Figure 46. Mill building immediately southeast of the project area boundary (downslope of Feature 2A complex), view to east

Figure 47. Pump House No. 12, southeast of the project area (mill building to the left), view to southeast

SIHP # 50-80-08-5593 Feature 1 consists of plantation-era drain pipes located within a ditch in the northeast portion of the project area (see Figure 42 for location). It is possible this feature was identified during the Dega et al. (1998) study, however, this could not be definitively discerned based on that documentation. The upper/west end of this feature consists of a single observable concrete pipe approximately 35 cm in diameter (the second pipe is likely obscured by collapsed earth) with overlying concrete rubble and stacked basalt, three stones wide and two to three courses high (Figure 48). This upper portion measures 82 cm tall and 90 cm wide. The east/lower end of Feature 1 consists of two steel pipes (Figure 49 and Figure 50), each approximately 35 cm in diameter, and the exposed portions approximately 40 cm tall. The function of this feature is related to agriculture and water control. Feature 1 is in fair condition, as much of the area is overgrown and heavily eroded.

SIHP # 50-80-08-5593 Feature 2 is a complex encompassing six structures (Features 2A through 2F) associated with the mill building and Pump House 12 (see Figure 42 for location, and Figure 51 through Figure 62). The Feature 2 complex begins at the northern boundary of the project area and extends southeast through the central portion of the project area down the natural slope. The complex is made up of six structures designed to move water from the Waiahole Ditch down the hillside to the pump house and mill building. According to Dega et al. (1998), steam engine pumps would disperse the water to sugarcane fields, likely those situated both above and below the pump house and mill. The entire complex measures approximately 240 m in length.

SIHP # 50-80-08-5593 Feature 2A, the uppermost portion of the complex, consists of various water catchment features attached to a portion of the Waiahole Ditch, related to the mill and pump house at the base of the slope (see Figure 51, Figure 52, and Figure 62). This portion is oriented northeast-southwest, and constructed of basalt, concrete, and metal pipes. The Feature 2A complex is situated on the northwest boundary of the project area. Portions of this upper complex contain modern rubbish (modern bottles and cans), as well as a cow skeleton, likely a livestock animal that fell, died, and decayed in place. The northeast portion of this section of the Waiahole Ditch consists of a concrete-lined ditch 140 cm wide and 163 cm deep. As it extends toward the Feature 2A complex, there is an overlying addition of mortared basalt three courses high, a portion of which bears the date inscription “MAR 1939” (Figure 53). The ditch then feeds into a large catchment basin measuring a maximum of 4.0 m long and 3.2 m wide, with a maximum depth of 180 cm. The basin is flanked by notches in the concrete on both sides, for former sluice gates which are no longer intact. The basin would have fed into the two drain pipes at the base of the southeast wall of the structure (Figure 54). These pipes extend down the slope to the pump house and mill. Portions of these pipes are exposed on the slope’s surface, and much of the pipes are likely intact underground.

An additional water retention component is positioned directly northwest of this basin. This portion consists of a rectangular mortared basalt catchment area measuring 5.1 m long by 3.8 m wide (Figure 55), feeding into an oval catchment area measuring 6.3 m long and 2.6 m wide (Figure 56), with notches for a sluice gate feature in between (gate not intact). It is possible these catchment areas are gravel traps, which would have served to trap silt and clay (Reeves 1954). This function is suggested based on the complex shape of the structure, which is somewhat similar to a gravel trap from the Iao-Maniania Ditch pictured in a publication on plantation ditches (Figure 57; Wilcox 1996). Three flumes feed from the upper catchment areas into the Waiahole Ditch (Figure 58 and Figure 59). The flumes are oriented north-south and northwest-southeast. The eastern flume

Figure 48. Upper portion of SIHP # 50-80-08-5593 Feature 1 showing concrete pipes, view to east (collapse to the southwest, at right, may have covered the second pipe)

Figure 49. Lower portion of SIHP # 50-80-08-5593 Feature 1 showing metal pipes, view to northwest

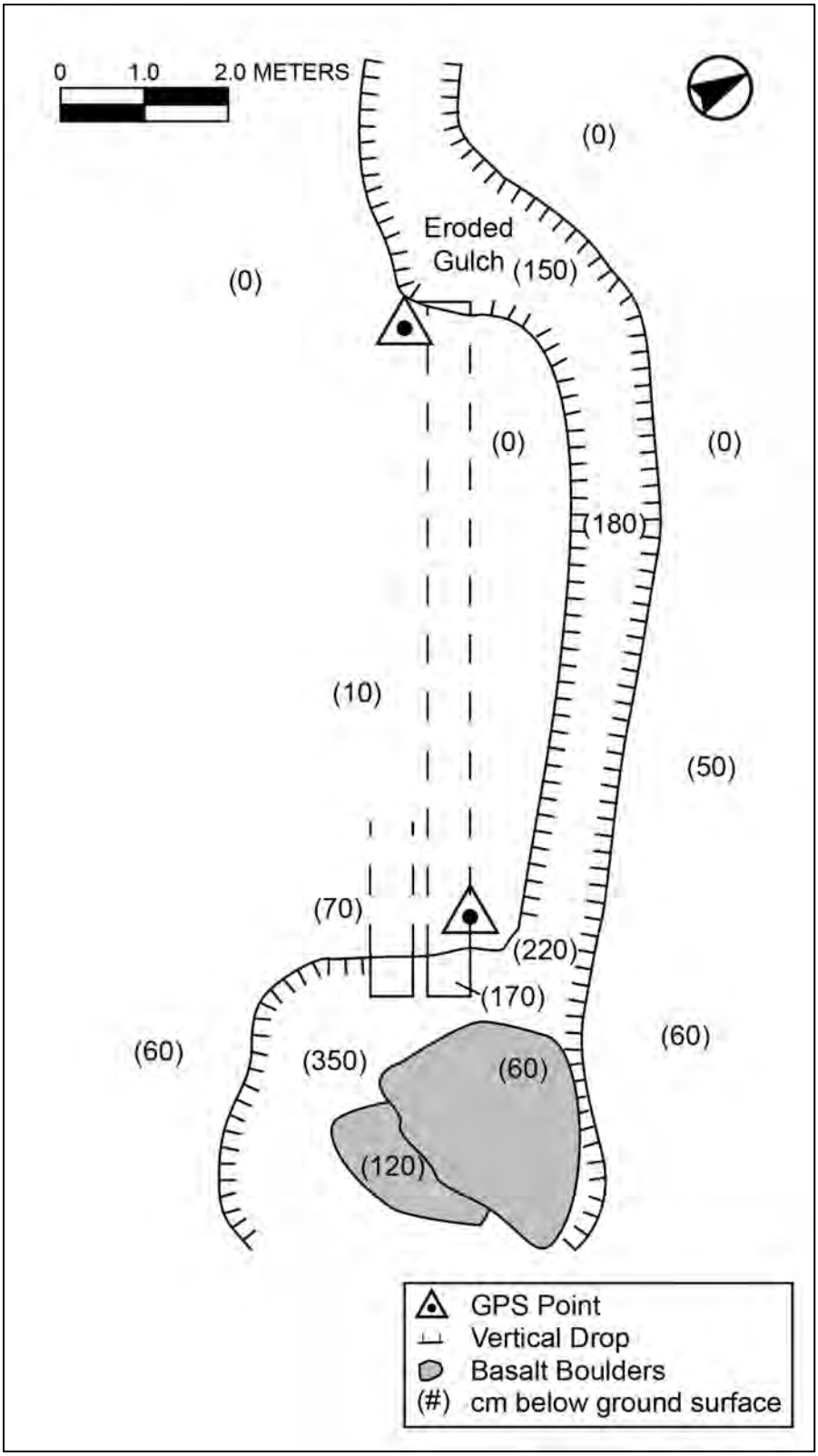


Figure 50. SIHP # 50-80-08-5593 Feature 1 plan map

Figure 51. Overview of SIHP # 50-80-09-2268 Waiahole Ditch portion, and SIHP # 50-80-08-5593 Feature 2A complex, with the pump house and mill building at the base of the slope, view to southeast

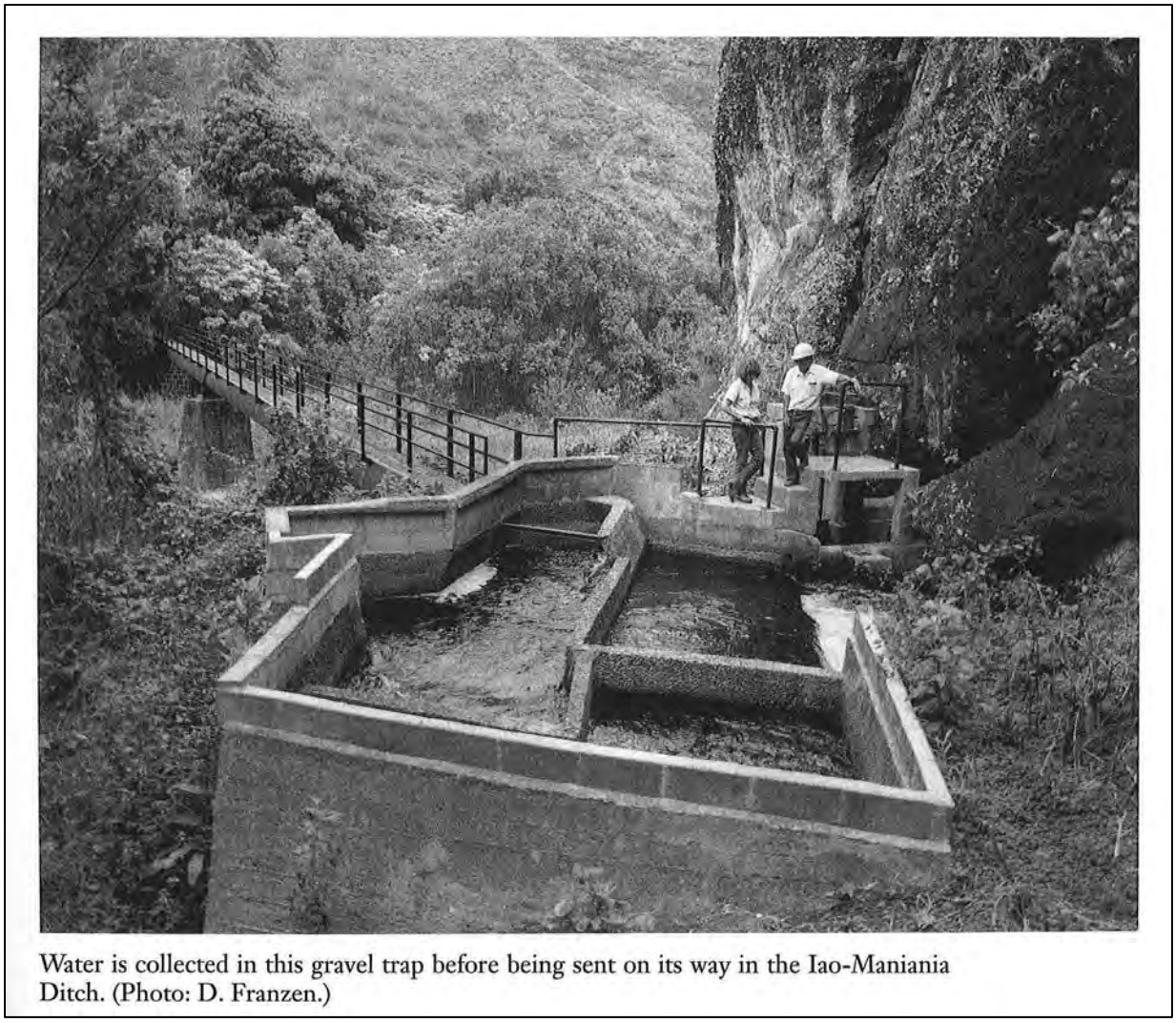
Figure 52. Overview of SIHP # 50-80-09-2268 Waiahole Ditch portion, and SIHP # 50-80-08-5593 Feature 2A complex, view to north

Figure 53. Plan view showing inscription in SIHP # 50-80-08-5593 Feature 2A complex

Figure 54. Overview of SIHP # 50-80-08-5593 Feature 2A and SIHP # 50-80-09-2268 Waiahole Ditch portion, with catchment basin (foreground) and drain pipes, view to east

Figure 55. Upper water retention area of SIHP # 50-80-08-5593 Feature 2A complex, view to west

Figure 56. Upper water retention areas (eastern portion) of SIHP # 50-80-08-5593 Feature 2A complex, view to northeast



Water is collected in this gravel trap before being sent on its way in the Iao-Maniania Ditch. (Photo: D. Franzen.)

Figure 57. Figure showing an example of a gravel trap on the Iao-Maniania ditch system on Maui (from Wilcox 1996:125)

Figure 58. Center flume of SIHP # 50-80-08-5593 Feature 2A complex extending from upper catchment area into SIHP # 50-80-09-2268 Waiahole Ditch, view to west

Figure 59. Overview of SIHP # 50-80-08-5593 Feature 2A complex with eastern flume (right), extending into SIHP # 50-80-09-2268 Waiahole Ditch, view to northwest

Figure 60. Water retention component of SIHP # 50-80-09-5593 Feature 2A complex, view to west

Figure 61. Plan view of SIHP # 50-80-09-5593 Feature 2A complex, water retention component, view to northwest

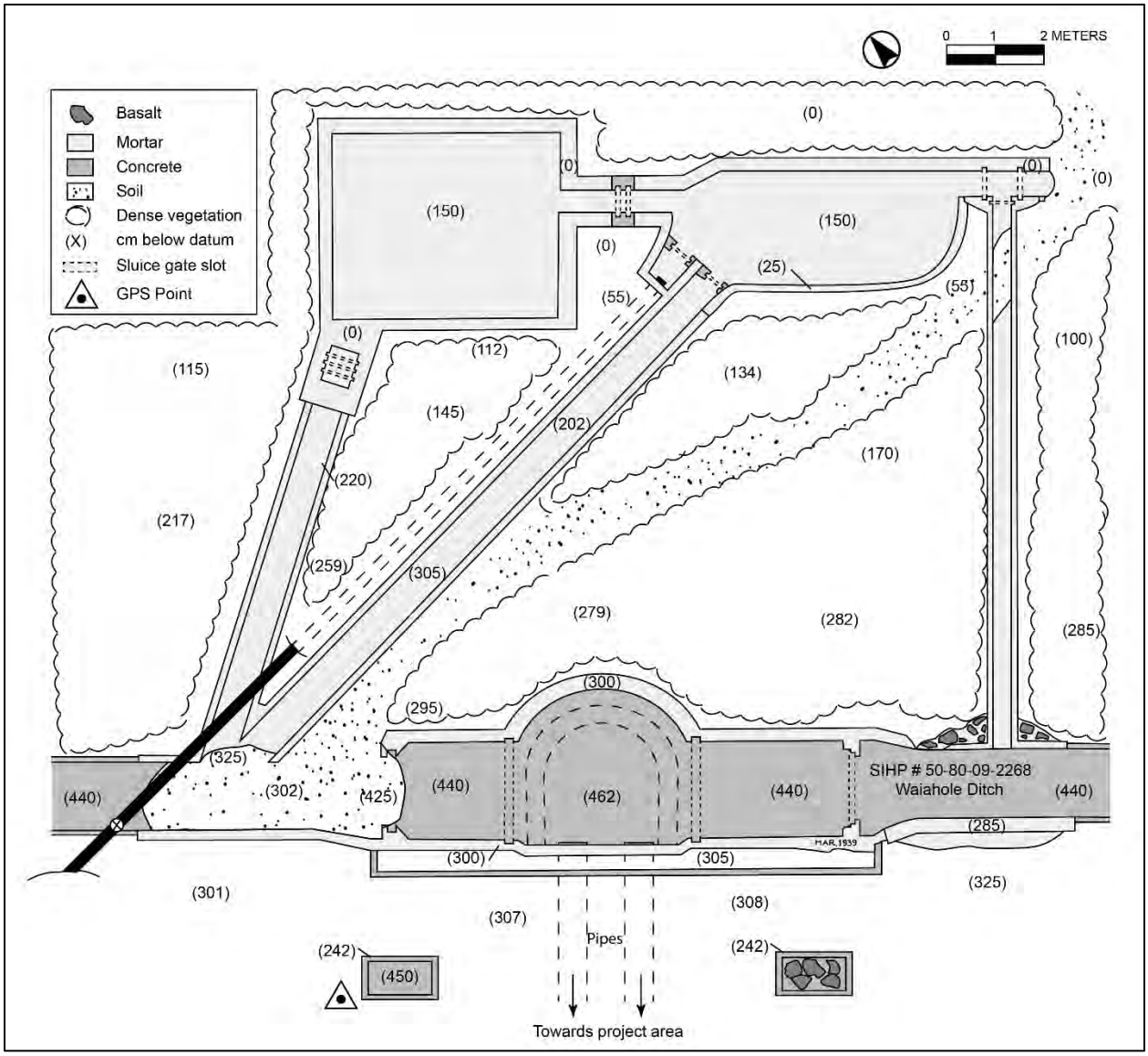


Figure 62. Plan map of SIHP # 50-80-08-5593 Feature 2A water diversion complex (just northwest of project area)

measures 11.0 m long and 0.6 m wide, the center flume measures 12.8 m long and 0.6 m wide, and the western flume measures 7.1 m long and 0.6 m wide.

The final components of the Feature 2A complex are two small rectangular water retention features, each measuring 152 cm long, 90 cm wide, and 118 cm deep, with 16-cm thick walls (see Figure 60). The south wall of the southwest retention feature contains a slit in the concrete that has a wood insert with an attached steel measuring rod (see Figure 61). The wood and steel components no longer exist in the northeast retention feature, but the slit in the concrete remains on the south wall of this component.

Descending the hillside from Feature 2A are various structures related to moving water down to the mill and pump house, including water retention areas, and concrete pads and boxes that housed pumps and pipes.

SIHP # 50-80-08-5593 Feature 2B is a rectangular water retention structure into which water from the upper Feature 2A complex/Waiahole Ditch would have been channeled (Figure 63 through Figure 66). Feature 2B measures approximately 15.2 m long, 10.6 m wide, extends 1.38 m above surface, and is a maximum depth of 3 m deep from top to bottom (see Figure 63 and Figure 64). The main structure, constructed entirely of concrete, consists of a large rectangular structure divided into two open rectangles by a concrete wall extending through the middle. The walls of the structure measure 25 cm wide, and the three northwest-southeast oriented walls have notches cut out of the surface that are 18 cm deep and range from 30 cm to 150 cm long. Two metal pipes extend out of the earth into the northeast half of the structure, at one time transporting water from the upper portion of the complex into this retention feature. Attached to the larger structure is a small rectangular portion, measuring 4.25 m long and 2.05 m wide, and containing a metal rung ladder descending into the structure and several metal pipes, which presumably continued transporting the water down the hillside (see Figure 65).

SIHP # 50-80-08-5593 Feature 2C consists of water tank remnants and related components (Figure 67 through Figure 71). The water tank was constructed of a concrete foundation with a wooden structure held together with steel cables. The wooden structure is no longer in place, leaving behind the 11 steel cables, concrete foundation, and several metal pipes (see Figure 67). The connected circular cable remnants measure a maximum 6.2 m in diameter, and the entirety of the remnants cover an area measuring 7.8 m long and 7.4 m wide. Two concrete squares measuring 80 cm by 80 cm and containing valves were documented immediately southwest of the water tower remnants (see Figure 68). A smaller related structure is 2.6 m northwest of the water tower remnants, which consists of a rectangular concrete structure measuring 3.0 m long and 2.8 m wide (see Figure 69). The northeast half of the structure is a solid concrete slab, and the southwest half of the structure is an open concrete rectangle containing metal pipes. The solid slab likely contains additional pipes related to the water control complex. Another 2.8 m northwest is an additional structure of concrete slabs and pipes, measuring 5.2 m long and 3.8 m wide. Additionally, approximately 7.4 m southwest of the water tower remnants is a damaged concrete component (see Figure 70). This concrete feature consists of three concrete walls—15 cm thick and a maximum 80 cm tall—that have broken and collapsed into a triangle shape. One metal pipe remains inside the collapsed walls. The tank is not noted on the 1943 Army War Department terrain map but appears on the 1953 Ewa and Schofield Barracks topographic quadrangles as a

Figure 63. Overview of SIHP # 50-80-08-5593 Feature 2B, showing dividing wall between two large water storage components, view to northeast

Figure 64. Overview of SIHP # 50-80-08-5593 Feature 2B, showing two large water storage compartments (background) and smaller compartment containing pipes and valves (foreground), view to northwest

Figure 65. Overview of SIHP # 50-80-08-5593 Feature 2B, smaller southeast portion, view to northeast

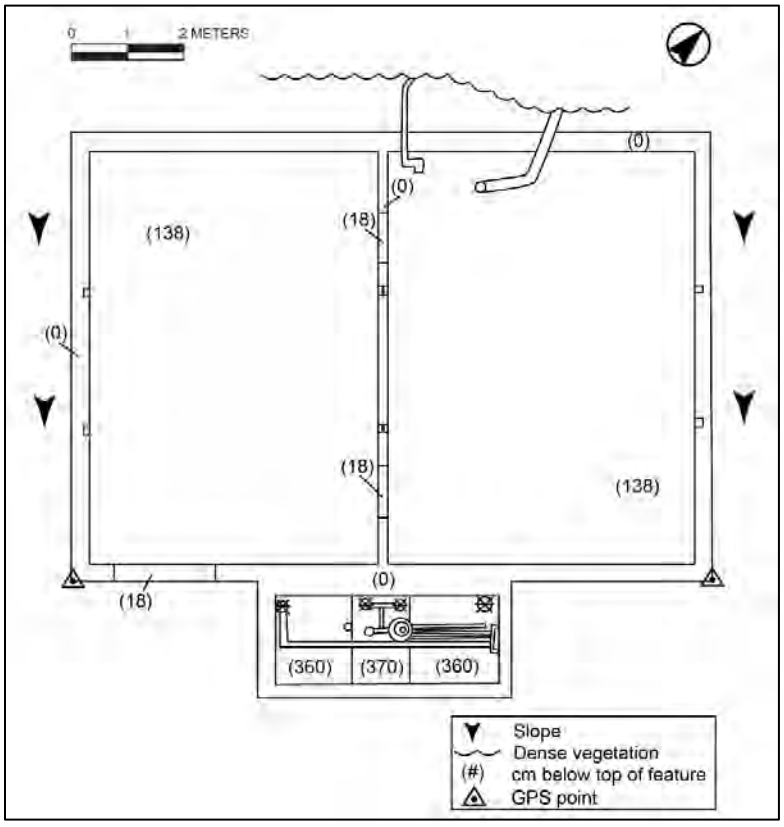


Figure 66. SIHP 3 50-80-08-5593 Feature 2B plan map

Figure 67. SIHP # 50-80-08-5593 Feature 2C, water tank and associated components, view to northeast

Figure 68. Concrete valve components of SIHP # 50-80-08-5593 Feature 2C, view to west

Figure 69. Overview of concrete foundation and pipes component of SIHP # 50-80-08-5593 Feature 2C, view to southeast

Figure 70. Collapsed walls with pipe, component of SIHP # 50-80-08-5593 Feature 2C, view to southeast

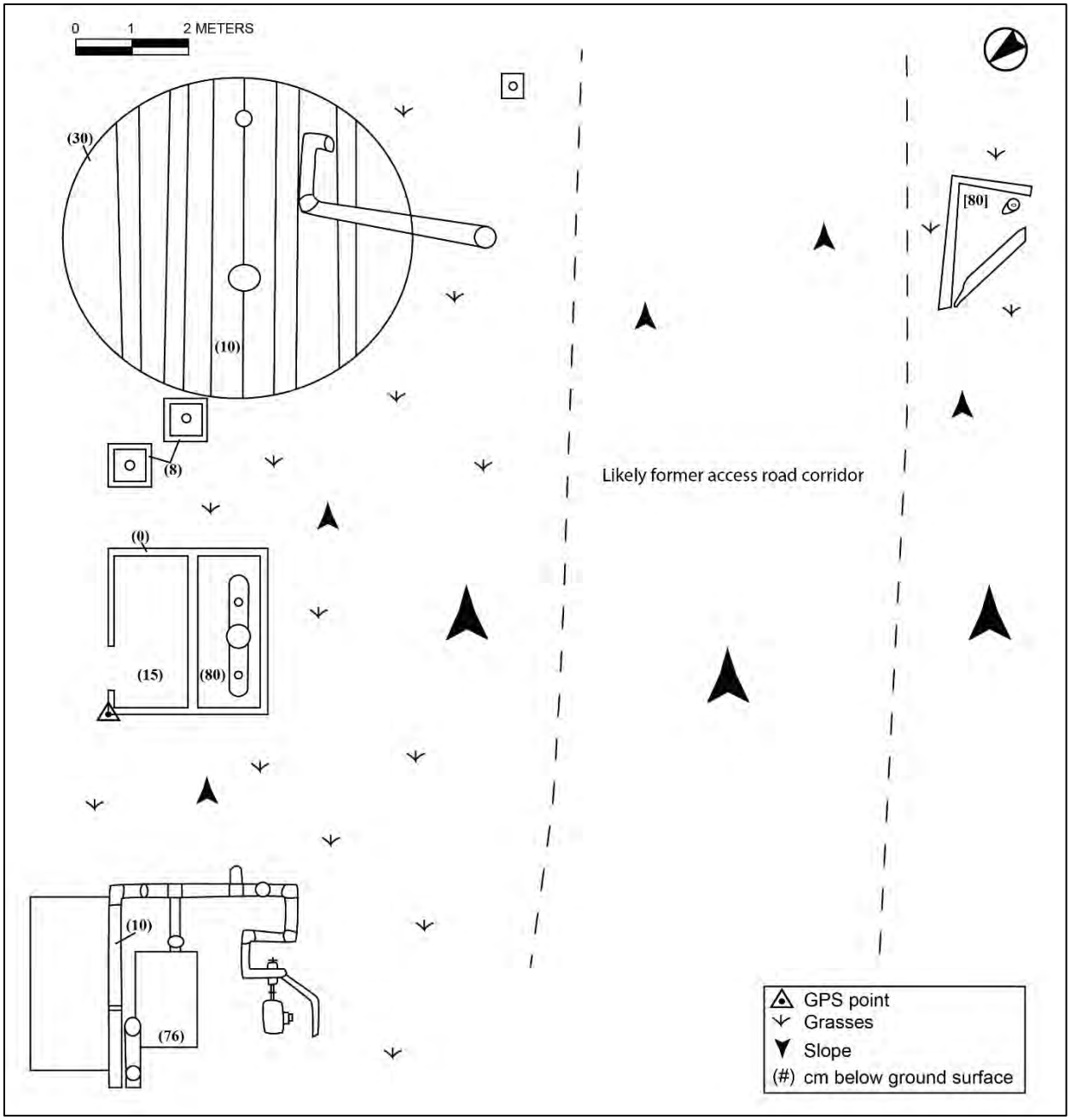


Figure 71. Plan map of SIHP # 50-80-08-5593 Feature 2C, water tank remnants and associated components

marked circular feature labeled “Water Tank” in the same location as the documented Feature 2C (see Figure 17 and Figure 19). Structures are visible in this general area as late as 1968, including an apparent circular structure, which is likely the water tank (see Figure 21; UH MAGIS 1968).

SIHP # 50-80-08-5593 Feature 2D, a rectangular-shaped likely water retention feature, is situated near the base of the slope toward the pump house and mill building (Figure 72 through Figure 76). This is constructed of concrete, metal, and wood. The feature has three components: two rectangular shafts and one concrete culvert. The first portion measures 2.4 m long and 2.0 m wide, consisting of a rectangular shaft extending to a maximum depth of 215 cm with an attached small square shaft extending to a maximum depth of 205 cm (see Figure 72). A metal pipe oriented north-south extends from inside the rectangular shaft out above ground for 3.6 m before extending downward into the shaft of the second rectangular component. The second rectangular shaft measures 2.1 m long and 1.2 m wide, extending to a maximum depth of 215 cm (see Figure 73). This second retention shaft includes notches for an intact wooden sluice gate on the east edge, which leads out into a sloped, mortared basalt channel, possibly for overflow runoff (see Figure 74 and Figure 75). The mortared basalt portion measures 3.6 m long by 1.4 m wide and is two courses high (exposed portion is 50 cm tall on average). This feature may be connected to Feature 2E, described below, as a pipe in the squared shaft on the northeast end appears to extend in the direction of Feature 2E (see Figure 75). Apparent infrastructure is observed in the vicinity of this feature in a 1951 aerial photograph (see Figure 18; UH MAGIS 1951).

SIHP # 50-80-08-5593 Feature 2E consists of a remnant concrete culvert (see Figure 76 through Figure 78). Feature 2E is in poor condition and measures 2.4 m long and 0.75 m wide. Feature 2E is in the lower portion of the project area and appears to have been used to help channel water overflow runoff. A pipe was observed in a shaft of Feature 2D extending in the direction of 2E, suggesting water overflow was channeled from the retention feature out of Feature 2E.

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). The current study assesses SIHP # 50-80-08-5593 as significant only under Criterion d. This historic property has yielded information on land utilization and agricultural history of the ‘Ewa Plain. However, it is suggested that SIHP # 50-80-08-5593 did not make an important contribution to the broad patterns of our history, unlike the Waiahole Ditch, which immeasurably altered the entirety of the landscape. The historic property possesses integrity of location, design, materials, and workmanship.

Figure 72. Overview of SIHP # 50-80-08-5593 Feature 2D, northeast valve box, view to east

Figure 73. Overview of SIHP # 50-80-08-5593 Feature 2D, southwest valve box, view to southwest

Figure 74. SIHP # 50-80-08-5593 Feature 2D sluice gate and possible water overflow channel, view to northeast

Figure 75. Feature 2D plan view of southern retention area with sluice gate and possible overflow channel, view to southwest

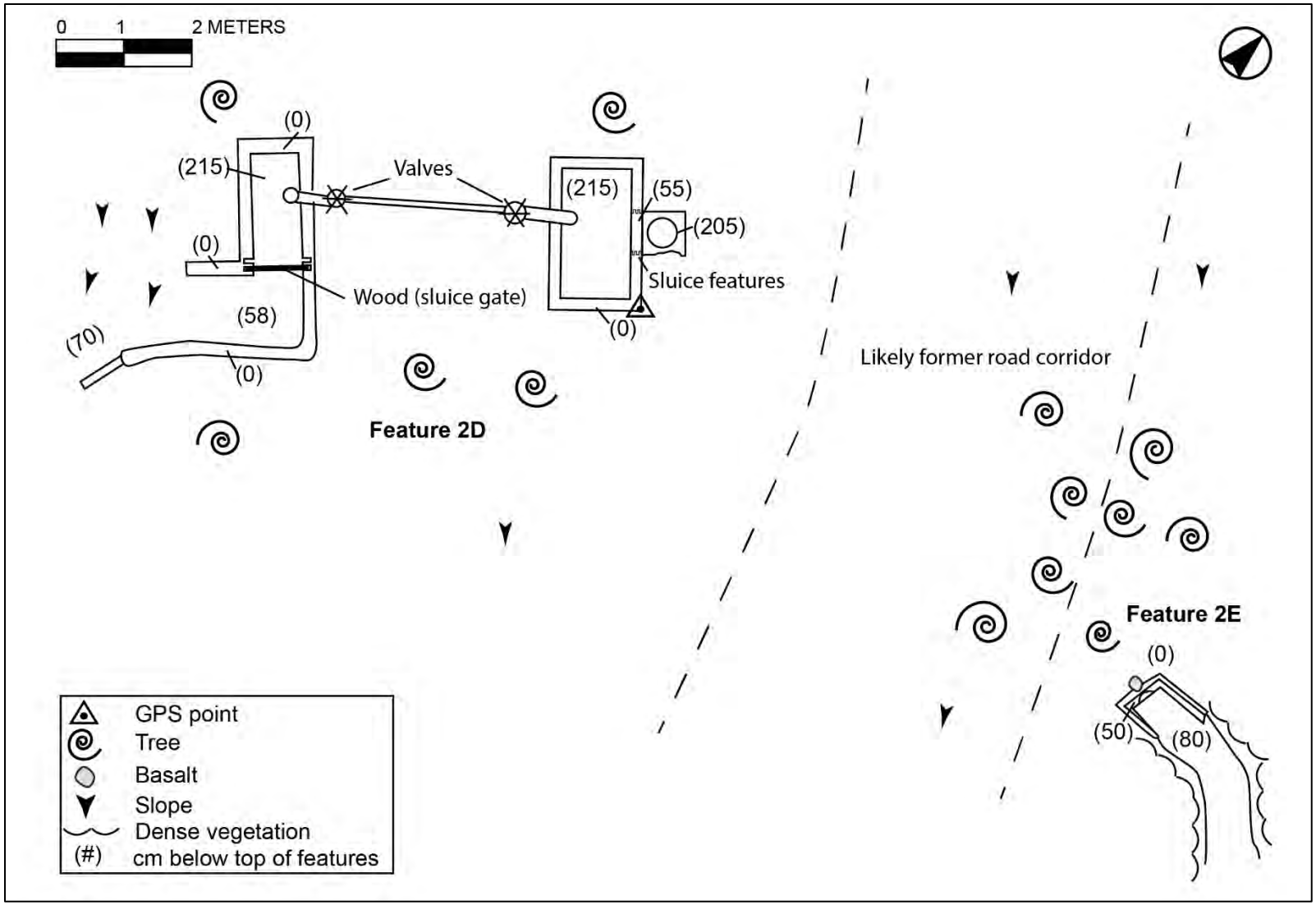


Figure 76. SIHP # 50-80-08-5593 Feature 2D, northeast and southeast valve boxes (top left), and Feature 2E runoff channel (bottom right) plan map

Figure 77. SIHP # 50-80-08-5593 Feature 2E, culvert remnants, view to northwest

Figure 78. SIHP # 50-80-08-5593 Feature 2E, close-up of culvert remnants, view to west

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

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
TMK:	[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

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 79) 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 80).

5.2.1 Overview

Currently, a portion of the Waiahole Ditch remains active (see Figure 79). 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).

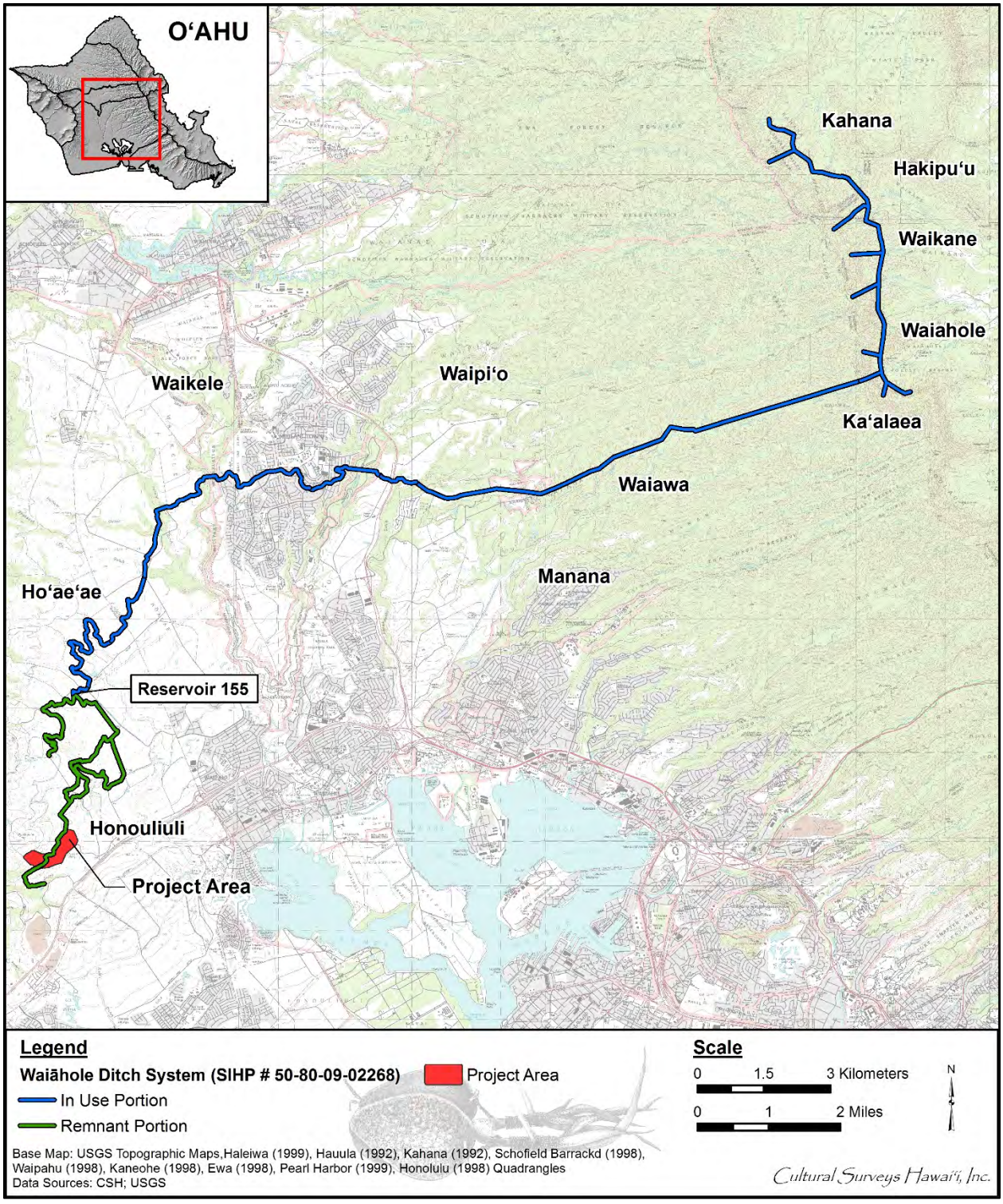


Figure 79. Route of the Waiahole Ditch System in relation to the present project area, showing in-use and remnant portions, depicted on a 1992–1999 USGS topographic quadrangle map

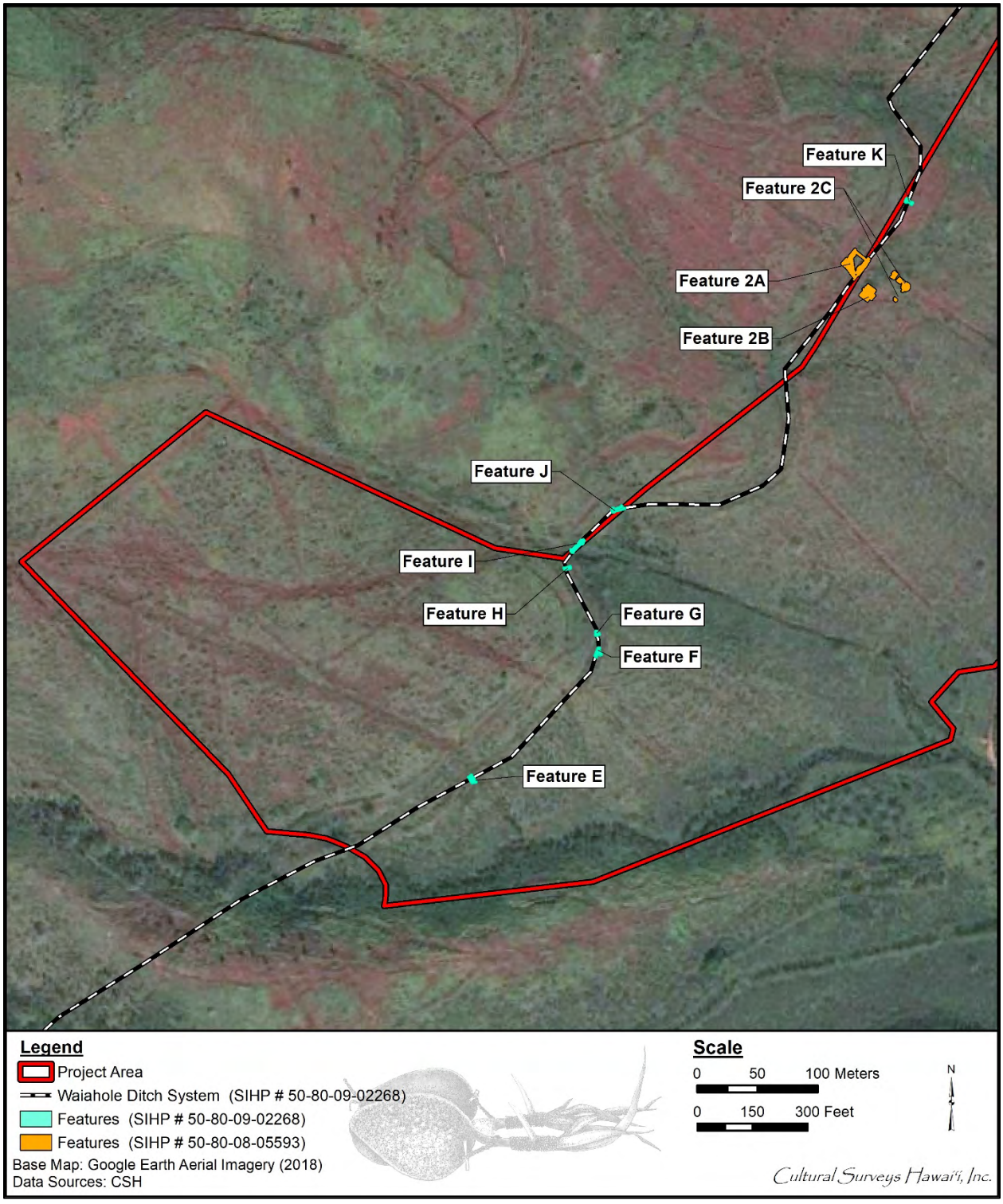


Figure 80. Aerial photograph depicting the distribution of portions of SIHP # 50-80-09-2268 Feature E through Feature K, as well as features of SIHP # 50-80-08-5593, identified within the current project area (Google Earth 2018)

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 81 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 82]. 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]

Figure 7: Site 2268, a Section of Water Flume. View to Northeast.

Figure 81. Portion of SIHP # 50-80-09-2268 documented by Dega et al. (1998:18)

Figure 82. 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 84 and Figure 83]. 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 87 and Figure 88]. 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 85]. 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 stacked-stone 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 86]. 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 83. 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)

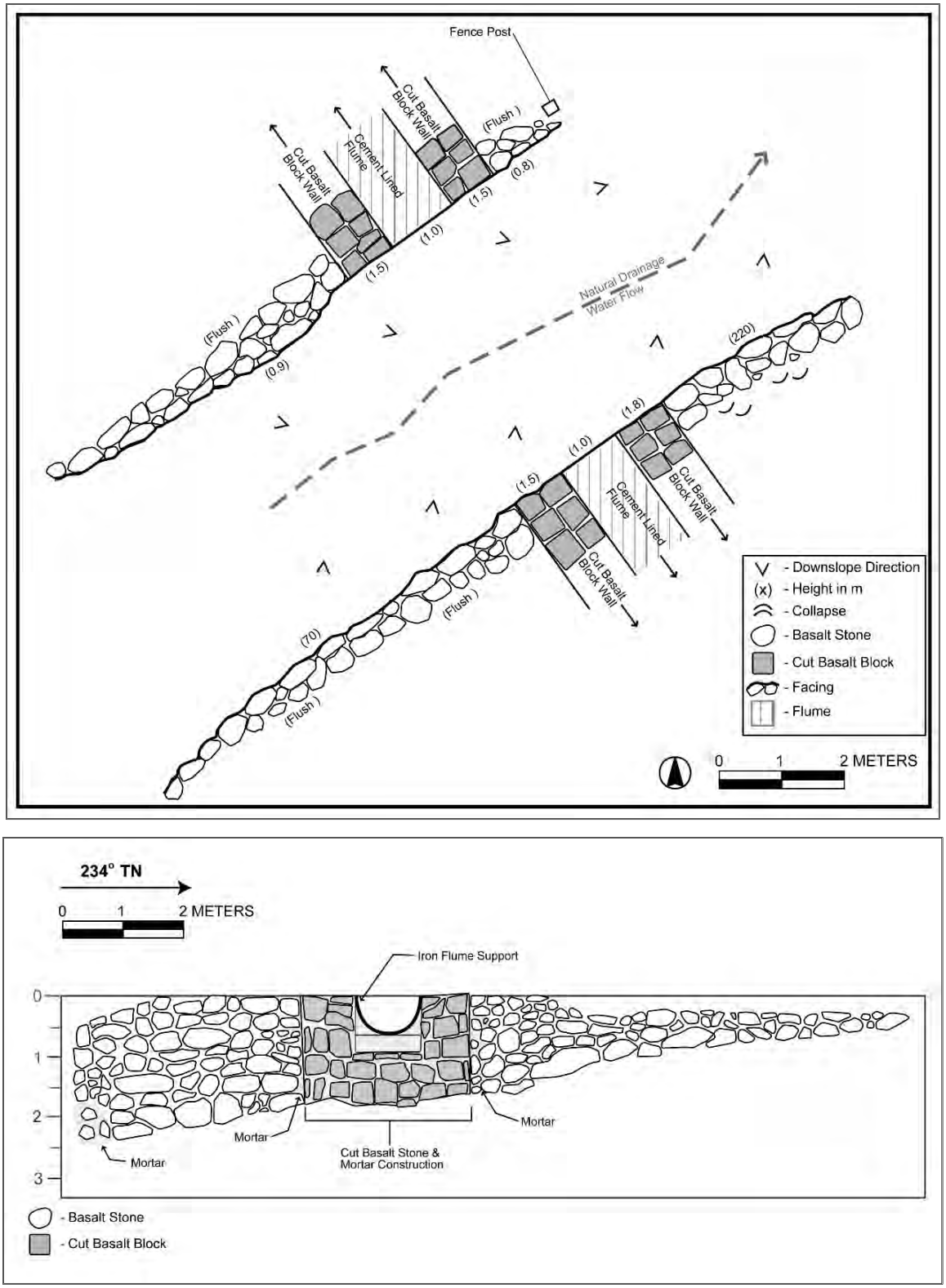


Figure 84. Plan view diagram (top) and profile (bottom) of SIHP # 50-80-09-2268 Feature A: flume bridge (Tulchin and Hammatt 2004:54)

Figure 85. SIHP # 50-80-09-2268 Feature B, showing stone and mortar flume support foundation, view to north (Hunkin and Hammatt 2009:50)

Figure 86. SIHP # 50-80-09-2268 Feature B flume, showing wooden flume extension (Hunkin and Hammatt 2009:50), view to southeast

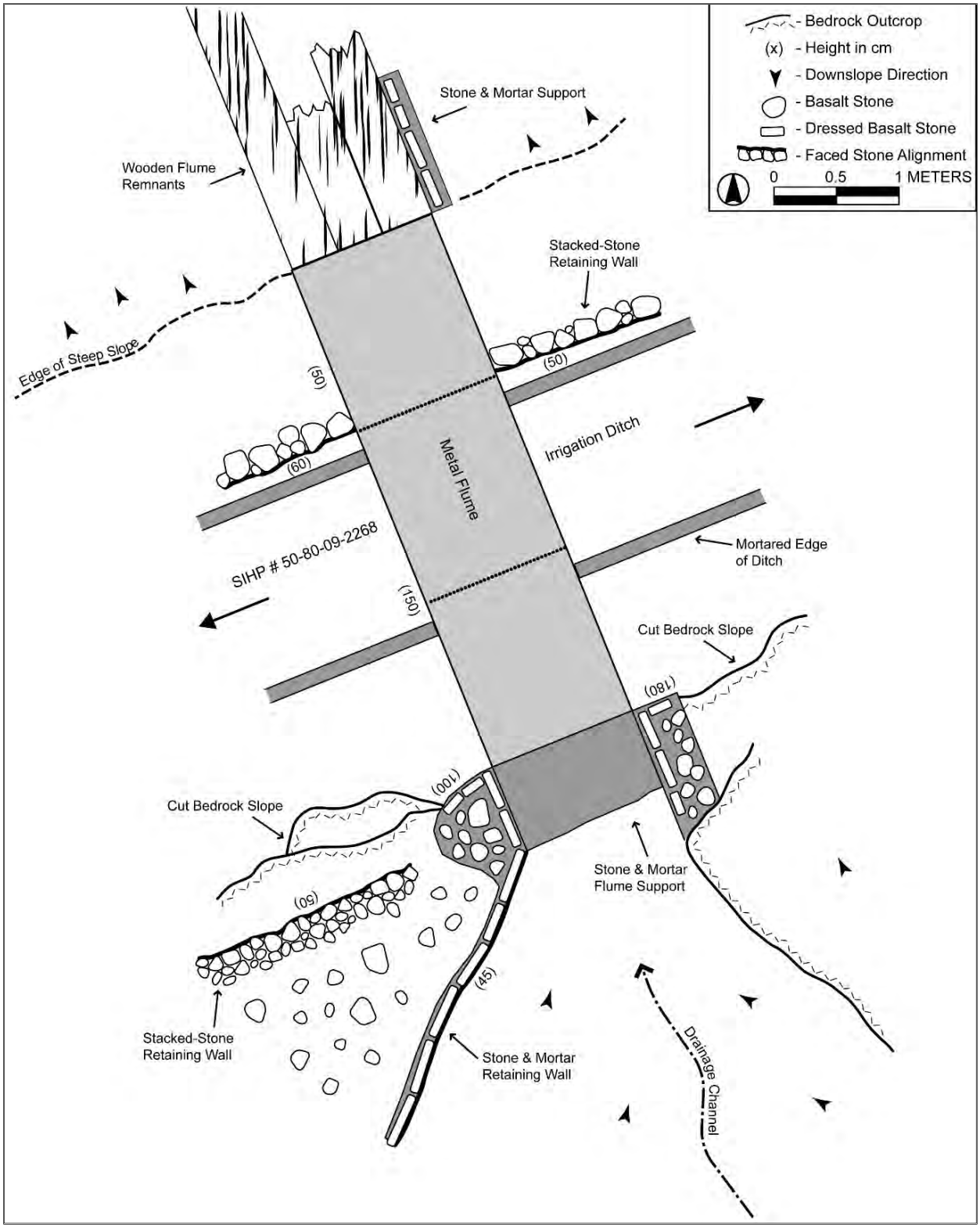


Figure 87. Plan view of SIHP # 50-80-09-2268 Feature B (Hunkin and Hammatt 2009:48)

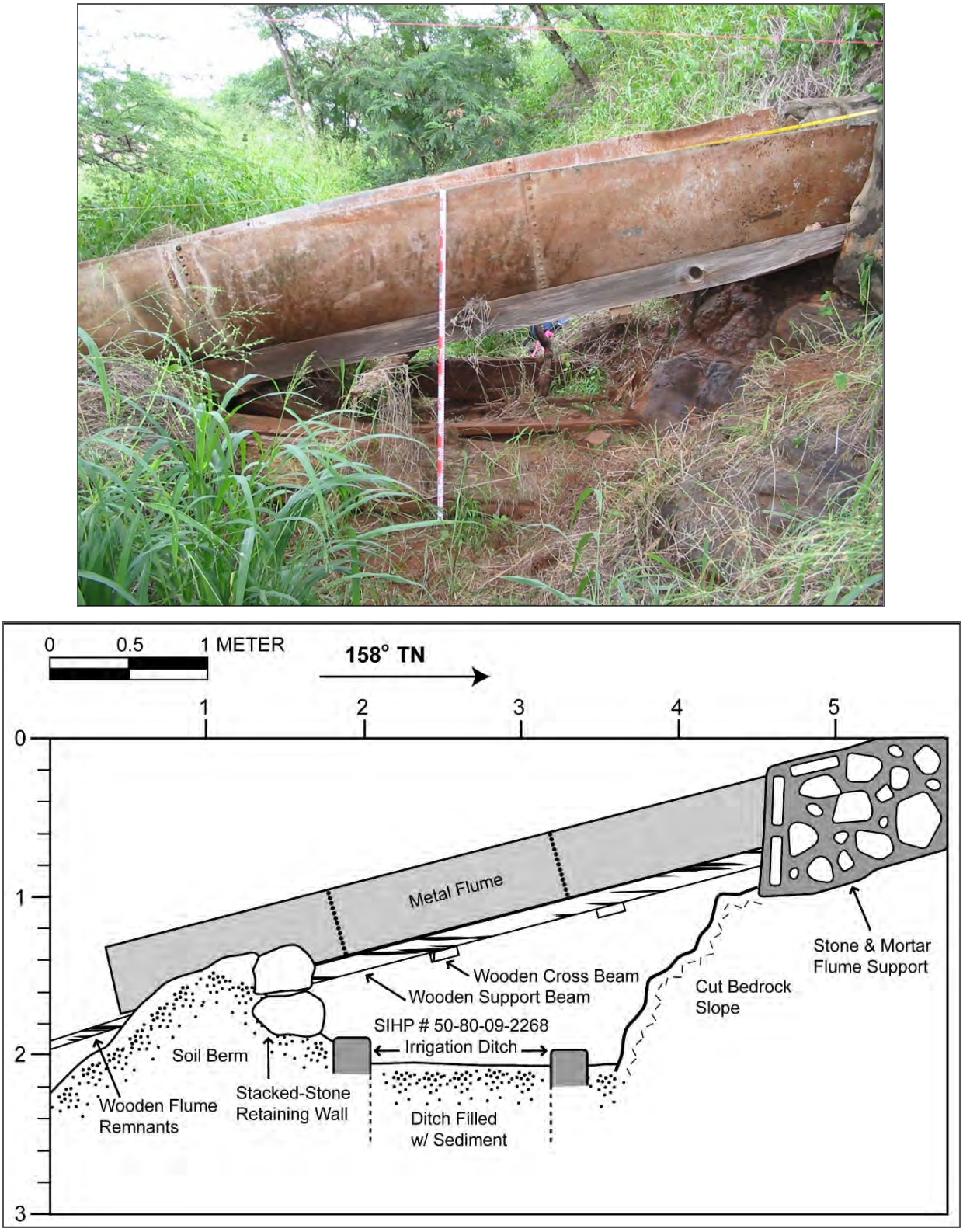


Figure 88. Photograph (top, view to east) and cross-section map (bottom) of SIHP # 50-80-09-2268 Feature B flume (Hunkin and Hammatt 2009:49)

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 91 through Figure 90). 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 92 and Figure 93] 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. Just outside the northern boundary of the project area, the ditch consists of a more formal construction, with mortared basalt sides and tunnels (Figure 94 through Figure 96). Concrete-lined portions were also observed just north of the project area boundary, as were several tunnel entrances and sluice gate features (Figure 97 and Figure 98). 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 99). In the southwest portion of the project area, dry-stacked basalt sides were observed (Figure 100 and Figure 101). As discussed above,

Figure 89. SIHP # 50-80-09-2268 Feature C, view to south (Hunkin and Hammatt 2009:52)

Figure 90. SIHP # 50-80-09-2268 Feature C, showing partially intact wooden flume section, view to south (Hunkin and Hammatt 2009:52)

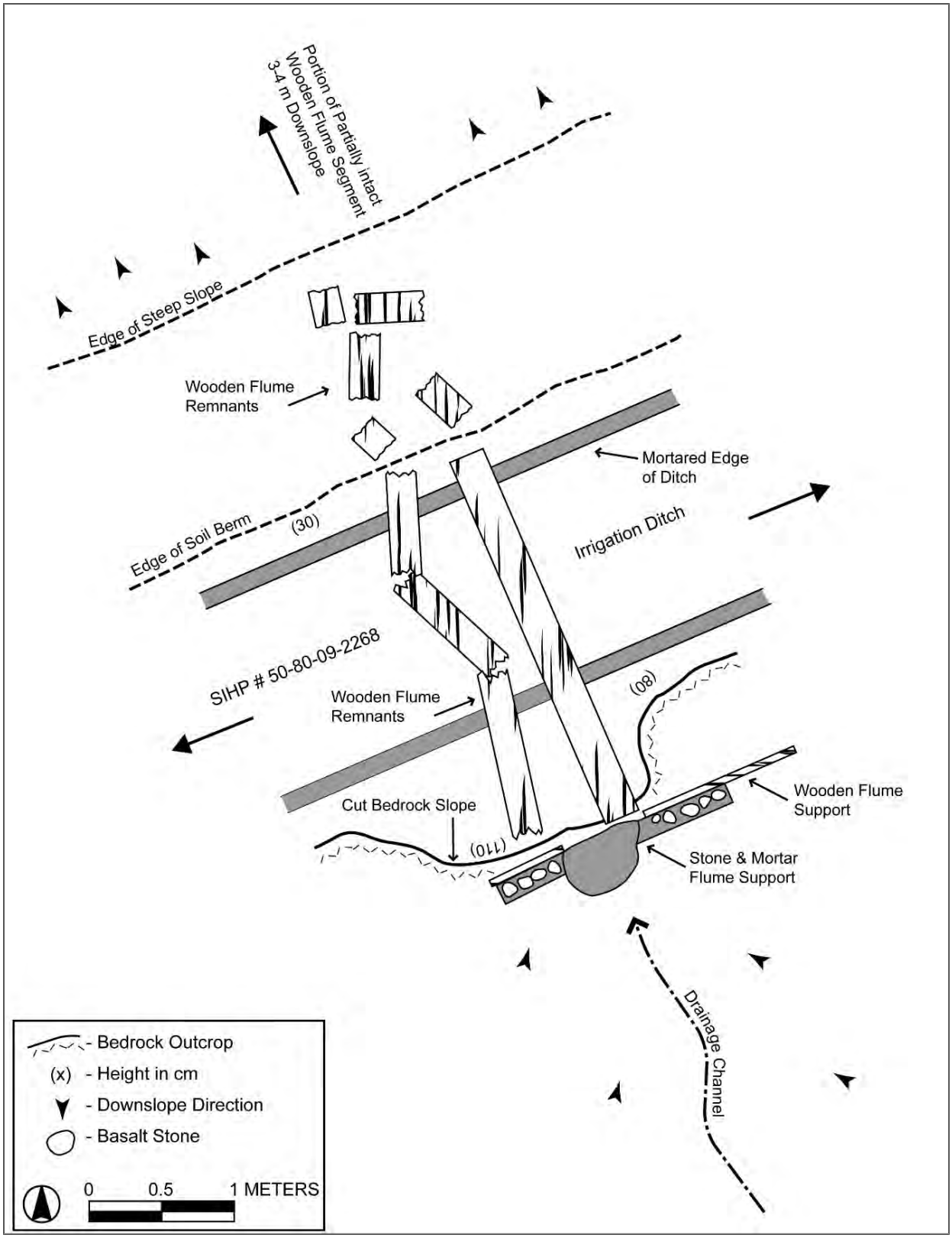


Figure 91. Plan view of SIHP # 50-80-09-2268 Feature C (Hunkin and Hammatt 2009:51)

Figure 92. SIHP # 50-80-09-2268 Feature D, earthen mound, view to southwest (Zapor et al. 2018:79)

Figure 93. SIHP # 50-80-09-2268 Feature D, stacked stone wall, view to southwest (Zapor et al. 2018:79)

Figure 94. Culvert of SIHP # 50-80-09-2268, Waiahole Ditch, northwest of (outside) the project area, view to southwest

Figure 95. Representative photo of SIHP # 50-80-09-2268, Waiahole Ditch outside (northwest) of the project area, view to east

Figure 96. 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

Figure 97. Portion of SIHP # 50-80-09-2268, Waiahole Ditch in northeastern project area, view to southwest

Figure 98. Representative photo of SIHP # 50-80-09-2268, Waiahole Ditch construction outside (northwest) of the project area, view to west

Figure 99. Representative photo of SIHP # 50-80-09-2268, Waiahole Ditch (left) in central project area, view to southwest

Figure 100. Representative photo of SIHP # 50-80-09-2268, Waiahole Ditch in southwest project area, dry-stacked basalt, view to north

Figure 101. Representative photo of SIHP # 50-80-09-2268, Waiahole Ditch in southwest project area, view to north

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 102 through Figure 105). The culvert consists of mortared cut basalt blocks, two to three courses high, constructed around a largely buried concrete drain pipe (see Figure 102). 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 103). 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 106 through Figure 111). 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 107). 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 108 and Figure 109). 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 110 and Figure 111). 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 112 and Figure 113). 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 115 and Figure 114). Feature H is

Figure 102. SIHP # 50-80-09-2268 Feature E, culvert and bridge components of the Waiahole Ditch in southern project area, view to northeast

Figure 103. SIHP # 50-80-09-2268 Feature E bridge overlying culvert of Waiahole Ditch in southern project area, view to east

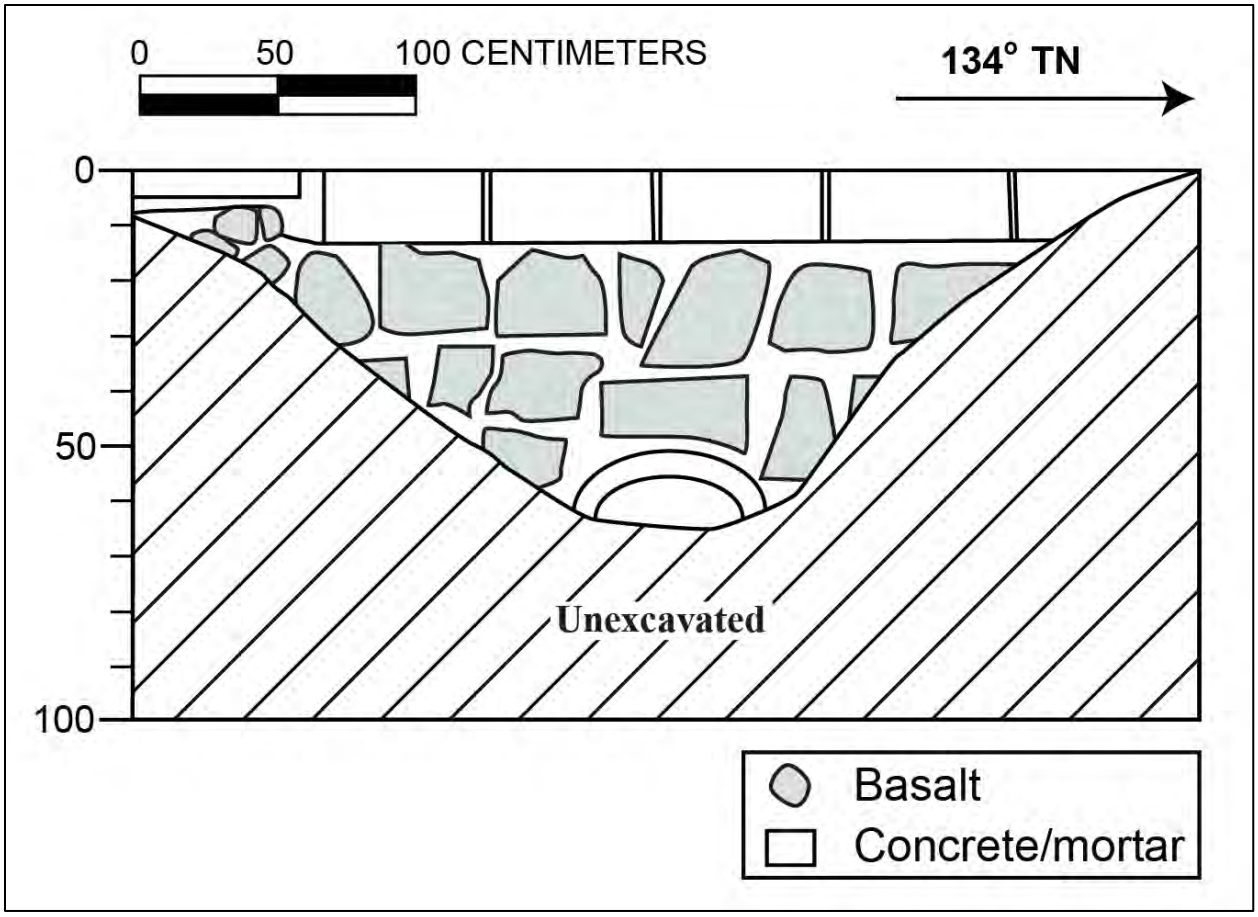


Figure 104. SIHP # 50-80-09-2268 Feature E southwest face of culvert profile