OFFICE OF PLANNING
STATE OF HAWAII

NEIL ABERCROMBIE
GOVERNOR

JESSE K. SOUKI
DIRECTOR
OFFICE OF PLANNING

235 South Beretania Street, 6th Floor, Honolulu, Hawaii 96813
Mailing Address: P.O. Box 2359, Honolulu, Hawaii 96804

Telephone: (808) 587-2846
Fax: (808) 587-2824
Web: http://hawaii.gov/dbedt/op/

Ref. No. P-13884

February 21, 2013

To: Daniel Orodenker, Executive Officer
State Land Use Commission

From: Jesse K. Souki, Director

Subject: DR12-49, Petition to Designate Important Agricultural Lands
Petitioner: Kunia Loa Ridge Farmlands
Location: Kunia, Oahu, Hawaii
Land Area: Approximately 854.23Acres

The Office Planning (OP) appreciates Kunia Loa Ridge Farmlands' (Petitioner) participation in the voluntary process for the designation of important agricultural lands (IAL). The designation of the most productive agricultural lands in Hawaii will help to realize the vision expressed in the Administration's New Day Plan, which calls for an agricultural renaissance in Hawaii.

Having reviewed the Petition after consulting with other agencies and applying the available information to the applicable IAL law, OP is unable to recommend at this time that the Land Use Commission (LUC) designate the Kunia Loa Ridge Farmlands as IAL. Additional information and clarification from the Petitioner is needed, particularly with respect to water availability and the allowance of farm dwellings on the individual lots. The following is provided in support of this recommendation.

Applicable Law. The State law for important agricultural lands is contained within Hawaii Revised Statutes (HRS) §§205-41 through 205-44. Lands being considered for IAL designation must meet the definition of IAL, pursuant to HRS §205-42(a), which provides that IAL lands:

> "(1) Are capable of producing sustained high agricultural yields when treated and managed according to accepted farming methods and technology;
> (2) Contribute to the State's economic base and produce agricultural commodities for export or local consumption; or
> (3) Are needed to promote the expansion of agricultural activities and income for the future, even if currently not in production."

HRS §205-44(c) lists eight (8) standards and criteria for the identification of IAL, which will be assessed as part of OP's review. OP recognizes that lands identified as IAL need not meet every standard and criteria listed; however, HRS §205-44(a) also requires that, "the designation of important agricultural lands shall be made by weighing the standards and criteria with each other to meet the constitutionally mandated purposes in article XI, section 3, of the Hawaii Constitution and the objectives, policies, standards, and criteria for important agricultural lands in sections 205-42 and 205-43."

Summary of key elements of the Petition. The Petitioner is requesting that the LUC issue a declaratory order designating 854.23 acres of land at Kunia, Oahu, Hawaii as IAL. (Refer to the attached Figure 1 for the petition area.) The Petitioner represents that if the petition is approved, it will waive all rights to any credits that may be earned under HRS §205-45(h). A general description of the petition area is as follows:

a. The land area is under one Tax Map Key parcel, comprising a contiguous land area of 854.23 acres.

b. Cultivation of Petition Area: According to the Petitioner, the area was previously used by Del Monte Foods for pineapple and by Oahu Sugar Company for sugar cultivation. Currently, the Petitioner indicates that about 44 percent of the land area is being used for various agricultural production. Small farmers and ranchers have been granted long-term leases.

c. The Petitioner is the fee simple owner of the petition area. It is further noted that the Petitioner is also a "Coop", a Hawaii nonprofit corporation, as described within Petitioner's Exhibit C-1 within the document, "Declaration of Covenants, Conditions, Restrictions and Reservation of Easements for the Kunia Loa Ridge Farms Agricultural Subdivision."

d. Petitioner indicates that the property was acquired "to be subdivided and sold in leasehold to small farmers in subdivided parcels of a minimum of 5 acres." According to the Petitioner's Exhibit B, "Agricultural Feasibility Study," the proposal is to subdivide the petition area into 99 lots, averaging a minimum of 5 acres in size. Petitioner should clarify whether 5 acres is a minimum or average. The Feasibility study further states that the Petitioner proposes to sell 98 lots in fee simple, and each lot will be subject to agricultural use easements and/or covenants and restrictions to ensure agricultural use of the lots. Whether the lots will be leased or sold in fee simple should be clarified. Petitioner's Exhibit C-1 is the "Limited Warranty Deed with Covenants, Reservation of Rights and Agreements; Amendments (CCNR)." According to Amendment Article II, 2.1.1 of the CCNR, no farm dwelling units will be permitted on any of the lots.

e. The petition area contains elevations from approximately 675 feet with slopes of about 5 to 10 percent. The majority of the western boundary area lots have steeper

slopes that are 15 percent or more, with elevations from 1,000 to 1,375 feet above mean sea level. The annual rainfall is about 28 inches per year. Most crops will require supplemental irrigation.

Basis of review and comments. OP's review is based on the petition, petition exhibits, and public data available on the proposed lands. In addition, OP received comments on the petition from the following entities.

- **U.S. Department of Agriculture's Natural Resource Conservation Service (USDA-NRCS), Pacific Islands Area Office** (Refer to the attached Exhibit A). The USDA-NRCS letter confirms the Petitioner's Agricultural Lands of Importance to the State of Hawai'i (ALISH) designation and elaborates upon the soil agricultural capacities. The letter notes that areas are excluded from ALISH, because of the following:

  > . . . soil areas within the parcel being categorized as having high slope (>20%), which limits traditional mechanized agriculture, or low available water capacity, which requires careful water management, if irrigated. A portion of the area designated as ALISH with slopes between 20% and 30% has favorable soil conditions for the production of adapted forages with grazing potential, but is limited for traditional mechanized agriculture.... Even though all of the land included in the area submitted by the Petitioner does not meet either the state (ALISH) or federal (USDA Prime Farmland) criteria for important agricultural lands, USDA-NRCS recognizes the potential benefits of preserving the Petitioned IAL as a large block of contiguous land area. Such a contiguous designation could be conducive to environmental protection and healthy integrated resource management.

- **Department of Land and Natural Resources, Commission on Water Resource Management (CWRM)** (Refer to the attached Exhibit B). The attached CWRM letter indicates the following:

  > The applicant states that there are sufficient quantities of water to support viable agricultural production based on well sources Nos. 2703-01, 2803-05, and 2803-07. However, these wells are part of the superfund site and are subject to current remediation. Therefore, the immediate disposition of the wells may not be conducive to providing sufficient quantities of water for irrigation purposes. Please clarify the adequacy of existing water supply for agricultural uses.

- Comments were requested but not yet received from the University of Hawaii, College of Tropical Agriculture and Human Resources (UH-CTAHR), and the Department of Health.

Assessment of Petition lands. The following assesses the proposed IAL areas relative to the eight (8) standards and criteria for the identification of IAL established in HRS §205-44(c).

1. §205-44(c)(1), Land currently used for agricultural production. Based on the Petitioner's information, about 378 acres or 44 percent of the petition area are currently used for agriculture under long term leases. The Petition's Agricultural Feasibility Study indicates that the previous landowner sub-leased portions of the land for horse and cattle grazing. OP notes that the concept of the 5-acre lots will help small farmers have their own plots.

2. §205-44(c)(2), Land with soil qualities and growing conditions that support agricultural production of food, fiber, or fuel- and energy-producing crops. The majority of the land proposed for IAL designation are within the unclassified or other lands, and within C, D, or E rated lands, which are considered to be fair or poor lands for agriculture. The petition indicates that this area was previously used for sugarcane and pineapple. The petition indicates that crops such as flower and nursery products, papaya, ginger root, seed crops, and guava could be grown for the export market. Also, a number of different crops could be grown for the local market, such as asparagus, avocado, banana, and many different food crops could be grown on the petition area. Excluded from this area would be crops that grow at the cooler, higher elevations, such as broccoli and cabbage.

3. §205-44(c)(3), Land identified under agricultural productivity rating systems, such as the Agricultural Lands of Importance to the State of Hawai'i (ALISH) system adopted by the Board of Agriculture on January 28, 1977. Over half or approximately 59 percent of the land area within the petition area is classified within ALISH. Much of the remaining unclassified lands are slopes above 20 percent and/or within the steep drainage ways. The Petitioner is representing that sufficient water will be provided for irrigation of the lots. If this is verified, then the petition area would be well suited for IAL designation. However, the CWRM has indicated that there may be a problem with the usage of this water for irrigation purposes. The Department of Health has been contacted for comments on this matter. The Petition provides ALISH and Land Study Bureau data, and is summarized below.

LSB Rating		
	Acres	**Percent**
A (Very Good)	9.71	1.1
B (Good)	49.73	5.8
C (Fair)	179.18	20.97
D (Poor)	260.89	30.54
E (Very Poor)	354.71	41.52
Total:	854.23	100%

ALISH Rating		
	Acres	**Percent**
Prime	8.32	.9
Unique	123.70	14.48
Other	371.16	43.45
Unclassified	351.04	41.09
Total:	854.23	100%

4. §205-44(c)(4), Land types associated with traditional native Hawaiian agricultural uses, such as taro cultivation, or unique agricultural crops and uses, such as coffee, vineyards, aquaculture, and energy production. The Petitioner indicates that small scale diversified agriculture on the proposed lots could include traditional Hawaiian agricultural uses and plants.

5. §205-44(c)(5), Land with sufficient quantities of water to support viable agricultural production. According to the petition, the Kunia Water Association, which is the former Del Monte Foods Pineapple plantation water system, and operates the Kunia Water System, owns the petition area. There are three (3) well sources, and a 2.0 million gallon reservoir. Although other water sources are possible, the Petitioner does not discuss the feasibility or intention of developing other water sources. The Petitioner indicates that, "Two or three additional reservoirs will be constructed on the site to provide onsite storage volume to accommodate the maximum day irrigation use (approximately 4 million gallons)." Based on consultation with the State Department of Agriculture, there are serious concerns regarding the availability of water to support agricultural production on the petition area. The petition area has been allocated only 500,000 gallons per day from the Kunia Water Wells, less than the estimated maximum day irrigation use stated in the petition. This is only sufficient to support about 135 acres in cultivation, less than the approximately 478.37 acres proposed for diversified agriculture. Otherwise, only very low intensity agricultural activities such as cattle and horse ranching would be permitted. There is no clear explanation of how the additional reservoirs will be used or what water source is available to fill these reservoirs.

   In addition, a comment from CWRM regarding the quality of the water within these wells may also limit what these waters can be used for. We are awaiting comments from the DOH which may provide some clarification on the quality of water for crop irrigation.

6. §205-44(c)(6), Land whose designation as important agricultural lands is consistent with general, development, and community plans of the county. The proposed lands are within the City and County of Honolulu's (City) AG-1 Restricted Agricultural Zoning district. Within the Central Oahu Sustainable Communities Plan, on Map A2, Urban Land Use, the petition area is designated as Agriculture and Preservation area.

On Map A1, the petition area is designated for Agriculture and as Natural Drainageways/Gulches.

7. §205-44(c)(7), Land that contributes to maintaining a critical land mass important to agricultural operating productivity. This criterion is not fully met because of extensive fragmentation of productive areas within the petition area due to some steep terrain, gulches, and poor soil qualities. The Petitioner indicates that 56 percent of the land or about 478.37 acres will be used for diversified agriculture, and the remaining lands will be used for ranching and grazing.

8. § 205-44(c)(8), Land with or near support infrastructure conducive to agricultural productivity, such as transportation to markets, water, or power. The proposed lands appear to meet this criterion with respect to its proximity and access to roads, markets, harbors, and power. Kunia Road is the major accessway to the major markets in the immediate area, such as Wahiawa, Waipahu, and Waipio.

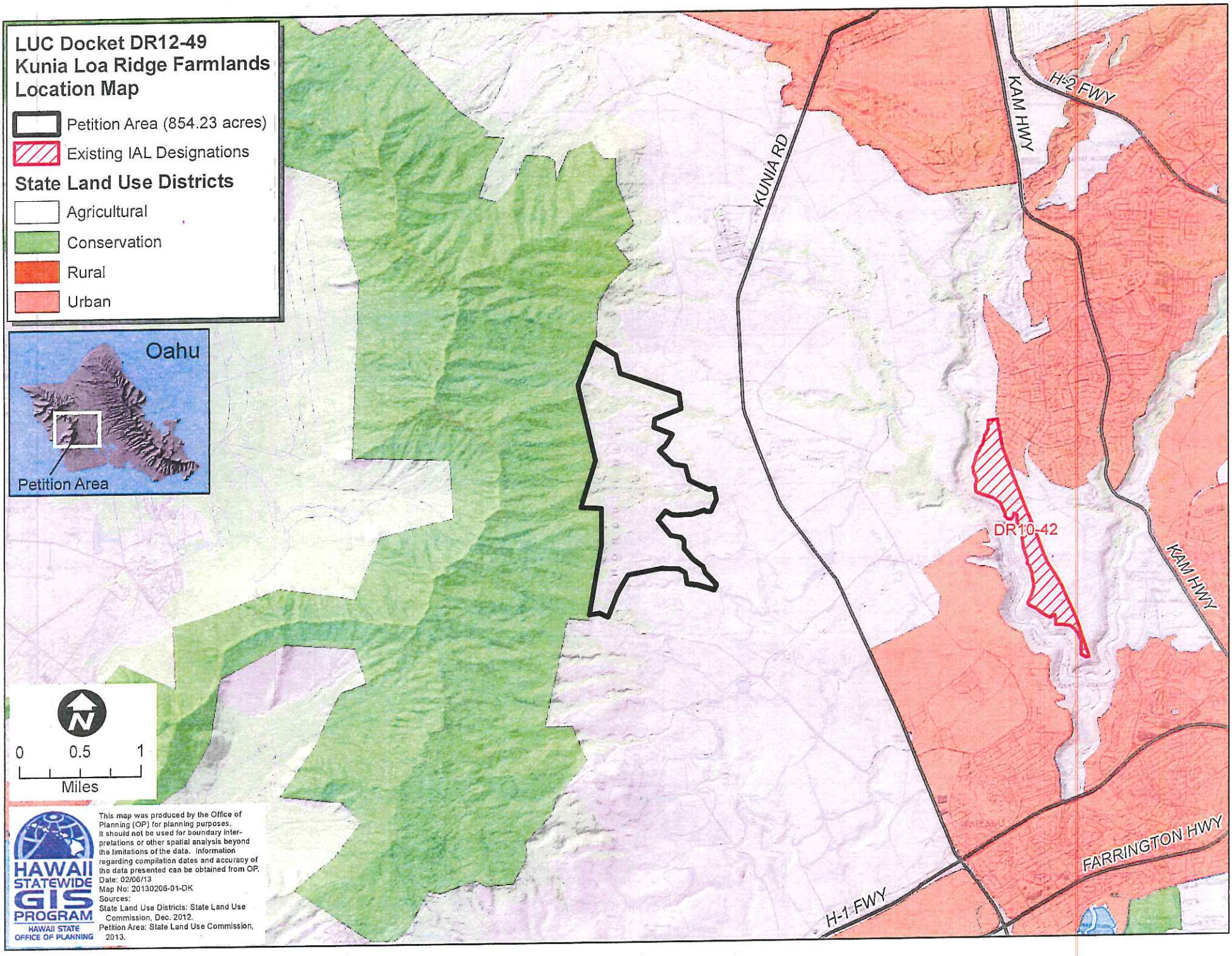
Summary and Recommendation

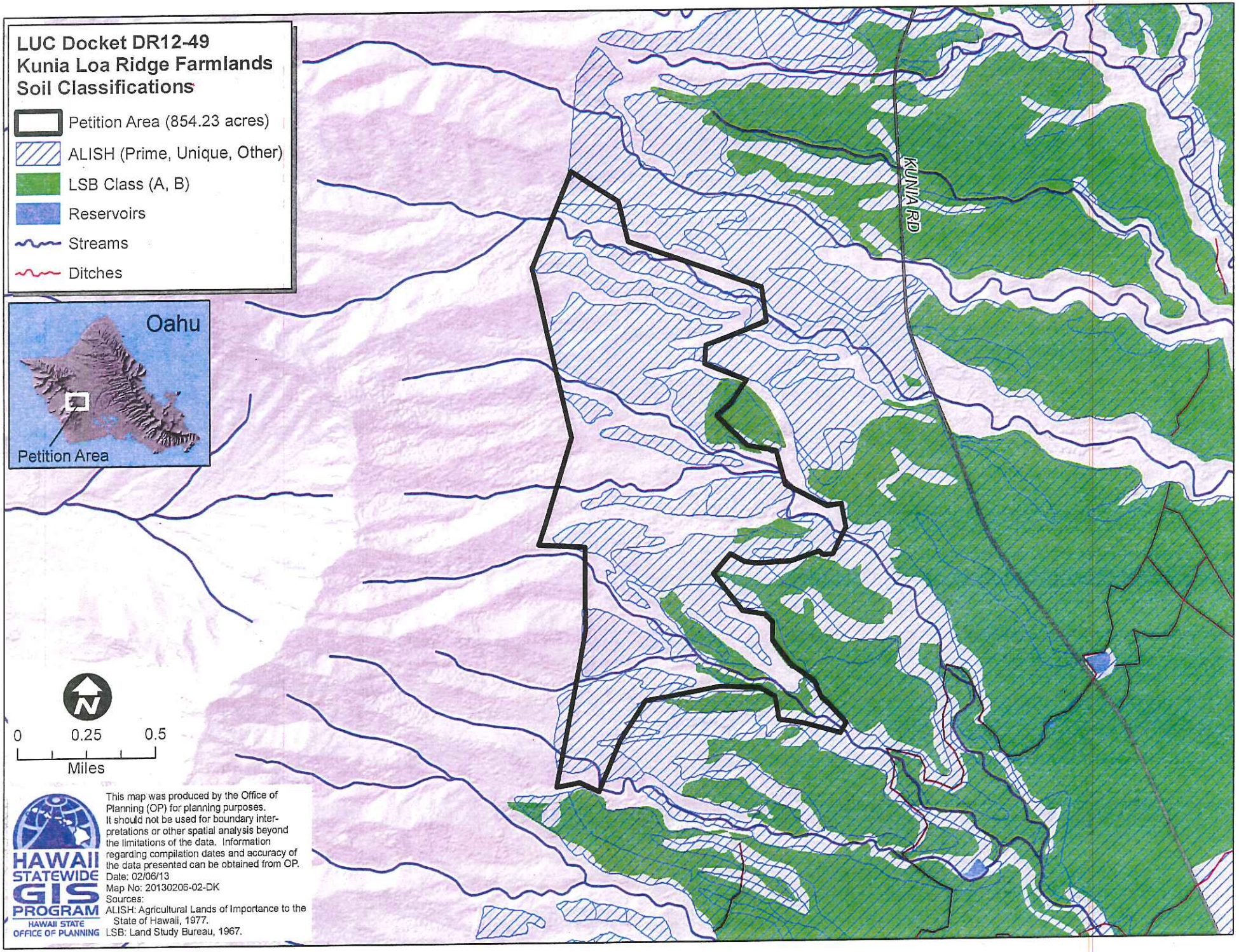
Based on available information and Petitioner's representations, and having weighed the IAL standards and criteria in consideration of the constitutionally-mandated purposes in Article XI, Section 3, of the Hawaii Constitution, and the objectives and policies for important agricultural lands in HRS §§205-41 through 205-44, OP is unable to recommend approval of the IAL designation of the petition area at this time. The Petitioner needs to demonstrate that they can resolve the water quality and quantity issues. Should the petition be granted, OP recommends that a condition of approval be imposed on the petition, waiving any and all rights to credits under HRS §205-45(h), as represented by the petitioner in its Petition.

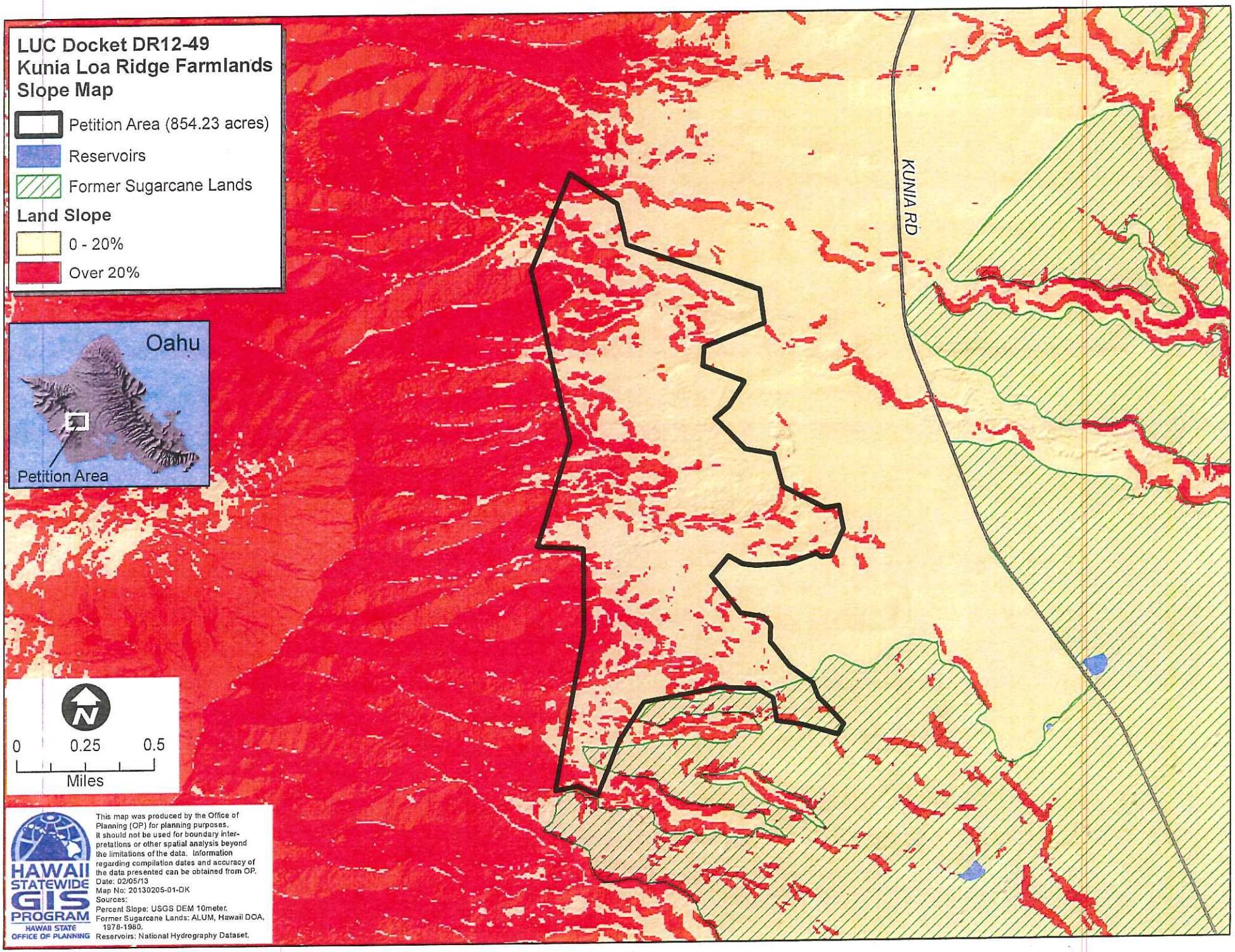
OP recognizes and fully supports the intent of this petition to make small agricultural lots available to small farmers. The petition also indicates that farm dwellings will be prohibited, as shown in the CCNR in Petitioner's Exhibit C-1. We would note, however, that the CCNR is enforced privately, and not through City zoning regulations. It also appears that these CCNR's may be amended to allow for farm dwellings in the future. Consequently, there may not be sufficient protection to prevent abuse and discourage "gentlemen estates" from being developed. The Petitioner should clarify the type of ownership and deed covenants and the sufficiency of the CCNRs to prevent this area from becoming a "gentlemen estates" subdivision. Should the petition be granted, OP recommends that a condition be imposed to ensure that no dwellings are permitted on the lots as part of this designation.

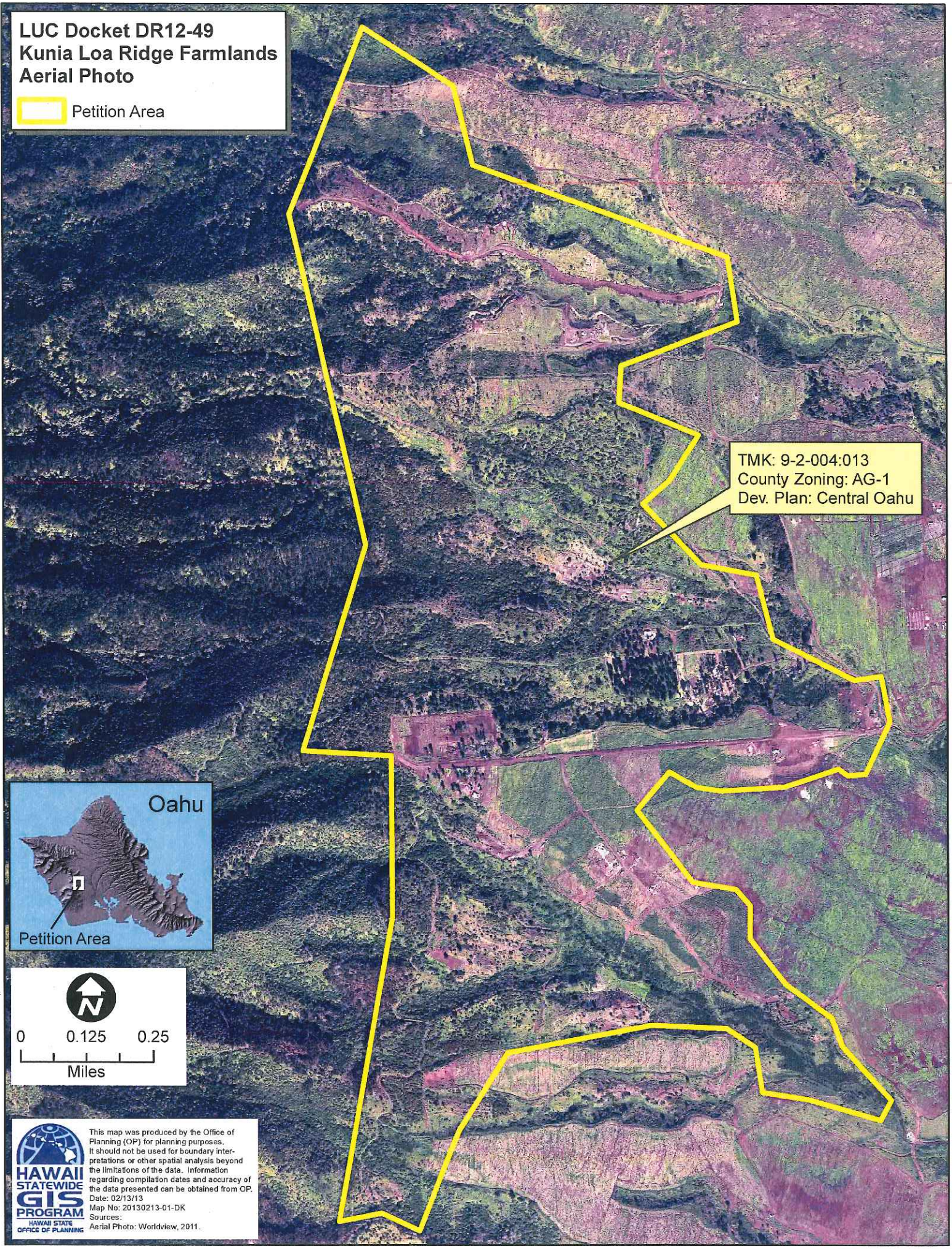
Thank you for the opportunity to comment on the Petition.

Attachments


LUC Docket DR12-49
Kunia Loa Ridge Farmlands
Location Map
Petition Area (854.23 acres)
Existing IAL Designations
State Land Use Districts
Agricultural
Conservation
Rural
Urban
Oahu
Petition Area
KUNIA RD
KAM HWY
H-2 FWY
DR10-42
KAM HWY
FARRINGTON HWY
H-1 FWY
N
0
0.5
1
Miles
HAWAII STATEWIDE GIS PROGRAM
HAWAII STATE OFFICE OF PLANNING
This map was produced by the Office of Planning (OP) for planning purposes. It should not be used for boundary interpretations or other spatial analysis beyond the limitations of the data. Information regarding compilation dates and accuracy of the data presented can be obtained from OP.
Date: 02/06/13
Map No: 20130206-01-DK
Sources:
State Land Use Districts: State Land Use Commission, Dec. 2012.
Petition Area: State Land Use Commission, 2013.


LUC Docket DR12-49
Kunia Loa Ridge Farmlands
Soil Classifications
Petition Area (854.23 acres)
ALISH (Prime, Unique, Other)
LSB Class (A, B)
Reservoirs
Streams
Ditches
Oahu
Petition Area
KUNIA RD
N
0
0.25
0.5
Miles
HAWAII STATEWIDE GIS PROGRAM
HAWAII STATE OFFICE OF PLANNING
This map was produced by the Office of Planning (OP) for planning purposes. It should not be used for boundary interpretations or other spatial analysis beyond the limitations of the data. Information regarding compilation dates and accuracy of the data presented can be obtained from OP.
Date: 02/06/13
Map No: 20130206-02-DK
Sources:
ALISH: Agricultural Lands of Importance to the State of Hawaii, 1977.
LSB: Land Study Bureau, 1967.


LUC Docket DR12-49
Kunia Loa Ridge Farmlands
Slope Map
Petition Area (854.23 acres)
Reservoirs
Former Sugarcane Lands
Land Slope
0 - 20%
Over 20%
KUNIA RD
Oahu
Petition Area
N
0
0.25
0.5
Miles
HAWAII STATEWIDE GIS PROGRAM
HAWAII STATE OFFICE OF PLANNING
This map was produced by the Office of Planning (OP) for planning purposes. It should not be used for boundary interpretations or other spatial analysis beyond the limitations of the data. Information regarding compilation dates and accuracy of the data presented can be obtained from OP.
Date: 02/05/13
Map No: 20130205-01-DK
Sources:
Percent Slope: USGS DEM 10meter.
Former Sugarcane Lands: ALUM, Hawaii DOA, 1978-1980.
Reservoirs: National Hydrography Dataset.


LUC Docket DR12-49
Kunia Loa Ridge Farmlands
Aerial Photo
Petition Area
TMK: 9-2-004:013
County Zoning: AG-1
Dev. Plan: Central Oahu
Oahu
Petition Area
N
0
0.125
0.25
Miles
HAWAII STATEWIDE GIS PROGRAM
HAWAII STATE OFFICE OF PLANNING
This map was produced by the Office of Planning (OP) for planning purposes. It should not be used for boundary interpretations or other spatial analysis beyond the limitations of the data. Information regarding compilation dates and accuracy of the data presented can be obtained from OP.
Date: 02/13/13
Map No: 20130213-01-DK
Sources:
Aerial Photo: Worldview, 2011.

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT
P.O. BOX 621
HONOLULU, HAWAII 96809

February 8, 2013

ORIGINAL

TO: Jesse Souki, Director
Office of Planning

FROM: William M. Tam, Deputy Director
Commission on Water Resource Management

SUBJECT: Petition for Declaratory Order to Designate Important Agricultural Lands
Kunia Loa Ridge Farmlands

FILE NO.: DR12-49
TMK NO.: N/A

Thank you for the opportunity to review the subject document. The Commission on Water Resource Management (CWRM) is the agency responsible for administering the State Water Code (Code). Under the Code, all waters of the State are held in trust for the benefit of the citizens of the State, therefore, all water use is subject to legally protected water rights. CWRM strongly promotes the efficient use of Hawaii's water resources through conservation measures and appropriate resource management. For more information, please refer to the State Water Code, Chapter 174C, Hawaii Revised Statutes, and Hawaii Administrative Rules, Chapters 13-167 to 13-171. These documents are available via the Internet at http://www.hawaii.gov/dlnr/cwrm.

Our comments related to water resources are checked off below.

☒ 1. We recommend coordination with the county to incorporate this project into the county's Water Use and Development Plan. Please contact the respective Planning Department and/or Department of Water Supply for further information.

☐ 2. We recommend coordination with the Engineering Division of the State Department of Land and Natural Resources to incorporate this project into the State Water Projects Plan.

☐ 3. We recommend coordination with the Hawaii Department of Agriculture (HDOA) to incorporate the reclassification of agricultural zoned land and the redistribution of agricultural resources into the State's Agricultural Water Use and Development Plan (AWUDP). Please contact the HDOA for more information.

☐ 4. We recommend that water efficient fixtures be installed and water efficient practices implemented throughout the development to reduce the increased demand on the area's freshwater resources. Reducing the water usage of a home or building may earn credit towards Leadership in Energy and Environmental Design (LEED) certification. More information on LEED certification is available at http://www.usgbc.org/leed. A listing of fixtures certified by the EPA as having high water efficiency can be found at http://www.epa.gov/watersense/pp/index.htm.

☐ 5. We recommend the use of best management practices (BMP) for stormwater management to minimize the impact of the project to the existing area's hydrology while maintaining on-site infiltration and preventing polluted runoff from storm events. Stormwater management BMPs may earn credit toward LEED certification. More information on stormwater BMPs can be found at http://hawaii.gov/dbedt/czm/initiative/lid.php.

☒ 6. We recommend the use of alternative water sources, wherever practicable.

☒ 7. There may be the potential for ground or surface water degradation/contamination and recommend that approvals for this project be conditioned upon a review by the State Department of Health and the developer's acceptance of any resulting requirements related to water quality.

Permits required by CWRM:
Additional information and forms are available at http://hawaii.gov/dlnr/cwrm/resources_permits.htm.

☐ 8. The proposed water supply source for the project is located in a designated water management area, and a Water Use Permit is required prior to use of water. The Water Use Permit may be conditioned on the requirement to use dual line water supply systems for new industrial and commercial developments.

☐ 9. A Well Construction Permit(s) is (are) required before any well construction work begins.

☐ 10. A Pump Installation Permit(s) is (are) required before ground water is developed as a source of supply for the project.

☐ 11. There is (are) well(s) located on or adjacent to this project. If wells are not planned to be used and will be affected by any new construction, they must be properly abandoned and sealed. A permit for well abandonment must be obtained.

☐ 12. Ground water withdrawals from this project may affect streamflows, which may require an instream flow standard amendment.

☐ 13. A Stream Channel Alteration Permit(s) is (are) required before any alteration(s) can be made to the bed and/or banks of a stream channel.

☐ 14. A Stream Diversion Works Permit(s) is (are) required before any stream diversion works is (are) constructed or altered.

☐ 15. A Petition to Amend the Interim Instream Flow Standard is required for any new or expanded diversion(s) of surface water.

☐ 16. The planned source of water for this project has not been identified in this report. Therefore, we cannot determine what permits or petitions are required from our office, or whether there are potential impacts to water resources.

☒ OTHER:

The applicant states that there are sufficient quantities of water to support viable agricultural production, based on well sources Nos. 2703-01, 2803-05, and 2803-07. However, these wells are part of the superfund site and are subject to current remediation. Therefore, the immediate disposition of the wells may not be conducive to providing sufficient quantities of water for agricultural purposes. Please clarify the adequacy of existing water supply for agricultural uses.

If there are any questions, please contact Ryan Imata at 587-0255.

United States Department of Agriculture

NRCS

Natural Resources Conservation Service
P.O. Box 50004 Rm. 4-118
Honolulu, HI 96850
808-541-2600

February 11, 2013

ORIGINAL
74606

Jesse K. Souki, Director
Office of Planning
State of Hawaii
PO Box 2359
Honolulu, Hawaii 96804

Dear Mr. Souki,

Thank you for providing the Natural Resources Conservation Service (NRCS) the opportunity to review the Petition for Declaratory Order to Designate Important Agricultural lands for the Petitioner Kunia Loa Ridge Farms, Island of O`ahu, Hawai`i. We have confined our comments to issues within the purview of NRCS, specifically those related to soil properties that are typically used to assess the quality of land for agricultural use.

After analysis of the data provided by the petitioner, we agree with that petitioner in the respective designations of the lands as "Prime" or "Other Important Agricultural Land" under the Agricultural Lands of Importance to the State of Hawaii system (ALISH; map provided by the LUC report). Exclusion of the areas as ALISH within the petition parcel is likely due to soil areas within the parcel being categorized as having high slope (>20%), which limits traditional mechanized agriculture, or low available water capacity, which requires careful water management, if irrigated. A portion of the area designated as ALISH with slopes between 20% to 30% has favorable soil conditions for the production of adapted forages with grazing potential, but is limited for traditional mechanized agriculture.

The ALISH system includes three categories of Important Farmlands: Prime, Unique, and Other Important Agricultural Lands. In considering their quality as agricultural lands, the areas that are currently classified as ALISH within the area petitioned are dominantly identified as "Unique" or "Other Important Agricultural Lands". The remaining petitioned areas not currently classified as ALISH are generally areas that are either high slope or along drainage ways that tend to be steep. Although they are not classified as prime, important, or unique under the current ALISH system, most of these areas have the potential for protection of watershed integrity.

Even though all of the land included in the area submitted by the petitioner does not meet either the state (ALISH) or federal (USDA Prime Farmland) criteria for important

agricultural lands, USDA-NRCS recognizes the potential benefits of preserving the petitioned IAL as a large block of contiguous land area. Such a contiguous designation could be conducive to environmental protection and healthy integrated resource management.

Please note: Soil surveys seldom contain detailed site-specific information and are not designed for use as primary regulatory tools in site-specific permitting decisions, but are useful for broad regulatory planning and application. Official Soil Survey Information is public information and may be interpreted by organizations, agencies, units of government, or others based on their own needs. However, users are responsible for the appropriate application of soil survey information. ***NRCS will not accept reassignment of authority for decisions made by other Federal, State, or local regulatory bodies. NRCS will not make changes to Official Soil Survey Information, or of any supplemental soil mapping, for purposes related solely to State or local regulatory programs.***

If you have any questions concerning the soils and related quality and suitability ratings for this project area, please contact, Cynthia A. Stiles, Assistant State Soil Scientist, by phone at (808) 541-2600 x129 or by email at Cynthia.Stiles@hi.usda.gov.

Sincerely,

ANGELA L. BIGGS
Acting Director
Pacific Islands Area

Cc: Michael Bajinting, Acting District Conservationist, NRCS, Aiea, HI
Tony Rolfes, Assistant Director – Soil Survey and Natural Resource Assessment, NRCS, Honolulu, HI
Cynthia A. Stiles, Assistant State Soil Scientist, NRCS, Honolulu, HI
Cheryl Morton, Administrative Assistant, NRCS, Honolulu, HI

United States Department of Agriculture

NRCS

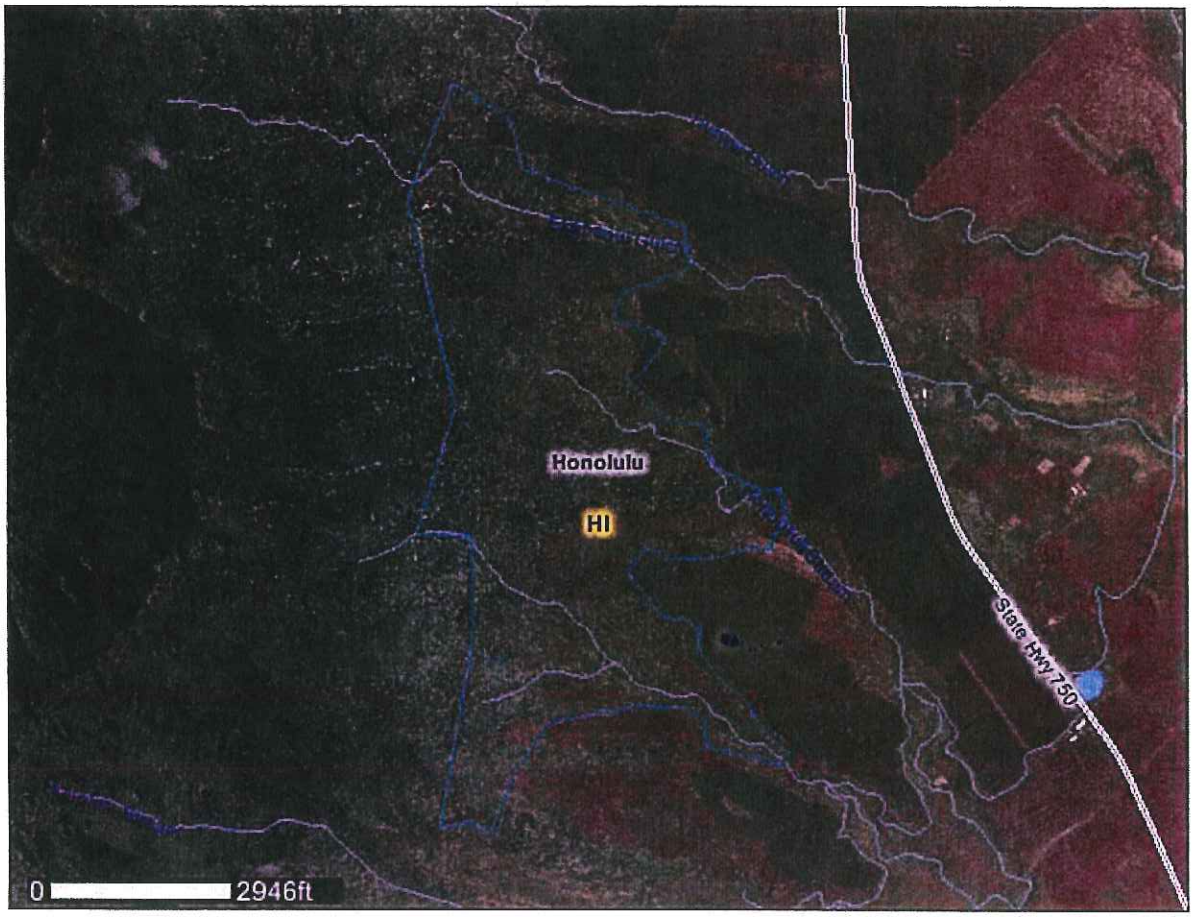
Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Island of Oahu, Hawaii

Kunia Loa Ridge Farms LUC Petition

ORIGINAL



February 7, 2013

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://soils.usda.gov/sqi/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (http://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://soils.usda.gov/contact/state_offices/).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Soil Data Mart Web site or the NRCS Web Soil Survey. The Soil Data Mart is the data storage site for the official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means

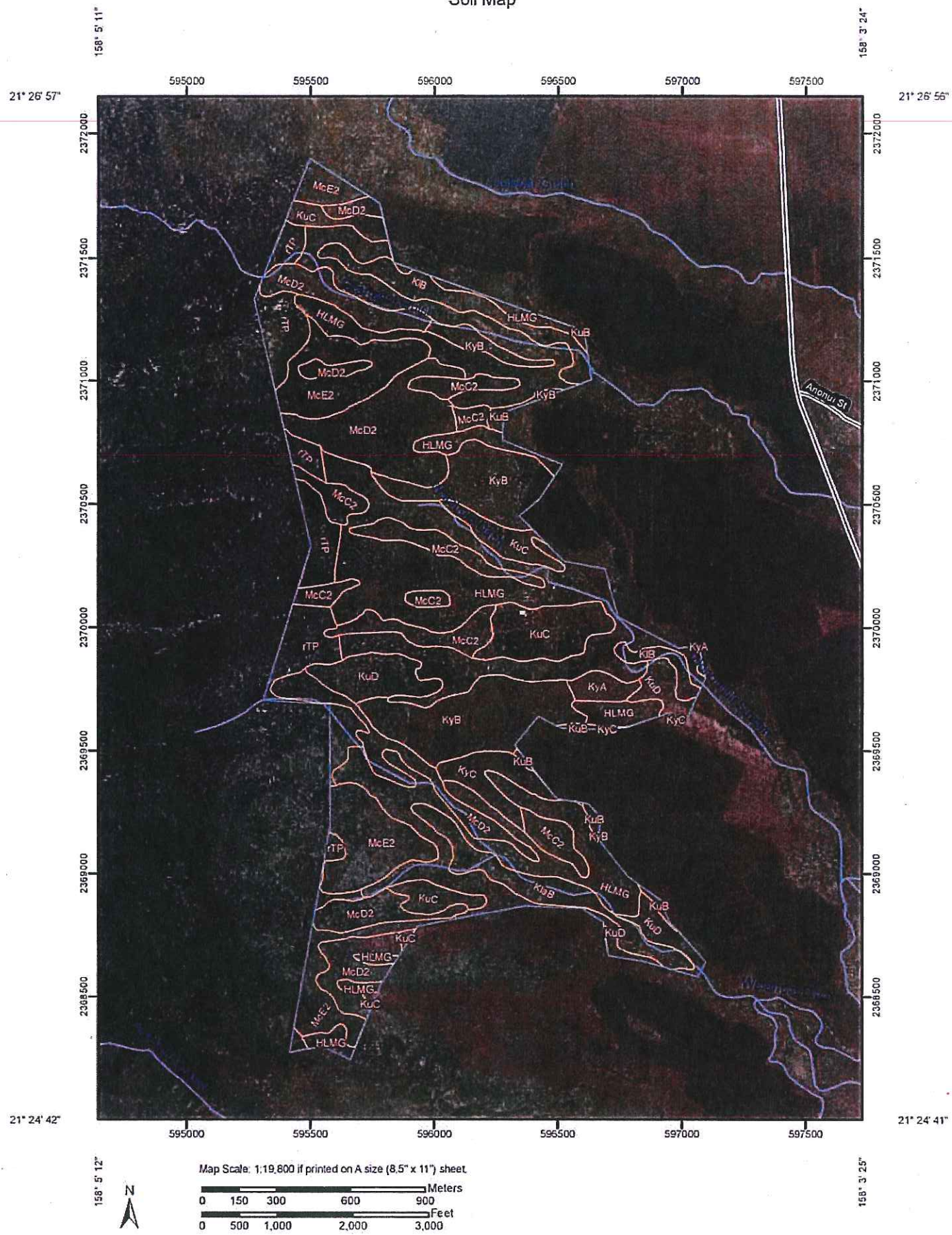
for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

Contents

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map



MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Units

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other

Special Line Features
- Gully
- Short Steep Slope
- Other

Political Features
- Cities

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

MAP INFORMATION

Map Scale: 1:19,800 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 4N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Island of Oahu, Hawaii
Survey Area Data: Version 7, Sep 27, 2012

Date(s) aerial images were photographed: Data not available.

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Island of Oahu, Hawaii (HI990)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
HLMG	Helemano silty clay, 30 to 90 percent slopes	271.1	32.2%
KlaB	Kawaihapai stony clay loam, 2 to 6 percent slopes	25.6	3.0%
KlB	Kawaihapai clay loam, 2 to 6 percent slopes	27.4	3.3%
KuB	Kolekole silty clay loam, 1 to 6 percent slopes	5.5	0.7%
KuC	Kolekole silty clay loam, 6 to 12 percent slopes	50.9	6.0%
KuD	Kolekole silty clay loam, 12 to 25 percent slopes	36.6	4.3%
KyA	Kunia silty clay, 0 to 3 percent slopes	6.9	0.8%
KyB	Kunia silty clay, 3 to 8 percent slopes	84.6	10.0%
KyC	Kunia silty clay, 8 to 15 percent slopes	15.5	1.8%
McC2	Mahana silty clay loam, 6 to 12 percent slopes, eroded	55.6	6.6%
McD2	Mahana silty clay loam, 12 to 20 percent slopes, eroded	118.6	14.1%
McE2	Mahana silty clay loam, 20 to 35 percent slopes, eroded	83.9	10.0%
rTP	Tropohumults-Dystrandepts association	59.8	7.1%
Totals for Area of Interest		841.9	100.0%

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally

are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series.* Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases.* Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas.* Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Island of Oahu, Hawaii

HLMG—Helemano silty clay, 30 to 90 percent slopes

Map Unit Setting

Elevation: 500 to 1,200 feet
Mean annual precipitation: 30 to 60 inches
Mean annual air temperature: 72 to 73 degrees F
Frost-free period: 365 days

Map Unit Composition

Helemano and similar soils: 100 percent

Description of Helemano

Setting

Landform: Gulches
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Basic igneous material

Properties and qualities

Slope: 30 to 90 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 5.8 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability (nonirrigated): 7e
Hydrologic Soil Group: B

Typical profile

0 to 10 inches: Silty clay
10 to 41 inches: Paragravelly silty clay
41 to 60 inches: Very paragravelly silty clay

KlaB—Kawaihapai stony clay loam, 2 to 6 percent slopes

Map Unit Setting

Elevation: 0 to 300 feet
Mean annual precipitation: 30 to 50 inches
Mean annual air temperature: 72 to 73 degrees F
Frost-free period: 365 days

Map Unit Composition
Kawaihapai and similar soils: 100 percent

Description of Kawaihapai

Setting
Landform: Alluvial fans
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Rise
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Basic igneous rock

Properties and qualities
Slope: 2 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Available water capacity: Moderate (about 6.8 inches)

Interpretive groups
Farmland classification: Prime farmland if irrigated
Land capability classification (irrigated): 2e
Land capability (nonirrigated): 2e
Hydrologic Soil Group: B

Typical profile
0 to 22 inches: Stony clay loam
22 to 32 inches: Sandy loam
32 to 54 inches: Sandy loam

KIB—Kawaihapai clay loam, 2 to 6 percent slopes

Map Unit Setting
Elevation: 0 to 300 feet
Mean annual precipitation: 30 to 50 inches
Mean annual air temperature: 72 to 73 degrees F
Frost-free period: 365 days

Map Unit Composition
Kawaihapai and similar soils: 100 percent

Description of Kawaihapai

Setting
Landform: Alluvial fans
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Rise

Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Basic igneous rock

Properties and qualities
Slope: 2 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Available water capacity: Moderate (about 7.2 inches)

Interpretive groups
Farmland classification: Prime farmland if irrigated
Land capability classification (irrigated): 2e
Land capability (nonirrigated): 2e
Hydrologic Soil Group: B

Typical profile
0 to 22 inches: Clay loam
22 to 32 inches: Sandy loam
32 to 54 inches: Sandy loam

KuB—Kolekole silty clay loam, 1 to 6 percent slopes

Map Unit Setting
Landscape: Uplands
Elevation: 500 to 1,200 feet
Mean annual precipitation: 35 to 50 inches
Mean annual air temperature: 72 to 73 degrees F
Frost-free period: 365 days

Map Unit Composition
Kolekole and similar soils: 100 percent

Description of Kolekole

Setting
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Basic igneous material

Properties and qualities
Slope: 1 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 0.20 in/hr)

Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 6.2 inches)

Interpretive groups

Farmland classification: Prime farmland if irrigated
Land capability classification (irrigated): 2e
Land capability (nonirrigated): 3e
Hydrologic Soil Group: C

Typical profile

0 to 12 inches: Silty clay loam
12 to 38 inches: Silty clay loam
38 to 60 inches: Stony silty clay loam

KuC—Kolekole silty clay loam, 6 to 12 percent slopes

Map Unit Setting

Landscape: Uplands
Elevation: 500 to 1,200 feet
Mean annual precipitation: 35 to 50 inches
Mean annual air temperature: 72 to 73 degrees F
Frost-free period: 365 days

Map Unit Composition

Kolekole and similar soils: 100 percent

Description of Kolekole

Setting

Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Basic igneous material

Properties and qualities

Slope: 6 to 12 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 6.2 inches)

Interpretive groups

Farmland classification: Prime farmland if irrigated
Land capability classification (irrigated): 3e
Land capability (nonirrigated): 3e
Hydrologic Soil Group: C

Typical profile
0 to 12 inches: Silty clay loam
12 to 38 inches: Silty clay loam
38 to 60 inches: Stony silty clay loam

KuD—Kolekole silty clay loam, 12 to 25 percent slopes

Map Unit Setting
Landscape: Uplands
Elevation: 500 to 1,200 feet
Mean annual precipitation: 35 to 50 inches
Mean annual air temperature: 72 to 73 degrees F
Frost-free period: 365 days

Map Unit Composition
Kolekole and similar soils: 100 percent

Description of Kolekole

Setting
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Basic igneous material

Properties and qualities
Slope: 12 to 25 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 6.2 inches)

Interpretive groups
Farmland classification: Not prime farmland
Land capability classification (irrigated): 4e
Land capability (nonirrigated): 4e
Hydrologic Soil Group: C

Typical profile
0 to 12 inches: Silty clay loam
12 to 38 inches: Silty clay loam
38 to 60 inches: Stony silty clay loam

KyA—Kunia silty clay, 0 to 3 percent slopes

Map Unit Setting

Elevation: 700 to 1,000 feet
Mean annual precipitation: 30 to 40 inches
Mean annual air temperature: 72 to 73 degrees F
Frost-free period: 365 days

Map Unit Composition

Kunia and similar soils: 100 percent

Description of Kunia

Setting

Landform: Alluvial fans
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Interfluve, tread
Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Alluvium

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 8.0 inches)

Interpretive groups

Farmland classification: Prime farmland if irrigated
Land capability classification (irrigated): 1
Land capability (nonirrigated): 3c
Hydrologic Soil Group: B

Typical profile

0 to 22 inches: Silty clay
22 to 47 inches: Silty clay
47 to 74 inches: Silty clay loam

KyB—Kunia silty clay, 3 to 8 percent slopes

Map Unit Setting

Elevation: 700 to 1,000 feet

Mean annual precipitation: 30 to 40 inches
Mean annual air temperature: 72 to 73 degrees F
Frost-free period: 365 days

Map Unit Composition
Kunia and similar soils: 100 percent

Description of Kunia

Setting
Landform: Alluvial fans
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Interfluve, tread
Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Alluvium

Properties and qualities
Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 8.0 inches)

Interpretive groups
Farmland classification: Prime farmland if irrigated
Land capability classification (irrigated): 2e
Land capability (nonirrigated): 3c
Hydrologic Soil Group: B

Typical profile
0 to 22 inches: Silty clay
22 to 47 inches: Silty clay
47 to 74 inches: Silty clay loam

KyC—Kunia silty clay, 8 to 15 percent slopes

Map Unit Setting
Elevation: 700 to 1,000 feet
Mean annual precipitation: 30 to 40 inches
Mean annual air temperature: 72 to 73 degrees F
Frost-free period: 365 days

Map Unit Composition
Kunia and similar soils: 100 percent

Description of Kunia

Setting

Landform: Alluvial fans
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Interfluve, tread
Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Alluvium

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 8.0 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability classification (irrigated): 3e
Land capability (nonirrigated): 3e
Hydrologic Soil Group: B

Typical profile

0 to 22 inches: Silty clay
22 to 47 inches: Silty clay
47 to 74 inches: Silty clay loam

McC2—Mahana silty clay loam, 6 to 12 percent slopes, eroded

Map Unit Setting

Landscape: Uplands
Elevation: 1,000 to 3,000 feet
Mean annual precipitation: 30 to 45 inches
Mean annual air temperature: 64 to 72 degrees F
Frost-free period: 365 days

Map Unit Composition

Mahana and similar soils: 100 percent

Description of Mahana

Setting

Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Volcanic ash

Properties and qualities

Slope: 6 to 12 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 5.6 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability classification (irrigated): 3e
Land capability (nonirrigated): 4e
Hydrologic Soil Group: B

Typical profile

0 to 4 inches: Silty clay loam
4 to 30 inches: Silt loam
30 to 43 inches: Silty clay loam
43 to 60 inches: Silty clay loam

McD2—Mahana silty clay loam, 12 to 20 percent slopes, eroded

Map Unit Setting

Landscape: Uplands
Elevation: 1,000 to 3,000 feet
Mean annual precipitation: 30 to 45 inches
Mean annual air temperature: 64 to 72 degrees F
Frost-free period: 365 days

Map Unit Composition

Mahana and similar soils: 100 percent

Description of Mahana

Setting

Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Volcanic ash

Properties and qualities

Slope: 12 to 20 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None

Frequency of ponding: None
Available water capacity: Low (about 5.6 inches)

Interpretive groups
Farmland classification: Not prime farmland
Land capability classification (irrigated): 4e
Land capability (nonirrigated): 6e
Hydrologic Soil Group: B

Typical profile
0 to 4 inches: Silty clay loam
4 to 30 inches: Silt loam
30 to 43 inches: Silty clay loam
43 to 60 inches: Silty clay loam

McE2—Mahana silty clay loam, 20 to 35 percent slopes, eroded

Map Unit Setting
Landscape: Uplands
Elevation: 1,000 to 3,000 feet
Mean annual precipitation: 30 to 45 inches
Mean annual air temperature: 64 to 72 degrees F
Frost-free period: 365 days

Map Unit Composition
Mahana and similar soils: 100 percent

Description of Mahana

Setting
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Volcanic ash

Properties and qualities
Slope: 20 to 35 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 6.1 inches)

Interpretive groups
Farmland classification: Not prime farmland
Land capability (nonirrigated): 6e
Hydrologic Soil Group: B

Typical profile
0 to 4 inches: Silty clay loam
4 to 30 inches: Silt loam
30 to 43 inches: Silty clay loam
43 to 60 inches: Silty clay loam

rTP—Tropohumults-Dystrandepts association

Map Unit Setting
Elevation: 1,000 to 4,000 feet
Mean annual precipitation: 30 to 75 inches
Mean annual air temperature: 63 to 72 degrees F
Frost-free period: 365 days

Map Unit Composition
Tropohumults and similar soils: 50 percent
Dystrandepts and similar soils: 30 percent

Description of Tropohumults

Setting
Landform: Ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Mountaintop
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Organic

Properties and qualities
Slope: 30 to 90 percent
Depth to restrictive feature: 57 to 57 inches to placic; 57 to 58 inches to paralithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 7.4 inches)

Interpretive groups
Farmland classification: Not prime farmland
Land capability (nonirrigated): 7e
Hydrologic Soil Group: C

Typical profile
0 to 11 inches: Silty clay
11 to 57 inches: Silty clay
57 to 58 inches: Cemented material
58 to 68 inches: Bedrock

Description of Dystrandepts

Setting

Landform: Ridges
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Mountainflank
Parent material: Volcanic ash

Properties and qualities

Slope: 30 to 90 percent
Depth to restrictive feature: 50 to 50 inches to paralithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: High (about 9.0 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability (nonirrigated): 7e
Hydrologic Soil Group: B

Typical profile

0 to 10 inches: Silty clay
10 to 50 inches: Silty clay loam
50 to 60 inches: Bedrock

Soil Information for All Uses

Suitabilities and Limitations for Use

The Suitabilities and Limitations for Use section includes various soil interpretations displayed as thematic maps with a summary table for the soil map units in the selected area of interest. A single value or rating for each map unit is generated by aggregating the interpretive ratings of individual map unit components. This aggregation process is defined for each interpretation.

Land Classifications

Land Classifications are specified land use and management groupings that are assigned to soil areas because combinations of soil have similar behavior for specified practices. Most are based on soil properties and other factors that directly influence the specific use of the soil. Example classifications include ecological site classification, farmland classification, irrigated and nonirrigated land capability classification, and hydric rating.

Irrigated Capability Class (Kunia Loa Ridge, Oahu, LUC Petition Lands)

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations that show suitability and limitations of groups of soils for rangeland, for woodland, or for engineering purposes.

In the capability system, soils are generally grouped at three levels-capability class, subclass, and unit. Only class and subclass are included in this data set.

Capability classes, the broadest groups, are designated by the numbers 1 through 8. The numbers indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class 1 soils have few limitations that restrict their use.

Class 2 soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class 3 soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class 4 soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

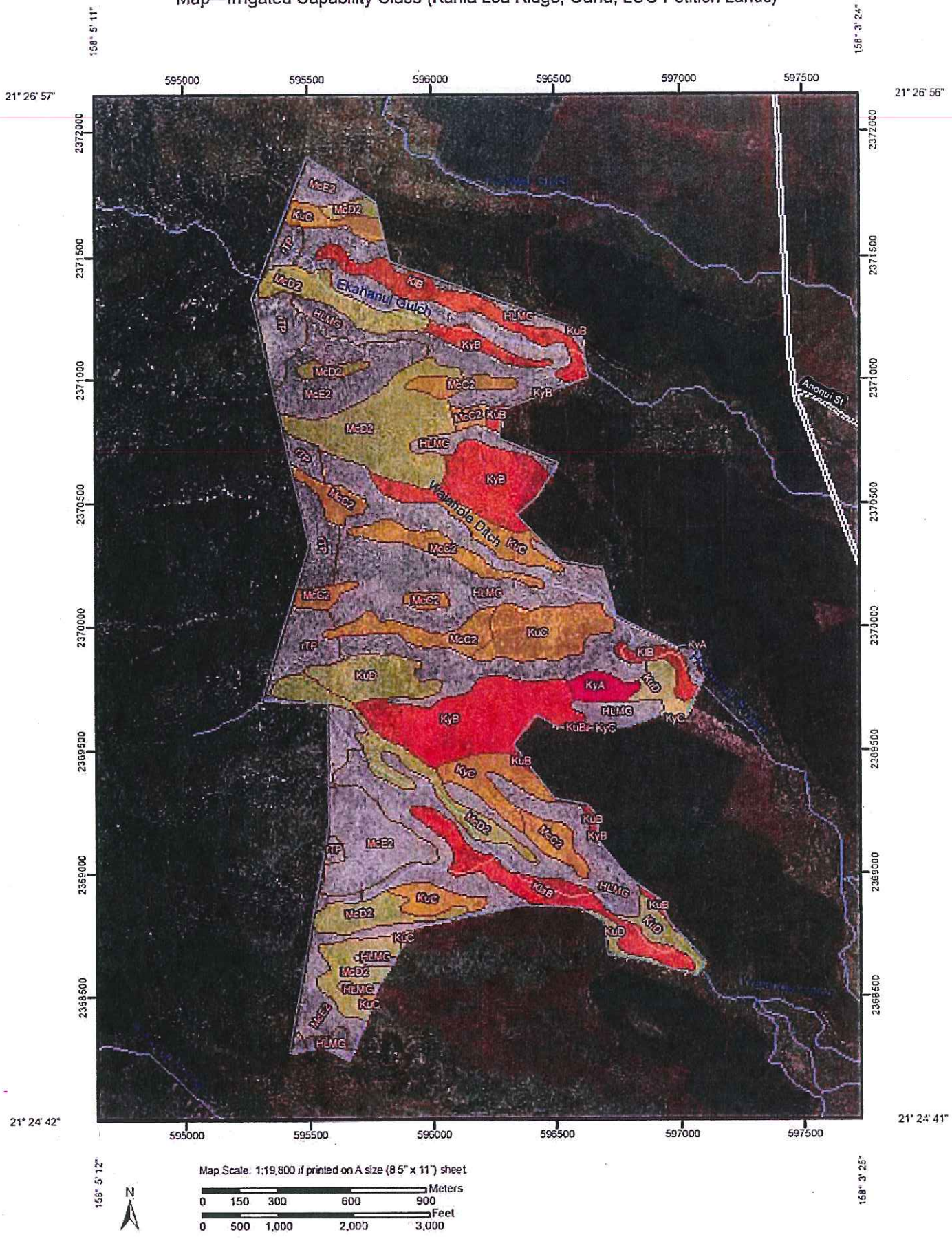
Class 5 soils are subject to little or no erosion but have other limitations, impractical to remove, that restrict their use mainly to pasture, rangeland, forestland, or wildlife habitat.

Class 6 soils have severe limitations that make them generally unsuitable for cultivation and that restrict their use mainly to pasture, rangeland, forestland, or wildlife habitat.

Class 7 soils have very severe limitations that make them unsuitable for cultivation and that restrict their use mainly to grazing, forestland, or wildlife habitat.

Class 8 soils and miscellaneous areas have limitations that preclude commercial plant production and that restrict their use to recreational purposes, wildlife habitat, watershed, or esthetic purposes.

Custom Soil Resource Report
Map—Irrigated Capability Class (Kunia Loa Ridge, Oahu, LUC Petition Lands)



MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Units

Soil Ratings
- Capability Class - I
- Capability Class - II
- Capability Class - III
- Capability Class - IV
- Capability Class - V
- Capability Class - VI
- Capability Class - VII
- Capability Class - VIII
- Not rated or not available

Political Features
- Cities

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

MAP INFORMATION

Map Scale: 1:19,800 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 4N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Island of Oahu, Hawaii
Survey Area Data: Version 7, Sep 27, 2012

Date(s) aerial images were photographed: Data not available.

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Table—Irrigated Capability Class (Kunia Loa Ridge, Oahu, LUC Petition Lands)

Irrigated Capability Class— Summary by Map Unit — Island of Oahu, Hawaii (HI990)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
HLMG	Helemano silty clay, 30 to 90 percent slopes		271.1	32.2%
KlaB	Kawaihapai stony clay loam, 2 to 6 percent slopes	2	25.6	3.0%
KlB	Kawaihapai clay loam, 2 to 6 percent slopes	2	27.4	3.3%
KuB	Kolekole silty clay loam, 1 to 6 percent slopes	2	5.5	0.7%
KuC	Kolekole silty clay loam, 6 to 12 percent slopes	3	50.9	6.0%
KuD	Kolekole silty clay loam, 12 to 25 percent slopes	4	36.6	4.3%
KyA	Kunia silty clay, 0 to 3 percent slopes	1	6.9	0.8%
KyB	Kunia silty clay, 3 to 8 percent slopes	2	84.6	10.0%
KyC	Kunia silty clay, 8 to 15 percent slopes	3	15.5	1.8%
McC2	Mahana silty clay loam, 6 to 12 percent slopes, eroded	3	55.6	6.6%
McD2	Mahana silty clay loam, 12 to 20 percent slopes, eroded	4	118.6	14.1%
McE2	Mahana silty clay loam, 20 to 35 percent slopes, eroded		83.9	10.0%
rTP	Tropohumults-Dystrandepts association		59.8	7.1%
Totals for Area of Interest			841.9	100.0%

Rating Options—Irrigated Capability Class (Kunia Loa Ridge, Oahu, LUC Petition Lands)

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Nonirrigated Capability Class (Kunia Loa Ridge, Oahu, LUC Petition Lands)

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a

substitute for interpretations that show suitability and limitations of groups of soils for rangeland, for woodland, or for engineering purposes.

In the capability system, soils are generally grouped at three levels-capability class, subclass, and unit. Only class and subclass are included in this data set.

Capability classes, the broadest groups, are designated by the numbers 1 through 8. The numbers indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class 1 soils have few limitations that restrict their use.

Class 2 soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class 3 soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class 4 soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

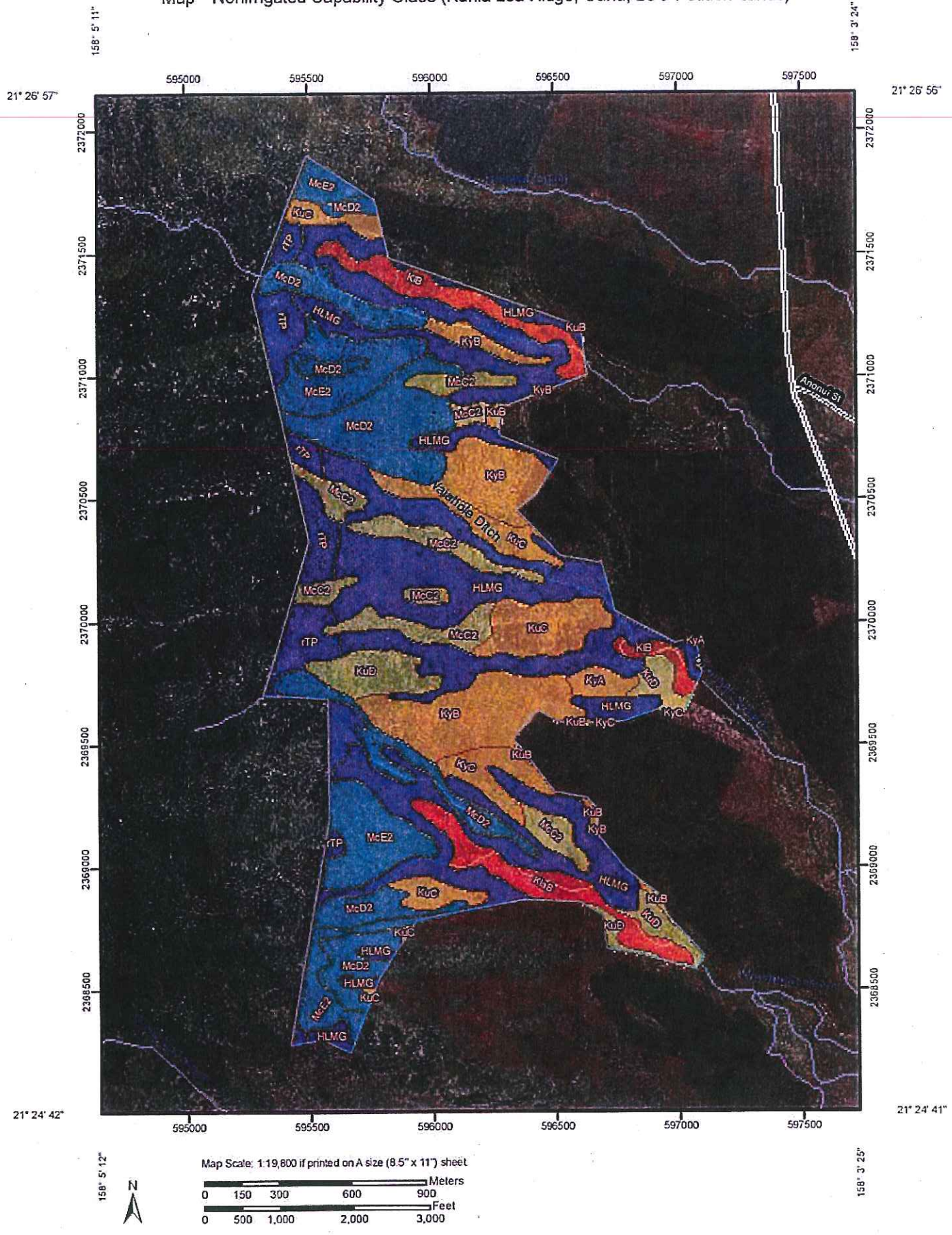
Class 5 soils are subject to little or no erosion but have other limitations, impractical to remove, that restrict their use mainly to pasture, rangeland, forestland, or wildlife habitat.

Class 6 soils have severe limitations that make them generally unsuitable for cultivation and that restrict their use mainly to pasture, rangeland, forestland, or wildlife habitat.

Class 7 soils have very severe limitations that make them unsuitable for cultivation and that restrict their use mainly to grazing, forestland, or wildlife habitat.

Class 8 soils and miscellaneous areas have limitations that preclude commercial plant production and that restrict their use to recreational purposes, wildlife habitat, watershed, or esthetic purposes.

Custom Soil Resource Report
Map—Nonirrigated Capability Class (Kunia Loa Ridge, Oahu, LUC Petition Lands)



MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Units

Soil Ratings
- Capability Class - I
- Capability Class - II
- Capability Class - III
- Capability Class - IV
- Capability Class - V
- Capability Class - VI
- Capability Class - VII
- Capability Class - VIII
- Not rated or not available

Political Features
- Cities

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

MAP INFORMATION

Map Scale: 1:19,800 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 4N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Island of Oahu, Hawaii
Survey Area Data: Version 7, Sep 27, 2012

Date(s) aerial images were photographed: Data not available.

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Table—Nonirrigated Capability Class (Kunia Loa Ridge, Oahu, LUC Petition Lands)

Nonirrigated Capability Class— Summary by Map Unit — Island of Oahu, Hawaii (HI990)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
HLMG	Helemano silty clay, 30 to 90 percent slopes	7	271.1	32.2%
KlaB	Kawaihapai stony clay loam, 2 to 6 percent slopes	2	25.6	3.0%
KlB	Kawaihapai clay loam, 2 to 6 percent slopes	2	27.4	3.3%
KuB	Kolekole silty clay loam, 1 to 6 percent slopes	3	5.5	0.7%
KuC	Kolekole silty clay loam, 6 to 12 percent slopes	3	50.9	6.0%
KuD	Kolekole silty clay loam, 12 to 25 percent slopes	4	36.6	4.3%
KyA	Kunia silty clay, 0 to 3 percent slopes	3	6.9	0.8%
KyB	Kunia silty clay, 3 to 8 percent slopes	3	84.6	10.0%
KyC	Kunia silty clay, 8 to 15 percent slopes	3	15.5	1.8%
McC2	Mahana silty clay loam, 6 to 12 percent slopes, eroded	4	55.6	6.6%
McD2	Mahana silty clay loam, 12 to 20 percent slopes, eroded	6	118.6	14.1%
McE2	Mahana silty clay loam, 20 to 35 percent slopes, eroded	6	83.9	10.0%
rTP	Tropohumults-Dystrandepts association	7	59.8	7.1%
Totals for Area of Interest			841.9	100.0%

Rating Options—Nonirrigated Capability Class (Kunia Loa Ridge, Oahu, LUC Petition Lands)

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Soil Reports

The Soil Reports section includes various formatted tabular and narrative reports (tables) containing data for each selected soil map unit and each component of each unit. No aggregation of data has occurred as is done in reports in the Soil Properties and Qualities and Suitabilities and Limitations sections.

The reports contain soil interpretive information as well as basic soil properties and qualities. A description of each report (table) is included.

Land Classifications

This folder contains a collection of tabular reports that present a variety of soil groupings. The reports (tables) include all selected map units and components for each map unit. Land classifications are specified land use and management groupings that are assigned to soil areas because combinations of soil have similar behavior for specified practices. Most are based on soil properties and other factors that directly influence the specific use of the soil. Example classifications include ecological site classification, farmland classification, irrigated and nonirrigated land capability classification, and hydric rating.

Land Capability Classification (Kunia Loa Ridge, Oahu, LUC Petition Lands)

The land capability classification of map units in the survey area is shown in this table. This classification shows, in a general way, the suitability of soils for most kinds of field crops (United States Department of Agriculture, Soil Conservation Service, 1961). Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for forestland, or for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit.

Capability classes, the broadest groups, are designated by the numbers 1 through 8. The numbers indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

- Class 1 soils have slight limitations that restrict their use.
- Class 2 soils have moderate limitations that restrict the choice of plants or that require moderate conservation practices.
- Class 3 soils have severe limitations that restrict the choice of plants or that require special conservation practices, or both.

- Class 4 soils have very severe limitations that restrict the choice of plants or that require very careful management, or both.
- Class 5 soils are subject to little or no erosion but have other limitations, impractical to remove, that restrict their use mainly to pasture, rangeland, forestland, or wildlife habitat.
- Class 6 soils have severe limitations that make them generally unsuitable for cultivation and that restrict their use mainly to pasture, rangeland, forestland, or wildlife habitat.
- Class 7 soils have very severe limitations that make them unsuitable for cultivation and that restrict their use mainly to grazing, forestland, or wildlife habitat.
- Class 8 soils and miscellaneous areas have limitations that preclude commercial plant production and that restrict their use to recreational purposes, wildlife habitat, watershed, or esthetic purposes.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, 2e. The letter *e* shows that the main hazard is the risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class 1 there are no subclasses because the soils of this class have few limitations. Class 5 contains only the subclasses indicated by *w*, *s*, or *c* because the soils in class 5 are subject to little or no erosion.

Report—Land Capability Classification (Kunia Loa Ridge, Oahu, LUC Petition Lands)

Land Capability Classification– Island of Oahu, Hawaii				
Map unit symbol and name	Pct. of map unit	Component name	Land Capability Subclass	
			Nonirrigated	Irrigated
HLMG—Helemano silty clay, 30 to 90 percent slopes				
	100	Helemano	7e	—
KlaB—Kawaihapai stony clay loam, 2 to 6 percent slopes				
	100	Kawaihapai	2e	2e
KlB—Kawaihapai clay loam, 2 to 6 percent slopes				
	100	Kawaihapai	2e	2e
KuB—Kolekole silty clay loam, 1 to 6 percent slopes				
	100	Kolekole	3e	2e

Land Capability Classification– Island of Oahu, Hawaii				
Map unit symbol and name	Pct. of map unit	Component name	Land Capability Subclass	
			Nonirrigated	Irrigated
KuC—Kolekole silty clay loam, 6 to 12 percent slopes				
	100	Kolekole	3e	3e
KuD—Kolekole silty clay loam, 12 to 25 percent slopes				
	100	Kolekole	4e	4e
KyA—Kunia silty clay, 0 to 3 percent slopes				
	100	Kunia	3c	1
KyB—Kunia silty clay, 3 to 8 percent slopes				
	100	Kunia	3c	2e
KyC—Kunia silty clay, 8 to 15 percent slopes				
	100	Kunia	3e	3e
McC2—Mahana silty clay loam, 6 to 12 percent slopes, eroded				
	100	Mahana	4e	3e
McD2—Mahana silty clay loam, 12 to 20 percent slopes, eroded				
	100	Mahana	6e	4e
McE2—Mahana silty clay loam, 20 to 35 percent slopes, eroded				
	100	Mahana	6e	—
rTP—Tropohumults-Dystrandepts association				
	50	Tropohumults	7e	—
	30	Dystrandepts	7e	—

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