INTRODUCTION

At the request of the University of Hawai‘i at Hilo, Pacific Consulting Services, Inc. (PCSI), is initiating community consultation for a Cultural Setting Report (CSR) being prepared for the decommissioning of the Hōkū Ke‘a Observatory. The University of Hawai‘i leases the approximately 11,288-acre Mauna Kea Science Reserve (MKSR; Lease No. S-419) from the State of Hawaii Department of Land and Natural Resources. The Hōkū Ke‘a Observatory is located inside the approximately 525-acre Astronomy Precinct, which is within the MKSR (Figures 1 and 2). The project proponent is the University of Hawai‘i at Hilo. The project goals are to remove the Hōkū Ke‘a Observatory and Generator buildings (Figure 3), including foundations and associated subsurface utilities, and restore the approximately 2,178-square foot (0.05 acres) site.

A historical, cultural, and archaeological background study, and architectural evaluation will evaluate potential effects on historic properties. This work will be carried out in accordance with Hawaii Revised Statutes (HRS) Chapter 6E, and Title 13 of the Hawaii Administrative Rules (HAR), Subtitle 13 (State Historic Preservation Division Rules), Chapter 275 (Rules Governing Procedures for Historic Preservation Review for Governmental Projects Covered Under Sections 6E-7 and 6E-8, HRS). In the event that adverse impacts are possible because of this project, mitigation measures will be recommended.

HISTORICAL, CULTURAL, ARCHAEOLOGICAL, AND ARCHITECTURAL SUMMARY FOR THE HŌKŪ KE‘A DECOMMISSIONING PROJECT

ENVIRONMENTAL BACKGROUND

Setting

Mauna Kea is the highest (4,205 m [13,796 ft] above sea level [asl]) and second largest of the five shield volcanoes forming the island of Hawai‘i and is between 600,000 and 1.5 million years old (DePaolo and Stolper 1996; Moore and Clague 1992; Sharp and Rene 2005; Wolfe et al. 1997;). The oldest stage of volcanism consists of a basaltic shield called the Hāmākua Volcanic Series (Stearns and Macdonald [1946]) or the Hāmākua Group (Porter 1979a). The most recent stage of volcanism consists of andesitic lavas (Macdonald and Abbott 1970:142; Sherrod et al. 2007; Wolfe and Morris 1996; Wolfe et al. 1997) called the Laupāhoehoe Volcanic Series (Stearns and Macdonald [1946]) or the Laupāhoehoe Group (Porter 1979a) (Figure 4). Even though the last eruption occurred sometime between 4,580 and 8,200 years ago (Sherrod et al. 2007:470), the U.S. Geological Survey (USGS) considers Mauna Kea to be an active post-shield volcano (U.S. Geological Survey 2002).

There are numerous cinder cones and associated lava flows on what is commonly known as the summit plateau (Figure 5). Wentworth and Powers (1941:1197) described the plateau as “a rudely circular dome 5 or 6 miles in diameter rising between 500 and 1000 feet per mile to a central area above 13,000 feet.”

The remnants of three or four glacial drift sheets, located above approximately 2,750 m asl [9,000 ft], are present on Mauna Kea (Porter 1972, 1975; Wolfe et al. 1997). Porter (1972, 1975:247) describes the effects of glaciation on the topography of the summit plateau:

> *Behind the belt of end moraines lies a broad zone of dominantly erosional topography irregularly mantled by thin patches of drift. Within this zone, lava-flow surfaces have been abraded into stoss-and-lee forms [“whaleback ridges] or roches moutonees] and are extensively striated, and the flanks of cinder cones have been oversteepened by glacial erosion so they stand at angles of 30 to 34, instead of the more typical 24 to 26.*

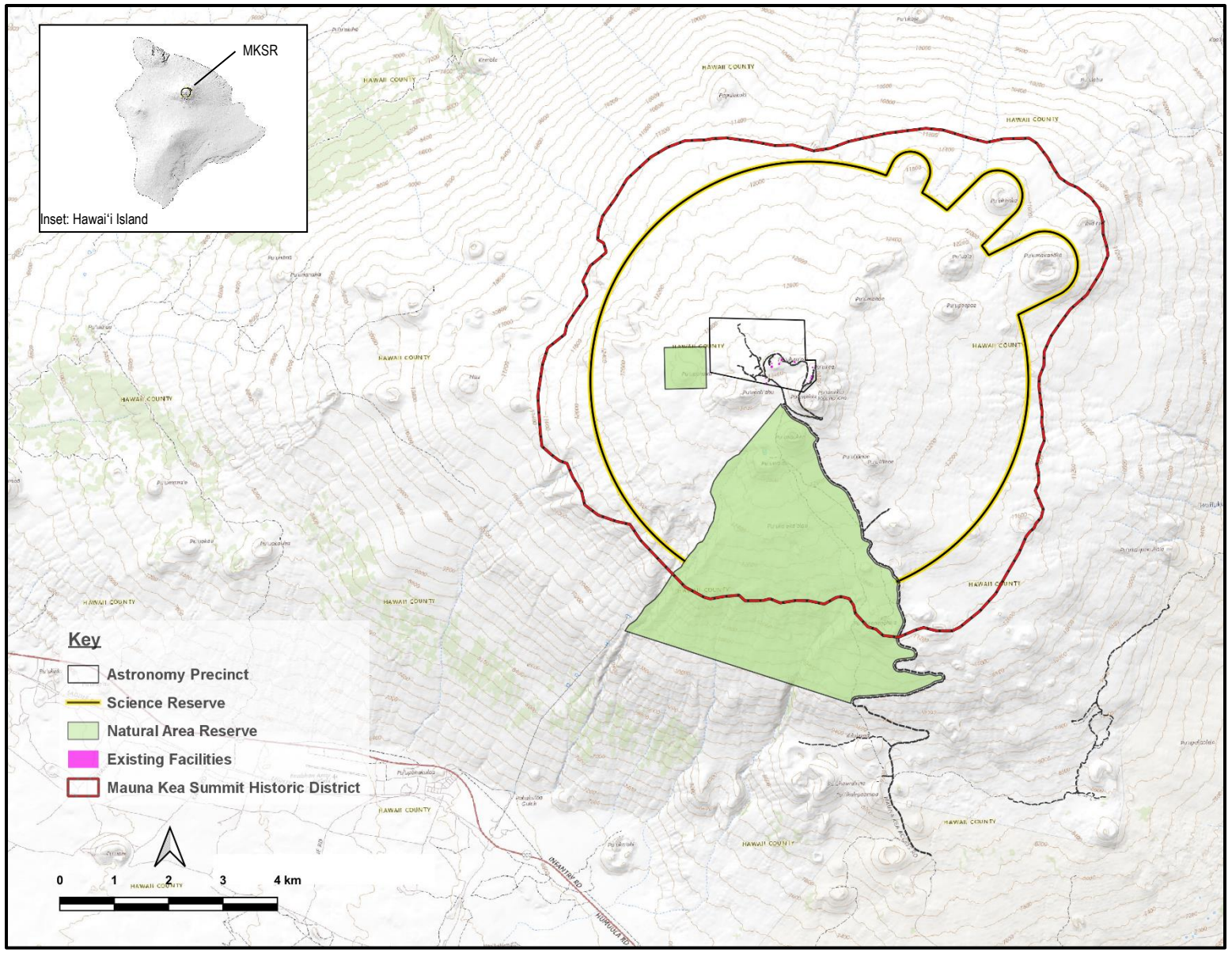

Figure 1. Mauna Kea Science Reserve Shown on the USGS 1:250,000 Topographic Sheet (1975).

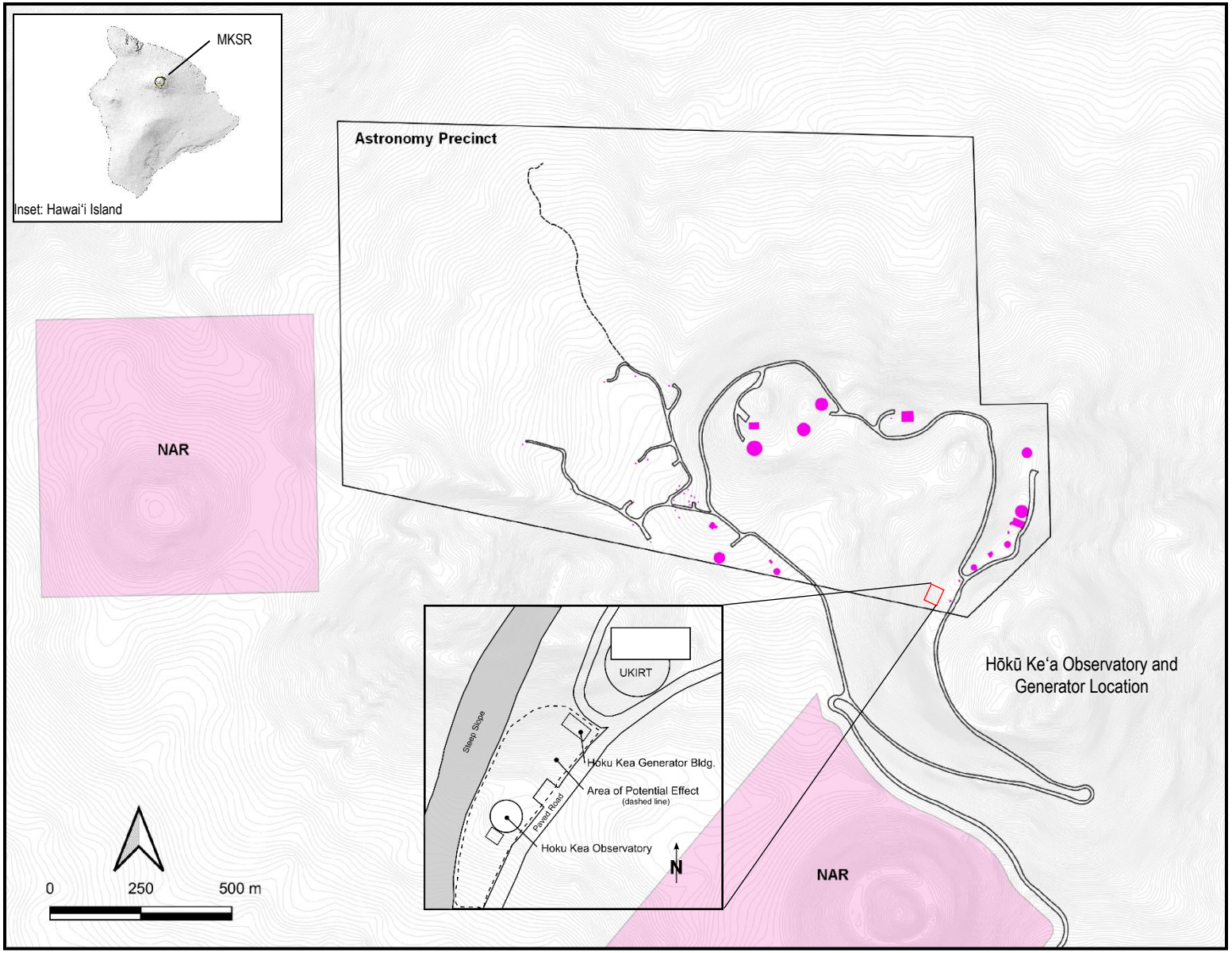

Figure 2. Mauna Kea Summit Region and Astronomy Precinct Showing the Location of the Hōkū Ke'a Observatory and Generator Buildings and APE.

Figure 3. Top: Hōkū Keʻa Observatory, View to the South.
Bottom: Hōkū Keʻa Generator Building, View to the West.

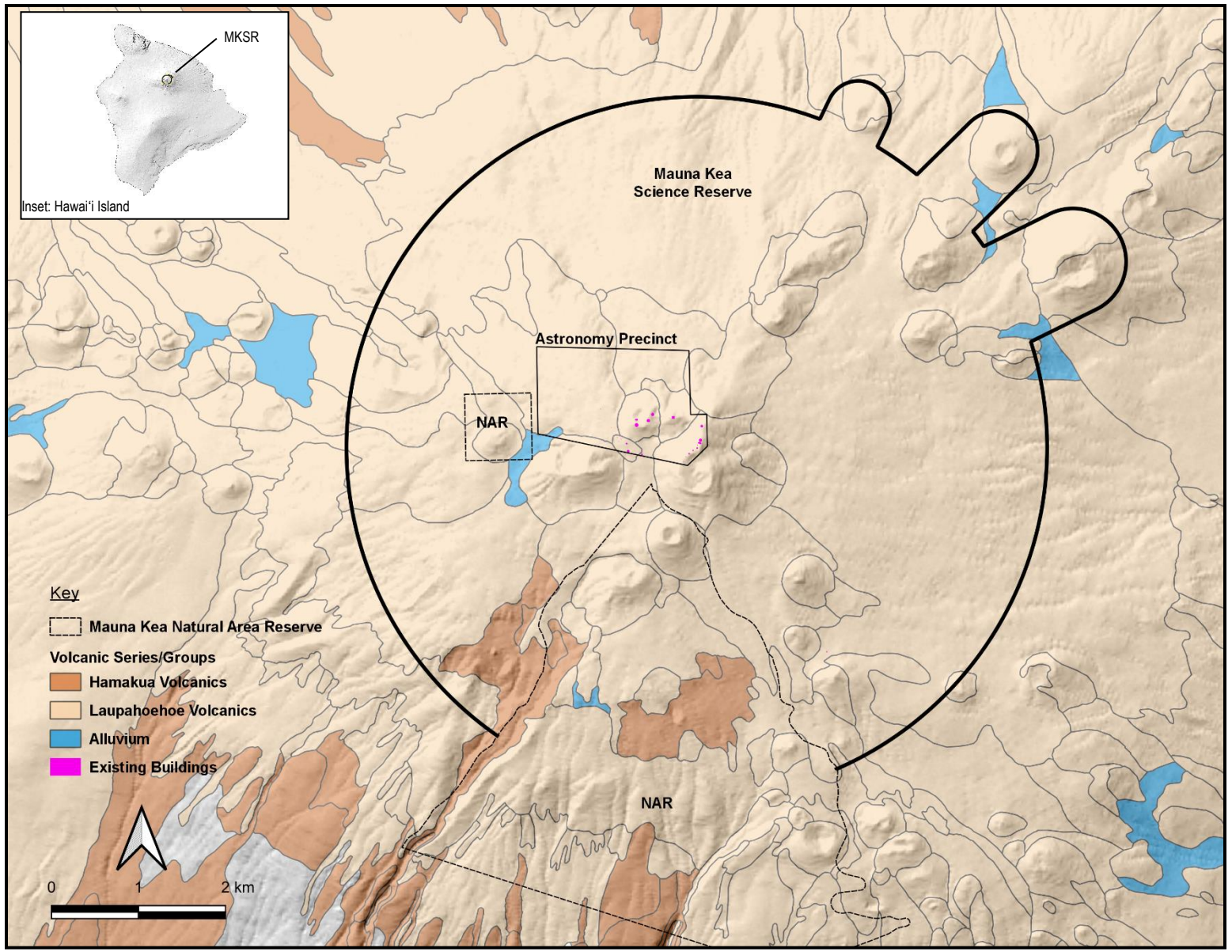

Figure 4. Mauna Kea Summit Region Showing Volcanic Series.

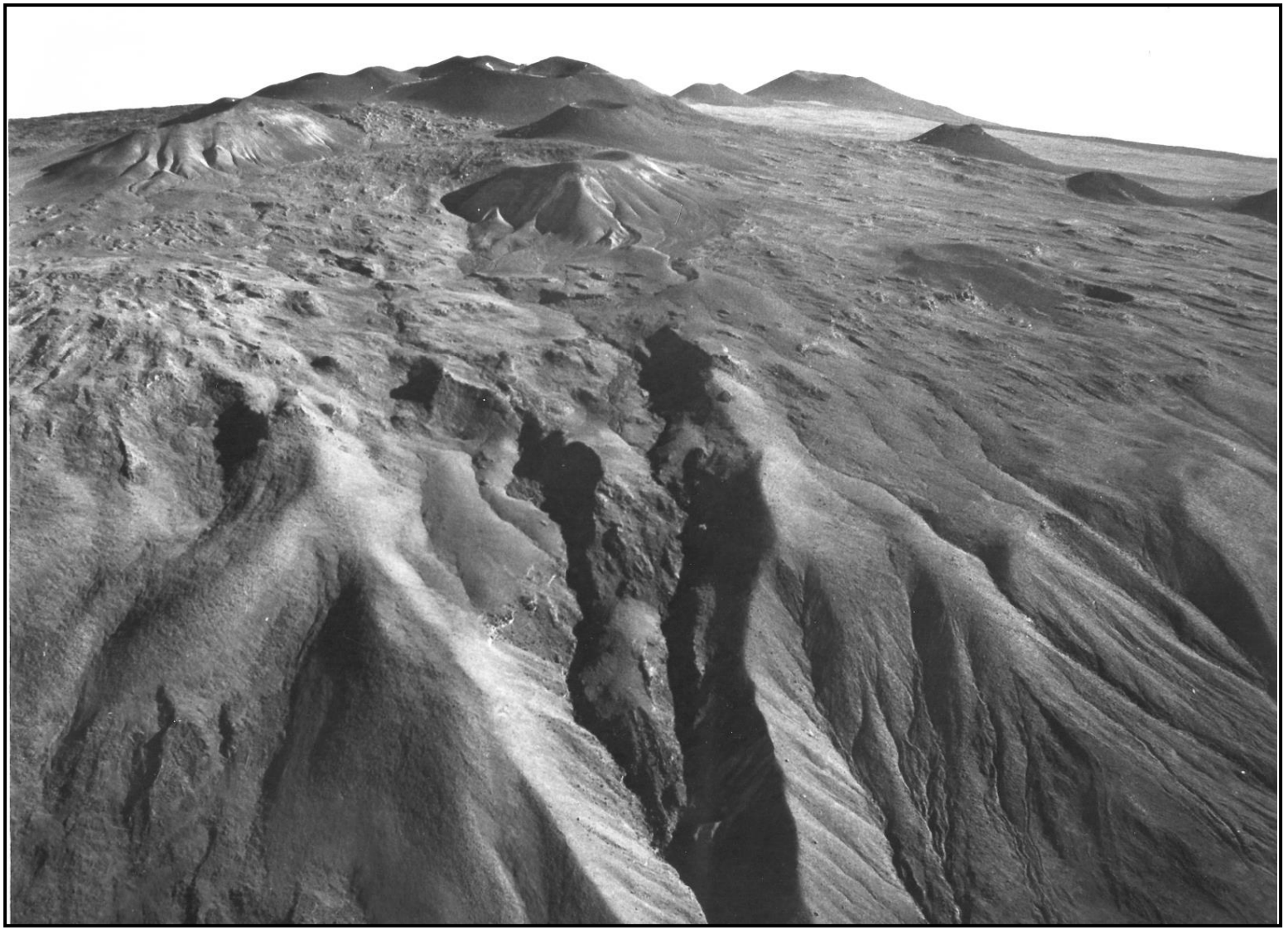

Figure 5. The Summit Plateau Looking Northeast with Pōhakoloa Gulch in the Foreground, Puʻu Kūkahauʻula (summit) at the top center, and Puʻu Makanaka in the Distance.

Climate, Hydrology, Fauna, and Flora

The summit region is dry and cold with little difference in the mean minimum and mean maximum temperature ranges throughout the year. Precipitation at the summit averages approximately 204 mm (8.0 inches) per year (Giambelluca et al. 2014). Prevailing winds at the summit are from the east-northeast.

Lake Waiau, to the southwest of the summit, is the only permanent body of water on the summit plateau (Maciolek 1982). Two intermittent streams, Pōhakuloa Gulch and Waikahalulu Gulch, originate near the lake.

Vegetation above the 3,000 m (9,842 ft) elevation is classified as a semiarid, barren alpine tundra (Krajina 1963) consisting of lichens, mosses, and bunch grasses such as *Trisetum glomeratum* and *Agrostis sandwichensis* (Hartt and Neal 1940; Krajina 1963; Mueller-Dombois and Krajina 1968; Smith, Hoe and O'Connor 1982). A lower xerophytic scrub zone, extending down to 2,100 m (6,890 ft) elevation, is characterized by the presence of *Styphelia douglasii, Vaccinium peleanum* and *Coprosma* spp., in addition to the higher elevation species.

In the summit region there is an "aeolian zone" occupied by a variety of insects (Howarth and Montgomery 1980; Papp 1981) that are believed to have been the only resident fauna in the alpine desert prior to European contact.

HISTORICAL BACKGROUND

McEldowney (1982), Langlas (Langlas et al. 1997; Langlas 1999), Maly (Maly 1998, 1999; Maly and Maly 2005), and McCoy and Nees (2010) have summarized the traditional culture history, traditions, historical accounts, oral histories, and spiritual significance of Mauna Kea's summit region through early journal accounts, maps, ethnographic collections, Boundary Commission testimonies, and oral interviews. McCoy and Nees (2010) summarized the cultural history and previous archaeological work on Mauna Kea. The overview that follows is based on these studies, which should be consulted for more detail.

Summit Place Names, Myths, Legends, and Traditional Histories

Place names in the Mauna Kea summit region are a mix of traditional and modern nomenclature. Mauna Kea has been interpreted literally as White (Kea) Mountain (Mauna), but also as a reference to the union between the gods Wākea and Papa that formed the mountain (Ellis 1979:292). In an account and *mele* of Queen Emma's trip to Lake Waiau in 1881 or 1882, de Silva and de Silva (2007) present details about the names of the mountain and Lake Waiau:

> *Although Maunakea is popularly translated as "white mountain," Kea is also an abbreviated form of Wakea, the sky father who, with Papa, the earth mother, stands at the apex of Hawaiian genealogy. Mauna Wakea is thus viewed traditionally as the sacred meeting point of sky and earth, father and mother, Wakea and Papa. Emma's poets were well-acquainted with the older name and its lasting significance; they refer to Waiau as "ka piko on Wakea"—as the mountain's navel/genital/umbilical/connecting-point/center (de Silva and de Silva 2007: footnote 7).*

The currently used name for the summit is Kūkahauʻula ("Kūkahauʻula of the red-hewed dew or snow"), instead of the formerly used Puʻu Wekiu, and refers to the legendary husband of Līlīnoe and an ʻ*aumakua* (family deity) of fishermen (Hibbard 1999). Maly and Maly (2005:vi) give the name as Puʻu o Kūkahauʻula, which they say was "named for a form of the god Ku, where the *piko* of new-born children were taken to insure long life and safety." According to Maly and Maly (2005:vi):

> *The name Puʻu of Kukahauʻula is the traditional name of the summit cluster of cones on Mauna Kea, appearing in native accounts and cartographic resources until c. 1932. The recent names, Puʻu Wekiu, Puʻu Hauʻoki and Puʻu Haukea, have…been used since the 1960s (since the development of astronomy on Mauna Kea), and have displaced the significant spiritual and cultural values and sense of place associated with the traditional name, Puʻu o Kukahauʻula.*

The names Kūkahauʻula and Līlīnoe are both attributed to cinder cones in the summit region: Kūkahauʻula at the summit and Līlīnoe immediately southeast of the summit cluster. These names, along with that of Waiau, appear on Lyon's 1884 sketch map (Figure 6) and Līlīnoe and Waiau are repeated in the next survey of the summit region in 1892 by Alexander (Figure 7). Kūkahauʻula is given as the name of "the highest peak" even earlier in 1873 land boundary testimonies. Of the place names in the summit region, these three are applied the earliest and most consistently to specific landmarks on the mountain. In compiling the 1892 map of Mauna Kea, W.D. Alexander refers to these as "genuine native names." Lyons' 1891 map (Figure 8) shows "Poliahu?" located east of Līlīnoe, however this location likely refers to a feature other than a peak or cinder cone.

According to Pukui and Elbert (1986:377) Waiau means "swirling water of a current." Maly and Maly (2005:vi) give the following account of Waiau:

> *Waiau, named for the mountain goddess, Waiau (Ka piko o Waiau), and home of the moʻo (water-form) goddess Moʻo-i-nanea. Place where piko of newborn children were taken to ensure long life; and from which "ka wai kapu on Kane" (the sacred water of Kane) was collected. These practices are still participated in at the present time.*

Native Hawaiian traditions state that ancestral *akua* (gods, goddesses, deities) reside within the summit area, physically manifested in earthly form as *puʻu*, and as the waters of Waiau. Native Hawaiian genealogical *mele* (poems, chants) explain the centrality of Mauna Kea within Hawaiian genealogy and cultural geography. *Mele* recount that as a result of the union of Papa and Wākea, who are considered the ancestors of Native Hawaiians, the island of Hawaiʻi was birthed. In the *Mele a Pakuʻi*, a chant describing the formation of the earth, Mauna Kea is likened as the first-born of the island children of Papa and Wākea, who also gave rise to Hāloa, the first man from whom all Hawaiians are descended (Kamakau 1991:126 in Maly and Maly 2005:7-8). A *mele hānau* (birth chant) for Kamehameha III, who was born in 1814, describes the origins of Mauna Kea:

> *Born of Kea was the mountain,*
> *The mountain of Kea budded forth.*
> *Wākea was the husband, Papa*
> *Walinuʻu was the wife,*
> *Born was Hoʻohoku, a daughter,*
> *Born was Hāloa, a chief,*
> *Born was the mountain, a mountain-son of Kea*
> (Pukui and Korn 1973:13-28 in Maly and Maly 2005:9).

Some contemporary Native Hawaiian cultural practitioners continue to view Mauna Kea as a first-born child of Papa and Wākea, and thus, the mountain is revered as "the *hiapo*, the respected older sibling of all Native Hawaiians" (Kanahele and Kanahele 1997 in Langlas 1999:7). Cultural practitioner Kealoha Piscotta explains that this link to Papa and Wākea "is the connection to our ancestral ties of creation" (Orr 2004:61). Pualani Kanakaʻole Kanahele states that "the very fact that it is the 'Mauna a Wākea' tells you that it is the *mauna* that is meeting Wākea" (Maly 1999:A-368).

Traditional genealogical *mele* and *moʻolelo* (stories, traditions) recount associations between Mauna Kea and Poliʻahu, Līlīnoe, Waiau, and Kahoupakane. In a *moʻolelo* recounting the travels of Pūpūkani-ʻoe, it was said that Mauna Kea was a mountain "on which dwell the women who wear the *kapa hau* (snow garments)" (Maly and Maly 2005:31). Another *moʻolelo*, which dates to the 1300s, explains that Ka-Miki was sent atop Mauna Kea's summit to the royal compound of Poliʻahu, Līlīnoe, and their ward, Kapiko-o-Waiau, to fetch water for use in an *ʻai-lolo* ceremony (Maly and Maly 2005:42-43).

In 1931, Emma Ahuʻena Taylor, a historian of Hawaiian descent with genealogical ties to the lands of Waimea and Mauna Kea, reported on Poliʻahu's residence at Mauna Kea, but also described the creation of Lake Waiau. She wrote:

> *Poliahu, the snow-goddess of Mauna-kea, was reared and lived like the daughter of an ancient chief of Hawaii. She was restricted to the mountain Mauna-kea by her godfather Kane. She had a nurse Lihau who never left her for a moment. Kane created a silvery*

Figure 6. Portion of C.J. Lyons 1884 Map Titled *North Side of Mauna Kea Information Sketch*, with Kūkahau'ula, Līlīnoe, and Waiau Highlighted (Hawaii State Archives Registered Map 1210).

Figure 7. Portion of Map Titled *Summit Peaks of Mauna Kea Surveyed by W.D. Alexander* (Hawaii State Archives Registered Map 1860).

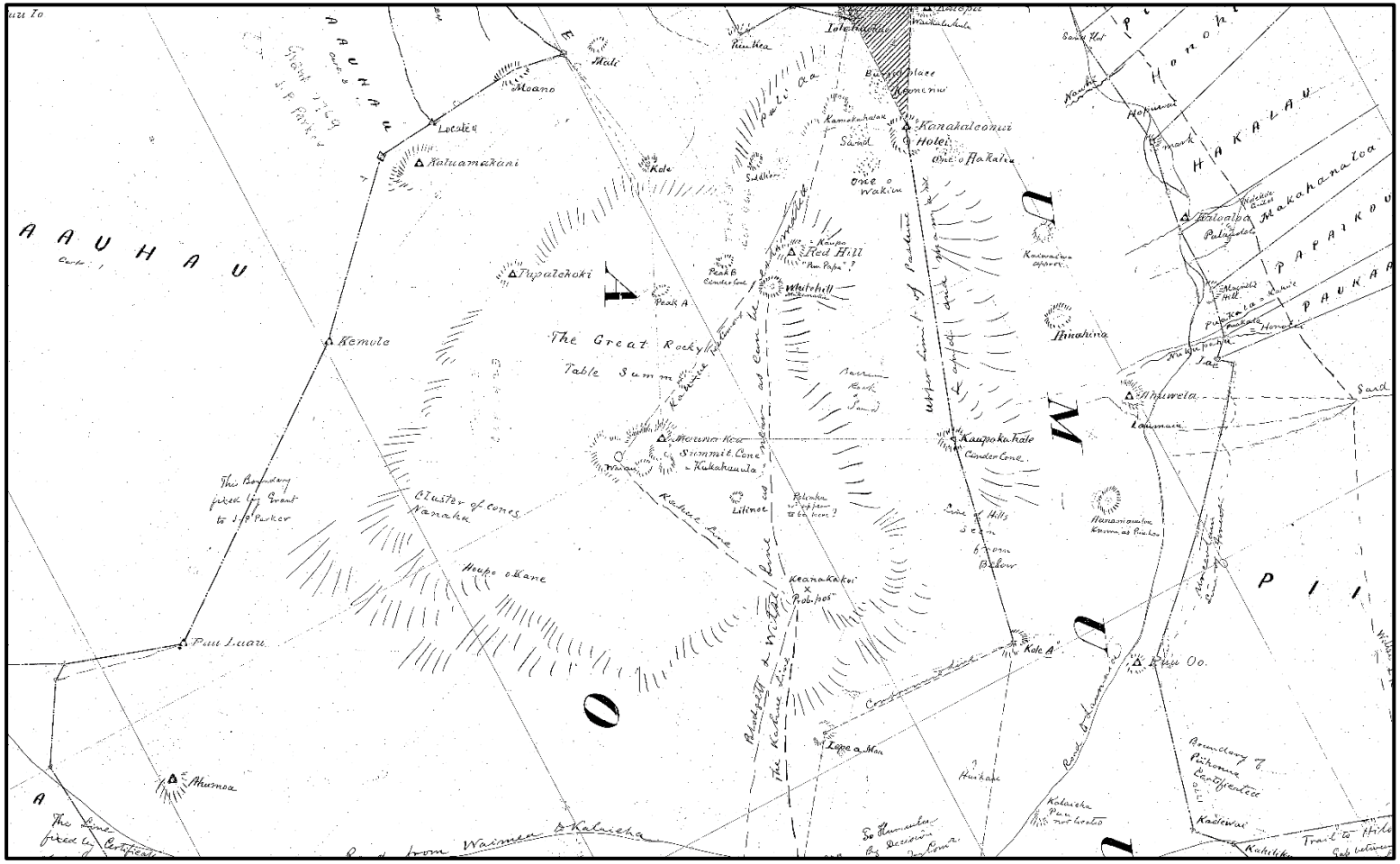

Figure 8. Portion of Map Titled *Kaohe and Humuula Hawaii Government Survey Map by C.J. Lyons 1891* (Hawaii State Archives Registered Map 1641).

swimming pool for his daughter at the top of Mauna-kea. The pool was named Wai-au. The father placed a supernatural guard [Mo`o-i-nanea] at that swimming pool so that Poliahu could play at leisure without danger of being seen by a man… (Maly and Maly 2005:53).

According to Taylor, on Mauna Kea, Poli'ahu's attendants Līlīnoe, Lihau, and Kipu'upu'u drove away her suitor, Kūkahau'ula (the pink-tinted snow god). But Mo'o-i-nanea allowed the snow god to embrace Poli'ahu, and to this day, Taylor reports, "Ku-kahau-ula, the pink snow god, and Poli'ahu of the snow white bosom, may be seen embracing on Mauna-kea" (Maly and Maly 2005:53).

Land Use

The summit of Mauna Kea is located in Ka'ohe Ahupua'a, Hāmākua District. Ka'ohe is a large *ahupua'a* found in what Lyons referred to as the "almost worthless wastes of interior Hawaii:"

Then there are the large ahupuaas which are wider in the open country than the others, and on entering the woods expand laterally so as to cut off the smaller ones, and extend toward the mountain till they emerge into the open interior country; not however to converge to a point at the tops of the respective mountains. Only a rare few reach those elevations, sweeping past the upper ends of all the others, and by virtue of some privilege in bird-catching, or some analogous right, taking the whole mountain to themselves...The whole main body of Mauna Kea belongs to one land from Hamakua, viz., Kaohe, to whose owners belonged the sole privilege of capturing the ua`u, a mountain-inhabiting but sea-fishing bird.

These same lands generally had the more extended sea privileges. While the smaller ahupuaas had to content themselves with the immediate shore fishery extending out not further than a man could touch bottom with his toes, the larger ones swept around outside of these, taking to themselves the main fisheries much in the same way as that in which the forests were appropriated. Concerning the latter, it should here be remarked that it was by virtue of some valuable product of said forests that the extension of territory took place. For instance, out of a dozen lands, only one possessed the right to kalai wa`a, hew out canoes from the koa forest. Another land embraced the wauke and olona grounds, the former for kapa, the latter for fish-line (Lyons 1875:111).

The boundaries of Ka'ohe, as shown on modern maps, are open to question. A map of the adjoining Humu'ula Ahupua'a made by S.C. Wiltse in 1862 (Hawaii State Archives Register Map No. 668) included the adze quarry and Lake Waiau, which was labeled on the map as "Pond Poliahu." Maly and Maly (2005:280-287) note that

By the time the Commissioners of Boundaries were authorized to certify the boundaries for lands brought before them in 1874, disputes over the boundary of Humu'ula and Ka'ohe had arisen…[and]…by the time of settlement in 1891, the boundary of Humu'ula was taken down to around the 9,000 foot elevation, with Ka'ohe taking in the entire summit region.

The testimony of Kahue of Humu'ula, presented in Maly and Maly (2005:287), mentions the boundary running from a gulch called Kahawai Koikapue, where *mele* were sung, to Waiau and then to the summit which was called Pu'uokūkahau'ula. Parenthetically, there is a note that "half of the water in the gulch belonging to Ka'ohe and half to Humu'ula."

In addition to the district and *ahupua'a* system of land tenure, there were other traditional land classifications, including one that employed the term *wao* for a series of natural and cultural zones (Malo 1951:16-18). According to some descriptions, the *wao kanaka* was a low-lying coastal area where the *maka'āinana* were free to move and inhabit. The *wao kele* was the upland forested area that the *maka`āinana* could only access for gathering purposes. The *wao akua*, which was believed to be inhabited by *akua*, was the subalpine desert region above the tree line. The *maka`āinana* were hesitant to venture into the *wao akua* and could do so only by offering prayer and displaying great respect (NASA 2005:3-18, 3-19).

The Mauna Kea summit region is commonly described today as lying within the *wao akua,* which is different, however, from Malo's description of this zone which placed it at a lower elevation in forested lands (Malo 1951:17). As noted in the footnotes to Malo's *Hawaiian Antiquities* (Malo 1951:18), *wao akua* can also be understood to mean "a remote desolate location where spirits, benevolent or malevolent, lived and people did not live. Usually these places were deep interior regions, inhospitable places such as high mountains, deserts and deep jungles. These areas were not necessarily *kapu* but were places generally avoided out of fear or respect" (PHRI 1999, 24). When Rev. William Ellis toured Hawai'i Island in 1823, he noted the reluctance of native Hawaiians to venture into the summit areas of Mauna Kea:

> *…numerous fabulous tales relative to its being the abode of the gods, and none ever approach the summit---as, they say, some who have gone there have been turned to stone. We do not know that any have been frozen to death; but neither Mr. Goodrich, nor Dr. Blatchely and his companion, could persuade the natives, whom they engaged as guides up the side of the mountain, to go near its summit (Ellis 1979:292).*

Although the *ahupua`a* system (including *kapu* restrictions) of land and resource management no longer exists legally, knowledge of some traditional *kapu* have been passed down and endure. In Maly (1999: A-371), Pualani Kanaka'ole Kanahele stated that she learned from her *kūpuna* that the forested regions are not the realm of humans but rather that the forest's *kupa* (citizens) are the trees. Kanahele notes that "when I go *maha`oi* [intrude] in their realm, I have to ask permission to be up there." Likewise, Irene Lindsey-Fergerstrom indicated that in the context of taking *piko* up to the Mauna Kea summit, that her *tūtū* (grandmother) had knowledge of the *kapu* restriction that only *ali`i* were permitted on the summit (Maly 1999:A-390).

During pre-Contact times, the slopes of Mauna Kea, above the limits of agriculture and permanent settlement, were a vast montane "wilderness" probably known to only a small number of Hawaiians engaged in primarily "special purpose" activities such as bird-catching, canoe making, stone-tool manufacture, or burial of the dead (McEldowney 1982); ethnographic information relating to specific activity localities is generally lacking although archaeological evidence provides some evidence of past land use in the form of adze production (primarily at the Mauna Kea Adze Quarry but elsewhere as well), human burial, and the erection of shrines.

Early post-Contact ascents of Mauna Kea by Europeans and Hawaiians occurred throughout the nineteenth century, including Queen Emma's famous visit to Lake Waiau in 1881 or 1882 (de Silva and de Silva 2007). de Silva and de Silva (2007:5) note that

> *the historical record of pilgrimages to Maunakea is not limited to Emma's mele and Phillips's mo'olelo. Steve Desha writes, that as a young man, Kamehameha Pai`ea went to Waiau to pray and leave an offering of 'awa. Kamakau tells us that Ka'ahumanu made the same journey in 1828 in an unsuccessful attempt to retrieve the iwi of her ancestress Lilinoe. Kauikeaouli visited Waiau and the summit in 1830, Alexander Liloliho in 1849 and Peter Young Ka'eo in 1854.*

Cultural Practices and Belief

Cultural practices and beliefs involving Mauna Kea have been changing since the arrival of the earliest Polynesian settlers, an evolutionary process that continues today. Absent a written language, Hawaiian practices and beliefs were originally recorded in chants and oral histories that were passed on from generation to generation for over 1,000 years. The earliest written records of native Hawaiian beliefs and practices were created by European explorers and settlers in the late eighteenth century.

A variety of cultural and religious beliefs and practices pertain to and are occurring on the mountain today. Whereas some traditional and customary Hawaiian practices and beliefs have survived and have gained wider practice in recent generations, other traditional and customary cultural practices and beliefs appear not be in practice. In addition, recent archaeological and ethnographic studies of Mauna Kea show that contemporary practices and beliefs have developed based on modern beliefs or have evolved from a traditional practice or belief. The difficulty in thoroughly documenting cultural practices is increased by the reluctance of some cultural practitioners to describe their practices and beliefs to researchers.

Traditional and customary cultural practices and beliefs have been defined as "those beliefs, customs, and practices of a living community of people that have been passed down through generations, usually orally or through practice" (Parker and King 1998:1; PHRI 1999:1). Traditional and customary cultural practices and beliefs contribute to the maintenance of a community's cultural identity and demonstrate historical continuity through the present. This is demonstrated through actual practice or through historical documentation of a practice or belief, including both written and oral historical sources (Parker and King 1998:1; PHRI 1999:2).

Contemporary cultural practices and beliefs have been defined as "those current practices and beliefs for which no clear specific basis in traditional culture can be clearly established or demonstrated – for example, the conducting of ritual ceremonies at sites or features for which no such prior traditional use and associated beliefs can be demonstrated. In some cases, however, it may be possible to demonstrate the reasonable evolutionary development of a contemporary practice from an earlier traditional practice" (PHRI 1999:3).

Modern-day oral history interviewees have described their knowledge concerning the presence of and meaning of *ahu* and burials in the summit region as well as other cultural practices such as the construction and maintenance of *kūahu* (family shrine), the scattering of cremated remains, *piko* deposition in Waiau*, as* well as navigation and orienteering. Other cultural practices are described in more detail in Maly (1999), Maly and Maly (2005), and Orr (2004), and summarized in McCoy and Nees (2010).

Ahu and Kūahu

Morphologically, *ahu* are a pile or mound of stones that may have served historically as altars or shrines, markers signifying burial locales, *ahupua`a* boundaries, or trail routes; the term *kūahu* refers more specifically to a shrine or alter maintained by a family. In the 1880s and 1890s, two surveyors, J.S. Emerson and E.D. Baldwin, independently denoted various *ahu* located upon *pu'u* in the lowlands surrounding Mauna Kea and the presence of "a pile of stones on the highest point of Mauna Kea" (Maly and Maly 2005:494-502, 505). While Emerson and Baldwin's observations confirm the presence of *ahu* as they are defined morphologically, the surveyors did not specifically assign functional meanings for the *ahu* on Mauna Kea.

Oral history consultants have noted the presence of *ahu* in the summit region and their general function (as described above) without necessarily identifying the specific function of specific *ahu* (Orr 2004:47; Maly 1999:A-134, -372; Maly and Maly 2006:A-183, -335, -349, -565). In 2004 (Orr 2004), Kealoha Piscotta described erecting a *kūahu* on Mauna Kea that consisted of a stone from her family, noting that "it [the place] was very beautiful and I was always attracted to that place. I prayed at that place all the time" (Orr 2004:52). Piscotta also noted that "some of the shrines mark the birth stars of certain *ali`i*…and also birth and death" (Orr 2004:47).

In 1998 the Royal Order of Kamehameha I erected a *lele* (altar) on the summit near Site 26224 (USGS benchmark). While maintaining the same approximate location, the *lele* has been extensively modified over time. The lele is approximately 330 m southeast of the Hōkū Ke'a Observatory.

Piko Beliefs and Practices

The cultural weight that Mauna Kea carries within the Hawaiian community is also evident in the phrase, "*piko kaulana o ka `āina*," which translates as "the famous summit of the land" and is used as a term of endearment (Maly 1999:A-3). However, the phrase also expresses the belief that the mountain is a *piko* (the navel, the umbilical cord) of the island and for this reason it is sacred (Maly 1999:D-20). In this context, the significance of the cultural practice of transporting and depositing a baby's *piko* on Mauna Kea can be understood to connect a child to her family as well as to the land. As noted in Maly (1999) and Maly and Maly (2006), families may entrust a family member to collect *piko* and deposit them in specific locations on Mauna Kea including Lake Waiau, the summit, and springs.

Burial

Some cultural practitioners have knowledge of burials located at a number of *pu'u* on Mauna Kea's western and eastern slopes, including Ahumoa, Kemole, Papalekoki, Pu'umākanaka, Pu'ukihe,

Puʻukanakaleonui, Kaupō, and Puʻuʻōʻō (Maly 1999:A-22, -48, -75, -165, -250, -279, -351, -395, -397) and even connect family and ancestral burials to the mountain (Maly 1999:240).

Scattering cremated ashes today is a contemporary cultural practice that has taken the place of traditional interment practices. Traditionally, cremation was not a common practice in Hawaiian culture, and when it was done it was a punishment and meant to defile the dead person. Writing in the 1830s, native Hawaiian historian David Malo stated that "the punishment inflicted on those who violated the tabu of the chiefs was to be burned with fire until their bodies were reduced to ashes" and that cremation was practiced on "the body of anyone who had made himself an outlaw beyond the protection of the tabu" (Malo 1951:57, 20).

Native Hawaiian historian and ethnologist Mary Kawena Pukui explains why cremation was a defilement "…if the bones were destroyed, the spirit would never be able to join its ʻ*aumakua*" (Pukui et al. 1972:109). Contemporary thought concerning cremation, however, may be changing. Pualani Kanakaʻole Kanahele explained in 1999 that while the scattering of cremation remains on Mauna Kea may be viewed by some as non-traditional, she notes that "…it may not be the *iwi* [bones] itself, but the ashes are the essence of what is left of the *iwi*. It doesn't matter, it's going back" (Maly 1999:A-377).

Navigation/Orienteering

Maly and Maly (2005:95) speculate that it is likely that *kilo hōkū* (observing and discerning the nature of the stars) was practiced on Mauna Kea, as the gods and deities associated with the mountain are also embodied in the heavens, but such accounts are absent from the historical literature. One oral history consultant believed that a platform ("navigational *heiau*") was present on the Mauna Kea summit before the observatories (Maly 1999:A-349).

Another cultural consultant, Kealoha Piscotta, stated that "the lake [Waiau] is like the navigation gourd," a concept which she learned from her auntie (Orr 2004:45). Piscotta also stated that *moʻolelo* passed down from her auntie describe solstice alignments with Mauna Kea and that the solstices were marked from the Mauna Kea summit. Piscotta is interested in understanding how the solstice alignments work and has concerns that the view plane from Mauna Kea has been diminished and obstructed by the leveling of *puʻu* and the erection of observatory domes (Orr 2004:54-55).

PREVIOUS ARCHAEOLOGY

A number of research and cultural resource management studies have been undertaken in the University of Hawaiʻi-managed areas of Mauna Kea. Within the MKSR, which includes the Astronomy Precinct and the Hōkū Keʻa project area, the first systematic archaeological investigations were carried out in 1975-76 in the context of a National Science Foundation funded research project on the Mauna Kea Adze Quarry (McCoy 1977, 1990; Cleghorn 1982; Allen 1981; Williams 1989). Between 1976 and 2005, several site-specific reconnaissance surveys were undertaken (Table 1). Between 2005 and 2010, OMKM undertook a comprehensive archaeological inventory survey (AIS) of the MKSR, recording or re-recording 263 historic properties as summarized in Table 2 (Figure 9). In addition, in accordance with the Mauna Kea Comprehensive Management Plan (CMP 2009) and Mauna Kea Cultural Resource Management Plan (McCoy et al. 2009), OMKM developed a Burial Treatment Plan (Collins et al. 2014) and a Long-Term Historic Properties Monitoring Plan (Gosser et al. 2014) based on the results of the AIS. Since 2012, OMKM has implemented the monitoring program outlined in Gosser et al. (2014). A traditional cultural property assessment (Langlas et al. 1997) has also been conducted in the MKSR.

Table 1. Previous Archaeological Studies in the Mauna Kea Science Reserve

Year	Project	Survey Type	Reference
1975-76	NSF Research Project on the Mauna Kea Adze Quarry	Reconnaissance and inventory	McCoy 1976, 1977; Cleghorn 1982
1981	Kitt Peak National Observatory	Reconnaissance	McCoy 1981
1982	Hawaii Institute for Astronomy	Reconnaissance	McCoy 1982a and McEldowney 1982
1982	Caltech Telescope	Reconnaissance	McCoy 1982b
1983	Mauna Kea Observatory Power Line	Reconnaissance	Kam and Ota 1983
1984	NSF Grant-in-Aid Survey	Reconnaissance	McCoy 1984
1987	Summit Road Improvement	Reconnaissance	Williams 1987; McCoy 1999
1988	VLBA Telescope	Reconnaissance	Hammatt and Borthwick 1990
1990	Subaru Telescope	Reconnaissance	Robins and Hammatt 1990
1990	Gemini Telescope	Reconnaissance	Borthwick and Hammatt 1990
1991	Pu`u Mākanaka	Reconnaissance	McCoy 1999a
1995	SHPD site relocation and GPS recording	Reconnaissance	McCoy 1999a
1997	SHPD transect survey	Reconnaissance	McCoy 1999a
1997	TCP Assessment	Assessment	Langlas et al. 1997
1999	SHPD survey of Pu'u Wekiu	Reconnaissance	McCoy 1999a
2005-2009	OMKM Archaeological Inventory Survey of MKSR	AIS	McCoy and Nees 2010
2012-present	OMKM Assessment of Historic Properties in the MKSR	Assessment	Gosser and Nees 2014, 2015, 2016, 2017, 2018, 2019

Summary Description of Historic Properties

While no above-ground archaeological sites have been recorded within the Hōkū Keʻa Observatory project area, four primary types of historic properties have been recorded in the MKSR: (1) shrines; (2) adze manufacturing "workshops"; (3) burials; (4) and probable survey markers. Each type of property is briefly described below. Table 2 summarizes the number and variety of historic property types found in the Science Reserve. The summary includes two previously identified traditional cultural properties, and 261 examples of what are commonly called archaeological sites.

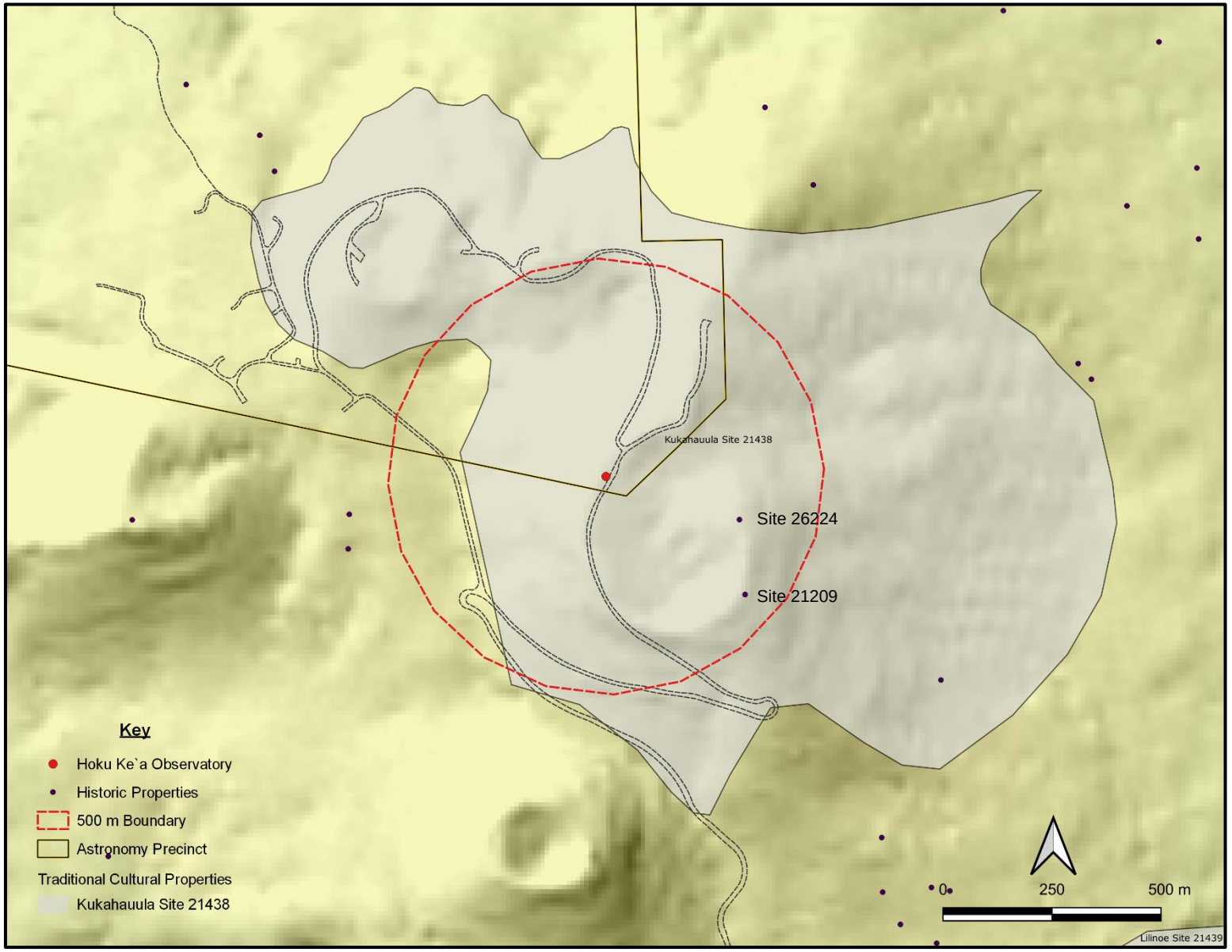

Figure 9. Mauna Kea Summit Region Showing Traditional Cultural Properties and Historic Properties Within 500 meters of the Hōkū Keʻa Observatory.

Table 2. Historic Property Types in the MKSR

Site Type	Number	Percent Total
Traditional Cultural Properties	2	0.76
Shrines and Possible Shrines	141	53.41
Mauna Kea Adze Quarry Complex Sites	67	25.38
Burials and Possible Burials	29	10.98
Stone Markers/Memorials	15	5.68
Temporary Shelters	3	1.14
Historic Campsites	2	0.76
Historic Transportation Route	1	0.38
Maunakea Summit Region Historic District	1	0.38
Unknown Function	3	1.14
TOTAL	**264**	**100%**

Traditional Cultural Properties

Traditional cultural properties (TCP) are a type of historic property formally defined for the first time in 1998 in National Register Bulletin 38 (*Guidelines for Evaluating and Documenting Traditional Cultural Properties*). A TCP:

> …can be defined generally as one that is eligible for inclusion in the National Register because of its association with cultural practices or beliefs of a living community that (a) are rooted in that community's history, and (b) are important in maintaining the continuing cultural identity of the community (Parker and King:1998:1).

Parker (1993) notes that an important difference between TCP and other kinds of historic properties is that the significance of TCP "cannot be determined solely by historians, ethnographers, ethnohistorians, ethnobotanists, and other professionals. The significance of traditional cultural properties must be determined by the community that values them" (Parker 1993:5).

Dr. Charles Langlas of the University of Hawaii at Hilo conducted a TCP assessment of Mauna Kea in 1997 as part of the cultural resource management studies for the Hawaii Defense Access Road and Saddle Road Project. In 1999-2000, SHPD designated three areas as TCP because of their association with legendary figures and on-going cultural practices. Two TCP (Kūkahau`ula [the summit; 50-10-23-21438] and Puʻulīlīnoe [50-10-23-21439) are in the MKSR; the Hōkū Keʻa Observatory and Generator buildings are within the Kūkahauʻula TCP. A third TCP, Lake Waiau (50-10-23-21440), is located in the Mauna Kea Ice Age Natural Area Reserve.

Shrines and Possible Shrines

Shrines are the most common site type in the MKSR. The primary characteristic of all the sites on Mauna Kea that have been interpreted as shrines is the presence of one or more upright stones that the Hawaiians called ʻ*eho* or *pohaku ʻeho*, which translates as "god-stone" (cf. Andrews 2003; Pukui and Elbert 1971; Buck 1957; Emory 1938). The conventional view of these and other kinds of Polynesian "god-stones" is that they were "places for the gods to inhabit," or "abodes of the gods," as opposed to icons or actual representations of the gods (Best 1976; Buck 1957; Handy 1927).

A number of shrines consist of just a single upright, while others are characterized by multiple uprights arranged in different patterns on a variety of different kinds of foundations. Kenneth Emory, who was the first one to describe the shrines on Mauna Kea and note their East Polynesian affinities, was of the opinion that the uprights represented or symbolized separate gods.

Mauna Kea Adze Quarry Complex

The Mauna Kea Adze Quarry Complex consists of two physically discrete but functionally interrelated parts: (1) the quarry proper, which is defined as the source areas of tool-quality basalt, and (2)

diverse activity remains located outside of the quarry proper as just defined. These include isolated adze manufacturing by-products (e.g., cores, flakes), hammerstones and unfinished adzes in various stages of completion found by themselves and also found with shrines and possible burials. The Mauna Kea Adze Quarry is also a National Historic Landmark.

Burials and Possible Burials

Prior to the 2005-2009 survey (McCoy and Nees 2010), the only positively identified human remains in the MKSR were located on the summit of Puʻumākanaka. Jerome Kilmartin, a surveyor with the United States Geological Survey, noted the presence of human remains on this prominent cinder cone in 1925. The 2005-2009 survey identified 29 sites with a total of 48 features in the MKSR that have been interpreted as burials or possible burials. Of the 48 features, five are confirmed burials and 43 are possible burials. Sites classified as possible burials lack the physical evidence of human bone, but include other physical factors common to burial sites on Mauna Kea including topographic location and architectural characteristics.

Historic Transportation Route

The only direct evidence of the Umi Koa Trail is a single horseshoe found in close proximity to the route shown on the USGS Mauna Kea Quadrangle maps.

Stone Markers/Memorials

One of the more ambiguous classes of sites are piles or stacks of rocks believed to be a marker of some kind or a memorial to some person or event. In all but a couple of cases the actual function is unclear. There are 15 sites that may have been survey markers, piles of stones left by unknown visitors as memorials of their visit to the top of a cinder cone or way-markers along an unmarked trail. The stacked cairns are unlike the piled mounds that have been interpreted as burials. Two of the 15 sites are USGS survey markers, one on the Kūkahauʻula summit, and one on Puʻu Poliʻahu.

Temporary Shelters

The evidence for “habitation” in the MKSR is meager. Crude stone walls have been recorded at various localities in the MKSR, usually in association with other features such as lithic scatters. One walled overhang shelter was found directly below a ridge-top shrine. All of these remains are interpreted as temporary shelters based on their morphology and environmental setting.

Historic Camp Sites

Possibly two camps occupied by the United States Geological Survey (USGS) survey team in 1925 were found on the northern and northeastern slope of the mountain near Puʻumāhoe and Puʻumākanaka. McCoy and Nees (2010) provide additional information concerning the historic camps.

Historic Districts

During the preparation of the 1999 Master Plan for Mauna Kea, SHPD proposed that the cultural landscape on the top of Mauna Kea be recognized as the Mauna Kea Summit Region Historic District (see Figure 1). The historic district proposal was summarized in the cultural impact assessment for the Master Plan (PHRI 1999:30-32) and discussed in more depth as part of the Keck Outrigger project (Hibbard 1999; NASA 2005). The Institute for Astronomy (IfA), NASA, and other parties agreed that the proposed district, which includes all of the Mauna Kea Science Reserve, the DLNR Natural Area Reserve, and additional areas lower on the mountain, meets the eligibility criteria for inclusion on the National Register of Historic Places. The district is now listed in the Statewide Inventory of Historic Places as Site 50-10-23-26869.

Historic Properties Within 500 m of the Hōkū Keʻa Observatory

While there is no formal declaration on how far from a proposed project a project proponent must extend a search for historic properties, a radius of 500 meters was selected for the current project due to the nature of the proposed work, the local landscape, and the abundance of publicly-available supporting literature concerning historic properties in the summit region.

Site 50-10-23-26224

Site 26224 is a USGS marker located on the summit of Kūkahauʻula (Puʻuwekiu). The marker is a brass disc cemented to a metal pole, roughly 10.0 cm in diameter. The marker was unearthed and displaced on the east slope of the puʻu sometime after 2012. The marker was located approximately 2.0 m northwest of a modern shrine, commonly referred to as the “Lele,” discussed above.

Site 50-10-23-21209

Site 21209 was not officially recorded until 1999 (McCoy 1999), but has been known since at least 1935 (Bryan 1979:35). Since 1999, the site has been altered to the point that none of the original features (a mound and an oval alignment) are extant. Photographs from the mid 2000s suggest that rock removed from Site 21209 and surrounding areas has possibly been incorporated into the nearby “lele,”

Described as a possible burial, there is no evidence of a subsurface interment in the absence of the above-ground features. However, over time, charred bone fragments (possibly cremated remains) have been observed between the “lele” and Site 21209.

Site 50-10-23-21438

As shown in Figure 9, Kūkahauʻula has a large, irregular boundary, which was determined based on the geological extent of the three *puʻu* that comprise the summit; there are no human-made above-ground historic properties directly associated with Kūkahauʻula, although the sites noted above are within its boundaries. The northwestern portion of Kūkahauʻula extends into the Astronomy Precinct. All of the observatories at the summit, except for the Caltech Submillimeter Observatory, the James Clerk Maxwell Telescope, and the Submillimeter Array, are within Kūkahauʻula.

3.2.4 Site 50-10-23-26869

As noted above and shown in Figure 1, the Mauna Kea Summit Region Historic District includes all historic properties within the Mauna Kea Science Reserve plus additional properties outside the management control of OMKM. Other than the sites listed above, there are no additional contributing historic properties of SIHP-26869 within 500 m of the proposed project area.

ARCHITECTURE

The two buildings to be demolished as part of the proposed project are historic properties over 50 years old and include the Hōkū Keʻa Observatory, built in 1968, and the Hōkū Keʻa Generator Building, built around 1968. Neither of the buildings are evaluated as eligible for the Hawaiʻi State Register of Historic Places. Despite significance relating to its role as the first telescope put into use at the Mauna Kea Stellar Observatory, and as a component of the "highest stellar observatory in the world", the Observatory has lost integrity due to replacement of the dome, wood interior walls, metal exterior walls, the installation of a new doorway opening, a replaced original door, and removal of both the original (and a second) telescope.

Likewise, the Generator Building that supported the observatory function is also evaluated as not eligible for the Hawaiʻi State Register of Historic Places. It lacks integrity of association, setting, and feeling due to the modifications to the building it originally supported. On its own, and without an eligible property to anchor its significance, it does not have sufficient significance or integrity for listing on the state or national registers.

ANTICIPATED FINDS

Based on the archival background, past land use, previous archaeological studies, and architectural evaluation, it is anticipated that no above-ground or subsurface archaeological resources will be recorded during the Hōkū Keʻa Observatory Decommissioning project, and that no significant historic architectural properties will be impacted.

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