental use of the property contributing to the purposes and programs of the park area or for certain less than 60 days in duration leases. Regardless of whether the lease is competitively awarded, it must require payment of rent to the government equal to or higher than the property's fair market value rent, taking into account any restrictions the National Park Service

may place on the use of the leased property and any requirements for its rehabilitation and maintenance. The term of a lease may be up to 60 years. Pertinent laws and regulations and NPS Policies (discussed in more detail below) include 16 USC §§1a-2(k), 470h-3; 50 CFR Part 18; and NPS Director's Order 38.

Special use permits may be used to authorize activities that provide a benefit to an individual or group rather than to the public at large and require some degree of management by the National Park Service to protect park resources and the public interest. Special use permits are, in effect, a license and, as such, are revocable. Additionally, special use permits may not violate or circumvent any relevant law and may not be issued for a visitor service or for activities subject to authorization by a lease. The National Park Service, depending on the circumstances, may recover costs related to special park uses or charge fees for the use of park lands and facilities. Special use permits typically are used to authorize activities such as rights-of-way, commercial filming, weddings, festivals, and other special events. Pertinent laws and regulations and NPS policies (discussed in more detail below) include 16 USC §§1-5, 79, 460l-6d; 50 CFR Parts 1-7, 14; and NPS Director's Order 38.

The National Park Service must determine what types and levels of commercial activities are permissible under applicable laws and regulations. At a minimum, all commercial activities must operate in a manner that is consistent with the mission of the park and should provide high quality visitor experience while protecting important natural, cultural, and scenic resources. Other requirements may also apply. For example, the NPS Concessions Management Improvement Act of 1998 limits the development of concession services to those that are necessary and appropriate for public use and enjoyment of the park unit and that are consistent to the highest practicable degree with the preservation and conservation of the resources and values of the unit. More information concerning the concepts of necessary and appropriate, and how they relate to the commercial services strategy, is presented in the section, "Appropriate" Commercial Services and "Necessary and Appropriate" Commercial Services.

Laws, Regulations, and NPS Policies

Numerous laws, regulations, and policies guide the management of commercial services in units of the national park system. Fundamentally, a commercial service may not be authorized within a NPS-administered area unless it meets the eligibility criteria for authorization under the applicable legal authority. In addition, general management principles set in the National Park Service Organic Act of 1916 and the National Park Service General Authorities Act of 1970 must be met in authorizing and managing commercial services. Additionally, park-specific legislation informs decisions regarding commercial services as do the various policies, directives, and other written guidance issued by the National Park Service regarding its authorization and management of commercial services in units of the national park system. Commercial services strategies must comply with applicable laws, regulations, and policies and must be consistent with the management philosophies found in the park's general management plan. Examples of the primary legal and regulatory mandates are summarized below.

NPS ORGANIC ACT

In the National Park Service Organic Act, Congress directed the National Park Service to manage parks

> *to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations.*

Congress supplemented and clarified these provisions through enactment of the NPS General Authorities Act and through enactment of an amendment to the act, which states, in part,

> *[t]he authorization of activities . . . shall not be exercised in derogation of the values and purposes for which these various areas have been established, except as may have been or shall be directly and specifically provided by Congress (16 USC 1a-1).*

The NPS Organic Act is silent as to the specifics of park management and leaves the NPS broad discretion in determining which management approaches best achieve the NPS Organic Act mandate. Simply put, the NPS is "empowered with the authority to determine what uses of park resources are proper and what proportion of the park resources is available for each use" (*Bicycle Trails Council of Marin v. Babbitt*, 82 F.3d 1445, 1454 (9th Cir. 1996)).

While the National Park Service has management discretion to allow impacts within parks, that discretion is limited by the statutory requirement that the National Park Service must leave park resources and values unimpaired unless a particular law directly and specifically provides otherwise. These congressional mandates ensure that park resources and values will continue to exist in a condition that will allow the American people to have present and future opportunities to enjoy them. Consistent with the NPS Organic Act and other applicable laws, any commercial services, including those offered at Hawai'i Volcanoes National Park, must be compatible with the park's natural resources, cultural resources, threatened and endangered species, and wilderness values.

NPS CONCESSIONS MANAGEMENT IMPROVEMENT ACT OF 1998

The National Park Service Concessions Management Improvement Act of 1998 (1998 Concessions Act) (Title IV of PL 105-391; 16 USC 5901 note, 5951 et seq.) contains two separate types of authority for commercial visitor services in units of the national park system—concession contracts and CUAs. The attributes of each of these means of authorizing commercial services are discussed above, in the section, "Authorization for Commercial Services".

The National Park Service has been awarding and administering concession contracts in various forms since 1916. Initially contracts were issued under the authority of the National Park Service Organic Act. In 1965, Congress "put into statutory form" various long standing concessions policies of the National Park Service through the enactment of the National Park Service Concessions Policy Act, Public Law No. 89-249 (1965). These policies later were substantially revised by Congress through the 1998 Concessions Act. Concession contracts are a unique form of government contract that differs from other government contracts, particularly procurement, in significant ways: for example, NPS concession contracts (1) provide for services to be given directly to the visiting public rather than to the federal government; (2) the contractor pays (through the vehicle of a franchise fee) the federal government for the privilege of operating; (3) facilities may be used and even constructed by the contractor on federal land for the direct benefit of the visiting public; and (4) the contractor is given protection against loss of investment (through the vehicle of leasehold surrender interest).

CUAs are available for certain qualifying commercial services that are more limited in scope and impact than concession operations and as a consequence may be authorized under less restrictive controls and conditions than those available to concession contracts.

CODE OF FEDERAL REGULATIONS

The national park system has been established and is preserved and managed for the benefit and inspiration of the people of the United States. Congress has mandated that park resources and values are to be conserved and are to be provided for enjoyment in such manner and means as will leave them

unimpaired for the enjoyment of future generations, unless a particular law directly and specifically provides otherwise.

To enforce these fundamental management principles, the National Park Service has adopted a number of regulations that apply to activities within NPS-administered areas, including business activities. These regulations are published in 36 CFR 1–199 and are available at http://www.gpo.gov/fdsys/. The regulations include a number of general restrictions that may affect business activities, including for example a prohibition on engaging in business except in accordance with a permit, contract, or other written agreement unless specifically authorized under special regulations (36 CFR 5.3) and significant restrictions on the display and distribution of commercial notices or advertisements (in 36 CFR 5.1). In addition, the regulations set out a number of specific requirements for NPS concessioners, including applicable labor standards (in 36 CFR 8) and provisions for the solicitation, award, and administration of concession contracts (in 36 CFR 51).

NPS MANAGEMENT POLICIES 2006

The NPS *Management Policies 2006* is the basic service-wide policy document of the National Park Service. It provides information on NPS policy including for park planning, natural and cultural resource management, wilderness stewardship, use of the parks, and park facilities, among other topics. NPS *Management Policies 2006* are intended solely as guidance to employees of the National Park Service and does not create rulemaking and may not be relied upon to create a right or benefit, substantive or procedural, enforceable at law or equity by any persons.

Section 10 of the NPS *Management Policies 2006* addresses commercial visitor services authorized through concession contracts (§10.2) and CUAs (§10.3). The policies state (among other things):

> *[p]ublic accommodations, facilities, and services must be consistent to highest practicable degree with the preservation and conservation of park resources and values.*

NPS *Management Policies 2006* also provide several other directions of relevance to this commercial services strategy. Sections 5.3.2 and 8.5 address use of national park system units by traditionally associated groups such as Native Hawaiians. Park managers are directed to protect sacred resources to the extent practicable and in a manner consistent with the goals of traditionally associated groups. To the extent feasible and allowable by law, accommodations will also be made for access to and the use of sacred places when interest is expressed by Native Hawaiians.

Section 7.5.7 addresses sales by cultural demonstrators of self-made handicrafts. Section 8.12 provides guidance on leases for the use of park property.

DIRECTOR'S ORDERS

Director's Orders are one level of the NPS Directives System, which provides internal instructions and guidance documents to ensure that NPS managers and staff have clear information on NPS policy and on required and/or recommended actions. Director's Orders provide more detailed interpretation of management policies, delegate specific authorities and responsibilities, and may articulate new or revised policy on an interim basis between publications of management policies. The following Director's Orders provide guidance for various commercial services: Director's Order 32: *Cooperating Associations*; Director's Order 38: *Real Property Leasing*; Director's Order 53: *Special Park Uses*; and Director's Order 48A: *Concession Management*. Director's Order 48B: *Commercial Use Authorizations* is under development.

NPS COMMERCIAL USE AUTHORIZATIONS: INTERIM GUIDELINES

In 2005, the National Park Service issued interim guidelines regarding implementation of the statutory requirements for CUAs. (These guidelines are intended solely as guidance for employees of the National

Park Service. They are not rulemaking and do not create or confer any legal rights, privileges, or benefits that may be enforced in any way by private parties.) Among other things, these guidelines provide for use of a competitive process if the number of CUAs to be issued for a particular type of commercial service is limited.

HAWAIʻI VOLCANOES NATIONAL PARK ENABLING LEGISLATION

Congress established Hawaiʻi National Park (later to become, separately, Hawaiʻi Volcanoes National Park and Haleakalā National Park[4]) on August 1, 1916, declaring:

> *"The tracts of land on the Island of Hawaiʻi and the Island of Maui, in the Territory of Hawaiʻi . . . shall be perpetually dedicated and set apart as a public park or pleasuring ground for the benefit and enjoyment of the people of the United States . . . [and provide for] . . . the preservation from injury of all timber, birds, mineral deposits, and natural curiosities or wonders within said park, and their retention in their natural condition as nearly as possible."*

This enabling legislation, along with 11 other acts that amend and/or supplement the initial legislation, identifies the park's key purposes and provides the basis for management of this NPS unit. Unique to Hawaiʻi Volcanoes National Park, this enabling legislation also includes authority to grant leases for the erection and maintenance of buildings for the accommodation of visitors subject to certain restrictions as to location, non-exclusive privileges, use, size, and duration (16 USC 394). Additionally, the enabling legislation authorizes the leasing under certain circumstances and subject to certain restrictions of land suitable for home site purposes in the Kalapana extension to Native Hawaiians (16 USC 396a). The full enabling legislation for Hawaiʻi Volcanoes National Park can be found in Appendix A of the Draft GMP/WS/EIS.

[4] The Maui portion of the park was established as a separate national park unit in July 1961 (74 Stat. 881; 16 USC §396b) and effective September 22, 1961, the Hawaiʻi portion was re-named Hawai'i Volcanoes National Park (16 USC 391d).

BACKGROUND OF COMMERCIAL SERVICES IN HAWAIʻI VOLCANOES NATIONAL PARK

History of Commercial Services

Commercial services for visitors to Kīlauea Volcano and the present-day park evolved along with the entire history of travel to Hawaiʻi Island. Prior to 1877, most people reached the volcano after sailing into the town of Hilo and then riding on horseback over a very rugged trail for 30 miles through forest and barren lava fields. Very early on there was a need for lodging at the caldera, and early travelers stayed at a grass hut constructed in 1846 on the northeast side of the crater which became the first Volcano House. At a dollar per person for lodging, visitors could also purchase foods such as fowl for 37.5 cents and a small calabash of potatoes for 25 cents. Thus began a succession of visitor accommodations, with various iterations of Volcano Houses built over time. A more modern hotel was built in 1877 (the existing relocated 1877 Volcano House) and by the mid-1880s two steamship companies began providing other routes to the volcano. Although visitation counts were not kept, records from the early Volcano House registry, as well as testimonials and articles written in local newspapers and popular magazines, show that scientists, researchers, politicians, businessmen, artists, and the general public were all willing to take the long, arduous, expensive trip to the brink of the caldera in hopes of viewing a once in a lifetime event—an active eruption. It is this popularity of Kīlauea that eventually spurred citizens familiar with the volcano to lobby Congress in the early 1900s for the establishment of a national park in Hawaiʻi (Moniz-Nakamura 2009).

Existing Conditions for Commercial Services

As of spring 2014, Hawaiʻi Volcanoes National Park offers a variety of commercial services through two concession contracts (lodging,

campground, food and beverage, and retail), approximately 143 CUAs (primarily tours), and two cooperating association agreements. The park also issues a number of special use permits for commercial services; however, none of the permittees provide visitor services. There are no commercial services in the park that operate under a lease at this time.

LODGING, CAMPGROUND, AND FOOD AND BEVERAGE SERVICE

In 2012, approximately 1.48 million people visited Hawai'i Volcanoes National Park (Park 2012a). While the majority of park visitors are day-use only, according to a 2009 visitor use survey, approximately 20% of visitors choose to spend the night in the park (averaging two nights per visitor) (NPS 2009c). While some of these overnight visitors camp at one of the backcountry campgrounds, commercial services also provide lodging at the following facilities.

VOLCANO HOUSE℠[5]— Located on the rim of Kīlauea Caldera, the historic 1941 Volcano House℠ provides overnight accommodations, food and beverage service, and retail to park visitors. Since 1969, the services provided in this location have been authorized under a concession contract with the Secretary of the Interior. Between 2010 and 2012, a number of renovations were made by the National Park Service to the Volcano House concession facilities, including deferred maintenance projects, seismic and fire suppression retrofits, and other upgrades related to life, health, and safety. Due to the extensive nature of this work as well as a concession facility improvement program implemented by a new concessioner, the National Park Service closed the Volcano House concession facilities to the visiting public beginning January 1, 2010 and did not re-open it until August 2012.[6] Volcano House℠ now has 33 hotel rooms, an approximately 219-seat dining room with additional outdoor seating, an approximately 58-seat snack bar, a cocktail lounge, and a retail sales operation. In 2012, the CC-HAVO001-12 concession contract for operations at Volcano House℠ was awarded to Hawai'i Volcanoes Lodge Company, LLC. That concession contract will expire in 2025.

The Volcano House℠ is also the only place for visitors to obtain food and beverage service within the park. Under the concession contract with Hawai'i Volcanoes Lodge Company, LLC, visitors can purchase breakfast, lunch, and dinner at the restaurant in Volcano House℠, as well as grab and go food during the day. In a survey conducted in 2007 in preparation for the concessions contract bidding process, 20% of all park visitors ate at the concession-operated restaurant during their stay at the park, 53% of whom valued Volcano House℠ as extremely important to their visit (Park 2007b).

Under CC-HAVO001-12, Hawai'i Volcanoes Lodge Company, LLC, also operates a retail shop in Volcano House℠ and at Nāmakanipaio Campground and is able to provide an occasional mobile retail enterprise during eruptive events. These retail services are authorized to sell convenience items (such as bottled water, raincoats, and sunscreen), interpretive items, and souvenirs tied to park themes to visitors. See "Volcano House℠ and Nāmakanipaio Campground" subheading under the next section, "Retail," for more information.

NĀMAKANIPAIO CAMPGROUND— Nāmakanipaio is a developed campground off Highway 11, to the northwest of park headquarters. It includes 10 cabins and 18 designated campsites and provides running water and flush toilets to visitors, as well as showers in a separate restroom building in the cabin area. In 2007, the cabins were filled to an occupancy rate of 65%, while the campground ran at a 51% occupancy rate (NPS 2009c). The CC-HAVO001-12 concession contract awarded to Hawai'i Volcanoes Lodge Company, LLC, also authorizes concession

[5] The service mark (SM) inserted after "Volcano House" is associated with a legally registered name or designation used in the manner of a trademark to distinguish an organization's services from those of its competitors.

[6] Re-opening occurred in phases. The retail store reopened on August 18, 2012. The Annex reopened on March 22, 2013, and the full hotel operations, along with the restaurant, bar, and gift shops reopened on May 23, 2013.

operations at Nāmakanipaio consisting of lodging and retail services for visitors. See the "Volcano House℠" subheading above and "Volcano House℠ and Nāmakanipaio Campground" subheading under the next section, "Retail," for more information about the retail services provided.

KILAUEA MILITARY CAMP— The United States Army operates this 54-acre historic recreational complex under a special use permit with Hawai'i Volcanoes National Park that will expire in 2021. The Special Use Permit, among other things, states that Kilauea Military Camp(KMC) is not open to the general public; its use is restricted to certain categories of users including Department of Defense personnel by Morale, Welfare, and Recreation patronage authority and eligibility published in Army Regulation 215-1. The KMC complex includes 90 rooms for overnight accommodations, a cafeteria, bar, grocery store, gas station, bowling alley, recreation room, exercise facility, conference rooms, and bus and van tours, as well as other support programs and facilities.

RETAIL

There are three general types of retail service in Hawai'i Volcanoes National Park: (1) visitor convenience items, (2) interpretive items that have the potential to enhance a visitor's understanding of the park and its resources, and (3) souvenirs tied to park themes. Convenience items include bottled water and sunscreen. Interpretive items include field guides and books about the history of the park, and souvenirs include items like coffee mugs that feature the name of the park or a recognized resource in the park. In a NPS survey conducted in 2007, 21% of visitors to the park spent a portion of their visit in one of the following retail outlets in the park (Park 2007b).

VOLCANO HOUSE℠ AND NĀMAKANIPAIO CAMPGROUND— Hawai'i Volcanoes Lodge Company, LLC, is authorized by the CC-HAVO001-12 concession contract to operate a retail shop in Volcano House℠ and Nāmakanipaio Campground and an occasional mobile retail enterprise during eruptive events. These retail services are authorized to sell convenience items (such as bottled water, raincoats, and sunscreen), interpretive items, and souvenirs tied to park themes, which includes a broader scope of items in comparison to other retail services in the park. See the "Volcano House℠" subheading under the previous section, "Lodging and Food and Beverage Service," for additional information.

KĪLAUEA VISITOR CENTER AND JAGGAR MUSEUM BOOKSTORES— Hawai'i Pacific Parks Association (HPPA) operates the bookstores at Kīlauea Visitor Center and Jaggar Museum under the authority of a cooperating association agreement (for interpretive items) and concession contract CC-HAVO002-06 (for convenience items), which both expire in 2015. HPPA is a nonprofit organization dedicated to supporting the interpretive, educational, scientific, and historic mission of the National Park Service through the sale of educational items.

VOLCANO ART CENTER GALLERY— The Volcano Art Center Gallery is operated under a cooperating association agreement by the Volcano Art Center (VAC), a 501(c)3 nonprofit organization dedicated to environmental education and art that perpetuates the artistic and cultural heritage of the people and environment of Hawai'i through activities in the visual, literary, and performing arts. The gallery occupies an 1877 historic building (called 1877 Volcano House) that was the first Volcano House Hotel on the rim of Kīlauea and now sits adjacent to the Kīlauea Visitor Center. In accordance with their cooperative agreement, VAC interprets the park through the sales of handmade art and crafts that are inspired by and pertain to, or reflect, Hawai'i Volcanoes National Park or the traditional Hawaiian culture. The Volcano Art Center also sponsors and/or produces park educational activities, demonstrations, and exhibits on the park's behalf, such as dance presentations at the nearby pā hula platform and hale. VAC's cooperative agreement with Hawai'i Volcanoes National Park will expire in 2014.

TOURS AND GUIDED EXCURSIONS

In addition to the above visitor facilities within Hawai'i Volcanoes National Park, approximately 143 private businesses are currently authorized under CUAs to provide small-scale, recreational services to visitors within the park every year (see *Table F.1. Total Commercial Use Authorizations in Hawai'i Volcanoes National Park, 2012*). These businesses provide a range of services to the public, such as bus and auto-based tours, guided bike tours, hiking tours, and other guided excursions including birding and lava viewing.

Table F.1. Total Commercial Use Authorizations in Hawai'i Volcanoes National Park, 2012

Recreational Service	Number of CUAs
Road-based Scenic Tours (Motorized vehicle use for transport of passengers on guided tours)	77
Nonroad-based tours (Tours of the park that are not on the park roads such as hiking, birding, and tours on bicycles)	43
Combination road and nonroad based permits	23
TOTAL CUAs	**143**

Source: NPS files

AUTO-BASED TOURS— Approximately 4% of the 429,327 recreation-based vehicles that entered the main part of the park in 2011 were commercial tour vehicles, 20% of which were motor coaches carrying, on average, 39 passengers and, at maximum, up to 81 passengers in one vehicle. Although representing a small percentage of the park's total traffic, these tour buses and the smaller cars and vans associated with these CUAs transported approximately 19% (259,354 people) of all paying visitors to Hawai'i Volcanoes National Park in 2011. This was up from 250,560 people in 2010. Of the 17,583 CUA vehicles that entered the park in 2011, 54% entered the park within a span of three hours, between 12:00 p.m. and 2:59 p.m. (see *Figure F.1. Timing of Daily CUA Visitation to Hawai'i Volcanoes National Park, 2011*). Due to traffic restrictions on Chain of Craters Road, motor coaches with the capacity of more than 26 passengers can only go as far as Kealakomo Overlook on Chain of Craters Road.

BICYCLE TOURS— In 2012, commercial service providers guided approximately 8,400 visitors on 660 bike tours in Hawai'i Volcanoes National Park, averaging roughly 13 people per tour and 13 tours a week (up from 11 per week in 2011). Most of these tours now stage at the Kīlauea Overlook and Picnic Area. Due to resource and safety concerns, the park places a number of restrictions on bicycle tours. For example, all bike tours are limited to 14 bicycles, including the guide, and must provide an escort vehicle for each trip. Similarly, bike tours in the park must stay on a park road and are not allowed below Muliwai a Pele on Chain of Craters Road or above Kīpukapuaulu on Mauna Loa Road.

HIKING TOURS AND OTHER GUIDED EXCURSIONS— In 2012, approximately 60,000 visitors to Hawai'i Volcanoes National Park (4.5% of the park's annual visitation) participated in a guided tour with a commercial service, including hiking tours and tours associated with birding and lava viewing. Due to natural and cultural resource concerns, the park places some restrictions on CUA operators that provide hikes within the park. For example, while all CUAs adhere to a standard set of park-specific conditions, all CUA operations in Mauna Ulu area are additionally restricted to a group size of 15, and only one tour is allowed in the area at one time. In addition, all guides that take visitors to Mauna Ulu must go through a certification course before guiding tours in the area.

EQUESTRIAN TOURS— As of spring 2013, there are no equestrian tours authorized to operate in Hawai'i Volcanoes National Park.

INTERPRETATION AND EDUCATION

In addition to the lodging/campground, food and beverage, retail, and guided services described above, commercial visitor service entities in the park also provide interpretive

and education services to the public, both through the primary service they offer (such as a guided tour in the park) and through the provision of additional programs, as in the case of the concession operation at the Volcano House℠ and Nāmakanipaio Campground. These interpretive services include, among others, presentations, printed materials, and guided services that are primarily educational in nature.

OTHER USES

In 2012, the park issued 71 Special Use Permits (SUPs) for activities such as filming, ash scattering, and weddings. As these permits are issued on a case by case basis, are of relatively short duration, and have minimal impacts on resources and visitor use, this CSS does not address SUPs associated with these types of activities.

Previous Planning Efforts Associated with Commercial Services

Throughout its almost 100 years of management, Hawai'i Volcanoes National Park has embarked on a number of planning efforts that have addressed commercial services. They include the following:

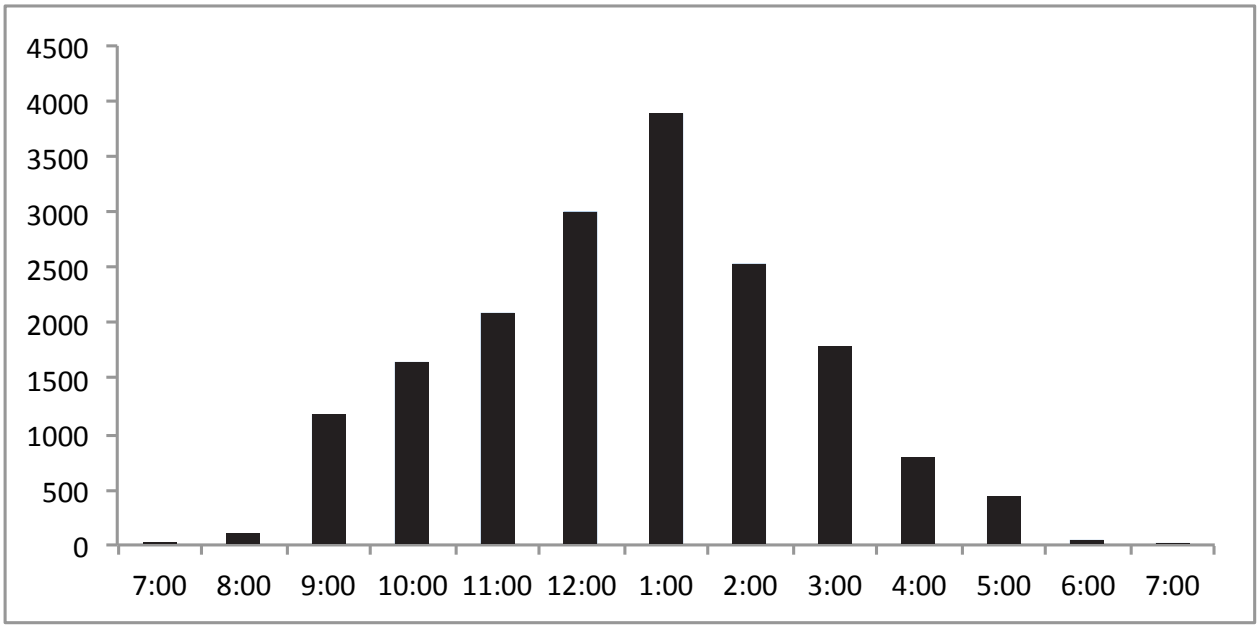
HAWAI'I VOLCANOES NATIONAL PARK MASTER PLAN, 1975

The 1975 *Master Plan for Hawai'i Volcanoes National Park* provides the following guidance for managing and operating commercial services within the park:

- Provide meal service, other day-use visitor needs, and limited overnight accommodations in the park through an authorized concessioner.
- Provide only enough overnight facilities (lodging and campground) for some visitors to experience an in-depth enjoyment of park resources, but within the estimated overnight carrying capacity for the park. The extent of campground development may be influenced by the availability of campsites outside the park.
- Depend on the gateway communities and private enterprise to develop any additional lodging facilities needed for park visitors.

Numerous conditions in the park have changed since this plan was completed. The *Final Hawai'i Volcanoes National Park General Management Plan / Wilderness Study / Environmental Impact Statement*

Figure F.1. Timing of Daily CUA Visitation to Hawai'i Volcanoes National Park, 2011



will supersede the 1975 master plan once completed and approved.

COMMERCIAL SERVICES PLAN, 2005 (PUBLIC SCOPING ONLY)

In 2005, Hawai'i Volcanoes National Park initiated a commercial services planning process to further define commercial development and services that are necessary and appropriate within the park. At the time, a public scoping newsletter was mailed to contacts on the park mailing list, and the public was invited to comment about a vision for commercial services. This public scoping process reinforced the public's interest in continued lodging and dining operations at the Volcano House℠, one of the longest continuously operated establishments in Hawai'i, and identified the following issues related to commercial services in Hawai'i Volcanoes National Park:

- **Facilities:** Are facilities currently assigned to commercial operations being used in the most effective and efficient manner? Are there deferred maintenance needs to be addressed? Are there existing facilities that could be used for other park purposes?
- **Operations:** Do current concession operations related to general maintenance, hours of operation, flexibility, accessibility, reliability, and health and safety meet the needs of the NPS and park visitors? If not, how could these be improved?
- **Interpretation:** Are all opportunities to enhance visitor education and appreciation being met? Can misinformation be reduced?
- **Coordination:** Can all commercial operations in the park be coordinated to provide a better range of services for all visitors?
- **Unauthorized/Inappropriate Commercial Activity:** Are all commercial activities in the park in compliance with federal law and the stipulations in their permitting authorities? Is inappropriate behavior occurring? If so, how can the park improve compliance, monitoring, and enforcement?
- **New Services:** What new, expanded, and/or consolidated commercial visitor services are appropriate in the park and in new expanded areas in the park?
- **Cultural Sensitivity:** How can commercial operations respect and remain sensitive to cultural traditions surrounding sacred sites and activities?

After the public scoping process, this plan was postponed to correspond with the general management plan in order to make commercial services decisions in concert with other decisions about Kahuku and the rest of the park.

HAWAI'I VOLCANOES NATIONAL PARK DRAFT GENERAL MANAGEMENT PLAN / WILDERNESS STUDY / ENVIRONMENTAL IMPACT STATEMENT

Hawai'i Volcanoes National Park Draft General Management Plan / Wilderness Study / Environmental Impact Statement proposes several actions that, if finalized and approved, may affect future concession contracts, CUAs, and other commercial services in the park. The full scope of proposed actions is included in Chapter 3: Alternatives of this Draft GMP/WS/EIS, but many of those that relate to commercial services have been tied directly to this strategy and are summarized in the "Managing Commercial Services at Hawai'i Volcanoes National Park" section at the end of this CSS. The Draft GMP/WS/EIS also outlines monitoring strategies for managing user capacity in Hawai'i Volcanoes National Park in order to proactively protect resources and ensure high quality visitor experiences. Information on user capacity is included in Chapter 3: Alternatives in the "User Capacity" section.

HAWAI'I VOLCANOES NATIONAL PARK FOUNDATION DOCUMENT

The foundation document for Hawai'i Volcanoes National Park provides basic

guidance for decision-making and management of this unit of the national park system. It was completed as part of the planning process for the general management plan, is included in Chapter 2: Foundation for Planning and Management of this Draft GMP/WS/EIS, and will be printed separately as a stand-alone document following the release of the Final GMP/WS/EIS. In its totality, this document presents a shared understanding of Hawai'i Volcanoes National Park's purpose, significance, fundamental resources and values, interpretive themes, and special mandates. It also documents the desired conditions for the park, providing the broadest level of direction for management of the park based on laws and policies that guide the National Park Service.

COMMERCIAL SERVICES STRATEGY FOR HAWAI'I VOLCANOES NATIONAL PARK

Based on federal laws, NPS policies, and former planning efforts described above, Hawai'i Volcanoes National Park developed the following necessary and/or appropriate criteria and goals for commercial services in order to achieve desired conditions within the park.

"Appropriate" Commercial Services and "Necessary and Appropriate" Commercial Services

Commercial services may take place within a unit of the national park system only under certain defined and limited circumstances. The national park system has been established and is preserved and managed for the benefit and inspiration of the people of the United States. The NPS Organic Act and the NPS General Authorities Act mandate that park resources and values be conserved and provided for in such manner and means as will leave them unimpaired for the enjoyment of future generations unless a particular law directly and specifically provides otherwise.

NPS *Management Policies 2006* provides guidance on how park resources and values are to be provided so as to meet these fundamental management principles of the acts. The only uses that are to be allowed are those that (1) are appropriate to the purposes for which the park was established; and (2) can be sustained without causing unacceptable impact (unless otherwise required by law). A process has been set out in chapter 8 of the NPS *Management Policies 2006* for determining whether a use is appropriate. That process includes evaluating a proposed park use for:

- consistency with applicable laws, executive orders, regulations, and policies
- consistency with existing plans for public use and resource management
- actual and potential effects on park resources and values
- total costs to the National Park Service
- whether the public interest will be served

In addition, parks are to continually monitor and examine all park uses to ensure that unanticipated and unacceptable impacts do not occur.

To assist in applying this process to commercial uses within Hawai'i Volcanoes National Park, two sets of more specific evaluation criteria were developed and are provided in *Table F.2. Commercial Services Evaluation Criteria*.

All commercial services must meet the "appropriate" criteria described in Table F.2 in order to be considered appropriate to the purposes for which the park was established. If a commercial service meets the appropriate criteria, then its impacts will be assessed and, if acceptable, the commercial service will be evaluated under any other legal eligibility criteria set out in the specific legal authority to authorize that service within Hawai'i Volcanoes National Park (for example, the requirements of 16 USC 5966, if a CUA) (see "Process for Addressing Requests for Commercial Visitor Services").

Table F.2 also includes a set of specific evaluation criteria for determining whether a commercial service is necessary. These necessary criteria were developed to provide park-specific criteria for one of the screening elements of the NPS Concessions Management Improvement Act. A public accommodation, facility, or service, among other things, must be both appropriate and necessary for public use and enjoyment of the unit of the national park system in which it is located in order to be authorized under a concession contract (16 USC 5951(b), 5952). All commercial services that meet the "appropriate" and "necessary" criteria described in Table F.2 will be considered to meet the 1998 Concessions Act screening criteria. If its impacts are acceptable, then the commercial service will also be evaluated under the other legal eligibility criteria set out in the 1998 Concessions Act (see "Process for Addressing Requests for Commercial Visitor Services").

The park-specific evaluation criteria in Table F.2 were applied to the following specific commercial services: (1) lodging; (2) food and beverage service; (3) retail; (4) road-based tours (auto); (5) road-based tours (bike); (6) hiking tours and other guided excursions; and (7) equestrian tours. Each of these commercial service types were determined to be appropriate for park purposes if managed properly. In addition, the legal authority of a CUA was determined to be the most suitable form of legal authorization for road-based tours (auto and bike), hiking tours and other guided excursions, and equestrian tours in Hawai'i Volcanoes National Park. Lodging, food and beverage service, and retail services were determined to meet at least one of the evaluation criteria for necessary services, and concession contracts were identified as the most suitable form of legal authorization for these services, with one exception. For retail associated with the sale of interpretive items, cooperating association agreements were determined to be another appropriate form of legal authorization. Other commercial services (for example commercial filming) will be evaluated on a case-by case basis using the criteria in Table F.2 and other applicable criteria, including impacts and eligibility for authorization under available legal authorities (for example, special use permits).

Several potential commercial service activities have been determined to be neither necessary nor appropriate in the park. The following list of activities determined to be inappropriate/ unnecessary is not exhaustive; the park will evaluate new and proposed uses as they arise following the process outlined under "Process for Addressing New Requests for Commercial Visitor Services."

Table F.2. Commercial Services Evaluation Criteria

Necessary	Appropriate
A SERVICE THAT IS NECESSARY ACCOMPLISHES ONE OR MORE OF THE FOLLOWING:	**A SERVICE THAT IS APPROPRIATE ACCOMPLISHES ALL OF THE FOLLOWING:**
The service contributes to visitor understanding and appreciation of park purpose and significance.	The service is consistent with laws, regulations, and policies.
The service enhances visitor experiences consistent with park area philosophies.	The service does not compromise public health and safety.
The service assists the park in managing visitor use and educating park visitors.	The service does not significantly impact or impair park resources or values.
The service is an essential service or facility not available within a reasonable distance from the park	The service does not unduly conflict with other park uses and activities.
The service is consistent with the purpose and significance of Hawai'i Volcanoes National Park.	The service does not exclude the public from participating in similar recreational opportunities.

- **Hunting:** Hunting is prohibited by law in national park units (36 CFR 2.4), and the Superintendent's Compendium re-affirms this prohibition (Park 2012c). This use conflicts with other park uses and activities and poses safety concerns. It is also inconsistent with park regulations and is therefore not an appropriate use in the park.
- **Cattle and other livestock:** Cattle and other livestock are not appropriate in the park for several reasons. Cattle are prohibited by law from running-at-large, herding, driving across, allowing on, pasturing, or grazing park lands (36 CFR 2.60). In addition, the use of a park area for agricultural purposes is prohibited (36 CFR 2.60). The use of these animals does not contribute to public use and enjoyment of the park. Additionally, cattle and other livestock have the potential to adversely affect soils and native vegetation through browsing and nonnative species introductions, and their use is inconsistent with protection of park natural and cultural resources.
- **Mountain biking:** Bicycling is prohibited on trails in the park, except for a few designated areas, under the Superintendent's Compendium (bicycles regulated in 36 CFR 4.30 which also refers to 36 CFR 1.5 and 1.7) (Park 2012c). In addition, bicycle use is prohibited in designated and eligible wilderness, which encompasses many areas of the park.
- **Skateboarding, rollerblading, segues, and similar devices:** Under the Superintendent's Compendium, these activities are prohibited in all public use areas of the park other than the paved area of the Waldron Ledge Road and paved and untraveled portions of parking lots (36 CFR 2.20) (Park 2012c). Skateboarding and rollerblading pose safety concerns and do not contribute to public use and enjoyment of the park.
- **Hang gliding, paragliding, ultra-light aircraft, base jumping, bungee jumping, and hot air balloons:** The use of parachutes or other airborne means is prohibited by 36 CFR 2.17 (3). In addition, these uses pose safety and user conflict concerns and do not contribute to public use and enjoyment of the park.
- **Rock climbing and rappelling:** Although not specifically prohibited in the Superintendent's Compendium, these activities have never occurred in the park commercially and do not contribute to public use and enjoyment of the park (Park 2012c). They are inconsistent with protection of park natural and cultural resources and pose safety concerns due to loose, fragile rocks and limited anchoring.
- **Snowmobiling:** This activity is prohibited in the park under the Superintendent's Compendium (36 CFR 2.18) (Park 2012c). This use conflicts with other park uses and activities, poses safety concerns, and could significantly impact or impair park resources. Snowmobiling is also inconsistent with park laws and regulations and is therefore not an appropriate use in the park.
- **All-terrain and utility-terrain vehicles (ATVs and UTVs):** ATVs/UTVs are not allowed in the park in accordance with State and park regulations. Under Hawai'i state law (HRS 286-291), these vehicles cannot be registered, do not possess the necessary equipment to allow on roadways in the State, and are therefore not street legal in Hawai'i Volcanoes National Park (36 CFR 4.2). In addition, all off-road vehicle travel is prohibited in the park (36 CFR 4.10) because of potential adverse effects to soils and native vegetation, conflicts with other park uses and activities, and safety concerns.

- **Boat tours:** The waters bordering Hawai'i Volcanoes National Park are outside NPS jurisdiction. However, all boats must conform to State and US Coast Guard regulations for private or commercial vessels, and persons entering the park must follow all NPS regulations (including paying the entrance fee, having a CUA or special use permit, and obtaining a backcountry permit for overnight stays and following all wilderness regulations). Although permitted under state and federal laws and regulations, boat tours are an inappropriate commercial service in Hawai'i Volcanoes National Park due to the limited capacity for the park to manage and regulate this use and thereby mitigate safety concerns, user conflicts, and potential impacts to fundamental resources and values in the park (such as impacts to species listed as threatened or endangered that inhabit the marine environment in and surrounding the park).

The park did not assess air tours under the necessary and appropriate criteria. This issue is being analyzed and discussed as part of the Air Tour Management Plan/EIS.

Goals for Commercial Services

In addition to the above criteria for commercial services, Hawai'i Volcanoes National Park developed the following goals for commercial services in the park. Staff developed this list from information and input following the public scoping phase for the commercial services plan in 2005, at alternatives development and refinement workshops during the planning phase of the general management plan/wilderness study/environmental impact statement, and from public comments received during both planning efforts. Goals related to specific commercial services that have been identified as appropriate and/or necessary follow the list of general goals below.

Goal 1**:** Commercial operations at Hawai'i Volcanoes National Park are run efficiently and effectively and in accordance with NPS law and policy. This means that:

- Hawai'i Volcanoes National Park has the staff, funding, and management tools to allow efficient and effective management of the commercial services program.
- Hawai'i Volcanoes National Park is meeting its fiduciary responsibility for fair return to the government.
- Hawai'i Volcanoes National Park is able to manage the impact of all commercial activity in the park.
- Partnerships to provide compatible commercial recreational activities and services that enhance visitor experience are used to the maximum extent possible.
- All commercial services comply with NPS law and policy in type, location, and authorization.

Goal 2**:** All commercial visitor services enhance visitor understanding and appreciation of park mission and values. This means that:

- All visitors who use commercial services in the park are made aware of being in a national park and understand the mission of the park. All commercial operators are made aware of, participate in, and educate visitors about the mission and significance of Hawai'i Volcanoes National Park.
- Commercial operators provide visitors with accurate interpretation of the park and its resources, including promoting sensitivity to cultural traditions around sacred sites.
- Commercial operators provide visitors with an understanding of the park from the perspective of the host culture.

Goal 3**:** All commercial visitor services facilitate or complement the fundamental

desirable experiences of park visitors. This means that:

- The range of commercial services at Hawai‘i Volcanoes National Park is diverse and provides a variety of experiences, opportunities, and interpretive messages to the public.
- Commercial services promote enjoyment of the park and visitor understanding and appreciation of the park through a direct association with, interaction with, or relation to park resources.
- Commercial services maintain and protect traditional park uses, experiences and/or historic structures (for example, ongoing lodging in a structure historically used for lodging).
- Commercial services, alone or in conjunction with the NPS or other commercial services, provide a seamless experience for visitors.
- A high level of quality exists for all commercial facilities and services.
- Commercial operators provide affordable, high-quality visitor experiences.
- Commercial operators provide outstanding customer service.

Goal 4: All commercial visitor services assist the park in managing visitor use and educating park visitors in appropriate safe and minimum impact techniques. This means that:

- Commercial services improve the park's ability to reach the conditions described in parkwide management policies and in the park's foundation document.
- Commercial operators help the park reduce impacts from visitors to resources by managing location and distribution of visitors between high and low visitor use areas.
- Safety is a top priority for all commercial operators. Commercial operators help provide safe visitor access within the park, particularly to eruptive activities and/or sensitive resources. Commercial operators have appropriate certifications, permits, and equipment to ensure safe operations within Hawai‘i Volcanoes National Park.
- All commercial facilities utilize sustainable technologies when feasible.
- All commercial operations provide services in an environmentally responsible manner.
- All commercial recreational activities are compatible with the resources of the park. All commercial operators reduce or mitigate impacts of proposed activity on natural and cultural resources when feasible.

LODGING AND CAMPGROUNDS

In addition to the general goals articulated above, Hawai‘i Volcanoes National Park would like to achieve the following goals with relation to lodging in the park:

- Provide visitors with a convenient and unique opportunity to extend their visit in the park in order to become further immersed in the resource.
- Provide clean, safe, quality overnight accommodations that provide amenities of the same, if not higher, caliber as historically offered.
- Continue the traditional use of a historic property while ensuring its ongoing maintenance and preservation.
- Provide a range of overnight lodging experiences that serve a variety of public audiences at differing cost levels, while providing some lower cost options.
- Provide access to Volcano House[SM] for general visitors.

FOOD SERVICE

Hawai‘i Volcanoes National Park would also like to achieve the following goals with relation to food service in the park:

- Provide visitors with convenient food and beverage service for all meal periods, allowing them to extend their stay within the park.
- Provide a safe, clean, and professional service.
- Provide a range of healthy food options and at prices that accommodate the general range of area visitors (for example, international visitors, vegetarians, light eaters, and children).
- Support local food producers, suppliers, and culture.
- Provide a service that complements the area's interpretive themes and is sensitive to cultural icons (for example, not naming items after Hawaiian sacred people or places).

RETAIL

Below are the park's specific goals tied to retail services at Hawai'i Volcanoes National Park:

- Create a premier resource for educational, interpretive, and inspirational materials specifically relevant to park-related themes and NPS values.
- Provide retail items that expand visitors' appreciation of the park beyond their visit and deepen the connection of visitors to the park (or introduce and create a connection to the park for nonvisitors). These items could be related to the park's significant values, fundamental resources, and/or interpretive themes.
- Provide a compelling diversity of products and services based on interpretive value, theme/topics, sales category, target audiences, quality, and price point.

TOURS

In addition to the general goals outlined above, Hawai'i Volcanoes National Park has identified the following goals for managing guided tours in the park:

- Provide alternative modes of transportation within the park, including a variety of opportunities and alternatives for multi-modal transportation.
- Provide access to unique opportunities in the park.
- Effectively manage crowding and congestion and visitor use conflicts at high-use areas in the park.

Managing Commercial Services at Hawai'i Volcanoes National Park

Based on law and policy and the necessary and/or appropriate criteria and goals identified above, Hawai'i Volcanoes National Park has identified the following management guidance for commercial services. While much of the guidance below is tied to a specific type of service or facility in the park, all future actions associated with commercial services at Hawai'i Volcanoes National Park would be in compliance with federal law and policy and would adhere to guidance outlined in this Draft GMP/WS/EIS.

Where this strategy does not provide guidance, law, policy, and park plans would be used to inform future decisions about commercial services at the park. All future proposals for commercial services at Hawai'i Volcanoes National Park, whether for the main unit of the park or Kahuku, would be evaluated under the process outlined in "Process for Addressing New Requests for Commercial Visitor Services" in this strategy.

This strategy does not apply retroactively to previously made decisions; it will not affect the terms of ongoing contracts or authorizations previously signed or issued prior to the completion of the Final GMP/WS/EIS. Current contracts, authorizations, agreements, and permits would be reevaluated in light of this strategy at the time they expire in order to assess the appropriateness and/or necessity of the commercial service, its alignment with the goals and strategies identified by this CSS and the general management plan, and to determine or reaffirm the appropriate legislative authority by which the commercial service should operate.

GENERAL GUIDANCE

The following management directions would continue to apply to all commercial service providers to the extent directed by federal statutes and regulations, NPS *Management Policies 2006*, the Superintendent's Compendium, and past NPS practices:

- This strategy would continue to allow the range of concession operations and commercial services that presently exist. In addition, commercial services would continue to operate in the existing developed area around Crater Rim Drive and would extend to the end of Chain of Craters Road when necessary, such as to provide access to eruptive events in that area. Commercial use would also continue at current levels along Hilina Pali and Mauna Loa Roads. Any proposed significant increases in use due to eruptive events, or even due to increased ecotourism or other type of tour not related to an eruptive event, would need to be evaluated due to safety concerns, natural and cultural resource concerns, and limited infrastructure in these areas. Any necessary environmental and/or cultural compliance would also need to be completed.
- All commercial services in the park would be managed in a way that protects the fundamental resources and themes and meets the desired conditions identified in Hawai'i Volcanoes National Park's Foundation Document.
- All commercial services would operate according to NPS laws and policies (see "Laws, Regulations, and NPS Policies").
- The conduct of the providers and of their patrons would be guided by park rules and regulations and by a specific set of special conditions that are included as part of the contract/authorization/agreement/permit that allows the service to be conducted in the park. The special conditions of contracts/authorizations/agreements/permits would be reviewed by the park as needed, and provisions relevant to the service would be made as needed.
- Commercial service providers would be required to demonstrate a commitment to their patron and staff safety, including maintenance of safe and reliable vehicles, stock, and equipment. Concessioners and CUA holders would be required to comply with all applicable federal, state, and local agency requirements for food service, transportation, liability insurance, and other required inspections, permits, training certifications, and licenses.
- The National Park Service would encourage, and in some cases require, commercial service providers to incorporate environmentally sustainable practices in their business plan, such as providing recycling facilities for guests and offering reusable or compostable utensils at meals. The National Park Service would encourage commercial service providers to employ Native Hawaiian guides and interpreters who can demonstrate knowledge of Hawaiian natural and cultural history.
- In managing commercial services, the park would continue to balance access to resources for commercial service providers and clients with access granted to the general public, ensuring that the public is not displaced from high use areas in the park.
- The park would also engage commercial service providers in managing visitor use and providing valuable information to the public, including general park visitor information, safety updates, and interpretation of the park's fundamental resources and values.

In addition to the current general management practices listed above, Hawai'i Volcanoes National Park would consider, and if appropriate, implement the actions identified in the *Hawai'i Volcanoes National Park General Management Plan / Wilderness Study / Environmental Impact Statement* (see "Chapter 3: Alternatives" in the GMP/WS/EIS). These actions include the following:

- Hawai'i Volcanoes National Park would monitor those indicators identified in the user capacity strategy in the general management plan. If thresholds are reached, the park would consider implementing the following strategies to protect natural and cultural resources in the park and ensure quality visitor experiences (list is not inclusive):
  - » Increase education for commercial service providers and users on threatened and endangered species and other park resources.
  - » Expand permit conditions for commercial users to decrease impacts.
  - » Implement infrastructure changes to accommodate commercial service uses such as adding parking and staging areas and limiting large commercial bus traffic to one-way traffic on Crater Rim Drive (if closed section is reopened).
  - » Develop limits on the number and/or size and capacity of commercial tours in the park at one time and/or within certain areas if infrastructure and operational tools are unsuccessful at managing congestion and visitor conflicts.
- The park would also continue to conduct visitor use studies to (1) better understand the impacts of commercial services and how their use complements and/or conflicts with general park use by the public and (2) develop strategies for improving both public and commercial service use in the park to mitigate any observed and documented impacts.

MANAGEMENT GUIDANCE FOR CONCESSION CONTRACTS

The following management directions would continue to apply to all concession contracts and concessioners to the extent directed by federal statutes and regulations, NPS *Management Policies 2006*, the Superintendent's Compendium, and past NPS practices:

- Lodging, food and beverage service, and some retail would continue to be authorized through concession contracts. Retail associated with the sale of interpretive items would also continue to be authorized under cooperating association agreements. Any changes in the provider of retail services and any expansion of cooperating association operations would be approved only if in accordance with the provisions of Director's Order 32: Cooperating Associations and all applicable laws and other polices.
- All concession contracts would continue to be issued through a competitive process, as outlined in the 1998 Concessions Act.
- All concession contracts, as required under law and policy, would continue to include the following standards:
  - » Concessioners would continue to be responsible for the care and maintenance of the facilities they use.
  - » All concessioners would be required to prepare and maintain a risk management plan.
  - » Commercial service providers under concession contract would be charged franchise fees in accordance with 36 CFR 51.

In addition to the current management practices listed above, Hawai'i Volcanoes National Park would consider, and if appropriate, implement those actions identified in the *Hawai'i Volcanoes National*

Park General Management Plan / Wilderness Study / Environmental Impact Statement (see "Chapter 3: Alternatives" in the GMP/WS/EIS) that apply to concession contracts. This includes the following:

- All concession employees would be required to attend a NPS-certified training course on park operations and policies, safety, and park resources, with an emphasis on interpreting those resources and minimizing impacts to them.

MANAGEMENT GUIDANCE FOR COMMERCIAL USE AUTHORIZATIONS

The following management directions would continue to apply to all CUA holders to the extent directed by federal statutes and regulations, NPS *Management Policies 2006*, the Superintendent's Compendium, and past NPS practices:

- All auto-based, biking, hiking, and other guided excursions would continue to be authorized under CUAs.
- For activities that are permitted under a CUA, all of the requirements specified in applicable sections of the 1998 Concessions Act (in particular 16 USC 5966) and NPS Management Policies 2006 would be followed. For example, provisions would be included in the CUAs for the protection of visitors and the resources and values of the park.
- CUAs would be issued on a yearly or biennial basis—existing holders of CUAs would continue to reapply for their authorization annually or biennially. Consistent with statutory restrictions, there would be no preferential right to renewal. Relevant conditions of authorization may be placed on providers, based on the nature of the service and type of impact the activity could have on park resources and operations.
- All employees of CUA holders who operate in the park would be required to attend a NPS-certified training course on park operations and policies, safety, and park resources, with an emphasis on interpreting those resources and minimizing impacts to them.
- When they are permitted to operate, commercial tours would be allowed the same access as general visitors to all facilities, roads, and designated public use, nonwilderness trails.
- NPS staff would encourage commercial service providers to work together to spatially distribute their tours in Hawai'i Volcanoes National Park. They would also be encouraged to schedule tours of popular sites / congested areas to times of day known to have less congestion.
- All nonauto-based tours would be limited to daylight hours only.
- Due to traffic restrictions on Chain of Craters Road, motor coaches with the capacity of more than 26 passengers would be prohibited beyond Kealakomo Overlook on Chain of Craters Road.
- All bike tours would continue to be limited to 14 bicycles, including the guide. These tours would be authorized to operate on designated park roads only, and would not be allowed below Muliwai a Pele on Chain of Craters Road or above Kīpukapuaulu on Mauna Loa Road.
- While guided hiking tours would continue to be permitted on designated public-use, non-wilderness trails, tours to Mauna Ulu would continue to be limited to a group size of 15, and only one tour would be allowed in the area at one time. All guides who take visitors to Mauna Ulu would attend an additional certification course before guiding tours in the area due to cultural resources concerns.
- Guided equestrian tours would continue to be limited in size (maximum 6 stock per party and/or destination) and location (stock use

is prohibited on a number of trails and some campgrounds in the park due to wilderness concerns and user conflicts). The park also has limited capacity for equestrian use. For example, rainforest trail widths and heights that accommodate hikers do not meet standards for stock use.

- Commercial guides would continue to be required to accompany tours at all times within the park. Guides would continue to have an understanding of the Leave No Trace Program and have current certifications in first aid and CPR. All guides would continue to ensure proper safety equipment is available and used when appropriate (for example, bike helmets).
- Commercial tours would continue to be required to reduce and/or mitigate impacts to threatened and endangered species. For example, CUA holders would be required to inspect and clean all vehicles prior to entrance to reduce the introduction of nonnative species and ensure visitors maintain a 60-foot distance from all nēnē.
- Commercial service providers under CUAs would be charged fees sufficient to recover associated management and administrative costs.

In addition to the current management practices listed above, Hawai'i Volcanoes National Park would consider, and if appropriate, implement those actions identified in the *Hawai'i Volcanoes National Park General Management Plan / Wilderness Study / Environmental Impact Statement* (see "Chapter 3: Alternatives" in the GMP/WS/EIS) that apply to CUAs. These actions include the following:

- Large commercial buses would be able to load and unload at Thurston but would be required to park at nearby underutilized lots such as Devastation Trail, Pu'u Pua'i, or Kīlauea Iki. The park would continue to evaluate implications of implementing one-way traffic on Crater Rim Drive between Jaggar Museum and Chain of Crater Road junction for large commercial buses and requiring buses to only load and unload at Thurston as conditions change.

MANAGEMENT GUIDANCE FOR SPECIFIC LOCATIONS

As stated above, this strategy does not apply retroactively to previously made decisions; it will not affect the terms of ongoing contracts or authorizations previously signed or issued prior to the completion of the final GMP/WS/EIS. Current contracts, authorizations, agreements, and permits would be reevaluated in light of this strategy at the time they expire in order to assess the appropriateness and/or necessity of the commercial service, its alignment with the goals and strategies identified by this CSS and the general management plan, and to determine or reaffirm the appropriate legislative authority by which the commercial service should operate.

For specific locations in the park, decisions related to commercial services would adhere to federal statutes and regulations, NPS *Management Policies 2006*, the Superintendent's Compendium, past NPS practices, and actions identified in the preferred alternative of the *Hawai'i Volcanoes National Park General Management Plan / Wilderness Study / Environmental Impact Statement* (see "Chapter 3: Alternatives" in the GMP/WS/EIS). These actions include the following:

VOLCANO HOUSE℠ AND NĀMAKANIPAIO—

- Lodging and retail, as provided at Volcano House℠ and Nāmakanipaio, would continue in order to provide a range of unique overnight lodging experiences in the park that serve a variety of public audiences at differing cost levels. The concession contract for Volcano House℠ would also continue to provide retail and food

and beverage service, and a mobile venue during eruptive events would continue to be authorized. Under authorization that is appropriate and separate from the concession contract, interpretive services such as educational programs and cultural demonstrations at Volcano House℠ would also continue to be offered by entities such as the Volcano Art Center, tour operators, and other park partners.

- The developed footprint of the Concession Facilities for Volcano House℠ and Nāmakanipaio would not expand to increase capacity. There is no room to extend the footprint of lodging due to the historic nature of the Volcano House℠ and its location on/near sensitive natural and cultural resources. The existing character of this historic structure would be maintained.
- In order to expand capacity and address demand for amenities, concession operations could expand at Nāmakanipaio under the preferred alternative to include the construction and operation of an indoor lodging opportunity such as a dormitory style or hostel-like facility. The construction and operation of such facility could be included, if feasible and appropriate, in the park's concession contract covering operations at Nāmakanipaio.
- General visitors would continue to be able to access public spaces in Volcano House℠.
- All contracts, as required under law and policy and in accordance with park goals for managing commercial services, would continue to include the following standards:
  - » Accommodations would continue to be clean, safe, and of high-quality.
  - » Food and beverage served at Volcano House℠ would continue to be convenient, varied, locally sourced (when feasible), and offered throughout the day at a variety of price points.
  - » The food and beverage served at Volcano House℠ would continue to be sensitive to cultural icons (for example, items would not be named after Hawaiian sacred people or places) and could reflect the park's interpretive themes.
  - » The National Park Service would continue to require that commercial service retail-providers carry diverse sale items that (1) expand appreciation of park beyond the visit and deepen the connection of visitors to the park (2) target a variety of audiences, and (3) are sold at a range of costs.
  - » Commercial service employee training would continue to be required so that front line staff, in addition to being courteous and friendly, are able to describe in detail the source, quality, and authenticity of each piece of Hawaiian handicraft to visitors.
  - » The National Park Service would continue to encourage the commercial service provider to seek local, handcrafted items representing the park and regional theme, focusing particularly on local artists with ancestral affiliation with the park. American-made merchandise would continue to be encouraged.
  - » Hawai'i Volcanoes National Park would continue to ensure all retail meets the requirements of the gift shop mission statement and approved merchandise plan.
- If concession operations do not continue in the future for any reason, Volcano House℠ could be adaptively reused for other park visitation and/or administrative functions.

KĪLAUEA VISITOR CENTER AND JAGGAR MUSEUM BOOKSTORES—

- Retail sales for interpretive items would continue to be authorized under a cooperating association agreement at Kīlauea Visitor Center and Jaggar Museum.
- Retail sales for convenience items would continue to be authorized under a concession contract at Kīlauea Visitor Center and Jaggar Museum.
- The retail sales at Kīlauea Visitor Center and Jaggar Museum bookstores would remain within the existing developed footprint.
- All contracts/agreements, as required under law and policy and in accordance with park goals for managing commercial services, would continue to include the following standards:
  - » The National Park Service would continue to require that commercial service retail providers carry diverse retail items that (1) expand appreciation of park beyond the visit and deepen the connection of visitors to the park, (2) target a variety of audiences, and (3) are sold at a range of costs.
  - » Commercial service employee training would continue to be required for front line staff.
  - » Hawai‘i Volcanoes National Park would continue to review new product proposals through an evaluation process.

KILAUEA MILITARY CAMP—

- Kilauea Military Camp would continue to operate as a military recreation facility using park-owned historic structures and land for the duration of the existing special use permit. The site would maintain its current function as a military, morale, welfare, and recreation center—a self-supporting operation under a Non-Appropriated Funding Instrument (NAFI), primarily for active duty military, military retirees, and their guests.
- The park would continue to coordinate with Kilauea Military Camp on resource protection, particularly historic resources on the List of Classified Structures and those that are eligible for the National Register of Historic Places. The park would also coordinate with Kilauea Military Camp to expand interpretation of the park's military history and KMC history, including the World War II Japanese internment and prisoner of war (POW) history. This interpretation could include the placement of additional waysides and guided tours.
- Kilauea Military Camp would continue to be an important component of the hydrogen shuttle pilot project. The hydrogen produced off-site would continue to be delivered to the fueling station at Kilauea Military Camp. In addition to hosting the hydrogen fueling station, it is anticipated that Kilauea Military Camp would provide shuttle drivers and the electric charging station, storage, and maintenance space at the KMC base yard. The buses would be refueled, recharged, and stored overnight at this facility. Kilauea Military Camp could also be a shuttle stop for the hydrogen shuttle pilot program.
- Kilauea Military Camp may continue to be used for parking during special events at the park.
- When the special use permit expires, the National Park Service would review existing laws, policies, authorities, and park goals to (1) assess the appropriateness and/or necessity of the commercial services provided by Kilauea Military Camp and their alignment with the goals and strategies identified by this CSS and the GMP, and (2) to determine or reaffirm the appropriate authority

by which these commercial services should be authorized to operate, such as whether or not the operation could occur under a special use permit or lease or some other legal instrument. If the permitted military recreation operations at Kilauea Military Camp are discontinued, the park would prepare a plan and explore future options for the site, such as: (1) adaptively reusing the site as the park's main visitor center, (2) adaptively reusing the site as a multi-agency and partner research and education campus, (3) converting the site to a commercial visitor services operation under a concession contract, and (4) leasing to or otherwise authorizing the use of the facilities by a noncommercial visitor service tenant, such as a nonprofit.

1877 VOLCANO HOUSE—

- The 1877 Volcano House would continue, for the duration of the existing cooperating association agreement with the Volcano Art Center, to be assigned for use by that cooperating association.
- The 1877 Volcano House would continue to be maintained in line with its historic character.
- The National Park Service would increase historic interpretation of the 1877 Volcano House and the historic campus.
- All contracts/agreements, as required under law and policy and in accordance with park goals for managing commercial services, would continue to include the following standards:
  - » Commercial service employee training would continue to be required so that front line staffs, in addition to being courteous and friendly, are able to describe in detail the source, quality, and authenticity of each piece of Hawaiian handicraft to visitors.
  - » The National Park Service would continue to encourage the commercial service provider to seek local, handcrafted items representing the park and regional theme, focusing particularly on local artists with ancestral affiliation with the park. American-made merchandise would continue to be encouraged.
- When the cooperating association agreement with the Volcano Art Center expires in 2014, the National Park Service would review existing laws, policies, authorities, and park goals to (1) assess the appropriateness and/or necessity of the commercial service and its alignment with the goals and strategies identified by this CSS and the general management plan, and (2) to determine or reaffirm the appropriate legislative authority by which the commercial service should operate. If Volcano Art Center were to relocate, the National Park Service would consider (1) continuing to maintain and adaptively reuse the building for continued visitor services, (2) evaluating the restoration of the building to its original function, (3) examining adaptively reusing the building for additional self-guided interpretive visitor services, and (4) leasing or otherwise authorizing the use of the facility by a noncommercial visitor service tenant, such as a nonprofit to provide commercial services.

KAHUKU—

- Commercial services would also be allowed in lower Kahuku, similar to access granted to the general public, but would be restricted from upper Kahuku, including all areas eligible for wilderness designation.
- Any commercial services in wilderness will be evaluated and determined in a wilderness stewardship plan, subsequent to the GMP/WS/EIS.

- The park would manage the amount of commercially guided recreation in lower Kahuku primarily through vehicle size limits and CUAs. The road would be evaluated to determine final vehicle size limits; however, based on current knowledge it is likely that commercial services would be limited to vehicles no greater than 22 feet in length or 15,000 pounds maximum GVWR in lower Kahuku, and large commercial vehicles would be restricted to the developed area around the existing visitor contact area due to the constraints of existing road infrastructure.
- The park would encourage commercial service groups to provide environmental or conservation-focused messages while sightseeing and/or recreating in lower Kahuku.
- Due to concerns about the introduction of invasive species and difficulty in managing use, the park would implement a small pilot program for equestrian use in lower Kahuku pastures that would be allowed by special permit and potentially through a CUA for guided trips. Best management practices (BMPs), such as weed-free protocols, would be implemented for resource protection, and use would be authorized only on designated trails or in designated sites. If impacts to resources are found to be acceptable and manageable, limited equestrian use could be allowed in lower Kahuku pastures in the long-term under similar conditions of the pilot program.
- No commercial services or commercially guided recreation would be permitted in upper Kahuku.

Process for Addressing Requests for Commercial Visitor Services

If new commercial services are proposed that are not considered in this strategy, if an applicant wants to make significant changes to a previously approved commercial activity, or if some aspects of a new activity have not been evaluated before, the proposed commercial services would have to meet the criteria set forth by applicable legal authorities and meet the necessary and/or appropriate criteria outlined in this commercial services strategy prior to any issuance of a concession contract, CUA, or other legal authority.

The following section outlines the process for evaluating requests for commercial visitor services, and the final section, "Evaluation Criteria for Reviewing New/Additional Commercial Visitor Services," outlines criteria that the park will use to evaluate whether or not to approve that request.

APPLICATION AND REVIEW PROCESS

While all concession contracts, with extremely limited exception, must be initiated by the park and undergo an open and competitive process, businesses may request, via writing and submission of an application fee, a CUA, cooperative agreement, special use permit, or lease from the park at any time. Hawai'i Volcanoes National Park reviews these requests on a case-by-case basis.

Applicants seeking to provide a commercial service at Hawai'i Volcanoes National Park must submit a written application to the park, using any application forms the park reasonably may require and providing detailed information about the proposed service including type and description of service, how the service aligns with the mission of the park, how the provider is qualified and able to provide the service, the number of anticipated patrons per visit, and anticipated frequency of the service.

After a request in writing is received and any required fees paid, the park would follow the steps outlined below. In some instances, additional environmental compliance may be required as directed by the National Environmental Policy Act and NPS Director's Order 12.

If new services are proposed that are not considered in this plan, if an applicant wants

to make significant changes to a previously approved commercial activity, or if some aspects of a new activity have not been evaluated before, the proposed services would have to meet the criteria set forth by applicable legal authorities, and must be necessary and/or appropriate in meeting the mission of the park. Due to the complexities of some proposals and the limited amount of staff time that could be dedicated to the review process, an application for such new or changed commercial service may require a year or more to review, depending on the level of potential impact.

Step 1: Initial Screening

The park concession specialist or designee would conduct an initial review of the written request to verify completeness and to determine if the proposal is similar to other permits or authorizations issued in the past (Existing Service) or if it is a request for new services or changes to previous services for which authorizations have been issued (New Service). All completed requests, once initially reviewed, would proceed to Step 2: Evaluation.

Step 2: Evaluation

If the proposal is an application for an Existing Service, the park concession specialist or designee would assess the proposal in accordance with the management strategies outlined in "Managing Commercial Services" above and the "Evaluation Criteria" outlined below. If the request is for a New Service, the park management interdisciplinary team would complete this assessment, which would:

- determine whether or not the service meets the criteria set forth by applicable legal authorities and the necessary and/or appropriate criteria outlined in this commercial services strategy;
- assess the service's alignment with the park's goals for commercial services;
- identify potential impacts from the service on park resources and visitation (particularly those identified in the park's purpose and significance); and
- evaluate the park's ability to effectively manage the service in order to meet the park's desired future conditions.

If environmental analysis is required to complete the evaluation, costs for compliance with the National Environmental Policy Act may be borne by the applicant. Costs may include surveys, specialist staff time, contractors, and administrative work. The amount would depend on the complexity of the proposal, and could range from minimal to over $40,000. Once all necessary environment compliance is complete, and if the park concession specialist and/or park management interdisciplinary team has determined that the request meets the evaluation criteria listed below and aligns with the management strategies outlined above in this CSS, the request would proceed to Step 3: Decision.

Step 3: Decision

The park superintendent would make the final decision as to whether the activity is appropriate and/or necessary and could be authorized based on the evaluation process. If the service is determined to be appropriate, the park superintendent would determine which kind of authorization is most appropriate—CUA, concession contract, cooperative agreement, lease, or special use permit. If the activity is determined to be more appropriately reviewed as a concession operation, an evaluation would be made through the provisions listed under the concession regulation (36 CFR 51) rather than through the completion of the commercial services authorization process.

EVALUATION CRITERIA.

The park would use the following criteria to evaluate proposals for commercial services at Hawai'i Volcanoes National Park.

Criteria	Yes	No	N/A
Service meets the criteria set forth by applicable legal authorities (those associated with commercial services).			
Service complies with Hawai'i Volcanoes National Park policies and goals as outlined in management documents such as the general management plan, strategic plan, commercial services strategy, and other plans or studies that exist or that might exist in the future.			
Service can be accomplished in a manner consistent to the highest practicable degree with the preservation and conservation of park resources and values.			
Service meets all of the appropriate criteria for commercial services. The service is consistent with laws, regulations, and policies. The service does not compromise public health and safety. The service does not significantly impact or impair park resources or values. The service does not unduly conflict with other park uses and activities. The service does not exclude the public from participating in similar recreational opportunities.			
Service meets at least one of the necessary criteria for commercial services.* The service contributes to visitor understanding and appreciation of park purpose and significance. The service enhances visitor experiences consistent with park area philosophies. The service assists the park in managing visitor use and educating park visitors. The service is an essential service or facility not available within a reasonable distance from the park. The service is consistent with the purpose and significance of Hawai'i Volcanoes National Park.			
Service assists the park in meeting the identified goals associated with commercial services. Commercial operations at Hawai'i Volcanoes National Park are run efficiently and effectively and in accordance with NPS law and policy. All commercial visitor services enhance visitor understanding and appreciation of park mission and values. All commercial visitor services facilitate or complement the fundamental desirable experiences of park visitors. All commercial visitor services assist the park in managing visitor use and educating park visitors in appropriate safe and minimum impact techniques.			
Service complies with applicable federal, state, and local laws, rules, codes, and regulations (associated with commercial service goal #1).			
Service includes an educational component appropriate to the activity (associated with commercial service goal #2).			
Service provides and documents staff training, particularly for quality educational services (associated with commercial service goal #3).			
Service incorporates measures to ensure safe visitor experiences (associated with commercial service goal #4).			
Service creates no unacceptable impacts on natural, cultural, or aesthetic resources (particularly those identified in the park's purpose, significance and fundamental values).			
Service creates no unacceptable impacts on visitor experience, such as increased use in crowded or congested areas.			
Service cannot be adequately met outside the park boundary.			
The park is able to effectively monitor and manage service in a manner that will meet the park's desired future conditions (see "Staffing Needs" below).			
The support facilities (such as parking spaces, restrooms, and picnic areas) for the proposed service are adequate and are not exceeded by the demand for the commercial service.			
Service does not include capital improvements within the park boundary.			

Criteria	Yes	No	N/A
Service does not require facilities within the park in order to operate (if yes, the proposal would most likely be reviewed through the concession process).			
THE STAFFING NEEDS ASSOCIATED WITH THIS SERVICE ARE (CHECK ONE OF THE FOLLOWING):			
High: Successful monitoring of the activity would include documented impacts to park resources related to CUA use; annual administrative review; frequent permit compliance reviews; and, whenever possible, regular on-site contact with the operation when the activities are occurring.			
Medium: Successful monitoring of the activity would include documented impacts to park resources related to CUA use; annual administrative reviews, intermittent permit compliance reviews, and intermittent on-site contact with the operation.			
Low: Successful monitoring would include documented impacts to park resources related to CUA use; annual administrative review, annual permit compliance review, and an annual on-site review of the areas used for the activity. Contact with CUA holders may or may not occur during scheduled activities.			

**Applicable only to services authorized by a concession contract*

ADDITIONAL CONSIDERATIONS AND REQUIREMENTS—

SUPPORT FACILITIES/SERVICES

Many commercial activities require support facilities and/or services, such as parking spaces, restrooms, and picnic areas. Such support activities have an impact on park budgets, staff, noncommercial visitors, and facilities. When the demand for commercial services exceeds the supply of support facilities and services, park managers may either request a modification of the activity or deny the proposed commercial activity.

STAFFING NEEDS

The process of monitoring individual CUAs and concession contracts would be examined to determine NPS staff requirements. The amount of staff time required is often dictated by the complexity of the operation and the potential impact on resources. To assess the amount of staff time needed for processing an application, for the evaluation and approval process, and for subsequent authorization and monitoring requirements, the following definitions of complexity would apply (see "Evaluation Criteria" above):

- **High:** Successful monitoring of the activity would include documented impacts to park resources related to CUA use; annual administrative review; frequent permit compliance reviews; and, whenever possible, regular on-site contact with the operation when the activities are occurring.
- **Medium:** Successful monitoring of the activity would include documented impacts to park resources related to CUA use; annual administrative reviews, intermittent permit compliance reviews, and intermittent on-site contact with the operation.
- **Low:** Successful monitoring would include documented impacts to park resources related to CUA use; annual administrative review, annual permit compliance review, and an annual on-site review of the areas used for the activity. Contact with CUA holders may or may not occur during scheduled activities.

CUA holders, at a minimum, would bear the expense of management and administrative costs for these activities on a cost recovery basis. Costs (application/administrative and management/ utility/monitoring costs) to CUA holders would be based on applicable Director's Orders and would be noted on a fee schedule. A list of administrative and management fees would be developed and updated annually for each activity once the strategy is implemented.

Concession contract holders pay a franchise fee to the NPS that is determined according to the requirements of the 1998 Concessions Act instead of cost recovery.

OTHER ISSUES

Local situations and conditions that are not anticipated would be identified on a case-by-case basis. These issues might include the effects of proposed activities on neighboring communities, agencies, organizations, individuals, and park partners. They might also include unforeseen and adverse cumulative effects caused by new commercial services along with already approved services.

NEXT STEPS/ FUTURE PLANNING NEEDS

After distribution of the draft GMP/WS/EIS, there will be a 60-day public review and comment period after which the NPS planning team will evaluate comments from federal agencies, Native Hawaiian groups, organizations, businesses, and individuals regarding the draft plan. The planning team will then incorporate appropriate changes to produce a final commercial services strategy to accompany the final GMP/WS/EIS.

Many of the actions in this strategy can be implemented immediately following the completion of the planning process. However, some actions will be phased in, depending on future NPS funding and staff workloads. The approval of a strategy does not guarantee that the funding and staffing needed to implement the strategy will be forthcoming. Other NPS management actions will depend on visitor use patterns; unanticipated environmental changes; actions of commercial services providers, such as how many providers apply for various CUAs; and monitoring of visitor experiences and resource conditions.

Once the CSS and accompanying final GMP/WS/EIS have been approved, additional planning and compliance will be completed, as appropriate, before some of the proposed actions could be carried out. For example, the park will need to complete an environmental assessment for increasing capacity at Nāmakanipaio, and a wilderness stewardship plan is still needed to guide decision-making about commercial services in wilderness.

To be useful, the commercial services strategy must be flexible. To protect park resources and the quality of the visitor experience, changes may be made to this strategy after its publication. Group size limits, area restrictions, client-to-guide ratios, and other specifications may be developed in response to new information, such as volcanic/seismic events, assessments of impacts to resources, and changes in park programs. Approved activities, if found incompatible with resource protection, visitor enjoyment, and/or safety, may be suspended or terminated.

Adaptive management will be employed by park staff in response to changes that occur during the life of this strategy. This consists of the following incremental steps: (1) collect information on an existing problem, (2) analyze it, (3) propose appropriate interventions, (4) implement the interventions, (5) monitor the interventions, and, if needed, (6) propose and implement additional interventions to address the problem. Depending on the nature of changes that occur, the National Park Service would either take additional actions consistent with the management directions in this strategy or, if necessary, amend or replace the strategy. Possible adjustments might include, but are not limited to:

- Developing a cap on the number of CUAs or concession contracts in the park;
- Developing a cap on the number and/or types of trips associated with CUAs;
- Changing or eliminating the locations where activities could occur; and/or
- Eliminating an activity entirely.

In all cases, appropriate environmental compliance would occur before new actions are taken.

APPENDIX G: USER CAPACITY INDICATORS AND STANDARDS

TABLE G.1. INDICATORS, STANDARDS, MANAGEMENT STRATEGIES, AND MONITORING STRATEGIES

Indicator Topic	Indicator	Indicator Rationale	Zone	Standard	Standard Rationale	Management Strategies	Monitoring Strategies and Timeline
NATURAL							
Informal trails	Number of informal trails leaving designated trail (measured every mile)	This indicator measures multiple issues of concern including vegetation trampling, soil compaction, spread of invasives, habitat fragmentation, safety concerns, visitor experience, degradation of cultural resources, wilderness character, and contact with sensitive resources. Also relates to impacts on threatened and endangered species habitat.	Wild/ Primitive Zone	No more than one informal trail leaving designated trail per 1-mile measurement.	The standard would be based on sensitivity of resource, amount of use, and tolerance of impact. There would be a range of acceptance depending upon-site, area, or zone.	• Educate visitors regarding sensitive resources and staying on trails. • Improve trail identification and signage. • Rehabilitate informal trails as soon possible. • Evaluate informal trails to determine appropriate management action. • Formalize informal trails as designated trails, if appropriate. • Use site management/ design such as constructing boardwalks, rails, borders, and pavement to improve delineation of designated trails. • Restrict off-trail travel in particularly sensitive areas. • Potential area closures that may be temporary or longer duration.	The monitoring effort would follow the frequency prescribed for all front and backcountry facilities by the Facility Management Software System (FMSS) for annual condition assessments and five-year comprehensive condition assessments.
	Number of informal trails leaving designated trail (measured every 0.5 mile)	This indicator measures multiple issues of concern including vegetation trampling, soil compaction, spread of invasives, habitat fragmentation, safety concerns, visitor experience, degradation of cultural resources, wilderness character, and contact with sensitive resources. Also relates to impacts on T&E species habitat.	Park Support, Transitional and Visitor Services zones	No more than one informal trail leaving designated trail per 0.5 mile measurement.	There is generally a higher tolerance of visitor impact in this zone than in the Wilderness/Primitive Zone but not in specific sensitive sites within these zones.	• Educate visitors regarding sensitive resources and staying on trails. • Improve trail identification and signage. • Rehabilitate informal trails as soon possible. • Evaluate informal trails to determine appropriate management action. • Formalize informal trails as designated trails, if appropriate. • Use site management/ design such as constructing boardwalks, rails, borders, and pavement to improve delineation of designated trails. • Restrict off-trail travel in particularly sensitive areas. • Potential area closures that may be temporary or longer duration.	The monitoring effort would follow the frequency prescribed for all front and backcountry facilities by the Facility Management Software System (FMSS) for annual condition assessments and five-year comprehensive condition assessments.

Table G.1. Indicators, Standards, Management Strategies, and Monitoring Strategies

Indicator Topic	Indicator	Indicator Rationale	Zone	Standard	Standard Rationale	Management Strategies	Monitoring Strategies and Timeline
Informal trails—sensitive sites	Number of informal trails leaving designated trail (measured every 0.5 mile)	This indicator measures multiple issues of concern including vegetation trampling, soil compaction, spread of invasives, habitat fragmentation, safety concerns, visitor experience, degradation of cultural resources, wilderness character, and contact with sensitive resources. Also relates to impacts on T&E species habitat.	Sensitive sites regardless of zone (ʻŌlaʻa, Sulfur Banks, Steam Vents, Kaʻū Footprints, Puhimau, upper Kahuku)	No informal trails leaving designated trail per mile measurement	The standard applies to the park's most sensitive resources, so there is very low tolerance for impact.	• Educate visitors regarding sensitive resources and staying on trails. • Improve trail identification and signage. • Rehabilitate informal trails as soon possible. • Evaluate informal trails to determine appropriate management action. • Formalize informal trails as designated trails, if appropriate. • Use site management/ design such as constructing board walks, rails, borders, pavement to improve delineation of designated trails. • Restrict off-trail travel in particularly sensitive areas. • Potential area closures that may be temporary or longer duration.	The monitoring effort would follow the frequency prescribed for all front and backcountry facilities by the Facility Management Software System (FMSS) for annual condition assessments and five-year comprehensive condition assessments.
Invasive plant and animal species	Number of present and abundant invasive species measured at each individual site (e.g., specific species along a segment of road corridor)	This indicator would vary depending upon landscape type, habitat, and transportation mode. This indicator would identify new species being brought into the park.	All zones	Detection of new species occurrences or spread of invasive species would trigger a management response (depends upon species).	Early detection requires early intervention.	• Increase visitor and staff education and awareness. • Implement existing protocols for eradication. • Continue monitoring. • Use/encourage sanitation protocols, boot cleaning stations, etc. • Regulate the type and amount of activities.	Future comprehensive monitoring for invasive plant species would occur every 3–5 years, as park capacity permits. In most cases, park staff does not have the capacity to monitor for invasive invertebrates and reptiles.

Table G.1. Indicators, Standards, Management Strategies, and Monitoring Strategies

Indicator Topic	Indicator	Indicator Rationale	Zone	Standard	Standard Rationale	Management Strategies	Monitoring Strategies and Timeline
Human-wildlife interactions	The number of incompatible interactions between humans and wildlife: see overview paragraph for species-specific indicators selected for monitoring.	Required by law and the resources are highly sensitive to impact (vulnerable given low numbers). Also related to park purpose and significance.	All zones	Every observation of interaction would trigger a management response.	Need to meet law and policy requirements, and given the sensitivity of these resources, the threshold for impact is very low.	• Educate visitors. • Evaluate each incident. • Modify or reduce artificial light sources. • Use of signage and/or traffic calming devices • Reduce speed limits. • Reduce the number or duration of visitors and staff to an area. • Temporary or permanent rerouting, relocation, or closure of trails, roads, campsites, and picnic facilities • Appropriate notification and/or consultation with USFWS	Monitoring would continuously occur via observations, and routine staff monitoring. For most species, population numbers are too low or unknown for routine monitoring to be feasible. Therefore documentation would be opportunistic. Annual monitoring is done for two endangered species throughout their breeding seasons, the nēnē (Hawaiian goose) and honu'ea (Hawksbill turtle).
Damage or theft of threatened or endangered plant and animal species	Incidences of damage or theft of T&E plant and animal species tracked through incident reports or staff monitoring	Required by law and the resources are highly sensitive to impact (vulnerable given low numbers); also related to park purpose and significance	All zones	Every incident of damage or theft would trigger a management response.	Need to meet law and policy requirements, and given the sensitivity of these resources, the threshold for impact is very low.	• Educate visitors on the sensitively of plant and animal species. • Increase monitoring. • Increase enforcement. • Use protective barriers and other site management. • Area closures (temporary or permanent) • Relocate, if appropriate • Appropriate notification and / or consultation with US. Fish and Wildlife Service	Monitoring would continuously occur via incident reports and staff monitoring. Given the large number of listed species and limited available resources, monitoring is currently done infrequently (occurring sporadically or every few years) for most species with the exception of four flagship species (nēnē, honu'ea, 'ua'u, Ka`ū silversword).

Table G.1. Indicators, Standards, Management Strategies, and Monitoring Strategies

Indicator Topic	Indicator	Indicator Rationale	Zone	Standard	Standard Rationale	Management Strategies	Monitoring Strategies and Timeline
Damage or loss of geologic resources	Observations and reports of damage or loss of significant geologic features, such as cave features, volcanic features, and products (e.g., sulfur crystals, tree molds, tree casts, etc.)	Nonrenewable (renewable in some instances) resource and related to the park purpose and significance; can be vulnerable to visitor use.	All zones	Standard will vary depending on the rarity and fragility of the features and also on the level of visitation for a given area. Threshold for impact would be low in pristine areas, especially for those features that are particularly rare or fragile, but may be higher in areas already impacted.	Potential for repeated damage once it occurs, so threshold for initial impact is low in a pristine area. Threshold may be higher in previously disturbed areas.	• Increase education and outreach. • Initiate monitoring and photo documentation. • Provide barriers, trail and overlook realignment, and other site management. • Area closures (temporary or permanent)	Park staff would continue to track incident reports of damage and would review log quarterly. Written reports of damage from staff would also be reviewed.
Campsite conditions	Percent of campsite expansion beyond designed campground size.	This indicator is important for protection of vegetation, soils, invasive species, habitat destruction, and visitor experience.	All zones	No more than 15% expanded footprint beyond designed campground size.	Standard based on desired backcountry campsite size and baseline conditions, but can be replicated in frontcountry campsites. Since some impact is expected given regular use of a site, it was determined that 15% above designed campsite size would allow for an acceptable amount of impact to sites of varying sizes.	• Educate visitors. • Better delineate campsite boundaries. • Designate campsites. • Restore disturbed areas. • Regulate use levels. • Close or relocate campsite (temporarily) with presence of T&E species. • Evaluate the ability to add an additional campsite option.	Monitoring on a two-year interval would be ideal, but no less frequently than every five years.
Fire risk	Number of human-caused fires reported	Use data on existing fire occurrences.	All zones	No increase in the five-year average of human-caused fire incidents.	Some accidents will occur, but the goal is that fire is not increasing.	• Improve fire prevention with increased information, education, and signage particularly during times of very high or extreme fire danger. • Expand the types of media used to communicate fire risk. • Limit campfires. • Implement area closures.	Continue to monitor weather conditions on a daily basis, fuel conditions on a monthly basis, and catalog fire occurrence with the Wildlife Fire Management Information program. Review human-caused fire trends every five years.

Table G.1. Indicators, Standards, Management Strategies, and Monitoring Strategies

Indicator Topic	Indicator	Indicator Rationale	Zone	Standard	Standard Rationale	Management Strategies	Monitoring Strategies and Timeline
Fire risk		Fire is a significant concern at Kahuku given the landscape, pastures, and resource and visitor concerns	Kahuku	Management action would be taken with the first report of human-caused fire.	There is no historic data for Kahuku, and we are about to introduce regular visitation to the area, so there is a need to be highly proactive in minimizing fire risk.	• Increase fire prevention. • Consider fire breaks especially around high-use areas. • Stage a wildland fire engine in Kahuku for quick response. • Ensure that enough staff at Kahuku are red-card-trained to staff an engine. • Increase information, education, and signage particularly during times of high or extreme fire danger. • Expand the types of media used to communicate fire risk. • Implement area closures. • Prohibit campfires during high risk times. • Enforce smoking restrictions (in vehicles only).	Continue to monitor weather conditions on a daily basis, fuel conditions on a monthly basis, and catalog fire occurrence with the Wildlife Fire Management Information program. Review human-caused fire trends every five years.
Artificial light	Presence of artificial light at night without the appropriate mitigation.	This indicator is important because of the continuation of dark night sky, orientation for species, visitor experience, and wilderness experience.	All zones	No artificial light sources without the appropriate mitigation	Would be mitigated as needed.	• Educate visitors and staff on importance of night sky. • Mitigation could include use of different wave lengths, shielding, and redirection of artificial light. • Include artificial light guidance in permit conditions for commercial, special use, and back country. • Conduct night sky monitoring. • Give campers red cellophane to cover flashlights.	Park staff would continue to monitor incidentally when in the field. Specific monitoring strategies to be determined.
CULTURAL							
Damage to archeological sites	Number of incident reports of vandalism or theft per year	Damage to archeological sites can occur through both intentional and unintentional means. Both can impact the integrity of these resources.	All zones, including Kahuku	No incidents of vandalism or theft	Archeological sites are nonrenewable and the threshold for acceptable impact is zero tolerance.	• Prioritize documentation of resources in high visitor use areas. • Continue monitoring. • Educate visitors on the sensitivity of resources and the need to protect archeological sites, including the use of signage. • Target education to groups that are accessing areas with archeological sites. • Increase ranger presence or patrol. • Increase enforcement and documentation. • Reroute trails. • Create physical barriers. • Area closures	Continue to record incidences of vandalism or theft. Review incident reports on a yearly basis.

TABLE G.1. INDICATORS, STANDARDS, MANAGEMENT STRATEGIES, AND MONITORING STRATEGIES

Indicator Topic	Indicator	Indicator Rationale	Zone	Standard	Standard Rationale	Management Strategies	Monitoring Strategies and Timeline
Damage to archeological sites	Documented changes to archeological site conditions from visitor-caused actions and disturbances, as defined in NPS Archeological Site Management Information System (ASMIS). This system includes a rating system of "good, fair, poor, and destroyed."	Damage to archeological sites can occur through both intentional and unintentional means. Both can impact the integrity of these resources.	All zones, prioritize Visitor Services Zone and Transitional Zone.	Maintain sites in a "good" condition, according to the Archeological Site Management Information System(ASMIS), with the following specific standards: Impacts directly associated with visitor use should not be a significant contributor of changing overall site condition to a lesser condition (i.e., good to fair, fair to poor, etc.) with an emphasis on maintaining sites in good condition. At sites in less than good condition, management actions should seek to improve condition at least one level.	Archeological sites are a nonrenewable resource so there is a zero tolerance for degradation based on human activity. Need to prioritize in areas of high visitor use, along trails, and along coastal areas.	• Continue condition assessments on an interval basis and increase frequency of condition assessments if necessary. • Prioritize documentation of resources in high visitor use areas. • Continue monitoring. • Educate visitors on the sensitivity of resources and the need to protect arch sites, including the use of signage. • Target education to groups that are accessing areas with archeological sites. • Increase ranger presence or patrol. • Increase enforcement and documentation. • Reroute trails, if appropriate. • Create physical barriers. • Area closures • Formalize access or take a design action to correct the problem.	Continue condition assessments on the predetermined basis designated in ASMIS.

Table G.1. Indicators, Standards, Management Strategies, and Monitoring Strategies

Indicator Topic	Indicator	Indicator Rationale	Zone	Standard	Standard Rationale	Management Strategies	Monitoring Strategies and Timeline
Lack of understanding of Native Hawaiian culture	Number of actions observed at active lava flows that interfere with the natural flow of lava or create an unsafe environment (such as: trash in the area, poking sticks in lava, throwing rocks in lava, cooking marshmallows over lava).	These actions observed demonstrate a lack of understanding of Native Hawaiian culture and the significance of lava.	All zones	No more than two observed instances of behavior within an eruption ranger shift.	This is a safety concern as well, so there is a very low tolerance for this indicator. In addition, once these types of behaviors occur, other visitors are more likely to engage in these types of activities, leading to increased impact.	• Increase ranger presence and staffing and visitor education. • Use visitor management strategies, such as orientation before traveling to the site. • Educate visitors about expected behaviors. • Increase information on the web about how to visit the park. • Direct Native Hawaiian practitioners to areas where visitors are not present. • Consider guided-only access to some areas (very staff- intensive). • Keep visitors further away from active lava so they can see it but not be too close.	Monitoring would occur during eruption ranger shifts.
	Instances of non-traditional offerings that are left on the landscape	Some offerings are considered litter and incidences of these offerings is upsetting to cultural practitioners. The offerings can also have effects on natural resources, including endangered species (nēnē eating trash, rice, etc.).	All zones, but emphasis on Visitor Services and Transitional zones	Finding no more than 10 pounds of non-traditional offerings per area per patrol over the course of a month. Nontraditional offerings are removed and recorded in terms of total pounds per patrol.	There is some tolerance and expectation for this type of impact, but it becomes more significant from a cultural resource protection and operational basis once it happens on a recurring basis. In addition, once these types of behaviors occur, other visitors are more likely to engage in these types of activities, leading to increased impact. Concerns exist about staff time and hazards associated with cleanup.	• Suggest and/or designate sites that are recommended for leaving all offerings; for example consider constructing a lele (altar) for offerings. • Offer traditional or culturally appropriate offerings for people to leave for Pele at the park (e.g., provide packets of salt or awa). • Increase visitor education— publish traditional offerings on the web (which can simply be a voice in prayer and leave no trace)	Monitoring would be conducted weekly according to existing park protocols.
Visitors impacting access for cultural practitioners (causing displacement)	Number of reports of practitioners being displaced (in visitor comments, oral reports at Kupuna meetings, third-party reporting)	Significance of the park to Native Hawaiian culture and the perpetuation of the living Hawaiian culture and place-specific cultural practices	All zones, but emphasis on Visitor Services and Transitional zones	No more than one complaint received quarterly in a given location	Need for immediate action because of the sensitivity of the park relations to the Native Hawaiian community	• Increase visitor education about Native Hawaiian cultural protocols. • Be proactive about asking if people have adequate space for cultural practices. • Offer temporary site closures for periods of time on a regular basis to ensure practices continue.	Park staff are currently tracking visitor complaints. Park staff would continue to track visitor complaints, and would review the complaint log quarterly.

TABLE G.1. INDICATORS, STANDARDS, MANAGEMENT STRATEGIES, AND MONITORING STRATEGIES

Indicator Topic	Indicator	Indicator Rationale	Zone	Standard	Standard Rationale	Management Strategies	Monitoring Strategies and Timeline
Soundscapes and the Acoustic Environment	Complaints related to human-caused noise/sounds affecting a park experience (cultural practice, visitor experience)	Significance of natural sounds to the cultural landscape and Native Hawaiian significance of the land	Visitor Services and Transitional zones	No more than five complaints received quarterly in a given location	Complaints don't necessarily come in often so examining quarterly is reasonable. Concern about repeated noise disrupting people in a given location	• Strategies may vary depending on source of noise. • Increase educational messages and information. • Increase enforcement of idling limits. • Implement time restrictions for different locations to ensure there are times of day for quiet hours and natural sounds to prevail.	Park staff are currently tracking visitor complaints. Park staff would continue to track visitor complaints, and would review complaint log quarterly.
	Complaints related to human-caused noise/sounds affecting a park experience (cultural practice, visitor experience)	Significance of natural sounds to the cultural landscape and Native Hawaiian significance of the land	Wild/ Primitive Zone	No more than two complaints received quarterly in a given location	Complaints don't necessarily come in often so examining quarterly is reasonable. Concern about repeated noise disrupting people in a given location Lower tolerance in the wild zone than other zones but still want more than one to establish a problem.	• Strategies may vary depending on source of noise. • Increase education and outreach about importance of quiet as part of solitude and wilderness character. • Increase educational messages and information, especially at trailhead signs. • Increase enforcement of idling limits.	Park staff are currently tracking visitor complaints. Park staff would continue to track visitor complaints, and would review complaint log quarterly.
VISITOR EXPERIENCE/SOCIAL							
Soundscapes and the Acoustic Environment	Decibel level (dBA) of human-caused sounds	Since this is a Park Support Zone, the indicator is different than other zones.	Park Support Zone	Permanent noise sources should not exceed sleep dBA thresholds (35dBA) at the receptor site at nighttime.	Sounds from park activities and visitors dominate during daytime hours. Natural sounds are more prevalent in the evening.	• Educate visitors about soundscapes in the park. • Limit idling of buses and larger vehicles. • Limit size of vehicles. • Implement Temporary Flight Restrictions (TFRs) when appropriate. • Enforce quiet hours at the campground. • Enforce noise ordinances 36 CFR Section 2.12. In addition to impacts from visitor-caused noise, it is important to reduce noise caused by administrative activities. • Limit administrative use of aircraft.	Acoustic monitoring would occur at specific intervals, to be determined. Park staff would incidentally monitor throughout the year, particularly related to projects or permits issued.

Table G.1. Indicators, Standards, Management Strategies, and Monitoring Strategies

Indicator Topic	Indicator	Indicator Rationale	Zone	Standard	Standard Rationale	Management Strategies	Monitoring Strategies and Timeline
Soundscapes and the Acoustic Environment	dBA levels which cause speech interference L_{10} (the sound level would exceed the specified value for no more than 10% of the time)	Wildlife behavior and the visitor experience are impacted by the duration and intensity of human-caused noise, but it should not negatively impact visitor experience.	Visitor Ser vices Zone	If dBA levels which cause speech interference occur, management strategies will be triggered. L_{10} does not exceed 45 dBA.	According to desired conditions set for this zone, this standard was set to ensure that natural sounds are generally audible in this zone. However, sounds from visitors and park activities can be heard and may dominate during daylight hours in certain areas, but levels that cause speech interference rarely occur.	• Educate visitors about soundscapes in the park. • Educate visitors about noise they are making at nighttime near eruptive areas. • Implement quiet times during specific times or in specific locations for particular sites. • Limit idling of buses and larger vehicles. • Limit size of vehicles. • Implement TFRs. • Enforce quiet hours at the campground. • Enforce noise ordinances 36 CFR Section 2.12 In addition to impacts from visitor-caused noise, it is important to reduce noise caused by administrative activities. • Limit administrative use of aircraft.	Acoustic monitoring would occur at specific intervals, to be determined. Park staff would incidentally monitor throughout the year, particularly related to projects or permits issued.
	Difference between existing and natural ambient sound levels – Mean L_{50} Impact (dBA)	Wildlife behavior and the visitor experience are impacted by the duration and intensity of human-caused noise. Human-caused noises reduce the opportunities for solitude.	Transitional Zone	Mean difference between natural and ambient dBA (L_{50}) is not more than 1.5 dBA.	Based on desired conditions, this standard is set to ensure that natural sounds dominate the soundscape. Sounds from visitor and park operations may be heard. However, sounds from visitor and park operations do not mask natural sounds or very seldom mask natural sounds. If human-caused noise is present, it occurs mostly during the daytime and does not cause speech interference. Noise sources would be distant.	• Educate visitors about soundscapes in the park. • Implement quiet times during specific times or location for particular sites. • Limit size of vehicles. • Enforce standards on idling. • Enforce noise ordinances 36 CFR Section 2.12. • Implement TFRs. In addition to impacts from visitor caused noise, it is important to reduce noise caused by administrative activities. • Limit administrative use of aircraft.	Acoustic monitoring would occur at specific intervals, to be determined. Park staff would incidentally monitor throughout the year, particularly related to projects or permits issued.

TABLE G.1. INDICATORS, STANDARDS, MANAGEMENT STRATEGIES, AND MONITORING STRATEGIES

Indicator Topic	Indicator	Indicator Rationale	Zone	Standard	Standard Rationale	Management Strategies	Monitoring Strategies and Timeline
Soundscapes and the Acoustic Environment	Difference between existing and natural ambient sound levels – Mean L_{50} Impact (dBA)	Wildlife behavior and the visitor experience are impacted by the duration and intensity of human-caused noise. Human-caused noises reduce opportunities for solitude.	Wild/ Primitive Zone	Mean difference between natural and ambient dBA (L_{50}) is not more than 1.0 dBA.	This standard is set to ensure that natural sounds dominate the soundscape. Distant artificial sounds may be heard in some areas of this zone. Human-caused noise should be rare or very infrequent in occurrence and in limited areas of the zone. Pristine soundscapes should occur in some areas of this zone.	• Educate visitors about soundscapes in the park. • Educate visitors about self-noise at nighttime near eruptive areas. • Enforce noise ordinances 36 CFR Section 2.12. • Implement TFRs. • In addition to impacts from visitor-caused noise, it is important to reduce noise caused by administrative activities. • Limit administrative use of aircraft.	Acoustic monitoring would occur at specific intervals, to be determined. Park staff would incidentally monitor throughout the year, particularly related to projects or permits issued.
Crowding	Level of service (m2 / pedestrian) OR (persons / feet^2) For the following: • Walkways • Viewing platforms/ areas • Stairs / steep areas	Crowding may displace visitors or negatively impact visitor experience in high-use areas (including eruptive sites)	The level of service indicator used for monitoring would vary by location and need. (For example, at Jaggar Museum we may only use the level of service indicator for viewing platforms)	**Walkway:** not to exceed level of service E. Take immediate action if level of service F is reached. **Viewing platforms / areas:** Level of service E. View would not be impeded. Visitor conflicts and arguments should not occur as a result of crowding. **Stairs / steep areas:** Level of service D would be acceptable (when no interpretive signs are there). Flow would not be impeded at any time. See Itami, 2002 for visual examples of level of service indicators.	This standard is set to allow highest access to features of the park while still allowing for flow of visitors through key areas.	• Inform visitors about crowding issues to create awareness, and to adjust expectations. • Increase staffing at high-use areas to keep people moving. • Talk to commercial service providers and ask them to shorten their length of stay or alter their schedule to avoid known congested periods. • Offer interpretive programs in locations at low-use times to offset some of the use that occurs at busy times. • Open alternative sites to offer alternative attractions and to disperse use. • Disperse visitor use elsewhere by offering other choices (information at the gate, social media, radio, website, electrical signs). • Expand trails and areas to allow for more use where appropriate. • Regulate number of tour buses in the parking lot or size of tour buses. • Regulate shuttle schedule. • Expand shuttle service.	Park staff would continue to track number of visitors at specific locations (e.g., Jaggar Museum area) during peak times as part of their daily log and the logs would be reviewed quarterly. Park staff would continue to track visitor complaints and would review complaint log quarterly.

Table G.1. Indicators, Standards, Management Strategies, and Monitoring Strategies

Indicator Topic	Indicator	Indicator Rationale	Zone	Standard	Standard Rationale	Management Strategies	Monitoring Strategies and Timeline
Crowding	Number of visitor-reported complaints and written staff reports of user conflicts on trails between different types of uses (hikers, bicycles, horses)	Concerns about mixed use on trails and a desire to promote positive trail-based experiences	Visitor Services and Transition zones	Four similar complaints received in the same area (single location or segment of trail) quarterly Complaints (visitor-related or staff reports)	Low standard given that the number of reports of conflicts has historically been low, and the park wants to promote a positive visitor experience on trails	• Implement better signage and education about trail etiquette. • Separate trail uses. • Change the design of a trail to accommodate multiple user groups. • Limit a particular type of use. Managers may also choose to adopt the following 12 principles for minimizing conflicts on multiple use trails: 1) recognize conflict as goal interference, 2) provide adequate trail opportunities, 3) minimize the number of contacts in problem areas, 4) involve users as early as possible, 5) understand user needs, 6) identify the actual source of conflict, 7) work with the affected users, 8) promote trail etiquette, 9) encourage positive interaction among different users, 10) favor light-handed management, 11) plan and act locally, 12) monitor progress (USDOT 2012). For more information on the aforementioned principles, please see the full synthesis of literature and state of practice for addressing user conflicts on multiple-use trails (USDOT 2012).	Number of complaints would be tracked at park office
Trail-based user conflicts		Concerns about mixed use on trails and a desire to promote positive trail-based experiences	Wild/ Primitive Zone	Two similar complaints received in the same area (single location or segment of trail) quarterly	We have a relatively low standard given the historically low number of reports of conflicts, and we want to promote a positive visitor experience on trails.		Number of complaints would be tracked at park office
Parking and traffic congestion (including bikes)		Concerns about mixed use on trails and a desire to promote positive trail-based experiences: this may be of particular concern at Kahuku	Kahuku	Standard TBD	No baseline data to establish a standard. Need to prioritize monitoring of trail user conflicts on Kahuku because we are opening this up to new uses and possibly mixed uses on trails.		Number of complaints would be tracked at park office

TABLE G.1. INDICATORS, STANDARDS, MANAGEMENT STRATEGIES, AND MONITORING STRATEGIES

Indicator Topic	Indicator	Indicator Rationale	Zone	Standard	Standard Rationale	Management Strategies	Monitoring Strategies and Timeline
Parking and traffic congestion (including bikes)	Number of incidents of illegal parking (when parking lots are full)	This informs management on frequency of full-capacity parking lots, which could also lead to other parking issues.	All zones Focus efforts in Visitor Services Zone and Transition Zone	Standard will be determined once baseline monitoring is completed.	A traffic study has been proposed and will provide baseline data for acceptable parking conditions and potentially will provide additional management strategies that can be implemented to achieve acceptable conditions.	• Educate visitors about other areas of the park to visit. • Use sign boards, AM radio stations, or social media to give transportation updates (direct traffic). • Advertise opportunities in a variety of areas to divert use to other areas. • Promote the use of underutilized parking areas and either have visitors walk to attractions or be shuttled. • Communicate with large tour companies about taking turns (different days or different locations). • If visitors choose to ride a provided shuttle, drop them off before reaching the prime locations to offer an additional walking experience and to disperse crowding, when practicable. • Have rangers divert traffic at congested areas and direct parking during peak times. • Enforce parking stall capacity. • Send volunteer or interpreter to help direct traffic. • Move bicycle staging areas to other locations. • Have bicycles use alternate routes (e.g. from Steam Vents to Jaggar). • Have bicycles utilize the Escape Road off of Crater Rim Drive. • Increase parking lot capacity. • Open access to another area of the park. • Limit the number of commercial tour buses that are allowed to park in the area. • Restrict private parking access. • Enact mandatory shuttle system for high-use attraction-sites.	Currently this threshold is exceeded regularly during peak periods. As management strategies are implemented, monitoring will be conducted to determine if additional management strategies are needed to bring this to a level under the threshold.

Table G.1. Indicators, Standards, Management Strategies, and Monitoring Strategies

Indicator Topic	Indicator	Indicator Rationale	Zone	Standard	Standard Rationale	Management Strategies	Monitoring Strategies and Timeline
Parking and traffic congestion (including bikes)	Amount of time a traffic lane is blocked	This informs management of when traffic congestion is occurring. Once congestion occurs, other issues could begin to occur as well. During monitoring, observer would want to capture the source of congestion (bikes, cars, buses, etc.).	Visitor Services Zone	Standard will be determined once baseline monitoring is completed.	A traffic study has been proposed/planned and will provide baseline data for acceptable levels for traffic flow and potentially will provide additional management strategies that can be implemented to achieve acceptable levels		Currently this threshold is exceeded regularly during peak periods. As management strategies are implemented, monitoring will be conducted to determine if additional management strategies are needed to bring this to a level under the threshold.

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APPENDIX H: SPECIAL STATUS SPECIES DESCRIPTIONS

MAMMALS

Endangered

HAWAIIAN MONK SEAL *(Monachus schauinslandi)*

The endangered Hawaiian monk seal is silvery gray to brownish in color with yellowish-brown ventral pelage, reaching an average length of approximately 7 feet by adulthood (NMFS and NOAA 2007). Within the park, Hawaiian monk seals have been known to haul out and bask along the shoreline (Pratt et al. 2011). Monk seal births are most common between February and August, peaking in March and April (NMFS and NOAA 2007). The beach areas used by the seal for hauling out, pupping, and nursing are critical to the well-being of the species. This critical area also includes the first line of vegetation bordering the beaches, which provides shelter from wind and other elements. The Hawaiian monk seal population is in a decline that has lasted over 20 years (NMFS and NOAA 2007). Threats to this species include food limitation, entanglement, predation, infectious disease, habitat loss, and human disturbance (NMFS and NOAA 2007).

HAWAIIAN HOARY BAT *(Lasiurus cinereus semotus)*

The Hawaiian hoary bat is a medium-sized, nocturnal, insectivorous bat with brown and gray, white-tinged fur. This subspecies is a solitary bat that roosts among foliage in trees. The Hawaiian hoary bat has been observed foraging in a variety of both open and more vegetated habitats, including over open water and near the edges of native forests. The Hawaiian hoary bat is widely distributed on the island of Hawai‘i and within the park; most frequently observed between sea level and 7,500 feet (USFWS 1998d). The breeding season for this species typically occurs from April to August when bats seem to shift into the lowlands of the island (Fraser et al. 2007). The largest populations of the Hawaiian hoary bat are thought to occur on Kaua‘i and Hawai‘i. Population numbers are not fully known; however, the bat is believed to have declined in number over the last 100 years (USFWS 1998c). Threats to the Hawaiian hoary bat include habitat destruction (elimination of roosting sites), and possibly the direct and indirect effects of pesticides, introduced insects, and disease (USFWS 1998c; Fraser et al. 2007).

BIRDS

Endangered

HAWAIIAN GOOSE; NĒNĒ *(Branta sandvicensis)*

The Hawaiian goose has a black head and nape and buff cheeks and neck with black furrows. It is heavily barred above and lighter underneath (Pratt et al. 2011). Nēnē are widely distributed throughout the park and range from sea level to over 8,000 feet. Habitat for this species is highly variable, and ranges from sparsely vegetated lava flows to scrubland to open grasslands. At the park, nēnē typically nest on lava flows concealed in patchy vegetation, however nest site selection varies widely across the state. Nests are constructed on the ground and contain up to four eggs. The nesting season is primarily from October through March. Goslings are particularly vulnerable to nutritional inadequacies and severe weather; nēnē of all ages, from eggs to adults, are vulnerable to predation by introduced mammals. During the nonbreeding season, the Hawai‘i Volcanoes National Park nēnē flock typically moves to higher elevations in search of seasonally available forage (including berries) and a wetter climate, as lower-elevation breeding areas often dry out during summer months.

The total population of Hawaiian geese in the park is small (approximately 200 birds), but is slowly increasing as a result of habitat management, predator control, and temporary access restrictions. Threats include predation by nonnative predators, habitat loss, and human interactions (e.g. vehicle collisions).

HAWAIIAN HAWK; ʻIO *(Buteo solitarius)*

The Hawaiian hawk is small and broad-winged with dark or a combination of dark and light plumage. Habitat includes most native and nonnative forests (including papaya, guava, and macadamia orchards), grasslands, and cane fields. The Hawaiian hawk is more abundant in windward than in leeward forests, avoids dry scrub areas, and prefers either open savanna or denser rainforest (Audubon 2007; USFWS 1984). Nesting occurs March through September, and eggs are typically laid in late April and early May. Clutch size generally varies from one to three eggs (USFWS 1984), and nests are found in the high branches of trees of various kinds and heights, ranging from 32 to 78 feet (10 to 24 meters). In a recent survey, native ʻōhiʻa trees were selected for nesting 80% of the time (Audubon 2007). The Hawaiian hawk can be found anywhere from near sea level to 8,500 feet in elevation (USFWS 1984). This species is widespread within the park and is known to occur in mesic and wet koa/ʻōhiʻa forest, ʻōhiʻa/māmane/naio subalpine woodland, and open pasture with remnant stands of native forest (Tweed et al. 2007). Threats include destruction or disturbance of nesting habitat, predation, avian diseases, and extensive modification and reduction of native forest habitat (USFWS 1984). The Hawaiian hawk is currently proposed for delisting from the Federal List of Endangered and Threatened Wildlife (74 FR 27004-05).

HONEYCREEPER; ʻAKIAPŌLĀʻAU *(Hemignathus munroi)*

The ʻakiapōlāʻau is a medium-sized (5.5 inches), stocky, short-tailed Hawaiian honeycreeper with a long, sickle-shaped upper mandible and a short, straight lower mandible. The birds are olive-green with yellow heads and abdomens, black bills, and black legs, with the females being duller in color than the males. All recent observations of this species have occurred in montane mesic and wet forest dominated by koa and ʻōhiʻa, or in subalpine dry forest dominated by māmane and naio. ʻAkiapōlāʻau often join mixed-species foraging flocks, possibly to reduce predator detection. Historically this species was much more common and widespread than it is today and was found in native forests island-wide. Forests at higher elevations are now critical to the ʻakiapōlāʻau, as these are locations where mosquitoes are absent or occur only seasonally. Introduced mosquitoes transmit avian malaria and avian pox to which ʻakiapōlāʻau is highly susceptible. ʻAkiapōlāʻau can be found breeding during any month of the year; however, breeding and molting occur primarily from February to July. Nests are most often found in the branches of tall ʻōhiʻa trees (USFWS 2006a).

Within the park, ʻakiapōlāʻau have been detected in the northeastern portion of the Kaʻū Forest between 5,000 and 6,400 feet in elevation. Detections were made within the boundaries of Kahuku above Kaʻū Forest Reserve (Tweed et al. 2007). Threats to this species include habitat loss and degradation, predation, introduced diseases, and introduction of nonnative species. This species is particularly vulnerable to these threats and slow to recover due to its low reproductive rate (USFWS 2006a).

HONEYCREEPER; ʻAKEPA *(Loxops coccineus coccineus)*

The Hawaiʻi ʻakepa is a red-orange (male) or grayish-green (female), 4-inch songbird with an asymmetrical bill. Highest densities of ʻakepa are found in old-growth forests with large, canopy-emergent ʻōhiʻa or koa trees. Foraging occurs primarily among ʻōhiʻa leaves and occasionally among koa leaves and seedpods. Large ʻōhiʻa trees are particularly important to ʻakepa, because they provide both nest sites and the preferred foraging substrate, whereas large koa trees provide primarily cavities (USFWS 2006a). ʻAkepa are believed to nest exclusively within tree cavities (Tweed et al. 2007). The ʻakepa has a clearly defined breeding season, with nest-building from early March to late May, egg-laying from mid-March to late May, hatching in late March to early June, and fledging from the beginning of April to the end of June (USFWS 2006a).

Within the park, ʻakepa have been detected within the boundaries of Kahuku above the Kaʻū Forest Reserve. All observations

of this species in Kaʻū occurred within forest habitat between 5,085 and 7,215 feet in elevation. ʻAkepa have been observed foraging in subalpine woodland in the Kaʻū area. Although suitable nesting trees do not occur in the subalpine woodland within the park, potential nesting trees do occur downslope in mature montane forest (Tweed et al. 2007). The historical range of this species once included much of the island, but their distribution has changed, resulting in a complete loss of birds from the lower elevations (below 4,300 feet). Threats include habitat loss and degradation, introduced predators, competitors, and diseases. ʻAkepa are not found below 4,300 feet presumably because of the distribution of introduced mosquitoes that transmit avian malaria and avian pox (USFWS 2006a).

HAWAIʻI CREEPER ***(Oreomystis mana)***

The Hawaiʻi creeper is an olive-green to gray honeycreeper with a white chin and throat. Hawaiʻi creepers travel in family groups and are most common in mesic and wet forests above 5,000 feet. The species prefers undisturbed, old-growth forests with large, canopy-emergent ʻōhiʻa or koa trees, and foraging primarily takes place on the branches, trunks, and foliage of these live trees. Nests have been found from January to August, but peak breeding for this species occurs from February to May. Hawaiʻi creepers apparently build open cup nests (though a small percentage are cavity nests) at mid-canopy, or approximately 43 feet high. The reproductive potential for the Hawaiʻi creeper appears to be low due to its small clutch size (usually two eggs), relatively long developmental period, and limited breeding areas (USFWS 2006a). Within the park, honeycreepers occur in Kahuku above the Kaʻū Forest Reserve. All observations of this species in Kahuku have occurred within forest habitat between 5,000 and 6,400 feet (1,525 and 1,950 meters) (Tweed et al. 2007). Threats include modification and loss of habitat, avian diseases, competition with introduced birds, and predation by introduced mammals (USFWS 2006a).

ʻŌʻŪ ***(Psittirostra psittacea)***

ʻŌʻū is a heavy-bodied, 7-inch Hawaiian honeycreeper with a thick hooked bill. Its upper and lower parts are colored in varying shades of olive-green; a bright yellow head distinguishes the male and an olive-green head denotes the female. ʻŌʻū historically occupied a wide range of forest habitats, extending from sea level to alpine areas, however their range was reduced to mid-elevation (3,000 to 5,000 feet [900 to 1,500 meters]) mesic and wet ʻōhiʻa forests with 47 to 98 inches of annual rainfall. It has been suggested that a peak in ʻōʻū nesting occurs during April and May, but nesting of this species has never been described and little is known of its breeding habits (USFWS 2006a).

ʻŌʻū were once found on the islands of Kauaʻi, Oʻahu, Molokaʻi, Lānaʻi, Maui, and Hawaiʻi, but the last verified sighting of the species was in 1989 on Kauaʻi. Within the park this honeycreeper is thought to be extirpated, and it may be extinct on the island of Hawaiʻi. A few ʻōʻū were noted within ʻŌlaʻa Forest and near Nāhuku (Thurston Lava Tube) between 1959 and 1961, but none were detected at Makaopuhi and Nāpau. Later detections in the park were in ʻŌlaʻa Forest in 1975 and 1978, southeast of park headquarters in 1977, and in the eastern lowland forests (Kalapana area) in 1979. The last confirmed sighting of ʻōʻū in the park was in ʻŌlaʻa Forest in 1987 (Pratt et al. 2011).

Threats include modification and loss of habitat, avian malaria and other diseases, and predation. Introduced ungulates have caused forest degradation by reducing or eliminating forest habitat and food resources, and they have additionally created mosquito breeding sites, all of which threaten ʻōʻū and other forest birds (USFWS 2006a). Although a widespread and adaptable species, the ʻōʻū may have been particularly susceptible because it favored lower elevations where these threats were (and continue to be) more severe (Pratt et al. 2011).

HAWAIIAN PETREL; ʻUAʻU *(Pterodroma sandwichensis)*

The Hawaiian petrel is a pelagic seabird that ranges thousands of miles over the central tropical Pacific and nests only on the Hawaiian Islands (Audubon 2007). The ʻuaʻu averages 16 inches in length, and has dark gray upperparts with a white forehead and underparts. When ʻuaʻu are not at open sea, their nesting habitat includes bare rock, talus slopes, or the edges of lava flow (USFWS 1983). In the park, Hawaiian petrels nest in colonies primarily above 8,000 feet elevation on Mauna Loa at several sites. At the Kahuku Unit on the western slope of Mauna Loa, nesting may extend down to 5,500 feet elevation (Pratt et al. 2011). ʻUaʻu are long-lived and lay only a single egg per year, making this species very susceptible to population declines. ʻUaʻu return to the same nesting burrows every year, entering and exiting their burrows only at night. In the park, nesting season begins typically in April and extends into December. Monitoring for nesting activity is not comprehensive, but approximately 30 to 60 active nests are estimated annually for the Mauna Loa Unit. Nesting activity occurs at Kahuku, but the number of nests is unknown. Young birds, identified by traces of natal down, occasionally are found in November on roads or near lighted buildings. These individuals were on their nocturnal fledgling journey to the sea and collided with some obstruction or became disoriented by artificial lighting. Once at sea, Hawaiian petrels are rarely sighted from shore. The primary threat is predation by introduced feral cats and mongooses (Pratt et al. 2011). Habitat destruction by nonnative ungulates outside the park and disorientation by artificial lights are additional limiting factors for this species.

Threatened

NEWELL'S SHEARWATER; ʻAʻO *(Puffinus auricularis newelli)*

Ranging from 12 to 14 inches in length, this small- to medium-sized seabird has black upperparts, which sharply contrast with its white undersides (USFWS 1983). Newell's shearwater is a highly pelagic species that forages over deep water east and south of Hawaiʻi (Audubon 2007; Holmes et al. 2011). Colonies are typically located in areas of open native forest dominated by ʻōhiʻa, with a dense understory of uluhe fern (Holmes et al. 2011). Newell's shearwater typically requires an open, downhill flight path to become airborne and thus favors ridge crests or embankments for its nesting habitat (USFWS 1983). Nesting occurs from April through November, during which time the shearwater lays a single egg (Holmes et al. 2011). Nests can be found in burrows or in deep crevices of high-elevation forests (Audubon 2007). Pushed to extremes to avoid predation by pigs, mongooses, and cats, they now nest almost entirely on slopes that exceed 65 degrees (Audubon 2007; Holmes et al. 2011), such as at Makaopuhi Crater in the park. In the past this species was documented nesting at the crater, until the site was overrun by lava in 1972 (USFWS 1994b). In summer 2005, researchers were unable to document nesting by ʻaʻo in the park, though several incidental auditory detections by park staff in 2003 and 2005 suggest that this species still occurs in the park (Swift and Burt-Toland 2009). Threats include depredation by introduced predators, collision with powerlines, disorienting artificial lights, and degradation of habitat by feral ungulates (Audubon 2007; Holmes et al. 2011).

Candidate

BAND-RUMPED STORM PETREL; ʻAKEʻAKE *(Oceanodroma castro)*

This small seabird is dark sooty-brown in color with a distinctive white band across the rump. Listed as endangered by the state of Hawaiʻi, the species is uncommon in Hawaiʻi, seen only during the breeding season of April through November (Pratt et al. 2011). Breeding habitats are not known, but breeding is suspected on Hawaiʻi, Kauaʻi, and possibly Maui. Within the park, high-elevation (greater than 8,000 feet) nesting is suspected on Mauna Loa. Birds have been identified in the area and at least two predated carcasses have been recovered, however nest sites have not been documented. The band-rumped storm petrel is threatened by introduced predators as well as disorienting artificial lights and powerlines (Pratt et al. 2011).

REPTILES

Endangered

HAWKSBILL TURTLE; HONU‘EA *(Eretmochelys imbricata)*

This endangered sea turtle is largely recognized by its small size (carapace length is less than 37 inches), narrow head with distinctive hawk-like beak, and thick, overlapping shell scutes on the carapace (NMFS and USFWS 1998b). Hawksbill turtles occur along the shoreline and surrounding waters of the island (Seitz et al. 2012). They are typically found feeding in the vicinity of rock or reef habitats in shallow tropical waters with little turbidity (NMFS and USFWS 1998b). Preferred nesting habitat consists primarily of low-energy sandy beaches within the cover of woody vegetation; in these situations the condition of the substrate appears to be less important for successful nesting than the proximity of the vegetative cover to the water's edge (NMFS and USFWS 1998b). Hawksbill nests are monitored and protected at ‘Āpua Point, Halapē, and Keauhou within the park (Seitz et al. 2012). Nesting season begins in late May and extends to December, with peak nesting activity occurring from late July to early September. During nesting, a female hawksbill crawls ashore at night to search for suitable habitat. Primary threats to the hawksbill on the main Hawaiian Islands include human development and activities (artificial lights, vehicles driving in nesting habitat), nonnative predators (e.g., rats, mongoose, and cats), and beach erosion (NMFS and USFWS 1998b).

Threatened

GREEN SEA TURTLE; HONU *(Chelonia mydas)*

The green turtle is the largest of the cheloniids: adults can exceed three feet (one meter) in carapace length and 220 pounds (100 kilograms) in body mass. This turtle is characterized by its green subdermal fat, smooth carapace with four pairs of lateral scutes, a single pair of prefrontal scales, and a lower jaw-edge that is coarsely serrated (NMFS and USFWS 1998a). Green turtles are most commonly found in fairly shallow waters (except when migrating) inside reefs, bays, and inlets. They prefer lagoons and shoals with an abundance of marine grass and algae and require open beaches with a sloping platform and minimal disturbance for nesting (USFWS 2009h). Nesting season varies with the locality but is typically April through October in Hawai‘i, with peak nesting from June to early August (Neithammer et al. 1997). The green sea turtle may forage offshore and occasionally haul out to bask on the park's beaches, but there are no known nesting sites at the park (Pratt et al. 2011). Threats to the green sea turtle include nest predation and destruction/degradation of nesting and foraging habitats by pollution and development (NMFS and USFWS 1998a).

CRUSTACEANS

Candidate

ANCHIALINE POOL SHRIMP *(Metabetaeus lohena)*

This pale pink to brilliant red shrimp grows up to 0.7 inches (18 millimeters) in length (USFWS 2012). Within the Hawaiian Islands, this species is known to occur in low- to high-salinity anchialine pools. Anchialine pools are rare and localized brackish waters along coastal lava flows that are subject to tidal fluctuations but are not openly connected to the ocean (USFWS 2012; USGS 2005b). Recent surveys (2004–09) for *Metabetaeus* in the national parks in Hawai‘i have documented that it is widespread within this unique habitat type (Pratt et al. 2011). Identified threats to this species include coastal development (filling/destroying pools, groundwater withdrawal, and groundwater pollution), introduction of nonnative fish and, possibly, sea level rise associated with climate change (USGS 2005b).

INSECTS

Endangered

Drosophila digressa

The proposed common name for this species is the "Pāpala picture-wing," because of its close association with the plant named Pāpala, *Charpentiera obovata*. *D. digressa*

generally occurs in mesic to wet forests ranging in elevation from 4,200 to 4,600 feet and is endemic to the island of Hawai‘i (78 FR 64638-64690). In the park, host plants of suitable size to provide breeding habitat are limited to ‘Ōla‘a Forest but, like *Clermontia Hawai‘iensis*, Pāpala once grew large in montane mesic kipuka of the park (Pratt et al 2011). Park staff have been replanting it in mesic sites over the last several decades, but the trees have not yet reached the stature as those in ‘Ōla‘a Forest, where D. digressa has been found. Feral pigs degrade and destroy host plants and habitat in ‘Ōla‘a Forest by directly trampling plants and spreading nonnative plant seeds (78 FR 64638-64690). In addition, feral pigs probably eat young plants and uproot them while digging in the soil for invertebrates, and nonnative plants degrade host plant habitat and compete for light, space, and nutrients (*Federal Register* [Vol. 73, No 238:75176-75244], published on December 10, 2008). The greatest threat to this species is loss of host plants (*Federal Register* [Vol. 78, No 209:64638-64690], published on October 29, 2013): in areas where pigs have been removed, the black twig-borer can also cause serious damage to Charpentiera. Direct predation by nonnative social insects, particularly yellowjacket wasps, is also a serious threat (*Federal Register* [Vol. 73, No 238:75176-75244], published on December 10, 2008). *Drosophila digressa* has been known to occur in the park but is currently only known from the Manukā Natural Area Reserve and the ‘Ōla‘a Forest Reserve. (*Federal Register* [Vol. 78, No 209:64638-64690], published on October 29, 2013).

Drosophila heteroneura

The picture-wing *Drosophila* have been referred to as the “birds of paradise” of the insect world, due to their relatively large size (0.17 to 0.25 inches), colorful wing patterns, and the territorial behaviors and elaborate courtship displays of males (USFWS 2006b). This species breeds predominantly in *Clermontia* species (‘oha) and other lobelioids. Breeding normally occurs year-round, but egg-laying and larval development increase following the rainy season as the availability of decaying matter, which the flies feed on (USFWS 2008a). *D. heteroneura* is considered endemic to the island of Hawai‘i where it was once known to be relatively widely distributed between 3,400 and 6,000 feet above sea level. Its historical range in the park includes Kahuku Ranch, in addition to ‘Ōla‘a and Thurston Lava Tube area (Pratt et al. 2011). In the 1930s, visitors to the park were directed to montane mesic forest kipuka to see one of the species’ major host plants, *Clermontia Hawai‘iensis*. These mesic kipukas were used as cattle paddocks as recently as the 1940s, and loss of these plants in many areas of the park can likewise be directly attributed to ungulate activity. There currently appear to be three documented extant populations: one on private land at Hualālai Volcano where the species was last observed in 1993; a site at approximately 4,436 feet above sea level near a host plant species, *Clermontia clermontioides*, last observed in 1998; and at the Kona Unit of the Hakalau Forest National Wildlife Refuge, last observed in 2001 (USFWS 2006b).

The historical distribution of *Drosophila heteroneura* in the park is probably limited by decreased forest cover or loss of suitable food material as a result of past and current feral ungulate activity. In addition, fire and the resulting invasion of fire-adapted nonnative plants threaten habitat of this species in dry to mesic grassland, shrubland, and forests on the island (USFWS 2008a). Critical habitat for this species has been designated on 4,582 acres on Hawai‘i Island, 687 acres of which are in the park.

FLYING EARWIG; HAWAIIAN DAMSELFLY *(Megalagrion nesiotes)*

This insect is a large and elongated damselfly, endemic to Hawai‘i. Males are up to five centimeters long and are a silvery blue-grey color. Females are predominantly brownish in color (Pratt et al. 2011). The species is currently known to occur in streambanks in moist to wet montane forest from about 1,000 to 3,000 feet on East Maui; it was last observed here in 2005. The most recent observations have come from dense banks of uluhe fern mats (*Dicranopteris linearis*). Its habits suggest

that immatures may inhabit damp fern litter, similar to a related species (*Megalagrion oahuense*) on the island of O'ahu. Extensive tracts of uluhe fern habitat in the park have not yet been surveyed for this damselfly, and without such surveys it is premature to state that the species is extirpated from Hawai'i Island and the park. Threats to this species include agriculture, urban development, and habitat modification by pigs and nonnative plants (*Federal Register* [Vol. 74, No 129:32490-32510], published on July 8, 2009).

Threatened

Drosophila mulli

The proposed common name for *Drosophila mulli* is Mull's picture-wing. This species has very few markings on its thorax and wings compared to most other picture-wings. Similar to *D. heteroneura*, this species is restricted to the island of Hawai'i. *D. mulli* has only been observed on or under *Pritchardia beccariana*, which occurs in the park at 'Ōla'a Forest Reserve at approximately 3,200 feet above sea level (Pratt et al. 2011). There are several concentrations of this palm in adjacent state forest reserves, and the USFWS has identified at least two separate populations of the fly based on collections from *Pritchardia*. Rats and nonnative beetles are both unchecked seed predators of the palm, and no fencing or rat control has been implemented in the state reserve. The last recorded observation at the 'Ōla'a Forest Reserve site occurred in 2001 (USFWS 2006b). Similar to other picture-wing fly species, primary threats include nonnative wasp predation and loss of host plants. Many hosts of drosophilids are extremely susceptible to damage from nonnative ungulates, especially when combined with competition from nonnative plants. In addition, microclimate alteration, such as opening of the canopy or understory, may adversely affect the flies, either directly through increased desiccation or by causing host plants to dry more rapidly and rot differently (Magnacca et al. 2008).

Candidate

ORANGE-BLACK DAMSELFLY *(Megalagrion xanthomelas)*

Megalagrion xanthomelas is called the "orange-black" Hawaiian damselfly because males of this species are duller and more orange in color compared to many other species in this genus. M. xanthomelas is generally most abundant at sea level and can develop large populations in spring-fed and even brackish coastal wetlands (Jordan et al. 2005). This endemic Hawaiian damselfly historically existed within the park (Pratt et al. 2011), and most of the present-known populations of this species are associated with anchialine pools. This species suffers from the same threats as those listed for Metabetaeus lohena (above). The fresh and brackish pools used for breeding are commonly threatened by development, and very few of these habitats are protected. In Hawai'I, only three national park units contain suitable breeding habitat for this species, all of which are located on the west coast of Hawai'i Island (USGS 2005b).

PLANTS

Endangered

PENDANT KIHI FERN; PALAI LĀ'AU *(Adenophorus periens)*

Palai lā'au is a small to medium-sized epiphytic (not rooted on the ground) fern. Its yellowish green fronds taper at each end and are usually between 4 to 16 inches long and covered with hairs (Pratt et al. 2011; USFWS 1999). Currently, palai lā'au is restricted to Hawai'i, Moloka'i, and Kaua'i at 2,300 to 4,260 feet in elevation. The largest Hawai'I Island population is in Kahauale'a Natural Area Reserve, adjacent to the park (Pratt et al. 2011). It is possible that this species is extirpated from the park (Pratt et al. 2011). Historically, this species was found growing on trees in wet forests in the East Rift near or on Kane Nui o Hamo as late as the 1980s (Pratt et al. 1999). Unconfirmed reports also indicate this species may have been found in the 'Ōla'a Forest area of the park (Higashino et al. 1988). On the island of Hawai'i, the primary threat to this species is

habitat degradation by pigs, which damage the understory plants, altering the moist, shady conditions apparently required by the fern. Other threats include infestation and replacement of native wet forest with nonnative plant species (namely strawberry guava), habitat destruction by fires, and fumes from volcanic eruptions. As of 1999, it is estimated that the total number of individuals in the state may be less than 2,000 (USFWS 1999). Park recovery efforts have included fencing to exclude feral ungulates and controlling nonnative plants from portions of wet forest in the East Rift and ʻŌlaʻa areas.

KAʻŪ; MAUNA LOA SILVERSWORD *(Argyroxiphium kauense)*

Kaʻū is a single stemmed or sparingly branched rosette shrub that reaches approximately eight feet tall when flowering, and is topped by a rosette of silvery hairy leaves. Flowering generally occurs in August to September (Pratt et al. 2011). Endemic to the island of Hawaiʻi, Kaʻū is known from three sites on Mauna Loa from 5,330 to 6,230 feet (1,625 to 1,900 meters) in elevation: Kahuku Unit, Kapāpala Forest Reserve, and Upper Waiākea Forest Reserve (Pratt et al. 2011). The only naturally occurring population in the park contains approximately 700 individuals in a fenced exclosure at Kahuku at approximately 6,000 feet (1,829 meters) in a woodland transition between closed forest and subalpine. Kaʻū was introduced to the park's Mauna Loa Unit in 1975, and in 1999–2005 thousands of seedlings were planted in two exclosures on the Mauna Loa Strip near 7,000 feet (2,135 meters) in elevation. Plantings have also been made in three new ungulate-proof exclosures at Kahuku (Pratt et al. 2011). In total, over 15,000 individuals have been planted inside protected fenced units in the park.

Individuals were first documented at Kahuku in the 1950s and were originally named *A. sandwicense* var. *kauense*. The named variety was elevated to its own species in 1957 and listed as endangered in 1993. Surveys conducted by Jacobi and Warshauer in the 1970s indicated more plants were present 30 years ago than today. Jacobi estimated the extent of Kaʻū occurrence to be at least 10 times the current range at Kahuku (Jacobi and Warshauer 2006, as cited in Benitez et al. 2008). The small population sizes and possible inbreeding depression may pose threats to the species (USFWS 1996b). The most immediate threats, however, are nonnative ungulates, primarily sheep, mouflon sheep, goats, and pigs (Pratt et al. 2011; USFWS 1996b). Critical habitat was designated for this species in four units totaling 35,657 acres on the island of Hawaiʻi (USFWS 2009d). Part of its critical habitat is found in Hawaiʻi Volcanoes National Park (Leonard 2009). The primary constituent elements for Kaʻū are as follows:

- Landform/forest type: moist, open forest; subalpine mesic shrubland; bogs; and weathered, old pāhoehoe or ʻaʻā lava with well-developed pockets of soil.
- Plant community: *Asplenium peruvianum* var. *insulare*, *Carex alligata*, *Carex* sp., *Coprosoma ernodeoides*, *Coprosoma montana*, *Deschampsia nubigena*, *Dodonaea vascosa*, *Dubautia ciliolata*, *Gahnia gahniiformis*, *Geranium cuneatum*, *Leptecophylla tameiameiae*, *Metrosideros polymorpha*, *Plantago hawaiensis*, *Rhynchospora chinensis*, *Silene Hawaiʻiensis*, or *Vaccinium reticulatum*.
- Elevation: from 5,193 to 8,024 feet (1,583 to 2,246 meters) (USFWS 2003).

AHINAHINA; MAUNA KEA SILVERSWORD *(Argyroxiphium sandwicense subsp. sandwicense)*

Ahinahina, *Argyroxiphium sandwicense* subsp. *sandwicense* is a tall, tap-rooted plant that produces a dense cluster of basal leaves preceding the formation of a flowering stalk some time later in its life cycle. An individual typically flowers only once during its life, or more infrequently it can form branches from near the base, each of which flowers and subsequently dies back (Wagner et al. 1999; USFWS 1993). Currently, the only known

natural populations of this plant are on the slopes of Mauna Kea on the island of Hawai'i. In addition, a small number of individuals have been planted at other places, including in the park. This species in vulnerable to any substantial habitat alteration, and faces the present threat of elimination through grazing and trampling by feral animals, and the potential threat of damage by insect larvae (USFWS 1986). There is no critical habitat designated for this species.

Mauna Kea silversword is not native to Hawai'i Volcanoes National Park. A small number of Mauna Kea silverswords were planted at Pu`u `Ula`ula, the end of the Mauna Loa Road, and within 2 exclosures along the Mauna Loa Trail in 1973-1975. Plantings were also made at Kilauea Military Camp and the Uwekahuna/Kīlauea Overlook area. Most died or were removed as inappropriate plantings in the 1970s (N. Zimmer, unpublished data), and it is unlikely that plants of this species persist in the park (Pratt et. al. 2011).

Asplenium peruvianum var. insulare

Asplenium fragile var. *insulare*, a member of the spleenwort family (Aspleniaceae), is an endangered fern with a short suberect stem and leaf stalks from 2 to 6 inches long (USFWS 1998b). This species is currently known to occur in eight populations on Hawai'i between elevations of 5,250 and 7,800 feet; those nearest to the park are Kūlani Correctional Facility, Kapāpala, and Ka'ū Forest Reserves (Pratt et al. 2011; USFWS 1998b). *A. fragile* var. *insulare* was historically collected at additional sites on Mauna Kea, Mauna Loa, Hualālai, and near Hilo (Pratt et al. 2011). The Mauna Loa Unit above 5,500 feet (1,680 meters) in elevation and Kahuku Unit above 6,030 feet (1,840 meters) contain the only known populations of this fern in the park. One lava tube in the Mauna Loa Unit has supported a population of *A. fragile* var. *insulare* since 1943 (Pratt et al. 2011). At Kahuku, this species was found at four subalpine sites above Ka'ū Forest Reserve (Benitez et al. 2008; Pratt et al. 2011). In the park, this species is known to occur in subalpine, montane seasonal, and alpine/aeolian environments, which are described in the Chapter 5 (NPS 2005; USFWS 1998b). It is generally restricted to large-diameter, moist lava tubes at high elevation (Benitez et al. 2008; Pratt et al. 2011). The fern is typically found on tube walls and ceilings in the lighted zone near the opening, but some individuals have been found in deep, dark recesses of lava tubes. The fern has also been observed growing in lava cracks and on cliffs (Pratt et al. 2011). Feral goats and mouflon sheep are potential threats to *Asplenium fragile* var. *insulare,* although it seems to persist in lava tubes (Pratt et al. 2011; USFWS 1998b). Additional threats may include nonnative plant species that infest lava tubes, such as common mullein (*Verbascum thaspus*) (Pratt et al. 2011). Park recovery efforts have included fencing to exclude feral ungulates and control of mullein in the Mauna Loa Unit.

Uhiuhi (Caesalpinia kavaiensis)

Uhiuhi is a medium-sized tree up to 35 feet (10 meters) tall with rough, dark bark and a spreading crown. The wood is highly valued for its color, grain and density. Early Hawaiians took advantage of the wood's high density to make a fishing implement that sinks rather that floats (USFWS 1994a). About 50 individuals of uhiuhi are known on the islands of Hawai'i, O'ahu, and Lana'i, as of 2010. This species is found on the dry leeward side of the island. Wildfire, the black twig borer insect, and nonnative ungulate are the main threats to this species (USFWS n.d.).

Uhiuhi is not native to Hawai'i Volcanoes National Park, but was planted at several localities between 1924 and 1979. More than 18 trees were planted around Kīpukapuaulu, Old Volcano House near Park Headquarters, Nāmakanipaio, Kīpuka Nēnē, and Hilina Pali between 1924 and 1958; these had all died by 1967 (Morris 1967). An additional 125 seedlings were out-planted at upper `Āinahou Ranch in 1974-1979 from material collected at Pu`uwa`awa`a. Surviving plants were removed to arboreta in 1980 (N. Zimmer, unpublished data). This species is likely no longer present at the park (Pratt et. al. 2011).

LINDSEY'S ʻŌHĀ WAI
(Clermontia lindseyana)

Lindsey's ʻōhā wai is a perennial tree that grows from approximately eight to 20 feet tall. It can be either terrestrial or epiphytic, living on the surface of other plants (Pratt et al. 2011; USFWS 1996a). The extant populations of Lindsey's ʻōhā wai grow on Hawaiʻi Island and the leeward slopes of Haleakalā, East Maui (Pratt et al. 2011). On the island of Hawaiʻi, plants have been reported from eastern Mauna Kea and eastern, southeastern, and southwestern Mauna Loa at elevations above 4,300 feet (Benitez et al. 2008; USFWS 1996a). In 1996, there were 12 known populations and 86 individuals thought to persist on the island. In the park, this species is known to occur naturally in several sites in the Kahuku Unit. These sites were found in mesic to wet ʻōhiʻa forest adjacent to the Kaʻū Forest Reserve at 5,905 to 6,234 feet in elevation (Benitez et al. 2008; Pratt et al. 2011). The major threats to Lindsey's ʻōhā wai are trampling and grazing by cattle, trampling and browsing by goats, and rooting and trampling by pigs (USFWS 1996a). A 2008 survey indicated extensive damage from pig activity and either feral cattle or mouflon sheep browsing in the areas of Kahuku where ʻōhā wai were observed (Benitez et al. 2008). Currently the species is protected in ungulate-free exclosures only in Hakalau Forest, Kūlani, and Kīlauea Forest Reserves and as planted individuals inside fenced exclosures in the Mauna Loa and Kahuku Units of the park. A 2008 survey indicated extensive damage to naturally occurring individuals from pig activity and either feral cattle or mouflon sheep browsing in the areas of Kahuku where ʻōhā wai were observed (Benitez et al. 2008).

PELE'S ʻŌHĀ WAI *(Clermontia peleana* SUBSP. *peleana)*

Pele's ʻōhā wai is an epiphytic shrub or small tree that grows between five and 20 feet tall on large ʻōhiʻa, koa, and ʻolapa trees (Pratt et al. 2011; USWFS 1996a). Endemic to the islands of Maui and Hawaiʻi, plants have been found in rainforests of East Maui, and windward Mauna Kea and Mauna Loa between 1,740 to 3,770 feet elevation (Pratt et al. 2011; USFWS 1996a). In 1996, there were four known populations on the island of Hawaiʻi, consisting of a total of eight individuals (Pratt et al. 2011). This species was thought to be extinct in the wild when the last individual died by 2000. Recently, six individuals were discovered along the Wailuku River. Major habitat destruction resulting from nonnative ungulates, particularly pigs, is a primary cause of the decline of this taxon. Slugs are also thought to be a limiting factor. Since 2001, the park has planted nearly 400 individuals in protected sites in the park's ʻŌlaʻa Forest from which feral pigs have been removed (Pratt et al. 2011).

HĀHĀ *(Cyanea hamatiflora* SSP. *carlsonii)*

This species is a palm-like tree that grows to a height of approximately 10 to 26 feet tall. It is typically found in ʻōhiʻa-dominated montane wet forests at elevations between 4,000 and 5,700 feet (USFWS 1996a). There are only two known extant populations, both on the island of Hawaiʻi, located on privately and state-owned land at Honuaula Forest Reserve and Keokea. At the time of federal listing, the two populations contained approximately 19 individuals. The declining Honuaula population currently has only 2 individuals, and the Keokea population contains 15 individuals (USFWS 2009e). Two subpopulations were planted in 1995 and 1996 in the native range: 45 individuals at Honuaula Forest Reserve and 6 individuals at Puʻuwaʻawaʻa (USFWS 1996a). In addition, two individuals were outplanted in a fenced area in South Kona in 2006 and one in Kīpāhoehoe Natural Area Reserve in 2008. The current status of the outplanted individuals, however, is not known (USFWS 2009e). Nonnative plants are a serious threat to the long-term survival of this species. In addition, grazing and trampling by cattle and uprooting by feral pigs degrade habitat and open major sites for nonnative plant invasion (USFWS 1996a). Although no plants have been documented in the park, designated critical habitat for hāhā lies adjacent to the park (Leonard 2009). As mentioned previously, the ESA requires that such actions avoid "destruction" or "adverse modification"

of designated critical habitat (USFWS 2009b). The primary constituent elements for this species on the island of Hawai‘i are as follows:

- Landform/forest type: Mesic montane forest dominated by *Acacia koa* or *Metrosideros polymorpha*.
- Plant community: *Athyrium* sp., *Cibotium* spp., *Clermontia clermontioides*, *Coprosma* sp., *Dryopteris* sp., *Hedyotis* sp., *Ilex anomala*, *Myoporum sandwicense*, or *Sophora chrysophylla*.
- Elevation: 4,482 to 5,759 feet (1,366 to 1,755 meters) (USFWS 2003).

HĀHĀ *(Cyanea shipmanii)*

C. shipmanii is a small unbranched or sparsely branched shrub that grows to a height of eight to 13 feet (2.5 to 4 meters). This species is distinguished by its small flowers, slender stems, and stalked and divided leaves. Preferred habitat includes montane mesic forest dominated by ‘ōhi‘a on the windward slopes of Hawai‘i, at elevations between 5,400 and 6,200 feet. At the time of federal listing in 1994, only four populations were known, containing fewer than 10 individuals (USFWS 1996a). By 2007, the species had declined to only 2 extant wild individuals in Upper Waiākea Forest Reserve and Pu‘u Kipu Unit of the Kīlauea Forest Reserve (USFWS 2009f). Just outside the park, a lone individual of *C. shipmanii* was recently discovered along the Kahuku boundary (PEPP 2009). Major threats to this species include nonnative ungulates and nonnative plant species (USFWS 1996a; USFWS 2009f). In particular, the remaining wild individual in the Upper Waiākea Forest Reserve is threatened from habitat destruction due to pigs and herbivory or disturbance by sheep. The Kīlauea populations are at risk from fruit and seed predation by rats (USFWS 2009f).

HĀHĀ; HA‘IWALE; KANAWAO KE‘OKE‘O *(Cyanea stictophylla)*

C. stictophylla is a small tree or shrub approximately 2 to 20 feet in height. The stems are sparsely branched and occasionally equipped with sharp outgrowths. Hāhā is distinguished from other taxa in the genus by its large, deeply lobed flowers and small calyx lobes (USFWS 1996a). This species is endemic to the island of Hawai‘i, and is known from Kona and Ka‘ū districts at elevations of 4,590–6,400 feet (Pratt et al. 2011). Preferred habitat of hāhā is generally lowland to montane, mesic to wet forest dominated by ‘ōhia‘a and koa (USFWS 1996a). In Hawai‘i Volcanoes National Park, two plants were discovered inside a pit crater, which is not accessible to ungulates, located in the Kahuku pasture/mesic forest zone at 3,281 feet elevation (Benitez et al. 2008; Pratt et al. 2011). In 1996, there were three known populations and fewer than 20 known individuals on the island of Hawai‘i, with 46 outplanted individuals persisting in exclosures on Pu‘uwa‘awa‘a and Ka‘ū Forest Reserves. The primary reasons for decline of this species are destruction of habitat by cattle grazing and feral pigs (USFWS 1996a). Feral goats and mouflon sheep are also threats to this soft-wooded species (Pratt et al. 2011). The park is currently propagating and planting individuals inside protected exclosures. Critical habitat for this species is found in Hawai‘i Volcanoes National Park (Leonard 2009). The primary constituent elements for *C. stictophylla* on the island of Hawai‘i are as follows:

- Landform/forest type: *Acacia koa* or wet *Metrosideros polymorpha* forests.
- Plant community: *Cibotium* sp., *Melicope* spp., *Urera glabra*.
- Elevation: 3,466 to 6,288 feet (1,056 to 1,917 meters) (USFWS 2003).

‘AKŪ *(Cyanea tritomantha)*

Cyanea tritomantha (‘akū), a palm-like shrub in the bellflower family (Campanulaceae), is known only from the island of Hawai‘i (Pratt and Abbott 1997; Lammers 2004). Historically, this species was known from the windward slopes of Mauna Kea, Mauna Loa, Kīlauea, and the Kohala Mountains, in the lowland wet, montane wet, and wet cliff ecosystems (Pratt and Abbott 1997, p. 13). Currently, there are 16 occurrences of *Cyanea tritomantha* totaling fewer than 400 individuals in the lowland wet, montane wet,

and wet cliff ecosystems. In Hawai‘i Volcanoes National Park, a survey conducted between 1992 and 1994 documented six plants ‘Ōla‘a Tract (Pratt and Abbott 1997). At least two of these individuals have died. An additional five plants were mapped between 2009 and 2010, two of which have since died or could not be re-located. Hawai‘i Volcanoes National Park also likely contains suitable habitat for *Cyanea tritomantha* in the East Rift forests. There is a published record of an individual in Puna Forest Reserve (Lamoureux et al. 1985). In 2001 and 2002, 68 individuals were outplanted in Hawai‘i Volcanoes National Park’s ‘Ōla‘a Tracts; however, by 2010, less than one third of these individuals remained. *Cyanea tritomantha* produces few seeds, and their viability tends to be low (Moriyasu 2009, in litt.). This species is threated by the destruction of habitat from nonnative ungulates.

HA‘IWALE *(Cyrtandra giffardii)*

Cyrtandra giffardii is a small shrubby tree that grows from 10 to 20 feet in height with opposite leaves positioned on the upper nodes of the stem. The habitat for this species is found in mesic/wet forest environments dominated by tree fern at elevations between 2,400 and 4,900 feet. In 1996, there were 11 known populations and more than 1,000 known individuals on the island of Hawai‘i. As of 1994, 90 known individuals occurred in the Koa and Pu‘u fenced units of ‘Ōla‘a Forest in Hawai‘i Volcanoes National Park. Subsequent surveys identified several plants in adjacent fenced units (Pratt et al. 2011). The major threat to Ha‘iwale is rooting and trampling by pigs and competition from invasive plants Known plants in the park are in areas that have been fenced and managed to exclude pigs and control of nonnative plants are carried out in portions of these units (USFWS 1996a). Critical habitat for this species is found in Hawai‘i Volcanoes National Park (Leonard 2009). The primary constituent elements for *C. giffardii* on the island of Hawai‘i are as follows:

- Landform/forest type: wet montane forest dominated by *Cibotium* sp. or *Metrosideros polymorpha*, and *Metrosideros polymorpha–Acacia koa* lowland wet forests.
- Plant community: *Astelia menziesiana*, *Diplazium sandwichianum*, *Hedyotis terminalis*, *Perrottetia sandwicensis*, or other species of *Cyrtandra*.
- Elevation: 2,146 to 4,723 feet (654 to 1,440 meters) (USFWS 2003).

HA‘IWALE *(Cyrtandra tintinnabula)*

This endangered small shrub grows from approximately three to seven feet in height. Its papery, toothed leaf blades are moderately covered with yellow-brown hairs. *C. tintinnabula* grows in lowland wet/mesic forest environments dominated by dense koa, ‘ōhi‘a, and tree fern (USFWS 1996a). This species is endemic to the island of Hawai‘i and generally occurs between 2,390 and 3,410 feet elevation (Pratt et al. 2011). In 1996, there were three known populations and 18 known individuals on the island of Hawai‘i (USFWS 1996a).In the park, *C. tintinnabula* was discovered in July 2001 growing on the lower walls of a prominent geological feature (‘Ōla‘a Trench) and two adjacent craters in the northeast quarter of ‘Ōla‘a Forest at 3,609 feet elevation (Pratt et al. 2011). Rooting and browsing by feral pigs directly damage and disturb the habitat of this species, breaking its weak and delicate stems. Because much of the native habitat is lost, appropriate pollinators may also be absent (USFWS 1996a).

HAU KUAHIWI *(Hibiscadelphus giffardianus)*

Hau kuahiwi is an endangered tree species that can grow up to 39 feet tall. Endemic to the island of Hawai‘i, this species occurs naturally only at Kīpukapuaulu near 4,000 feet elevation (Pratt et al. 2011). When it was discovered in 1911, there was only one tree remaining, which was found on the edge of a collapsed lava tube on the southwestern edge of the kīpuka (Pratt et al. 2011). At the time of federal listing in 1996, hau kuahiwi was extinct in the wild and known only from

11 reintroduced individuals at Kīpukapuaulu in the park. Planted individuals are also found at Kīpuka Kī and a handful of sites in the montane seasonal environment of the Mauna Loa area, which is described in Chapter 5 (NPS 2005, 2009e; Pratt et al. 2011). As of 2008, the number of known planted individuals is estimated at over 400 (USFWS 2008d). In the past, habitat degradation and predation by cattle and feral pigs, as well as goats, were major threats to hau kuahiwi. These threats have been controlled by the park, and all naturally occurring and planted individuals are in fenced areas. Current threats include competition from nonnative plant species, fire, and rats that strip the bark and eat the seeds (Pratt et al. 2011; USFWS 2008d). In addition, the recently introduced two-spotted leaf hopper attacks the foliage of the plant species and may contribute to drought damage (Pratt et al. 2011). Critical habitat for this species is found in Hawai'i Volcanoes National Park (Leonard 2009). The primary constituent elements for hau kuahiwi on the island of Hawai'i are as follows:

- Landform/forest type: mixed montane mesic forest.
- Plant community: *Acacia koa*, *Coprosma rhynchocarpa*, *Dodonaea viscosa*, *Melicope* spp., *Metrosideros polymorpha*, *Myoporum sandwicense*, *Nestegis sandwicensis*, *Pipturus albidus*, *Psychotria* sp., *Sapindus saponaria*.
- Elevation: 3,914 to 4,181 feet (1,193 to 1,274 meters) (USFWS 2003).

HILO ISCHAEMUM *(Ischaemum byrone)*

This perennial grass is distinguished from other native Hawaiian grasses by its tough outer flower bracts and dissimilar basic flower units. It contains creeping underground stems and erect stems that grow from 16 to 31 inches in height (USFWS 1996a). This perennial grass is found in scattered locations on the windward coastlines of Maui, Moloka'i, and Hawai'i islands. In 1996, there were 17 known populations and several thousand known individuals on the island of Hawai'i (USFWS 1996a). In the park, Hilo ischaemum was found naturally along the immediate shoreline among boulders and rocks or in cracks in the pāhoehoe surface in the eastern coastal lowlands from Kamoamoa to Lae 'Apuki (Pratt et al. 2011). All of these sites were covered by lava flows from 1993 through 2006. Plants were salvaged from the largest population at Kamoamoa, propagated ex situ, and their progeny were planted at Lae 'Apuki, Hōlei Sea Arch, Kealakomo, Kahue, Ka'aha, and Kalue in more western and drier locations than the naturally occurring populations. In 2010, less than 1% of the planting survived, one of these plantings was at the eastern-most site at Hōlei Sea Arch. The most immediate threat to Hilo ischaemum in the park is lava flows. Feral goats may also be a potential threat (Pratt et al. 2011). Critical habitat for this species is found in Hawai'i Volcanoes National Park (Leonard 2009). The primary constituent elements for Hilo ischaemum on the island of Hawai'i are as follows:

- Landform/forest type: coastal wet to dry shrubland; near the ocean; rocks or pāhoehoe lava in cracks and holes.
- Plant community: *Fimbristylis cymosa*, *Scacevola taccada*.
- Elevation: 0 to 91 feet (0 to 28 meters) (USFWS 2003).

KOKI'O *(Kokia drynarioides)*

This small tree is endemic to the leeward slopes of Hualālai in North Kona on the island of Hawai'i between 1,510 and 2,950 feet elevation (Pratt et al. 2011; USFWS 1994a). It reaches up to approximately 26 feet tall and has shallowly lobed leaves with large, ornamental, scarlet flowers (Pratt et al. 2011). This tree inhabits dry forests on rough, relatively unweathered lava flows and is found in mid-elevation and montane seasonal environments (NPS 2005; USFWS 1994a). Koki'o is not historically known in the park; individuals were outplanted at Kīpukapuaulu, Kīpuka Kī, Kīpuka Nēnē, Hilina Pali, and 'Āinahou Ranch between 1924 and 1958, but only the Kīpuka Nēnē planting persists (Pratt et al. 2011). Currently, two populations exist: the first at Ka'ūpūlehu, located outside the park, containing one

mature individual; and the second population at Kīpuka Nēnē, containing a single surviving individual. Seventy-five outplanted individuals at Kaʻūpūlehu appear to be reproducing (USFWS 2009g). Fire is a serious threat to the remaining trees due to the invasion of fire-prone nonnative grasses. Past threats included domestic cattle and feral goats, which browsed and damaged native trees of the dry forests of North Kona, and interfered with tree reproduction and recruitment. Insects such as Chinese rose beetle are also reported to attack kokiʻo leaves (Pratt et al. 2011).

ZAHLBRUCKNER'S PELEA; ALANI *(Melicope zahlbruckneri)*

This endangered tree is endemic to the southeastern portion of the island of Hawaiʻi and reaches approximately 33 to 39 feet tall. This tree is known from few sites, including Kīpukapuaulu and Moaʻula in Kaʻū District; Glenwood in Puna District; and recently reported from Laupāhoehoe Natural Area Reserve in Hamākua District (Pratt et al. 2011). In Hawaiʻi Volcanoes National Park, only one naturally occurring population of 20 trees is known (Pratt et al. 2011) from montane seasonal forest in Kīpukapuaulu (Pratt et al. 2011). Four plants of alani have also been successfully planted at Kīpuka Kī (Pratt et al. 2011). Inside the park, ungulate threats have been controlled (USFWS 2008d). Current threats include seed predators, such as rats and insects; loss of natural pollinators; the recently introduced two-spotted leaf hopper; and competition from nonnative plant species (Pratt et al. 2011; USFWS 2008d). Critical habitat for this species is found in Hawaiʻi Volcanoes National Park (Leonard 2009). The primary constituent elements for alani on the island of Hawaiʻi are as follows:

- Landform/forest type: *Acacia koa–Metroideros polymorpha* dominated montane mesic forest.
- Plant community: *Coprosma rhynchocarpa*, *Melicope* spp., *Myoporum sandwicense*, *Nestegis sandwicensis*, *Pipturus albidus*, *Pisonia brunoniana*, *Psychotria Hawaiʻiensis*, *Sapindus saponaria*, *Zanthoxylum dipetalum*.
- Elevation: 3,476 to 4,383 feet (1,060 to 1,336 meters) (USFWS 2003).

MAʻALOA *(Neraudia ovata)*

This endangered sprawling shrub is endemic to the leeward side of the island of Hawaiʻi between 980 and 4,820 feet. Its stems can reach approximately three to nine feet long and male and female flowers are borne on separate plants. This shrub inhabits dry forests, open lava flows, and subalpine forest. Currently remaining natural populations of maʻaloa include 14 to 18 mature individuals and up to 125 immature individuals. At the time of federal listing, the species was known from 11 individuals in two populations. In addition, plantings at various locations on the island, have resulted in approximately 327 individuals (USFWS 2008b). While the natural population of maʻaloa was extirpated from the park, individuals were recently planted near the presumed original site, as well as at Kīpuka Kī and several sites along Hilina Pali Road (Pratt et al. 2011). The plantings of maʻaloa in the park are all in fenced units managed to exclude goats and mouflon sheep. Threats to this species include browsing by ungulates, competition with nonnative shrubs and grasses, and insects (particularly the spiraling whitefly) (Pratt et al. 2011).

ʻAIEA *(Nothocestrum breviflorum)*

Endemic to the island of Hawaiʻi at elevations of 1,800 to 6,000 feet, this tree species grows from approximately 33 to 39 feet in height. The trunk, about 18 inches in diameter, has a soft, sappy wood with dark brown bark. Habitats where ʻaiea are found include montane seasonal environments, lowland dry forest, montane dry forest, and montane mesic forest (USFWS 1996a). Individuals generally occur on ʻaʻā lava substrates at elevations ranging from 260 to 6,000 feet. In 1996, there were six known populations on the island of Hawaiʻi. In the park, this species was reported from dry forest near 1,804 feet to mesic forest at 4,300 feet (Pratt et al. 2011). The species was lost from these historical sites and exists in the park today only as plantings in Kīpukapuaulu

and Nāulu in areas fenced and protected from nonnative goats, mouflon sheep and cattle (Pratt et al. 2011). On the island, this species has been negatively impacted by cattle and sheep grazing, and by the introduction of nonnative plant taxa such as Brazilian peppertree, which may afford enough fuel to support a destructive fire (USFWS 1996a).

HŌLEI *(Ochrosia kilaueaensis)*

Hōlei is a medium-sized tree, endemic to the island of Hawai‘i at elevations between 2,200 and 4,000 feet. It grows to about 50 to 60 feet in height and contains a milky sap. It is found in montane seasonal environments and occurs at elevations between 2,200 and 4,000 feet (USFWS 1996a). In 1996, there was one possible extant population at Pu‘uwa‘awa‘a on state-owned land; however, the population was last collected at an unknown date, and it is unknown how many individuals are present in the population, if any (USFWS 1996a). In the park, hōlei is known only from Kīpukapuaulu, where the last tree was observed in 1927. It is now considered to be likely extirpated from the park, and possibly extinct (Pratt et al. 2011). If the species is still extant, potential threats include goats, domestic cattle, pigs, sheep, fire, and nonnative plants. Feral goats browse and trample the native vegetation, disturbing the substrate and understory. Predation of fruits by black rats is also a potential threat to the viability of this species (Pratt et al. 2011; USFWS 1996a).

MANY-FLOWERED PHYLLOSTEGIA *(Phyllostegia floribunda)*

Also known as many-flowered Hawaiian mint, *Phyllostegia floribunda* is a perennial herb with flowers (maroon to red, white on base) on short, leafless lateral branches (Pratt et al. 2011) that is endemic to the island of Hawai‘i at elevations of 1,410 to 3,710 feet. Historically, *P. floribunda* was reported in the lowland wet, montane mesic, and montane wet ecosystems at scattered sites along the slopes of the Kohala Mountains; southeast through Hamakua, Laupahoehoe NAR, Waiakea FR, and Upper Waiakea FR; and southward into Hilo, Hawai‘i Volcanoes National Park, and Puna. Currently, there are 12 known occurrences of *P. floribunda* totaling fewer than 100 individuals (Bruegmann 1998, in litt.; Giffin 2009, in litt.; HBMP 2010b). At Hawai‘i Volcanoes National Park a survey conducted between 1992 and 1994 documented one plant in ‘Ōla‘a (Pratt et al. 1997). In 2000 this individual was not found and is presumed dead. However, this area has not been re-surveyed recently and there may be undetected individuals. An additional survey was conducted within several East Rift pit craters detected four plants within the Nāpau Trail pit crater in 1995 (Belfield 1998). No recent monitoring has been conducted however there is no pig disturbance and it is likely that these plants have persisted through seedling recruitment. Between 2002 and 2004, 258 individuals were planted in the ‘Ōla‘a koa and small tract units. At the time of last monitoring (2009) 21% had survived. In general, endemic mints are highly vulnerable to nonnative ungulate impacts (Pratt et al. 2011).

KĪPONAPONA *(Phyllostegia racemosa)*

Kīponapona is in the mint family (Lamiaceae), and is a climbing vine with many-branched, square stems and spicy-smelling leaves. Flower clusters, densely covered with short, soft hairs, are composed of 6 to 12 flowers. It is typically found epiphytically in disturbed koa, ‘ōhi‘a, and hāpu‘u-dominated montane mesic or wet forests, at elevations between 4,650 and 6,070 feet (USFWS 1998a). Although individuals were listed by USFWS as part of the park flora (Leonard 2009), no natural plants have been documented in the park. Outplantings of some individuals were made in the park, but none survived. Threats include habitat disturbance by feral pigs and cattle, logging, competition from nonnative plant taxa, habitat change due to volcanic activity, and risk of extinction from naturally occurring events and/or reduced reproductive vigor due to the small number of existing populations and individuals (USFWS 1998a).

HOAWA *(Pittosporum Hawai‘iense)*

Pittosporum Hawai‘iense is a small tree in the pittosporum family (Pittosporaceae), is known only from the island of Hawai‘i (Wagner et

al. 1999). Historically, *P. Hawai'iense* was known from the leeward side of the island, from the Kohala Mountains south to Ka'ū, in the lowland mesic, montane mesic, and montane wet ecosystems (Wagner et al. 1999). Currently, there are 14 known occurrences totaling fewer than 175 individuals, from Hawai'i Volcanoes National Park to Puu O Umi NAR, and south Kona, in the lowland mesic, montane mesic, and montane wet ecosystems. At Hawai'i Volcanoes National Park there are at least 58 individuals in the Kahuku Unit. In addition there are several individuals adjacent to the 'Ōla'a tract in the State of Hawai'i Forest Reserve. Between 2006 and 2009, 360 seedlings were planted within the paddock exclosures at Kahuku. Biologists have observed very low regeneration in these occurrences, which is believed to be caused, in part, by rat predation on the seeds (Bio 2011). In addition this species is threatened by nonnative ungulates.

LAUKAHI KUAHIWI *(Plantago hawaiensis)*

Laukahi kuahiwi is a perennial herb characterized by thick, leathery basal leaves and short stem containing red-brown wooly hairs (USFWS 1996a). It occurs at elevations from 5,900 to 8,040 feet mainly on the leeward side of the island, and its habitat is somewhat variable (USFWS 1996a). Laukahi kuahiwi grows in either montane wet sedgeland with mixed sedges and grasses, or in montane mesic forest growing with stunted koa and 'ōhi'a; it is sometimes found growing in cracks in lava (USFWS 1996a). About 5,000 individuals are thought to be present in at least eight populations on the island of Hawai'i (Benitez et al. 2008; USFWS 1996a). In the park, this species has been found naturally occurring on Mauna Loa near 7,000 feet elevation in subalpine and montane seasonal environments of Kahuku and the Mauna Loa units (NPS 2005, 2009j, 2009e). Feral goats and mouflon sheep have been excluded from the two populations that occur on Kīpuka Kulalio and Kīpukamauna'iu in the Mauna Loa Unit by protective fencing since the 1970s. Populations found in Kahuku are not fenced or protected from nonnative ungulates (Pratt et al. 2011). Browsing by the ungulates affects the viability of this species by precluding the establishment of juveniles and damaging the habitat, thereby opening suitable sites for the establishment of nonnative weeds (USFWS 1996a). Critical habitat for this species is found in Hawai'i Volcanoes National Park (Leonard 2009). The primary constituent elements for laukahi kuahiwi on the island of Hawai'i are as follows:

- Landform/forest type: montane wet sedgeland (often in damp cracks of pāhoehoe lava) with mixed sedges and grasses, montane mesic forest, dry subalpine woodland, or *Metrosideros polymorpha* and native shrub.
- Plant community: *Acacia koa*, *Coprosma ernodeoides*, *Coprosma montana*, *Dodonaea viscosa*, *Leptecophylla tameiameiae*, *Metrosideros polymorpha*, or *Vaccinium reticulatum*.
- Elevation: 5,198 to 8,243 feet (1,584 to 2,513 meters) (USFWS 2003).

HAWAI'I HALA PEPE *(Pleomele Hawai'iensis)*

This tree exhibits long, narrow leaves that are borne at the branch tips, and pale yellow flowers. It can grow to approximately 21 feet in height. Hawai'i hala pepe is endemic to dry (or occasionally moist) forests on old lava flows on the leeward side of the island of Hawai'i at elevations of 985 to 2,820 feet (Pratt et al. 2011). In the park, this species has been identified in coastal lowland and mid-elevation seasonal forest environments at Nāulu Forest, Kealakomo Kīpuka, Poliokeawe Pali, the Great Crack, and Kahuku (NPS 2005, 2009j; Pratt et al. 2011). Fewer than two dozen plants have been observed in these areas. In 2001–03, Hawai'i hala pepe was planted successfully at the Nāulu and Kealakomo sites. The species faces the threats that endanger many native plants of the dry lowlands, including fire spread by nonnative grasses; nonnative animals, including feral goats and rats; and nonnative plant species (Pratt et al. 2011). Feral goats have been eliminated from hala pepe habitat in the older section of the

park. Critical habitat for this species is found in Hawai‘i Volcanoes National Park (Leonard 2009). The primary constituent elements for Hawai‘i hala pepe on the island of Hawai‘i are as follows:

- Landform/forest type: dry and mesic lowland forests of lama (*Diospyros sandwicensis*) and ‘ōhi‘a (*Metrosideros polymorpha*).
- Plant community: *Bidens micrantha* ssp. *ctenophylla, Bobea timonioides, Caesalpinia kavaiensis, Cocculus trilobus, Colubrina oppositifolia, Diospyros sandwicensis, Dodonaea viscosa, Erythrina sandwicensis, Kokia drynarioides, Metrosideros polymorpha, Myoporum sandwicense, Neraudia ovata, Nestegis sandwicensis, Nothocestrum breviflorum, Nototrichium sandwicense,Osteomeles anthyllidifolia, Psydrax odorata, Reynoldsia sandwicensis, Santalum paniculatum, Sida fallax,* or *Sophora chrysophylla*.
- Elevation: 281 to 2,925 feet (86 to 892 meters) (USFWS 2003).

PO‘E; ‘IHI MĀKOLE *(Portulaca sclerocarpa)*

Po‘e is an endangered perennial with a fleshy, tuberous taproot that becomes woody with maturity. It inhabits montane dry shrubland and is often found on bare cinder, near steam vents, and in open ‘ōhi‘a-dominated woodlands at elevations between 3,380 and 5,340 feet. In 1996, there were 12 known populations and more than 1,000 known individuals on the island of Hawai‘i (USFWS 1996a). In the park, this species grows in the Puhimau Geothermal Area, along Hilina Pali Road, and in Keanakāko‘i (Pratt et al. 2011). At the time of the 1996 USFWS report, the Puhimau Geothermal Area supported just under 1,000 plants, but since that time the population of this species has declined to fewer than 300 individuals (Pratt et al. 2011). In the park, a major threat to this species is competition from nonnative grasses such as beardgrass and broomsedge, as well as potentially feral goats and rats which are seed predators. Critical habitat for this species is found in Hawai‘i Volcanoes National Park (Leonard 2009). The primary constituent elements for Po‘e on the island of Hawai‘i are as follows:

- Landform/forest type: montane dry shrubland, often on bare cinder, near steam vents, and in open *Metrosideros polymorpha*–dominated woodlands.
- Plant community: *Dodonaea viscosa*, *Melanthera venosa*, *Sophora chrysophylla*.
- Elevation: 3,380 to 5,340 feet (1,030 to 1,630 meters) (USFWS 1996a).

LOULU *(Pritchardia affinis)*

Loulu is a palm tree that grows from 33 to 82 feet in height. It inhabits coastal lowland forest environments and coastal mesic forest on the leeward side of the island of Hawai‘i, possibly near or in brackish water, at elevations of 0 to 2,000 feet. In 1996, there were eight known populations and between 50 and 65 known individuals on the island of Hawai‘i (USFWS 1996a). Until recent fires and lava flows in the park, there was one group of trees (probably planted) on the Kalapana Trail at 985 feet elevation (Pratt et al. 2011). More recently, this tree has been planted in coastal talus slopes behind the shoreline at Kālu‘e and in coastal strand vegetation at Keauhou in the park (Pratt et al. 2011). Continued development and human disturbance are serious threats to the viability of this species, as are feral pigs, which root and destroy seedings, preventing regeneration island-wide (USFWS 1996a). In the park’s coastal lowlands, rat predation on seeds is probably the most important threat to loulu restoration efforts (Pratt et al. 2011). In some coastal lowland location, fire carried by alien grasses may be a threat.

LOULU *(Pritchardia lanigera)*

Pritchardia lanigera (loulu), a medium-sized tree in the palm family (Arecaceae), is found only on the island of Hawai‘i (Read and Hodel 1999; Hodel 2007). Historically, *P. lanigera* was known from the Kohala Mountains, Hamakua district, windward slopes of Mauna

Kea, the lowland mesic, lowland wet, montane wet, and wet cliff ecosystems (Read and Hodel 1999; HBMP 2010a). Currently, P. lanigera is known from eight occurrences totaling fewer than 30 individuals scattered along the windward side of the Kohala Mountains, Kaʻū FR, and TNC Kaʻū Preserve, in the lowland mesic, lowland wet, montane wet, and wet cliff ecosystems. At Hawaiʻi Volcanoes National Park this species only occurs from plantings. Twenty-one were planted in a Kahuku exclosure in March 2011. Survival was high (95%) seven months post planting. According to field biologists, pollination rates appear to be low for this species, and the absence of seedlings and juveniles at known locations suggests that regeneration is not occurring, which they believe to be caused, in part, by beetle, rat, and pig predation on the fruits, seeds, and seedlings (Bio 2011, pers. comm.; Crysdale 2013).

Schiedea diffusa ssp. *macraei*

Schiedea diffusa ssp. *macraei*, a perennial climbing herb in the pink family (Caryophyllaceae), is reported only from the island of Hawaiʻi (Wagner, Herbst, and Sohmer 2005)—Flowering Plants of the Hawaiian Islands database; Wagner, Weller, and Sakai 2005). Historically, *S. diffusa* ssp. *macraei* was known from the Kohala Mountains, the windward slopes of Mauna Loa, and the ʻŌlaʻa Tract of Hawaiʻi Volcanoes National Park, in the montane wet ecosystem (Perlman et al. 2001, in litt.; Wagner, Weller, and Sakai 2005; HBMP 2010c). At Hawaiʻi Volcanoes National Park a single individual found in 1985 in ʻŌlaʻa at approximately 1250 m elevation in wet *Metrosideros*/*Cibotium* forest. It persisted for at least 20 years but could not be re-located in 2008. In 2003, 136 individuals were planted in ʻŌlaʻa. Survival has been low with only 10 plants surviving in 2009 (Belfield et al. 2011). One-hundred and twelve individuals were also planted within the Thurston Special Ecological Area in 2010. At seven months 81.3% were alive with 1.1% reproductive. By 24 months survival had declined to 51.79% with no evidence of reproduction, and in 2013 only 30% were still alive. This species is under propagation in the park's native plant nursery.

ʻŌHAI *(Sesbania tomentosa)*

ʻŌhai is typically a sprawling shrub with branches up to 45 feet, but may also be a small tree up to 20 feet in height (USFWS 1999). This species is found in coastal sites with plants growing in sand and ash pockets over pāhoehoe in disturbed coastal vegetation dominated by naupaka kahakai; coastal lowlands vegetated primarily with native pili and nonnative grasses; and lowland dry woodlands of ʻōhiʻa, native shrubs, and nonnative grasses (Pratt et al. 2011). Less than 5,000 individuals of this plant are believed to exist (USFWS 1999). In Hawaiʻi Volcanoes National Park, it has been identified in the ʻĀpua Point, Kīpuka Nēnē, Hilina Pali, Kamoʻoaliʻi, Kūʻēʻē, and Kīpuka Pepeiau areas (Pratt et al. 2011). Feral goats and fire are major threats to this species. Rats, nonnative grasses, and loss of natural pollinators are also potential threats to this shrub/tree species (Pratt et al. 2011). Critical habitat for this species is found in Hawaiʻi Volcanoes National Park in fenced units that protect it from feral goats (Leonard 2009). The primary constituent elements for ʻōhai on the island of Hawaiʻi are as follows:

- Landform/forest type: open, dry *Metrosideros polymorpha* forest with mixed native grasses, *Scavevola taccada* coastal dry shrubland on windswept slopes, and weathered basaltic slopes.
- Plant community: *Dodonaea viscosa*, *Fimbristylis Hawaiʻiensis*, *Ipomoea pes-caprae*, *Jacquemontia ovalifolia* ssp. *sandwicensis*, *Leptecophylla tameiameiae*, *Melanthera integrifolia*, *Myoporum sandwicense*, *Sida fallax*, *Sporobolus virginicus*, *Waltheria indica*.
- Elevation: 0 to 3,025 feet (0 to 922 meters) (USDA-NRCS 2005).

WHITE-BUR CUCUMBER; ʻĀNUNU *(Sicyos alba)*

White-bur cucumber is a short-lived annual vine with black-spotted stems. Its habitat includes wet forest of ʻōhiʻa, hāpuʻu, or tree ferns near 4,000 feet elevation (Pratt et al. 2011). In the park, this species is only known in the ʻŌlaʻa Forest (Pratt et al. 2011), but is also found in similar habitats just outside the park in ʻŌlaʻa Forest Reserve, and Puʻu Makaʻala Natural Area Reserve (Pratt et al. 2011). Threats to the survival of this plant include feral pigs and nonnative plants (Pratt et al. 2011). Critical habitat for this species is found in Hawaiʻi Volcanoes National Park (Leonard 2009). The primary constituent elements for white-bur cucumber on the island of Hawaiʻi are as follows:

- Landform/forest type: *Metrosideros polymorpha–Cibotium glaucum–* dominated montane wet forests.
- Plant community: *Astelia menziesiana*, *Athyrium microphyllum* and other ferns, *Broussaisia arguta*, *Cheirodendron trigynum*, *Coprosma* sp., *Cyanea tritomantha*, *Cyrtandra lysiosepala*, *Perrottetia sandwicensis*, *Platydesma spathulata*, *Pritchardia beccariana*, *Psychotria* sp., *Stenogyne* sp.
- Elevation: 3,170 to 5,072 feet (966 to 1,546 meters) (USDA-NRCS 2005).

Spermolepis Hawaiʻiensis

Spermolepis Hawaiʻiensis is an endangered annual herb bearing small white flowers. This species is known from open areas in the lowland and montane zones, as well as cultivated fields at low elevation. On Hawaiʻi Island, *S. Hawaiʻiensis* is extant at several sites in Pōhakuloa Training Area and Puʻu Anahulu (Pratt et al. 2011). In Hawaiʻi Volcanoes National Park, historical records (1943) indicate its existence in coastal lowland and mid-elevational woodland environments west of Kīpuka Kahaliʻi (Pratt et al. 2011). Since last documented, this area has been covered by lava. There have been unsuccessful attempts to establish plants through seed broadcasting along the Chain of Craters and Hilina Pali Roads. Feral goats may have been a factor in the original decline of this species in the park (Pratt et al. 2011). Additional threats include other nonnative ungulates, nonnative plants, fire, and landslides (Pratt et al. 2011).

Stenogyne angustifolia

Stenogyne angustifolia is a sprawling perennial vine. Flowers are borne in the leaf axils and are maroon to yellow in color (USFWS 1993). The extant population of this species is found in dry subalpine shrubland, but plants of Molokaʻi, Maui, and leeward Hawaiʻi formerly occurred in lower-elevation dry habitats. All known naturally occurring individuals on the island of Hawaiʻi are at the Pōhakuloa Training Area (a military training area) between 5,080 and 7,050 feet (Pratt et al. 2011). In the park, historical records indicate its existence between Kīlauea and Kapāpala, where it was collected in 1868 (Pratt et al. 2011). This species has also been planted at two sites in the Mauna Loa Strip; however, survival of plantings has been poor. Threats to the species include fire and competition with nonnative plants. Trampling and disruption from nonnative ungulates, including goats, sheep, and cattle, are also significant threats to *S. angustifolia* (Pratt et al. 2011).

HAWAIʻI PRICKLYASH; AʻE *(Zanthoxylum Hawaiʻiense)*

Hawaiʻi pricklyash is a medium-sized tree with pale, smooth bark that reaches 26 feet (8 meters) in height. This species generally occurs in lowland dry and mesic forests, and montane dry forest, at elevations between 1,800 and 5,710 feet (550 and 1,740 meters) (USFWS 1996a). Individuals occur on lava flows and, in the park, prefer forests dominated by koa, ʻōhiʻa, and mānele (Pratt et al. 2011). In 1996, five populations of this tree were known to occur at Puʻuwaʻawaʻa and Pōhakuloa Training Area on the island of Hawaiʻi (USFWS 1996a). In the park, this species was reported from Kīpuka Puaulu in 1921, but the observation was not documented by a specimen, and there are no reported occurrences of this species between Pōhakuloa and the park. Feral goats, sheep,

and pigs as well as domestic cattle are all threats to Hawai‘i pricklyash, but are excluded from Kīpuka Puaulu. Additional threats may include fire and nonnative plants (Pratt et al. 2011).

Threatened

HALEAKALĀ SILVERSWORD; HAWAIIAN CATCHFLY; ‘AHINAHINA; *(Argyroxiphium sandwicense* SSP. *macrocephalum)*

This species is a single-stemmed rosette shrub that grows up to 10 feet (3 meters) tall (Pratt et al. 2011). ‘Ahinahina is endemic to the subalpine and alpine deserts of Haleakalā on East Maui; however, it was outplanted to Mauna Loa, where a few plants persist in the alpine environment of the park (Pratt et al. 2011). In its natural habitat, this species was threatened by feral goats until the Haleakalā Crater District was fenced and goats were removed. Feral goats, mouflon sheep, and pigs are potential threats to outplanted individuals in the park. Argentine ants (*Linepithema humile*) are a potential threat because of their impacts on insect pollinators (Pratt et al. 2011).

HAWAIIAN CATCHFLY; SHERIFF’S CATCHFLY *(Silene Hawai‘iensis)*

Hawaiian catchfly is a sprawling shrub endemic to the island of Hawai‘i found primarily in dry open areas in montane seasonal and subalpine environments (USFWS 1996a). In the park, plants occur on ash flows and dry lava flows and have been identified in the Mauna Loa, Kīlauea Crater rim, and Ka‘ū Desert areas of the park (Pratt et al. 2011). One population in the park near 5,600 feet elevation lost more than 70% of its plants in five years, and a second population decreased by more than 50% from 1998 to 2000 because of browsing by mouflon sheep that penetrated a fenced area of the park (Pratt et al. 2011). In the Kahuku Unit, where mouflon sheep are abundant, only one documented and two reported (unconfirmed) individuals were discovered in 2005 surveys. These individuals were not relocated in subsequent surveys. In 1996, there were 11 known populations and around 11,000 known individuals on the island of Hawai‘i (USFWS 1996a). Fragile branches and stems are easily broken or browsed almost to the base of the plant. As a result, feral animals (goats, pigs, and sheep) are detrimental to the survival of this species (USFWS 1996a). This plant is preferred forage for mouflon sheep, as evidenced by browsing and mortality described above resulting from ingress sheep on the Mauna Loa Unit. Recovery efforts in the park include six foot tall fences to exclude mouflon sheep and outplanting at Kahuku in fenced silversword exclosures.

Critical habitat for this species is found in Hawai‘i Volcanoes National Park (Leonard 2009). The primary constituent elements for Hawaiian catchfly on the island of Hawai‘i are as follows:

- Landform/forest type: weathered lava or variously aged lava flows and cinder substrates in montane and subalpine dry shrubland.
- Plant community: *Dodonaea viscosa*, *Leptecophylla tameiameiae*, *Metrosideros polymorpha*, *Rumex giganteus*, *Sophora chrysophylla*, *Vaccinium reticulatum*.
- Elevation: 3,352 to 7,915 feet (1,021 to 2,412 meters) (USDA-NRCS 2005).

Candidate

‘OHE *(Joinvillea ascendens* SSP. *ascendens)*

‘Ohe is an erect herb that can reach approximately 5 to 16 feet tall and contains fruits that are reddish orange (Pratt et al. 2011; USFWS 2013a). It is primarily located in wet forest and streambeds at middle elevations. Habitat in the park is montane wet ‘ōhi‘a forest with hāpu‘u understory (Pratt et al. 2011). Currently, there are 45 known populations (8 on the island of Hawai‘i) totaling approximately 200 individuals (USFWS 2013a). In the park, there has been only one documented collection in Ōla‘a Forest, near the middle of the Large Tract, south of the trench and crater feature (Pratt et al. 2011). Herbivory and disturbance by

feral pigs are potential threats in unfenced areas of the ʻŌlaʻa Forest, where this plant was last observed (Pratt et al. 2011). Competition from nonnative plant species is a potential threat as well, along with low seed germination (USFWS 2013a; Pratt et al. 2011).

HŌLEI *(Ochrosia haleakalae)*

Hōlei is a tree that can reach seven to 26 feet tall, with white flowers and yellow or plum-colored mature fruits (USFWS 2008c). It is endemic to East Maui and the northeastern portion of the island of Hawaiʻi, where it is found at elevations between 2,300 and 3,940 feet (Pratt et al. 2011). There are 11 total known populations on Maui and Hawaiʻi, totaling fewer than 130 wild individuals (USFWS 2008c). Hōlei is not native to the park. However, it was planted in montane mesic forest of koa, ʻōhiʻa, and mānele in Kīpukapuaulu (Pratt et al. 2011). In wet forests, hōlei is most threatened by feral pigs. In dry and mesic forest habitats, hōlei is primarily threatened by feral goats, domestic cattle, nonnative grasses, and wildfire (Pratt et al. 2011). The threats from nonnative ungulates apply to plants in unfenced areas located outside the park.

LARGE-FLOWER NATIVE BUTTERCUP; MAKOU *(Ranunculus hawaiensis)*

Large-flower native buttercup is a perennial herb reaching 79 inches in height (USFWS 2013c). Habitat for this species is mesic forest, on grassy or rocky slopes, and in open pastures. It has been recorded at elevations between 5,970 and 6,700 feet on East Maui and Hawaiʻi Islands (Pratt et al. 2011). On Hawaiʻi Island, this herb was historically wide-ranging in Kona, Hualālai, Mauna Kea, and Kaʻū. Currently this species is known from six locations on the island of Hawaiʻi, with a total of 14 individuals (USFWS 2013c). In Hawaiʻi Volcanoes National Park, a single population of fewer than 10 plants has been identified in the western Kahuku Unit (Pratt et al. 2011). Nonnative ungulates, including goats, mouflon sheep, and cattle, may impact this species. Rats, fire, and nonnative grasses are all additional threats to large-flower native buttercup (Pratt et al. 2011).

LARGE-LEAF BUR-CUCUMBER; ʻĀNUNU; LARGE-LEAVED ʻĀNUNU *(Sicyos macrophyllus)*

This species is a perennial vine characterized by stems approximately 49 feet long and 2 inches in diameter (USFWS 2013b). Habitat for this species is montane mesic forest of koa, māmane, ʻōhiʻa, and mānele at elevations between 3,940 and 6,560 feet. On Hawaiʻi, it has been recorded in montane wet forest and subalpine forest (Pratt et al. 2011). It is currently known from approximately 10 populations totaling fewer than 30 individuals (USFWS 2013b). In Hawaiʻi Volcanoes National Park, ʻānunu was identified at Kīpuka Kī in 2000 (Pratt et al. 2011). Kīpuka Kī is in the montane seasonal zone of the Mauna Loa Strip, which is fenced to exclude nonnative ungulates. Nonnative ungulates, domestic cattle, fire, rats, and nonnative plants are all potential threats to the species (Pratt et al. 2011).

Table H.1. Species of Special Concern in Hawai‘i Volcanoes National Park

Scientific Name	Common Name	Status	Habitat Description and/or Location in the Park
BIRDS			
Anous minutus melanogenys	noio, black noddy	Rare or Sensitive	Nests either on vegetation or on sea cliffs; occasionally nests on human-made structures that mimic cliff-nesting habitat. Found near the shoreline and offshore islets.
Bulweria bulwerii	‘ou, Bulwer’s petrel	Rare or Sensitive	Nests in rocky holes, on crevices in cliffs, under rock overhangs, and on the ground under thick vegetation on small oceanic islands and offshore islets. In the park it is found adjacent to the shoreline.
Phaethon lepturus dorotheae	koa‘ekea, white-tailed tropicbird	Rare or Sensitive	Found in craters and pit craters. Breeds by laying a single egg directly onto the ground or a cliff ledge.
Vestiaria coccinea	‘i‘iwi	Rare or Sensitive	Found above 4,100 feet (1,250 meters) elevation on the islands of Hawai‘i, Maui, and Kaua‘i; occurs at reduced densities below 3,300 feet. In the park primarily above 5,000 feet and most abundant in upper montane seasonal and lower subalpine zones. ‘I‘iwi occupy mesic and wet forest dominated by ‘ōhi‘a (*Metrosideros polymorpha*) and koa (*Acacia koa*) (DLNR 2005).
INSECTS			
Drosophila engyochracea	NCN	Rare or Sensitive	Found in mesic forest kīpuka. Host plant is mānele (*Sapindus saponaria*) (Foote 2009a). In the park, found only in two locations in the lower montane seasonal zone in the Mauna Loa Unit.
Drosophila Hawai‘iensis	NCN	Rare or Sensitive	Found in mesic forest kīpuka.
Drosophila silvestris	NCN	Rare or Sensitive	Found between elevations of approximately 3,280 to 4,270 feet (1,000 to 1,300 meters) on the wetter slopes of the volcanoes.
Megalagrion koelense	Koele mountain damselfly	Rare or Sensitive	Often found in the water-filled narrow leaf axils of plants in the East Rift and ‘Ōla‘a sections of the park.
PLANTS			
Alphitonia ponderosa	kauila	Species of Concern	Found in dry to mesic lowland forest and lower mid-elevation woodlands. In the park, they are found near Kīpuka Nēnē, along Hilina Pali from the road terminus to Pepeiau, Kealakomo Kīpuka, Poliokeawe Pali, and in the western lowlands near the Great Crack. Plantings have persisted in the Nāulu Forest, Kīpukapuaulu, and Kīpuka Ki (Pratt et al. 2011).
Anoectochilus sandvicensis	honohono, Hawai‘i jewel orchid	Species of Concern	Found in wet forests at low to mid-elevations. In the park, they have recently been found at the ‘Ōla‘a Forest (Koa Unit) the East Rift SEA, and in a kīpuka west of Nāpau. They have also recently been planted in ‘Ōla‘a Koa Unit, Thurston Lava Tube, and ‘Ōla‘a Small Tract (Pratt et al. 2011).
Antidesma pulvinatum	hame	Rare	In the park, grows in dry to mesic lowland forest in Nāulu (one to two trees) (Pratt et al. 2011).
Asplenium schizophyllum	fringed spleenwort	Species of Concern	Found in montane rain forests at 2,461–4,921 feet elevation. In the park, they are probably found only in the ‘Ōla‘a Forest (Pratt et al. 2011).

Table H.1. Species of Special Concern in Hawai'i Volcanoes National Park

Scientific Name	Common Name	Status	Habitat Description and/or Location in the Park
Bidens hawaiensis (B. skottsbergii)	ko'oko'olau, Hawai'i beggarticks	Rare	Found in mid-elevation 'ōhi'a woodland in the park. They have been found at the 'Āinahou Ranch, along the upper Hilina Pali Road, and near Kīpukapuaulu and Ko'oko'olau Craters. They have been planted at 'Āinahou, the upper Hilina Pali Road, Kīpuka Nēnē, and in 'ōhi'a woodland near Kīpukapuaulu (Pratt et al. 2011).
Bobea timonioides	'ahakea	Species of Concern	Found in dry to mesic lama ***(****Diospyros sandwicensis****)*** forests at low elevations. In the park, they have been found in the Nāulu Forest, Kealakomo Kīpuka, and planted in the East Rift SEA south of the Makaopuhi Crater (Pratt et al. 2011).
Canavalia Hawai'iensis	'awikiwiki, Hawaiian jackbean	Rare	Grows in dry to mesic habitats. Found in Kukalau'ula, Pu'u Kapukapu, and above the Kalapana Trail in the park.
Capparis sandwichiana	pua pilo, maiapilo, native caper	Species of Concern	Found on rocky coastlines and in dry coastal lowlands. They were historically found in the park offshore of Halapē, and at low elevations near the eastern park boundary. However, recent plantings at Kālu'e near Halapē did not persist (Pratt et al. 2011).
Chamaesyce celastroides	'akoko	Rare	Grows in coastal dry shrubland on windward talus slopes and in mid-elevation seasonal environments at elevations of 30 to 2,100 feet. Found naturally occurring in 'Āinahou and along Hilina Pali road and the Kalapana trail; and as planted individuals in Kīpuka Pepeaio.
Charpentiera obovata	pāpala	Rare	Found in wet to mesic 'ōhi'a forest on soils over rock rubble. In the park, found in the Kahuku Unit, in Kīpuka Kī and in Kīpukapuaulu, and the Mānele bend area along the Mauna Loa Road (Benitez et al. 2008).
Clermontia Hawai'iensis	'ōhā kēpau	Rare	In the park, plants grow in rainforest areas from low to high altitudes. Grows in the Kīlauea Crater Rim, East Rift, and 'Ōla'a areas. Planted in various mesic and wet forests on Kīlauea and lower Mauna Loa Unit.
Clermontia montis-loa	'ōhā	Rare	Found most commonly in ōhi'a/hāpu'u (*Cibotium spp.*) forest and less commonly in mesic to wet 'ōhi'a forest. In the park, found primarily in 'Ōla'a and the Kahuku Unit eastern region (Benitez et al. 2008).
Cuscuta sandwichiana	kauna'oa	Rare	In the park, plants grow in coastal areas, often in sandy soil. Found in Ka'aha.
Cyanea pilosa ssp. *Longipedunculata*	hāhā	Rare	Tends to grow in deep forest, often in narrow gulches where there is little wind. Grows in 'Ōla'a. Also found inside the park in the forested pit crater in Kahuku (subspecies remains undetermined); formerly found in the vicinity of the Thurston Lava Tube on Kīlauea (Benitez et al. 2008).
Cyrtandra menziesii	ha'iwale	Species of Concern	Found in mesic to wet 'ōhi'a forests. In the park, small populations have been found in the Kahuku Unit, in a crater at Pu'u 'Akihi, in the southeastern section of the central pasture, and in a large forested crater surrounded by pasture (Pratt et al. 2011).

Table H.1. Species of Special Concern in Hawai‘i Volcanoes National Park

Scientific Name	Common Name	Status	Habitat Description and/or Location in the Park
Embelia pacifica	kilioe, Pacific embelia	Species of Concern	Grows in montane wet forests dominated by ‘ōhi‘a and hāpu‘u and mesic kīpuka forests with a mix of koa, mānele and ‘ōhi‘a. Found in the park at the ‘Ōla‘a Forest, at Kīpukapuaulu, and at Kīpuka Kī (Pratt et al. 2011).
Erythrina sandwicensis	wiliwili	Rare	Grows in lowland dry forests and shrublands. In the park, a few trees still remain in the coastal lowland and possibly at the Great Crack. There are plantings at Pu‘u Kaone, ‘Āpua Point, Kālu‘e, the Nāulu Forest, the base of Hōlei Pali near Pali Uli, and northeast of the hairpin turn of the Chain of Craters Road (Pratt et al. 2011).
Eurya sandwicensis	anini	Species of Concern	Found in wet to mesic forests and on windswept ridges. In the park, they have recently been found in the Kahuku Unit near the northern boundary of Ka‘ū Forest Reserve, ‘Ōla‘a Small Tract (planted), and in the ‘Ōla‘a Forest near the Koa Unit boundary (Pratt et al. 2011).
Exocarpos gaudichaudii	hulumoa, heau, Gaudichaud’s exocarpus	Species of Concern	Grows in mesic forests, shrublands, and open ‘ōhi‘a woodlands. Found in the park at ‘Āinahou Ranch, south of the ranch house in mid-elevation woodland (Pratt et al. 2011).
Exocarpos menziesii	heau, Menzies’ exocarpus	Rare	Grows in subalpine ‘ōhi‘a woodland and shrublands. Found in the park in the Kahuku Unit and less frequently in the Mauna Loa Unit (Benitez et al. 2008).
Fimbristylis Hawai‘iensis	Hawai‘i fimbry	Species of Concern	Grows on old lava flows in coastal lowland and mid-elevation seasonal environments. Grows at Ka‘ena Point, Kamo‘oali‘i and other sites.
Fragaria chiloensis ssp. *sandwicensis*	‘ōhelo papa, Hawaiian strawberry	Species of Concern	Found on Maui and Hawai‘i Islands at an elevation of 3,800–10,070 feet. This plant occurs at scattered localities in subalpine shrubland north of the boundary with Ka‘ū Forest Reserve in the Kahuku Unit (Pratt et al. 2011).
Gonocormus prolifer	NCN	Rare	Grow in areas that are damp and shady on rocks or trees. In the park, plants are known from ‘Ōla‘a.
Jacquemontia ovalifolia ssp. *sandwicensis*	pā‘u o hi‘iaka	Rare	Grows in the coastal strand at ‘Āpua Point, Keauhou, Kālu‘e and Ka‘aha.
Pritchardia beccariana	loulu	Rare	In the park, plants are found in tall, wet forests at ‘Ōla‘a.
Liparis hawaiensis	‘awapuhi a kanaloa, Hawaiian twayblade	Species of Concern	Found in wet to mesic forests at mid-elevations and more rarely in seasonal woodlands. In the park, they have been found in the ‘Ōla‘a Forest, the Kīlauea East Rift near Nāpau Crater, and between the Chain of Craters Road and Keanakāko‘i Crater. However, recent surveys in these areas have yielded no sightings, including in the Kahuku Unit (Benitez et al. 2008; Pratt et al. 2011).
Marattia douglasii	pala, kapua‘ilio, Hawai‘i marattia	Rare	Found in ‘ōhi‘a/hāpu‘u forest. In the park, found in the Kahuku Unit, and less commonly in the ‘Ōla‘a Forest (Benitez et al. 2008).

Table H.1. Species of Special Concern in Hawai'i Volcanoes National Park

Scientific Name	Common Name	Status	Habitat Description and/or Location in the Park
Melicope hawaiensis	manena	Species of Concern	Grows in mesic forests dominated by koa, ʻōhiʻa, and mānele as well as dry ʻōhiʻa forests. Found in the park at Kīpukapuaulu and mid-elevation woodland along Kapāpala Ranch boundary. Also recently planted at Kīpuka Kī (Pratt et al. 2011).
Myrsine lanaiensis	kōlea, Lanaʻi colicwood	Rare	Found in dry ʻōhiʻa woodland on lava substrate. In the park, found in the southwestern region of the Kahuku Unit and downslope of the ʻĀinahou Ranch house (Benitez et al. 2008).
Nestegis sandwicensis	olopua	Rare	In the park, plants were formerly found in wet/mesic forest at 100 feet elevation above Kamoamoa. Now found only at 4,250 feet in Kīpukapuaulu and Kīpuka Ki in montane mesic forest.
Nothocestrum longifolium	ʻaiea, longleaf nothecestrum	Rare	Grows in wet/mesic forest. In the park, found primarily in wet forest at ʻŌlaʻa and in mesic forest at Kīpukapuaulu, Kīpuka Ki, and Kīpuka ʻAiea.
Nototrichium sandwicense	kuluʻī, Hawaiian nototrichium	Rare	In the park, plants are found at elevations below approximately 750 feet in open dry forests, exposed ridges, and lava fields. Found at Poliokeawe Pali, this species was extirpated and reintroduced.
Phyllostegia ambigua	NCN	Rare	Grows in wet montane forests of ʻōhiʻa and hāpuʻu as well as subalpine forests. Found in the ʻŌlaʻa Forest Small Tract and the Kahuku Unit (Pratt et al. 2011).
Phyllostegia macrophylla	NCN	Rare	Grows on steep slopes and in gulches in diverse mesic to wet forests at an elevation of approximately 1,500 to 6,000 feet (457 to 1,829 meters). Grows in the ʻŌlaʻa region.
Phyllostegia stachyoides	NCN	Species of Concern	Found in mesic to wet montane forests of koa, mānele, and ʻōhiʻa in the park. One collection was found in 1915 at Kīpukapuaulu in the park (Pratt et al. 2011).
Phyllostegia vestita	island phyllostegia, clothed Hawaiian mint	Rare	Grows in wet montane forests of ʻōhiʻa and hāpuʻu tree ferns. Found in the park in the ʻŌlaʻa Forest Koa and New units, the East Rift SEA, the crater of Kane Nui o Hamo, and the ʻŌlaʻa Koa Unit (planted) (Pratt et al. 2011).
Phytolacca sandwicensis	pōpolo ku mai, Hawaiʻi pokeweed	Rare	Historically found in mesic montane forests of koa, ʻōhiʻa, and mānele as well as wet montane forests of ʻōhiʻa and hāpuʻu. In the park, they have been found in the ʻŌlaʻa Forest's Koa and Puʻu units, and in Kahuku. Recently planted in Kīpukapuaulu and Kīpuka Ki (Pratt et al. 2011).
Pisonia brunoniana	pāpala kēpau, Australian catchbird tree	Rare	Found in mesic/wet forest environments and grows in Kīpukapuaulu and Kīpuka Ki, where it is localized.
Pisonia umbellifera	pāpala kēpau, umbrella catchbird tree	Rare	Grows in lowland forests.

Table H.1. Species of Special Concern in Hawai'i Volcanoes National Park

Scientific Name	Common Name	Status	Habitat Description and/or Location in the Park
Pittosporum confertiflorum	hō'awa	Rare	Grows in subalpine 'ōhi'a woodland and lowland mesic forests, occasionally on old pāhoehoe lava flows. Found in the park in the upper region of the Kahuku Unit and in the East Rift SEA, and less recently in the upper Mauna Loa SEA (Benitez et al. 2008).
Pittosporum hosmeri	hō'awa, Hosmer's pittosporum	Rare	Grows in koa/'ōhi'a woodland forest on soil over old lava flows. Less frequently found in 'ōhi'a/hāpu'u forest on substrates of soil over old pāhoehoe flows. In the park, found in numerous sites throughout the Kahuku Unit, and in and around Kīpukapuaulu and Kīpuka Ki (Benitez et al. 2008).
Plumbago zeylanica	'ilie'e	Rare	Grows in coastal lowlands. Extirpated and replanted at Lae 'Apuki, Hōlei.
Pneumatopteris hudsoniana	Hudson's air fern, laukahi	Rare	Found in lowland forests.
Portulaca villosa	'ihi, hairy purslane	Species of Concern	In the park, known only near the coast in shallow ash over pāhoehoe, in a site now covered by lava. Recently planted at four sites in the coastal strand but no plantings survived (Pratt et al. 2011).
Rauvolfia sandwicensis	hao	Rare	Grows in dry to mesic forests. Found in the park at Nāulu and Hōlei Pali.
Reynoldsia sandwicensis	'ohe mākai, 'ohe	Species of Concern	Grows predominately in dry to mesic lowland forests and less commonly in open vegetation on old lava flows. Found in the park along Poliokeawe Pali near the trail from 'Āinahou Ranch to coastal Keauhou, east of 'Āinahou, in the Kealakomo kīpuka, and recently planted at the Nāulu Forest and Kealakomo (Pratt et al. 2011).
Rhus sandwicensis	neneleau	Rare	Grows in disturbed areas, especially along roadsides and in pastures from relatively wet to dry environments. In the park, plants grow above Nāulu and the Kalapana Trail.
Rubus macraei	'ākala	Species of Concern	Found in montane wet forests, bog margins, and subalpine shrubland. In the park, they have been found in the Kahuku Unit north of Ka'ū Forest Reserve and historically reported in the upper Mauna Loa Strip (Pratt et al. 2011).
Rumex giganteus	pāwale	Rare	Grows in wet 'ōhi'a/hāpu'u forest, and mesic 'ōhi'a/koa woodland. In the park, found in four different sites in the Kahuku Unit and less frequently at the 'Ōla'a Forest, Kīpuka 'Aiea, Mauna Loa SEA, and woodlands near Pu'u Puai (Benitez et al. 2008).
Sanicula sandwicensis	tall Hawaiian sanicle, snakeroot	Species of Concern	Grows in subalpine shrublands and woodlands, specifically 'ōhi'a woodland. In the park, a small population exists in the western section of the Kahuku Unit.
Sapindus saponaria	mānele, 'ae, soapberry	Rare	Grows in mesic forests with deep ash soil in and near Kīpukapuaulu and Kīpuka Ki.
Scaevola kilaueae	Kīlauea naupaka, huahekili uka	Species of Concern	Found in the park's mid elevation woodland and scrub in the Ka'ū Desert, from the upper Chain of Craters in the east to the Keā'moku Flow in the west, and along the upper Hilina Pali Road (Pratt et al. 2011).

Table H.1. Species of Special Concern in Hawai'i Volcanoes National Park

Scientific Name	Common Name	Status	Habitat Description and/or Location in the Park
Sicyos pachycarpus	paha, kūpala	Rare	Grows in moist to wet forests at elevations of approximately 500 to 2,600 feet. Probably occurred in Nāulu, but now extirpated.
Sisyrinchium acre	mau'u lā'ili, Hawaiian blue-eyed-grass	Species of Concern	Grows in dry subalpine shrubland of scattered 'ōhi'a trees and native shrubs or bogs. In the park, plants are found in Kīpukamauna'iu, in Kīpuka Kulalio, and in the subalpine shrubland at Kahuku (Pratt et al. 2011).
Stenogyne macrantha	Hawaiian stenogyne	Species of Concern	Found in montane 'ōhi'a/hāpu'u rain forests. Found in the park in the 'Ōla'a Forest, Koa and Ag units, and planted in the Koa Unit and Small Tract.
Stenogyne scrophularioides	scroph stenogyne, mōhihi	Rare	Grows in montane 'ōhi'a/hāpu'u rain forests. Found in the 'Ōla'a Forest's Koa Unit (planted), New Unit, and Small Tract (planted and natural populations) (Pratt et al. 2011).
Stenogyne sessilis	sessile stenogyne	Rare	In the park, plants were historically documented in Mauna Loa and recently discovered in Kahuku (Benitez et al. 2008).
Tetraplasandra hawaiensis	'ohe	Rare	Typically found in mesic to wet lowland forest. In the park, plants are known from Kīlauea's East Rift, formerly near Nāulu, and Kamoamoa, and as a half dozen scattered individuals in pasture in Kahuku (Benitez et al. 2008; Wagner et al. 1999).
Tetraplasandra kavaiensis	'ohe'ohe	Rare	Grows in montane 'ōhi'a/hāpu'u rain forests. Found in the park in the 'Ōla'a Forest near its boundary with Pu'u Maka'ala Natural Area Reserve (Pratt et al. 2011).
Tetraplasandra oahuensis	'ohe mauka	Rare	Grows in mesic valleys and wet forests. In the park, trees are found in 'Ōla'a.
Touchardia latifolia	olonā	Rare	Plants are typically found in mesic valleys and wet forest from 230 to 3,937 feet elevation. In the park, plants are known from 'Ōla'a and from a single individual in Kahuku (Benitez et al. 2008; Wagner et al. 1999).
Trematolobelia grandifolia	koli'i, large-flower false lobelia	Species of Concern	Found in the exposed areas of montane and mid-elevation rain forests. Often grows on fallen logs and tree ferns in closed wet 'ōhi'a/hāpu'u forests and occasionally on cliff tops near bogs. In the park, they are found in all of the fenced units of the 'Ōla'a Forest as well as in the unfenced Koa Kīpuka, the Kīlauea Caldera rim rain forest, the East Rift SEA, the forested pit crater at Kahuku, and on Kāne Nui o Hamo (Pratt et al. 2011).
Urera glabra	ōpuhe	Rare	Typically found on slopes and gulch bottoms in mesic to wet forest. In the park, plants are found in wet forest of 'Ōla'a and Kīlauea's East Rift, in mesic forest on Mauna Loa and as a single individual in Kahuku (Benitez et al. 2008).
Xylosma Hawai'iense	maua	Rare	In the park, plants occur in mesic forest at Kīpukapuaulu, 'Ōla'a, and Nāulu.

Table H.1. Species of Special Concern in Hawai‘i Volcanoes National Park

Scientific Name	Common Name	Status	Habitat Description and/or Location in the Park
Zanthoxylum dipetalum var. dipetalum	kāwa‘u	Species of Concern	Grows in montane mesic forests of koa, ‘ōhi‘a, and mānele. Found naturally growing and planted in the park at Kīpukapuaulu and Kīpuka Ki (Pratt et al. 2011).
Zanthoxylum kauaense (Z. maviense)	a‘e	Rare	Grows in mesic dry or wet forests, often composed of koa/’ōhi‘a and montane wet ‘ōhi‘a/hāpu‘u. Found in Kīpukapuaulu and the ‘Ōla‘a Forest (Pratt et al. 2011).

Sources: NatureServe 2009; Park 2009d.

NCN = no common name.

APPENDIX I: ACOUSTIC SAMPLING AREAS

See *Figure 5.3. Acoustic Sites and Sampling Areas* in Chapter 5 for a map of the acoustic sampling areas. The following is the general description of these areas.

Zone 1 (Shoreline). Sounds from surf and waves as well as birds are prominent natural sound characteristics of this zone. This zone is also comprised of strong trade winds, bluffs, and low shoreline vegetation with elevations ranging from sea level to approximately 100 feet. Additional sounds within this zone include aircraft overflights, vehicles, and hikers, especially in the vicinity of measurement site1B, which is nearest to the lava eruption viewing area. L50 natural ambient sound levels range between 50 to 55 dBA in the southwestern portion of this zone and 45 to 50 dBA in the northeastern portion of this zone. Variability within the zone may be attributed to differences in visitor activity (USDOT-FAA 2006).

Zone 2 (Coastal Lowlands). This zone extends over an elevation range of 100 to 1,500 feet, has strong trade winds like the shoreline due to the mountains, contains low grass or scrub vegetation as well as widespread barren lava flows, and has natural animal sounds (i.e., compared to pets brought by park visitors) that are negligible. Near the measurement site locations (2A, 2B, and 2C), sound sources include wind noise through the grass, insect noise, and vehicle noise. L50 natural ambient sound levels within this zone range between 25 to 35 dBA, where variability may be attributed to differences in visitor uses throughout the zone (USDOT-FAA 2006).

Zone 3 (Sparsely Vegetated). Elevations within this zone range between 700 and 3,800 feet, with recent lava flows and low vegetative cover. The predominant natural sound source in this zone is the trade winds. In the vicinity of the measurement locations, winds, insect noises and aircraft activity also contribute to sound levels. L50 natural ambient sound levels range between 30 to 35 dBA in the northernmost tip and southern portion of this zone and between 20 and 30 dBA in other portions of this zone. Variations may be attributed to differences in visitor activity and higher wind speeds in some locations (USDOT-FAA 2006). Data was extrapolated to areas of similar vegetation and topography for Kahuku, since no ambient data was collected for this area of the park.

Zone 4 (Montane Rain Forest). This zone encompasses the tree fern rain forest on slopes of Mauna Loa, with elevations between 3,300 and 4,400 feet in ʻŌlaʻa, and from 5,000 to 6,200 feet elevation in Kahuku. The dominant natural sounds include rain on the tree canopy, crickets, and some bird sounds within specific locations. L50 natural ambient sound levels within this zone range between 30 to 35 dBA (USDOT-FAA 2006). Data was extrapolated to areas of similar vegetation and topography for Kahuku, since no ambient data was collected for this area of the park until fall 2013 and analysis of the new data is not yet completed.

Zone 5 (Mauna Loa Montane/Subalpine). This zone covers an elevation range between 4,000 and 8,500 feet on the Mauna Loa slopes. It contains forest, shrublands, grasslands, and lava flows. Wind speeds are less than along the coast and bird sounds are heard in the forested portions of the zone. Additional sounds sources observed near the measurement locations within this zone include vehicle noise from the nearby Mauna Loa Strip Road and aircraft activity. L50 natural ambient sound levels range between 20 to 25 dBA in the western portion of this zone, 25 to 30 dBA in the central portion, and 30 to 35 dBA in the easternmost portion. Based on the measurement data collected at sites 5A, 5B, and 5C, variations in sound level ranges may be attributable to differences in air tour activities within the zone (USDOT-FAA 2006). Data was collected in 2008 at one measurement site in this zone above the other sites, but data was expressed as Median

A-weighted, not L50. A-weighting emphasizes the frequencies between one kHz and 6.3 kHz to simulate the relative response of human hearing. L50 uses all frequencies recorded. The daytime Median A-weighted natural ambient sound levels of this site were 18.1 dBA. Data was extrapolated to areas of similar vegetation and topography for Kahuku, since no ambient data was collected for this area of the park until fall 2013 and analysis of the new data is not yet completed.

Zone 6 (Dry ʻŌhiʻa Woodlands). Elevations within this zone range between 1,000 and 3,300 feet, with forests, woodlands, and savannas. The predominant natural sound source is the trade winds rushing through the forest canopy. Additional sounds observed at the measurement locations within this zone include insect noise and aircraft events. L50 natural ambient sound levels range between 25 to 30 dBA throughout most of this zone and between 30 and 35 dBA in the portion adjacent to zones 2, 8, and 9. Variability in the sound levels may be attributed to aircraft activities (USDOT-FAA 2006). Data was extrapolated to areas of similar vegetation and topography for Kahuku, since no ambient data was collected for this area of the park.

Zone 7 (Mauna Loa Alpine). This zone comprises the barren portion on Mauna Loa from approximately 8,500 to 13,677 feet. The climate is dry, and although winds are not strong, the dominant natural sounds in this zone are winds rushing over the lava fields, as well as occasional birds. Weather and accessibility to this zone proved to be issues during the measurement period in 2003 (USDOT-FAA 2006). Data was collected for this zone in fall 2013, but analysis of data is not yet completed.

Zone 8 (Lowland Rain Forest). Located along the edge of Kīlauea Caldera and the East Rift Zone, elevations within this zone range between 2,000 and 4,000 feet. Dominant natural sound sources include rain on vegetation and a great number of birds in the closed canopy forest. Additional sounds observed at the measurement site locations within this zone include traffic noise from Highway 11 at sites 8A and 8B, and aircraft activity at site 8C, which is near Nāpau Crater. L50 natural ambient sound levels range between 25 to 30 dBA in the portion of the zone where measurement site 8C is located and between 35 to 45 dBA in the remaining portion of the zone where measurement sites 8A and 8B are located. Variability in the sound levels within the zone may be attributable to human activity, including aircraft sounds and traffic noise (USDOT-FAA 2006).

Zone 9 (New Lava Flows). This zone is located on the East Rift Zone of Kīlauea, where elevations range between 100 and 3,500 feet, and includes recent lava flows (within the past 40 years). Sounds within this zone from the newest lava flows include: bench collapses, rock fall from cinder cones and pit crater edges, crackling of cooling pāhoehoe flows and sounds of clinkers falling in moving ʻaʻa flows, gas venting, methane explosions, and falling trees on the edge of lava flows (USDOT-FAA 2006). Additional sound sources observed near the measurement sites include birds and insects and aircraft activity, especially near measurement site 9A, which was along an air tour flight path. L50 natural ambient sound levels range between 25 to 30 dBA throughout the entire zone (USDOT-FAA 2006).

Zone 10 (Kahuku Pastures). The Kahuku Unit was added to Hawaiʻi Volcanoes subsequent to data collection in 2002-2003 and contains woodlands and rainforests, lava flows, ancient archaeological sites, and Mauna Loa's Southwest Rift Zone. Since no ambient data has been collected for this area of the park, vegetative and topographical comparisons were used between this zone and zones where ambient data was collected to characterize the acoustics of Zone 10. Knowing this zone contains rare and endangered plant, bird, and insect species, the predominant natural sound sources expected include bird and insect sounds. L50 natural ambient sound levels were estimated between 25 to 30 dBA. Variations may be attributable to traffic noise from Highway 11 (USDOT-FAA 2006). Data was collected for this zone in fall 2013, but analysis of data is not yet completed.

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GLOSSARY

ʻAʻā: ʻAʻā is a type of basaltic lava flow. It is characterized by its rough and jagged textures.

Acoustic environment: The acoustic environment is the combination of all the acoustic resources within a given area – natural sounds as well as human-caused sounds. The acoustic environment includes sound vibrations made by geological processes, biological activity, and even sounds that are inaudible to most humans, such as bat echolocation calls.

Acoustic resources: Acoustic resources are physical sound sources, including both natural sounds (wind, water, wildlife, vegetation) and cultural and historic sounds (battle reenactments, tribal ceremonies, quiet reverence).

Archeological Site: An archeological site is defined as the physical remains of human activity, such as old villages, rock shelters, abandoned gardens, artifact scatters, and petroglyphs (and including deteriorated buildings, structures, and objects, i.e., other categories of property that have become ruins).

Badlands: Badlands are a landscape that is intricately dissected and is characterized by a very fine drainage network with high drainage density and short, steep slopes with narrow interfluves. Badland develops on surfaces that have little, if any, vegetative cover, and are underlain by unconsolidated or poorly cemented material, such as clay, silt, or sand (USDA-NRCS 2008). At HAVO badlands are associated with geothermal areas, near calderas, and near vents.

Beaches: Beaches are a unique process occurs where lava meets the ocean. As hot lava hits cold water, lava is quickly quenched shattering it into small volcanic products—black sand. There are a few places in the park where white and mixed white and black sand beaches can be found. White sand beaches form due to mechanical weathering of nearby coral stands.

Building: A building is a constructed facility intended to shelter human activity. However, if a building has lost its basic structural elements, it is usually considered a 'ruin' and is categorized as a site, specifically an archeological site (see above).

Calderas: Calderas are large geologic depressions that are found only at the very summit of volcanoes. A caldera is a large, usually circular depression. It forms over ten of thousands of years and can change in shape with the likes of one large eruption. The depression develops following an eruption when magma is emptied either by ejection or retraction of magma from its underground magma reservoir. This removal of large volumes of magma often results in loss of structural support for the overlying rock. This in turn leads to the collapse of the ground and formation of a large depression. In the park, lone calderas can be found at both summits of Mauna Loa and Kīlauea volcanoes. Mokuʻāweoweo caldera on Mauna Loa sits at 13,677 feet and is some 9,842 feet by 16,404 feet across and 600 feet deep. Kīlauea caldera is approximately three miles by two miles in diameter. Its current elevation is 4,190 feet, as determined by recent USGS surveys. Both calderas are located with park boundaries.

Cheloniids: From the family of Cheloniidae, which includes green turtles and hawksbill turtles.

Cinder Cones: Cinder cones are conical-shaped hills shaped by volcanic products (e.g. tephra, cinders, Pele's hair, Pele's tears, reticulite, etc.). Built from the base up, cinder cones grow in height leaving a steep sided landform. As magma explodes into the air, these products rain out of the sky to build the cone—the larger materials falling close to the source. The smaller products are carried further downwind littering the downwind landscape. Cinder cones can also erupt lava in either its ʻaʻā or pāhoehoe forms. Like calderas and craters, cinder cones of varied size can be found through the park. The Puʻu ʻŌʻō

cone, which is located on the East Rift zone of Kīlauea, is currently the only active cone vent in Hawai‘i. Due to its degrading nature, it has been closed by the park. Cinder cones are sometime referred to as scoria, cinder, or spatter vents.

Craters: Craters are funnel shaped depressions from which eruptions occur. Unlike calderas, craters are created primarily by explosion. Craters are smaller (less than a one mile in diameter) geologic depressions and can be found scattered at the summit and along the rift zones of Hawaiian volcanoes. Craters, like calderas, are often circular. In the history of both Mauna Loa and Kīlauea, a plethora of craters populate the park.

Cultural soundscape: Cultural soundscapes include opportunities for appropriate transmission of cultural and historic sounds that are fundamental components of the purposes and values for which a park was established.

District: A district possesses a significant concentration, linkage, or continuity of sites, buildings, structures, or objects united historically or aesthetically by plan or physical development.

Fumaroles: A fumarole is a "vent" from which hot volcanic gases and other vapors are emitted into the atmosphere. Fumaroles often form over persistent heat sources and in locations where it is not accompanied by liquid or solid matter.

Geothermal Features: Geothermal features are active subsurface geologic formations. These areas are noted for their continuous vapor emissions (steam) through cracks in the ground. The ground in this area can be hot, reaching as high as 135 degrees near the surface. Rainwater continually drains into the cracks and is heated and released as steam; these cracks are referred to as steam vents.

Hawaiian Shield Volcano: Hawaiian volcanoes are shield volcanoes which are large broad volcanic mountains composed of basalt. These shield-shaped volcanoes grow lava flow upon lava flow, on the seafloor and rise well above sea level to soaring heights. The source of their growth is attributed to the "hot spot" some 25–37 miles below the Earth's surface.

Historic Event Site: An historic event site is the geographic location of an historically important event or events, regardless of whether there are any physical remains (archeological sites are also historic event sites).

Hornitos: Hornitos are small rootless spatter cones. They vary in height and in overall dimension. Hornitos typically form over lava tubes versus over larger and deeper magma source like a rift zone, hence they are considered rootless.

Intelligent Transportation System (ITS): ITS is the use of electronic sensors, cameras, or other devices connected to a computer program to monitor traffic conditions at designated locations.

Kīpuka: Kīpuka is an area of land completely surrounded by one or more younger lava flows; an island of native forest or plants in the middle of a recent lava flow.

L10: This abbreviation represents the sound level that would not exceed a specified value for more than 10% of the time specified.

Lava Lakes: Lava Lakes form within larger volcanic features like craters, and calderas. An active lava lake now populates a portion of the Halema‘uma‘u Crater.

Lava Trees: Lava trees form as highly-fluid lava surrounds a tree and then recedes leaving a cooled solidified layer of lava around the charred tree.

Lava Tubes: Lava tubes form throughout the evolution of a Hawaiian volcano. They are natural conduits through which lava is transported from its source. Tubes form by the crusting over of lava channels. A broad lava-flow field can consist of a main lava tube and bifurcate into a series of smaller

tubes that supply lava to the front of one or more separate flows. When the supply of lava stops or is diverted elsewhere, lava in the tube system will often drain downslope leaving a partially empty conduit beneath the ground. Lava tubes may contain cultural, paleontological, and biological resources as they were used for shelter, collecting of water, and as burial sites by Native Hawaiians. The Federal Cave Protection Act of 1988, as amended (16 USC 4301–4310) and the NPS Management Policies 2006 require the NPS to protect cave resources.

Lobelioids: Lobelioids is a group of flowering plants in the bellflower family Campanulaceae, all of which are endemic to the Hawaiian Islands.

Low-energy beach: A low-energy beach is a beach typically found within a protected environment; waves typically are not as powerful and the rate of deposition exceeds the rate of erosion. This state can be seasonal (e.g. summer low-energy and winter high energy).

Mesic: Mesic is an environment characterized by a moderate amount of moisture.

Montane: Montane is an environment of relatively moist cool upland slopes below timberline.

Noise: Noise refers to sound which is unwanted, either because of its effects on humans and wildlife, or its interference with the perception or detection of other sounds.

Pelage: Pelage is the hairy covering of a mammal.

Object: An object is a constructed feature that is primarily artistic in nature or. . .relatively small in scale and simply constructed. It is designed and set in a specific locale, such as a monument or a fountain.

Outplant: To outplant is to transplant from nursery bed, greenhouse, or other location to an outside area, such as a location in the park.

Pāhoehoe: Pāhoehoe is a type of basaltic lava flow. It is characterized by its smooth and ropy textures.

Pele's hair: Pele's hair is fine, fragile strands of volcanic glass. They form as molten lava is ejected into the air and quickly chilled as a thread. Large mats of Pele's hair can be found downwind of the vent that produced it. Pele's hair is a modern term named for Native Hawaiian deity, Pelehonuamea (Pele).

Pele's tears: Pele's tears are lava fragments ejecting into the air in the form of droplets. They quickly solidify in the atmosphere in an "air-streamlined" spherical shape. Pele's tears are named for Native Hawaiian deity, Pelehonuamea (Pele).

Reticulite: A reticulite is a gold-brown foam-like type of glass produced by eruptions and often found in considerable quantities.

Rift Zones: A rift zone is an elongate system of crustal fractures, typically subsurface, associated with an area that is experiencing active ground deformation. Each rift zone originates at the summit caldera of a Hawaiian shield volcano. Mauna Loa and Kīlauea are comprised of two rift zones each. Many different features are associated with and along rift zones such as narrow dikes and eruptive fissures, cinder and spatter cones, spatter ramparts, pit craters, lava flows, ground cracks, and faults to name a few. Rift zones play a very important role in the dynamics of Hawaiian volcanoes. They are a conduit by which magma travels through; a subsurface plumbing system that transports magma great distances to its point of eruption.

Sea Arches, Stacks, Caves, and Headlands: Rock arches form along the lava coastal cliffs due to wind and wave erosion. These features of various size form over long periods of time and eventually collapse into the ocean.

Site: A site is the location of a significant event, a prehistoric or historic occupation or activity, or a building or structure, whether

standing, ruined, or vanished, where the location itself possesses historic, cultural, or archeological value regardless of the value of any existing structure. By the NRHP definition, a site is a place of cultural value and significance.

Solfataras: Solfataras are areas where sulfur-rich gas is being emitted into the atmosphere. They can occur along fault lines or in areas where shallow bodies of magma exist. The largest solfatara area in the park is located at the Sulphur Banks site on the north rim of the Kīlauea caldera.

Soundscape: A soundscape is the component of the acoustical environment that can be perceived and comprehended by humans. The character and quality of the soundscape influences human perceptions of an area, providing a sense of place that differentiates it from other regions.

Spatter: Spatter forms as fluid liquid lava is ejected into the air. Upon ejection, it cools, congeals, and flattens when it hits the ground. Spatter fragments are often found near cinder and littoral cones.

Spatter Rampart/Cone: Spatter ramparts are long "walls" of congealed spatter (solidified lava). These fragile features can vary in height from a few feet in height to tens of feet. They typically form as part of a larger fissure eruption, at varied locations. As with cinder cones, the features name is determined by what it is comprised of; if the hill is comprised of primarily cinder fragments then it's called a cinder cone, if spatter then it's called a spatter cone.

Special ecological areas (SEAs): SEAs are natural areas located within the park that are the focus of intensive management to protect and restore native species and habitats and selected based on: (1) the biological communities representative of a particular ecological zone and/or rarity in the park or on the islands; (2) manageability and intactness; (3) concentrations of species diversity and rare species; and (4) value for research and interpretation to the public (Tunison and Stone 1992; Loh and Tunison 2009).

Stochastic event: A stochastic event is an event having a random probability distribution or pattern that may be analyzed statistically but may not be predicted; frequently referred to in terms of a threat for the extinction of a species.

Structure: A structure is a constructed facility that is not a building or an object. This category includes bridges, dams, roads, and fences, for example, as well as aircraft and ships (although these are often mistakenly called objects). Like a deteriorated building, a deteriorated structure is categorized as an archeological site.

Substrate: Substrate is the base on which an organism lives.

Talk Story: Known in Hawai'i as mo'olelo, is the tradition of personally sharing important stories to preserve them for future generations. The phrase is also often used in Hawai'i to conotate general chatting, gossiping, or "shooting the breeze". A talk story session in the case of this general management plan is an open house-style meeting, where people can talk to subject matter experts, as well as other participants.

Tephra: Tephra are fragments of lava that are airborne for at least a short time before being deposited on the ground, and can include ash, cinders, Pele's hair, reticulite, etc.

Traditional Ecological Knowledge: Native Hawaiian Traditional Ecological Knowledge is a cumulative body of knowledge, beliefs, practices that refer to the relationships and effects between living things and their environment which passes from one generation to the next through traditional practice, stories, chants and songs. The Native Hawaiian culture was an oral culture; therefore the stories, chants, and songs documented significant events, and documented and perpetuated their scientific understanding of the environment. The

traditional land management system of the ahupua‘a is an example of the application of traditional ecological knowledge, which informed individuals of the appropriate uses, harvest times, and planting sequences from the ocean to the mountain tops. This knowledge was applied across each island and managed by the people so that the resources from all environments within the ahupua‘a would be sustainable for future generations.

Traditional Place: A traditional place is a legendary place or a place with a traditional place name. Such a place may be a natural feature and it may or may not have any archeological remains. If this is identified as a “significant site” to an ethnic group, particularly a native population, it has come to be called a TCP (traditional cultural place or property), as coined by Parker and King (1990).

Tree Molds: Tree molds are the physical remains of where a tree once stood. As fluid lava moves through a forested area, it will often surround and ignite trees in its path. As the tree burns and the flow cools, the lava preserves the shape of the tree trunk that once stood.

Tumuli: Tumuli is an artificial hillock or mound of earth and stone.

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ACRONYMS

Audubon	National Audubon Society
BEA	US Bureau of Economic Affairs
CEQ	Council on Environmental Quality
CCC	Civilian Conservation Corps
CUA	Commercial Use Authorization
DCP	Development Concept Plan
DLNR	Department of Land and Natural Resources
DOI US	Department of the Interior
EIS	Environmental Impact Statement
EPA	US Environmental Protection Agency
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FHWA	Federal Highway Administration
FTE	Full Time Equivalent
GMP	General Management Plan
HABS	Historic American Buildings Survey
HAER	Historic American Engineering Record
HALS	Historic American Landscape Survey
HAWP	Hawai'i Association of Watershed Partnership
HVO	Hawai'i Volcanoes Observatory
IPCC	Intergovernmental Panel on Climate Change
ITS	Intelligent Transportation System
KMC	Kilauea Military Camp
MRA	Minimum Requirements Analysis
MRDG	Minimum Requirements Decision Guide
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NHT	National Historic Trail
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NP	National Park
NPCA	National Parks Conservation Association
NPS	National Park Service
NRHP	National Register of Historic Places
OUV	Outstanding Universal Value
PEPC	Planning, Environment and Public Comment
PEPP	Plant Extinction Prevention Program

PIERC	Pacific Island Ecosystems Research Center
SEA	Special Ecological Area
TCP	Traditional Cultural Property
TEK	Traditional Ecological Knowledge
TMA	Three Mountain Alliance
TNC	The Nature Conservancy
UNEP-WCMC	United Nations Environment Programme World Conservation Monitoring Centre
UNFCCC	United Nations Framework Convention on Climate Change
USDA	US Department of Agriculture
USDA-NRCS	US Department of Agriculture, Natural Resource Conservation Service
USDOT	US Department of Transportation
USFWS	US Fish and Wildlife Service
USGS	US Geological Survey
VSE	Visitor Spending Effects
WRCC	Western Regional Climate Center
WS	Wilderness Study

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Lava wolf spider. *NPS photo by Jay Robinson*

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Rainbow over Halema‘uma‘u Vent and Kīlauea Caldera. *Photo by Peter Anderson*

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