

Figure 85. Aerial view of SIHP # 50-80-08-5593 Features 4A (top left), 4B (lower left), and 4C (upper center) (Google Earth 2020)



Figure 86. Overview of southern portion of SIHP # 50-80-08-5593 Feature 4D, view to northeast (Photo P; Figure 27)

SIHP # 50-80-08-5593 Feature 4E originates at the Waiahole Ditch and extends downslope through the central project area, parallel to a large pipeline connecting the ditch and the mill building at the base of the hill (see Figure 38 and Figure 87). The documented portion of Feature 4E extends for 245.3 m in length and measures on average 6.0 m wide. The road is oriented northwest-southeast and intersects Feature 4F at its northwest end. Feature 4E is immediately adjacent to many of the components of the Feature 2 complex (see Figure 69 and Figure 74). The southern portion of Feature 4E is covered by overgrown vegetation.

SIHP # 50-80-08-5593 Feature 4F originates north of the northern-most corner of the project area and extends along the edge of the northern boundary before crossing through to the southern project area, generally following the trajectory of the Waiahole Ditch (see Figure 38 and Figure 88). The documented portion of Feature 4F extends for 1344.5 m in length and measures on average 6.0 m wide. The road is generally oriented northeast-southwest, though it winds slightly to follow the contours of the landscape. Feature 4F intersects with Feature 4D at its north end, Feature 4E and Feature 4C within the central project area, and Feature 4B in the southern project area.

5.1.3 Significance

SIHP # 50-80-08-5593, historic irrigation system and plantation infrastructure, was previously assessed by Dega et al. (1998) as significant under Hawai'i State historic property significance Criteria a (be associated with events that have made an important contribution to the broad patterns of our history) and d (has yielded, or may be likely to yield, information important for research on prehistory or history).

We concur with this assessment of SIHP # -5593 significance under Criteria a and d. SIHP # -5593 is significant under Criteria a as part of the overall ditch system related to plantation agricultural history. We concur with this assessment of SIHP # -5593 significance under Criteria d for the information it has yielded and may be likely to yield pertaining to plantation agricultural history. Much of the irrigation system has been buried and destroyed by erosion and livestock. The SIHP # -5593 historic property possesses diminished but sufficient integrity of location, design, materials, and workmanship, for which it is significant.



Figure 87. Aerial view of SIHP # 50-80-08-5593 Features 4E (Google Earth 2020)



Figure 88. Overview of SIHP # 50-80-08-5593 Feature 4F, showing Waiahole Ditch running parallel to the access road (right), view to southwest (Photo Q; Figure 27)

NAME:	Waiahole Ditch System			
FORMAL TYPE:	Post-Contact irrigation ditch			
FUNCTION:	Agricultural (plantation irrigation)			
NUMBER OF FEATURES:	11; 7 newly identified (and designated as Feature E through Feature K)			
AGE:	Post-Contact, irrigation ditch from 1916			
SIZE:	22 miles total; approximately 380 linear m within project area			
LOCATION AND DISTRIBUTION:	Extends from the windward side of the Ko'olau Range on to the 'Ewa Plain; within the current project area extends through the western portion			
ТМК:	[1] 9-2-001, 9-2-002, 9-2-003, 9-4-003, 9-4-006, 9-6-005			
LAND JURISDICTION:	State of Hawai'i			
PREVIOUS DOCUMENTATION:	Hammatt and Borthwick 1988; Goodman and Nees 1991; Hammatt et al. 1996; Dega et al. 1998; Tulchin and Hammatt 2004; Hunkin and Hammatt 2009; Tulchin et al. 2009; Groza et al. 2014; Zapor et al. 2018			

5.2 SIHP # 50-80-09-2268 Waiahole Ditch System/ post-Contact Irrigation Ditch

SIHP # 50-80-09-2268 consists of the entire Waiahole Ditch System, a post-Contact irrigation ditch dating from 1916. The historic property spans approximately 22 miles (Figure 89) transporting water from the windward side of the Ko'olau Range through the Ko'olau Range by a system of tunnels, across central O'ahu and on to the 'Ewa Plain (Condé and Best 1973). Approximately 380 linear m of the Waiahole Ditch was identified in the northern and western portions of the project area. The ditch extends along the northern boundary, crossing the central project area as it extends southwest down the natural sloping landscape, exiting the southern boundary and continuing to extend southwest away from the project area (Figure 90).

5.2.1 Overview

Currently, a portion of the Waiahole Ditch remains active (see Figure 89). This active portion begins on the windward side of the island and terminates at Reservoir 155 in Honouliuli. Various features associated with the active portions of the Waiahole Ditch have been identified, including the reservoirs, flumes, sluices, and siphons (Goodman and Nees 1991; Groza et al. 2014; Hammatt and Borthwick 1988; Hammatt et al. 1996; Tulchin et al. 2009). Descriptions of the in-use stretch of the Waiahole Ditch range from a concrete-lined ditch to only a metal siphon structure crossing over gulches.

Remnant, inactive portions of the Waiahole Ditch extend beyond the reservoir. This includes a portion of the main ditch extending west of the reservoir and a portion that originates at the ditch and extends southwest from the reservoir. Several archaeological studies documented this southwest extending inactive portion of the Waiahole Ditch, including the current project (Dega et al. 1998; Hunkin and Hammatt 2009; Tulchin and Hammatt 2004; Zapor et al. 2018).

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Figure 89. Route of the Waiahole Ditch System in relation to the present project area, showing in-use and remnant portions, depicted on a 1992–1999 USGS topographic quadrangle map

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Figure 90. 2013 Ewa and Schofield Barracks USGS topographic quadrangles with the distribution of portions of SIHP # 50-80-09-2268 Feature A through D (identified in previous studies outside the project area, SIHP # 50-80-09-2268 Feature E through Feature K identified within the current project area

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Documented features related to the inactive ditch include flumes, tunnels, walls, drainage channels, sluice gates, culverts, bridges, and one earthen mound, as discussed below. Portions of the remnant portion likely no longer exist or may have been buried. The historic property description presented here focuses on the remnant portion of the Waiahole Ditch, as that is the portion documented within the current project area and immediate vicinity.

Dega et al. (1998) documented remnant portions of the Waiahole Ditch, described as follows:

The ditch was encountered on the western slope of the westernmost gulch which trends north-south through the eastern portion of the property. The major flume crosses the bottom of the gulch through a concrete flume and enters a c. 1000 m long tunnel. A branch within this tunnel is also connected to the Waiahole Ditch System via a more northerly route. This ditch exits the tunnel, crosses the bottom of another smaller gulch through a shorter concrete flume and then enters another tunnel. The ditch follows along the 400 to 440 foot contours in this manner along the eastern and southern slopes of Pu'u Kapua'i and exits the property to the west near Kaloi Gulch. There are, altogether, seven tunnels of various lengths along the ditch within the project area.

The flume itself is 60 cm deep and about 1 m across [...] The sides of the ditches have been shored with stone masonry. The tunnels are 90 cm wide and about 140 cm high. Cement was used to support the sides and roofs of the tunnels only near the entrances. At greater depth within the tunnels cement was used only to shore up the walls. The tunnel roofs in these areas consist of bare rock.

Along the south-facing slope of Pu'u Kapua'i there are segments of the ditch which are lined with concrete and smaller segments lined with corrosive metal. Differing channels appear to divert some of the water to the sugarcane fields which occur at and near the base of the slope. There is also a small, rectangular, concrete basin in this area measuring about 12 by 10 m and 2 m deep which perhaps served to store small quantities of water for later diversion downslope. [Dega et al. 1998:17–18]

Figure 91 shows the section of the flume feature documented by Dega et al. (1998).

5.2.2 Previously Identified Features of the Remnant Portion of SIHP # -2268 outside the **Current Project Area**

Tulchin and Hammatt (2004) described additional remnant portions of the ditch (outside the present project area), describing the components as follows:

The improved ditch appeared to be constructed in a U-shaped configuration, with a flat bottom and nearly vertical sidewalls. However, heavy sedimentation within the interior of the ditch did not allow for direct observation of the base of the ditch. The main constructed portion of the ditch measured 90 cm [centimeter] wide and 1 m [meter] in height. The sidewalls were of cut basalt stone and mortar construction [present Figure 92]. In areas where the ditch was cut deeply into the slope, loosely stacked basalt boulder and cobble retaining walls were constructed along the top edges of the ditch as necessary. The stones composing the retaining wall appeared to be flaked, likely during the fashioning of cut basalt blocks. [Tulchin and Hammatt 2004:52]

AIS for the AES West O'ahu Solar Project, Honouliuli, 'Ewa, O'ahu



Figure 91. Portion of SIHP # 50-80-09-2268 documented by Dega et al. (1998:18)



Figure 92. SIHP # 50-80-09-2268 showing the dressed basalt boulder and mortar Waiahole Ditch (top), and stacked basalt boulder and cobble retaining wall (below) (Tulchin and Hammatt 2004:53)

SIHP # 50-80-09-2268 Feature A, a flume bridge documented by Tulchin and Hammatt (2004), is described as follows:

Near the easternmost point of the project area, the ditch crosses an unnamed drainage gully which empties into Kalo'i Gulch. In order to cross the gully, foundations were constructed at each edge of the gully to support a metal flume section spanning the approximately 4.8 m gap. At the time of the inventory survey, the metal flume was not intact, though remnants were observed in the brush in the immediate vicinity of the structure. Each foundation consisted of a central portion constructed of cut basalt boulders and mortar, measuring 2.8 m wide and a maximum height of 1.8 m [Figure 94 and Figure 93]. In addition to the central stone and mortar constructed portion, additional stacked basalt boulder and cobble retaining walls were constructed along the edges of the gully both up and down slope of the main ditch foundation. The retaining walls extended approximately 7.2 m upslope and 3.4 m down slope of the main ditch foundation. The stones were stacked a maximum of 7-8 courses high, with a maximum height of 2.2 m. The retaining walls were generally constructed of loosely stacked stones, though mortar was observed at the interface between the retaining wall and the ditch foundation, as well as at the down slope terminus of the retaining wall. Wooden fence posts with attached barbed wire were observed to run along the top of the retaining walls and over the ditch foundations. [Tulchin and Hammatt 2004:52]

SIHP # 50-80-09-2268 Feature B identified by Hunkin and Hammatt (2009) is described as follows:

Feature B is an improved drainage channel and short flume section. Feature B is located in the central portion of the project area, where the Waiāhole Ditch crosses a small drainage channel along the Kalo'i Gulch slope. The drainage channel appears to have been improved by excavation of loose soil and stones to improve water flow. Feature B consists of a metal half-pipe flume section constructed over the Waiāhole Ditch [Figure 97 and Figure 98]. The metal flume is constructed of three (3) riveted sections of U-shaped sheets of iron. The flume is oriented perpendicular to the ditch, with the upslope end of the flume located in the center of the drainage channel. The flume is supported on the upslope end by a stone and mortar foundation and retaining walls that direct the water flow from the drainage channel into the flume [Figure 95]. The central portion of the flume is supported by wooden support beams and crossed with wooden cross beams. The down slope portion of the flume rests on the soil berm down slope of the ditch, with a stackedstone retaining wall constructed along the berm in the vicinity of the flume. Down slope of the end of the metal flume section are remnants of a wooden flume that likely connected to the end of the metal flume [Figure 96]. Feature B functions as a drainage improvement associated with the Waiāhole Ditch. The flume collects storm water from an improved drainage channel and transports the water over the ditch and down the gulch slope, thereby reducing damage to and sedimentation of the ditch during periods of heavy rainfall. [Hunkin and Hammatt 2009:47]



Figure 93. Showing the eastern (top, view to east) and western (bottom, view to south) ends of the southern portion of SIHP # 50-80-09-2268 Feature A: flume bridge (Tulchin and Hammatt 2004:55)



Figure 94. Plan view diagram (top) and profile (bottom) of SIHP # 50-80-09-2268 Feature A: flume bridge (Tulchin and Hammatt 2004:54)

AIS for the AES West O'ahu Solar Project, Honouliuli, 'Ewa, O'ahu



Figure 95. SIHP # 50-80-09-2268 Feature B, showing stone and mortar flume support foundation, view to north (Hunkin and Hammatt 2009:50)



Figure 96. SIHP # 50-80-09-2268 Feature B flume, showing wooden flume extension (Hunkin and Hammatt 2009:50), view to southeast



Figure 97. Plan view of SIHP # 50-80-09-2268 Feature B (Hunkin and Hammatt 2009:48)





Figure 98. Photograph (top, view to east) and cross-section map (bottom) of SIHP # 50-80-09-2268 Feature B flume (Hunkin and Hammatt 2009:49)

AIS for the AES West O'ahu Solar Project, Honouliuli, 'Ewa, O'ahu

SIHP # 50-80-09-2268 Feature C, also identified by Hunkin and Hammatt (2009), is described as follows:

Feature C is an improved drainage channel and short flume section, similar to Feature B. Feature C is located where the Waiahole Ditch crosses a small drainage channel, approximately 100 m east of Feature B. The drainage channel appears to have been improved by excavation of loose soil and stones to improve water flow. Feature C consists of a wooden U-shaped flume section constructed over the Waiahole Ditch (Figure 101 through Figure 100). The flume is oriented perpendicular to the ditch, with the upslope end of the flume located in the center of the drainage channel. The flume is supported on the upslope end by a stone and mortar foundation and retaining walls that direct the water flow from the drainage channel into the flume. The downslope portion of the flume rests on the soil berm downslope of the ditch. Feature C functions as a drainage improvement associated with the Waiahole Ditch. The flume collects storm water from an improved drainage channel and transports the water over the ditch and down the gulch slope, thereby reducing damage to and sedimentation of the ditch during periods of heavy rainfall. Due to its wooden construction, much of the Feature C flume has deteriorated. [Hunkin and Hammatt 2009:47]

As noted in Zapor et al. (2018), based upon consultation with SHPD staff and Mr. Shad Kane, the alignment of SIHP # 50-80-09-2268 along the southern slope of Kalo'i Gulch is suggested to be a traditional Hawaiian trail alignment facilitating pedestrian travel from the uplands of Pālehua down to the coast.

SIHP # 50-80-09-2268 Feature D was identified by Zapor et al. (2018) and described as follows:

The newly identified Feature D is a large earthen mound and stacked stone wall [Figure 102 and Figure 103] located in the northeastern portion of the project area running adjacent to SIHP # 50-80-12-6951 and is likely the remnants of the reservoir that can be seen on historic maps at the terminus of the Waiahole Ditch System...Sometime after 1977, the reservoir was filled in with sediment resulting in the current state of Feature D. [draft Zapor et al. 2018:76]

5.2.3 Features of the Remnant Portion of SIHP # -2268 within the Current Project Area

Components related to the Waiahole Ditch were documented within the project area and are discussed below. The Waiahole Ditch and all associated components are related to former water control needs for agriculture in the area.

Several variations of the Waiahole Ditch were observed during the current study. Along the northern boundary of the project area, the ditch consists of a more formal construction, with mortared basalt sides and tunnels (Figure 104 through Figure 107). Concrete-lined portions were also observed at the north edge or just outside of the project area, as were several tunnel entrances and sluice gate features (Figure 107 and Figure 108). Much of the length of the Waiahole Ditch runs underground in concrete-lined tunnels. In the central portion of the project area, the ditch was observed as an informal earthen ditch, largely overgrown (Figure 109). In the southwest portion of the project area, dry-stacked basalt sides were observed (Figure 110 and Figure 111). As

AIS for the AES West O'ahu Solar Project, Honouliuli, 'Ewa, O'ahu



Figure 99. SIHP # 50-80-09-2268 Feature C, view to south (Hunkin and Hammatt 2009:52)



Figure 100. SIHP # 50-80-09-2268 Feature C, showing partially intact wooden flume section, view to south (Hunkin and Hammatt 2009:52)

AIS for the AES West O'ahu Solar Project, Honouliuli, 'Ewa, O'ahu



Figure 101. Plan view of SIHP # 50-80-09-2268 Feature C (Hunkin and Hammatt 2009:51)

AIS for the AES West O'ahu Solar Project, Honouliuli, 'Ewa, O'ahu



Figure 102. SIHP # 50-80-09-2268 Feature D, earthen mound, view to southwest (Zapor et al. 2018:79)



Figure 103. SIHP # 50-80-09-2268 Feature D, stacked stone wall, view to southwest (Zapor et al. 2018:79)



Figure 104. Culvert of SIHP # 50-80-09-2268, Waiahole Ditch, northwest of (outside) the project area, view to southwest (Photo R; Figure 27)



Figure 105. Representative photo of SIHP # 50-80-09-2268, Waiahole Ditch outside (northwest) of the project area, view to east (Photo S; Figure 27)



Figure 106. Portion of SIHP # 50-80-09-2268, Waiahole Ditch outside (north) of project area, with date "1920" inscribed on basalt and mortar culvert, view to northeast (Photo T; Figure 27)



Figure 107. Portion of SIHP # 50-80-09-2268, Waiahole Ditch in northeastern project area (with Feature K), view to southwest (Photo U; Figure 27)



Figure 108. Representative photo of SIHP # 50-80-09-2268, Waiahole Ditch construction along northern edge of the project area, view to west (Photo V; Figure 27)



Figure 109. Representative photo of SIHP # 50-80-09-2268, Waiahole Ditch (left) in central project area, view to southwest (Photo W; Figure 27)



Figure 110. Representative photo of SIHP # 50-80-09-2268, Waiahole Ditch in southwest project area, dry-stacked basalt, view to north (Photo X; Figure 27)



Figure 111. Representative photo of SIHP # 50-80-09-2268, Waiahole Ditch in southwest project area, view to north (Photo Y; Figure 27)

discussed above, there is a formal concrete and mortared cut basalt blocks portion of the ditch with various components for water control, related to the pump station building that is southeast of the project area (see SIHP # 50-80-08-5593 Feature 2A discussion for description).

Portions of the Waiahole Ditch within and surrounding the project area have additional components related to water control including culverts, metal pipes, sluice gates, and bridges. The first designated feature of the Waiahole Ditch for the current project, SIHP # 50-80-09-2268 Feature E, consists of a culvert associated with the ditch, documented in the southwest portion of the project area (Figure 112 through Figure 115). The culvert consists of mortared cut basalt blocks, two to three courses high, constructed around a largely buried concrete drain pipe (see Figure 112). Both sides of the tunnel are faced, and a concrete slab extends over top of the culvert. The concrete slab is approximately 6.5 m long and 1.5 m wide (Figure 113). The faces of the culvert are approximately 3.5 m wide, and the height of the exposed portion is 1.3 m. The observed portion of the mouth of the pipe is 50 cm in diameter. These components are in fair condition. The southeast portion of the concrete slab is damaged due to partial collapse.

SIHP # 50-80-09-2268 Feature F of the ditch system was identified as part of a two-course mortared basalt portion of the ditch in the central portion of the southwest project area (Figure 116 through Figure 121). Feature F consists of a portion of the ditch with pipes, cross beams, and sluice gate components. A metal pipe extends north-south within the ditch, and two metal cross beams extend perpendicular across the ditch face, positioned under the metal pipe directly overlying the ditch surface (see Figure 117). The metal pipe extends beyond both of the cross beams. The metal cross beams are 10 cm wide and are spaced 7.1 m apart. Additionally, a channel extends southeast from the main ditch, which is blocked by a sluice gate feature, the wooden gate of which is still intact (see Figure 118 and Figure 119). The main ditch measures 1.2 m wide, and the channel extending from it is 0.7 m wide, widening to 1.7 m as it extends to the southeast. Depths of the ditch range from 40 to 80 cm, due to the accumulation of sediment in the base of the ditch. The sluice gate component is 0.7 m wide and 0.5 m tall. Notches for a second sluice gate are present in the concrete approximately 12 cm from the intact sluice gate component. The wood of this second sluice feature is no longer intact. Additional sluice notches were noted inside the main ditch as well, approximately 0.5 m southwest of the channel portion. A representative plan view and profile were completed for this section of the ditch (see Figure 120 and Figure 121). All of these components including this portion of the Waiahole Ditch are in fair condition.

SIHP # 50-80-09-2268 Feature G, a second, similar portion of the ditch was documented approximately 18 m northeast of Feature F (Figure 122 and Figure 123). Feature G consists of a mortared cut basalt portion of the ditch, with three pipes (one parallel and two perpendicular), and sluice gate remnants. Here the ditch is oriented north-south and measures 1.3 m wide and ranges from 33 cm to 45 cm deep. Note that much sediment has accumulated in the base of the ditch. A channel extends east off the main ditch which measures 0.7 m wide and 67 cm deep. The same metal pipe detailed above extends parallel along the east edge of the ditch. Additionally, two 5 cm pipes extend perpendicular across the ditch 30 cm north of the east-extending channel, spaced 1.2 m apart. There are notches for two sluice gate features in the east-extending channel.

SIHP # 50-80-09-2268 Feature H consists of a metal drainage flume feature documented in the northern portion of the southwest project area (Figure 125 and Figure 124). Feature H is oriented northeast-southwest and measures 1.1 m wide and 5.0 m long, and a maximum 56 cm

AIS for the AES West O'ahu Solar Project, Honouliuli, 'Ewa, O'ahu



Figure 112. SIHP # 50-80-09-2268 Feature E, culvert and bridge components of the Waiahole Ditch in southern project area, view to northeast



Figure 113. SIHP # 50-80-09-2268 Feature E bridge overlying culvert of Waiahole Ditch in southern project area, view to east



Figure 114. SIHP # 50-80-09-2268 Feature E southwest face of culvert profile



Figure 115. SIHP # 50-80-09-2268 Feature E culvert and ditch plan map

AIS for the AES West O'ahu Solar Project, Honouliuli, 'Ewa, O'ahu



Figure 116. SIHP # 50-80-09-2268 Feature F, basalt and mortar-lined ditch, with metal cross beam (right background), view to north



Figure 117. SIHP # 50-80-09-2268 Feature F, basalt and mortar ditch portion, with metal pipe and cross beam, view to south



Figure 118. Plan view of SIHP # 50-80-09-2268 Feature F, showing pipe, southeast channel, and sluice gate components



Figure 119. SIHP # 50-80-09-2268 Feature F, close-up of southeast channel and sluice gate component, view to north



Figure 120. SIHP # 50-80-09-2268 Feature F, west wall of ditch representative profile



Figure 121. SIHP # 50-80-09-2268 Feature F plan map



Figure 122. SIHP # 50-80-09-2268 Feature G, showing sluice gate component and two metal pipes, view to east



Figure 123. SIHP # 50-80-09-2268 Feature G plan map

AIS for the AES West O'ahu Solar Project, Honouliuli, 'Ewa, O'ahu



Figure 124. Overview of SIHP # 50-80-09-2268 Feature H (left)



Figure 125. SIHP # 50-80-09-2268 Feature H plan map

AIS for the AES West O'ahu Solar Project, Honouliuli, 'Ewa, O'ahu

TMK: [1] 9-2-002:007 (por.)

deep (Figure 126). The flume extends toward a vertical drop, at one time funneling water into the gulch below. A decaying wood portion extends perpendicular over the northeast end of the metal chute. Approximately 20 cm from the wood, a metal pipe extends perpendicular over the top of the flume. At the southwest end of the chute, on the south side, there is a pile of mortar and basalt cobbles measuring 1 m wide and 90 cm tall (Figure 127). The flume extends over top of the Waiahole Ditch.

SIHP # 50-80-09-2268 Feature I consists of a portion of the ditch with several associated features, constructed to carry the water over the gulch in the area. This bridge component has four mortared basalt block pillars (Figure 129 through Figure 131). At one time an elevated metal half pipe connected the pillars, the middle of which appears to have collapsed. In the north end a portion of the metal in between the two pillars was still visible, and an incised line was noted, possibly a former space for a sluice gate or similar component (see Figure 130). The middle portion of this feature has largely collapsed, and with much of the footings obscured by earth. Approximately 3.5 m to the south, a basalt and mortar headwall and culvert were observed, measuring 2.5 m long, 20 cm wide, and 95 cm tall.

SIHP # 50-80-09-2268 Feature J is similar to Feature I, another area of components to carry the ditch over gulches in the area. The first component consists of four mortared basalt block pillars connected by an elevated concrete bridge (Figure 132 through Figure 134). The concrete has been entirely filled in with soil and is overgrown, and portions of the pillars are also obscured. A 12-cm metal pipe extends the entire length of this feature and beyond, resting on top of the *makai*/south pillars. The letters "B M +" are inscribed in the mortared surface of the northwestern pillar. Approximately 2 m east of this bridge component is a culvert constructed of mortared basalt, which measures 55 cm tall and 105 cm wide (see Figure 133). Only 80 cm of length is exposed, the remainder covered with earth; however, the tunnel appears to extend toward the ditch wall. Overall, the bridge components of Features J and K span an area approximately 53 m long.

SIHP # 50-80-09-2268 Feature K of the ditch system consists of a culvert and tunnel feature with intact metal sluice gate, along the northern boundary of the project area (Figure 135 through Figure 136). Feature K extends southeast off the ditch, extending under the access road, though the feature could not be identified on the other side of the road. Two concrete patches were noted in the road, which appear to have been used to cover collapsed portions of the tunnel. It is possible the entire tunnel has collapsed. The observable portion of the feature—from the head gate to the end of the second concrete patch—spans 3 m in length and is a maximum of 0.7 m wide. The first, fragmented concrete slab measures 95 cm long and 75 cm wide. The second concrete slab, which is in the middle of the road, measures 1.6 m long by 0.7 m wide. The head wall of Feature I measures 0.9 m long. Overall the feature is in fair condition, as portions of the concrete are fragmented and collapsing.

5.2.4 Significance

SIHP # 50-80-09-2268, Waiahole Ditch and associated features, has been previously assessed by a variety of studies under various criteria. See Section 7 for a full discussion of prior significance assessments. SIHP # 50-80-09-2268 is assessed as significant under HAR §13-284-6 Criteria a, c, and d. The Waiahole Ditch has yielded information on agricultural history of the area and contributed greatly to the development and evolution of the 'Ewa Plain throughout its history,

AIS for the AES West O'ahu Solar Project, Honouliuli, 'Ewa, O'ahu



Figure 126. SIHP # 50-80-09-2268 Feature H, drainage flume, along north edge of project area, view to northeast



Figure 127. Mortar and basalt pile south end of SIHP # 50-80-09-2268 Feature H, drainage flume, view to west



Figure 128. Collapsed bridge component of SIHP # 50-80-09-2268 Feature I, view to south



Figure 129. Collapsed bridge component of SIHP # 50-80-09-2268 Feature I, view to southwest



Figure 130. Close-up plan view showing metal portion, collapsed bridge component of SIHP # 50-80-09-2268 Feature I



Figure 131. Plan map of SIHP # 50-80-08-2268 Feature I, showing portion of the Waiahole Ditch, collapsed bridge components, and head wall



Figure 132. Overview of bridge component of SIHP # 50-80-09-2268, Feature J, view to southwest

AIS for the AES West O'ahu Solar Project, Honouliuli, 'Ewa, O'ahu TMK: [1] 9-2-002:007 (por.)



Figure 133. Culvert component of SIHP # 50-80-09-2268 Feature J documented east of bridge component, view to north



Figure 134. Plan map of SIHP # 50-80-09-2268 Feature J, bridge component



Figure 135. SIHP # 50-80-09-2268 Feature K, culvert and tunnel feature, view to north



Figure 136. SIHP # 50-80-09-2268 Feature K, showing culvert with intact sluice gate, view to east



Figure 137. Plan map of SIHP # 50-80-09-2268 Feature K

AIS for the AES West O'ahu Solar Project, Honouliuli, 'Ewa, O'ahu

and may continue to yield additional information on plantation-era history on O'ahu. However, within the project area, the historic property only retains sufficient integrity of location, which is also diminished in portions of the project area due to erosion and neglect. While there are some portions that retain some integrity of design, materials, and workmanship within the project area, this integrity is diminished. The overall ditch is significant, however, the remnant portion of SIHP # 50-80-09--2268 within the project area does not retain sufficient integrity to be considered significant under criteria a and c. Since the historic property does provide information, it is considered to be significant under criteria d. Information potential has been documented during the course of this AIS study and will be addressed further in the incorporation into an existing historical context study (Mason Architects, Inc. 2018).

Section 6 Summary and Interpretation

At the request of Tetra Tech, Inc., and on behalf of AES Distributed Energy, CSH has prepared this AISR for the AES West O'ahu Solar project, Honouliuli Ahupua'a, 'Ewa District, O'ahu, TMK: [1] 9-2-002:007 (por.). The project area is on undeveloped lands in the southeastern foothills of the Wai'anae Range, northeast of Pu'u Makakilo and the Makakilo subdivision and about 600 m northwest of the intersection of the H-1 Freeway and the Kualaka'i Parkway.

Background research indicates little traditional land use in the portion of Honouliuli Ahupua'a in which the project area is situated. Large settlements were primarily concentrated near the coast, near marine and estuarine resources, or in the irrigated lowlands suitable for wetland cultivation. Any evidence of traditional land use in the area was likely wiped out by historic agricultural and ranching activities that lasted through the mid-twentieth century. The northeast portion of the project area and much of the surrounding land was occupied by Oahu Sugar Company fields by 1925. The Waiahole Ditch, constructed for much needed irrigation of the sugarcane fields, is known to extend through the current project area. Small plantation-related residential camps were the only settlements found in the upper slopes in the early twentieth century, with "Pump Camp 5" existing within the project area, according to historic maps. Various roads and fence lines related to agricultural and/or ranching activities in the region are known to have existed in the project area at one time. Archaeological studies in the vicinity of the project area have documented various plantation-era historic properties including walls, alignments, mounds, ditches and other irrigation features, as well as portions of the Waiahole Ditch (SIHP # 50-80-09-2268).

Fieldwork included 100% pedestrian inspection of the project area, GPS data collection, and documentation of surface historic properties. The vicinity of the former "Pump Camp 5", indicated on a 1936 U.S. Army map to have included approximately seven houses on the northeast side of the pipeline and 17 houses on the southwest side of the pipeline within the present project area (Figure 16), was a focus of the present AIS fieldwork but no trace of "Pump Camp 5" was observed (no trace of this circa 1936 plantation housing was reported in the Dega et al. 1998 AIS study either).

Two previously identified historic properties were documented within the project area: SIHP # 50-80-08-5593, historic irrigation and plantation infrastructure, and SIHP # 50-80-09-2268, the Waiahole Ditch System. The AIS documented four features of SIHP # 50-80-08-5593: drain-pipes (Feature 1), a complex of components related to the pump house and mill located just southeast of the project area (Features 2A through 2E), temporary water diversion features (Features 3A through 3C), and dirt access roads (Features 4A through 4F). No indications of traditional land use were observed. No remnants of Pump Camp 5 were identified. The majority of the SIHP # 50-80-08-5593 features were identified extending through the northern portion of the project area.

The Waiahole Ditch System (SIHP # 50-80-09-2268) and associated components were identified extending through the western portion of the project area. The AIS documented seven remnant features of SIHP # 50-80-09-2268: a culvert and bridge (Feature E), two ditch portions with metal pipes and sluice gate components (Features F and G), a metal drainage flume (Feature H), two bridge components (Features I and J), and a culvert feature with sluice gate (Feature K). The remnant portion of SIHP # 50-80-09-2268 within the project area is at the far west end of the ditch system. It is not a portion of the continuous transmission line Waiahole Ditch

AIS for the AES West O'ahu Solar Project, Honouliuli, 'Ewa, O'ahu

(most of which is still in use), but rather extends from a reservoir fed directly from the ditch that extends from Windward O'ahu. From the reservoir, Ko'olau water is fed into various ditches. While the remnant of the ditch within the project area is undoubtedly part of the Waiahole Ditch System as a whole, the portion within the project area and its components are in remnant condition. Additional portions of the remnant ditch and associated components are still extant in the vicinity, outside the project area.

The results of this AIS correspond with the history of the slopes of Honouliuli Ahupua'a, representing historic agriculture, ranching, and related activities throughout the twentieth century.

Section 7 Significance Assessments

Historic property significance is evaluated and assessed based on the five State of Hawai'i historic property significance criteria. To be considered significant, a historic property must possess integrity of location, design, setting, materials, workmanship, feeling, and/or association and meet one or more of the following broad cultural/historic significance criteria (in accordance with HAR §13-284-6):

- a. Be associated with events that have made an important contribution to the broad patterns of our history;
- b. Be associated with the lives of persons important in our past;
- c. Embody the distinctive characteristics of a type, period, or method of construction, represent the work of a master, or possess high artistic value;
- d. Have yielded, or is likely to yield, information important for research on prehistory or history; or
- e. Have an important value to the native Hawaiian people or to another ethnic group of the state due to associations with cultural practices once carried out, or still carried out, at the property or due to associations with traditional beliefs, events or oral accounts—these associations being important to the group's history and cultural identity.

Two previously identified historic properties were documented within the project area. Table 4 lists the historic properties along with their significance assessments and specific mitigation commitments. These mitigation commitments are included in this AISR for the review and concurrence of the SHPD.

SIHP # 50-80-08-5593, historic irrigation system and plantation infrastructure, was previously assessed by Dega et al. (1998) as significant under Hawai'i State historic property significance Criteria a (be associated with events that have made an important contribution to the broad patterns of our history) and d (has yielded, or may be likely to yield, information important for research on prehistory or history). We concur with this assessment of SIHP # -5593 significance under Criteria a and d. SIHP # -5593 is significant under Criterion a as part of the overall ditch system related to plantation agricultural history. We concur with this assessment of SIHP # -5593 significance under Criterion d for the information it has yielded and may be likely to yield pertaining to plantation agricultural history. There is presently insufficient information as to whether SIHP # -5593 may also be significant under Criterion c (embodies the distinctive characteristics of a type, period, or method of construction, represent the work of a master, or possess high artistic value). The agreed upon mitigation will clarify this possible significance.

Much of the irrigation system has been buried and destroyed by erosion and livestock. The SIHP # -5593 historic property possesses diminished but sufficient integrity of location, design, materials, and workmanship, for which it's significant. All the features of SIHP # -5593 identified in the project area yielded information during this AIS study. In addition, all the features within the project area have the potential to yield additional information regarding the overall SIHP # -5593 system.

AIS for the AES West O'ahu Solar Project, Honouliuli, 'Ewa, O'ahu TMK: [1] 9-2-002:007 (por.)

SIHP #	Formal Type/ Description	Int	egri	rity					Significance	Mitigation Commitments
		Location	Design	Setting	Materials	Workmanship	Feeling	Association		
50-80-08-5593	Historic irrigation system and plantation infrastructure	Y	Y	N	Y	Y	N	N	a and d	Avoidance of Feature 2A through 2E, no further work for Features 1, 3, and 4, and HAER documentation
50-80-09-2268	Waiahole Ditch System	Y	N	N	Ν	N	N	N	a, c, and d	Avoidance of designated features and incorporation within a historic context study

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Table /I	Archaeological	historic proper	ty integrity	cignificance	and nroiect_c	necitic mitiga	tion commitmente
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SIHP # 50-80-09-2268, The Waiahole Ditch System, has a long history of significance evaluation (Table 5).

• The Bishop Museum Public Archaeology Section Applied Research Group (Goodman and Nees 1991) conducted archaeological reconnaissance and inventory surveys of 3,600 acres in the uplands of Waiawa Ahupua'a, and touched on the Waiahole Ditch (SIHP # 50-80-09-2268) as it crossed their project area (Goodman and Nees 1991:64). The only

discussion of significance is in their statement "The significance of the following sites has been realized through field and archival research and no further work is recommended: State Sites [...] 2268; B4-15 (the Waiahole Ditch)" (Goodman and Nees 1991:137). Thus, while the Waiahole Ditch is assigned an SIHP #, there is really no discussion of significance of the Waiahole Ditch in the Goodman and Nees (1991) study.

- A Hammatt et al. (1996) archaeological inventory survey of 1,339 acres of Castle & Cooke lands within portions of Waipio and Waiawa Ahupua'a discusses that portion of the Waiahole Ditch within the Koa Ridge area west of the H-2 Freeway. At the time of that study, it was anticipated that a portion of the ditch (which conveyed large volumes of water of significant import) would not be impacted. While the significance of the Waiahole Ditch was noted, the significance was not formally evaluated. It was simply asserted that "If the portion of the Waiahole Ditch which crosses the two parcels of the project area is ever to be impacted by future development, the State Historic Preservation Division should be notified beforehand, so that appropriate mitigative measures, if necessary, can be established" (Hammatt et al. 1996:55).
- The Dega et al. study asserts (1998:22), "The Waiahole Ditch System has previously been assessed as significant (see Goodman and Nees 1991)." The Dega et al. study offers no further discussion of the significance of the Waiahole Ditch System (and avoids any substantive comment regarding the conclusion of the referenced Goodman and Nees 1991 study).
- A Tulchin and Hammatt 2004 AIS of an approximately 86-acre proposed Pālehua Community Association project identified a portion of the Waiahole Ditch System. SIHP # 50-80-09-2268 was evaluated as significant under NRHP and HRHP Criteria A and D (Tulchin and Hammatt 2004:65).
- The Tulchin et al. (2009:66–68) archaeological inventory survey addresses that portion of the Waiahole Ditch within the Koa Ridge project area east of the H-2 Freeway crossing a small northern tributary gulch of Pānakauahi Gulch. Two features have been designated for the Waiahole Ditch during the Koa Ridge project (but without any letter or numeric designations): one for the main ditch including both the open ditch and Pānakauahi siphon and one feature designation including two 1-m long basalt boulder support walls.

The 2009 archaeological inventory survey provides the following assessment of significance:

SIHP # 50-80-09-2268 is assessed as significant under Criterion A (associated with events that have made an important contribution to the broad patterns of our history), Criterion C (embody the distinctive characteristics of a type period

AIS for the AES West O'ahu Solar Project, Honouliuli, 'Ewa, O'ahu

Study or Review	General Location	Evaluation in terms of HAR criteria	Evaluation in terms of National/Hawai'i Register of Historic Places (NRHP/HRHP) criteria				
Goodman and Need 1991	3,600 acres in uplands of Waiawa Ahupua'a	Significance not evaluated: "significance [] has been realized through field and archival research and no further work is recommended"					
Hammatt et al. 1996	1,339 acres within portions of Waipio and Waiawa Ahupua'a	Significance not evaluated: "If the portion of the Waiahole Ditch which crosses the two parcels of the project area is ever to be impacted by future development, the State Historic Preservation Division should be notified beforehand, so that appropriate mitigative measures, if necessary, can be established."					
Dega et al. 1998	Proposed University of Hawaiʻi West Oʻahu Campus project	Significance not evaluated: "The Waiahole Ditch System has previously been assessed as significant" (refers to Goodman and Nees 1991)					
Tulchin and Hammatt 2004	86-acres at Pālehua in Makakilo	Not evaluated under HAR criteria	Significant under NRHP and HRHP Criterion A and D				
Tulchin et al. 2009	Koa Ridge project	HAR significance not evaluated	Significant under NRHP and HRHP Criteria A, C, and D				
SHPD acceptance letter for Tulchin et al. 2009	Koa Ridge project	SHPD acceptance letter f	or this study makes no reference to site significance.				
Hunkin and Hammatt 2009	Makakilo Dr Extension project	HAR significance not evaluated	Significant under NRHP and HRHP Criteria A, C, and D				
SHPD review letter for Hunkin and Hammatt 2009	Makakilo Dr Extension project	HAR significance not evaluated	Significant under NRHP and HRHP Criteria A, B, and D				
Shideler and Hammatt 2018	Koa Ridge project	HAR significance not evaluated	Evaluated integrity; supports significance assessment made in Tulchin et al. 2009 as significant under NRHP and HRHP Criteria A, C, and D				

Table 5	Significance	evaluations	for	portions	of the	Wajahole Ditch
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AIS for the AES West O'ahu Solar Project, Honouliuli, 'Ewa, O'ahu

Study or Review	General Location	Evaluation in terms of HAR criteria	Evaluation in terms of National/Hawai'i Register of Historic Places (NRHP/HRHP) criteria
SHPD review letter for Shideler and Hammatt 2018	Koa Ridge project	Assessed as significant pursuant to HAR §13- 284-6 Criteria a, c, and d	NRHP and HRHP significance not addressed
Zapor et al. 2018	Makakilo Dr Extension project	Assessed as significant pursuant to HAR §13- 275-6, under Criteria a, c, and d	Evaluated for listing on the NRHP and HRHP pursuant to 36 CFR 60.4 and HAR §13-198-8

or method of construction), and Criterion D (have yielded, or may be likely to yield information important in prehistory or history) of the National and Hawai'i Registers of Historic Places evaluation criteria. [Tulchin et al. 2009:66]

The integrity of SIHP # 50-80-09-2268, Waiahole Ditch was not assessed at the time of identification (Hammatt et al. 1996:47–50; Tulchin et al. 2009:89–91). The SHPD acceptance letter for this study dated 10 February 2009 (LOG NO. 2009.0605, DOC. NO. 0902WT21) makes no reference to historic property significance.

• An archaeological inventory survey for a Makakilo Drive Extension project (Hunkin and Hammatt 2009) discusses a portion of the Waiahole Ditch and concludes, "The SIHP # 50-80-09-2268 alignment continues to be significant under criteria A, C, and D" with reference to the criteria established for the NRHP and HRHP (Hunkin and Hammatt 2009:65).

The SHPD acceptance letter for this AIS dated 18 August 2009 (LOG NO. 2008.3209, DOC. NO. 0908NM28) asserts that SIHP # 50-80-09-2268, the Waiahole Ditch System is eligible for listing on the NRHP and HRHP under Criteria A, B, and D (the AIS declares significance under Criteria A, C, and D and the acceptance letter specifies A, B, and D).

• A preservation plan for the Koa Ridge project (Shideler and Hammatt 2018) addressed a portion of the SIHP # 50-80-09-2268, Waiahole Ditch System. The report evaluated the significance of the Waiahole Ditch System as follows:

SIHP # -7046 is evaluated as possessing integrity of location, design, materials, and workmanship. The setting is evaluated as lacking integrity as the character of the place as a locus of agriculture has been lost and the vegetation is much different. The feeling of agricultural life of the historic property has been lost. The historic property has lost its association with the events and activities of agriculture.

The relationship of the historic property to the local history of agriculture and the integrity of location, design, materials, and workmanship is evaluated as supporting the site significance assessment made in 2009. [Shideler and Hammatt 2018:20]

So while not spelled out per se in the 2018 preservation plan, the preservation plan supports the significance assessment made in 2009 "assessed as significant under Criterion A\[...] Criterion C [...] and Criterion D of the NRHP and HRHP evaluation criteria."

The SHPD acceptance letter for this preservation plan dated 28 February 2018 (Log No. 2018.00220, Doc. No. 1802JA04) asserts slightly differently that "Site 2268 retains integrity of location, design, materials, and workmanship and is assessed as significant under HAR §13-284-6 Criteria a, c, and d."

• A supplemental archaeological inventory survey for the Makakilo Drive Extension project (Zapor et al. 2018) further documented previously identified components of the Waiahole Ditch and documented one newly identified feature. Zapor et al. (2018) assess the ditch as significant pursuant to HAR §13-275-6, under Criteria a, c, and d.

Based on the findings of this AIS report, SIHP # 50-80-09-2268 is assessed as significant under HAR §13-284-6 Criteria a, c, and d. The historic property has yielded information on the

agricultural history of the area and contributed greatly to the development and evolution of the 'Ewa Plain throughout its history. However, within the project area, the historic property only retains sufficient integrity of location, which is also diminished in portions of the project area due to erosion and neglect. While there are some portions that retain some integrity of design, materials, and workmanship within the project area, this integrity is very diminished. While the overall ditch is significant, the remnant portion of SIHP # 50-80-09-2268 within the project area does not retain sufficient integrity to be considered significant under criteria a and c. Since the historic property does provide information, it is considered to be significant under criteria d. Information potential has been documented during the course of this AIS study and will be addressed further in the incorporation into an existing historical context study (Mason Architects, Inc. 2018).

Section 8 Project Effect and Mitigation Commitments

8.1 Project Effect

Two historic properties (SIHP #s 50-80-08-5593 and 50-80-09-2268) were identified within the project area (the same as identified in a prior Dega et al. 1998 study). Pursuant to HAR §13-284-7, the project-specific effect determination is "Effect, with agreed upon mitigation commitments."

8.2 Mitigation Commitments

In consultation with the SHPD, the agreed upon mitigation commitment is avoidance of adverse impact to the designated features of SIHP # 50-80-09-2268 and SIHP # 50-80-08-5593 Features 2A through 2E within the project area (Figure 138). SHPD shall be consulted should it not be possible to avoid impact to one or more of these features.

Sufficient information regarding the location, extent, function, and age of SIHP # 50-80-08-5593 Features 1, 3, and 4 has been generated by the current archaeological inventory survey investigation to mitigate any effect caused by the proposed project on these features.

Data Recovery in the form of archaeological monitoring will be conducted in the immediate vicinity of "Pump Camp 5" as shown on Figure 16. A monitoring plan in accordance with HAR \$13-279-4 will be prepared for the review and acceptance by the SHPD.

Mitigation will include Historic American Engineering Record (HAER) documentation of SIHP # 50-80-08-5593 Feature 2.

In addition, the portion of SIHP # 50-80-09-2268 within the project area will be incorporated within an existing Addendum to the Waiahole Ditch Historic Context Study (Mason Architects, Inc. 2018).



Figure 138. AES West Oahu Overall Site Plan (supplied by client, dated 1/30/2019) with overlay of historic properties identified within the project area; the features will be designed around for avoidance, and any features that cannot be avoided will be discussed with SHPD.

AIS for the AES West O'ahu Solar Project, Honouliuli, 'Ewa, O'ahu

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