Appendices

Appendix A

Neighborhood Board and Community Meeting Notes

KAHALU'U NEIGHBORHOOD BOARD NO. 29
(He'eia Kea, 'Āhuimanu, Kahalu'u, Waihe'e, Ka'alaea, Waiāhole, Waikāne, Hakipu'u, Kualoa)
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REGULAR MEETING MINUTES
WEDNESDAY, JUNE 12, 2019
KUALOA HE`EIA ECUMENICAL YOUTH (KEY) PROJECT

CALL TO ORDER: Chair Amy Luersen called the Kahalu'u Neighborhood Board No. 29 meeting to order at 7:05 p.m. **Quorum was established with ten (10) members present.** Note – This 15-member Board requires eight (8) members to establish quorum and to take official Board action.

Members Present: Daniel Bender, Cameron Deal, Lee Gomes, Ken LeVasseur, Clifford Loo, Amy Luersen, Art Machado, Flora Obayashi, John Reppun, Richard Vermeesch (arrived at 7:15 p.m.), Leialoha Kaluhiwa (arrived at 7:10 p.m.), and Rick Towill.

Members Absent: Yvonne Nelson.

Guests: Captain Mark Adams (Honolulu Fire Department); Lieutenant Michael Kuroda (Honolulu Police Department); Barry Usagawa (Board of Water Supply); Tiffany Patrick (Marine Corp Base Hawaii); Aulii Dudoit and Kalae Kukahiko (KEY Project); Councilmember Heidi Tsuneyoshi; Michael Sakata (Office of Councilmember Heidi Tsuneyoshi); Clifford Wong (Wong's Taro Farm); Evern Williams (Olelo Community Media); Barbara Natale (G70); Joseph Haili, Marie Samudio, Jackie Graessle, R. Miller, S. Miller, Shae Cotteen, Liz Aulsebrook, and Bill South (Residents); Casey Ishitani and Jackson Coley (Neighborhood Commission Office).

PUBLIC SAFETY REPORT
Honolulu Fire Department (HFD): HFD Captain Mark Adams reported the following: May 2019 Statistics: Captain Adams reported that HFD responded to 32 medical emergencies, three (3) motor vehicle collisions, one (1) mountain rescue, and one (1) ocean rescue.

Questions, comments, and concerns followed: Open Fires: The Board inquired if it is legal to have an open fire on private property and Captain Adams responded that it is not.

Honolulu Police Department (HPD): Lieutenant Michael Kuroda reported the following: May 2019 Statistics: There were three (3) motor vehicle thefts, five (5) burglaries, five (5) thefts, and five (5) unauthorized entries into motor vehicles (UEMV).

Questions, comments, and concerns followed: Likelike Highway Crash: Deal inquired about a multiple vehicle crash that occurred on Wednesday, June 12, 2019. Lieutenant Kuroda responded that allegedly a tow truck was unable to stop and impacted several other vehicles. The driver of the tow truck remained at the scene.

Kaluhiwa arrived at 7:10 p.m. 11 members present.

FILLING OF VACANCIES
Sub-District 1: As there were no nominations or volunteers, this item was deferred to the next meeting.

Sub-District 6: As there were no nominations or volunteers, this item was deferred to the next meeting.

Vermeesch arrived at 7:15 p.m. 12 members present.

RESIDENT/COMMUNITY CONCERNS
- Olelo: Olelo Community Relations Specialist Evern Williams reported that Olelo is hosting a Junior Academy for Media - a summer media camp that leads into yearlong student engagement through project-based learning and event engagements. Students participating in the camp will complete three (3) independent projects and participate in three (3) Olelo Community Media events prior to completion of the program in June 2020. The Summer Media Camp runs Monday, July 8, 2019 to Friday, July 26, 2019.
- Board Elections: Machado raised concerns regarding outreach by the Neighborhood Commission toward the senior members of Kahaluu. Machado cited senior residents at KEY Project not hearing about the Neighborhood Board elections.

CITY, STATE, AND FEDERAL AGENCY REPORTS
Marine Corps Base Hawaii (MCBH): MCBH Representative Tiffany Patrick reported the following:
- Bellows Base Japanese Cemetery: Descendants of Japanese Americans buried at the cemetery on Bellows Air Force Base were allowed to visit the culturally significant site.
- Belmont University: On Tuesday, May 14, 2019, students from Belmont University visited MCBH at Kaneohe Bay. The tour stops included the Marine Corps Air Station Kaneohe Bay terminal, Kaneohe Bay Range Training Facility, and the Pacific War Memorial. The visit informed students on the relations with the community and U.S. Marine Corps training on Oahu.
- Marina Fest 2019: On Friday, May 24, 2019, Marina Fest was held at the MCBH Marina. The public event featured live music and activities.
- Relocation: Ms. Patrick informed the Board that she was relocating to England. The board thanked her for her service and Member Obayashi recognized her with lei and song.

Board of Water Supply (BWS): BWS Programs Director Barry Usagawa reported the following:
- Water Main Break Report: There were no main breaks in May 2019.
- Water Levels: Potable production for May 2019 was 138.7 million gallons per day (MGD). The five (5) month moving average for rainfall is 72% of normal. Severe drought conditions exist for Leeward Oahu. The National Weather Service is predicting El Nino conditions through summer 2019, with 70% chance of five (5) to eight (8) tropical cycles through November 2019, increasing probabilities of above normal rainfall.

COMMUNITY PROJECTS PRESENTATIONS
Waihee Nature Park and Waihee Falls: BWS Programs Director Usagawa reported the following:
- Waihee Ahupuaa Initiative (WAI): BWS and KEY Project have partnered on WAI. Since 1959, BWS has assumed ownership of the Waihee Tunnel System, which is the largest source of water in Koolau Poko with a five (5) MGD production.
- Current WAI Activities: Since October 2007, WAI participants have been meeting regarding the construction of a fish passage in Waihee Stream near the "Ice Pond" and the old abandoned USGS gage. The fish passage would provide native aquatic species such as o`opu with passage of the upper reaches of the stream to lay and fertilize their eggs.
- Periodic Volunteer "Work Trips": KEY Project has coordinated several community volunteer "work trips" to remove large bulky items and invasive plant species along the access road to the upper valley.
- Vegetative Cover Mapping: Vegetative cover mapping is estimated to cost between 5,000 and 10,000 dollars. The projected mapping is to help better understand the resources of the Waihee ahupuaa.
- Waihee Loi Restoration and Riparian Learning Center: BWS is partnering with G70 for a proposed restoration of traditional loi kalo and the stream environment through community education activities. The 13 acre proposed region would extend from Waihee Road to the dam and evaluate access improvements into the watershed while mitigating adverse impacts to the ecosystem caused by hikers.

Questions, comments, and concerns followed:
1. Resident Concerns: Residents who live on Waihee Road raised that hikers have been trespassing on private property and into the Waihee Falls area. Trespassers have been bringing pets into the valley, causing concerns about fecal matter and pollution. Resident Clifford Wong raised concerns for the cleanliness of the water that flows downstream to his taro farm. Residents also raised concerns regarding trespassers harassing their pets and creating unsafe traffic conditions for their children. Several residents noted that social media posts seem to be encouraging trespassing.
2. Board Concerns: Kaluhiwa inquired if there were any ways that HPD could enforce the No Trespassing policy for Waihee Falls. Reppun inquired if the Board could call upon Department of Transportation Services (DTS) and HPD to enforce the No Parking policy at the end of the pedestrian streets. Reppun reiterated the concerns regarding pollution in the water table cascading from upstream hikers, in particular e. coli. Reppun also raised that social media can be used to deter trespassers, due to the sheer volume of thousands of individuals every weekend, pointing to the legal matters that trespassing individuals may face. LeVasseur inquired if trespassers are a Homeland Security risk.

Reppun Moved and Machado Seconded to call upon the relevant City and County of Honolulu entities to convene in a discussion group and to enact immediate enforcement of No Trespassing signage at Waihee Nature Park, with proposals being returned to the Kahaluu Neighborhood Board by Wednesday, July 10, 2019. The Motion was ADOPTED BY UNANIMOUS CONSENT, 12-0-0 (**Aye**: Bender, Deal, Gomes, LeVasseur, Loo, Luersen, Machado, Obayashi, Reppun, Vermeesch, Kaluhiwa, and Towill; **Nay**: None; **Abstain**: None).

At 8:26 p.m. Chair Luersen handed the gavel to Vice Chair Towill in order to present.
Dredging of Kahaluu Lagoon: Chair Luersen reported that there is a contract to dredge Kahaluu Lagoon from the City and County of Honolulu. The contract includes a Department of Parks and Recreation (DPR) agreement to dump waste spoils in the Heeia Kea area. Kahaluu Regional Park is designed to have an area to dispose of dredged spoils.

Questions, comments, and concerns followed:

1. Heeia Disposal Area: Kaluhiwa raised concerns regarding the disposal of wastes in the Heeia Kea area, especially in regard to wastes polluting the ocean.
2. Upstream Impacts: Resident Clifford Wong raised concerns about dredging causing increased water flows and bridges upstream from the lagoon and the culvert being unable to maintain the increased pressure. Vice Chair Towill responded that the invert appears to be degrading as well.
3. Kahaluu Watershed Work Plan: Reppun raised that in 1969, a work plan was developed to manage the Kahaluu watershed. He stated that no alternatives were sought by the City and County of Honolulu, raising concerns that sluiceways are outdated and that native fish upstream migration was not taken into account.
4. Board Approval: Obayashi raised concerns that the Board taking action against the dredging will run counter to past Board approval of dredging, namely from Reppun. Reppun responded that he has never insisted on approval of dredging, further elaborating that new findings about community outrage and environmental impacts are reason to put a stay on current dredging proposals.

Reppun Moved and Kaluhiwa Seconded a Motion to request that the City and County of Honolulu put a stay on both the dredging of Kahaluu Lagoon and disposal of dredged spoils at Heeia Kea while collaborating with the State of Hawaii to review and reevaluate the 1969 Kahaluu watershed work plan. The Motion PASSED BY UNANIMOUS CONSENT, 12-0-0 (**Aye**: Bender, Deal, Gomes, LeVasseur, Loo, Luersen, Machado, Obayashi, Reppun, Vermeesch, Kaluhiwa, and Towill; **Nay**: None; **Abstain**: None).

At 8:45 p.m. Chair Luersen reacquired the gavel.

Proposed Rezone from Agriculture (AG) 2 to Residential (R) 10 – 47-532 Ahuimanu Road: Dennis Silva reported that he is a planning consultant and will be seeking a zoning change for the property at 47-532 Ahuimanu Road. The property is proposed to be changed from an AG2 to R10 property with individual residential units as part of CRP, with shared access way. Silva informed the Board that this was an informational presentation prior to formally submitting the Environmental Assessment (EA).

Questions, comments, and concerns:

1. Access: Chair Luersen inquired about access to and from the property.
2. Proposed Property Size: Towill inquired about the property size after rezoning and Silva responded that there will be at least 10,000 square feet of land area for each residential unit. Reppun inquired if Silva was aware of the Community Growth Boundary location change. LeVasseur inquired if the property will result in spot-zoning since it is surrounded by AG 2. Resident Samudio raised concerns about affordability of lots on the property. Gomes raised concerns regarding total property area size and ability of neighboring residents to traverse around property. Silva responded that he will report back to the Board at a future Neighborhood Board meeting.
3. Environmental Assessment (EA): Towill inquired about an EA from BWS and Silva responded that BWS will conduct an EA when sewage lines are completed. Chair Luersen inquired if Silva will be submitting results under the new Environmental Impact Statement (EIS) rules and Silva responded that he will.
4. Proximity: Loo inquired about proximity to a community growth property. LeVasseur raised concerns regarding illegal activity in the change of the community growth property. Reppun inquired about the impact of the zoning change on schools in the area.

At 8:55 p.m. LeVasseur raised concerns regarding a member of the Kahaluu Neighborhood Board taking part in illegal activity regarding the change of the community growth property. Obayashi raised objection to LeVasseur's concerns. Chair Luersen gaveled to reestablish order.

Report on Windward Emergency Preparedness Fair: Obayashi reported that the Windward Emergency Preparedness Fair was held on Saturday, May 18, 2019. Handouts at the fair included emergency instructions, go-bags with emergency checklists, and Meals Ready to Eat (MRE's). Obayashi noted that 2019 is an El Nino year, meaning an increased likelihood of cyclone events.

REPORTS BY ELECTED OFFICIALS
Mayor Kirk Caldwell's Representative: Rebecca Soon was not in attendance. Chair Luersen requested that the following report be included in the minutes.

- Kahaluu Lagoon: The Department of Facility Maintenance (DFM) reported that dredging of the Kahaluu Lagoon would be performed by specialized contractor as part of a Capital Improvement Project to be administered by the Department of Design and Construction (DDC). Appropriate studies would be conducted as part of the project.
- Illegal Dumping: The Department of Environmental Services (ENV) reported that depending on the location, the State Department of Transportation (HDOT) has jurisdiction of the roadway and roadside along Kamehameha Highway. Previous attempts by ENV to utilize evidence from cameras were deemed by HPD and the City Prosecuting Attorney's office to be insufficient to prosecute. However, ENV will look into using camera evidence, under its existing authority, to enforce against illegal dumpers. If someone witnesses illegal dumping as it's occurring, they should immediately call 911 to notify the police. Illegally dumped materials or bulky items placed out for collection outside of the normal collection schedule can be reported directly to the City's Refuse Inspectors at (808) 768-5220.
- Refuse Transfer Station: Councilmember Heidi Tsuneyoshi has included Capital Improvement Program (CIP) monies in Fiscal Year 2020 (FY20) to begin the planning process for a Kahaluu Transfer Station. This is currently going through the budget approval process. However, the Kahaluu area is served by the Kapaa Transfer Station, located 20 minutes away, at 100 Kapaa Quarry Road.
- Waihee Falls: The DPR has extended the fence, placed "Government Property, No Trespassing" signs, and is working with BWS to resolve this issue. The entrance to the area, including the vehicle gate, is under the control of the Department of Parks and Recreation (DPR). BWS continues to work with DPR and area residents when large groups or unusual vehicular traffic is reported. Social media sites make the area very popular with both residents and visitors and due to the geography of the area, restricting access to the trail is challenging.
- Ahilama Road between Waihee Bridge and Kalohaku Bridge: DFM is not aware of an Administrative Order to turn over privately-owned bridges to the City and County of Honolulu.
- Oahu Society for the Prevention of Cruelty to Animals (OSPCA) Property Update: Notice of Order No. 2016/NOO-115 was issued on April 26, 2016. The current amount of civil fines is 110,500 dollars. DPP is requesting a Major Shoreline Management Area permit be obtained and an Environmental Impact Statement (EIS) be resubmitted to DPP's Land Use Approval Branch.
- Aloha Animal Sanctuary at 47-119 Pulama Road: The specified lot is vacant. No application has been submitted for a structure other than application for a six (6) foot high chain-link fence. Building Permit No. 823827 was issued for a fence on October 22, 2018. Proximity of the structure on the property to the ocean will be reviewed at the time of submittal for a building permit. The DFM requests that additional information be provided by the Neighborhood Board clarifying the specific concern with the Aloha Animal Sanctuary in order to determine the appropriate course of action to be taken.
- Ahuimanu Place between Kahekili and Ahuimanu Road Safety Concerns: The Department of Transportation Services (DTS) is still performing an investigation, which will include a site inspection, speed study, review of the traffic collision history, etc. The DTS will take appropriate action as warranted by the analysis. The DTS will contact the Mayor's representative should any additional information be required during the investigation.
- Stream Maintenance by the United States Army Corp of Engineers (USACE): The streams included in the stream maintenance permit that was applied to the USACE was developed through discussion with the USACE, State Department of Health and the City and County of Honolulu to address anticipated maintenance work performed on streams within five (5) years from the discussion date in 2017. Currently it is believed that the USACE is reviewing comments from the U.S. Fish and Wildlife Services (USFWS) that does not allow any permitted vegetation exceeding 15 feet to be cut between June and September, due to possible Hoary Bat rearing. USFWS is uncertain of the location of Hoary Bat habitat and understands that juvenile bats may be reared on unprotected vegetation branches. The City's application that proposes to perform stream maintenance during the low flow periods, typically in the summer months, may involve the removal of haole koa and mangroves in excess of 15 feet, which may conflict with USFWS comments and a Hoary Bat expert is being consulted by USFWS.

Councilmember Heidi Tsuneyoshi: Councilmember Tsuneyoshi reported the following:

- Councilmember Tommy Waters: Councilmember Waters has been sworn in and his appointment makes a full council.

- Kahalu`u Lagoon: Sakata reported that a project for the dredging of Kahalu`u Lagoon has been fully designed with the anticipated location for dredge spoils at He`eia Kea.
- Transient Vacation Rentals: Councilmember Tsuneyoshi's main issue was transient vacation rentals with Bill 85 and Bill 89 still in committee.
- Bridges: Councilmember Tsuneyoshi reported that City and County of Honolulu money is being requested to repair the Kalohaku Bridge.

Questions, comments, and concerns followed:

1. Bridges: Chair Luersen confirmed that the bridge being proposed for repair is Kalohaka, not Waihee Bridge. LeVasseur raised concerns regarding repairs needed at Waihee Bridge, as the spillway has been blown out. Machado inquired about repairs to the Kamehameha Highway from the bridge to Haiku Rd. and Councilmember Tsuneyoshi's representative Mike Sakata responded that a project has been scheduled for 2020.
2. Solar Panels: The Board raised concerns regarding solar panels containing cadmium, especially in instances of high wind or hurricanes. Sakata responded that he will get back to the Board.
3. Natural Resources and Conservation Service (NRCS): Reppun requested that Councilmember Tsuneyoshi invite NRCS to meetings.
4. Repaving Near the Canoe Club: Reppun inquired about repaving near the Canoe Club as the Board put a lot of work into the repaving. LeVasseur raised concerns regarding repaving promised by the Honolulu Film Office in the area around Heeia Kea Pier and Sakata responded that he would inquire about it.

Councilmember Ikaika Anderson: No representative was present; no report was given.

Governor David Ige's Representative: No representative was present; no report was given.

Senator Gil Riviere: No representative was present; no report was given.

Senator Jarrett Keohokalole: No representative was present; no report was given.

Representative Lisa Kitagawa: No representative was present; no report was given.

Representative Sean Quinlan: No representative was present; no report was given.

STANDING COMMITTEE REPORTS
Military Liaison Committee: Machado was not present; no report was given.

Planning and Zoning Committee: Chair Luersen reported the following

- New EIS Rules: Governor Ige is holding off on signing in order to ensure a smooth transition process. Hawaii Administrative Rules (HAR) 11-200 will be repealed. Information can be found at http://health.hawaii.gov/oeqc/.
- Heeia State Park: Chair Luersen reported that Kamaiana Kids commercial recreational activities at Heeia Kea Park technically should not be operating as they do not have a commercial recreation permit since March 2019.

Preservation of Hawaiian Heritage Committee: Kaluhiwa reported that a composers contest will be held at Haiku Gardens in September 2019.

Transportation and Safety Committee: LeVasseur had no report.

Water and Environment Committee: Vice Chair Towill raised concerns regarding snakes being flown into the islands, the sustainability of individual property septic systems. Reppun added further concern regarding waste disposal fees

Emergency Preparedness Committee: Obayashi inquired if Committees may retain a representatives even if they are not board members and Chair Luersen responded that they may.

At 9:20 Deal left. 11 members left.

BOARD BUSINESS

Treasurer's Report: Bender reported a remaining balance of $496.68.

Adoption of Regular Meeting Minutes of Wednesday, May 8, 2019: The Board raised that on Page 5 of 6, in the section Planning and Zoning Committee under "Questions, comments, and concerns followed", there should be an amendment reading "A resident raised concerns regarding the property being subdivided".

Bender Moved and Obayashi Seconded to Adopt the Regular Meeting Minutes of Wednesday, May 8, 2019 as amended. The Motion was ADOPTED BY MAJORITY VOTE, 11-0-1 (**Aye**: Bender, Deal, Gomes, LeVasseur, Loo, Luersen, Machado, Obayashi, Reppun, Kaluhiwa, and Towill; **Nay**: None; **Abstain**: Vermeesch)**.**

Adoption of Regular Meeting Minutes of Wednesday, April 10, 2019: Approval of Regular Meeting Minutes of Wednesday, April 10, 2019 was deferred until the next Neighborhood Board Meeting, Wednesday, July 10, 2019. Board members were asked to submit any significant changes to the Chair or Neighborhood Assistant prior to the Board meeting.

Adoption of Regular Meeting Minutes of Wednesday, May 9, 2018 and Special Meeting Memorandum for the Record of Wednesday, April 25, 2018 –: Chair Luersen submitted the Neighborhood Commission's original draft of the Wednesday, May 9, 2018 Regular Meeting Minutes, prior to any revisions, with the caveat that the Minutes be considered Draft Minutes pending results of LeVassuer's Appeal of the Findings of Fact Hearing held on Monday, October 22, 2018.

Bender Moved and Reppun Seconded to Adopt the Regular Meeting Minutes of Wednesday May 9, 2018 as Amended. The Motion FAILED TO MEET QUORUM, 6-4-1 (**Aye**: Bender, Luersen, Machado, Reppun, Towill, and Vermeesch; **Nay**: Gomes, LeVasseur, Loo, and Obayashi; **Abstain**: Kaluhiwa).

SUB-DISTRICT REPORTS: There were no sub-district reports.

ANNOUNCEMENTS
Next Meeting – The next meeting of the Kahalu'u Neighborhood Board No. 29 is tentatively scheduled for Wednesday, July 10, 2019 at the Key Project, 47-200 Waihee Road at 7:00 p.m.

ADJOURNMENT – The meeting adjourned at 10:25 p.m.

Submitted by: Casey Ishitani, Neighborhood Assistant
Reviewed by: Jackson Coley, Public Relations
Final approval by: Chair Amy Luersen

KAHALU'U NEIGHBORHOOD BOARD NO. 29
(He'eia Kea, 'Āhuimanu, Kahalu'u, Waihe'e, Ka'alaea, Waiāhole, Waikāne, Hakipu'u, Kualoa)

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"LET US NOT EVER HAVE AN UNHAPPY MINORITY; RATHER, LET US BUILD A COMMUNITY CONSENSUS."

INITIAL CONVENING MEETING MINUTES
WEDNESDAY, JULY 10, 2019
KUALOA HE`EIA ECUMENICAL YOUTH (KEY) PROJECT

CALL TO ORDER: Chair Pro Tem Amy Luersen called the Kahalu'u Neighborhood Board No. 29 meeting to order at 7:05 p.m. **Quorum was established with twelve (12) members present.** Note – This 15-member Board requires eight (8) members to establish quorum and to take official Board action.

Members Present: Daniel Bender, Kaanoi Walk, Lee Gomes (arrived at 7:24 p.m.), Leialoha Kaluhiwa (arrived at 7:34 p.m.), Ken LeVasseur, Joseph Haili, Amy Luersen, Art Machado, Yvonne Nelson, Flora Obayashi, John Reppun, Rick Towill, Richard Vermeesch, and Jean Tangaro.

Members Absent: None.

Guests: Major Crizalmer Caraang, Captain Shellie Paiva, Lieutenant Michael Kuroda (Honolulu Police Department); Danny Hayes (Marine Corps Base Hawaii); Captain Clayton Madrona (Honolulu Fire Department); Barry Usagawa (Board of Water Supply); Representative Lisa Kitagawa; Aulii Dudoit (KEY Project); Cliffor Wong (Wong Farm); Marie Samudio, Garrett Howard, Kai Kahele, Matthew Lee, Won-Seok Yuh, Lara Pangon, Bill South, Chuck Peason, Alan Texeira, Kalae Kukahiko, and Clifford Loo (Residents); Casey Ishitani (Neighborhood Assistant).

SWEARING IN OF NEW BOARD MEMBERS: The Neighborhood Assistant swore in the Kahaluu Neighborhood Board No. 29.

PUBLIC SAFETY REPORT
Honolulu Fire Department (HFD): Captain Clayton Madrona reported the following.

- June 2019 Statistics: There were no structure fires, one (1) wild-land fire, two (2) nuisance fires, no cooking fires, two (2) automobile fires, one (1) activated alarm, 39 medical emergencies, no motor vehicle collisions with pedestrians, three (3) motor vehicle crashes, no mountain rescues, two (2) ocean rescues, and one (1) hazardous materials incident.
- Safety Tip: Captain Madrona reported tips for grill safety. Each year, an average of 8,900 home fires are caused by grilling. Almost half of all injuries involving grills are due to thermal burns. HPD provided the following tips: propane and charcoal barbecue grills should only be used outdoors; grills should be placed well away from the home, deck railings, and out from under eaves and overhanging branches; keep children and pets at least three (3) feet away from the grill area; keep the grill clean by removing grease; never leave grills unattended; and ensure the gas grill lid is open before lighting it. Specific tips for charcoal grills include: charcoal chimney starters allow residents to light charcoal using newspaper as fuel; if using a starter fluid, only use charcoal starter fluid; keep charcoal fluid out of reach of children; and let coals cool completely before disposing of it in a metal container.

Questions, comments, and concerns followed: Beach Fire: Towill raised concerns regarding charcoal disposal at beaches. Towill referred to a Hawaii News Now story regarding a toddler being burned by hot coals that were buried. Captain Madrona responded that residents should properly dispose of coals.

Honolulu Police Department (HPD): Lieutenant Michael Kuroda reported the following.

- June 2019 Statistics: There was one (1) motor vehicle theft, 12 burglaries, six (6) thefts, and eight (8) unauthorized entries of motor vehicles.
- Safety Tips: Lieutenant Kuroda provided a handout regarding safety tips for children, including sections regarding internet safety and instructions on walking to and from school.

ORGANIZATION OF THE KAHALUU NEIGHBORHOOD BOARD
Chair: **Obayashi Moved and Machado Seconded to appoint Luersen as Chair. The Motion was ADOPTED BY UNANIMOUS CONSENT, 12-0-0** (**Aye**: Bender, Walk, LeVasseur, Haili, Luersen, Machado, Nelson, Obayashi, Reppun, Towill, Vermeesch, and Tangaro; **Nay**: None; **Abstain**: None).

Vice Chair: **Machado Moved to nominate Reppun. Reppun declined. There was no Second.**

Reppun Moved and Nelson Seconded to Appoint Towill as Vice Chair. The Motion was ADOPTED BY MAJORITY VOTE, 11-1-0 (**Aye**: Bender, Walk, LeVasseur, Haili, Luersen, Machado, Nelson, Reppun, Towill, Vermeesch, and Tangaro; **Nay**: Obayashi; **Abstain**: None).

Treasurer: **LeVasseur Moved and Machado Seconded to Appoint Bender as Treasurer. The Motion was ADOPTED BY UNANIMOUS CONSENT, 12-0-0** (**Aye**: Bender, Walk, LeVasseur, Haili, Luersen, Machado, Nelson, Obayashi, Reppun, Towill, Vermeesch, and Tangaro; **Nay**: None; **Abstain**: None).

Secretary: **Tangaro Moved and Reppun Seconded to Appoint Nelson as Secretary. The Motion was ADOPTED BY MAJORITY VOTE, 11-1-0** (**Aye**: Bender, Walk, LeVasseur, Haili, Luersen, Machado, Nelson, Reppun, Towill, Vermeesch, and Tangaro; **Nay**: Obayashi; **Abstain**: None).

Date, Time, and Location**: Reppun Moved and LeVasseur Seconded to retain the current date of the month, time, and location for the Kahaluu Neighborhood Board. The Motion was ADOPTED BY UNANIMOUS CONSENT, 12-0-0** (**Aye**: Bender, Walk, LeVasseur, Haili, Luersen, Machado, Nelson, Obayashi, Reppun, Towill, Vermeesch, and Tangaro; **Nay**: None; **Abstain**: None).

Recess Schedule: Chair Luersen suggested with no objection that the Kahaluu Neighborhood Board Recess in December 2019. Seeing no objection, the Board scheduled a Recess in December 2019.

Gomes arrived at 7:24 p.m. The Neighborhood Assistant swore her in. 13 members were present.

Olelo Broadcast Media: **Obayashi Moved and Machado Seconded to have Olelo Broadcast Media record Kahaluu Neighborhood Board meetings. The Motion was ADOPTED BY MAJORITY VOTE, 12-0-1** (**Aye**: Bender, Walk, Kaluhiwa, LeVasseur, Haili, Luersen, Machado, Nelson, Obayashi, Reppun, Towill, Vermeesch, and Tangaro; **Nay**: None; **Abstain**: Gomes).

Kaluhiwa arrived at 7:34 p.m. The Neighborhood Assistant swore her in. 14 members present.

Oral Testimony: LeVasseur raised issue regarding the rules of oral testimony, claiming that the Neighborhood Commission is not compliant with "the law". Obayashi raised that the Board may adopt their own rules. Bender responded that Robert's Rules allows civil discussion. Reppun raised that time limits to oral testimony during Board meetings should be at Chair Luersen's discretion.

FILLING OF VACANCIES ON THE BOARD: Sub-District Six (6): He'eia ahupua`a (Hui Iwa `ili): Chair Luersen inquired if there were any volunteers. Seeing none, this item was deferred to the August 2019 Meeting.

RESIDENT/COMMUNITY CONCERNS
57th Annual Hawaii State Farm Fair: Chair Luersen reported that the 57th Annual Hawaii State Farm Fair will take place at Kualoa Ranch from Saturday, July 13, 2019 to Monday, July 15, 2019.

Morning Glass Coffee: KEY Project Executive Director Aulii Dudoit reported that Morning Glass Coffee is now open at KEY Project, Monday to Friday from 7:00 a.m. to 1:00 p.m. More information can be found at http://www.morningglasscoffee.com/key-project.

Koolaupoko: Resident Marie Samudio reported that Hawaiian Electric Company (HECO) has been facilitating community conversations around Koolaupoko community resilience. Samudio stated that Kahaluu may require a separate power source. Chair Luersen responded that when the HECO report is finalized it will be shared with the Board.

CITY, STATE, AND FEDERAL AGENCY REPORTS
Marine Corps Base Hawaii (MCBH): Danny Hayes reported that MCBH will partner with Oahu Waterkeeper for an oyster deployment in Kaneohe Bay and at Mokapu Peninsula to aid in filtering pollutants and aiding biodiversity.

Questions, comments, and concerns followed: Fishponds: Kaluhiwa raised concerns regarding use of Nuupia ponds, stating that they could be developed as sustainable community fishponds.

Board of Water Supply (BWS): BWS Programs Director Barry Usagawa reported the following:

- Main Breaks: There were no main breaks.
- Usage: 140 Million Gallons per Day (MGD) were used in June 2019.
- 31st Annual Halawa Xeriscape Garden Open House and Unthirsty Plant Sale: BWS presents the 31st Annual Halawa Xeriscape Garden Open House and Unthirsty Plant Sale on Saturday, August 3, 2019 from 9:00 a.m. to 3:00 p.m. More information can be found at www.boardofwatersupply.com, visit www.facebook.com/bwshonolulu, follow @bwshonolulu on Twitter, or call the BWS Communications Office at (808) 748-5041.

COMMUNITY PROJECTS PRESENTATIONS

Update on Waihee Valley Nature Park: BWS Programs Director Usagawa reported that, with the E. coli reading in June 2019, drinking water contamination has become a priority. The drinking water is safe to drink but the area near Waihee Falls will need to be protected from contamination. BWS has activated a second gate within the trail, which remains closed and locked as a management access plan is needed to enter. BWS is also waiting for an Environmental Impact Statement for a proposed loi restoration project within Waihee Valley Nature Park. Special duty HPD officers have been effective at deterring trespassers but Department of Parks and Recreation (DPR) will need to hire security guards. BWS recorded 3,000 trespassers on a three (3) day weekend.

Questions, comments, and concerns followed:

1. Chlorine and Pollution: A resident raised concerns regarding chlorine in the water table near the Waihee Ice Ponds. The resident reported that shrimp were found dead in the pools on Sunday, June 30, 2019. Usagawa responded that chlorine is used to treat drinking water in reservoirs after the Ice Ponds and that if dead shrimp are found residents will need to report to HPD. Obayashi reported that Councilmember Heidi Tsuneyoshi has raised the issue of drinking water being at risk of pollution.
2. Trail Access: A resident raised concerns about trail access, stating that he is a former HPD officer and that he feels citations and court cases are needed to deter trespassers. HPD Captain Shellie Paiva responded that due to graffiti on the "No trespassing" signs, some citations may not be upheld in court. Reppun raised that trash cans being placed at the entrance of the access gate may appear to be an invitation to trespass.
3. Social Media and Tourism Outreach: Tangaro raised that social media posts within trail can be used as a means of citation. A resident reported that posts regarding Waihee Falls can be found on www.alltrails.com. Resident Samudio suggested contacting the Hawaii Tourism Authority.

Update on Dredging of Kahaluu Lagoon: Department of Community Services Deputy Director Rebecca Soon reported that Councilmember Tsuneyoshi has been attempting to meet with Department of Design and Construction Director Robert Kroning.

Questions, comments, and concerns followed:
Dredged Materials: Kaluhiwa raised concerns regarding the dredged materials being transferred to Heeia Kea area.
Water Flow: Resident Clifford Wong raised concerns regarding increased stream flow causing erosion damage to properties up Waihee Stream.
Environmental Impacts: A resident inquired if an Environmental Impact Statement (EIS) will be needed. Deputy Director Soon responded that an Environmental Assessment (EA) is being conducted and will be utilized to determine if an EIS will be needed.

At 9:01 p.m., Chair Luersen handed the gavel to Vice Chair Towill.

Update on Status of Holokai Tours: Chair Luersen reported that Holokai Tours does not have a commercial recreation permit to operate at Heeia State Park. The Department of Land and Natural Resources (DLNR) informed her that residents who witness Holokai Tours operating at the park are encouraged to contact DLNR at (808) 643-3567. An officer will require time and date of incident to write a citation. Chair Luersen also added that Holokai Tours has applied for a permit.

At 9:05 p.m., Chair Luersen received the gavel from Vice Chair Towill.

Questions, comments, and concerns followed: Senator Gil Riviere: Senator Gil Riviere responded that residents can report violations to The DLNRTip app and tip411. People without a smartphone will be able to send an anonymous text tip via their cell phone to DLNR Division of Conservation and Resources Enforcement (DOCARE) by texting keyword DLNRTIP and their message/tip to 847411 (tip411). Anonymous web tips can also be submitted through the DOCARE website https://dlnr.hawaii.gov/docare/.

REPORTS BY ELECTED OFFICIALS

Mayor Kirk Caldwell's Representative: Deputy Director Rebecca Soon of Mayor Caldwell's office reported the following.

- Oahu Society for the Prevention of Cruelty to Animals (OSPCA): Soon informed the Board that a permit will not be granted to OSPCA to build at a proposed location.
- Hui Koloa Place: Regarding a property on Hui Koloa Place, Soon reported that a grading permit was not granted as Department of Planning and Permitting (DPP) will need to inspect the property.

Councilmember Heidi Tsuneyoshi: Councilmember Tsuneyoshi and her Representative Mike Sakata reported the following:

- Kahaluu Lagoon Dredging: Councilmember Tsuneyoshi responded to earlier questions about EA and EIS that residents will be given a comments process.
- Waihee Valley Nature Park: Councilmember Tsuneyoshi reported that there is a permitting process to allow necessary access to City and County of Honolulu employees and cultural leaders. Social media platforms are also being monitored and citations are being explored for sites that encourage trespassing. Parking could be restricted at the end of Waihee Road with fees established if requested by residents and the Kahaluu Neighborhood Board.
- Resolution 1392: Repairs to the Kalohaku Bridge have been budgeted.
- Windward Coast Disaster Preparedness Fair: Councilmember Tsuneyoshi took a moment to honor the Windward Coast Disaster Preparedness Fair.

Questions, comments, and concerns: Waihee Marsh: Reppun inquired if DPP would support designating Waihee Marsh as a protected wetland.

Councilmember Ikaika Anderson: Councilmember Anderson reported the following.

- Bill 89: Councilmember Anderson reported that Bill 89, which will restrict vacation rentals, has been signed into law.
- Haiku Stairs: The comment period is active at the BWS website (https://www.boardofwatersupply.com/community/haiku-stairs), comments will be accepted no later than 11:59 PM HST, Wednesday, August 7, 2019

Senator Gil Riviere: Senator Riviere reported the following.

- Community Emergency Response Team (CERT): Senator Riviere reported that he graduated from the City and County of Honolulu's Department of Emergency Management (DEM) CERT training.
- Pali Lanes: Senator Riviere supports saving the Kailua bowling Pali Lanes.
- House Bill (HB) 1326: Senator Riviere reported that HB 1326 did not pass in spite of pressure to DLNR for water licenses from Alexander and Baldwin.
- HB 551: HB 551 passed and was forwarded to Governor Ige. HB 551 would extend various reporting deadlines and the sunset date of the cesspool conversion working group established pursuant to Act 132, Session Laws of Hawaii 2018.

Representative Lisa Kitagawa: Representative Kitagawa handed out a newsletter and reported the following.

- Windward Emergency Preparedness: Representative Kitagawa handed out a pamphlet for Emergency Preparedness. The pamphlet highlighted planning, emergency kits, and provided resources for further information. Residents can contact Kaneohe / Kahaluu CERT to get involved at kkcertsos@gmail.com.
- Windward Homelessness: Representative Kitagawa reported that the Joint Outreach Center at the Kaneohe Civic Center will be opening by the end of Summer 2019 with medical services for homeless Medicaid individuals. H4 Hawaii and The Institute for Human Services (IHS) will expand to include substance abuse treatment along with housing referrals.

Governor David Ige's Representative: Hawaii Department of Business Director Mike McCartney took questions.

Questions, comments, and concerns followed:

1. Emergency Shelters: Reppun raised concerns regarding the costs that Hurricane Lane caused in 2018. Reppun also inquired about which State department will take up liability for the Department of Education (DOE) and Waiahole Elementary School in the case of another storm event.

2. Solar Panels: Reppun and resident Samudio raised concerns regarding the cadmium toxicity in floatable solar panels in Kahaluu and Director McCartney responded that he would speak to the manufacturers of the panels and get back to the Board.
3. Pali Lanes: Machado raised concerns regarding Pali Lanes requiring assistance from the State of Hawaii. He stated that Pali Lanes regularly hosts Special Olympics events.

Senator Jarrett Keohokalole: No representative was present; no report was given.

Representative Sean Quinlan: No representative was present; no report was given.

ESTABLISH COMMITTEES, SUBCOMMITTEES, AND THEIR MEMBERSHIP
Committees: Chair Luersen stated that she recognized that there are many recurring issues that have faced the community for years and the KNB has positions for many. She proposed organizing these into a spreadsheet by geography, maybe in three a sections, as a means to better track the issues. Chair Luersen proposed modifying the committee structure aligned with some of the major issues. She proposed the establishment of three (3) committees – Land and Water Planning, Infrastructure, and Community Resilience.

Discussion followed:

- LeVasseur inquired and Chair Luersen confirm that Transportation would be imcluded under Infrastructure.
- Bender inquired if Agriculture could be a committee and Chair Luersen responded that it would be Included in Land and Water Planning.
- Obayashi raised objections as she felt that an Emergency Preparedness Committee is of immediate importance to the Kahaluu Neighborhood Board and warrants its own committee. she also stated that she felt we should use FEMA terms.
- Kaluhiwa inquired about where culture would be included.
- Walk stated that he felt Culture should be a separate committee
- Kaluhiwa inquires I f the making of committees and subcommittees can be added to the August 2019 Agenda.
- Reppun added that the process is a way of simplifying the language of committees and encourage proactivity and more communication within the Board.
- Obayashi objected without acknowledgement from Chair Luersen.

At 10:12 p.m. Chair Luersen gaveled to reestablish order.

At 10:15 Tangaro left. 13 Board members were present.

Kaluhiwa, LeVasseur, and Obayashi left the Board meeting as Gomes made a Motion and Towill Seconded to Adopt Committees. Neighborhood Assistant retrieved Kaluhiwa, LeVasseur, and Obayashi as a Motion was made and Sunshine Law issues were present with absent Board members.

Gomes Moved and Towill Seconded to Establish Three (3) Standing Committees (Land and Water Planning; Infrastructure; and Community Resilince) with time to develop subcommittees before the Wednesday, August 14, 2019 Kahaluu Neighborhood Board Meeting. The Motion was ADOPTED BY MAJORITY VOTE, 11-0-2 (**Aye**: Bender, Walk, Kaluhiwa, LeVasseur, Haili, Luersen, Nelson, Reppun, Towill, Vermeesch, and Tangaro; **Nay**: None; **Abstain**: Machado and Obayashi).

Chair Luersen stated that she will add further discussion of committee and subcommittee structure to the August agenda. She encouraged Board members to send her an email with additional thoughts on structure.

BOARD BUSINESS
Treasurer's Report: Bender reported a remaining balance of $495.24.

Approval of Regular Meeting Minutes of Wednesday, June 12, 2019: Neighborhood Assistant reiterated that residents who do not sign in or state their names will not be named in minutes. Obayashi raised that in "Report on Windward Emergency Preparedness Fair" references to "cyclones" should be changed to "hurricanes". Kaluhiwa raised that in "Preservation of Hawaiian Heritage Committee" the contest will be held at Windward Mall. LeVasseur raised that all instances of "Kalohaka" should be changed to "Kalohaku". Reppun raised that in "Solar Panels" the devices mentioned were water panels or floatable photovoltaic devices. Machado was mentioned as not being present, but was present at the time of the Military Liaison report.

Bender Moved and Gomes Seconded to Adopt the Wednesday, June 12, 2019 Regular Meeting Minutes as Amended. The Motion was ADOPTED BY UNANIMOUS CONSENT, 13-0-0 (**Aye**: Bender, Walk, Kaluhiwa, LeVasseur, Haili, Luersen, Nelson, Reppun, Towill, Vermeesch, Tangaro, Machado, and Obayashi; **Nay**: None; **Abstain**: None).

Approval of Regular Meeting Minutes of Wednesday, April 10, 2019: Approval of Regular Meeting Minutes of Wednesday, April 10, 2019 was deferred until the next Neighborhood Board Meeting, Wednesday, August 15, 2019. Board members were asked to submit any significant changes to the Chair or Neighborhood Assistant prior to the Board meeting.

Adoption of Regular Meeting Minutes of Wednesday, May 9, 2018 and Special Meeting Memorandum for the Record of Wednesday, April 25, 2018 – Deferred Pending Appeal Findings of Fact of Hearing held on Monday, October 22, 2018: Chair Luersen submitted the Neighborhood Commission's original draft of the Wednesday, May 9, 2018 Regular Meeting Minutes, with the Amendment that the Minutes be Draft Minutes pending results of LeVassuer's Appeal to Findings of Fact Hearing held on Monday, October 22, 2018.

SUB-DISTRICT REPORTS: There were no sub-district reports.

ANNOUNCEMENTS
Next Meeting – The next meeting of the Kahalu'u Neighborhood Board No. 29 is tentatively scheduled for Wednesday, August 14, 2019 at the Key Project, 47-200 Waihee Road at 7:00 p.m.

ADJOURNMENT – The meeting adjourned at 10:25 p.m.

Submitted by: Casey Ishitani, Neighborhood Assistant
Reviewed by: Jackson Coley, Public Relations
Final approval by: Chair Amy Luersen

CONFERENCE REPORT

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Suite 170
Honolulu, HI 96813
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www.g70.design

TO:	Files		
FROM:	G70 (BN)		
DATE:	7/31/2019	**LOCATION:**	KEY Project
PROJECT:	BWS Waiheʻe Loʻi Restoration and Riparian Learning Center	**PROJECT NO:**	218043-01
SUBJECT:	Small Community Meeting, 7/31/2019	**NO. OF PAGES:**	4
THOSE PRESENT:	Community: John Reppun, Kaipo Faris, Shae Cotteen, Clifford Wong, Steven Springel, Kent Yamaguchi, Kauaoa Fraiola, Peter Field, Carl Brown, Ikaika Higa, Daniel Salsedo	BWS: Barry Usagawa, Kaimana Wong, Amy Tsuneyoshi G70: Kawika McKeague, Barbara Natale, Janice Jensen	

Summary: This was a community meeting to talk about the Waiheʻe Loʻi Restoration and Riparian Learning Center (WLRRLC). The Kualoa Heʻeia Ecumenical Youth (KEY) Project is interested in working on this parcel to restore loʻi and create a Riparian Learning Center. Because of this, BWS is facilitating an Environmental Assessment (EA) to reach an informed decision for moving forward. Community members came together to talk about the issues related both to current trespassing issues in the area as well as concerns for the future WLRRLC.

History of the area

John R. - Lewers & Cooke owned the land at the back of Waiheʻe Road. The land was originally zoned for a hotel/resort. Landowners in Waiheʻe sued for the down designation of the land and the lawsuit was settled out of court. The result was that the City was assigned the land in the lower section. BWS maintained control of the mauka sections due to the tunnel. When Frank Fasi came on as Mayor, he floated a plan to create a golf course in the back of Waiheʻe Valley. The community and BWS banded together to stop this plan and the land was ultimately designated as a nature park to prevent the development of a golf course.

There was a lot of flooding in the area in the 1960s and this spurred the development of the Kahaluʻu Watershed Work Plan, a joint effort between City, State, and Federal entities. This plan may need revisiting and updating.

In 2003 BWS entered into a MOU with KEY Project granting KEY a ROE to access the valley for restoration work. The WAI Initiative originated from this work and the idea of a riparian learning center was born.

KEY Project and community members have excavated an old dump site along the road in preparation for the WRRLC (proposed bus turnaround area and parking).

UNLESS WRITTEN OBJECTION IS RECEIVED WITHIN SEVEN DAYS, WE ASSUME STATEMENTS CONTAINED WITHIN ARE ACCEPTED
ARCHITECTURE // CIVIL ENGINEERING // INTERIOR DESIGN // PLANNING & ENVIRONMENT

Clifford W. - The area now owned by BWS at the back of the valley was once owned by the Kalahiki family. When Hawaiʻi went through statehood, the family lost their lands due to not having paid taxes on them. The Kalahiki family may have burials in the valley.

Clifford spent a lot of time in the valley as a child. They used to go back in the valley and pick mountain apples. There was also a lot of ʻilima and maile in the forest. A pig farm used to exist close to the current gate on Waiheʻe Road. A large area was turned into cow pasture after the rice mills were closed. The rice mills were removed by DPR without SHPD consultation.

The creation of the tunnel drew the water away from the many large springs that used to be in the area. These springs supplied water to the loʻi that used to exist here. The entire lower area near Kahaluʻu was swampy and the rice mills were able to run by water wheel. Clifford used to catch ʻōpae in the springs as a child.

The Higa family, who started the Waiāhole Poi Factory, has long been in the Kahaluʻu area and may also have family burials on the land.

Issues and concerns regarding trespassing

- Kids can't play in the neighborhood because of cars
- Food safety standards (for taro production) and water quality
- Water safety: trespassers put the drinking water supply at risk for threats and acts of terrorism
- Pollution
  - Large amounts of rubbish left on the trail and in the stream by hikers, cleaned up by the community. Putting trash cans out gives the appearance that hiking is allowed/encouraged.
  - Aquatic organisms are extremely susceptible to the chemicals (e.g. sunblock, insect repellant). Some have noticed dead fish and prawns (most likely the invasive variety).
- Invasive species taking over the forest
- Hikers are extremely disrespectful to the forest and the neighborhood (driveways, fire hydrants, littering)
- Social media is an invitation that brings more people up to hike. The tourism industry is also a factor—tours drop people off to hike, some hikers said the front desk of their hotel told them of the hike.
  - Possible need for some communication/outreach to the military base and tour companies to get the no trespassing message across.
  - Tourism industry should be told there are places they should not go.

Actions taken to address trespassing

BWS - Police have been present on a few occasions to warn hikers about trespassing and have issued citations.

On 7/24 DPR and BWS put up 20+ new No Trespassing signs at the gate and along the road, repaired the second cattle gate and locked it with a different combination. The combinations of both gates will be changed more often to prevent unauthorized vehicle entry.

BWS is willing to fund 50% of the cost of private security but would need DPR to fund the other 50%.

BWS has put out communications and outreach to the public and social media outlets about not trespassing on the trail. Kaimana is not sure exactly what the messages have been or through what channels they were distributed.

Issues and concerns about the WLRRLC project

- Responsibility for land currently falls to DPR and BWS. DPR's presence gives the impression that it should be publicly accessible.
- The WLRRLC would require a land agreement or permit with DPR. DPR does not want to assume liability and has no resources to devote to the area. This may pose problems for a future MOU with KEY Project or another third-party nonprofit who is also not capable of taking on the liability.
- There is a spring in the loʻi that works with the stream to provide water.
- Don't move the gate further back from the road. People like to gather there and drink in the evenings and this may encourage them to go further up the valley where they are not visible to the neighbors.
- The tunnels under the garages of Waiheʻe Road residents where the original ʻauwai flows are beginning to crumble and sometimes become clogged. Kaipo (first house next to the gate) monitors his to make sure it continues to flow.
- Department of Health requires all cesspools to be upgraded or converted or the property must connect to a sewer system before January 1, 2050. The ʻauwai should have precedence when making connections to the houses.
- The project is not currently scoped for a managed access plan in the EA, but Barry has a list of components for a management system. Access may need to be provided to hikers, as with shoreline access requirements to create public right-of-ways (same with mauka access as makai).
- How long will it take to get this project off the ground?

Possible solutions

- BWS taking over the land currently assigned to DPR down to the very first cattle gate at the road to create a single jurisdiction of land designated for watershed purposes. This would limit or prevent access to the area for recreational purposes.
- Involving a land trust in the purchase of the DPR land for conservation purposes and creating an MOU with them to address management.
- Creating a community presence near the first gate may alleviate some of the trespassing issues, instill some kuleana in visitors.
  - Is there a need for a caretaker's presence? Should there be an office space?
- Tunnels under resident garages for the ʻauwai should have flow rates measured
- BWS Vision (Barry proposes including this list of possibilities in the EA): the WLRRLC may present opportunities for:
  - GIS mapping
  - conditions assessment
  - future ʻauwai studies in the area through BWS funding and WAI management
  - testing divergent structures
  - removal of invasive species in the mauka sections of the forest to improve watershed health
  - long-term access issues with hikers— e.g. hikers would need to help with forest restoration work to go up the trail. They would need to follow a set of guidelines/obey kapu, etc.
- The EA should be completed in July 2020. The RFP process and permitting will occur soon after.

Potential contacts

- Kauaoa Fraiola
  - Stream monitoring and ecology
  - Did a project on oʻopu in Koʻolaupoko streams, including a section of Waiheʻe stream
- Vincent Mahoe - contact Kauaoa to get in touch
  - Long-time resident of the area; remembers exactly where things were located (e.g. springs)
- Roy Ryder – suggested by Clifford
- Bob Nakata – suggested by Steve

Appendix B

Memorandum of Understanding

MEMORANDUM OF UNDERSTANDING

Between
Kualoa He'eia Ecumenical Youth Project (KEY Project)
And the
Honolulu Board of Water Supply

Background:

Waihe'e Ahupua'a, Ko'olaupoko, O'ahu is one of nine ahupua'a that surround and include Kaneohe Bay and its contributing watershed(s).

Handy, Handy & Pukui *(Native Planters In Old Hawaii – Their Life, Lore and Environment)* describe the area as follows:

> "The main stream bearing this name has its headwaters in a waterfall against the mountain wall, and is joined by two others, *Hamama* and *Kalia*. Carefully terraced but abandoned taro *lo'i* follow the stream and its tributaries almost to their several sources. It is said that the ahupua'a took its name from a *kapu lo'i* belonging anciently to the *ali'i* of the place situated mauka of the *muliwai* (lagoon) called Pa'ele, into which the main stream empties."

In modern times, Waihe'e has gained recognition as a place of contest over water allocation and management issues. This ahupua'a has spawned or contributed to intense debate, litigation, constitutional and legislative deliberation...and most importantly, a keen interest in understanding our precious water resources and the task of stewardship that we all inherit.

Preamble:

The purpose of this document is one of providing fertile ground for, and the means to cultivate a new understanding of inherited public resources within this ahupua'a. By this document, these two parties – and others to join in – will restore and/or form anew the relationships that are necessary to the sustainable management of any watershed. From such a relationship, we hope to nurture development of a viable, community-based management plan for Waihe'e, Koolaupoko that will guide generations to come.

This agreement will assist the parties in identifying resources and opportunities towards achievement of agreed-upon goals including, but not limited to the following:

> *1) To preserve, protect, restore, enhance and interpret the unique natural and cultural inheritance of Waihe'e for future generations by fostering knowledge of relevant history, culture, local economy and science such that an understanding of the elements that are critical to ahupua'a restoration becomes widespread;*
>
> *2) To protect endangered tropical forest(s), wetlands, riparian, coastal, estuarine, and*

> *marine habitat through promotion of environmental policies and practices that address biological sustainability and human well being. This will be accomplished, in part, by integrating current Western management strategies with traditional Hawaiian resource stewardship models – each of which are now better understood;*
>
> *3) Develop natural resource stewardship models that respect the native Hawaiian rights and those of an island community while helping to re-establish a corresponding acceptance of civic responsibilities attached to said rights;*

Partnership Agreement:

The "Partners", as referred to in the agreement, fully support the need to include all parties who demonstrate a willingness to contribute positively to the expressed goals of the Waihe'e Ahupua'a Initiative [WAI].

This agreement is, therefore, but a first step towards development of a framework within which other individuals, organizations and resources can be added or assembled to accomplish common goals.

By this MEMORANDUM OF UNDERSTANDING, the Honolulu Board of Water Supply, hereinafter referred to as "BWS", and the Kualoa-He'eia Ecumenical Youth Project, hereinafter referred to as "KEY Project", agree to participate in cooperative management, and educational activities in Waihe'e Ahupua'a, hereinafter known as the WAI'HEE AHUPUA'A INITIATIVE ("WAI")

WHEREAS, KEY Project and **BWS**, hereinafter collectively referred to as "**PARTNERS**", wish to work cooperatively to foster appropriate management of and planning for all or portions of Waihe'e ahupua'a, from the summit of the Koolau range to the outer edge of Kane'ohe Bay; and

WHEREAS, Waihe'e Ahupua'a contains an abundance of publicly-owned lands and, therefore, offers a critical opportunity for cultural and environmental education, ahupua'a restoration and/or enhancement; and

WHEREAS, Waihe'e Stream and its system tributaries are a critical source of fresh water input supporting the estuary and fisheries of Kane'ohe Bay; and

WHEREAS, Waihe'e is historically an important source of water for both the **BWS** and adjacent farmers, including the cultivation of lo'i kalo; and

WHEREAS, proper management of this area would benefit Hawaii's watersheds, culture, native flora and fauna and provide valuable public benefit; and

WHEREAS, active and effective stewardship of the Waihe'e Ahupua'a is important to the programs of each of the **PARTNERS**; and

WHEREAS, effective management is best achieved through the coordinated actions of such partnerships; and.

NOW, THEREFORE, the **PARTNERS** hereby agree in principle as follows:

1. To jointly pursue the development of a strategic plan for the Waihe'e watershed that shall include, but not be limited to: a water resources and management plan; plans for the development/restoration of cultural, environmental and educational resources; opportunities for sustainable community-based economic development, and a plan for the development of additional partnerships that will support the goals of **WAI** as identified in a strategic plan; and

2. To determine costs to implement specific aspects of Waihe'e Ahupua'a Initiative agreed upon in #1 and join in cooperative efforts to raise funds for agreed-upon projects.

3. To develop and implement specific agreements and working plans for the individual projects considered by the parties hereto having mutual interest. Such agreements and working plans may be developed whenever appropriate.

4. To enter into specific agreements, as occasion demands, which may include the use of specialized equipment, hiring and supervision of personnel, transfer of funds, purchasing of supplies, and other matters pertaining to the general purposes of management agreed upon by the parties hereto. Limitation of expenditures under this MEMORANDUM OF UNDERSTANDING will be determined by specific working agreements, with consensus agreement of PARTNERS, entered into under authority of this instrument contingent upon compliance with applicable laws or policy guidelines which govern such expenditures.

5. That, in carrying out the terms of this understanding, each PARTNER will provide up to two, but not less than one, representatives for the purpose of resolving differences and determining the direction and flow of common work.

6. That other associates may enter into this partnership at any time by way of an addendum to this MEMORANDUM OF UNDERSTANDING.

7. The PARTNERS agree to a mediated conflict resolution process in the event of irreconcilable differences. Any PARTNER may elect to not participate in this MEMORANDUM OF UNDERSTANDING by providing 90 days written notice to the others.

IN WITNESS WHEREOF, the PARTNERS hereto have executed this MEMORANDUM OF UNDERSTANDING made and entered into on the 25th day of October 2003, at Waihe'e Ahupua'a, Koolaupoko, Oahu.

KEY Project

By: _____
Rick Towill, President,
Board of Directors

Date: 10/25/03

John L. Reppun

Honolulu Board of Water Supply

By: _____
Clifford Jamile,
Manager and Chief Engineer

Date: 10.25.03

Appendix C

Ko‘olaupoko Stream Diversion Survey

Koʻolaupoko Stream Diversion Survey, 2008 to 2011
Stream Diversion Field Notes

Conducted for

State of Hawaiʻi
Department of Land and Natural Resources
Commission on Water Resource Management
Stream Protection and Management Branch

Prepared by

Honolulu Board of Water Supply
Water Resources Division
Hydrology-Geology Section

August 2011

Acknowledgments

The reconnaissance of stream diversions could not have been conducted without assistance from the following people and their area of expertise, in parentheses.
Kaipo Faris; (Waiheʻe Valley).
John Morgan, Brody Hartle; Kualoa Ranch Hawaiʻi (Hakipuʻu Valley).
Alfredo Lee, Vernon Pico, Joan Kawamoto, Gary Anguay, John Bautista; State of Hawaiʻi Agribusiness Development Corporation (Waiāhole Ditch System).
Gary Umeda; Hawaiʻi Housing Finance and Development Corporation (Waiāhole Valley Agricultural Park and Residential Lots Subdivision).
Randolph Teruya, Eddie Paulo, Shaun Wilcox; Hawaiʻi State Department of Agriculture (Maunawili Ditch – Waimānalo Irrigation System).
Jennifer Kobayashi (Student Aide III), Arthur Kham Sing (Poʻokela Program)

Product

Included in this submittal are the field notes, map, and summary of the Koʻolaupoko diversions. Reconnaissance was performed to the extent practicable. The field notes represent observations of Honolulu Board of Water Supply staff and make no representation of opinion regarding the utilization of any diversion.

Respectfully submitted by:

Barry Usagawa
Principal Executive
Water Resources Division

Glenn Oyama
Hydrologist-Geologist
Water Resources Division

Executive Summary

Staff of the Honolulu Board of Water Supply conducted field surveys of the stream diversions within the Koʻolaupoko district of Oʻahu during the period October 2008 to July 2011. The surveyed district encompassed Kaʻaʻawa Valley on the Northwestern boundary of the district, to Waimānalo on the Southeastern edge of the district. Included within the compilation of field notes are the Waiāhole Ditch System intakes 1 through 19, which are located within the Kahana hydrologic unit. Although these intakes are not within the Koʻolaupoko area, they are integral to the Waiāhole Ditch System. The Kaʻaʻawa Valley diversions, as listed in the Department of Land and Natural Resources inventory, were also included although that hydrologic unit is not within the Koʻolaupoko ahupuaʻa.

Discharge measurements were taken utilizing various methods. In many reaches of the streams or tributaries it was not possible to take measurements because of unsuitable site conditions. Due to staff time constraints, stream reconnaissance was pursued in reaches of the streams that were likely to have diversions. The existing Department of Land and Natural Resources inventory of stream diversions was used as the baseline for conducting these surveys.

In keeping with the previous stream surveys done on Maui by the R.M. Towill Corporation, the field sheets and stream measurement forms were kept to a similar format to maintain a degree of consistency.

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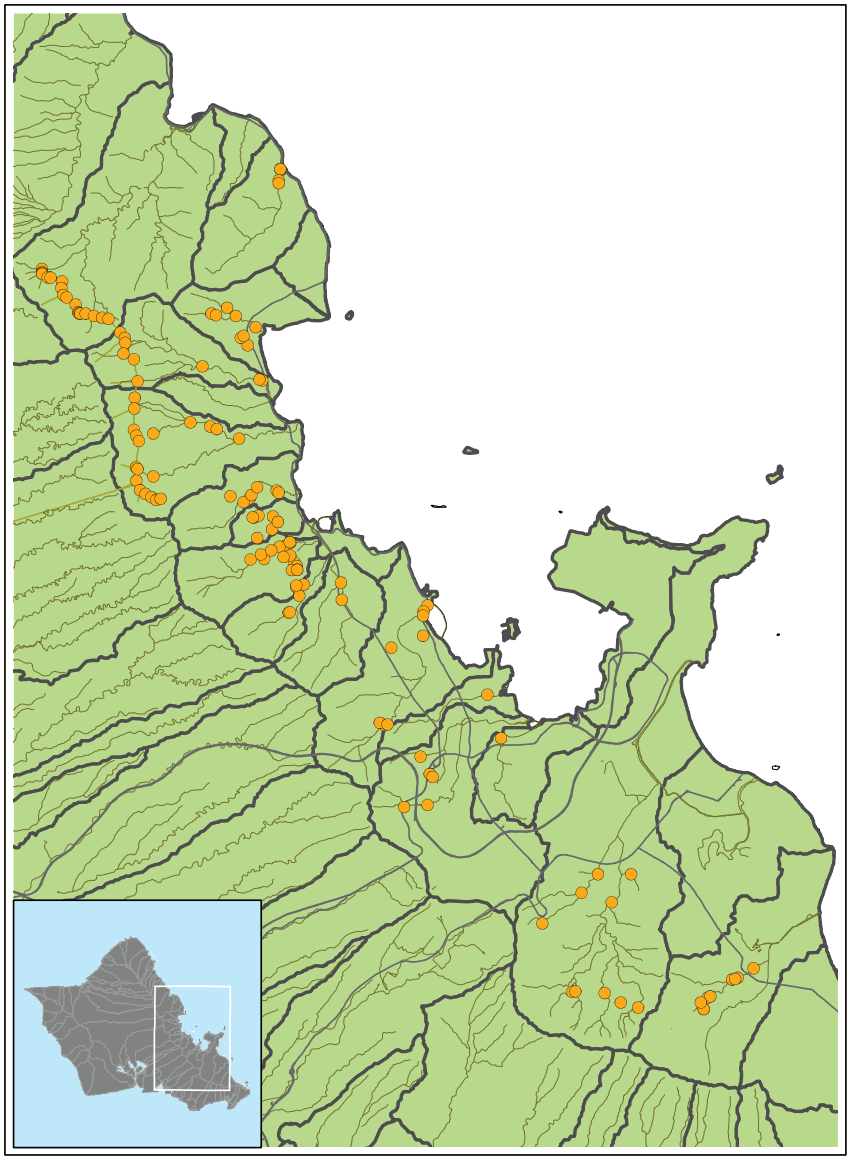
Ko'olaupoko Stream Diversions, 2008 to 2011 (HBWS)



Koʻolaupoko Stream Diversion Survey, 2008 to 2011 (HBWS)

Diversion Name	Surface Hydrologic Units	TMK	Diversion	[a]Status	Stream	[b]Stream (mgd)	Diversion (mgd)	[b]Acreage	Crop
Fuller W&C	3035	4-1-010:048	—	I	Waimanalo	—	0.00	5.00	—
Fuller W&C	3035	4-1-010:048	—	I	Waimanalo	—	0.00		—
Lee (Green DW)	3035	4-1-025:042	pump	I	Waimanalo	—	0.00	1.00	—
Hashimoto Orchids	3035	4-1-018:015	pump	I	Waimanalo	—	0.00	1.00	diversified ag.
Hongs FF	3035	4-1-025:046	—	I	Waimanalo	—	0.00	2.00	other uses
Kamei ES	3035	4-1-013:003	—	I	Waimanalo	—	0.00	2.00	—
Lum AK	3035	4-1-025:040	gravity	I	Tributary to Waimanalo	—	0.00		kalo
Yamashita WM	3035	4-1-018:013	pump	I	Waimanalo	—	0.00	e0.86	diversified ag.
Yamashita Y	3035	4-1-018:014	pump	I	Waimanalo	—	0.00	e0.71	diversified ag.
Makalii Valley Farmers	3033	4-2-006:001	pump	I	Tributary to Maunawili	—	0.00	46.00	—
Maunawili Farmers Association	3033	4-2-008:001	gravity	I	Tributary to Maunawili	—	0.00	51.00	diversified ag.
St. Stephens Diocesan spring box 1	3033	4-2-010:001	gravity	A	Tributary to Kahanaiki				
St. Stephens Diocesan spring box 2	3033	4-2-010:001	gravity	A	Tributary to Kahanaiki	—	0.009	—	potable supply
St. Stephens Diocesan spring box 3	3033	4-2-010:001	gravity	A	Tributary to Kahanaiki				
Maunawili Ditch System Source 1	3033	4-2-010:001	gravity	A	Tributary to Maunawili	0.92	0.92		diversified ag.
Maunawili Ditch System Source 3	3033	4-2-010:001	gravity	A	Maunawili	0.29	0.29		diversified ag.
Maunawili Ditch System Source 10	3033	4-2-010:001	gravity	A	Ainoni	0.15	0.14	[c]750	diversified ag.
Maunawili Ditch System Source 16	3033	4-2-010:001	gravity	A	Tributary to Makawao	—	0.22		diversified ag.
Maunawili Ditch System Source 17	3033	4-2-010:001	gravity	I	Makawao	0.15	0.00		diversified ag.
Lew A	3033	4-2-012:001	pump	I	Kahanaiki	—	0.00	3.00	diversified ag.
Tanaka M	3033	4-2-011:002	pump	I	Kahanaiki	—	0.00		—
Atlas	3031	4-5-030:037	pump	I	Kawa	—	0.00	—	other uses
State Hospital	3030	4-5-023:002	gravity	A	Kapunahala	0.23	0.17	0.76	kalo
Yanagida	3030	4-5-025:005	—	U	Unnamed spring	—	--	—	—
Crocker	3030	4-5-025:025	—	U	Unnamed spring	--	--	—	—
Salas	3030	4-5-041:016	gravity	I	Luluku	0.78	0.14	e0.16	kalo
Stride	3030	4-5-041:017	gravity	A	Luluku	0.78	0.08	e5.00	diversified ag.
Burgher	3029	4-5-012:011	pump	I	Keaahala	—	0.00	—	other uses
Heeia Fishpond Wai 1	3028	4-6-005:001	gravity	A	Heeia	—	—	88.00	aquaculture
Heeia Fishpond Wai 2	3028	4-6-005:001	gravity	A	Heeia	—	—	88.00	aquaculture
Heeia Fishpond Wai 3	3028	4-6-005:001	gravity	I	Heeia	—	0.00	88.00	aquaculture
Hakipuu Learning Center	3028	4-6-014:001	gravity	A	Haiku	0.42	0.05	e0.39	kalo
Hui kū Maoli Ola	3028	4-6-014:002	gravity	A	Haiku	0.08	—	e0.46	kalo
Wing Wo Tai auwai	3028	4-6-016:001	gravity	A	Heeia	—	—	e0.04	kalo
Lee auwai	3028	4-6-016:002	gravity	A	Heeia	—	—	—	kalo
S Asato	3027	4-7-005:002	pump	A	Tributary to Waihee	0.31	—	e7.00	diversified ag.
Silverstein (McCord)	3027	4-7-005:009	gravity	A	Tributary to Waihee	0.45	0.23	e0.34	kalo
Field	3027	4-7-005:013	pump	A	Unnamed spring	e0.10	--	e0.02	diversified ag.
Akima	3027	4-7-005:017	pump	A	Waihee (auwai 3)	0.31	—	—	other uses
Chen	3027	4-7-005:070	pump	I	Tributary to Waihee	—	0.00	4.00	—
Silva	3027	4-7-005:073	pump	A	Tributary to Waihee	0.38	—	1.75	diversified ag.
Spencer	3027	4-7-005:074	pump	A	Tributary to Waihee	0.38	—	1.75	diversified ag.
Y Higa	3027	4-7-005:075	pump	A	Tributary to Waihee	0.29	—	e1.80	diversified ag.
Wainwright	3027	4-7-005:079	pump	A	Tributary to Waihee	0.24	—	e0.92	diversified ag.

[a] Status: A (active), I (inactive), U (unknown).
[b] Stream/Acreage: (e) estimation.
[c] Randolph Teruya, State DOA (personal communication).

Koʻolaupoko Stream Diversion Survey, 2008 to 2011 (HBWS)

Diversion Name	Surface Hydrologic Units	TMK	Diversion	[a]Status	Stream	[b]Stream (mgd)	Diversion (mgd)	[b]Acreage	Crop
Alvarado	3027	4-7-005:090	gravity	A	Waihee (auwai 3)	0.31	0.003	e0.04	other uses
B Young	3027	4-7-012:003	pump	A	Waihee	2.97	—	e0.25	diversified ag.
Anderson	3027	4-7-029:010	gravity	I	Kahaluu	—	0.00	—	—
C&C Hio Basin	3027	4-7-029:034	gravity	A	Kahaluu	3.62	3.62	—	—
C&C Hio Basin	3027	4-7-029:002			Kahaluu				kalo, div. ag.
C&C Hio Basin	3027	4-7-029:003			Kahaluu			e2.00	kalo, div. ag.
C&C Hio Basin	3027	4-7-029:004			Kahaluu			e3.00	kalo, div. ag.
C&C Hio Basin	3027	4-7-029:005			Kahaluu	3.62	3.62	e2.50	kalo, div. ag.
C&C Hio Basin	3027	4-7-029:017			Kahaluu			0.70	diversified ag.
C&C Hio Basin	3027	4-7-029:018			Kahaluu			1.00	diversified ag.
C&C Hio Basin	3027	4-7-029:033			Kahaluu			e5.00	diversified ag.
Hasegawa	3027	4-7-037:020	pump	I	Kahaluu	—	0.00	—	other uses
S Higa	3027	4-7-039:017	pump	I	Kahaluu	—	0.00	3.00	diversified ag.
Lesperance	3027	4-7-046:027	pump	I	Tributary to Kahaluu	—	0.00	e0.34	diversified ag.
Bowman	3027	4-7-046:028	pump	I	Tributary to Kahaluu	—	0.00	—	—
DT Chang	3027	4-7-049:002	gravity	A	Unnamed spring	e0.01	---	e0.01	kalo
Au	3027	4-7-049:003	gravity	I	Unnamed spring	0.01	0.00	—	diversified ag.
Waihee auwai 1	3027	4-7-006:010	gravity	A	Waihee	3.29	0.21	4.00	—
Waihee auwai 1	3027	4-7-006:004				3.29	0.21	1.00	kalo
Waihee auwai 1	3027	4-7-006:013						e4.00	kalo
Waihee auwai 2	3027	4-7-006:010	gravity	A	Waihee	3.08	0.19		
Waihee auwai 2	3027	4-7-064:001				3.08	0.21	0.50	diversified ag.
Waihee auwai 3	3027	4-7-064:014	gravity	A	Waihee	2.93	1.09	—	kalo
Waihee auwai 3	3027	4-7-005:017				—	0.31	—	diversified ag.
Waihee auwai 3	3027	4-7-005:090						e0.04	other uses
Waihee auwai 3	3027	4-7-006:002						e0.14	kalo
Waihee auwai 3	3027	4-7-006:003				2.93	0.78	e1.50	kalo, div. ag.
Waihee auwai 3	3027	4-7-006:013						e0.30	kalo, div. ag.
Waihee auwai 3	3027	4-7-026:002				—	0.31	e2.00	kalo
Waihee auwai 3	3027	4-7-026:005						e2.00	kalo
Waihee auwai 3	3027	4-7-026:024				—	0.31	e1.00	kalo
Waihee auwai 3	3027	4-7-027:006						e2.30	kalo
Waihee auwai 4	3027	4-7-012:021	gravity	A	Waihee	2.97	0.69	2.00	kalo
Waihee auwai 4	3027	4-7-026:004				2.97	0.69	e1.00	kalo
Waihee auwai 4	3027	4-7-026:024						e6.00	kalo
W. Chang	3026	4-7-033:010	pump	I	—	—	0.00	—	—
S Yogi	3026	4-7-033:016	pump	I	Unnamed spring	—	0.00	—	diversified ag.
R Yogi	3026	4-7-033:017	pump	I	Unnamed spring	—	0.00	1.00	diversified ag.
Saiki	3026	4-7-033:026	pump	I	Unnamed spring	—	0.00	—	diversified ag.
Senkaku	3026	4-7-047:015	pump	I	Unnamed spring	e0.02	0.00	0.67	diversified ag.
K Chang	3026	4-7-047:016	pump	A	Unnamed spring	e0.02	—	—	other uses
Higuchi	3026	4-7-047:020	gravity	I	Unnamed spring	—	0.00	—	diversified ag.

[a] Status: A (active), I (inactive), U (unknown).
[b] Stream/Acreage: (e) estimation

Koʻolaupoko Stream Diversion Survey, 2008 to 2011 (HBWS)

[d]Diversion Name	Surface Hydrologic Units	TMK	Diversion	[a]Status	Stream	Stream (mgd)	Diversion (mgd)	[b]Acreage	Crop
H Asato	3026	4-7-047:042	pump	A	Unnamed spring	—	—	0.01	diversified ag.
Fong	3025	4-7-007:010	gravity	I	Kaalaea	—	0.00	—	—
Magoon	3025	4-7-015:013	gravity	I	Kaalaea	1.48	0.00	—	—
Murakami (lower pump)	3025	4-7-015:014	pump	A	Kaalaea	1.48	—		
Murakami (upper pump)	3025	4-7-015:014	pump	A	Kaalaea	1.48	—	e10.00	diversified ag.
Wong's Taro Leaf Farm-auwai	3025	4-7-015:009	gravity	A	Kaalaea	1.48	0.52	e6.00	aquaculture
Wong's Taro Leaf Farm-pump 1	3025	4-7-015:009	pump	A	Kaalaea				kalo
Wong's Taro Leaf Farm-pump 2	3025	4-7-015:009	pump	A	Kaalaea				kalo
Wong's Taro Leaf Farm	3025	4-7-015:010							kalo
Wong's Taro Leaf Farm	3025	4-7-015:020				1.48	0.52	e6.00	kalo
Wong's Taro Leaf Farm	3025	4-7-014:026							kalo
Wong's Taro Leaf Farm	3025	4-7-014:006							kalo
Wong's Taro Leaf Farm	3025	4-7-014:013							kalo
Wong's Taro Leaf Farm	3025	4-7-016:007							kalo
Dan Bishop	3024	4-8-011:001	gravity	A	Waiahole	8.12	1.49	e3.49	kalo
Dan Bishop	3024	4-8-011:008			Waiahole		—	e0.21	kalo
Dan Bishop	3024	4-8-011:009			Waiahole		—	e0.12	kalo
Ota	3024	4-8-011:002	—	U	Waiahole	—	—	3.78	—
Lau	3024	4-8-012:001	—	U	Waiahole	—	—	51.55	—
Lam Ho	3024	4-8-012:002	—	I	Waiahole	—	0.00	3.80	—
Emelia L. H. Kailio	3024	4-8-012:003	—	I	Waiahole	—	0.00	1.34	—
McCandless	3024	4-8-013:013	gravity	A	Waianu	—	0.62	e32.05	kalo/diversified ag.
McCandless	3024	4-8-012:010			Waianu			e7.00	diversified ag.
McCandless	3024	4-8-012:022			Waianu			e6.00	diversified ag.
McCandless	3024	4-8-012:023			Waianu			e8.00	diversified ag.
McCandless	3024	4-8-012:027			Waianu			e0.75	diversified ag.
McCandless	3024	4-8-012:030			Waianu			e1.20	diversified ag.
McCandless	3024	4-8-012:034			Waianu			e1.50	kalo
McCandless	3024	4-8-012:035			Waianu			e5.90	diversified ag.
McCandless	3024	4-8-012:036			Waianu			e1.00	kalo/diversified ag.
McCandless	3024	4-8-012:043			Waianu			e0.70	diversified ag.
Chris Wilkinson	3024	4-8-012:014	gravity	A	Waianu	3.99	2.54	e0.36	other uses
Reppun-upper auwai	3024	4-8-012:021	gravity	A	Waianu	5.65	0.54	e1.50	kalo
Reppun-lower auwai	3024	4-8-012:021	gravity	A	Waianu	5.11	0.40	e0.75	kalo
Nguyen (Minakami)	3022	4-8-004:005	—	U	Waikane	—	---	2.74	—
Roman Catholic Church	3022	4-8-005:001	—	I	Waikane	—	0.00	3.97	—
Roberts	3022	4-8-006:009	—	U	Waikeekee	—	—	3.10	—
Waiahole Ditch System Intake 20	3022	4-8-014:005	gravity	A	Tributary to Waikane	—	—	[e]5644.00	diversified ag./other uses
Waiahole Ditch System Intake 21 (Kahana gage)	3022	4-8-014:005	gravity	A	Tributary to Waikane	—	—	[e]5644.00	diversified ag./other uses
Waiahole Ditch System Intake 22 (Development tunnel 1)	3022	4-8-014:005	gravity	A	Tributary to Waikane	—	—	[e]5644.00	diversified ag./other uses

[a] Status: A (active), I (inactive), U (unknown).
[b] Acreage: (e) estimation.
[d] Waiahole Ditch System intakes 1 through 19 are in Kahana.
[e] CWRM 2006, Waiahole Findings of Fact, Conclusions of Law; and Decision and Order. Table 2 and Table 3.

Ko'olaupoko Stream Diversion Survey, 2008 to 2011 (HBWS)

[a]Diversion Name	Surface Hydrologic Units	TMK	Diversion	[a]Status	Stream	Stream (mgd)	Diversion (mgd)	[b]Acreage	Crop
Waiahole Ditch System Intake 23 (release point)	3022	4-8-014:005	gravity	I	Tributary to Waikane	—	0.00	[e]5644.00	diversified ag./other uses
Waiahole Ditch System Intake 24	3022	4-8-014:005	gravity	A	Tributary to Waikane	—	—	[e]5644.00	diversified ag./other uses
Waiahole Ditch System Intake 25	3022	4-8-014:005	gravity	A	Waikeekee	—	—	[e]5644.00	diversified ag./other uses
Waiahole Ditch System Intake 26	3022	4-8-014:003	gravity	A	Tributary to Uwau	—	—	[e]5644.00	diversified ag./other uses
Waiahole Ditch System Intake 27	3022	4-8-014:003	gravity	A	Uwau	—	0.01	[e]5644.00	diversified ag./other uses
Waiahole Ditch System Intake 28	3022	4-8-013:014	gravity	A	Tributary to Waianu	—	—	[e]5644.00	diversified ag./other uses
Waiahole Ditch System Intake 29	3022	4-8-013:014	gravity	A	Tributary to Waianu	—	—	[e]5644.00	diversified ag./other uses
Waiahole Ditch System Intake 30 (release point to Waianu Stream)	3022	4-8-013:013	gravity	A	Tributary to Waianu	—	—	[e]5644.00	diversified ag./other uses
Waiahole Ditch System Intake 31 (release point to Waiahole Stream)	3022	4-8-013:001	gravity	A	Waiahole	—	—	[e]5644.00	diversified ag./other uses
Waiahole Ditch System Intake 32	3022	4-8-013:001	gravity	A	Waiahole	—	—	[e]5644.00	diversified ag./other uses
Waiahole Ditch System Intake 33	3022	4-8-013:001	gravity	A	Tributary to Waiahole	—	—	[e]5644.00	diversified ag./other uses
Waiahole Ditch System Intake 34	3022	4-8-013:001	gravity	A	Tributary to Halona	—	—	[e]5644.00	diversified ag./other uses
Waiahole Ditch System Intake 35	3022	4-8-013:001	gravity	A	Tributary to Halona	—	—	[e]5644.00	diversified ag./other uses
Waiahole Ditch System Intake 36	3022	4-8-013:001	gravity	A	Tributary to Halona	—	—	[e]5644.00	diversified ag./other uses
Waiahole Ditch System Intake 37	3022	4-8-013:001	gravity	A	Tributary to Halona	—	—	[e]5644.00	diversified ag./other uses
Waiahole Stream pumphouse	3022	4-8-013:001	gravity	I	Tributary to Waiahole	—	0.00	—	—
Waiahole baseyard	3022	4-8-013:001	gravity	A	Tributary to Waiahole	—	—	—	other uses
JUDD MS (Pahalona Spring)	3021	4-9-001:002	gravity	I	Pahalona Spring	—	0.00	2.40	—
K Johnson (Kealohiwai Spring)	3021	4-9-001:006	gravity	A	Kealohiwai Spring	—	—	—	kalo/other uses
K Johnson (Kealohiwai Spring)	3021	4-9-001:007				—	—	—	other uses
K Johnson (Kealohiwai Spring)	3021	4-9-001:014				—	—	e1.40	kalo
North Tributary to Hakipuu Stream	3021	4-9-002:001	gravity	I	Unnamed spring	0.08	0.00	—	—
Hakipuu Spring	3021	4-9-006:001	gravity	A	Hakipuu spring	0.12	0.06	e6.00	diversified ag./other uses
Hakipuu Lo'i	3021	4-9-006:001	gravity	A	Hakipuu spring	—	0.05	0.62	kalo
Sebastian JT	3021	4-9-002:005	gravity	I	Hakipuu	—	0.00	0.20	—
Kualoa Ranch ponds (UH4)	3021	4-9-001:014	pump	A	Hakipuu Stream	0.70	—	e4.00	aquaculture

[a] Status: A (active), I (inactive), U (unknown).
[b] Acreage: (e) estimation.
[d] Waiahole Ditch System intakes 1 through 19 are in Kahana.
[e] CWRM 2006, Waiahole Findings of Fact, Conclusions of Law; and Decision and Order. Table 2 and Table 3.

Field Check List

I. Diversion Information

Island: Oahu	Watershed code: 3027
Quad Name: Kaneohe	Attach Location Map: attached
Stream Name: Waihee	
auwai 1	Priority: 4
Tax Map Key: 4-7-006:010	Address: Department of Facility Maintenance
Land Owner: City and County of Honolulu	1000 Uluohia Street, Suite 215
Diversion User(s): see attached list	Kapolei, HI 96707
Location: Approximately .25 miles S-SW of the end of Waihee Road.	GPS recording: Latitude: d: 21N m: 27 s: 3.8 Longitude: d: 157W m: 51 s: 19.0

II. Stream Flow

a. Gage Data: USGS Gaging Station 16284200 (3.29 mgd on 3/30/10)			
b. Flow Character above:	High ☐	Average ☒	Low ☐
c. Stream capture %: 6.4. calculation: 0.21mgd / 3.29 mgd			
d. Elevation (amsl): +132 feet, approximate. Taken from map.			
Diversion Character: Intake pipe to auwai		Dimensions/Size:	
a. Dam ☒	Dimensions:	Width: 30 feet	Height: 5 feet
b. Ditch Flume	Dimensions:	Width:	Height:
c. Pipe ☐ Dia.(in):	Type: steel ☐	aluminum ☐	concrete/clay ☐
Photographs	Upstream ☐	Site ☒	Downstream ☐

III. End User(s)

a. Number of Users 2	
b.Use/Purpose Residence ☐ Farm ☒	Growing: Lo'i ☒ Crops ☐
c.Estimated volume:	Flowers ☐ Animals ☐
e. Area Irrigated:	Other ☐
DLNR Notes:	
Field Notes: Uppermost auwai that diverts Waihee Stream flow. USGS gage 16284200 had a discharge of 3.29 mgd prior to current meter measurements of auwai 1 and 2. Auwai 1 was measured at 0.21 mgd, leaving 3.08 mgd of Waihee Stream flow available to auwai 2 on the date of visit.	

Notes By: GO Date: 10/8/2009, 3/30/10
Data Entry By: GO Date: 10/14/2009, 3/31/10

III. End User(s)

a. TMK: 4-7-006:013 Owner: Clarence Young		
b.Use/Purpose Residence ☐ Farm ■	Growing: Lo'i ■ Crops ☐	
c.Estimated volume na	Flowers ☐ Animals ☐	
e. Area Irrigated? 3.0 to 4.0 acres (per C. Young)	Other ☐ aquaculture	

a. TMK: 4-7-006:004 Owner: Marcus Rosehill		
b.Use/Purpose Residence ☐ Farm ■	Growing: Lo'i ■ Crops ☐	
c.Estimated volume na	Flowers ☐ Animals ☐	
e. Area Irrigated? 1.0 acre	Other ☐ aquaculture	

Meter Type: pygmy current meter Serial No.: 580066

ZERO ADJUSTMENT CHECK PERFORMED BEFORE: na AFTER: na

Stream/Diversion Interior Width: 3.5 Water Depth: 0.27

Measurement rating:	Excellent (2%) ☐	Good (5%) ☐	Fair (8%) ■	Poor (>8%) ☐
Flow State:	Steady ☐	Turbulent ☐	Laminar ■	
X-Section Characteristics:	Ditch ■	Boulders ☐	Gravel Bottom ☐	Steep Banks ☐
Weather:	Clear/Sunny ☐	Partly Cloudy ■	Light Rain ☐	Constant Rain ☐

Measurement: JK, GO Date: 3/30/2010

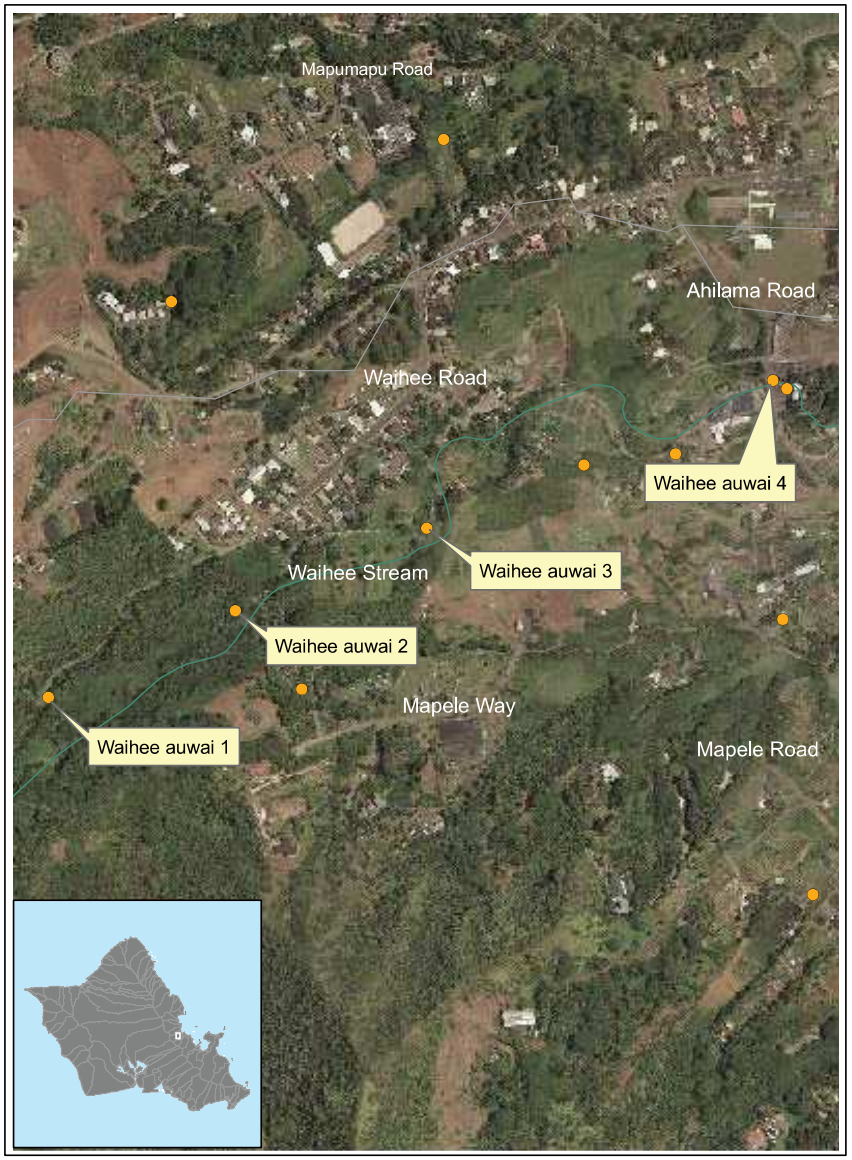
STREAM READINGS - CROSS SECTION

Tagline Station	Distance	Width	Depth	Obs. Depth	Vel. At Point	Vel. In Vertical	Adjusted	Area (ft^2)	Discharge (mgd)
0 RB		0.25	0.26		0.02		0.10	0.07	0.00
1	0.5	0.75	0.26	0.6	0.21			0.20	0.03
2	1.5	1.00	0.40	0.6	0.41			0.40	0.11
3	2.5	0.75	0.40	0.6	0.41			0.30	0.08
4	3.0	0.50	0.16	0.6	0.00			0.08	0.00
5 LB	3.5	0.25	0.16		0.00		0.10	0.04	0.00
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
TOTAL									0.21

Distance = distance from start
Width = distance 1/2 back + 1/2 forward
Depth = water depth
Observed depth = 0.2, 0.6, or 0.8
Velocity at Point = from meter
Velocity at Vertical = at 0.2 or 0.8
Area = width x depth
Discharge = area x velocity
Total = discharge of all stations

IF PIPE: formula K x D2 x U = flow
K = Level/Diameter ratio = from Table 1 (use cfs) =
D (diameter of pipe) = (x in./12)2 D=
U (flow from meter cfs) U=
Flow = total flow in cfs Flow:

Notes/Remarks: Laminar flow.



Waihee auwai 1

diversion dam

inlet of pipe

outlet of pipe to auwai

auwai

Waihee auwai 1

auwai

lo'i

distribution pipe

lo'i

Field Check List

I. Diversion Information

Island: Oahu	Watershed code: 3027
Quad Name: Kaneohe	Attach Location Map: attached
Stream Name: Waihee auwai 2	Priority: 4
Tax Map Key: 4-7-006:010	Address: Department of Facility Maintenance, 1000 Uluohia Street, Kapolei, HI 96707
Land Owner: City and County of Honolulu	
Diversion User(s): A. Ishida (4-7-064:001)	
Location: 0.09 miles S-SE from end of Waihee Road	GPS recording: Latitude: d: 21 m: 27 s: 7.8; Longitude: d: 157 m: 51 s: 9.6

II. Stream Flow

a. Gage Data: na. 3.08 mgd available on date of auwai measurement (3/30/10)			
b. Flow Character above:	High ☐	Average ☒	Low ☐
c. Stream capture %: 6.2. calculation: 0.19 mgd / 3.08 mgd			
d. Elevation (amsl): + 125 feet, approximate. Taken from map.			
Diversion Character: open channel		Dimensions/Size: 1.5 feet (w) x 0.3 feet (d)	
a. Dam ☒	Dimensions:	Width: 25 feet	Height: 3 feet
b. Ditch Flume	Dimensions:	Width:	Height:
c. Pipe ☐	Dia.(in):	Type: steel ☐	aluminum ☐ concrete/clay ☐
Photographs	Upstream ☐	Site ☐	Downstream ☐

III. End User(s)

a. Number of Users 1	
b.Use/Purpose Residence ☐ Farm ☒	Growing: Lo'i ☐ Crops ☒
c.Estimated volume:	Flowers ☐ Animals ☐
e. Area Irrigated: 0.5 acre (estimated from map)	Other ☐
DLNR Notes:	
Field Notes: The diversion is located on the right bank of Waihee Stream. The available stream discharge of 3.08 mgd is the estimated stream discharge below the Waihee auwai 1 diversion (0.21 mgd). USGS Stream Gage 16284200 measured 3.29 mgd on 3/30/2010.	

Notes By: GO — Date: 10/8/2009, 3/30/10
Data Entry By: GO — Date: 10/16/2009, 3/31/10

Meter Type: pygmy current meter Serial No.: 580066

ZERO ADJUSTMENT CHECK PERFORMED BEFORE: na AFTER: na

Stream/Diversion Interior Width: 1.4 Water Depth: 0.26

Measurement rating:	Excellent (2%)	■	Good (5%)	☐	Fair (8%)	☐	Poor (>8%)	☐
Flow State:	Steady	☐	Turbulent	☐	Laminar	■		
X-Section Characteristics:	Ditch	■	Boulders	☐	Gravel Bottom	☐	Steep Banks	☐
Weather:	Clear/Sunny	☐	Partly Cloudy	■	Light Rain	☐	Constant Rain	☐

Measurement: JK, GO Date: 3/30/2010

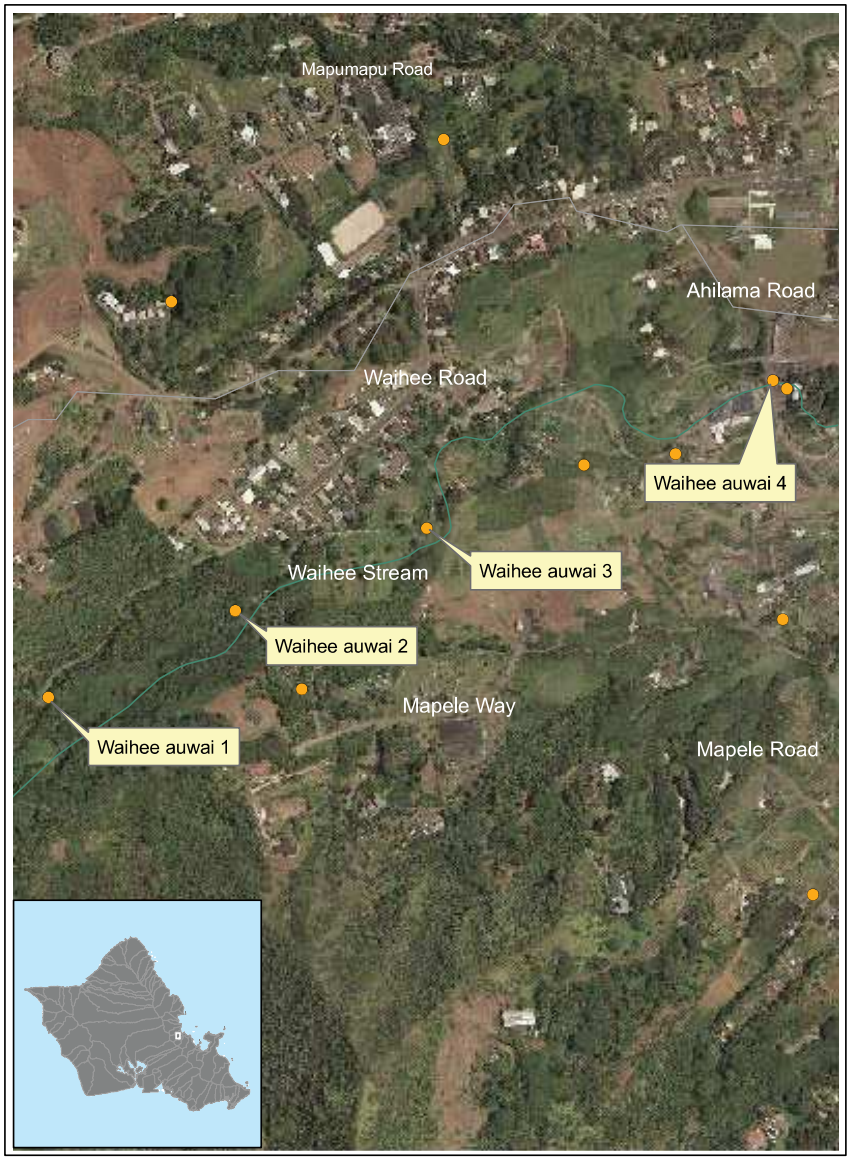
AUWAI READINGS - CROSS SECTION

Tagline Station	Distance	Width	Depth	Obs. Depth	Vel. At Point	Vel. In Vertical	Adjusted	Area (ft^2)	Discharge (mgd)
0 RB		0.20	0.27		0.04		0.10	0.05	0.00
1	0.4	0.40	0.37	0.6	0.41			0.15	0.04
2	0.8	0.40	0.42	0.6	1.06			0.17	0.11
3	1.2	0.30	0.16	0.6	1.01			0.05	0.03
4 LB	1.4	0.10	0.10		0.00			0.01	0.00
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
TOTAL									0.19

Distance = distance from start
Width = distance 1/2 back + 1/2 forward
Depth = water depth
Observed depth = 0.2, 0.6, or 0.8
Velocity at Point = from meter
Velocity at Vertical = at 0.2 or 0.8
Area = width x depth
Discharge = area x velocity
Total = discharge of all stations

IF PIPE: formula K x D2 x U = flow
K = Level/Diameter ratio = from Table 1 (use cfs) =
D (diameter of pipe) = (x in./12)2 D=
U (flow from meter cfs) U=
Flow = total flow in cfs Flow:

Notes/Remarks: Laminar flow. Former Nakata auwai.



Waihee auwai 2

Waihee Stream

diversion dam

pipeline protected by river rocks

auwai

Field Check List

I. Diversion Information

Island: Oahu	Watershed code: 3027
Quad Name: Kaneohe	Attach Location Map: attached
Stream Name: Waihee auwai 3	Priority: 4
Tax Map Key: 4-7-064:014	
Land Owner: K-4 Enterprises, Inc	Address: 514 Loring Avenue Los Angeles, CA 90024
Diversion User(s): attached list	
Location: Access off 47-252 Waihee Road	GPS recording: Latitude: d: 21 m: 27 s: 11.6 Longitude: d: 157 m: 51 s: 0.0

II. Stream Flow

a. Gage Data: na. 2.93 mgd (current meter measurement)			
b. Flow Character above:	High ☐	Average ■	Low ☐
c. Stream capture %: 37.2. calculation: 1.09 mgd/2.93 mgd			
d. Elevation (amsl): + 79 feet, approximate. Taken from map.			
Diversion Character: unlined channel	Dimensions/Size: 4-5 feet (w) x 2-5 feet (bank)		
a. Dam	Dimensions:	Width:	Height:
b. Ditch Flume	Dimensions:	Width:	Height:
c. Pipe ☐	Dia.(in):	Type: steel ☐	aluminum ☐ concrete/clay ☐
Photographs	Upstream ☐	Site ☐	Downstream ☐

III. End User(s)

a. Number of Users 5, utilizing 9 parcels.	
b.Use/Purpose Residence ■ Farm ■	Growing: Lo'i ■ Crops ☐
c.Estimated volume:	Flowers ☐ Animals ☐
e. Area Irrigated: 9.28 acres	Other ■ ti leaf
DLNR Notes:	
Field Notes: On the date of visit, 0.78 mgd of the auwai diversion was used for the upper section of lo'i and Ti leaf. The remaining 0.31 mgd of flow continued to the upper portion of the Alvarado property.	

Notes By: GO Date: 10/8/2009, 4/27/10
Data Entry By: GO Date: 10/14/2009, 5/01/10

III. End User(s)

a. TMK: 4-7-006:002 Owner: Clifford Wong		
b.Use/Purpose Residence ☐ Farm ■	Growing: Lo'i ■ Crops ☐	
c.Estimated volume na	Flowers ☐ Animals ☐	
e. Area Irrigated? 0.14 acre (estimate from map)	Other ☐ ti leaf	

a. TMK: 4-7-006:003 Owner: Clifford Wong	
b.Use/Purpose Residence ☐ Farm ■	Growing: Lo'i ■ Crops ☐
c.Estimated volume na	Flowers ☐ Animals ☐
e. Area Irrigated? 1.5 acres (estimate from map)	Other ■ ti leaf

a. TMK: 4-7-006:013 Owner: Clarence Young	
b.Use/Purpose Residence ☐ Farm ■	Growing: Lo'i ■ Crops ☐
c.Estimated volume na	Flowers ☐ Animals ☐
e. Area Irrigated? 0.3 acres (estimate from map)	Other ■ ti leaf

a. TMK: 4-7-005:090 Owner: Helen Alvarado	
b.Use/Purpose Residence ■ Farm ☐	Growing: Lo'i ☐ Crops ■
c.Estimated volume na	Flowers ☐ Animals ☐
e. Area Irrigated? 1560 ft^2 (approximate)	Other ☐

a. TMK: 4-7-005:017 Owner: Joseph Akima	
b.Use/Purpose Residence ■ Farm ☐	Growing: Lo'i ☐ Crops ☐
c.Estimated volume na	Flowers ☐ Animals ☐
e. Area Irrigated? na	Other ■ yard

a. TMK: 4-7-026:002 Owner: Reginald and Nadine Wong	
b.Use/Purpose Residence ☐ Farm ■	Growing: Lo'i ■ Crops ☐
c.Estimated volume na	Flowers ☐ Animals ☐
e. Area Irrigated? 2 acres (estimate from map)	Other ☐ aquaculture

III. End User(s)

a. TMK: 4-7-026:005 Owner: Reginald and Nadine Wong	
b.Use/Purpose Residence ☐ Farm ■	Growing: Lo'i ■ Crops ☐
c.Estimated volume na	Flowers ☐ Animals ☐
e. Area Irrigated? 2 acres (estimate from map)	Other ☐ aquaculture

a. TMK: 4-7-026:024 Owner: Clifford Wong	
b.Use/Purpose Residence ☐ Farm ■	Growing: Lo'i ■ Crops ☐
c.Estimated volume na	Flowers ☐ Animals ☐
e. Area Irrigated? 1 acre (estimate from map)	Other ☐ aquaculture

a. TMK: 4-7-027:006 Owner: Clifford Wong	
b.Use/Purpose Residence ☐ Farm ■	Growing: Lo'i ■ Crops ☐
c.Estimated volume na	Flowers ☐ Animals ☐
e. Area Irrigated? 2.3 acres (estimate from map)	Other ☐ aquaculture

Meter Type: pygmy current meter Serial No.: 580066

ZERO ADJUSTMENT CHECK PERFORMED BEFORE: na AFTER: na

Stream/Diversion Interior Width: 8.3 Water Depth: 0.57

Measurement rating:	Excellent (2%)	■	Good (5%)	☐	Fair (8%)	☐	Poor (>8%)	☐
Flow State:	Steady	☐	Turbulent	☐	Laminar	■		
X-Section Characteristics:	Ditch	☐	Boulders	☐	Gravel Bottom	■	Steep Banks	☐
Weather:	Clear/Sunny	☐	Partly Cloudy	■	Light Rain	☐	Constant Rain	☐

Measurement: JK, GO Date: 4/27/2010

STREAM READINGS - CROSS SECTION

Tagline Station	Distance	Width	Depth	Obs. Depth	Vel. At Point	Vel. In Vertical	Adjusted	Area (ft^2)	Discharge (mgd)
0 RB		0.50	0.40		0.07		0.25	0.20	0.01
1	1.0	1.00	0.50	0.6	0.27			0.50	0.09
2	2.0	1.00	0.50	0.6	0.61			0.50	0.20
3	3.0	1.00	0.51	0.6	1.03			0.51	0.34
4	4.0	1.00	0.61	0.6	1.26			0.61	0.50
5	5.0	1.00	0.69	0.6	1.26			0.69	0.56
6	6.0	1.00	0.75	0.6	1.14			0.75	0.55
7	7.0	1.00	0.72	0.6	1.24			0.72	0.58
8	8.0	1.00	0.48	0.6	0.31			0.48	0.10
9 LB	8.3	0.50	0.52		0.08		0.25	0.26	0.01
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
TOTAL									2.93

Distance = distance from start
Width = distance 1/2 back + 1/2 forward
Depth = water depth
Observed depth = 0.2, 0.6, or 0.8
Velocity at Point = from meter
Velocity at Vertical = at 0.2 or 0.8
Area = width x depth
Discharge = area x velocity
Total = discharge of all stations

IF PIPE: formula K x D2 x U = flow
K = Level/Diameter ratio = from Table 1 (use cfs) =
D (diameter of pipe) = (x in./12)2 D=
U (flow from meter cfs) U=
Flow = total flow in cfs Flow:

Notes/Remarks: Laminar flow. Banks of stream had recently been cleared of vegetation.

Meter Type: pygmy current meter Serial No.: 580066

ZERO ADJUSTMENT CHECK PERFORMED BEFORE: na AFTER: na

Stream/Diversion Interior Width: 2.9 Water Depth: 0.54

Measurement rating:	Excellent (2%)	■	Good (5%)	☐	Fair (8%)	☐	Poor (>8%)	☐
Flow State:	Steady	☐	Turbulent	☐	Laminar	■		
X-Section Characteristics:	Ditch	☐	Boulders	☐	Gravel Bottom	■	Steep Banks	☐
Weather:	Clear/Sunny	☐	Partly Cloudy	■	Light Rain	☐	Constant Rain	☐

Measurement: JK, GO Date: 4/27/2010

AUWAI READINGS - CROSS SECTION

Tagline Station	Distance	Width	Depth	Obs. Depth	Vel. At Point	Vel. In Vertical	Adjusted	Area (ft^2)	Discharge (mgd)
0 RB		0.25	0.47		0.59		0.75	0.12	0.05
1	0.5	0.50	0.51	0.6	0.79			0.26	0.13
2	1.0	0.50	0.55	0.6	1.18			0.28	0.21
3	1.5	0.50	0.60	0.6	1.09			0.30	0.21
4	2.0	0.50	0.61	0.6	1.46			0.31	0.29
5	2.5	0.45	0.51	0.6	1.26			0.23	0.19
6 LB	2.9	0.20	0.50		0.31		0.25	0.10	0.02
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
TOTAL									1.09

Distance = distance from start
Width = distance 1/2 back + 1/2 forward
Depth = water depth
Observed depth = 0.2, 0.6, or 0.8
Velocity at Point = from meter
Velocity at Vertical = at 0.2 or 0.8
Area = width x depth
Discharge = area x velocity
Total = discharge of all stations

IF PIPE: formula K x D2 x U = flow
K = Level/Diameter ratio = from Table 1 (use cfs) =
D (diameter of pipe) = (x in./12)2 D=
U (flow from meter cfs) U=
Flow = total flow in cfs Flow:

Notes/Remarks: Laminar flow.

Meter Type: pygmy current meter Serial No.: 580066

ZERO ADJUSTMENT CHECK PERFORMED BEFORE: na AFTER: na

Stream/Diversion Interior Width: 2.7 Water Depth: 0.35

Measurement rating:	Excellent (2%)	☐	Good (5%)	■	Fair (8%)	☐	Poor (>8%)	☐
Flow State:	Steady	☐	Turbulent	☐	Laminar	■		
X-Section Characteristics:	Ditch	☐	Boulders	☐	Gravel Bottom	■	Steep Banks	☐
Weather:	Clear/Sunny	☐	Partly Cloudy	■	Light Rain	☐	Constant Rain	☐

Measurement: JK, GO Date: 4/27/2010

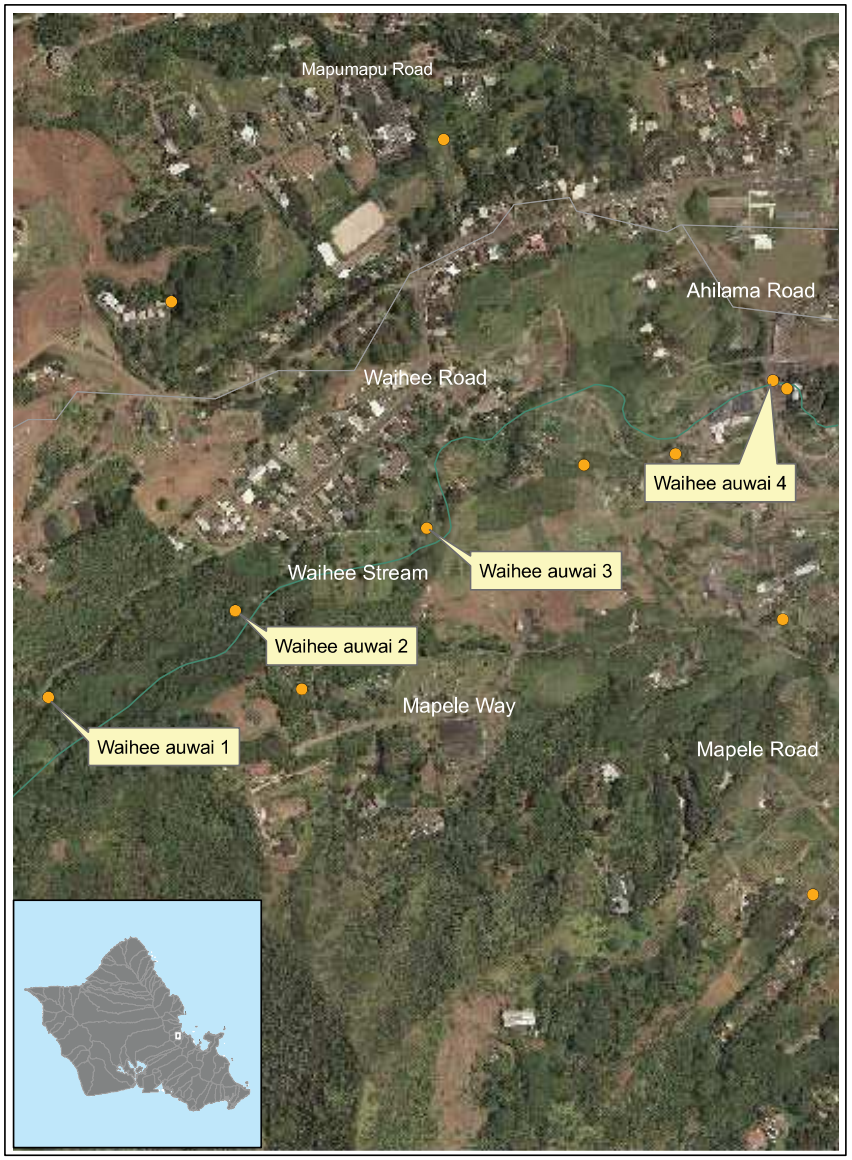
AUWAI READINGS - CROSS SECTION

Tagline Station	Distance	Width	Depth	Obs. Depth	Vel. At Point	Vel. In Vertical	Adjusted	Area (ft^2)	Discharge (mgd)
0 RB		0.25	0.32		0.05		0.25	0.08	0.00
1	0.5	0.50	0.35	0.6	0.21			0.18	0.02
2	1.0	0.50	0.32	0.6	0.59			0.16	0.06
3	1.5	0.50	0.32	0.6	0.89			0.16	0.09
4	2.0	0.50	0.39	0.6	0.79			0.20	0.10
5	2.5	0.35	0.39	0.6	0.37			0.14	0.03
6 LB	2.7	0.10	0.39		0.09		0.25	0.04	0.00
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
TOTAL									0.31

Distance = distance from start
Width = distance 1/2 back + 1/2 forward
Depth = water depth
Observed depth = 0.2, 0.6, or 0.8
Velocity at Point = from meter
Velocity at Vertical = at 0.2 or 0.8
Area = width x depth
Discharge = area x velocity
Total = discharge of all stations

IF PIPE: formula K x D2 x U = flow
K = Level/Diameter ratio = from Table 1 (use cfs) =
D (diameter of pipe) = (x in./12)2 D=
U (flow from meter cfs) U=
Flow = total flow in cfs Flow:

Notes/Remarks: Laminar flow. Flow measurement point is downstream of where water is taken to irrigate lo'i on parcels 4-7-006:003 and 4-7-006:013. The auwai continues from this point to the Alvarado and Akima properties before running parallel to Ahilama Road (mauka side). The auwai then crosses under Ahilama Road to feed the remaining 4 parcels.



Waihee auwai 3

diversion (left edge) on right bank of Waihee Stream

auwai

auwai

auwai flow to upper lo'i left bottom, auwai to Alvarado upper right

Waihee auwai 3

upper lo'i - looking down

Alvarado pipeline

Alvarado garden

auwai along Akima property

Waihee auwai 3

Akima pump

Akima yard

auwai 3 along Ahilama Road

lo'i

Field Check List

I. Diversion Information

Island: Oahu	Watershed code: 3027
Quad Name: Kaneohe	Attach Location Map: attached
Stream Name: Waihee auwai 4	Priority: 4
Tax Map Key: 4-7-012:021	Address: Department of Facility Maintenance, 1000 Uluohia Street, Suite 215, Kapolei, HI 96707
Land Owner: City and County of Honolulu	
Diversion User(s): see attached list	
Location: Waihee stream, right bank, 15 feet downstream of Ahilama bridge	GPS recording: Latitude: d: 21 m: 27 s: 18.4; Longitude: d: 157 m: 50 s: 42.6

II. Stream Flow

a. Gage Data: na			
b. Flow Character above:	High ☐	Average ■	Low ☐
c. Stream capture %: 23.2. calculation: 0.69 mgd / 2.97 mgd			
d. Elevation (amsl): + 37 feet (approximate elevation taken from map)			
Diversion Character: Intake pipe to auwai		Dimensions/Size:	
a. Dam ☐	Dimensions:	Width:	Height:
b. Ditch Flume	Dimensions:	Width:	Height:
c. Pipe ☐	Dia.(in):	Type: steel ☐	aluminum ☐ concrete/clay ☐
Photographs	Upstream ☐	Site ■	Downstream ☐

III. End User(s)

a. Number of Users 2, utilizing 2 parcels	
b.Use/Purpose Residence ☐ Farm ■	Growing: Lo'i ■ Crops ☐
c.Estimated volume:	Flowers ☐ Animals ☐
e. Area Irrigated:	Other ☐
DLNR Notes:	
Field Notes: The diversion for auwai 4 is located on the right bank of Waihee Stream, immediately downstream of the Ahilama Road bridge. The auwai runs parallel to Ahilama Road before turning east on to parcel 4-7-012:020 (not used on that parcel). It then continues on to parcels 4-7-026:024 and 4-7-026:004. The Waihee Stream measurement was taken on the eastern boundary of parcel 4-7-008:002.	

Notes By: GO — Date: 10/15/2009, 4/06/10
Data Entry By: GO — Date: 10/16/2009, 5/01/10

III. End User(s)

a. TMK: 4-7-026:004 Owner: Hookano Trust		
b.Use/Purpose Residence ☐ Farm ■	Growing: Lo'i ■ Crops ☐	
c.Estimated volume na	Flowers ☐ Animals ☐	
e. Area Irrigated? 1 acre (estimate from map)	Other ☐ aquaculture	

a. TMK: 4-7-026:024 Owner: Clifford Wong		
b.Use/Purpose Residence ☐ Farm ■	Growing: Lo'i ■ Crops ☐	
c.Estimated volume na	Flowers ☐ Animals ☐	
e. Area Irrigated? 6 acres (estimate from map)	Other ☐ aquaculture	

Meter Type: AA current meter Serial No.: 271596

ZERO ADJUSTMENT CHECK PERFORMED BEFORE: na AFTER: na

Stream/Diversion Interior Width: 3.6 Water Depth: 0.73

Measurement rating:	Excellent (2%) ■	Good (5%) ☐	Fair (8%) ☐	Poor (>8%) ☐
Flow State:	Steady ☐	Turbulent ☐	Laminar ■	
X-Section Characteristics:	Ditch ☐	Boulders ☐	Gravel Bottom ■	Steep Banks ☐
Weather:	Clear/Sunny ☐	Partly Cloudy ■	Light Rain ☐	Constant Rain ☐

Measurement: JK, GO Date: 4/6/2010

STREAM READINGS - CROSS SECTION

Tagline Station	Distance	Width	Depth	Obs. Depth	Vel. At Point	Vel. In Vertical	Adjusted	Area (ft^2)	Discharge (mgd)
0 RB		0.25	0.73		1.50		0.95	0.18	0.18
1	0.5	0.50	0.85	0.6	1.58			0.43	0.43
2	1.0	0.50	0.86	0.6	1.47			0.43	0.41
3	1.5	0.50	0.79	0.6	1.80			0.40	0.46
4	2.0	0.50	0.75	0.6	2.74			0.38	0.66
5	2.5	0.50	0.70	0.6	1.98			0.35	0.45
6	3.0	0.55	0.69	0.6	1.18			0.38	0.29
7 LB	3.6	0.30	0.50		0.89		0.75	0.15	0.09
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
TOTAL									2.97

Distance = distance from start
Width = distance 1/2 back + 1/2 forward
Depth = water depth
Observed depth = 0.2, 0.6, or 0.8
Velocity at Point = from meter
Velocity at Vertical = at 0.2 or 0.8
Area = width x depth
Discharge = area x velocity
Total = discharge of all stations

IF PIPE: formula K x D2 x U = flow
K = Level/Diameter ratio = from Table 1 (use cfs) =
D (diameter of pipe) = (x in./12)2 D=
U (flow from meter cfs) U=
Flow = total flow in cfs Flow:

Notes/Remarks: Laminar flow.

Meter Type: pygmy current meter Serial No.: 580066

ZERO ADJUSTMENT CHECK PERFORMED BEFORE: na AFTER: na

Stream/Diversion Interior Width: 4.5 Water Depth: 0.29

Measurement rating:	Excellent (2%)	■	Good (5%)	☐	Fair (8%)	☐	Poor (>8%)	☐
Flow State:	Steady	☐	Turbulent	☐	Laminar	■		
X-Section Characteristics:	Ditch	■	Boulders	☐	Gravel Bottom	■	Steep Banks	☐
Weather:	Clear/Sunny	☐	Partly Cloudy	■	Light Rain	☐	Constant Rain	☐

Measurement: JK, GO Date: 4/6/2010

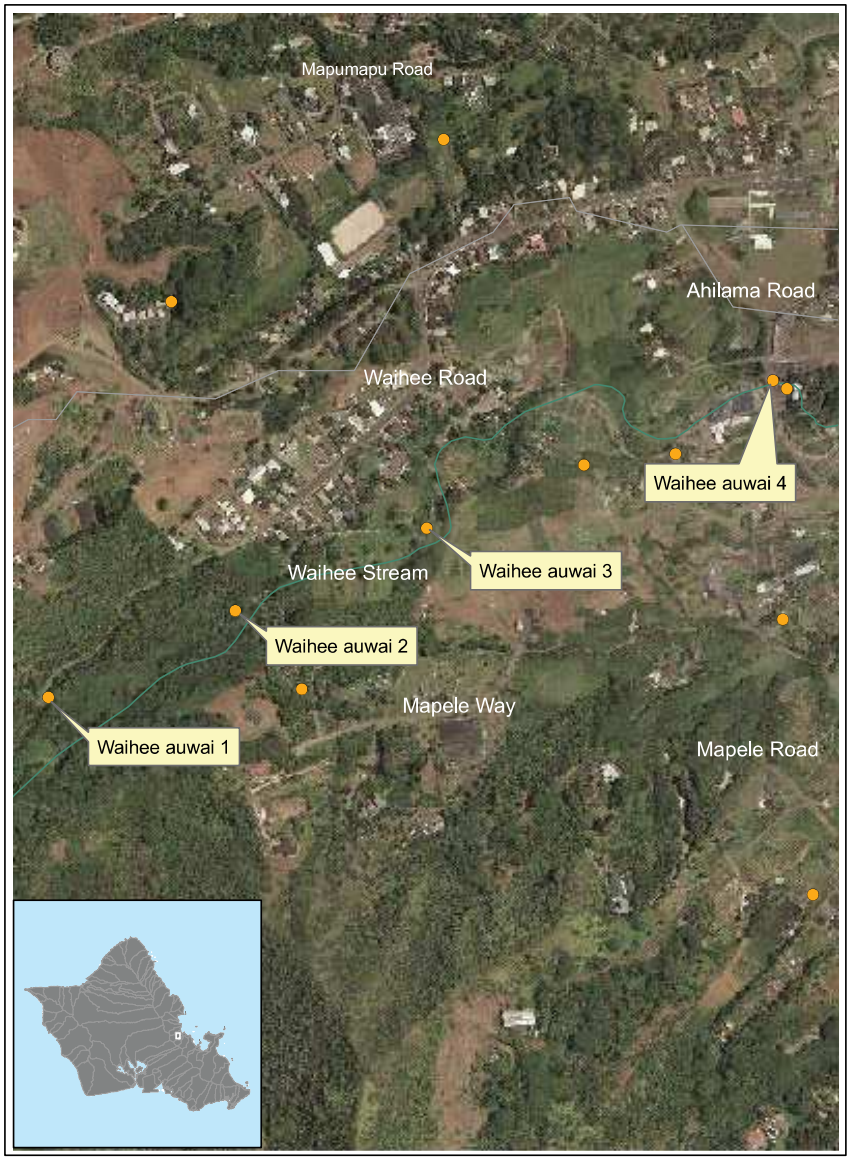
AUWAI READINGS - CROSS SECTION

Tagline Station	Distance	Width	Depth	Obs. Depth	Vel. At Point	Vel. In Vertical	Adjusted	Area (ft^2)	Discharge (mgd)
0 RB		0.50	0.20		0.13		0.25	0.10	0.01
1	1.0	1.00	0.30	0.6	0.52			0.30	0.10
2	2.0	1.00	0.37	0.6	1.53			0.37	0.36
3	3.0	1.00	0.33	0.6	0.84			0.33	0.18
4	4.0	0.75	0.30	0.6	0.26			0.23	0.04
5 LB	4.5	0.25	0.25		0.06		0.25	0.06	0.00
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
TOTAL									0.69

Distance = distance from start
Width = distance 1/2 back + 1/2 forward
Depth = water depth
Observed depth = 0.2, 0.6, or 0.8
Velocity at Point = from meter
Velocity at Vertical = at 0.2 or 0.8
Area = width x depth
Discharge = area x velocity
Total = discharge of all stations

IF PIPE: formula K x D2 x U = flow
K = Level/Diameter ratio = from Table 1 (use cfs) =
D (diameter of pipe) = (x in./12)2 D=
U (flow from meter cfs) U=
Flow = total flow in cfs Flow:

Notes/Remarks: Laminar flow. Auwai runs parallel to Ahilama Road (makai).



Waihee auwai 4

Waihee Stream upstream of Ahilama bridge

diversion on right bank

pipeline to auwai

pipeline running underground - auwai upper right

Waihee auwai 4

auwai parallel to Ahilama Road (makai)

auwai before entering Nona Wong property

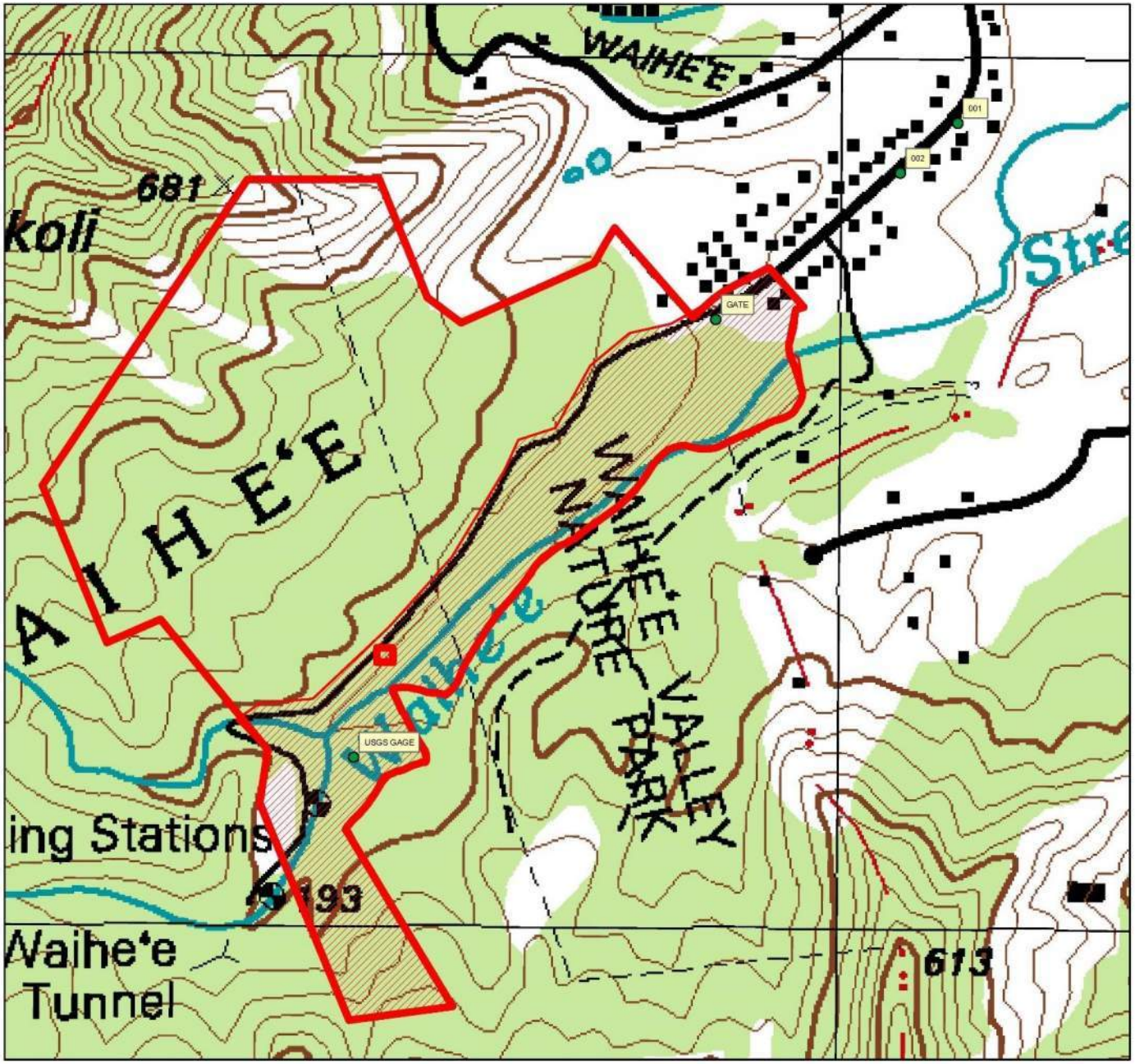
lo'i

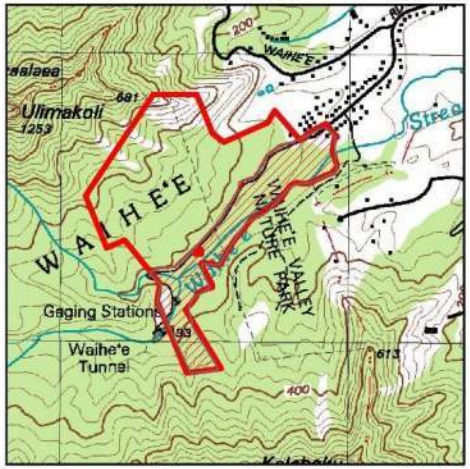
lo'i

Appendix D

Waihe‘e Stream USGS Gage and ‘Auwai Map and Pictures

Proposed Waihee Riparian Learning Center
Waihee Valley, Oahu, Hawaii





Legend

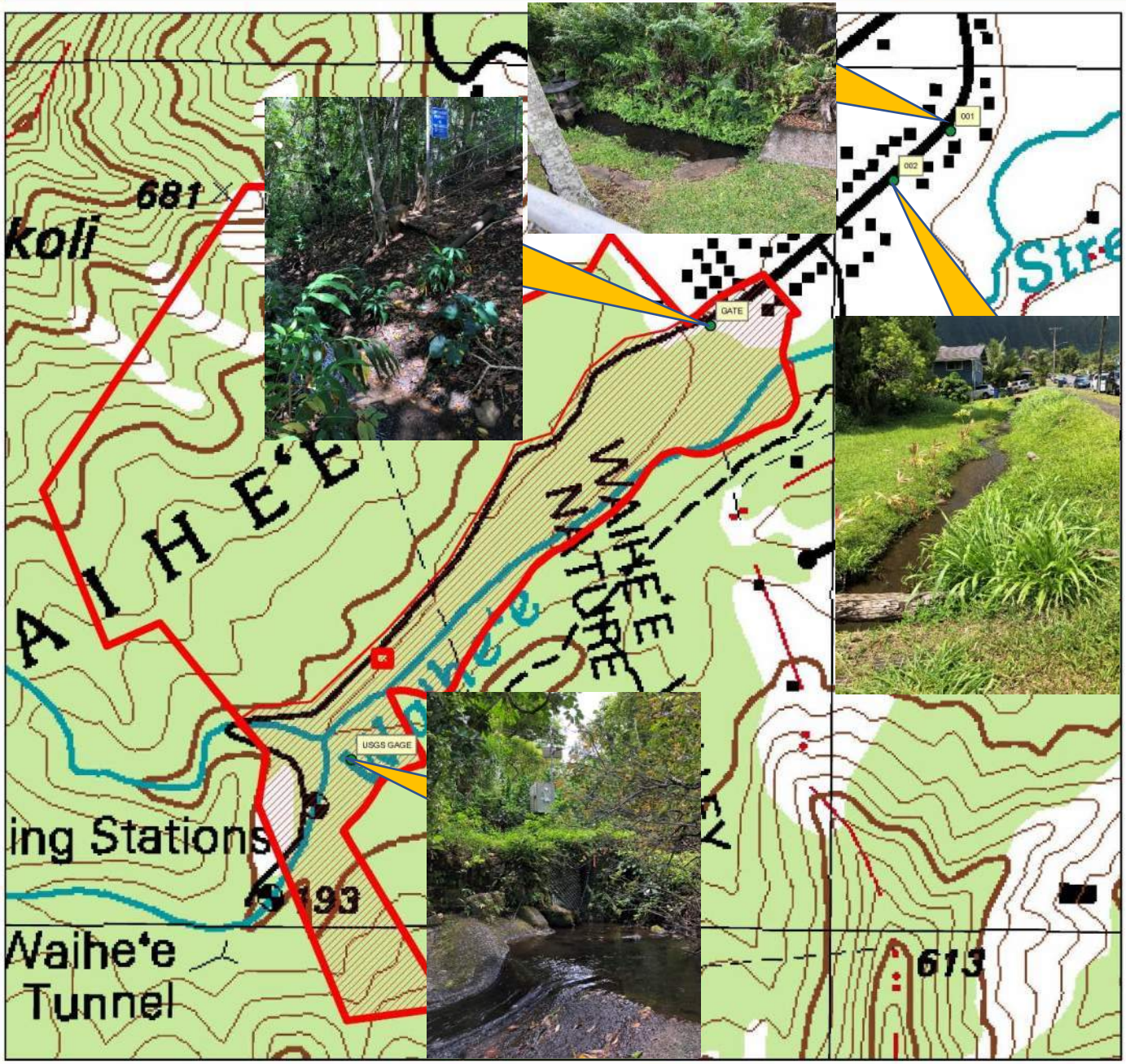
- auwai wpt_050720
- proposed Waihee Riparian Learning Center
- TMK 4-7-006:010 (DPR)

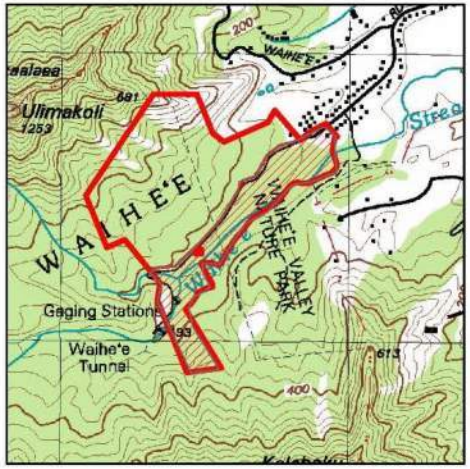
0 250 500 1,000 Feet

N

Honolulu Board of Water Supply 5/2020

Proposed Waihee Riparian Learning Center
Waihee Valley, Oahu, Hawaii





Legend

auwai
wpt_050720

proposed
Waihee Riparian
Learning Center

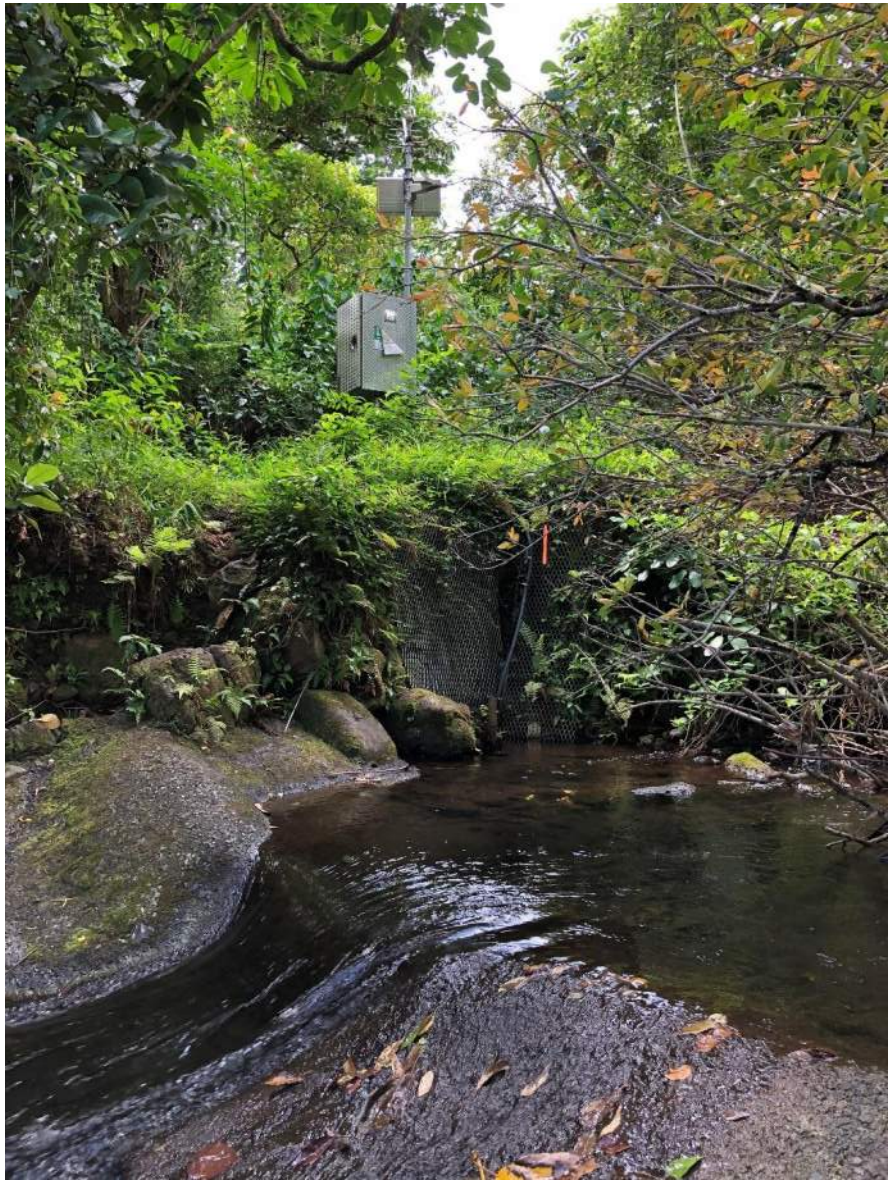
TMK 4-7-
006:010 (DPR)

0 250 500 1,000 Feet

N

Honolulu Board of Water Supply 5/2020

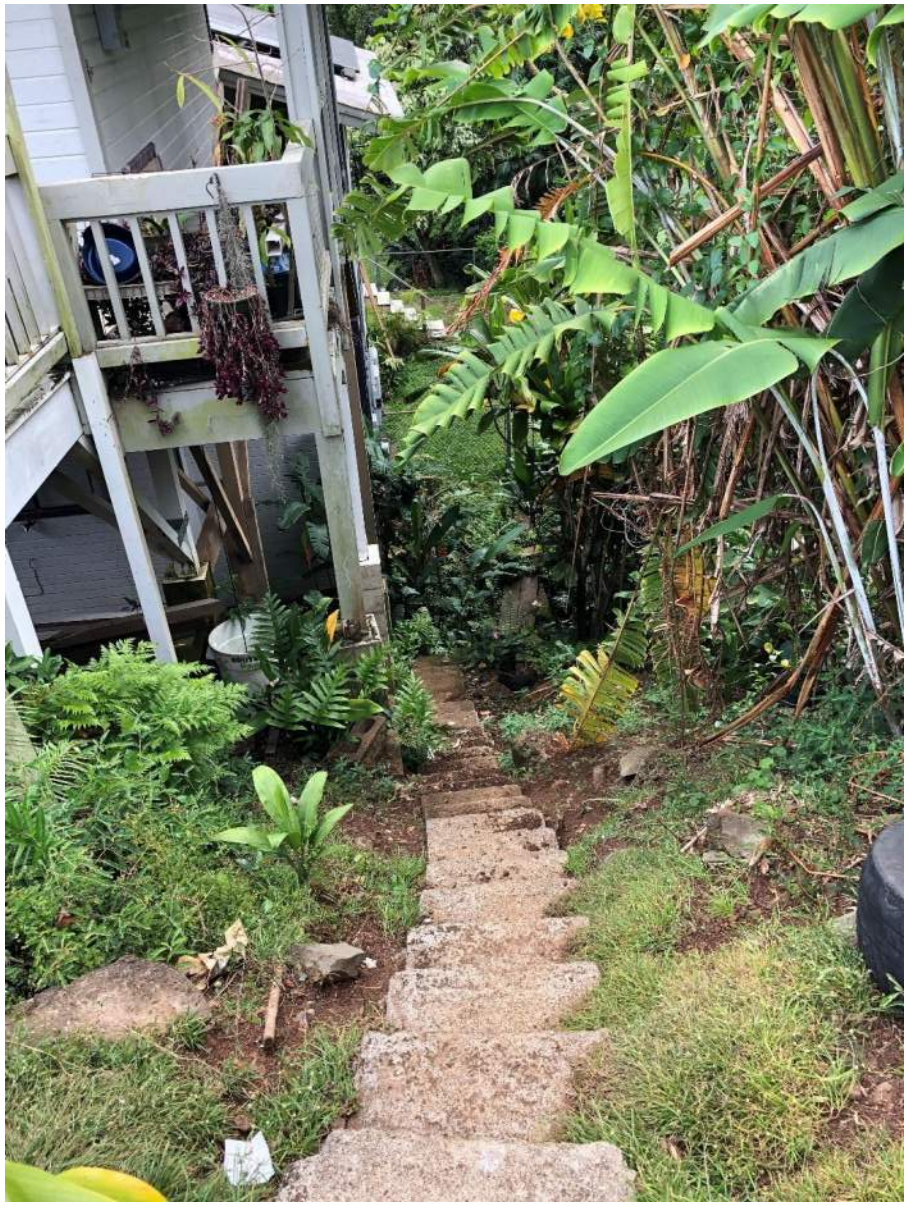
USGS stream gauge (5/7/2020)



Auwai (Gate) near front gate (5/7/2020)

Auwai downstream of Kaipo’s house (5/7/2020)

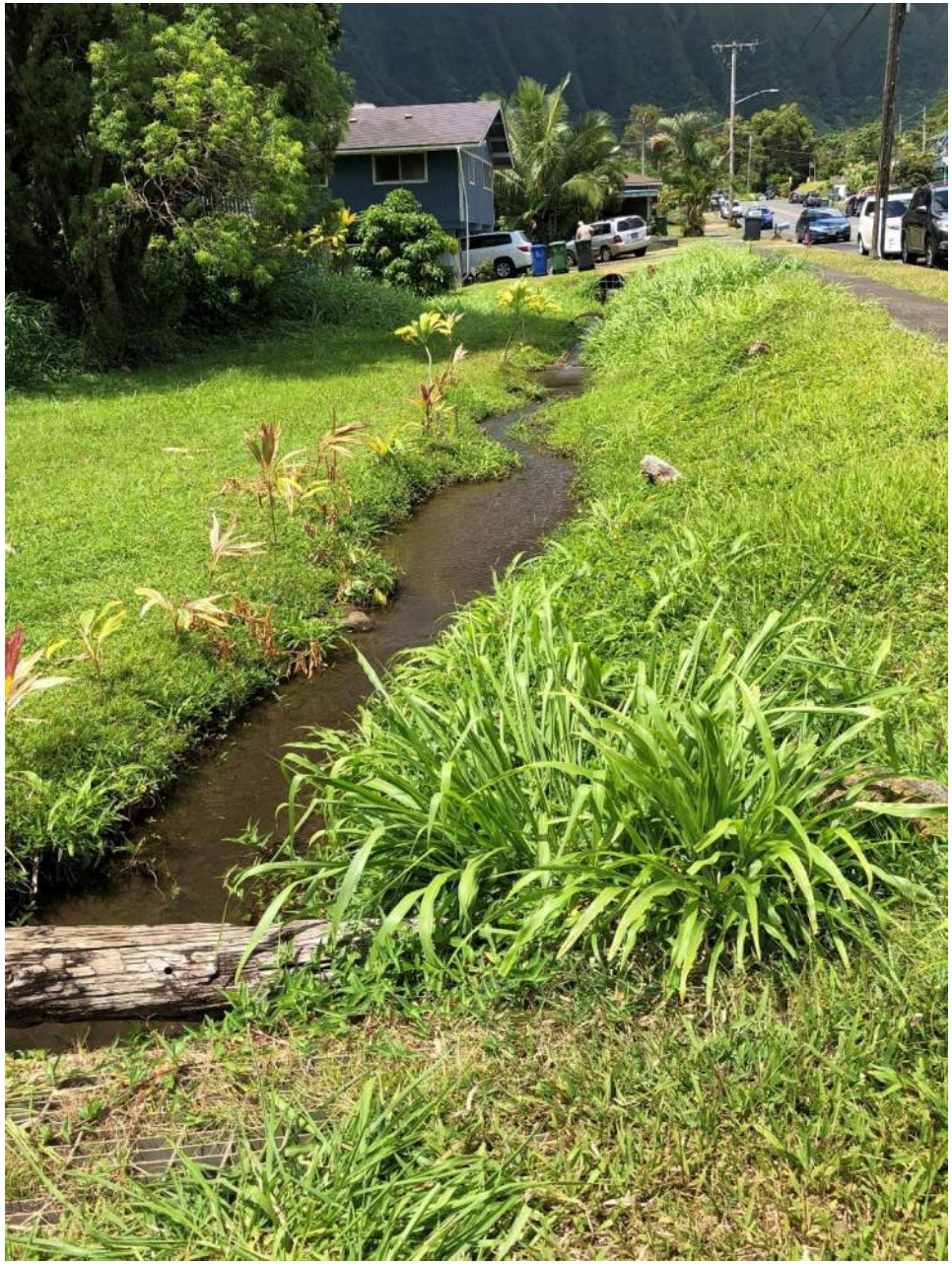
Auwai upstream of Kaipo’s house (5/7/2020)



Auwai (001) near 47-358 Waihee Road

Auwai (001) near 47-358 Waihee Road going into 47-356 Waihee Road)

Auwai (002) near 47-410 Waihee Road (looking downstream)



Appendix E

Water Rights in Hawai‘i, The Public Trust Doctrine and The Precautionary Principle

Appendix E

Water Rights in Hawai‘i, The Public Trust Doctrine and The Precautionary Principle

E.1 Water Rights in Hawai‘i

Water rights and uses in Hawai‘i are governed by the State Water Code[1] and the common law. The Water Code preserved appurtenant rights but not correlative and riparian rights in designated water management areas. Thus, when a ground water management area is designated, existing correlative uses within that area can be issued water use permits under the existing use provisions of the Water Code, but unexercised correlative rights are extinguished.

Similarly, when a surface water management area is designated, existing riparian uses within that area are eligible for water use permits as existing uses, but unexercised riparian rights are extinguished. Furthermore, the Hawaii Supreme Court has ruled that when there is an undisputed direct interrelationship between the surface and ground waters, designation of a ground water management area subjects both ground and surface water diversions from the designated area to the statutory permit requirement.[2] Presumably, permits would also be required for ground and surface water diversions when the interrelationship occurs in a surface water management area.

While water use permits are required only in designated water management areas and the common law on water rights and uses continue to apply in non-designated areas, other provisions of the Water Code apply throughout the state. Thus, for example, well construction and pump installation permits are required for any new or modified ground water use and stream diversion, and stream alteration permits are required for any new or modified surface water diversions. If the proposed stream diversion will affect the existing instream flow standard, a successful petition to amend the interim instream flow standard is also required.

E.1.1 Correlative Rights

Under the common law, owners of land overlying a ground water source have the right to use that water on the overlying land as long as the use is reasonable and does not injure the rights of other overlying landholders.[3] When the amount of water is insufficient for all, each is limited to a reasonable share of the ground water. Overlying landowners who have not exercised their correlative rights cannot prevent other landowners from using the water on the theory that they are using more than their reasonable share. They must suffer actual, not potential, harm. Only when landowners try to exercise their correlative rights and the remaining water is insufficient to meet their needs, can they take action to require existing users to reduce their uses.

E.1.2 Riparian Rights

Riparian rights are rights of land adjoining natural watercourses and are the surface water equivalent of correlative rights to ground waters; i.e., the use has to be on the riparian lands, the use has to be reasonable, and the exercise of those rights cannot actually harm the reasonable use of those waters by other riparian landowners. The Court had originally stated that the right was to the natural flow of the stream without substantial diminution and in the shape and size given it by nature,[4] but later concluded that the right should evolve in accordance with changing needs and circumstances. Thus, in order to maintain an action against a diversion which diminishes the quantity or flow of a natural watercourse, riparian owners must demonstrate actual harm to their own reasonable use of those waters.[5]

E.1.3 Appurtenant Rights

Appurtenant water rights are rights to the use of surface water utilized by (non-riparian) parcels of land at the time of their original conversion into fee simple lands; i.e., when land allotted by the Mahele was confirmed to awardees by the Land Commission and/or when the Royal Patent was issued based on such award, the conveyance of the parcel of land carried with it the appurtenant right to water.[6] The amount of water under an appurtenant right is the amount that was being used at the time of the Land Commission award and is established by cultivation methods that approximate the methods utilized at the time of the Mahele; for example, growing wetland taro.[7] Once established, future uses are not limited to the cultivation of traditional products approximating those utilized at the time of the Mahele,[8] as long as those uses are reasonable, and if in a water management area, meets the Water Code's test of reasonable and beneficial use ("the use of water in such a quantity as is necessary for economic and efficient utilization, for a purpose, and in a manner which is both reasonable and consistent with the State and county land use plans and the public interest"). As mentioned earlier, appurtenant rights are preserved under the Water Code, so even in designated water management areas, an unexercised appurtenant right is not extinguished and must be issued a water use permit when applied for, as long as the water use permit requirements are met.

E.1.4 Extinguishing Riparian or Appurtenant Rights

Unlike appurtenant rights, which are based in the common law, the Court has interpreted riparian rights as originating in an 1850 statute.[9] This has led to a curious inconsistency in that, while unexercised appurtenant rights are preserved and unexercised riparian rights are extinguished in designated water management areas, actions by private individuals can extinguish appurtenant but not riparian rights. Both appurtenant and riparian rights cannot be severed from the lands they are attached to, and such rights pass with the title to the land whether or not the rights are expressly mentioned in the deed. If the transferor of the land attempts to reserve the riparian right in the deed, the reservation is not valid and the right nevertheless belongs to the transferee as the new owner of the land. The law with regards to appurtenant rights is not clear. The Court in Reppun held that where a landowner attempted to reserve an appurtenant right while selling the underlying land, the reservation is not valid and the attempt to reserve extinguishes the appurtenant right. In doing so, the Court reasoned that there is nothing to prevent a transferor from effectively providing that the benefit of the appurtenant right not be passed to the transferee.[10] This difference is due to the Court's interpretation that riparian rights had been created by the 1850 statute, so any attempt by the grantor to reserve riparian water rights in the deed when riparian lands are sold is invalid.

Presumably, the inconsistency could be cured by legislation providing a statutory basis for appurtenant rights. In fact, the Court in the Waiāhole Ditch Contested Case cited to the Water Code's recognition of appurtenant rights and legislative comment to the effect that "Appurtenant rights may not be lost."[11] However, the Court did not explicitly discuss its prior Reppun decision, so it is unclear whether its Waiāhole decision overruled Reppun.

E.1.5 Appropriated Uses

Appropriated uses are uses of surface or ground waters on non-riparian or non-overlying lands. In the case of ground water, "(p)arties transporting water to distant lands are deemed mere 'appropriators,' subordinate in right to overlying landowners ...(T)he correlative rights rule grants overlying landowners a right only to such water as necessary for reasonable use. Until overlying landowners develop an actual need to use ground water, non-overlying parties may use any available 'surplus' (citations omitted)."[12] For surface waters, "the effect of permitting riparian owners to enjoin diversions beneficial to others in the absence of a demonstration of actual harm may occasionally lead to wasteful or even absurd results...The continuing use of the waters of the stream by the wrongful diversion should be contingent upon a demonstration that such use will not harm the established rights of others."[13] Thus, appropriated uses are not based on water rights but are allowed as long as they are reasonable and do not actually impinge on correlative and riparian rights. Note that appurtenant uses would be a type of appropriated uses if they were not based on appurtenant rights, and that in fact, the history of appurtenant uses in the Kingdom of Hawaiʻi has led to their establishment as water rights superior to riparian rights. Also note that when a water management area is designated, appropriated uses become superior to unexercised water rights, because appropriated uses become existing uses and are eligible for water use permits, while unexercised correlative and riparian rights are extinguished.

E.1.6 Obsolete Rights: Prescriptive and Konohiki Rights

Until 1973, surface waters were treated as private property and could be owned. Prescriptive water rights were the water equivalent of "adverse possession" in land ownership, where open and hostile occupation of another's private property for a specified number of years entitled the occupier to take legal ownership, because it raised the legal presumption of a grant. Prescriptive rights to water were exercisable only against the ownership of other private parties and not against the government. Thus, under prescriptive rights, appropriated uses could ripen into a prescriptive right superior to riparian rights. (Some early Court cases viewed appurtenant rights as a type of prescriptive right.) In 1973, the Court voided private ownership of water resources and prescriptive rights because of public ownership of all surface waters.[14] As for ground water, two early cases (1884[15] and 1896[16]) reflected the then prevailing law on surface waters that water could be private property, but those cases also concluded that prescriptive rights cannot be exercised against subterranean waters that have no known or defined course; i.e., you could not adversely possess what you could not see. In 1929, the Court adopted the correlative rights rule,[17] in which the overlying landowners could not use the water as they pleased, because it was a shared resource.

Until 1973, "*konohiki* lands," or lands whose title had passed from persons documented as *iki*, owned the "normal daily surplus water" in excess of waters reserved by appurtenant and prescriptive rights. (Despite a number of earlier cases, in 1930 the Court had concluded that riparian rights had never been the law in Hawaiʻi.[18] The 1973 Court, instead of overturning that decision, found a statutory basis for riparian rights in the 1850 statute.) In 1973, in addition to voiding any private property interest in water, the Court ruled that there can be no "normal daily surplus water," because the recognition of

riparian rights entitled owners of riparian lands to have the flow of the watercourse in the shape and state given it by nature.[19]

E.1.7 Native Hawaiian Water Rights

The Water Code contains the following provisions on Native Hawaiian water rights (section 174C-101):

- Provisions of this chapter shall not be construed to amend or modify rights or entitlements to water as provided for by the Hawaiian Homes Commission Act, 1920, as amended, and by chapters 167 and 168, relating to the Molokai irrigation system. Decisions of the commission on water resource management relating to the planning for regulation, management, and conservation of water resources in the State shall, to the extent applicable and consistent with other legal requirements and authority, incorporate and protect adequate reserves of water for current and foreseeable development and use of Hawaiian home lands as set forth in section 221 of the Hawaiian Homes Commission Act.
- No provision of this chapter shall diminish or extinguish trust revenues derived from existing water licenses unless compensation is made.
- Traditional and customary rights of ahupuaʻa tenants who are descendants of native Hawaiians who inhabited the Hawaiian Islands prior to 1778 shall not be abridged or denied by this chapter. Such traditional and customary rights shall include, but not be limited to, the cultivation or propagation of taro on one's own kuleana and the gathering of hīhīwai, ʻōpae, ʻoʻopu, limu, thatch, ti leaf, aho cord, and medicinal plants for subsistence, cultural, and religious purposes.
- The appurtenant water rights of kuleana and taro lands, along with those traditional and customary rights assured by this section, shall not be diminished or extinguished by a failure to apply for or to receive a permit under this chapter. (The exercise of an appurtenant water right is still subject to the water use permit requirements of the Water Code, but there is no deadline to exercise that right without losing it, as is the case for correlative and riparian rights, which must have been exercised before designation of a water management area.

E.2 The Public Trust Doctrine and the Precautionary Principle

The Waiāhole Ditch Contested Case drew upon principles from the Public Trust Doctrine and Precautionary Principle in one of the landmark decisions in Hawaiʻi water law.

E.2.1 The Public Trust Doctrine

In its review of the Waiāhole Ditch Contested Case, the Hawaiʻi Supreme Court held that: 1) title to the water resources is held in trust by the state for the benefit of its people; 2) article XI, sections 1 and 7 of the Hawaiʻi Constitution adopted the public trust doctrine as a fundamental principle of constitutional law in Hawaiʻi; 3) the legislature incorporated public trust principles into the Water Code; and 4) nevertheless the Water Code did not supplant the protections of the public trust doctrine, which the Court would continue to use to inform the Court's interpretation of the Water Code, define its outer limits, and justify its existence.[20]

The Court has identified four trust purposes, three in the Waiāhole Ditch Contested Case, and a fourth in its 2004 decision, In the Matter of the Contested Case Hearing on Water Use, Well Construction, and Pump Installation Permit Applications, Filed by Waiʻola o Molokaʻi, Inc. and Molokaʻi Ranch, Limited:

- Maintenance of waters in their natural state;
- Domestic water use of the general public, particularly drinking water;
- The exercise of Native Hawaiian and traditional and customary rights, including appurtenant rights;[1] and
- Reservations of water for Hawaiian home lands.

The Court also identified the following principles for the water resources trust:[2]

- The state has both the authority and duty to preserve the rights of present and future generations in the waters of the state;
- This authority empowers the state to revisit prior diversions and allocations, even those made with due consideration of their effect on the public trust;
- The state also bears the affirmative duty to take the public trust into account in the planning and allocation of water resources and to protect public trust uses whenever feasible;
- Competing public and private water uses must be weighed on a case-by-case basis, and any balancing between public and private purposes begin with a presumption in favor of public use, access, and enjoyment;
- There is a higher level of scrutiny for private commercial uses, with the burden ultimately lying with those seeking or approving such uses to justify them in light of the purposes protected by the trust; and

[1] Although the Court has not ruled specifically on the issue, the exercise of an appurtenant right presumably would have to be done in a traditional and customary manner if it is to be considered a public trust purpose. Otherwise, commercial uses of appurtenant rights would be a protected public trust use. Note, however, that unexercised appurtenant rights cannot be extinguished, and this also applies to commercial uses of appurtenant rights as long as that use is reasonable and beneficial.

[2] While these principles are directed at surface water resources, they apply equally to ground water resources.

- Reason and necessity dictate that the public trust may have to accommodate uses inconsistent with the mandate of protection, to the unavoidable impairment of public instream uses and values; offstream use is not precluded but requires that all uses, offstream or instream, public or private, promote the best economic and social interests of the people of the state.

E.2.2 The Precautionary Principle

When scientific evidence is preliminary and not conclusive regarding the management of the water resources trust, it is prudent to adopt "precautionary principles." The Court's interpretation as explained in the Waiāhole Ditch Contested Case is as follows:

- As with any general principle, its meaning must vary according to the situation and can only develop over time. At a minimum, the absence of firm scientific proof should not tie the commission's hands in adopting reasonable measures designed to further the public interest.
- The precautionary principle simply restates the commission's duties under the Constitution and the Code. The lack of full scientific certainty does not extinguish the presumption in favor of public trust purposes or vitiates the commission's affirmative duty to protect such purposes wherever feasible. Nor does its present inability to fulfill the instream use protection framework render the statute's directives any less mandatory. In requiring the commission to establish instream flow standards at an early planning stage, the Water Code contemplates the designation of the standards based not only on scientifically proven facts, but also on future predictions, generalized assumptions, and policy judgments. Neither the Constitution nor the Water Code constrains the commission to wait for full scientific certainty in fulfilling its duty toward the public interest in minimum instream flows.

The Court's linking of the Public Trust Doctrine to the Precautionary Principle offers significant guidance to the Watershed Management Plans. The tenets of the Precautionary Principle state that:

- There is a duty to take anticipatory action to prevent harm to public resources;
- There is an obligation to examine the full range of alternatives before starting a new activity and in using new technologies, processes, and chemicals; and
- Decisions should be open, informed and democratic and include affected parties.

In this regard, "precautionary actions" may include:

- Anticipatory and preventive actions;
- Actions that increase rather than decrease options;
- Actions that can be monitored and reversed;
- Actions that increase resilience, health, and the integrity of the whole system; and
- Actions that enhance diversity.

The Public Trust Doctrine establishes a general duty to take precautionary actions and thus shifts the burden of proof to non-trust purposes and requires preventive action in the face of uncertainty.

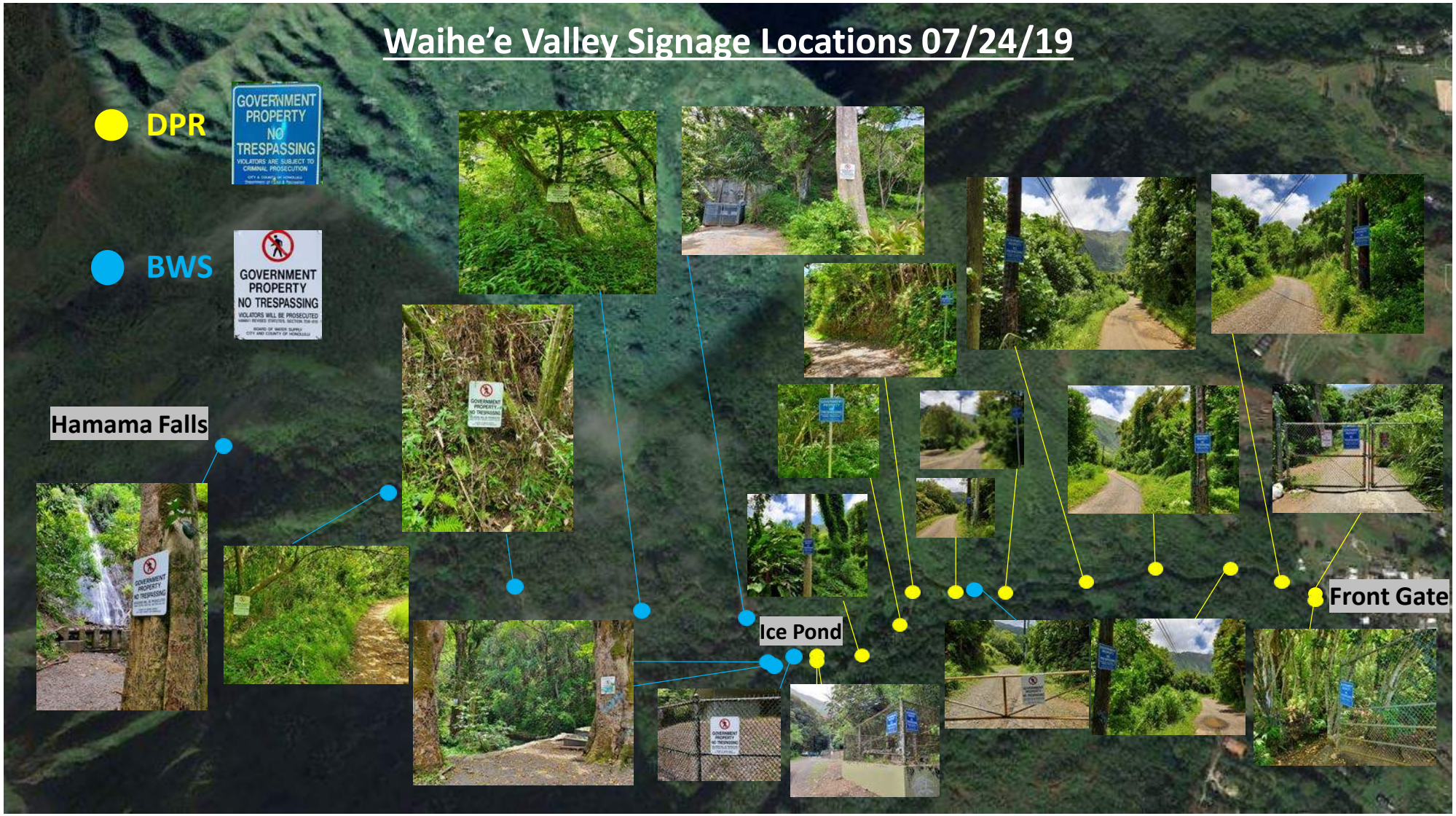
Notes

[1] HRS 174C, §§ 174C-1 to 174C-101.
[2] In re Water Use Permit Applications, 94 Haw. 97, at 173; 9 P3d 409, at 485 (2000).
[3] City Mill Co. v Hon. S. & W. Com., 30 Haw. 912 (1929).
[4] McBryde v Robinson, 54 Haw. 174, at 198; 504 P.2d 1330, at 1344 (1973); aff'd on rehearing, 55 Haw. 260; 517 P.2d 26 (1973); appeal dismissed for want of jurisdiction and cert. denied, 417 U.S. 962 (1974).
[5] Reppun v Board of Water Supply, 65 Haw. 531, at 553; 656 P.2d 57, at 72 (1982).
[6] 54 Haw. 174, at 188; 504 .2d 1330, at 1339.
[7] 65 Haw. 531, at 554; 656 P.2d 57, at 72.
[8] Peck v Bailey, 8 Haw. 658, at 665 (1867).
[9] 54 Haw. 174; 504 P.2d 1330.
[10] 65 Haw. 531, at 552; 656 P.2d 57, at 71 (1982).
[11] 94 Haw. 97 at 179, 9 P.3d 409 at 491 (2000).
[12] 94 Haw. 97, at 178; 9 P3d 409, at 490 (2000).
[13] 65 Haw. 531, at 553-554; 656 P.2d 57, at 72 (1982).
[14] 54 Haw. 174; 504 P.2d 1330 (1973).
[15] Davis v Afong, 5 Haw. 216 (1884).
[16] Wong Leong v Irwin, 10 Haw. 265 (1896).
[17] City Mill Co. v Hon. S. & W. Com., 30 Haw. 912 (1929).
[18] Territory v Gay, 31 Haw. 376 (1930); aff'd 52 F.2d 356 (9th Cir. 1931); cert. denied 284 U.S. 677 (1931).
[19] 54 Haw. 174, at 198; 504 P.2d 1330, at 1344 (1973).
[20] 94 Haw. 97, at 130-133; 9 P3d 409, at 443-445.

Appendix F

Waihe‘e Valley Signage Locations

Waihe'e Valley Signage Locations 07/24/19



Board of Water Supply

Department of Parks and Recreation

Front Gate

Fence Extension

Pole 27

Pole 28

Pole 30

Pole 32

BWS Chlorinator on left

BWS Cattle Gate – Combination Lock

Pole 37

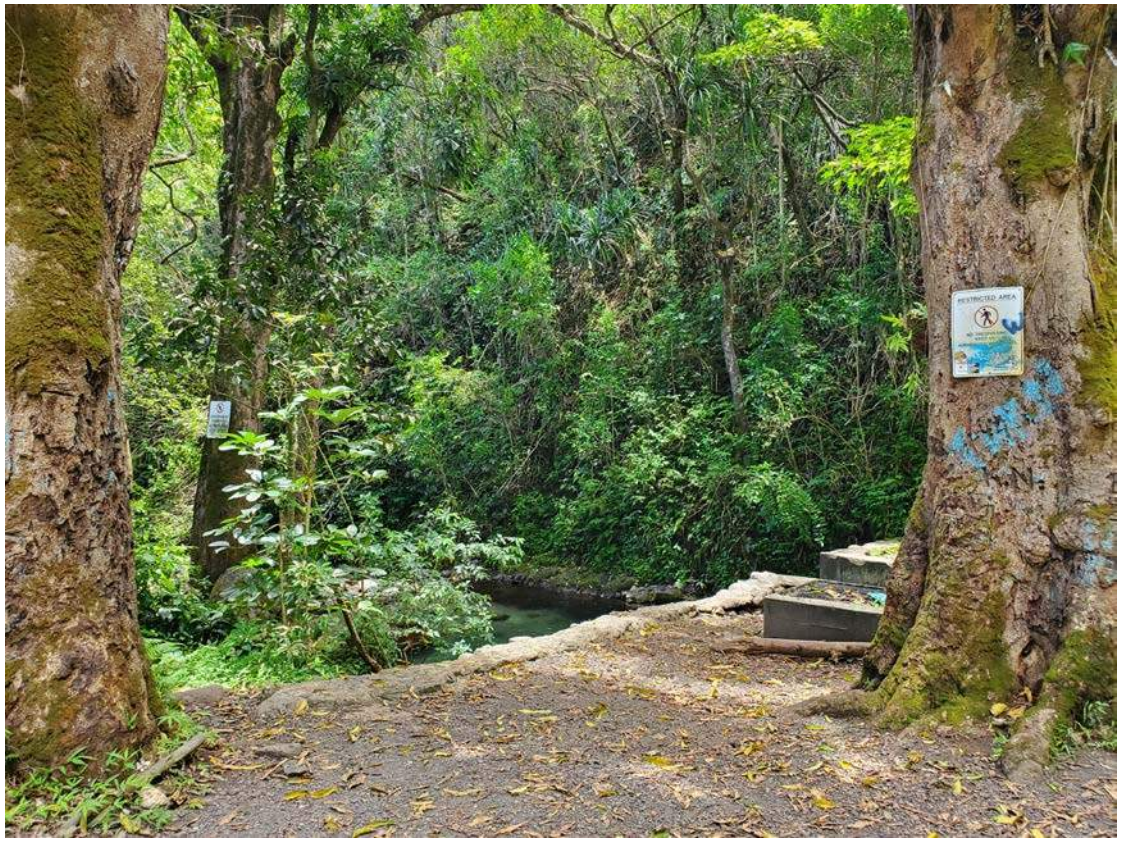
Road turns as stream flows beneath

Sign Posted

Sign on telephone pole

Signs posted on BWS fence before ice pond

BWS facility across ice pond



Signs posted at ice pond

Waihe’e Tunnel and Restoration Area

Along trail to Hamama Falls above Waihe’e Tunnel

Trail to falls

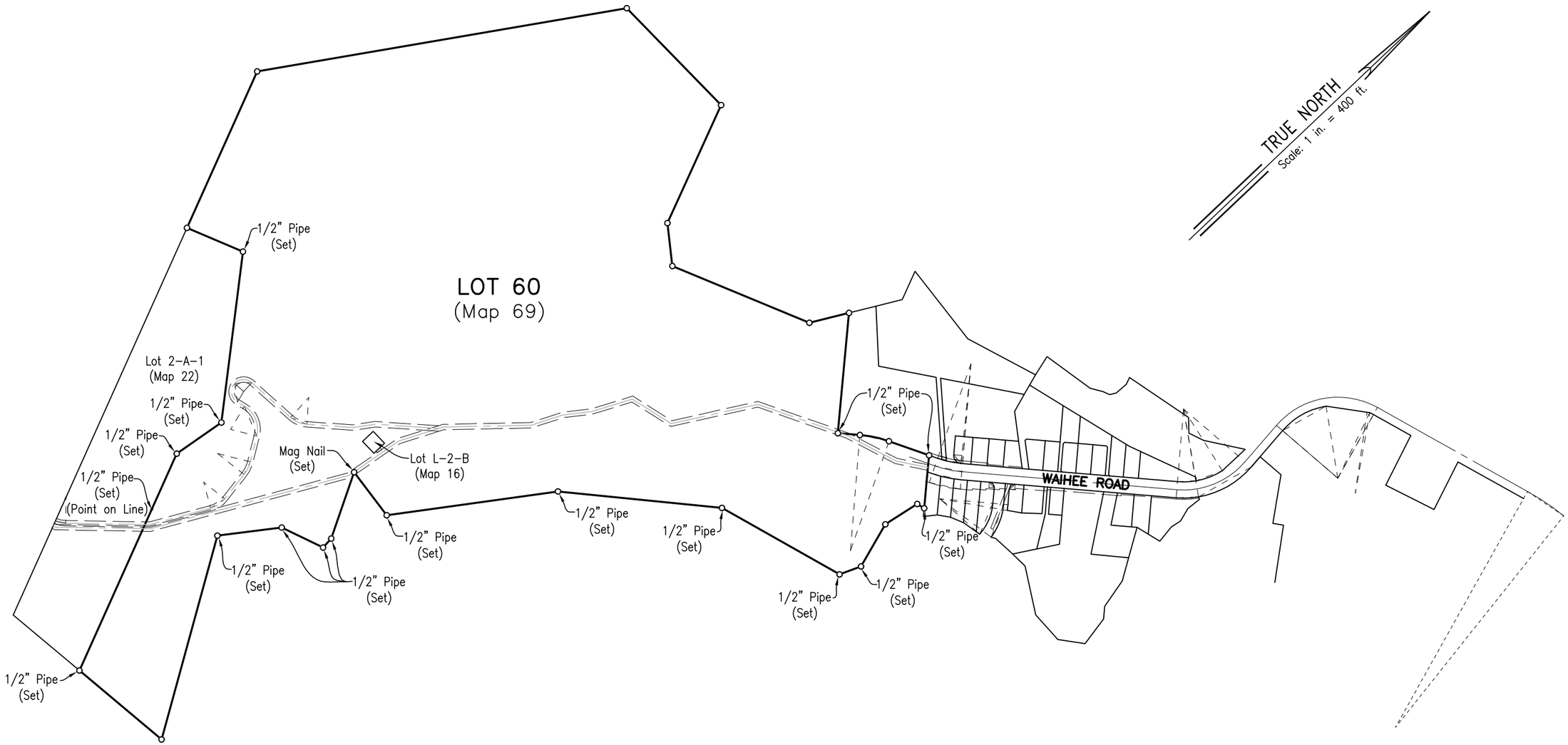
Hamama Falls

July 24, 2019

Honolulu Police Department
Board of Water Supply
Department of Parks and Recreation

Appendix G

Boundary and Topography Surveys



SKETCH

BOUNDARY STAKE OUT
LOT 60
LAND COURT APPLICATION 1133
(MAP 69)

At Waihee, Koolaupoko, Oahu, Hawaii

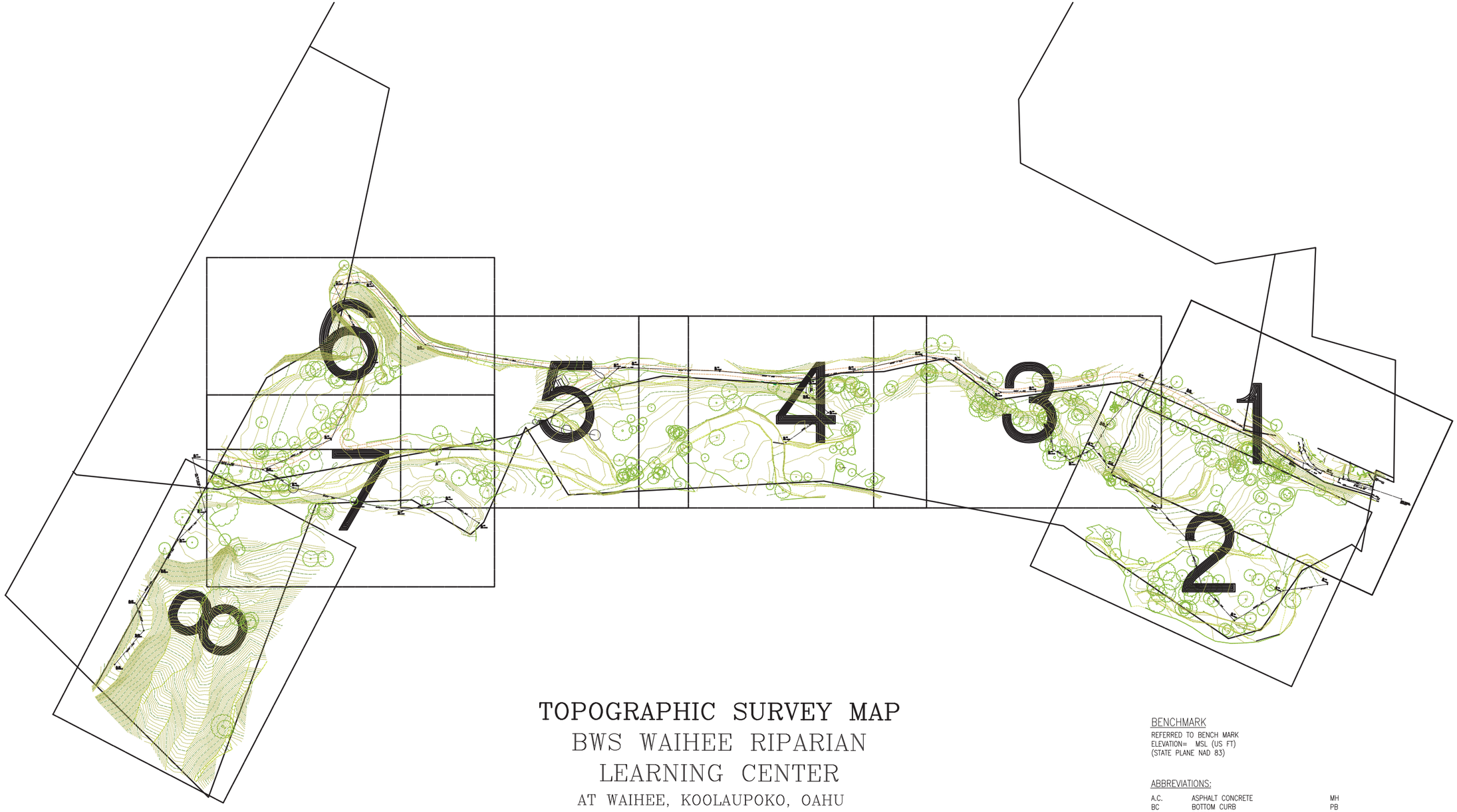
FN: N:\TOPOGRAPHIC SURVEY MAPS\2018\100\18113\dwg\18113 BDY-SO.dwg

TMK: 4-7-06: 10
Job No. 18113 BDY-SO

CONTROLPOINT SURVEYING, INC.
615 Piikoi Street, Suite 700
HONOLULU, HAWAII 96814

March 12, 2019

17" x 11"



TOPOGRAPHIC SURVEY MAP
BWS WAIHEE RIPARIAN LEARNING CENTER
AT WAIHEE, KOOLAUPOKO, OAHU

TMK: (1) 4-7-06

SCALE: 1 in. = 20 ft. JUNE 07, 2019

JOB NO. 18113 FIELD BOOK : 3213A: 07

DRN: MW FLD: WD,NL

CONTROLPOINT SURVEYING, INC.
615 Piikoi Street, Suite 700
HONOLULU, HAWAII 96814

BENCHMARK

REFERRED TO BENCH MARK
ELEVATION= MSL (US FT)
(STATE PLANE NAD 83)

ABBREVIATIONS:

A.C.	ASPHALT CONCRETE	MH	
BC	BOTTOM CURB	PB	
BW	BOTTOM WALL	S	
CONC.		SL	STREET LIGHT
CRM	CONCRETE ROCK MASONRY	TC	TOP CURB
D		TP	TOP PIPE
ELEC	ELECTRIC	TS	TOP STEM
FH	FIRE HYDRANT	TW	TOP WALL
G.W.		UB	UTILITY BOX
G.P.		UP	UTILITY POLE
H	HEIGHT	WM	WATER METER
INV	INVERT	WV	WATER VALVE BOX

NOTE

UNDERGROUND UTILITY LINES AND/OR STRUCTURES, IF SHOWN, ARE PROVIDED FOR INFORMATION ONLY AND ARE BASED ON INFORMATION SHOWN ON PLANS/MAPS PREPARED BY OTHERS. THE INFORMATION SHOWN, THEREFORE, MAY OR MAY NOT BE REPRESENTATIVE OF ACTUAL FIELD CONFDTIONS. THE UNDERGROUND UTILITY LINES AND/OR STRUCTURES MAY OR MAY NOT BE PRESENT AT THE LOCATIONS SHOWN OR OTHER UNDERGROUND UTILITY LINES AND/OR STRUCTURES NOT SHOWN MAY BE PRESENT.

UNLESS OTHERWISE NOTED, ALL LOCATIONS OF UNDERGROUND UTILITY LINES AND/OR STRUCTURES ARE APPROXIMATE. NO GUARANTEE IS MADE ON THE ACCURACY OR COMPLETENESS OF THE INFORMATION SHOWN. THE USER(S) OF THIS TOPOGRAPHIC SURVEY MAP SHALL VERIFY THE INFORMATION, AS NEEDED, DURING DESIGN AND CONSTRUCTION.

1

STA. 247
1/2 PIPE
ELEV.=142.91

57°53'42" — 102.72

69°47'21" — 317.75

STA. 246
IRON PIN
ELEV.=133.70

62°10'58" — 102.28

STA. 558
HUB
ELEV.=130.29

57°32'01" — 184.44
(ST. MON TO STA. 558)

STREET MONUMENT
TOP OF BRASS DISK
ELEV.=123.71

INV.=120.03(30")

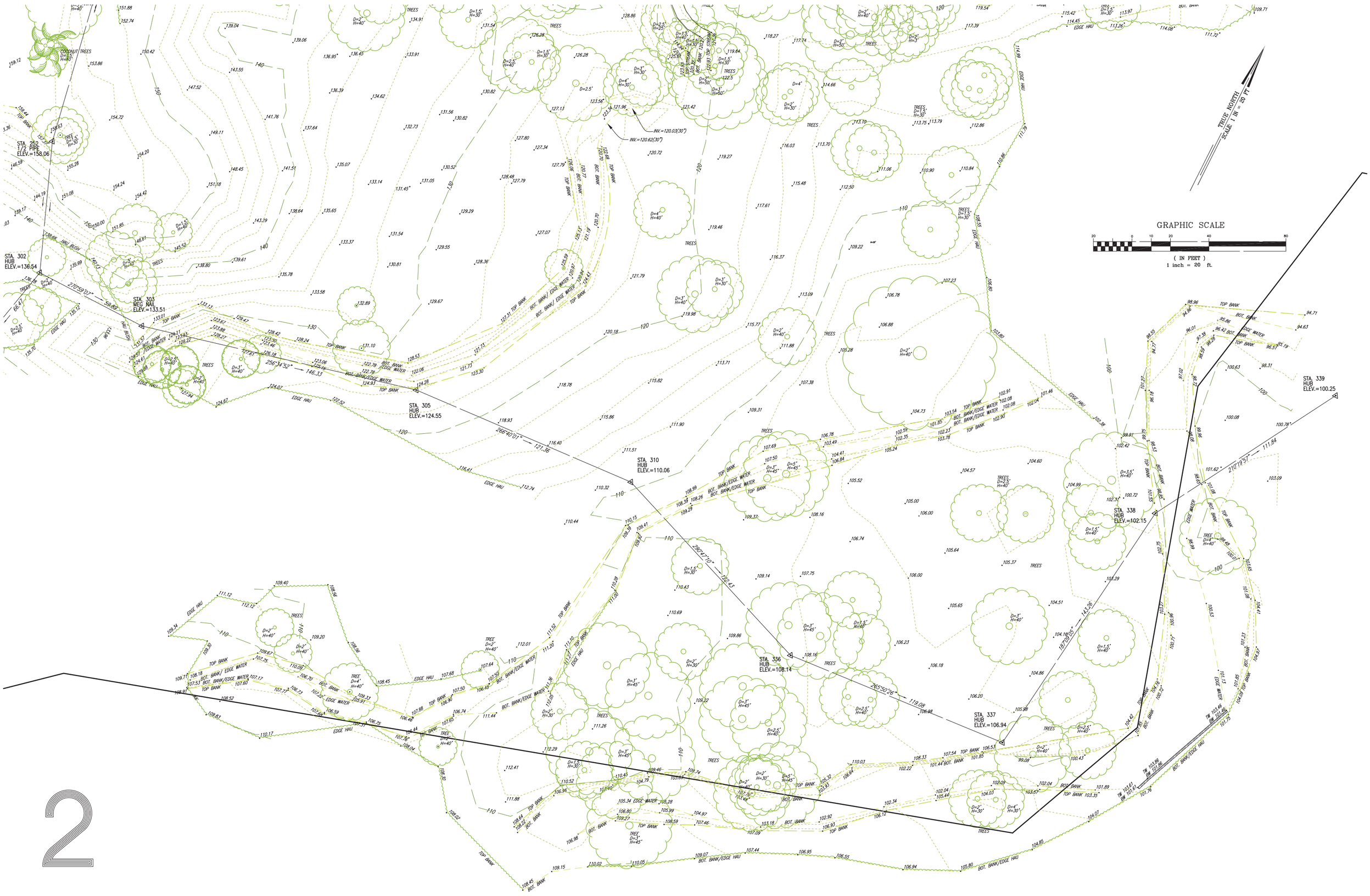
INV.=120.62(30")

TRUE NORTH
SCALE: 1 IN = 20 FT

GRAPHIC SCALE

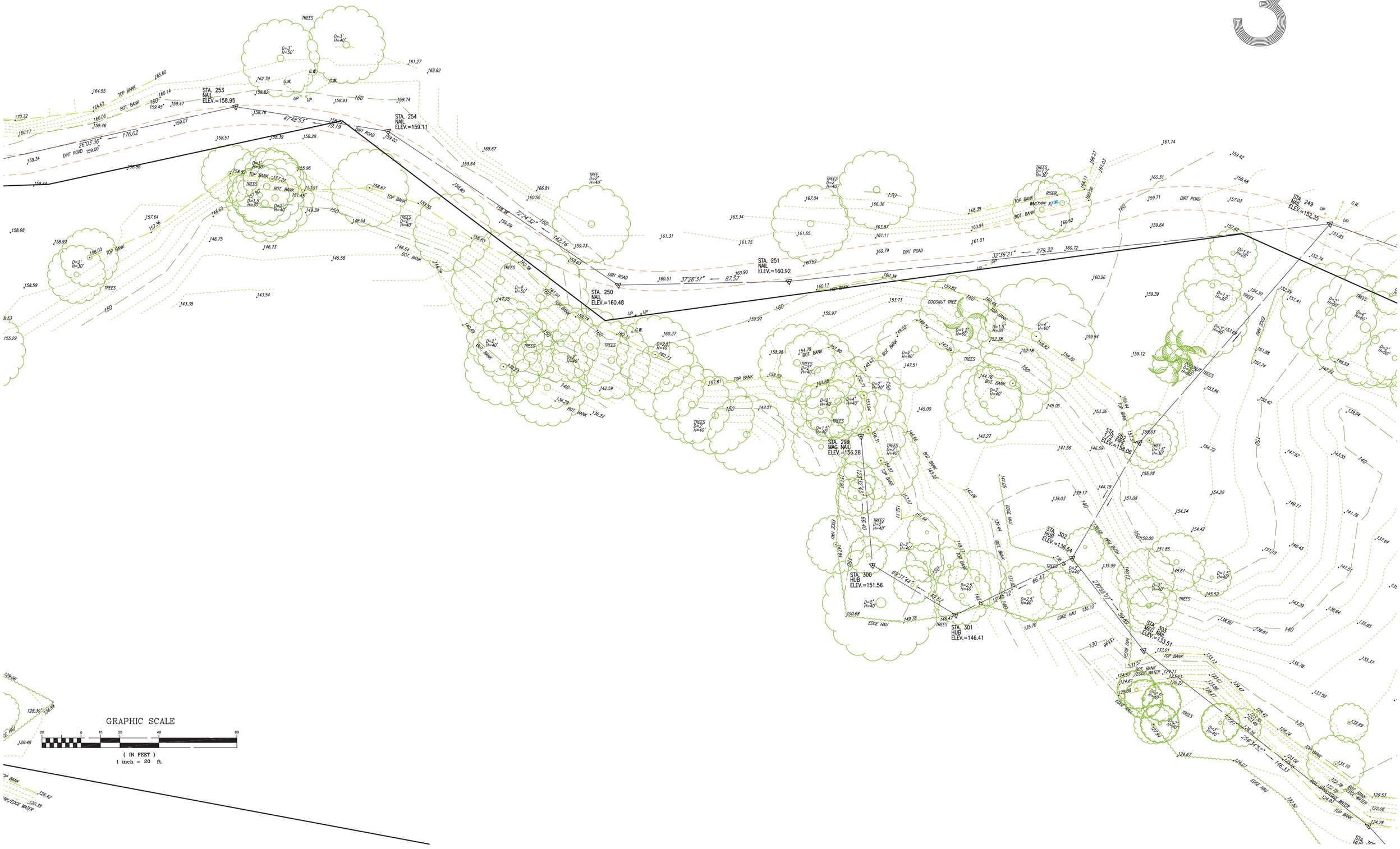
20 0 10 20 40 80

(IN FEET)
1 inch = 20 ft.

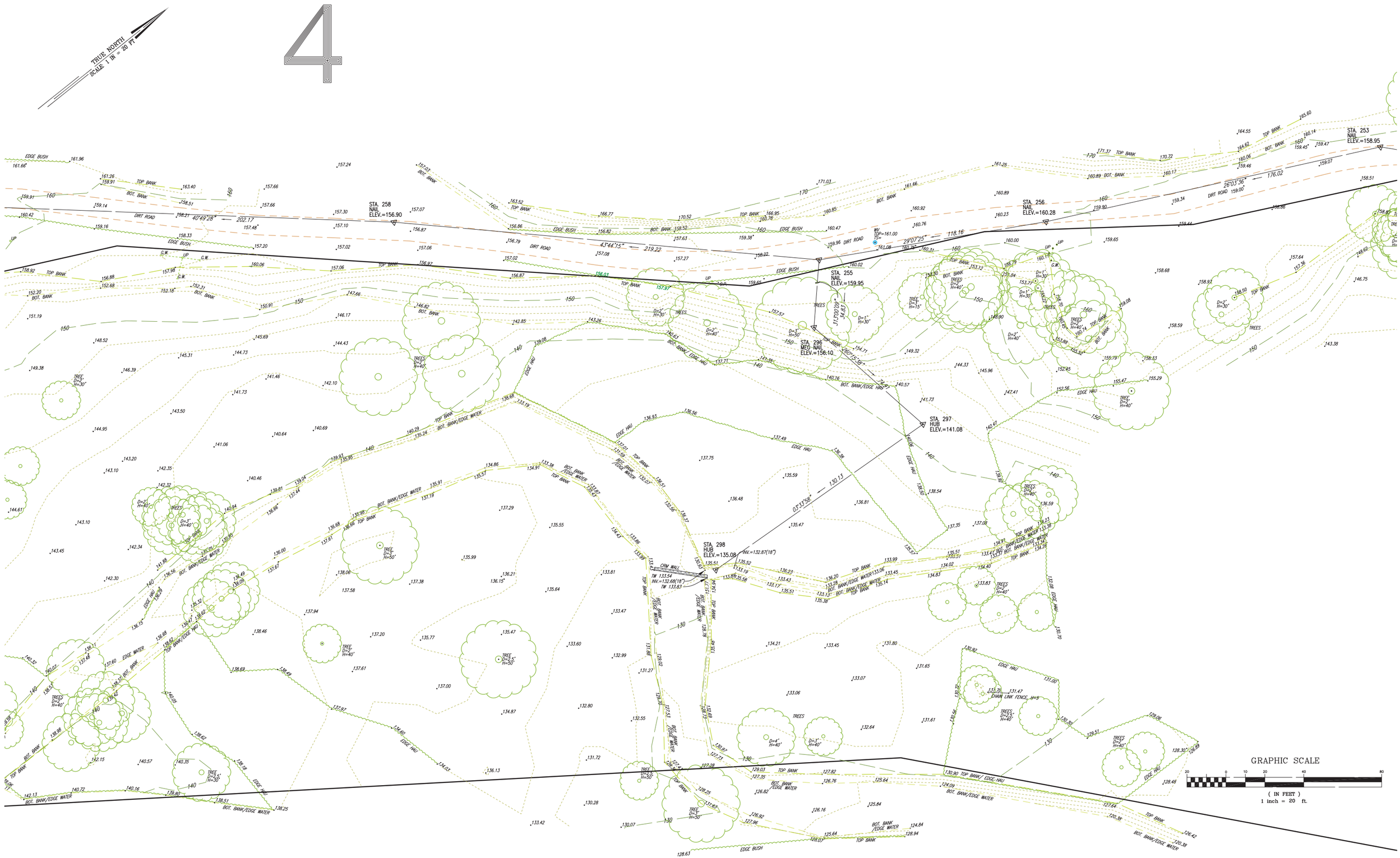

TRUE NORTH
SCALE: 1 IN = 20 FT
GRAPHIC SCALE
(IN FEET)
1 inch = 20 ft.
STA. 252
1/2 PIPE
ELEV.=158.06
STA. 302
HUB
ELEV.=136.54
STA. 303
MEG NAIL
ELEV.=133.51
STA. 305
HUB
ELEV.=124.55
STA. 310
HUB
ELEV.=110.06
STA. 336
HUB
ELEV.=108.14
STA. 337
HUB
ELEV.=106.94
STA. 338
HUB
ELEV.=102.15
STA. 339
HUB
ELEV.=100.25
INV.=120.03(30")
INV.=120.62(30")
270°59'07"
256°34'52"
266°40'01"
280°47'10"
263°50'26"
210°19'57"
TREES
EDGE HAU
TOP BANK
BOT. BANK
BOT. BANK/EDGE WATER
EDGE WATER
HAU BUSH

2

3


STA. 253
NAIL
ELEV.=158.95
STA. 254
NAIL
ELEV.=159.11
STA. 250
NAIL
ELEV.=160.48
STA. 251
NAIL
ELEV.=160.92
STA. 249
NAIL
ELEV.=152.35
STA. 299
MAG. NAIL
ELEV.=156.28
STA. 300
HUB
ELEV.=151.56
STA. 301
HUB
ELEV.=146.41
STA. 302
HUB
ELEV.=136.54
STA. 303
REC. NAIL
ELEV.=133.51
STA. 298
PIPE
ELEV.=152.06
DIRT ROAD
TOP BANK
BOT. BANK
TREES
COCONUT TREE
COCONUT TREES
RISER
WM(TYPE X)
EDGE HAU
EDGE WATER
GRAPHIC SCALE
(IN FEET)
1 inch = 20 ft.

4


TRUE NORTH
SCALE 1 IN = 20 FT
STA. 258
NAIL
ELEV.=156.90
STA. 255
NAIL
ELEV.=159.95
STA. 256
NAIL
ELEV.=160.28
STA. 253
NAIL
ELEV.=158.95
STA. 296
MEG-NAIL
ELEV.=156.10
STA. 297
HUB
ELEV.=141.08
STA. 298
HUB
ELEV.=135.08
INV.=132.87(18")
CRM WALL
TW 133.54
INV.=132.68(18")
TW 133.83
DIRT ROAD
TOP BANK
BOT. BANK
EDGE BUSH
EDGE HAU
BOT. BANK/EDGE WATER
TOP BANK/EDGE HAU
TREES
CHAIN LINK FENCE, H=5
GRAPHIC SCALE
(IN FEET)
1 inch = 20 ft.

5

TRUE NORTH
SCALE: 1 IN = 20 FT

STA. 263
IRON PIN
ELEV.=200.34

STA. 259
IRON PIN
ELEV.=175.62

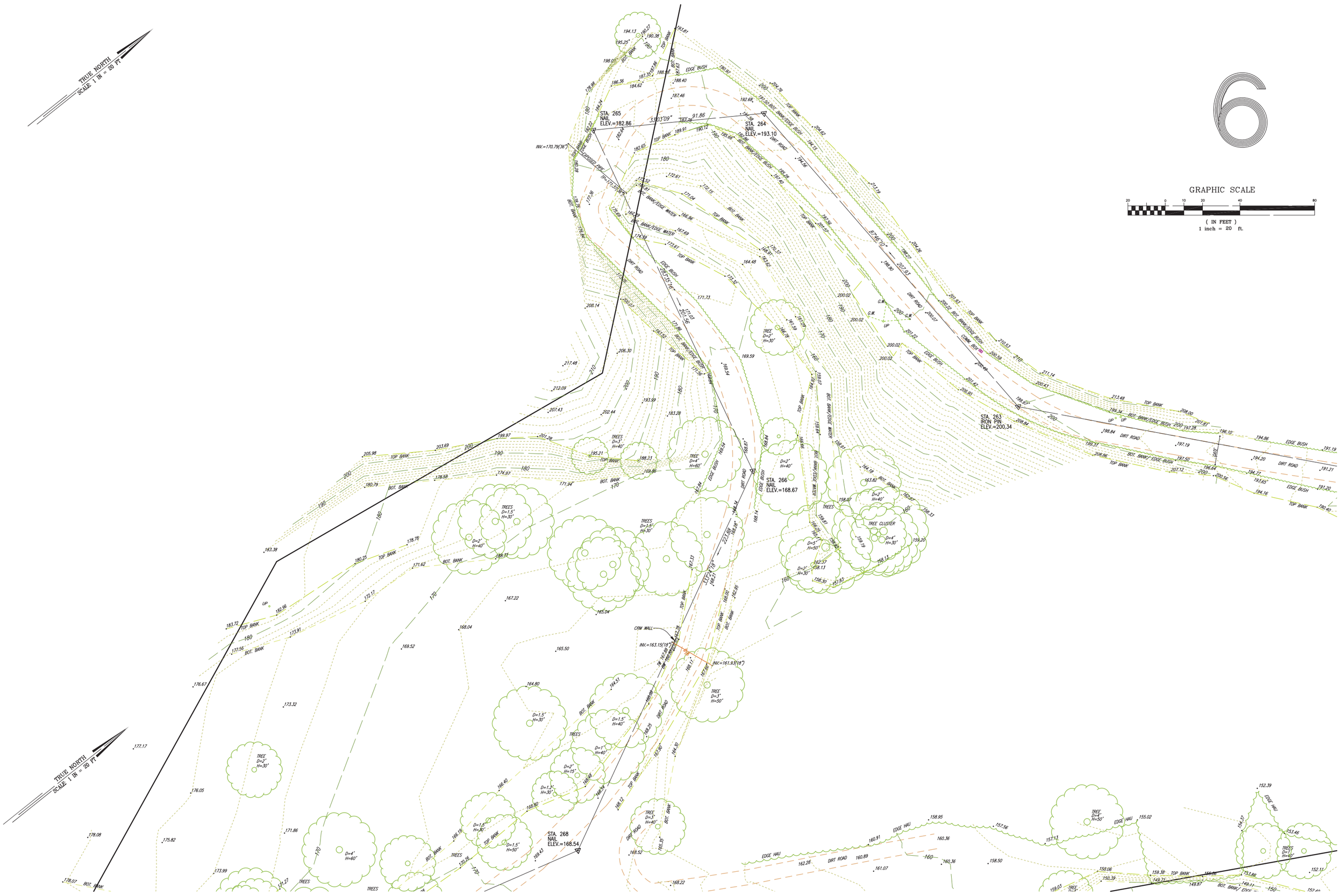
STA. 260
HUB
ELEV.=162.73

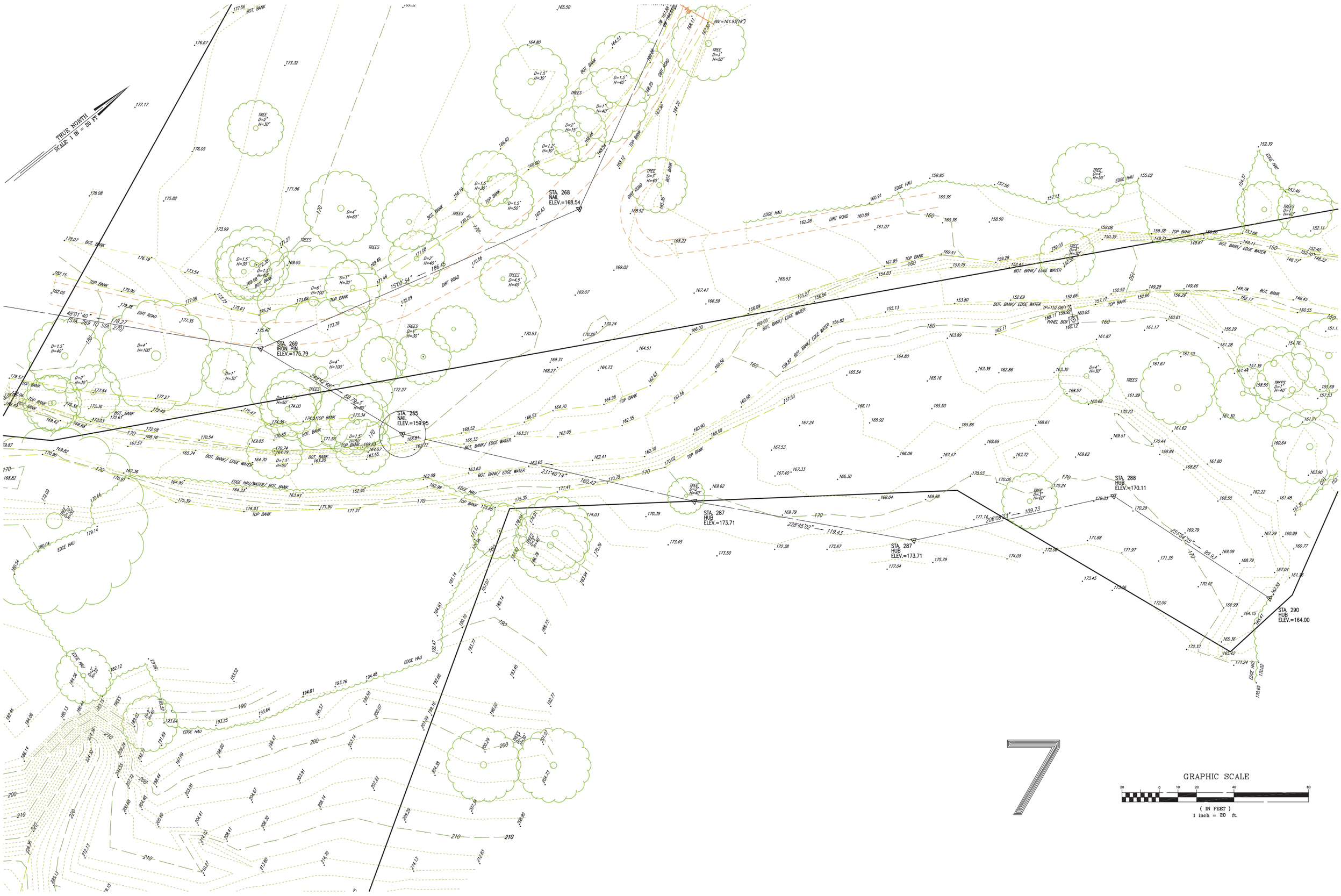
STA. 257
NAIL
ELEV.=160.50'

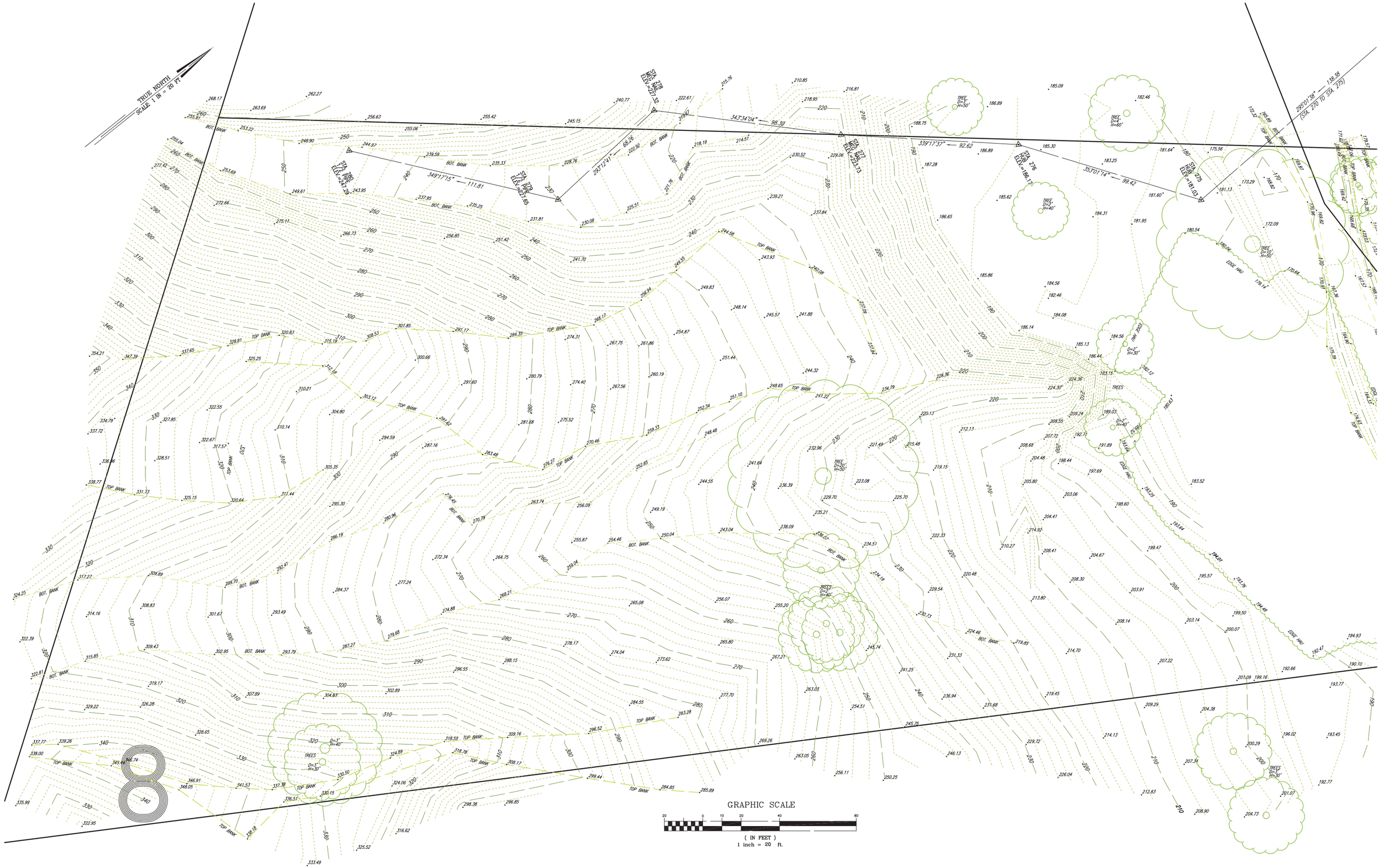
STA. 288
HUB
ELEV.=170.11

GRAPHIC SCALE

(IN FEET)
1 inch = 20 ft.


6
TRUE NORTH
SCALE 1 IN = 20 FT
GRAPHIC SCALE
(IN FEET)
1 inch = 20 ft.
STA. 265
NAIL
ELEV.=182.86
STA. 264
NAIL
ELEV.=193.10
STA. 263
IRON PIN
ELEV.=200.34
STA. 266
NAIL
ELEV.=168.67
STA. 268
NAIL
ELEV.=168.54
INV.=170.79(36")
CRM WALL
INV.=163.15(18")
INV.=161.93(18")
TOP BANK
BOT. BANK
EDGE BUSH
DIRT ROAD
EDGE WATER
TREE CLUSTER
EDGE HAU
GATE


TRUE NORTH
SCALE 1 IN = 20 FT
STA. 268
NAIL
ELEV.=168.54
STA. 269
IRON PIN
ELEV.=175.79
STA. 255
NAIL
ELEV.=159.95
STA. 287
HUB
ELEV.=173.71
STA. 287
HUB
ELEV.=173.71
STA. 288
HUB
ELEV.=170.11
STA. 290
HUB
ELEV.=164.00
45°01'40"
(STA. 269 TO STA. 270)
15°00'54"
231°40'14"
226°45'02"
206°08'23"
251°54'25"
DIRT ROAD
EDGE HAU
TOP BANK
BOT. BANK
BOT. BANK/ EDGE WATER
EDGE HAU/WATER/ BOT. BANK
TREES
PANEL BOX
GRAPHIC SCALE
(IN FEET)
1 inch = 20 ft.


TRUE NORTH
SCALE: 1 IN = 20 FT
STA. 278
MAG. BAR.
ELEV.=227.32
STA. 277
ELEV.=223.73
STA. 276
ELEV.=186.17
STA. 275
ELEV.=181.03
STA. 280
ELEV.=247.29
STA. 279
ELEV.=227.65
34°34'04" — 98.30'
339°17'37" — 92.62'
353°01'14" — 99.42'
349°17'15" — 111.81'
293°12'41" — 68.76'
298°01'38" — 138.38'
(STA. 270 TO STA. 275)
BOT. BANK
TOP BANK
EDGE HAU
TREES
GRAPHIC SCALE
(IN FEET)
1 inch = 20 ft.

Appendix H

Natural Resources Survey for the Waihe‘e Riparian Learning Center

AECOS No. 1559

Natural resources survey for the Waiheʻe Riparian Learning Center TMK: 4-7-006: 010 (por.) Kahuluʻu, Koʻolau Poko District, Oʻahu

Prepared by:

AECOS, Inc.
45-939 Kamehameha Hwy, Suite 104
Kāneʻohe, Hawaiʻi 96744-3221

May 7, 2019

Natural resources survey for the Waiheʻe Riparian Learning Center TMK: 4-7-006: 010 (por.) Kahuluʻu, Koʻolau Poko District, Oʻahu

May 7, 2019 | ***Draft*** | *AECOS* No. 1559

Susan Burr, Chad Linebaugh, and Bryson Luke
AECOS, Inc.
45-939 Kamehameha Hwy, Suite 104
Kāneʻohe, Hawaiʻi 96744
Phone: (808) 234-7770 Fax: (808) 234-7775 Email: sburr@aecos.com

Introduction

The Board of Water Supply, City and County of Honolulu (BWS) proposes to create the "Waiheʻe Riparian Learning Center," to educate the public about the importance of streams, watersheds, and regenerative agriculture (the "Project"). *AECOS* Inc. was contracted by G70 to complete a natural resources survey of a portion of TMK: 4-7-006:100 and assess potential environmental impacts from the proposed Project[1].

Site Description

Waiheʻe Valley is located on the windward side of Koʻolau Mountain, Oʻahu (Figure 1). Stream erosion of Koʻolau Mountain formed the current distinctive half-circular valley shape with steep walls resembling an amphitheater. Waterfalls and intermittent stream tributaries near the top of the valley converge into the main course of Waiheʻe Stream at approximately 60 m (200 ft) above sea level (ASL). Waiheʻe Stream discharges into Kāneʻohe Bay through Kahuluʻu Lagoon, a dredged flood control channel located on the coastal plain. ʻĀhuimanu and Kahuluʻu streams also discharge into Kahuluʻu lagoon and the three streams make up the larger Kahuluʻu Watershed (State ID code: 32007). The proximity of Koʻolau Mountain to the shore in the project vicinity results in the longest length of Waiheʻe Stream being only 4.8 km (3.0 mi).

[1] This document will be incorporated into the Environmental Assessment (EA) for the Project and become part of the public record.

Figure 1. Location of the Project area and Kahaluʻu watershed in windward Oʻahu.

A real-time U.S. Geological Survey (USGS) stream gage located at 52 m (170 ft) ASL just upstream of the Project area has measured discharge and gage height of Waiheʻe Stream since 1974. Waiheʻe Stream has a median flow of 5.6 cubic feet per second (cfs) and an average flow of 7.1 cfs (USGS, 2019a) and is, therefore, considered a small stream (Hawaii Cooperative Park Service Unit, 1990). Just upslope from the USGS gage, Waiheʻe Tunnel, installed in 1955, captures and transports 5 million gallons per day (mgd) of dike-confined Koʻolau Range water for use as drinking water by Windward Oʻahu residents. Water withdrawn from the tunnel and wells is regulated to maintain an instream flow of 4.2 cfs (Charles F. Reppun vs. Board of Water Supply, City and County of Honolulu, 1982). Two waterfalls, Hāmama and Waiheʻe, are located just upstream of the tunnel.

At 50 m (160 ft) ASL, a diversion directs some flow from Waiheʻe Stream into an *ʻauwai* (irrigation ditch). This water was used to irrigate former *loʻi kalo* (terraced taro pondfields) in the Project area and is still being used for irrigation downstream of the Project area. Flow is directed back into the main channel upstream of Ahilama Road at 15 m (50 ft) ASL. *A r*iparian forest lines the banks of the stream and *ʻauwai*, creating a relatively closed canopy. The stream channel has a substratum of mainly boulders and large cobbles, with moderate water velocity and moderate siltation and embeddedness (Brasher, et al., 2003). The *ʻauwai* has a substratum of cobbles and silt, with moderate water velocity and high siltation and embeddedness.

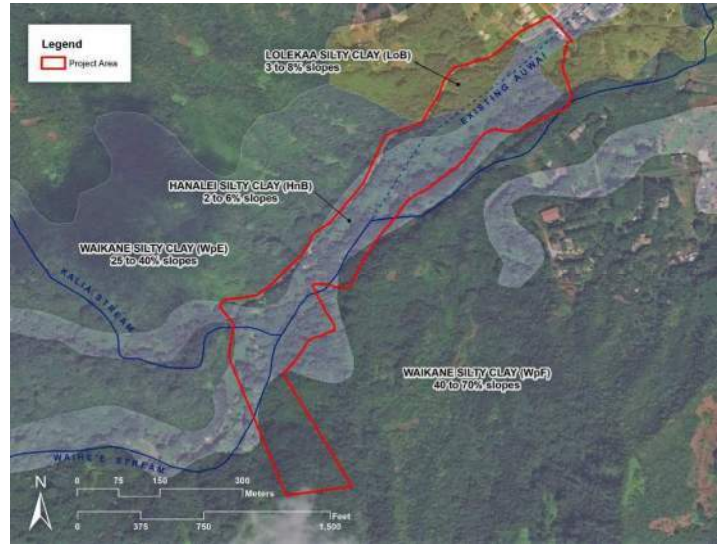


Figure 2. The Project area (outlined in red) is on the valley floor; most of the soils are mapped as Hanalei silty clay (HnB).

The U.S. Department of Agriculture – Natural Resources Conservation Service (USDA-NRCS) maps four soil types in the Project area (Figure 2, above). Hanalei silty clay (2 to 6 percent slopes [HnB]) occupies the majority of the Project area

on the valley floor and riparian flood zone of Waiheʻe Stream. USDA-NRCS describes Hanalei silty clay as derived from alluvial deposits on bottomlands (USDA-NRCS, 2019), and classifies it as a Typic Endoaquept soil, a geologically-recently formed soil with a high water table. These soils are somewhat poorly drained to poorly drained and are susceptible to seasonal flooding (USDA-NRCS, 2019b).

Project Description

The Project area is located along Waiheʻe Stream, from the end of Waiheʻe Road to the BWS Waiheʻe Tunnel. Elevation of the Project area ranges from approximately 35 m to 75 m (115 ft to 245 ft) ASL, and the total area of the is approximately 11 ha (27 ac). The land is currently unoccupied and, due to the ample rainfall, supports a lush vegetation. In 2007, the Hawaiʻi Biological Survey of Bishop Museum (BISH) mapped the vegetation in the Project area as Alien Wet Forest (Imada et al., 2007).

Proposed Project activities include the following: restore existing fallow *loʻi*, maintain existing *ʻauwai* system, and restore riparian and forest areas with appropriate native and non-invasive plants. Specific actions to implement these activities include: clear existing *loʻi*, develop parking areas, replace existing gate and install a new gate, remove invasive species, plant native species, create a *hale* (pavilion), evaluate toilet options, install signs, construct a plant nursery, and create a new *loʻi* from an existing ginger patch. Figure 3 depicts proposed Project activities.

Methods

Water Quality

On March 27, 2019, *AECOS* biologists took field measurements in Waiheʻe Stream for temperature, conductivity, dissolved oxygen, and pH and collected water samples for analysis of total suspended solids (TSS), turbidity, nitrate-nitrite nitrogen (NO_3+NO_2), total nitrogen (TN), and total phosphorus (TP) at three stations (Figure 4).

Additionally, stream velocity was measured with a Swoffer Instruments® Model 3000 flow meter and the average depth and width of the flowing portion of the stream or *ʻauwai* were measured in order to estimate stream discharge at each station during sampling.

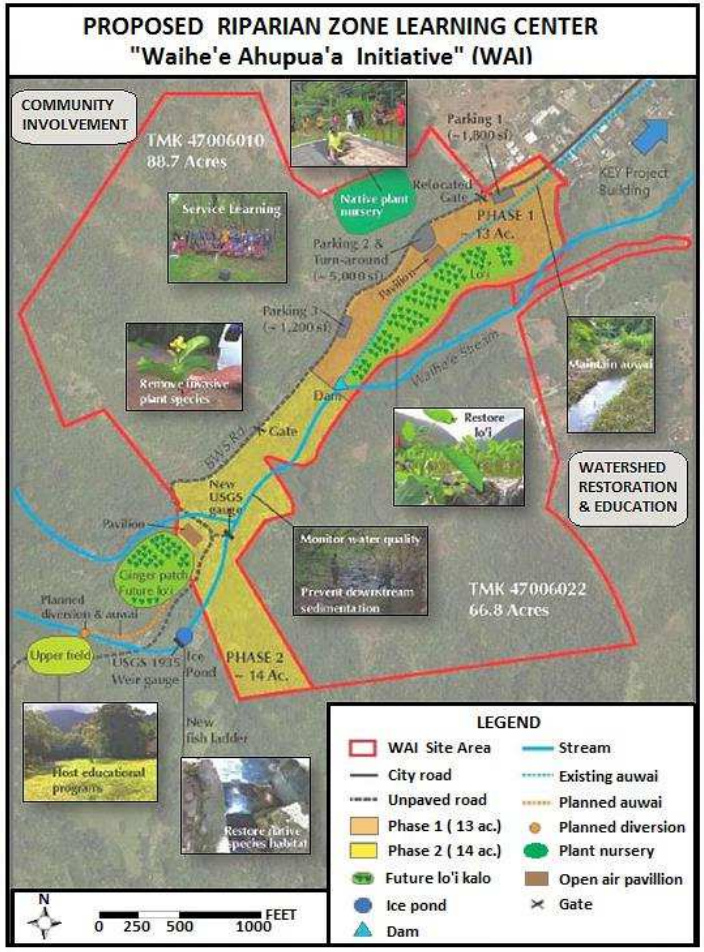


Figure 3. Proposed Project activities.

All water samples were collected into screw cap, polypropylene bottles from just below the surface and delivered to *AECOS* laboratory in Kāneʻohe, Oʻahu for laboratory analyses (*AECOS* Log No. 37565). Table 1 lists analytical methods and instruments used in these measurements.

Table 1. Analytical methods and instruments used for water quality analyses.

Analysis	Method	Reference	Instrument†
Temperature	SM 2550 B	Standard Methods 20th Edition (1998)	YSI ProPlus multi-meter
Conductivity	SM 2510-B	Standard Methods, 20th Edition (1998)	YSI ProPlus multi-meter
pH	SM 4500 H+	Standard Methods 20th Edition (1998)	Hannah pocket pH meter
Dissolved Oxygen	SM 4500-O G	Standard Methods 20th Edition (1998)	YSI ProPlus multi-meter
Turbidity	EPA 180.1 Rev 2.0	EPA (1993)	HACH 2100Q Turbidimeter
Total Suspended Solids	Method 2540 D	Standard Methods 20th Edition (1998)	Mettler Toledo XS204 balance
Nitrate + Nitrite	EPA 353.2	USEPA (1993)	Lachat Quikchem 8500, FIA
Total Nitrogen	EPA 353.2	USEPA (1993)	Lachat Quikchem 8500, FIA
Total Phosphorus	EPA 365.3	USEPA (1993)	Lachat Quikchem 8500, FIA

† typical instruments listed, others may have been substituted

Station "Downstream" was located just upstream from a small bridge culvert in the *ʻauwai* about 165 m (540 ft) from the northeast end of the Project site. Sta. "Mid-Project" was located near the center of the Project site, approximately 150 m (500 ft) downstream from the Waiheʻe-Kalia streams confluence. Sta. "USGS" was collected at the measuring weir in the former location of the USGS gage station, just upstream from a plunge pool locally referred to as "Ice Pond."

Aquatic Biota

AECOS biologists conducted an aquatic biota survey of streams and *ʻauwai* in the Project area on March 27, 2019. Our survey consisted of making visual observations of aquatic organisms while walking in or adjacent to the stream and snorkeling deeper segments. The biologists noted relative abundances (e.g., rare, common, abundant) of each species encountered as the survey progressed.

Hand nets were used to capture fishes for close inspection and discover more cryptic, bottom-dwelling species. Nomenclature for aquatic species follows *AlgaeBase* (Guiry and Guiry, 2019), *Integrated Taxonomic Information System* (ITIS, 2017), and *World Register of Marine Species* (WoRMS Editorial Board, 2019). A review of biological records from previous surveys within the watershed is included in the species list developed for the survey.

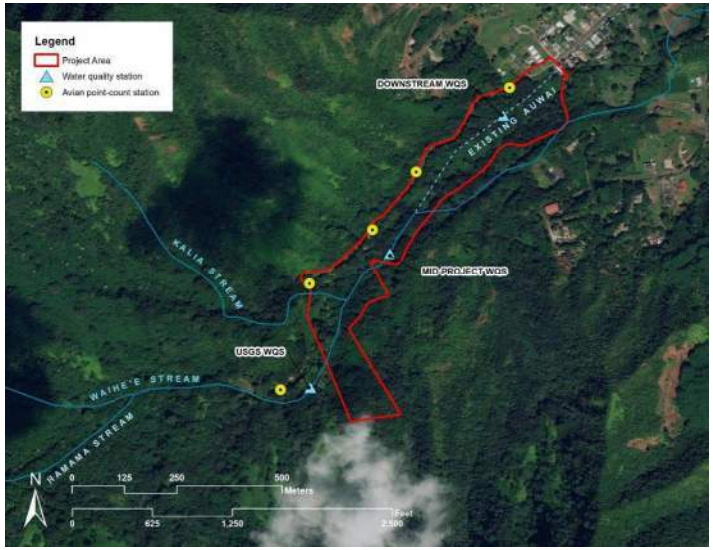


Figure 4. Locations of water quality stations (WQS) (blue triangles) and avian point-count stations (yellow circles) located in the Project vicinity.

Avian Survey

The avian survey was conducted during the morning hours when birds are most active. Five point-count stations (shown in Fig. 4, above) were selected in the Project area at equidistant positions, roughly 200 m (650 ft) apart. Weather conditions during the survey were ideal for avian observations, with no rain and light variable winds. At each point-count station, birds observed and/or heard

during an 8-minute period were identified to species and counted. Any additional avian species observed in the Project area beyond these point-count periods were noted as incidental observations. *AECOS* biologists spent additional time walking the the Project area, including the location of the planned diversion and *ʻauwai* and future *loʻi*..

The avian phylogenetic order and nomenclature used in this report follows the Hawaiian Island Birds Checklist 2017 (VanderWerf et al. 2018), which is based on the *Checklist* of *North and Middle America Birds* by American Ornithological Society (AOS; Chesser et al., 2018). Hawaiian common names are provided for indigenous and endemic species, as applicable.

Mammalian Survey

AECOS biologists compiled a list of terrestrial mammal species observed in the Project area. Visual observations of tracks, scat, and other sign indicating mammals using the survey area were noted. Mammalian scientific names follow *Mammal Species of the World* (Wilson and Reeder, 2005).

Results

Water Quality

Results from stream discharge calculations, *in situ* water quality measurements, and analyses of water samples collected are provided in Tables 2 and 3. Also included in these tables are data collected from Waiheʻe Stream in 1999 and 2012 at the former USGS Gage Station and 1 km (0.6 mi) downstream from the Project area at Ahilama Road (*AECOS*, 2012).

In the Project area, the swift-flowing stream waters are cool and clear. Temperature and conductivity varied little from station to station. Temperature readings ranged from 20.0°C at Sta. USGS to 20.9°C at Sta. Downstream. Stream waters were well oxygenated at all stations with saturation values of 102, 106, and 99% calculated based on ambient water temperature. Values for pH ranged from 6.75 to 7.34 standard units.

Turbidity and total suspended solids concentrations were low in Waiheʻe Stream represented by Sta. USGS and Sta. Mid-Project and somewhat higher at Sta. Downstream, in the *ʻauwai*. The bulk of nitrogenous nutrient substances present in the sample waters were as soluble nitrate+nitrite, indicating the flow conditions during the sampling event were primarily groundwater driven

Table 2. Results for *in situ* measurements on March 27, 2019 and historical data from June 1999 and July 2012 in Waiheʻe Stream.

Station	Time (hh:mm)	Discharge (cfs)	Temp. (°C)	Dissolved Oxygen (mg/l)	Dissolved Oxygen (% sat.)	pH --	Conductivity (µmhos/cm)
USGS (1999)†	1010	4.4	20.5	8.90	99	8.20	155
USGS (2012)‡	1046	--	20.7	9.02	100	7.99	152
USGS	1130	3.0	20.0	9.28	102	6.88	134
Mid-Project	1355	7.0	20.5	9.53	106	7.34	136
Downstream	1012	0.8	20.9	8.92	99	6.75	136
Ahilama Rd (2012)‡	0949	--	22.0	8.59	98	7.56	166

† (Brasher et al., 1999)
‡ (*AECOS*, 2012)

Table 3. Results for turbidity, suspended solids, and nutrients concentrations from samples collected on March 27, 2019 in the Project area and historical data from June 1999 and July 2012 in Waiheʻe Stream.

Station	TSS (mg/l)	Turbidity (ntu)	Nitrate+ Nitrite (µg N/l)	Total N (µg N/l)	Total P (µg P/l)
USGS(1999)†	2.0	--	120	170 (est.)	33
USGS(2012)‡	0.4	0.40	138	199	48
USGS	0.7	0.74	149	183	34
Mid-Project	0.7	0.82	174	219	58
Downstream	9.2	5.06	147	177	43
Ahilama Rd (2012)‡	2.4	2.36	51	64	98

† (Brasher et al., 1999)
‡ (*AECOS*, 2012)

rather than a result of surface water runoff. Total phosphorus concentrations ranged from 34 to 58 μgP/L.

Aquatic Biota

The aquatic biota in Waiheʻe Stream and *ʻauwai* in the Project area comprises both native and non-native species (Table 4). The list in Table 4 presents qualitative abundances for species observed in the Project area during our present survey and includes, without abundance values, species previously reported from Waiheʻe Stream (*AECOS*, 2012; Brasher et al., 2003) and Kahaluʻu Watershed (Parham et al., 2008).

Table 4. List of aquatic species observed in or reported from Kahaluʻu Watershed and Waiheʻe Stream.

PHYLUM, CLASS, ORDER, FAMILY *Species*	Common name	Abundance	Status	Reach <ID Code>
	ALGAE			
CHLORPHYTA, CHLOROPHYCEAE				
OEDOGONIALES				
OEDOGONIACEAE				
Oedogonium sp.		--	--	Low<2>
CHLORPHYTA, ULVOPHYCEAE				
ULVALES				
CLONIOPHORACEAE				
Cloniophora sp.		--	--	Low<2>
ULVACEAE				
Ulva flexuosa Wolfen		--	--	Est<2>
RHODOPHYTA, FLORIDEOPHYCEAE, HILDENBRANDIALES				
HILDENBRANDIACEAE				
Hildenbrandia angolensis Welw. ex W. West & G. S. West		A	**Ind**	Mid<1>
	INVERTEBRATES			
PLATYHELMINTHES	flatworms			
undet. platyhelminthes		--	?	Mid<3>
MOLLUSCA, BIVALVIA, VENEROIDA,	clams			
CORBICULOIDIDAE				
Corbicula fluminea O.F. Müller	Asian clam	--†	Nat	Est<2> Low<4>
MOLLUSCA, GASTROPODA,	snails			
undet. Gastropoda		--	?	Mid<3>

Table 4 (continued).

PHYLUM, CLASS, ORDER, FAMILY Species	Common name	Abundance	Status	Reach <ID Code>
MOLLUSCA, GASTROPODA, ARCHITAENIOGLOSSA				
AMPULLARIIDAE				
Pila conica Gray	applesnail	--	Nat	<4>
Pomacea canaliculata Lam.	channeled applesnail	--	Nat	Est<2>, <4>
MOLLUSCA, GASTROPODA BASOMMATOPHORA				
LYMNAEIDAE				
indet.	pond snail	--	--	Low, Mid<4>
PHYSIDAE				
indet.		--	Nat	Mid<4>
Physa virgata Gould [syn: *Physella virgata* (Gould)	pouch snail	--	Nat	<4>
MOLLUSCA, GASTROPODA CYCLONERITIDA				
NERITIDAE				
Neritina granosa (G. B. Sowerby)	*hihīwai*	O	**End**	Mid<4>
MOLLUSCA, GASTROPODA, NEOTAENIOGLOSSA				
THIARIDAE				
indet. Thiaridae	melania	--	--	Low, Mid<4> Mid<3>
Melanoides tuberculata Muller	red-rimmed melania	--	Nat	Mid<4>
Tarebia granifera Lamarck	quilted melania	C	Nat	Mid<1> Low, Mid<4>
ANNELIDA, CLITELLATA, HIRUDINIDAE	leaches			
indet. Hirudinidae		---	?	Mid<4>
ERPOBDELLIDAE				
indet. Erpobdellidae		---	?	Mid<5>
PISCICOLIDAE				
?*Myzobdella lugubris* Leidy	fish leech	R	Nat	Mid<4>
ANNELIDA, CLITELLATA ENCHYTRAEIDAE				
indet. Enchytraeidae		---	?	Mid<3>
NAIDIDAE				
indet. Naididae		---	?	Mid<3>
TUBIFICIDAE				
indet. Tubificidae		---	?	Mid<3>
ANNELIDA, OLIGOCHAETA,				
Megadrile sp.		--	?	Mid<3>

Table 4 (continued).

PHYLUM, CLASS, ORDER, FAMILY Species	Common name	Abundance	Status	Reach <ID Code>
ANNELIDA, POLYCHAETA, PHYLLODOCIDA	polychaete			
NEREIDIDAE				
Namalycastis sp.		--	**Ind**	Mid<4>
Namalycastis abiuma (Mueller, in Grube)		--	**Ind**	Mid<3>
ARTHROPODA, INSECTA, COLEOPTERA				
HYDROPHILIDAE	water scavenger beetles			
indet. Hydrophilidae		--	?	Mid<3>
ARTHROPODA, INSECTA, COLLEMBOLA				
indet. Collembola	springtails	--	?	Mid<3>
ARTHROPODA, INSECTA, DIPTERA				
EMPIDIDAE	dance flies			
Hemerodromia stellaris Melander		--	Nat?	Mid<3>
EPHYDRIDAE	brine flies			
indet.		--	Nat	Mid <3,4>
Discocerina mera Cresson		--	Nat	Est <4>
CHIRONOMIDAE	midges			
indet. Chironomidae		--	?	Mid<3>
Apedilum sp.		--	Nat?	Mid<3>
Cricotopus bicinctus (Meigen, 1818)		--	Nat	Est, Mid<4>
Paratanytarsus sp.		--	Nat?	Mid<3>
indet. Orthocladiinae		--	Nat	Mid<3>
Cricotopus/Orthocladius sp.		--	Nat	Mid<3>
Eukiefferiella sp.		--	Nat?	Mid<3>
CULICIDAE	mosquitos			
indet.		--	Nat	Mid<4>
Orthocladius sp.		--	**End**	Mid<4>
DIXIDAE				
Dixa longistyla Takahashi	dixid midges	--	Nat	Mid<3,4>
TETHINIDAE				
Dasyrhicnoessa insularis (Aldrich)	tethnid fly	--	**Ind**	Est<4>
TIPULIDAE				
Limonia sp.	crane fly	--	?	Mid<3,4>
ARTHROPODA, INSECTA HEMIPTERA				
MESOVELIIDAE				
Mesovelia amoena Mulsant and Rey	water treader	--	Nat	Mid<3,4>
VELIIDAE				
indet. Veliidae		--	Nat	Mid<4>
Microvelia vagans White	water strider	--	**End**	Mid<4,5>

Table 4 (continued).

PHYLUM, CLASS, ORDER, FAMILY Species	Common name	Abundance	Status	Reach <ID Code>
ARTHROPODA, INSECTA, LEPIDOPTERA				
indet. Lepidoptera		--	?	Mid<3>
ARTHROPODA, INSECTA, ODONATA	**dragonflies**			
AESHNIDAE				
Anax junius Drury	*pinao*, common green darner	R	**End**	Mid<1>
COENAGRIONIDAE	damselflies			
Ischnura ramburii Selys	fragile forktail	--	Nat	Est, Low<4>
Megalagrion sp.	*pinao ʻula*	--	**End**	Low, Mid<4>
Megalagrion hawaiiense McLachan	*pinao ʻula,* Hawaiian upland damselfly	--	**End**	Mid<4>
Megalagrion nigrohamatum nigrolineatum Blackburn	*pinao ʻula,* blackline Hawaiian damselfly	--	**End**	Mid, Head<4>
Megalagrion oceanicum McLachan	*pinao ʻula,* oceanic Hawaiian damselfly	--	**End**	Mid<4>
ARTHROPODA, INSECTA, TRICHOPTERA				
indet.				Mid<4>
HYDROPSYCHIDAE	net-spinning caddisflies			
indet.		--	Nat	Mid<4>
Cheumatopsyche analis (Banks)		--	Nat	Mid<4>
Cheumatopsyche pettiti Banks		--	**Ind**	Mid<3>
HYDROPTILIDAE	micro-caddisflies			
Hydroptilia sp.		--	Nat	Mid<3>
Hydroptilia icona Mosely		--	Nat?	Mid<3>
Oxyethira maya Denning		--	Nat	Mid<3,4>
ARTHROPODA, ARACHNIDA	arachnids			
indet. Oribatida		--	?	Mid<3>
ARTHROPODA, MAXILLAPODA SESSILIA				
BALANIDAE				
Balanus eburneus Gould	ivory barnacle	--†	**Ind**	Est<2>
ARTHROPODA, MALACOSTRACA, DECAPODA				
indet. Decapoda			?	Mid<3>
ATYIDAE				
Atyoida bisulcata J.W. Randall	*ʻōpae kalaʻole*	--	**End**	Low, Mid, Up<4> Mid<3>
Neocaridina denticulata sinensis Kemp	grass shrimp	U	Nat	Mid<1> Mid<3,4>
CAMBARIDAE				
Procambarus clarkii Girard	crayfish	U	Nat	Mid<1> Low<2> Low, Mid<4> Mid<3>

Table 4 (continued).

PHYLUM, CLASS, ORDER, FAMILY Species	Common name	Abundance	Status	Reach <ID Code>
GRAPSIDAE				
Metopograpsus thukuhar Owen	*kukuau*	--	**Ind**	Est<2>
PALAEMONIDAE				
Macrobrachium sp.	prawn	--	---	Low <4>
Macrobrachium grandimanus J.W. Randall	*ʻōpae ʻoehaʻa*	--	**End**	Low, Mid<4>
Macrobrachium lar J.C. Fabricus	Pacific river prawn	C	Nat	Mid<1> Low, Mid, Up<4> Mid<3>
PORTUNIDAE				
Thalamita crenata H. Milne Edwards	blue-pincer crab	--	Nat	Est<2>
	FISHES			
CHORDATA, ACTINOPTERYGII				
ACANTHURIDAE				
Acanthurus triostegus sandvicensis Streets	*manini*; convict tang	--	**End**	Est<2>
CALLICHTHYIDAE				
Corydoras aeneus Gill	bronze catfish	--	Nat	Low<4>
CICHLIDAE				
Archocentrus nigrofasciatus Gunther	convict cichlid	--	Nat	Low<2, 4>
Hemichromis elongatus Guichenot in Duméril	jeweled cichlid	--	Nat	<4>
Oreochromis mossambicus Peters	Mozambique tilapia	--	Nat	Est<2> <4>
Sarotherodon melanotheron Rupell	black-chin tilapia	--	Nat	Est<2> Low<4>
Tilapia sp.	unid. tilapia	--	Nat	Est, Low<4>
CHANIDAE				
Chanos chanos Forsskal	*awa*; milkfish	--	**Ind**	Est<2>
CLARIIDAE				
Clarias fuscus Lacepede	clarias; whitespotted catfish	--	Nat	Low<4>
COBITIDAE				
Misgurnus anguillicaudatus Cantor	dojo, loach, oriental weatherfish	--	Nat	Low, Mid<4>
ELEOTRIDAE				
Eleotris sandwicensis Vaillant and Sauvage	*ʻoʻopu ʻakupa*; Sandwich Isle sleeper	--	**End**	Est<2> Low<4>
ENGRAULIDAE				
Encrasicholina purpurea Fowler	*nehu*; Hawaiian anchovy	--	**End**	Est<2>
GOBIIDAE				
indet.	*ʻoʻopu*	--	--	Low, Mid<4>

Table 4 (continued).

PHYLUM, CLASS, ORDER, FAMILY Species	Common name	Abundance	Status	Reach <ID Code>
GOBIIDAE (cont.)				
Awaous staminensis (Eydoux & Souleyet	*ʻoʻopu nākea*	C	**End**	Mid<1> Low<2> Low, Mid<4>
Lentipes concolor Gill	*ʻoʻopu alamoʻo* or *ʻoʻopu hiʻu kole*	R	**End**	Mid<1> Mid<4>
Sicyopterus stimpsoni Gill	*ʻoʻopu nōpili*	--	**End**	Mid<4>
Stenogobius hawaiiensis Watson	*ʻoʻopu naniha*	--	**End**	Low<2, 4>
KUHLIDAE				
Kuhlia sp.	*ʻāholehole*; flagtail	--	**Ind**	Low<4>
Kuhlia xenura Jordan & Gilbert	*ʻāholehole*; Hawaiian flagtail	--	**Ind**	Est<2,4> Low<4>
LORICARIIDAE				
Ancistrus c.f. *temminckii* Valenciennes in Cuvier and Valenciennes	bristle-nose catfish	A	Nat	Mid<1> Low, Est<2> <4>
Hypostomus watawata Hancock	armored catfish	--	Nat	Low<4>
MUGILIDAE				
Mugil cephalus Linnaeus	striped mullet	--	**Ind**	Est<2, 4>
POECILIIDAE				
indet.		--	Nat	Est, Low, Mid<4>
Gambusia affinis Baird and Girard	mosquitofish	--	Nat	Est<4>, Low<2,4>, Mid<2>
Poecilia latipinna Lesueur	sailfin molly	--	Nat	Mid<4>
Poecilia reticulata Peters	guppy	A	Nat	Mid<1> Est<2> Low<2,4> Mid<4>
Poecilia sphenops Valenciennes	liberty/Mexican molly	--	Nat	Low, Mid<4>
Poecilia sp. hybrid complex (*salvatoris/mexicana* group)	hybrid molly	O	Nat	Mid<1>
Poecilia spp.	indet. molly	--	Nat	Est, Low, Mid<2> Low, Mid<4>
Xiphophorus sp.	swordtail	--	Nat	Mid<4>
Xiphophorus helleri Heckel	green swordtail	C	Nat	Mid<1> Est, Low<2> Low, Mid<4>
Xiphophorus maculatus Gunther	moonfish, platyfish	--	Nat	Mid<4>
SPHYRAENIDAE				
Sphyraena barracuda Edwards	barracuda	--	Nat	Est<4>

Table 4 (continued).

PHYLUM, CLASS, ORDER, FAMILY Species	Common name	Abundance	Status	Reach <ID Code>
	AMPHIBIANS			
VERTEBRATA, AMPHIBIA, ANURA				
BUFONIDAE				
Rhinella marina Linnaeus	cane toad	--	Nat	Low, Mid<4>
RANIDAE				
Lithobates catesbeianus (Shaw)	American bullfrog	O	Nat	Mid<1>

KEY TO SYMBOLS USED:

Abundance categories:
- R – Rare – only one or two individuals observed.
- U – Uncommon – several to a dozen individuals observed.
- O – Occasional – seen irregularly in small numbers
- C – Common -observed everywhere, although generally not in large numbers.
- A – Abundant – observed in large numbers and widely distributed.

Status categories:
- **End** – Endemic – species native only in Hawaiʻi
- **Ind.** – Indigenous – species native in Hawaiʻi and elsewhere
- Nat – Naturalized – species introduced to Hawaiʻi, intentionally or accidentally.

Stream reach codes:
- Est – Estuary – between the shore and 1 meter elevation
- Low – Lower Reach – between 1 and 20 meter elevation
- Mid – Middle Reach – between 20 and 200 meter elevation
- Up – Upper Reach – between 200 and 750 meter elevation
- Head – Headwaters – greater than 750 meter elevation

ID codes:
- <1> March 27, 2019
- <2> *AECOS* (2012)
- <3> Brasher et al. (2003)
- <4> reported from the watershed, specific stream not identified (Parham et al, 2008)

† - Specimen identified from non-living material: shell, test, or carapace only.

Boulders In the Project stream are encrusted with a red alga that appears to be *Hildenbrandia* sp. (see Figure 5). In 2012, green algae (*Cloniophora* sp. and *Oedogonium* sp.) were conspicuous on boulders and bedrock of the stream bed downstream from the Project area at Ahilama Road. Our survey found *hīhīwai*(*Neritina granosa*), an endemic, amphidromous snail, tucked under boulders throughout the Project area (Figure 6). This population of *hīhīwai*, apparently thriving and reproducing (as evident by egg capsules adhered to boulders) in Waiheʻe Stream, are likely transplants from Maui. In the early 2000s, *hīhīwai* stranded in the low flows of ʻĪao Stream (now known as Wailuku Stream), which had been diverted for sugar cane irrigation for over 100 years, were transplanted to Waiheʻe Stream (Hau, 2007; K. Faris, pers. comm.). These

Figure 5. Patches of a crustose red alga (probably *Hildenbrandia* sp.) covers boulders in shaded, fast-moving segments the stream within the Project area.

Figure 6. This (and others) *ʻoʻopu nākea* has a fish leech adhered to its second dorsal fin. A nocturnal *hīhīwai* rests under a boulder in Waiheʻe Stream during the day.

Figure 7. The amphidromous Pacific prawn is a common inhabitant of Waiheʻe Stream in the Project area.

Figure 8. We observed a single *ʻoʻopu alamoʻo* in Waiheʻe Stream just upstream of the Project area and fish ladder.

snails had not been previously reported from the streams of Kahaluʻu watershed (Parham et al., 2008; Brasher et al., 2003; *AECOS*, 2012), and prior to installation of the fish ladder at the USGS gage station in 2013, did not have access to the unaltered upper reach of the stream.

At least three endemic species of *pinao ʻula* (Hawaiian damselflies)—Hawaiian upland damselfly (*Megalagrion hawaiiense*), blackline Hawaiian damselfly (*M. nigrohamatum nigrolineatum*), and Oceanic Hawaiian damselfly (*M. oceanicum*)—have been reported from the middle reach (20 m to 200 m ASL) and headwaters (>750 m) of Waiheʻe Stream. Preferred habitats for these species include margins of streams and side pools along middle and upper stream reaches and seeps, wet banks, and waterfalls. The Hawaiian upland damselfly and blackline Hawaiian damselfly also inhabit upland forest pools and bogs and, as the name suggests, the Hawaiian upland damselfly can also be found on forest trails, ridges, and gulches (Polhemus and Asquith, 1996). We observed the native dragonfly or *pinao* (*Anax junius*), but not any damselflies in the Project area.

The introduced amphidromous Pacific prawn (*Macrobrachium lar*) resides in the deeper pools of Waiheʻe Stream (Figure 7). Bottom dwelling *ʻoʻopu nākea* (*Awaous stamineus*) and bristle-nosed catfish (*Ancistrus* c.f. *temmincki*) are the most common fishes in Waiheʻe Stream within the Project area. External parasitic leeches (most likely *Myzobdella lugubris*) were conspicuous on the fins of several *ʻoʻopu nākea* in the Project area (see Figure 5). These ectoparasites were introduced by either freshwater fishes or crabs from the Southeast USA and stream dwelling gobioids are often heavily infested (Font, 2007).

We observed a single *ʻoʻopu alamoʻo* or *ʻoʻopu hiʻu kole* (*Lentipes concolor*) in Waiheʻe Stream, a short distance upstream of the Project area (Figure 8). Installation of the fish ladder at the USGS gage station in 2013 made it possible for *ʻoʻopu nākea* and *ʻoʻopu alamoʻo* to inhabit an additional 1.5 km (1.0 mi) of stream above the gage station, including the reaches above Waiheʻe and Hāmama Falls. *ʻOʻopu alamoʻo* is a particularly adept climber—having been found above the 300-m vertically-dropping Hiʻilawe Falls in Lalakea Stream, a tributary to Waipio Stream on Hawaiʻi Island (Englund and Filbert, 1997).

Guppy (*Poecilia reticulata*) and swordtail (*Xiphophorus helleri*) inhabit the shallow side pools of the stream and are common in the slower-flowing waters of the *ʻauwai* through the Project area. Crayfish (*Procambarus clarkii*) and minute grass shrimp (*Neocaridina denticulata*) are also found in the silt bottom and grassed sides of the *ʻauwai*.

ʻOʻopu nākea, *ʻoʻopu naniha* (*Stenogobius hawaiiensis*), and *ʻoʻopu akupa* (*Eleotris sandwicensis*) were observed in the lower reach of Waiheʻe Stream and Kahaluʻu lagoon (*AECOS*, 2012) and these animals plus *ʻoʻopu nōpili* (*Sicyopterus stimpsoni*), *ʻōpae ʻoehaʻa* (*Macrobrachium grandimanus*), and *ʻopae kalaole* (*Atyoida bisulcata*) have been reported from the watershed (Parham et al., 2008).

Avian Survey

During five 8-minute avian point-count surveys, a total of 208 individual birds of 18 species representing 13 families was identified (Table 5). Nearly all of the avifauna observed is non-native species, with the exception of a solitary Pacific Golden-Plover or *kōlea* (*Pluvialis fulva*), an indigenous migratory species. A pair of Mallard-like ducks were observed in transit over the Project area and are likely to be Hawaiian Duck-Mallard hybrids. On Oʻahu, the endemic endangered Hawaiian Duck or *koloa* (*Anas wyvilliana*) population has interbred extensively with the non-native feral Mallard (*Anas platyrynchos*), such that hybrids of the two species are predominantly observed and are difficult to distinguish from pure *koloa* (Uyehara et al., 2007).

Table 5. Avian species detected during the March 27, 2019 survey.

ORDER FAMILY *Species*	Common Name	STATUS	RA
ANSERIFORMES			
ANATIDAE			
Anas wyvilliana x *platyrynchos*	Hawaiian Duck x Mallard hybrid	NN	0.4
GALLIFORMES			
PHASIANIDAE			
Gallus gallus	Domestic Chicken	**ND**	0.6
COLUMBIFORMES			
COLUMBIDAE			
Streptopelia chinensis	Spotted Dove	NN	4.8
Geopelia striata	Zebra Dove	NN	2.8
CHARADRIIFORMES			
CHARADRIIDAE			
*Pluvialis fulva**	Pacific Golden-Plover; *kōlea*	**IM**	0.2
PASSERIFORMES			
PYCNONOTIDAE			
Pycnonotus cafer	Red-vented Bulbul	NN	4.6
Pycnonotus jocosus	Red-whiskered Bulbul	NN	1.4

Table 5 (continued).

ORDER *FAMILY Species*	Common Name	STATUS	RA
ZOSTEROPIDAE			
Zosterops japonicus	Japanese White-eye	NN	5.4
TIMALIIDAE			
Garrulax canorus	Chinese Hwamei	NN	0.6
Leiothrix lutea	Red-billed Leiothrix	NN	2.6
MUSCICAPIDAE			
Copsychus malabaricus	White-rumped Shama	NN	3.2
STURNIDAE			
Acridotheres tristis	Common Myna	NN	2.4
CARDINALIDAE			
*Cardinalis cardinalis**	Northern Cardinal	NN	1.8
THRAUPIDAE			
Paroaria coronata	Red-crested Cardinal	NN	2.2
FRINGILLIDAE			
*Haemorhous mexicanus**	House Finch	NN	3.6
ESTRILDIDAE			
Estrilda astrild	Common Waxbill	NN	1.6
Lonchura oryzivora	Java Sparrow	NN	1.0
Lonchura atricapilla	Chestnut Munia	NN	2.4

Legend to Table 5.

Status – **I** = Indigenous
IM = Indigenous Migrant.
NN = Naturalized, non-native species (introduced).
ND = Naturalized, domestic
RA = Relative Abundance; the species count / number of stations (5).

Oʻahu ʻElepaio (*Chasiempis ibidis*) was not observed during this survey. Oʻahu ʻElepaio is an endemic species listed as endangered under federal and state endangered species statutes. Critical Habitat established for this native bird occurs just *mauka* of the Project area. HBS and Honolulu Board of Water Supply surveyed Waiheʻe Valley in 2007 (Imada et al., 2007) and observed three Oʻahu ʻElepaio and noted calls from two gulches in the valley, located above approximately 215 m (~700 ft) elevation.

Mammalian Survey

Domestic dog (*Canis lupis familiaris*) was observed with hikers on Waiheʻe Road throughout the survey period. Feral pig (*Sus scrofa*) wallows and scat were observed near Waiheʻe Stream in the survey area. No other mammalian species were detected during the survey.

Discussion

Water Quality

U.S. Geological Survey (USGS) gage station No. 16284200 at 52 m (170 ft) ASL measures real-time stream flow on Waiheʻe Stream (USGS, 2019a). The average discharge measured between October 1, 1990 and March 19, 2019 was 0.2 cubic meter per second or cms (7.1 cfs) and the average gage height measured between October 1, 2007 and March 19, 2019 was 0.8 m (2.8 ft). The maximum discharge was 51.0 cms (1,800 cfs) and the maximum gage height was 2.9 m (9.4 ft).

Table 6. State of Hawaiʻi water quality criteria for streams for wet (Nov. 1-Apr. 30) and dry (May 1-Oct. 31) seasons from HAR §11-54-05.2(b) (HDOH, 2014).

Parameter	**Total Nitrogen** (µg N/l)	**Nitrate + Nitrite** (µg N/l)	**Total Phosphorus** (µg P/l)	**Turbidity** (NTU)	**Total Suspended Solids** (mg/l)
Geometric mean not to exceed given value (dry season) (*wet season*)	180.0 *250.0*	30.0 *70.0*	30.0 *50.0*	2.0 *5.0*	10.0 *20.0*
Not to exceed more than 10% of the time (dry season) *(wet season)*	380.0 *520.0*	90.0 *180.0*	60.0 *100.0*	5.5 *15.0*	30.0 *50.0*
Not to exceed more than 2% of the time (dry season) *(wet season)*	600.0 *800.0*	170.0 *300.0*	80.0 *150.0*	10.0 *25.0*	55.0 *80.0*

- pH – shall not deviate more than 0.5 units from ambient and not be lower than 5.5 nor higher than 8.0
- Dissolved oxygen – not less than 80% saturation
- Temperature – shall not vary more than 1 °C from ambient
- Conductivity – not more than 300 micromhos/cm

Waiheʻe Stream is classified by the State of Hawaiʻi as a perennial stream. The stream appears on the Hawaiʻi Department of Health latest list of impaired waters in Hawaiʻi (HDOH, 2018), prepared under Clean Water Act §303(d). The listing indicates that water quality within the stream may not meet all state water quality standards for streams (Table 6, above). Specifically, Waiheʻe

Stream is listed as impaired for *enterococcus*, total nitrogen, nitrate+nitrite, and turbidity during the dry season (May 1 - Oct. 31) and listed as impaired for *enterococcus*, total nitrogen, nitrate+nitrite and total phosphorus in the wet season (Nov. 1 - Apr. 30), with the latter three parameters based solely on "visual" assessments.

Not all of the water quality measurements made in our survey can be compared directly with the state water quality criteria to establish compliance with these standards because such a comparison requires representative geometric mean values, calculated from a minimum of three sampling events at each station in the stream. Our one time sampling event only reveals stream conditions at the time of our survey. Stream discharge estimates (7.0 cfs at Sta. Mid-Project), field measurements, and nutrient concentrations found at the Project site are similar to long term historical data from the USGS station near the Project site (Table 7) indicating our survey likely encountered typical conditions for the Waiheʻe Stream and the *ʻauwai*. Consistent with the listing for impairedness, our survey found high levels of nitrate+nitrate in the stream and *ʻauwai*, but very low turbidity in the stream (and only slightly elevated in the *ʻauwai*).

Table 7. Water quality results from Waiheʻe Stream alongside historical water quality data collected monthly from the USGS station in Waiheʻe Stream near the Project site from 1999 to 2001 (USGS, 2019b).

	Temp (mg/l)	Cond (µs/cm)	pH (su)	DO (mg/l)	Nitrate + Nitrite (µg N/l)	Total N (µg N/l)	Total P (µg P/l)
Sta. Mid Project (3/27/19)	20.5	136	7.34	9.53	147	219	58
Sta. USGS (3/27/19)	20.0	134	6.88	9.28	149	183	34
USGS Station							
mean†	**20.5**	**139**	**7.66**	**8.73**	**105‡**	**214‡**	**60‡**
st dev	0.58	21.0	0.27	0.25	0.02	0.02	0.24
n=	*32*	*64*	*55*	*22*	*27*	*27*	*32*
min	19.5	74	6.9	8.10	50	75	32
max	22.0	160	7.9	9.30	150	5150	1230

† arithmetic mean values unless otherwise noted
‡ geometric mean values

Flow in Waiheʻe Stream is dominated by ground water and therefore, has little variation between maximum and minimum daily temperature (Brasher et al., 2003), little seasonal variation (Figure 9), and cool temperatures relative to surface water driven stream systems. Water quality in the Project area is relatively good compared to most streams on Oʻahu, despite the HDOH (2018) impairment listings for Waiheʻe Stream.

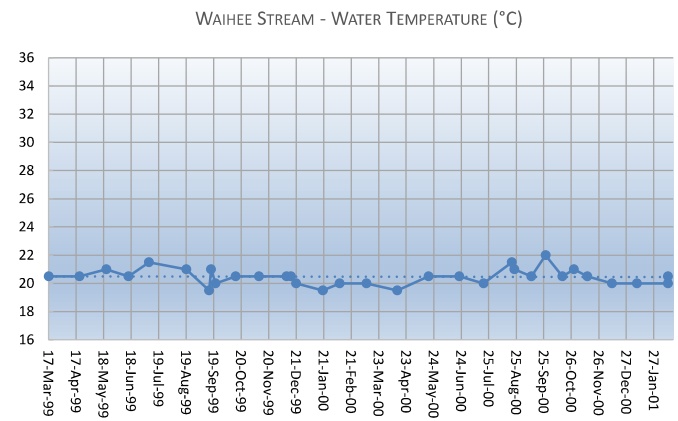


Figure 9. Water temperature readings in Waiheʻe Stream from March 1999 to February 2001 (USGS, 2019b). Note - little seasonal variation exists.

Specific Project work to develop parking areas, replace existing gate and install a new gate, create a pavilion and plant nursery, and installation of signs can be completed without negative impacts to water quality if proper construction BMPs are implemented. The planned action to evaluate toilet options will presumably benefit water quality indirectly. The high volume of people currently using the Project area for hiking and swimming indicates human effects are certainly occurring to water quality due to the lack of restroom facilities.

Project work to construct a plant nursery, remove invasive species and plant native species will benefit water quality if riparian vegetation is maintained or improved. Clearing of existing and creation of new *loʻi* may have limited

adverse effects to water quality that will be temporary in nature. Certainly, the benefits of education and outreach provided by a facility such as proposed will lead to better understanding of water quality issues and aquatic environments by the public.

Aquatic Biota

We did not observe any aquatic species protected by state or federal endangered species statutes (HDLNR, 2015; USFWS, nd) in Waiheʻe Stream or the *ʻauwai* in the Project area; however, some animals previously reported from the Project area or vicinity are protected and some animals observed by us and reported from the stream are unique. The blackline Hawaiian damselfly (*Megalagrion nigrohamatum nigrolineatum*) and Oceanic Hawaiian damselfly (*M. oceanicum*) are listed as endangered on state and federal endangered species lists (HDLNR, 2015; USFWS, 2012). *Hīhīwai* (*Neritina granosa*) and the Oceanic Hawaiian damselfly are considered to be vulnerable to extinction and are on the International Union for Conservation of Nature (IUCN) Red List of Threatened Species (Corderio and Perez, 2012; Odonata Specialist Group, 1996). Hawaiʻi Department of Land and Natural Resources (HDLNR) administrative rules regulate fisheries in the state, including the taking of *ʻoʻopu* (HDLNR, 1989). *ʻOʻopu alamoʻo* (*Lentipes concolor*), previously considered for placement on the endangered species list and IUCN Red List, is sensitive to habitat degradation and rarely found on Oʻahu (Timbol et al., 1980; Fitzsimons et al., 1990; Higashi and Yamamota, 1993; G. Smith, USFWS, pers. comm., 2019; field notes of authors).

With the exception of the estuarine-dwelling snails, *hapawai* (*Neritina vespertina*) and *pipiwai* (*Theodoxus cariosus*), all possible native amphidromous animals that could be expected to be found in a stream in Hawaiʻi, were observed by us or have been reported to exist in Waiheʻe Stream. The amphidromous life cycle of native Hawaiian stream macrofauna entails eggs that are laid in the stream and larvae that hatch from the eggs moving downstream and out into the ocean where they develop for a time before migrating back into freshwater to grow to maturity (Ford and Kinzie, 1982; Kinzie, 1988). Project activities must not impede this life cycle, which will require maintenance of open migration pathways through a new and restored *ʻauwai*. New structures (e.g., new USGS gage) should not include drains or grates that may entrain drifting larvae or overhanging culverts that may obstruct upstream movement of recruiting juveniles. Maintaining good water quality in the stream and *ʻauwai* should be a priority, with specific attention paid to maintaining adequate temperature. Project plans should leave a sufficient number of trees overhanging the waterways, such that the channel and *ʻauwai* receive shade and water temperatures do not exceed 35°C. The upper-lethal

temperature limit for native aquatic species generally ranges from about 35 to 40°C (Hathaway, 1978).

Avian Resources

The avian assemblage surveyed in the Project area is consistent with the habitats available there, including disturbed lowland wet forest and streams. All birds counted during the survey are non-native species with the exception of a single Pacific Golden-Plover. The most abundant species were Japanese White-eye (*Zosterops japonicus*), Spotted Dove (*Streptopelia chinensis*), and Red-vented Bulbul (*Pycnonotus cafer*). Combined, these three species represent just over one third (36%) of the total birds observed during the survey. No federal- or state-listed endangered or threatened bird species were detected during the survey, but protected bird species may transit-through, overfly, or otherwise utilize the Project site on a part-time basis.

A small breeding population (less than 5 individuals) of Oʻahu ʻElepaio were recorded in Waiheʻe Valley in 2001 (VanderWerf et al., 2001), and three individuals and one call were noted from the valley in 2007 (Imada et al., 2007). From 2011 to 2012, only a single breeding pair was recorded in the valley (VanderWerf et al., 2013). The Koʻolau population of Oʻahu ʻElepaio is typically observed from an elevational range of 150 to 550 m (500 to 1,800 ft; Pyle and Pyle, 2017). Critical habitat for Oʻahu ʻElapaio, occurs just beyond the upper boundary of the Project (USFWS, nd. b, see Figure 10). Given the close proximity of the Project to critical habitat and lower elevational range of the species, USFWS endangered forest bird recommendations may apply for some Project activities (USFWS, nd. c).

- Actions such as road construction and development increase human access and result in increased invasive species threats. Avoid conducting activities within forest bird habitat that promote the spread or survival of invasive species.
- Avoid increasing mosquito populations by creating stagnant water habitat.
- Avoid removing tree cover during the peak breeding season, between January 1 and June 30.

Protected seabirds may utilize cliff habitat in upper Waiheʻe Valley, and have some potential to overfly the Project area. Protected seabird species include threatened Newell's Shearwater or *ʻaʻo* (*Puffinus newelli*), endangered Hawaiian Petrel or *ʻuaʻu* (*Pterodroma sandwichensis*), and endangered Band-rumped Storm-Petrel or *ʻakēʻakē (Oceanodroma castro)*. USFWS advises that Hawaiian seabirds may traverse projects during the breeding, nesting, and fledging

seasons (March 1 to December 15). Night lights can disorient seabirds, resulting in their potential downing and harm from collision with objects and/or predation by dogs and cats if downed (Reed et al., 1985; Telfer et al., 1987).

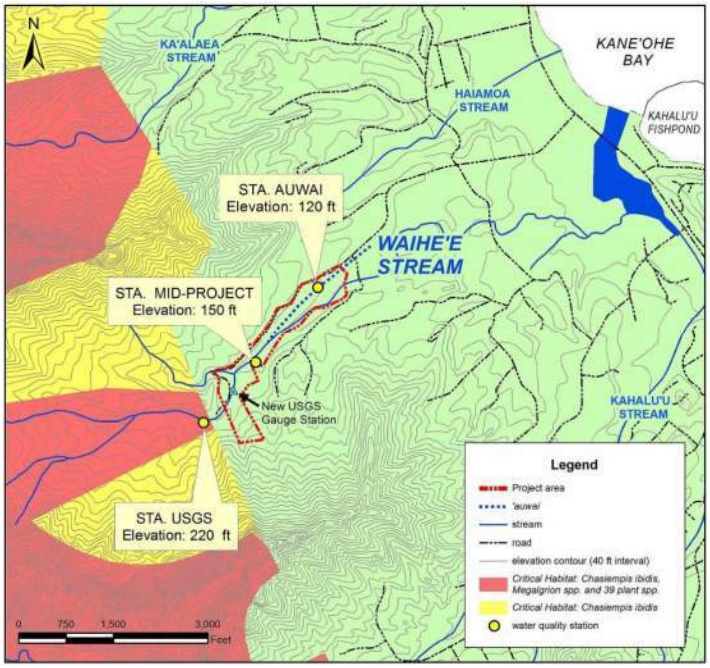


Figure 10. Federally-designated Critical Habitat near the Waiheʻe Riparian Learning Center Project site.

- If the Project will result in additional night-time lighting sources, including lights from night-time construction, residential lighting, or street lights, then risk of incidentally downing nocturnally-flying seabirds will increase. To avoid and minimize potential Project impacts to seabirds, USFWS recommend the following applicable measures: Fully

shield all outdoor lights so the bulb can only be seen from below bulb height and only use when necessary; install automatic motion sensor switches and timer controls on all outdoor lights or turn off lights when human activity is not occurring in the lighted area; and avoid night-time construction during the seabird fledging period from September 15 through December 15 (USFWS, nd (c)). All external lighting structures should be fully "dark sky compliant" (HDLNR-DOFAW, 2016).

White Tern (*Gygis alba*), or *manu o Kū*, is another indigenous seabird listed as threatened under the State of Hawaiʻi endangered species statute HRS 195D (HDLNR, 2015). White Tern occurs on Oʻahu (USFWS, 2005), with the majority of the population found in the Honolulu area. White Tern was not observed (or expected to occur) in the Project area, and Project activities are not anticipated to have a deleterious impact to the species.

Mammalian Resources

Several hikers on Waiheʻe Road were walking with domestic dog (*Canis lupis familiaris*). Residences surrounding the Project may support house cat (*Felis catus*) and domestic dog, which may utilize the Project area or vicinity. While not directly observed during the survey, sign (tracks, scat, wallows) of pig (*Sus scrofa*) was encountered during the survey. One or all of the four naturalized rodents (Family Muridae) in the Hawaiian Islands and Small Asian mongoose (*Herpestes javanicus*) are also likely to utilize the Project area to some extent. Mammals detected during the survey are not native to Hawaiʻi and offer little value from an ecological perspective.

The Hawaiian hoary bat is the only Endangered Species Act (ESA)-listed terrestrial mammal in Hawaiʻi. Potential Hawaiian hoary bat roosts (trees over 4.6 m [15 ft]) are abundant in the Project area. USFWS typically includes a standard BMP for areas with bat roosting habitat in permit conditions:

- To avoid potential deleterious impacts to roosting bats with pups, it is recommended that no woody vegetation taller than 4.6 m (15 ft) be removed during the bat pupping season between June 1 and September 15 (USFWS, 1998). The use of barbed wire to top fence lines may entangle flying bats and must be avoided (Zimpfer and Bonaccorso, 2010).

The Hawaiian Hoary Bat is known to forage for insects along waterways (USFWS, 1998), such as those found in the Project along Waiheʻe Stream. Because Hawaiian Hoary Bat is noted habitat generalists that may forage several locations through a wide geographic home range (Bonaccorso, 2010),

and the proposed Project activities along Waiheʻe Stream are not expected to reduce stream forage habitat, deleterious impacts to Hawaiian Hoary Bat are not anticipated so long as appropriate aforementioned BMPs are followed.

Critical Habitat

Federally delineated Critical Habitat is not present in the 27 ac included in Phases 1 and 2 of the Project (USFWS, 2019). Thus, the Project, as currently proposed, will not impinge on federally designated Critical Habitat. No equivalent habitat designation exists under state law.

However, Critical Habitat for native damselflies, Oʻahu *ʻElepaio*, and several endemic plant species begins just *mauka* from the Phase 1 and 2 work areas (Figure 8). The location of future planned stream diversion and work in the *ʻauwai* to convert the ginger patch to *loʻi* (as depicted in Project plans; see Figure 3) or any improvement near the upper field would be conducted within the Critical Habitat. Such work would likely not have adverse effects to Critical Habitat, and only improve the quality of habitat since "removing invasive plant species and planting natives" is part of the Project work. Species for which the adjacent Critical Habitat has been designated are listed in Table 8.

Table 8. Species for which land located upslope from (*mauka* of) the Project site has been federally-designated as Critical Habitat.

Species Group / Common name	Scientific Name
Flowering plants	
hāhā	*Cyanea acuminate, Cyanea calycina, Cyanea crispa, Cyanea grimesiana* ssp. *obatae, Cyanea koolauensis, Cyanea lanceolate, Cyanea purpurellifolia, Cyanea st.-johnii, Cyanea truncata*
hāiwale	*Cyrtandra gracilis, Cyrtandra kaulantha, Cyrtandra polyantha, Cyrtandra sessilis, Cyrtandra subumbellata, Cyrtandra viridiflora, Cyrtandra waiolani*
ʻakoko	*Euphorbia rockii* var. *rockii*
nānū	*Gardenia mannii*
wāwaeʻiole	*Huperzia nutans*
aupaka	*Isodendrion longifolium*
kāmakahala	*Labordia cyrtandrae*

Table 8 (continued).

Species Group / Common name	Scientific Name
--	*Lobelia gaudichaudii* ssp. *koolauensis*
--	*Lobelia oahuensis*
alani	*Melicope hiiakae, Melicope lydgatei*
kōlea	*Myrsine juddii*
--	*Phyllostegia hirsuta*
--	*Phyllostegia mollis*
--	*Phyllostegia parviflora* var. *parviflora*
--	*Platydesma cornuta* var. *cornuta*
ʻoheʻohe	*Polyscias gymnocarpa*
kōpiko	*Psychotria hexandra* ssp. *oahuensis* var. *oahuensis*
kaulu	*Pteralyxia macrocarpa*
--	*Schiedea hookeri*
--	*Schiedea kaalae*
--	*Trematolobelia singularis*
ōpuhe	*Urera kaalae*
--	*Viola oahuensis*
aʻe	*Zanthoxylum oahuense*
Insects	
Crimson Hawaiian damselfly; *pinao ʻula*	*Megalagrion leptodemas*
Blackline Hawaiian damselfly; *pinapinao ānuenue*	*Megalagrion nigrohamatum nigrolineatum*
Oceanic Hawaiian damselfly; *pinao ʻula*	*Megalagrion oceanicum*
Birds	
Oahu ʻelepaio	*Chasiempis ibidis*

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Appendix I

Botanical Survey for the Waiheʻe Riparian Learning Center

FINAL DRAFT

Botanical Survey for the Waiheʻe Riparian Learning Center

TMK: 4-7-006:010 (por.)
Koʻolaupoko, Oʻahu

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Executive Summary

This report was prepared for the Honolulu Board of Water Supply's (BWS) proposed Waiheʻe Loʻi Restoration and Riparian Learning Center project. A field survey was requested in order to identify any significant species and document the botanical composition of the area within the specified boundaries. This survey took place over two separate days in March and April 2019.

A total of 84 plant taxa were identified, approximately 23% of which may be considered native to the Hawaiian Islands. The highly disturbed nature of the vegetation may be attributed to the historical land use patterns in the area such as intensive agriculture and ungulate grazing. Large, flat sections were noted during surveys of the makai end of the specified project area and were presumed to have been historic loʻi.

The forest community within the survey area consists of variations of Alien Wet forest. Different canopy and understory species emerge as dominant with changes in topography (i.e. riparian zones vs. slopes and low ridges). Hau (*Hibiscus tiliacuea*) was particularly dominant throughout the project site, and often formed an impenetrable barrier to survey efforts. Other dominant alien vegetation included shoebutton ardisia (*Ardisia elliptica*), juniperberry (*Cytharexylum caudatum*), fiddlewood (*Citharexylum spinosum*), Java plum (*Syzygium cuminii*), octopus tree (*Schefflera actinophylla*) simpoh ayer (*Dillenia suffruticosa*) and strawberry guava (*Psidium cattleianum*). Hala (*Pandanus tectorius*) was the primary native (Polynesian introduction) species observed throughout the forested area.

No plants which are proposed or listed as threatened or endangered species under state or federal regulations were observed during these surveys.

Successful restoration of the historic loʻi and the forest community will require significant effort to remove invasive overgrowth and deplete the seedbank that is likely to exist in the soil, along with the reintroduction of agricultural and indigenous forest species, respectively. Consistent monitoring and management strategies will be necessary to keep invasive vegetation from encroaching on restored areas.

Introduction

Setting and Soil Types

Waiheʻe Valley is located on the windward side of Oʻahu in the district of Koʻolaupoko. The project area lies at the end of a residential area on Waiheʻe Road near the base of the Koʻolau Mountains. The elevation of the project area reflects the geographic features of the terrain it contains, including streambeds, trenches and flat areas at the makai (northernmost) end, and a low elevation ridgeline at the mauka (southeasternmost) portion of the boundary.

Soil types in the area were determined using the Natural Resources Conservation Service web soil survey platform. Profiles created for the character and properties of each soil type were used to describe those soils that were mapped within the project boundary.

The soils within the designated project area primarily consist of Hanalei silty clay (HnB). HnB soils are described as somewhat poorly drained to poorly drained soils on gentle slopes (2-6%) and prone to

flooding. This soil type originates from alluvial deposits and occurs largely along the banks of Waiheʻe Stream. It is known to be suitable for growing taro, sugarcane and pastureland.

The higher elevations of the project area are composed of Waikane silty clays (WpF). These well-drained soils result from alluvial deposits and occur on steep slopes (40-70%). Soils of this type are highly susceptible to runoff and erosion. Due to these properties, areas of WpF soils are most suitable for pasture or rangeland, or as woodland and wildlife habitat.

Small deposits of a less steeply-sloped (25-40%) Waikane silty clay (WpE) occur to the north of Waiheʻe Stream. WpE soils share many of the same characteristics as WpF, except for slope steepness, though they are still capable of severe runoff and erosion. Soils of this type are also recommended for use as pasture, rangeland, woodland and wildlife habitat.

Lolekaa silty clays on 3-8% slopes (LoB) is also found in a section of the northern project area. These well-drained soils originate from alluvial deposits of igneous rock and occur along old drainages at the base of the Koʻolau Mountains. LoB soils are considered prime farmland.

A small portion of the project area adjacent to the residences on Waiheʻe Road consists of Typic Endoaquepts mucky silt loam (TR). This soil type is derived from alluvial deposits of basalt and is typical of flood and coastal plains, valley floors depressions and alluvial fans. TR soils are poorly drained and are not suitable for agriculture.

Prehistorical and Historical Land Use Patterns

At least a small portion of the project area was likely to consist of terraced loʻi and traditional agricultural practices. Historical accounts of the area, pre-Western contact, describe the stretch of coast from Waiʻāhole to Heʻeia as a contiguous expanse of cultivated wetland taro loʻi that reached back toward the valleys for 1.5 miles.

In the years following the Great Māhele (1848) a succession of plantation crops occupied the fallow loʻi and dozens of acres in the uplands in Kahaluʻu and Waiheʻe when these areas fell into neglect after the dispossession of Hawaiian farmers. These crops included sugarcane (1860s-1880s), rice (1880-1920s), and pineapple (1910-1925).

The forested upper reaches of the valley that were not under cultivation prior to Western contact likely remained intact and used for traditional Hawaiian gathering. The native vegetation likely became heavily disturbed with the introduction of cattle and goats which were permitted to roam and grazed unchecked throughout the Kahluʻu region during the 1880s. These ungulates reportedly destroyed the crops being tended by the residents of that time and would have contributed to the drastic alteration of forest composition, particularly in the areas left uncultivated. The continued decline of native flora (excepting hala) and the spread of invasive species may today be attributed to the presence of wild pigs. Pig sign was noted in several places during this survey.

This survey also uncovered the presence of a potential landfill area. A small ravine near the access road was discovered to contain decomposed trash such as tires and glass bottles dating to the 1970s suggesting that the area was used for the disposal of unwanted items in relatively recent history.

The parcel containing the project area is currently owned by the City and County Department of Parks and Recreation. BWS currently uses the access road off Waiheʻe Road for the management of its land in the mauka sections of the valley and the Waiheʻe Tunnel.

Current Land Use Patterns

The survey area, and much of the area owned by BWS in the upper mauka portion of Waiheʻe Valley, is heavily forested. A BWS access road leads from Waiheʻe Road to the tunnel. The area has become a popular hiking trail for visitors and residents alike to reach the Hāmama and Waiheʻe waterfalls at the back of the valley. The surveyors encountered dozens of hikers over the course of the road survey on March 28, 2019.

In addition to recreational hiking, BWS frequently brings groups into the area for educational tours of the Waiheʻe Tunnel (a tour was also observed taking place during the March 28 survey). BWS has also partnered with a local conservation organization called the Koʻolau Mountains Watershed Partnership (KMWP) to adopt a site on the hillside next to the tunnel entrance for a forest restoration project. This project commenced in May 2018 and much of the dominant alien vegetation has since been thinned from the site and replace with natives. With permission from BWS, KMWP staff hold regular volunteer workdays to weed and install native plants.

Critical Habitat

There is no federally designated Critical Habitat for any species within the project area, therefore the proposed modifications to the site will not impact Critical Habitat.

Methods

A brief survey of the western edge of the project area (primarily along Waiheʻe Road) was conducted on March 28, 2019 by Rick Barboza, Kelvin McKeague (Hui Kū Maoli Ola, LLC) and Janice Jensen (G70). A Garmin 60CSx hand-held GPS was used to track the path taken by the surveyors and to mark sites of note for individual plants or plant communities (Figure 1). The second, final survey of the densely vegetated interior, as well as the eastern boundaries of the project area was completed by Rick Barboza and Janice Jensen on April 10, 2019.

Plants were identified and logged as they were encountered. GPS points and corresponding notes and pictures were taken as needed to document the general character of the vegetation. Any plants that could not be identified in the field were also documented with a GPS point and photographed for later identification.

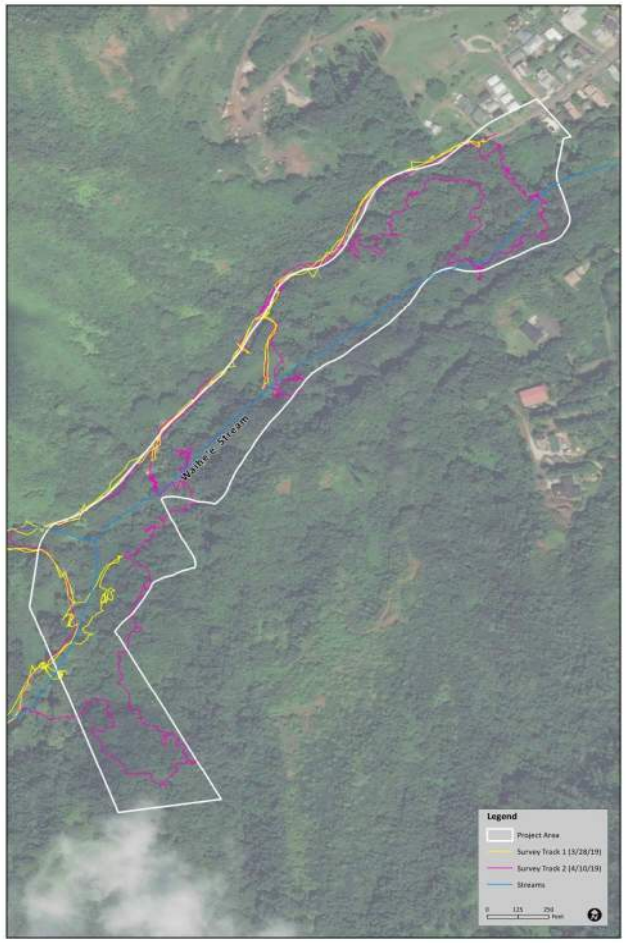

Figure 1 Department of Parks and Recreation land in upper Waiheʻe Valley with the project site outline in white. GPS tracks taken by the authors during the two botanical surveys are shown in yellow and magenta.

Results

Vegetation Zones and Plant Communities

The vegetation within and immediately surrounding the project area can generally be characterized as Alien Wet forest. Dominant canopy and understory species varied throughout the survey area (see Figure 2).

This survey identified 84 plant taxa, of which approximately 19 (23%) may be considered native (either indigenous to Hawaiʻi or of Polynesian introduction). A 2007 botanical survey of the Waiheʻe and Kahaluʻu valley regions (Hawaii Biological Survey) inventoried a total of 243 plant taxa, 31% of which were considered native to Hawaiʻi.

A complete inventory of plant species observed during both surveys is provided in Appendix I. This table is organized in alphabetical order by family name and lists each species by its scientific name, followed by the common and/or Hawaiian name. Species status in the islands and an estimation of abundance are also noted.

No plants which are proposed or listed as threatened or endangered species under state or federal regulations were observed during these surveys and none have been previously documented in the proposed project area.

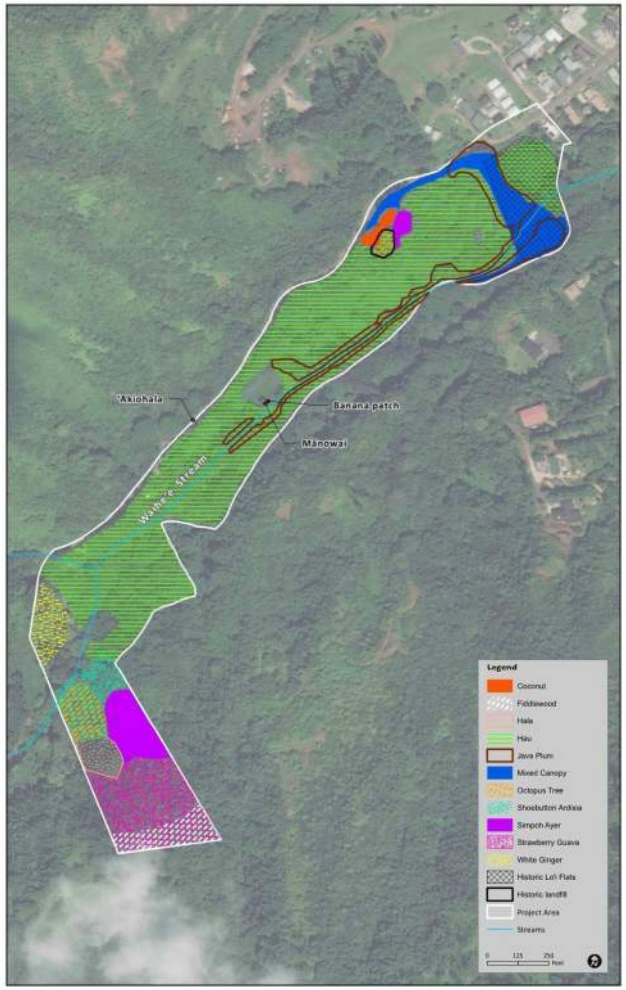

Figure 2 Dominant vegetation and sites of significance located within the project site boundaries during the botanical surveys. Area of coverage is approximated based on observations and collected GPS data.

The designated project site interior features flat areas and trenches presumed to be historical loʻi terraces (Figure A1) and ʻauwai found in the makai portion support a mixed canopy of invasive tree species such as shoebutton ardisia (*Ardisia elliptica*), juniperberry (*Cytharexylum caudatum*), fiddlewood (*Citharexylum spinosum*). These communities are occasionally punctuated by a few large established trees such as the African tulip (*Spathodea campanulata*), trumpet tree (*Cecropia obtusifolia*), kukui (*Aleurite moluccana*), hala (*Pandanus tectorius*) and a small grove of coconut trees (*Cocos nucifera*) located near the BWS access road. A large fallen octopus tree (*Schefflera actinophylla*) located along the streambank appeared to be alive and sprouting new roots and small offshoots (Figure A2). Java plum (*Syzygium cuminii*) was a noticeably significant part of the canopy along the lower portion of the stream, as well as the mixed canopy area.

Understory species varied according to canopy type. In areas identified as mixed or open canopy the understory consisted of grass and ferns. Basket grass (*Oplismenus hirtellus*) was commonly observed, sometimes intermixed with sword ferns (*Nephrolepis multiflora*) and white ginger (*Hedychium coronarium*) (Figure A3). In the overgrown loʻi flats elephant ear (*Xanthosoma rosea*) and patches of heliconia (Figure A4) were encountered fairly often. Dense stands of Indian head ginger (*Costus woodsonii*) growing at heights greater than 8 ft. appeared at intervals along the survey track. Honohono grass (*Commelina diffusa*) also appeared in patches throughout the survey area.

Extensive thickets of impenetrable hau (*Hibiscus tiliaceua*) shrubland encompass a significant portion of the project area between the BWS access road and Waiheʻe Stream. It was often necessary to circumvent these thickets by wading into the stream. The twisting branches of the hau form a dense canopy (Figure A5) shading out most of the understory species that would grow there, though the occasional vine was detected.

Much of the observable canopy along the road and in the interior of lower elevation areas of the project site also host colonies of climbing vines (Figure A6). Commonly observed species include maunaloa (*Canavalia cathartica*), pothos (*Epipremnum pinnatum*), maile pilau (*Paederia foetida*), and bitter yam (*Dioscorea bulbifera*).

The trail to the mānowai passed through a dense area of Java plum, followed by an open field of honohono grass, California grass and vegetable ferns (*Diplazium esculentum*), commonly referred to as hōʻiʻo (Figure A7). A group of banana trees (*Musa x paradisiaca*) and cultivated taro (*Colocasia esculenta*) are established along an ʻauwai connecting to the stream below the mānowai (Figure 2 and Figure A8). These traditional agricultural features appear to be in use and are well-maintained.

Moving in the mauka direction, the project area gains in elevation culminating in a low ridgeline. Sudden and distinct shifts are observable in the dominant species composition for both forest canopy and understory with the change in terrain. These patches of nearly monotypic forest alternate between shoebutton ardisia, simpoh ayer (*Dillenia suffruticosa*), strawberry guava (*Psidium cattleianum*) and fiddlewood (*Citharexylum spinosum*) (Figure A9). A handful of enormous Chinese banyan trees (*Ficus macrocarpa*) were scattered throughout this portion of the landscape (Figure A10), including at the base of a gulch on the northwestern ridge face that contained many large hala trees (Figure A11).

The plant communities observed along the BWS access road on the western boundary were home to a diverse mixture of alien grasses, shrubs and trees (Figure A12). Species most commonly observed include the typical invasive grasses such as guinea grass (*Megathyrsus maximus*) and California grass

(*Brachiaria mutica*), as well as tree species such as albizia (*Falcataria moluccana*), gunpowder tree (*Trema orientalis*), simpoh ayer, juniperberry, and fiddlewood. Native ferns uluhe (*Dicranopteris linearis*) and palaʻa (*Sphenomeris chinensis*) were occasionally sited along the roadway. A small grove of coffee (*Coffea arabica*) and mountain apple (*Syzygium malaccense*) (Figure A13) grow between the road and a large field of white ginger (*Hedychium coronarium*) where a new loʻi has been proposed for construction (Figure A14).

Endemic and indigenous species such as olonā (*Touchardia latifolia*) (encountered during the 2007 survey), *Carex wahuensis* (a native sedge whose Hawaiian name has been lost), and ʻōhiʻa lehua (*Metrosideros polymorpha*) were expected to be among the native species present, however none were observed. Only four indigenous fern species were identified during these surveys: ʻekaha (*Asplenium nidus*), moa or whisk fern (*Psilotum nudum*), uluhe, and palaʻa. ʻEkaha, moa, and whisk fern were found in the deeper forested areas, while uluhe and palaʻa, as previously mentioned, were mainly noted along the road. Occasionally, small patches of uluhe were observed during the survey of the ridgeline. One indigenous hibiscus, the ʻakiohala (*Hibiscus furcellatus*), was observed to be in bloom along the road (Figure 2).

Weedy Plants of Concern

Of the approximately 65 non-native taxa that were observed and recorded during these surveys, 15 species appear on the list below as "plants of concern". Three of these species—shoebutton ardisia, Koster's curse and tropical kudzu— are found on the List of Plant Species Designated as Noxious Weeds for Eradication or Control Purposes by the Hawaii Department of Agriculture (HAR, Title 4 Chap 68; last updated June 18, 1992). This list was developed to better regulate those species identified under the five designated criteria for traits such as reproduction, growth, detrimental effects, control, and distribution and spread.

Taxa that do not appear on the state's noxious weed list may still be considered invasive as their characteristics make them a threat to the watershed. The invasive qualities of each plant as well as their presence in the project site are discussed briefly, below.

African tulip tree (*Spathodea campanulata*)- This tree can reach heights up to 25 meters and is recognized by the large, orange horn-like flowers it produces. Its seeds are winged and wind-dispersed, but it can also be propagated from cuttings. The African tulip tree can spread rapidly in its favored climate of moist, wet areas. Its canopy of large leaves shades out other trees, reducing the species richness of the area. Its large limbs have a tendency to drop when the tree becomes old. The African tulip tree was relatively uncommon in the project site, though the few individuals that were observed were noted to be large and well-established. These trees were located primarily among the mixed forest canopy identified at the makai end of the site.

Albizia (*Falcataria moluccana*)- This deciduous tree is extremely fast-growing and can achieve heights of up to 40 meters. Previously used as both an ornamental and a forestry planting it is capable of growing on nutrient-poor soils in mesic to wet habitats and can form dense stands across a large area. Its wide-spreading branches create a canopy that can shade out native plants and present a danger during high winds as they easily break and drop. Albizia were observed regularly along the western border of the

BWS access road during the surveys, though none were observed in the dense interior of the project site.

Bingabing (*Macaranga mappa*)- This evergreen tree grows in mesic to wet forest environments and prefers disturbed areas. It can reach up to 10 meters in height and crowd out other forest trees. Its large leaves (2-3 ft. long) can shade out vegetation growing in its understory. This species was identified along the access road in only one area at the project site.

Cat's claw (*Caesalpinia decapetala*)- This shrub can grow between 2-4 meters tall and produces climbing vines that can grow to heights of over 10 meters. These thorny, sprawling vines form dense thickets that act as impenetrable barriers to animal passage. Cat's claw is generally found in mesic lowland habitats and its primary method of dispersal is likely by man. Only one individual plant was observed during these surveys. This plant is located along the western border of the access road, close to the gated entrance.

Hau (*Hibiscus tiliaceua*)- Though it exhibits many of the characteristics common to weedy plants, there is some controversy over whether hau should be considered invasive in the islands. Considered native and likely of Polynesian introduction, this evergreen shrub can spread rapidly over large areas of disturbed land. Its large crooked branches spread out to form extremely dense, impenetrable thickets. The shade created by this canopy impedes the growth of plants underneath. Surveys revealed hau to be a significant feature of the landscape, encompassing the greater part of the project area in the mid-low elevation sections.

Gunpowder Tree (*Trema orientalis*)- This evergreen tree can grow on poor soils and prefers disturbed mesic forest habitats. It can reach heights up to 36 meters and has been used for forest rehabilitation due to its extremely fast growth. It can also spread via birds which feed on its seeds. Gunpowder tree was found occasionally throughout the site, though mainly along the access road border.

Java plum (*Syzygium cuminii*)- This evergreen tree spreads rapidly and can achieve heights of 13 to 30 meters with a dense canopy. This canopy effectively shades out other young trees while the Java plum's shade-tolerant young grow to form monotypic stands. Its roots also create significant competition for surrounding plants. Surveys of the project area showed the greatest density of this species occurred along the trail leading to the mānowai on Waiheʻe Stream.

Juniperberry/Fiddlewood (*Citharexylum spp.*)- Juniperberry (*C. caudatum*) and fiddlewood (*C. spinosum*) share many of the same characteristics. Both are evergreen shrubs/trees that may grow from 15 to 20 meters in height. They are prolific seeders, bearing fruit that is consumed and spread by birds. *C. caudatum* may also spread vegetatively. *C. spinosum* was extensively planted as an ornamental. These species can form thickets with dense canopies and their seedlings are capable of sprouting in low light conditions. Both species were noted in abundance during the survey where they made up a significant part of the mixed forest canopy in the makai portion of the project area. *C. spinosum* was also present in large stands on the low ridgeline, intermixed with stands of strawberry guava.

Koster's curse (*Clidemia hirta*)- This shrub is extremely fast-growing and may reach heights up to 3 meters. It is a pioneer shrub, growing aggressively in steep and disturbed areas in mesic and wet forests, sometimes forming impenetrable thickets. It is tolerant of both full sunlight and deep shade and its large leaves can shade out native vegetation. Koster's curse produces flowers and dark-colored berries

throughout the year; these fruits are consumed by birds which are the main method of dispersal. This plant was sited regularly over the course of the surveys, primarily in previously disturbed areas adjacent to the BWS access road.

Octopus tree (*Schefflera actinophylla*)- This tree grows rapidly and can reach 6-9 meters in height. It is shade-tolerant, thriving in moist environments, and forming dense thickets. Its seeds are bird-dispersed and can germinate in the nooks of larger, established trees where it may grow as an epiphyte. These traits enable it to easily invade undisturbed forests.

Shoebutton Ardisia (*Ardisia elliptica*)- This evergreen shrub/tree is an escaped ornamental that can reach 6 meters in height. Generally found in lowland wet forests, it is shade-tolerant and capable of forming dense monotypic stands. The fruits are appealing to birds, which consume them and contribute to their spread. This species was abundant in the project area and a particularly dense monotypic stand populated an area leading up the small ridgeline at the mauka end of the site.

Simpoh ayer (*Dillenia suffruticosa*)- According to the 2007 botanical survey, this tree was only noted in the Waiheʻe valley. By contrast, it appeared to be absent in Kahuluʻu. Indeed, this tree was abundant in Waiheʻe, particularly along the BWS access road where it was observed in a mixed canopy, as well as the interior of the project site itself where two separate patches were present in monotypic stands.

Tropical kudzu (*Pueraria phaseoloides*)- This herbaceous vine prefers to colonize disturbed areas in moist environments. It is spread by seed and is also able to reproduce vegetatively if a vine touches the ground. It is extremely fast-growing and can colonize entire forests in a short amount of time. The vines form tangled mats that can fully cover other plants potentially smothering, strangling, breaking off limbs and even uprooting them. This plant was identified from one location during the surveys.

Trumpet tree (*Cecropia obtusifolia*)- This fast-growing tree reaches heights between 5-10 meters. Its seeds are bird-dispersed and, though it is short-lived, it can quickly invade gaps in the native forest to form dense stands and obstruct the growth of native plants. This species was observed occasionally around the project site, primarily as established trees within the mixed canopy of the makai section and along portions of the access road border.

Recommendations

Loʻi Restoration

Restoring a fallow loʻi is often the easiest option since they have already been prepared to meet the conditions for wet taro cultivation. Wet taro requires well-drained soil at a minimum depth of 10 inches, full sun exposure, open air circulation and proximity to a consistant source of fresh water. Water must also be able to drain from the loʻi when not in cultivation.

Several flat areas near the makai end of the project area were noted during the botanical survey. These areas may have previously been utilized for cultivating wet taro and other crops and became overgrown once they went out of production. The areas being proposed for future loʻi in this part of the site may also be former loʻi that have become unrecognizable with extensive overgrowth.

Successful restoration of these loʻi will require the removal of all vegetation from the areas intended for cultivation and the simultaneous reconstruction of surrounding walls so that these areas may be flooded to suppress weed growth. Flooding the newly-opened loʻi will prevent the germination of the dense seedbank that lies dormant in the soil and help rot any remaining roots for easy removal. Without flooding, digging out stumps and dense root systems would be an arduous process and would likely require earth-moving equipment that would create the potential for a large amount of runoff.

Several months of flooding may be necessary to ensure the seedbank is exhausted and enable the removal of large, rotted root systems. Once the flooding is concluded, the water should be cut off and the loʻi left to fallow for a time before being put back into production. Riparian zones that will not be restored to cultivated loʻi should be replanted with a dense vegetation buffer to help minimize runoff.

Another site proposed for the creation of a future loʻi is currently dominated by a large patch of white ginger. It is unknown whether this portion of the site was ever engaged in agricultural production. The area exhibits marsh-like qualities, however any connections between this area and a water source that may have existed were not visible during the botanical survey. Along with vegetation removal, a reliable connection to a continuous water source will need to be established to bring this area into wet taro production.

Forest Restoration and Management

Introduced and invasive species currently dominate the vegetation of the project site. A successful forest restoration effort will require a plan to strategically remove invasive plants from key areas and replace them with native species either previously known to Kahaluʻu-Waiheʻe or those best suited to the soil and climate conditions. Long-term management strategies and weed control will also be necessary to prevent the encroachment of non-native species on restored areas.

Past recommendations from the 2007 Hawaii Biological Survey report included the eradication of species known to be of "high weed threat," particularly those that were not yet common in the area. Species cited under the 2007 recommendation that were also observed during our surveys include fern tree, small shell ginger, albizia and tropical kudzu. Observations of their relative abundance suggest that these eradication efforts may still be worth undertaking as these species are not yet common. Albizia especially should be targeted as they are extremely fast-growing. Many young albizia trees observed along the access road were still at a manageable size for removal. Bingabing and cat's claw, both listed

above as "plants of concern," may also be candidates for eradication in this area due to their low abundance.

Endemic and indigenous plant species previously observed in and/or known to inhabit Waiheʻe and adjacent valleys should be reintroduced to the area as part of any restoration effort. The following list of native plant species are suggested for forest restoration efforts in Waiheʻe:

Species	Scientific Name
Trees	
hala*	*Pandanus tectorius*
koa*	*Acacia koa*
ʻōhiʻa lehua*	*Metrosideros polymorpha*
hame*	*Antidesma platyphyllum*
lama	*Diospyros sandwicensis*
maua	*Xylosma hawaiiense*
loulu	*Pritchardia martii*
papalakepau	*Pisonia umbellifera*
neneleau	*Rhus sandwicensis*
Shrubs & Vines	
olonā	*Touchardia latifolia*
ʻakoko	*Chamaesyce celastroides*
mamaki	*Pipterus albidius*
naupaka kuahiwi	*Scaevola gaudichaudiana*
hōʻawa	*Pittosporum glabrum*
ʻilima	*Sida fallax*
kokiʻo keʻokeʻo	*Hibicus arnottianus*
ʻawikiwiki	*Canavalia galeata*
maile	*Alyxia stellata*
Groundcovers	
palapalai*	*Microlepia strigose*
hōʻiʻo*	*Diplazium sandwichianum* or *Diplazium arnottii*
carex sedge*	*Carex wahuensis*
ʻukiʻuki	*Dianella sandwicense*
neke	*Cyclosorus interruptus*

**Primary forest restoration species for the Waiheʻe area*

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Appendix I: Photos

Figure A1 Flat areas overgrown with vegetation were presumed to be historical loʻi.

Figure A2 A large octopus tree (*Schefflera actinophylla*) continues to grow after falling, its roots holding onto stones that formed a low rock wall.

Figure A3 Basket grass (*Oplismenus hirtellus*) was abundant throughout the project area, particularly in the lower elevations where it tended to intermix with sword ferns (*Nephrolepis multiflora*) and white ginger (*Hedychium coronarium*).

Figure A4 Elephant ear (*Xanthosoma rosea*) and patches of heliconia (*Heliconia indica*) were common in the overgrown loʻi flats.

Figure A5 Thickets of dense, impenetrable hau (*Hibiscus tiliaceua*) dominated the forest canopy in the lower elevations of the project area.

Figure A6 Maunaloa (*Canavalia cathartica*) and bitter yam (*Dioscorea bulbifera*) were common among the many species of climbing vines encountered during the surveys.

Figure A7 Honohono grass (*Commelina diffusa*), California grass and hoʻiʻo/vegetable ferns (*Diplazium esculentum*) grow adjacent to the trail leading to the mānowai on Waiheʻe Stream.

Figure A8 Banana trees (*Musa x paradisiaca*) grow along the connecting ʻauwai along with cultivated taro (*Colocasia esculenta*).

Figure A9 Looking downslope at a section of monotypic strawberry guava (*Psidium cattleianum*) forest.

Figure A10 A handful of enormous Chinese banyan trees (*Ficus macrocarpa*) were scattered in the landscape.

Figure A11 A gulch off the northwest ridge contained many large hala (*Pandanus tectorius*) trees.

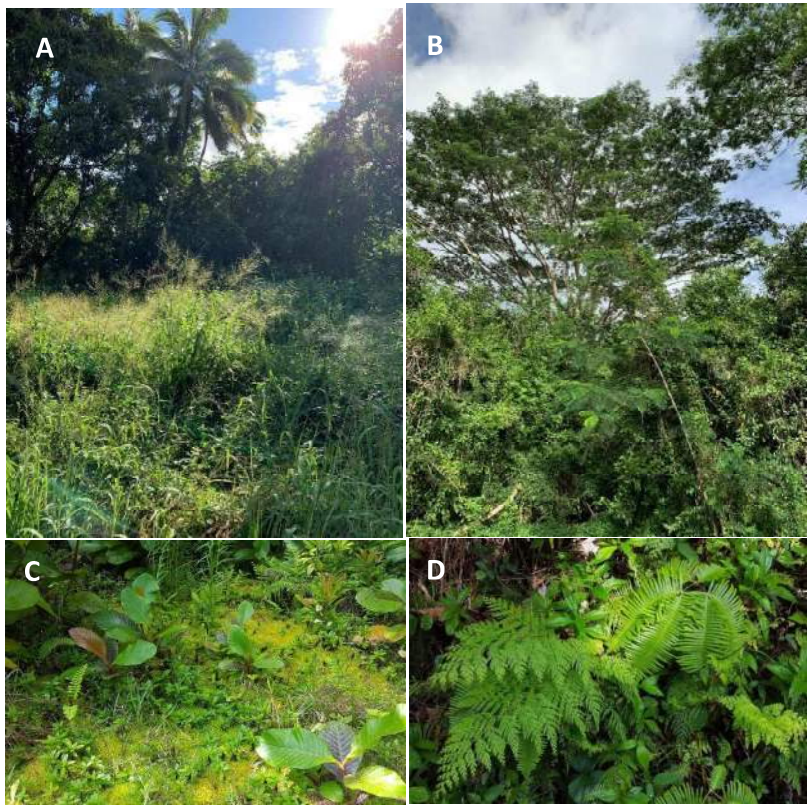

Figure A12 Examples of the mixed plant communities observed along the BWS access road. **A)** A mix of tall California grass (*Brachiaria mutica*) and guinea grass (*Megathyrsus maximus*). **B)** Albizia (*Falcataria moluccana*) towers over the lower canopy formed by juniperberry and fiddlewood (*Citharexylum* spp.) covered in vines. **C)** Simpoh ayer (*Dillenia suffruticosa*) springs up from a mossy bank. **D)** Native uluhe (*Dicranopteris linearis*) and palaʻa (*Sphenomeris chinensis*) ferns were occasionally sited among herbaceous weeds such as Koster's curse (*Clidemia hirta*) and wedelia (*Sphaneticola trilobata*).

Figure A13 A small grove of coffee (*Coffea arabica*) and mountain apple (*Syzygium malaccense*) trees grow between the road and a field of white ginger where a new loʻi has been proposed for construction.

Figure A14 Field of white ginger (*Hedychium coronarium*).

Appendix II: Plant Checklist

The following checklist list was prepared after the conclusion of two surveys conducted in the proposed project area in Waiheʻe Valley, Koʻolaupoko, Oʻahu on March 28, 2019 and April 10, 2019. During these surveys as total of 84 taxa were identified including 10 indigenous (including Ind? species), 9 Polynesian-introduced (including Pol? species) and 65 naturalized.

The list is divided into three groups: pteridophytes, dicots, and monocots. Each group is organized alphabetically by family, then by scientific name (e.g. genus, species). The common and Hawaiian names are also included. A key with explanations of the abbreviations used in the checklist is provided below.

PLANT CHECKLIST KEY

Biogeographic Status

Nat	Naturalized: Introduced to Hawaiʻi by humans, either directly or indirectly, since Western contact. Includes ornamentals and plants that may have formerly been cultivated.
Pol	Polynesian introduction: Introduced to Hawaiʻi by the original Polynesian settlers.
Pol?	Possible Polynesian introduction: May have been introduced to Hawaiʻi by the original Polynesian settlers; or may have been introduced post-Western contact.
Ind	Indigenous species: Occurs naturally both within and outside of the Hawaiian Islands.
Ind?	Possible indigenous species: May occur naturally in Hawaiʻi; or may have been introduced post-Western contact.

Abundance

R	Rare: 1-3 individuals observed.
U	Uncommon: Several to a dozen individuals observed.
O	Occasional: Found regularly at the site.
C	Common: Observed numerous times; makes up a large portion of the vegetation.
A	Abundant: Large numbers of plants observed; likely a locally-dominant species.

Scientific Name	Common/Hawaiian Names	Status	Abundance
PTERIDOPHYTES - FERNS & FERN ALLIES			
AMARYLLIDACEAE			
Crinum pedunculatum	spider lily	Nat	R
ASPLENIACEAE			
Asplenium nidus	*ʻekaha*	Ind	R
ATHYRIACEAE			
Diplazium esculentum	vegetable fern; *hoʻiʻo/pohole*	Nat	O
BLECHNACEAE			
Blechnum occidentale	hammock fern	Nat	O
CYATHEACEAE			
Sphaeropteris cooperi	Australian tree fern	Nat	R
DAVALLIACEAE			
Davallia tyermannii	rabbit's foot fern	Nat	R
GLEICHENIACEAE			
Dicranopteris linearis	*uluhe*	Ind	O
LINDSAEACEAE			
Sphenomeris chinensis	*palaʻa*	Ind	O
MARATTIACEAE			
Angiopteris evecta	mule's foot fern	Nat	R
NEPHROLEPIDACEAE			
Nephrolepis multiflora	sword fern	Nat	U
PSILOTACEAE			
Psilotum nudum	*moa*, whisk fern	Ind	O
PTERIDACEAE			
Christella parasitica	maiden fern	Nat	C
Pteris cretica	*ʻōali*, cretan brake	Ind	O
FLOWERING PLANTS - DICOTS			
ACANTHACEAE			
Hemigraphis reptans	red flame	Nat	U
ANACARDIACEAE			
Mangifera indica	mango	Nat	R
ARALIACEAE			
Schefflera actinophylla	octopus tree	Nat	C
ASTERACEAE			
Bidens pilosa	hairy beggartick	Nat	O
Sphaneticola trilobata	wedelia	Nat	O
BEGONIACEAE			
Begonia vitifolia	begonia	Nat	R
BIGONACEAE			
Spathodea campanulata	African tulip tree	Nat	U

Scientific Name	Common/Hawaiian Names	Status	Abundance
CECROPIACEAE			
Cecropia obtusifolia	trumpet tree	Nat	O
CONVOLVULACEAE			
Ipomea alba	moonflower	Nat	R
Ipomea indica	*Koaliʻawa*	Ind	R
Ipomea ochracea	fence morning glory	Nat	R
DILLENIACEAE			
Dillenia suffruticosa	simpoh ayer	Nat	A
EUPHORBIACEAE			
Aleurites moluccana	*kukui*	Nat	O
Macaranga mappa	bingabing	Nat	R
Macaranga tanarius	parasol leaf tree	Nat	R
FABACEAE			
Caesalpinia decapetala	cat's claw	Nat	R
Canavalia cathartica	*maunaloa*	Nat	C
Centrosema molle	butterfly pea	Nat	O
Falcataria moluccana	albizia	Nat	O
Leucaena leucocephala	*koa haole*	Nat	O
Mimosa pudica	sensitive plant	Nat	O
Mucuna gigantea sub. giantea	*kaʻeʻeʻe*	Ind	R
Mucuna sloanei	sea bean	Ind	R
Pueraria phaseoloides	tropical kudzu	Nat	U
MELASTOMATACEAE			
Clidemia hirta	Koster's curse	Nat	O
Pterolepis glomerata	false meadowbeauty	Nat	U
MALVACEAE			
Hibiscus furcellatus	*ʻakiohala*	Ind	R
Hibiscus tiliaceua	*hau*	Pol?	A
Sida rhombifolia	Cuban jute	Nat	R
MORACEAE			
Ficus microcarpa	Chinese banyan tree	Nat	U
MYRSINACEAE			
Ardisia crenata	Hilo holly	Nat	R/U
Ardisia elliptica	shoebutton ardisia, inkberry	Nat	A
Syzygium malaccense	mountain apple; *ʻohiʻa ʻai*	Pol	C
MYRTACEAE			
Syzygium cuminii	Java plum	Nat	C
Psidium cattleianum	strawberry guava	Nat	A
Psidium guajava	common guava	Nat	C

Scientific Name	Common/Hawaiian Names	Status	Abundance
OCHNACEAE			
Ochna thomasiana	mickey mouse plant	Nat	R
ULMACEAE			
Trema orientalis	gunpowder tree	Nat	O
ONAGRACEAE			
Ludwigia octovalvis	kāmole	Pol?	U
ROSACEAE			
Rubus rosifolius	thimbleberry	Nat	O
RUBIACEAE			
Coffea arabica	coffee	Nat	O
Paederia foetida	*maile pilau*	Nat	O
SAPINDACEAE			
Dimocarpus longan	longan	Nat	U
Filicium decipiens	fern tree	Nat	U
VERBENACEAE			
Citharexylum caudatum	juniperberry	Nat	A
Citharexylum spinosum	fiddlewood	Nat	A
Stachytarpheta jamaicensis	Jamaica vervain	Nat	O
FLOWERING PLANTS - MONOCOTS			
ARACEAE			
Alocasia cucullata	Chinese taro	Nat	O
Colocasia esculenta	taro	Pol	U
Epipremnum pinnatum	pothos	Nat	A
Syngonium podophyllum	arrowhead plant	Nat	O
Xanthosoma sagittifolium	elephant ear	Nat	O
ARECACEAE			
Cocos nucifera	coconut tree	Ind?	U
Ptychosperma macarthurii	Macarthur palm	Nat	O
ASPARAGACEAE			
Cordyline fruticosa	*ti*, *laʻi*	Pol	U
COMMELINACEAE			
Commelina diffusa	*honohono*	Nat	C
COSTACEAE			
Costus woodsonii	indian head ginger	Nat	A
DIOSCOREACEAE			
Dioscorea bulbifera	*hoi*, bitter yam	Pol	O
HELICONIACEAE			
Heliconia indica	heliconia	Nat	O
MUSACEAE			
Musa x paradisiaca	banana	Pol	U

Scientific Name	Common/Hawaiian Names	Status	Abundance
ORCHIDACEAE			
Phaius tankervilleae	nun's hood orchid	Nat	U
Spathoglottis plicata	Malayan ground orchid	Nat	R
PANDANACEAE			
Pandanus tectorius	hala	Pol	C
POACEAE			
Brachiaria mutica (*Urochloa mutica*)	California grass	Nat	C
Coix lachryma-jobi	Job's tears	Nat	U
Megathyrsus maximus	guinea grass	Nat	O
Oplismenus hirtellus	basketgrass	Nat	C
ZINGIBERACEAE			
Alpinia mutica	small shell ginger	Nat	R
Etlingera elatior	torch ginger	Nat	O
Hedychium coronarium	white ginger	Nat	A
Zingerber zerubet	shampoo ginger	Pol	C