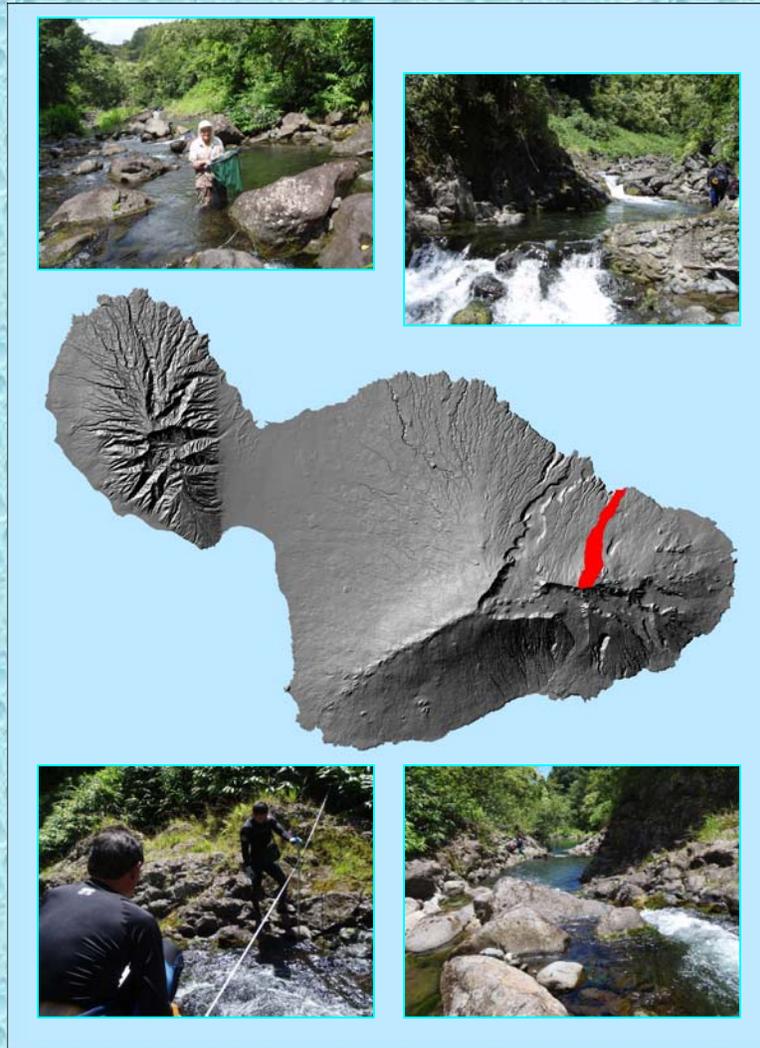


Report on Hanawī Stream Maui, Hawai‘i



August 2009

State of Hawai‘i
Department of Land and Natural Resources
Division of Aquatic Resources
and
Bishop Museum





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and



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Report on Hanawī Stream Maui, Hawai‘i

August 2009

Prepared for
Commission on Water Resource Management
Department of Land and Natural Resources
State of Hawai‘i

Prepared by
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Section 1: Introduction

Overview

On May 24, 2001, the Native Hawaiian Legal Corporation (NHLC) filed a Petition to Amend the Interim Instream Flow Standard (IIFS) for 27 streams in east Maui on behalf of resident taro farmers. Since the acceptance of the petitions in July 2001, the Commission on Water Resource Management (CWRM) has been focused on gathering information for the 27 petitioned streams. Shortly thereafter, NHLC and CWRM staff reached an agreement that efforts would focus on 8 of the 27 petitioned streams: Honopou, Hanehoi, Huelo, Waiokamilo, Kualani, Pi'ina'au, Palauhulu, and Wailua Nui Streams. Currently, the CWRM is collaborating with the State's Division of Aquatic Resources and the U.S. Geological Survey (USGS) for assistance in collecting biological and hydrologic data to determine measurable interim IFS. CWRM has also requested biological data on the remaining 19 petitioned streams which is the main purpose of this report.

This report is an accounting of the aquatic resources that have been observed in Hanawā Stream, Maui from year 2000 to present. The report was generated to provide information to aid in the instream flow determination for the East Maui Streams at the request of the Commission on Water Resource Management. The focus of this report is the animals that live in the stream and the data collected during surveys of the stream. The report covers four main sections, including:

- Overview
- Watershed Atlas Report
- DAR Point Quadrat Survey Report
- Photographs of stream taken during stream surveys

The overview provides the introduction for the purpose of this report, a summary of the findings on the stream and its animals, and a discussion of the importance of the findings and how stream conditions influence native species populations. The Watershed Atlas Report provides a description of the watershed and its aquatic resources from Division of Aquatic Resources (DAR) and other published and unpublished surveys as well as a rating of the condition of the stream compared to other streams on Maui as well as statewide. The DAR Point Quadrat Survey Report describes the distribution, habitats, and species observed during the standardized DAR stream surveys. The analysis of depth use vs. availability looks at habitat use by native species and the availability of suitable depths in the stream. Finally, the photographs provide context to the conditions that the stream surveyors encountered in the stream.

This overview reports on the highlights of these findings and provides a discussion of the importance of the information presented. We hope that this format provides the reader with a simplified, general discussion and understanding of the condition of Hanawā Stream while also providing substantial evidence to support the conclusions presented.

Findings for Hanawā Stream, Maui

Hanawā is a small (5.7 sq miles), is steep in the upper sections, and with little embayment. It is

mostly zoned for conservation (93%) with some agriculture (7%) and the land cover is mostly evergreen forest (88%), grassland (8%), scrub (3%), and bare land (2%). Numerous stream surveys of different types have been completed in Hanawā stream beginning in 1962 to the present. This watershed rates high, based on the data contained in the DAR aquatic surveys database, in comparison to other watersheds in Maui and statewide. It has a total watershed rating of 8 out of 10, a total biological rating of 8 out of 10, and a combined overall rating of 9 out of 10.

Native species observed in the stream include the following categories and species:

Fish - *Awaous guamensis*, *Eleotris sandwicensis*, Gobiid sp., *Kuhlia sandwicensis*, *Kuhlia xenura*, *Lentipes concolor*, *Sicyopterus stimpsoni* and *Stenogobius hawaiiensis*

Crustaceans - *Atyoida bisulcata*

Insect - *Anax junius*, *Anax* sp, *Megalagrion blackburni*, *Megalagrion calliphya*, *Megalagrion hawaiiense*, *Megalagrion nigrohamatum nigrohamatum*, *Megalagrion pacificum*, *Megalagrion* sp., *Procanacae* sp., *Telmatogen* sp.

Snails - *Neritina granosa*

Introduced species observed in this stream includes the following categories and species:

Amphibian - *Rana catesbiana*, *Rana rugosa* and Ranid sp.

Crustaceans - *Macrobrachium lar*

Fish - *Oncorhynchus mykiss*

Insects - *Cheumatopsyche analis*, Chironomid sp., Culicid sp. and *Pantala flavescens*

Snails - Lymnaeid sp., *Lymnea* sp. and *Oxychilus* sp.

Discussion

Hanawā watershed is narrow and steep with good to moderate stream flow below Hāna Highway. Aerial photographs show a profile characterized by a small estuary with waterfalls and pools below and above Hāna Highway.

A helicopter was used to access the middle of Hanawā Stream above the estuary and first waterfall. The stream mouth was closed during the time of the stream survey in June. Heavy north swells in May, may have deposited sand, gravel, and cobble on the beach and across the stream mouth. Each time the stream mouth is closed by a berm will decrease the chance for post larval amphidromous animals to recruit to the stream and for newly hatched larvae to drift back to the ocean. No estuary surveys were conducted for Hanawā Stream.

Point quadrat surveys were conducted from the mouth to the upper reach. Measurements of stream discharge in the middle section showed twice as much water was flowing below the springs (18.32 cfs). Upstream the flow was 9.70 cfs.

Hanawā Stream had water depths and water temperatures suitable for providing habitat for native stream animals. Water temperatures dropped from 19 to 16 degrees from the lower reach to the middle reach, probably due to contribution by springs.

The native shrimp, **‘ōpae kala‘ole** (*Atyoida bisulcata*), were in the lower and middle reaches. The native goby, **‘o‘opu nōpili** (*Sicyopterus stimpsoni*), **‘o‘opu nākea** (*Awaous guamensis*), **Hihīwai** (*Neritina granosa*), **āholehole** (*Kuhlia xenura*), **‘o‘opu ‘akupa** (*Eleotris sandwicensis*)

were also mostly observed in the lower and middle reaches. The native goby, ‘o‘opu alamo‘o (*Lentipes concolor*) was abundant in the middle reach.

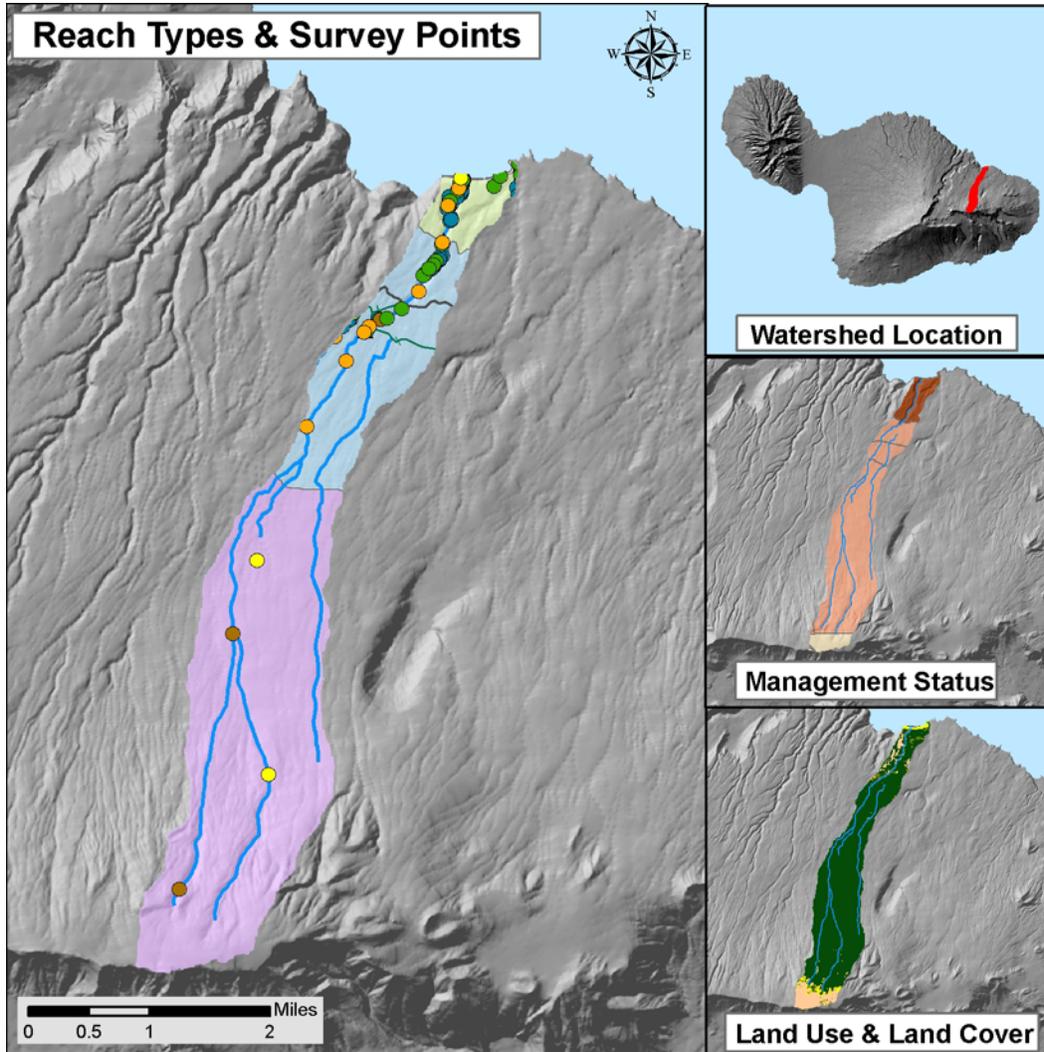
In the lowest sections below the first major waterfalls, Hanawī Stream had a range of native animals with both adults and juveniles present. The sites had good depths ranging from 10 to 36 inches deep and were characterized by gravel, cobble, and boulder substrates. In the middle section of the stream below Hāna Hwy, the stream was typically composed of boulder or bedrock substrates with numerous pools with water depths greater than 20 inches. *S. stimpsoni*, *A. guamensis*, *L. concolor* were common as were *A. bisulcata*. Clearly habitat and migration routes for both fish and crustaceans exist in this section of the stream. In the upper section, above Hāna Hwy and the stream diversion, only *A. bisulcata* were observed.

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Section 2: Watershed Atlas

DAR Watershed Code: 64022

Hanawī, Maui



Watershed Features

Hanawī watershed occurs on the island of Maui. The Hawaiian meaning of the name is unknown. The area of the watershed is 5.7 square mi (14.7 square km), with maximum elevation of 8074 ft (2461 m). The watershed's DAR cluster code is 2, meaning that the watershed is small, steep in the upper watershed, and with little embayment. The percent of the watershed in the different land use districts is as follows: 7% agricultural, 93% conservation, 0% rural and 0% urban.

Land Stewardship: Percentage of the land in the watershed managed or controlled by the corresponding agency or entity. Note that this is not necessarily ownership.

<u>Military</u>	<u>Federal</u>	<u>State</u>	<u>OHA</u>	<u>County</u>	<u>Nature Conservancy</u>	<u>Other Private</u>
0.0	6.3	83.0	0.0	0.0	0.0	10.7

Land Management Status: Percentage of the watershed in the categories of biodiversity protection and management created by the Hawaii GAP program.

Permanent Biodiversity <u>Protection</u>	Managed for Multiple <u>Uses</u>	Protected but <u>Unmanaged</u>	<u>Unprotected</u>
6.3	83.0	0.0	10.7

Land Use: Areas of the various categories of land use. These data are based on NOAA C-CAP remote sensing project.

	<u>Percent</u>	<u>Square mi</u>	<u>Square km</u>
High Intensity Developed	0.0	0.00	0.00
Low Intensity Developed	0.0	0.00	0.00
Cultivated	0.0	0.00	0.00
Grassland	7.7	0.44	1.14
Scrub/Shrub	2.5	0.14	0.36
Evergreen Forest	87.5	4.98	12.90
Palustrine Forested	0.0	0.00	0.00
Palustrine Scrub/Shrub	0.0	0.00	0.00
Palustrine Emergent	0.0	0.00	0.00
Estuarine Forested	0.0	0.00	0.00
Bare Land	2.1	0.12	0.31
Unconsolidated Shoreline	0.1	0.00	0.01
Water	0.0	0.00	0.01
Unclassified	0.0	0.00	0.00

Stream Features

Hanawā is a perennial stream. Total stream length is 14.3 mi (23 km). The terminal stream order is 2.

Reach Type Percentages: The percentage of the stream's channel length in each of the reach type categories.

<u>Estuary</u>	<u>Lower</u>	<u>Middle</u>	<u>Upper</u>	<u>Headwaters</u>
0.0	0.3	5.8	28.8	65.0

The following stream(s) occur in the watershed:
Hanawā

Biotic Sampling Effort

Biotic samples were gathered in the following year(s):

1962	1977	1979	1980	1984	1986	1987
1990	1991	1992	2000	2003	2004	2009

Distribution of Biotic Sampling: The number of survey locations that were sampled in the various reach types.

<u>Survey type</u>	<u>Estuary</u>	<u>Lower</u>	<u>Middle</u>	<u>Upper</u>	<u>Headwaters</u>
Damselfly Surveys	0	3	0	0	4
DAR General Surveys	0	0	0	1	0
DAR Point Quadrat	0	4	28	2	0
DAR Rapid BioAssessment	0	0	0	1	0
HDFG	0	0	3	5	0
Published Report	0	6	17	12	0
Unpublished Report	0	1	0	1	2

Biota Information

Species List

Native Species

Crustaceans	<i>Atyoida bisulcata</i>
Fish	<i>Awaous guamensis</i>
	<i>Eleotris sandwicensis</i>
	Gobiid sp.
	<i>Kuhlia sandwicensis</i>
	<i>Kuhlia</i> sp.
	<i>Kuhlia xenura</i>
	<i>Lentipes concolor</i>
	<i>Sicyopterus stimpsoni</i>
	<i>Stenogobius hawaiiensis</i>
Snails	<i>Neritina granosa</i>

Native Species

Insects	<i>Anax junius</i>
	<i>Anax</i> sp.
	<i>Megalagrion blackburni</i>
	<i>Megalagrion calliphya</i>
	<i>Megalagrion hawaiiense</i>
	<i>Megalagrion nigrohamatum</i>
	<i>nigrohamatum</i>
	<i>Megalagrion pacificum</i>
	<i>Megalagrion</i> sp.
	<i>Procanace</i> sp.
	<i>Telmatogeton</i> sp.

Introduced Species

Amphibians	<i>Rana catesbiana</i>
	<i>Rana rugosa</i>
	Ranid sp.
Crustaceans	<i>Macrobrachium lar</i>
Fish	<i>Oncorhynchus mykiss</i>
Snails	Lymnaeid sp.
	<i>Lymnea</i> sp.
	<i>Oxychilus</i> sp.

Introduced Species

Insects	<i>Cheumatopsyche analis</i>
	Chironomid sp.
	Culicid sp.
	<i>Pantala flavescens</i>

Species Size Data: Species size (inches) observed in DAR Point Quadrat Surveys.

<u>Scientific Name</u>	<u>Status</u>	<u>Minimum Size</u>	<u>Maximum Size</u>	<u>Average Size</u>
<i>Atyoida bisulcata</i>	Endemic	1.165	2	1.6
<i>Eleotris sandwicensis</i>	Endemic	2.5	6	4.5
<i>Kuhlia xenura</i>	Endemic	1	3	1.1
<i>Lentipes concolor</i>	Endemic	0.75	4	2.0
<i>Sicyopterus stimpsoni</i>	Endemic	1.5	4	2.3
<i>Awaous guamensis</i>	Indigenous	1	6	2.4
<i>Kuhlia</i> sp.	Indigenous	0.63	1	0.9
<i>Neritina granosa</i>	Endemic	0.06	1.75	0.4

Average Density: The densities (#/square yard) for species observed in DAR Point Quadrat Surveys averaged over all sample dates in each reach type.

<u>Scientific Name</u>	<u>Status</u>	<u>Estuary</u>	<u>Lower</u>	<u>Middle</u>	<u>Upper</u>	<u>Headwaters</u>
<i>Atyoida bisulcata</i>	Endemic			1.8		
<i>Eleotris sandwicensis</i>	Endemic		1.16	0.19		
<i>Kuhlia xenura</i>	Endemic		1.73	1.03		
<i>Lentipes concolor</i>	Endemic			3.08		
<i>Neritina granosa</i>	Endemic		1.73	15.2		
<i>Sicyopterus stimpsoni</i>	Endemic		1.73	2.12		
<i>Awaous guamensis</i>	Indigenous		1.44	1.28		
<i>Kuhlia</i> sp.	Indigenous		1.44	0.19		

Species Distributions: Presence (P) of species in different stream reaches.

<u>Scientific Name</u>	<u>Status</u>	<u>Estuary</u>	<u>Lower</u>	<u>Middle</u>	<u>Upper</u>	<u>Headwaters</u>
<i>Atyoida bisulcata</i>	Endemic		P	P	P	
<i>Eleotris sandwicensis</i>	Endemic		P	P		
<i>Kuhlia xenura</i>	Endemic		P	P		
<i>Lentipes concolor</i>	Endemic		P	P	P	
<i>Sicyopterus stimpsoni</i>	Endemic		P	P		
<i>Megalagrion blackburni</i>	Endemic		P			
<i>Megalagrion calliphya</i>	Endemic		P			P
<i>Megalagrion hawaiiense</i>	Endemic					P
<i>Megalagrion nigrohamatum</i>	Endemic					P
<i>Megalagrion pacificum</i>	Endemic		P			
<i>Megalagrion</i> sp.	Endemic		P	P	P	
<i>Neritina granosa</i>	Endemic		P	P		
<i>Awaous guamensis</i>	Indigenous		P	P		

Gobiid sp.	Indigenous		P	
<i>Kuhlia sandvicensis</i>	Indigenous	P		
<i>Kuhlia</i> sp.	Indigenous	P	P	
<i>Anax junius</i>	Indigenous	P	P	P
<i>Anax</i> sp.	Indigenous		P	
<i>Telmatogeton</i> sp.	Indigenous			P
<i>Rana catesbiana</i>	Introduced			P
<i>Rana rugosa</i>	Introduced			P
Ranid sp.	Introduced	P		P
<i>Macrobrachium lar</i>	Introduced	P	P	
<i>Oncorhynchus mykiss</i>	Introduced			P
<i>Cheumatopsyche analis</i>	Introduced	P	P	
Chironomid sp.	Introduced			P
Culicid sp.	Introduced	P	P	
<i>Pantala flavescens</i>	Introduced	P	P	P
Lymnaeid sp.	Introduced		P	P
<i>Lymnea</i> sp.	Introduced			P

Historic Rankings

Historic Rankings: These are rankings of streams from historical studies. "Yes" means the stream was considered worthy of protection by that method. Some methods include non-biotic data in their determination. See Atlas Key for details.

Multi-Attribute Prioritization of Streams - Potential Heritage Streams (1998): No

Hawaii Stream Assessment Rank (1990): Outstanding

U.S. Fish and Wildlife Service High Quality Stream (1988): Yes

The Nature Conservancy- Priority Aquatic Sites (1985): Yes

National Park Service - Nationwide Rivers Inventory (1982): Yes

Current DAR Decision Rule Status: The following criteria are used by DAR to consider the biotic importance of streams. "Yes" means that watershed has that quality.

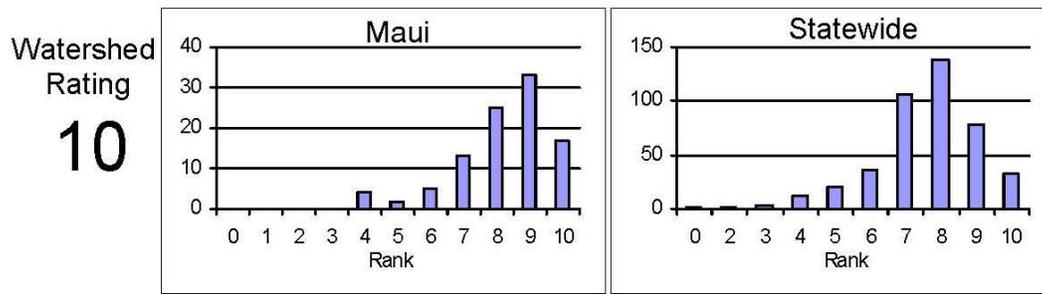
Native Insect Diversity <u>> 19 spp.</u>	Native Macrofauna <u>Diversity > 5 spp.</u>	Absence of Priority 1 <u>Introduced</u>
No	Yes	No
Abundance of Any <u>Native Species</u>	Presence of Candidate <u>Endangered Species</u>	Endangered Newcomb's <u>Snail Habitat</u>
No	Yes	No

CURRENT WATERSHED AND STREAM RATINGS

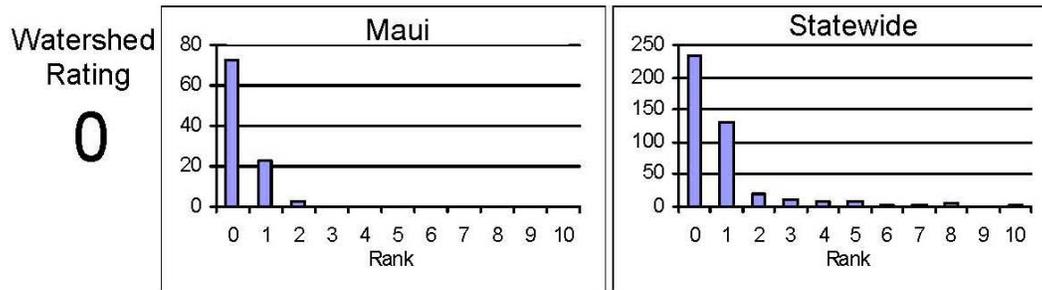
The current watershed and stream ratings are based on the data contained in the DAR Aquatic Surveys Database. The ratings provide the score for the individual watershed or stream, the distribution of ratings for that island, and the distribution of ratings statewide. This allows a better understanding of the meaning of a particular ranking and how it compares to other streams. The ratings are standardized to range from 0 to 10 (0 is lowest and 10 is highest rating) for each variable and the totals are also standardized so that the rating is not the average of each component rating. These ratings are subject to change as more data are entered into the DAR Aquatic Surveys Database and can be automatically recalculated as the data improve. In addition to the ratings, we have also provided an estimate of the confidence level of the ratings. This is called rating strength. The higher the rating strength the more likely the data and rankings represent the actual condition of the watershed, stream, and aquatic biota.

WATERSHED RATING: Hanawī, Maui

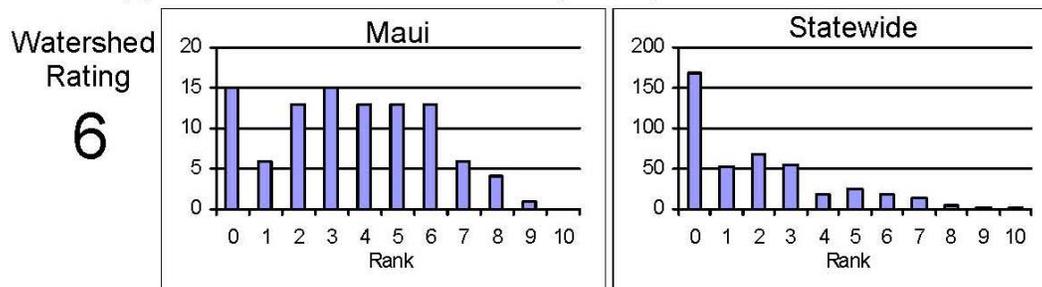
Land Cover Rating: Rating is based on a scoring system where in general forested lands score positively and developed lands score negatively.



Shallow Waters Rating: Rating is based on a combination of the extent of estuarine and shallow marine areas associated with the watershed and stream.

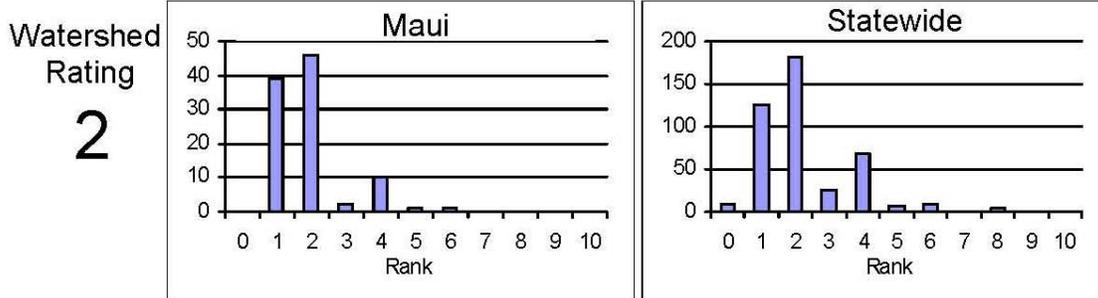


Stewardship Rating: Rating is based on a scoring system where higher levels of land and biodiversity protection within the watershed score positively.

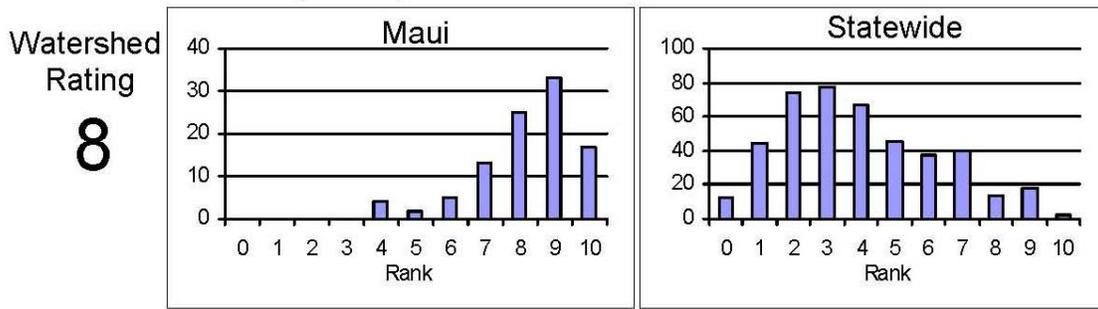


WATERSHED RATING (Cont): Hanawī, Maui

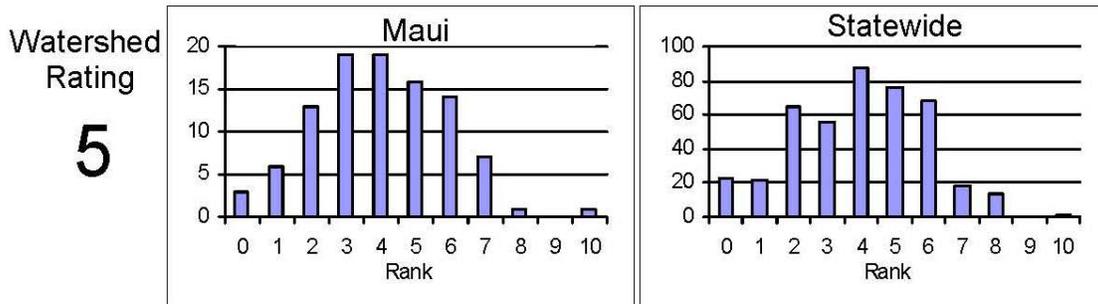
Size Rating: Rating is based on the watershed area and total stream length. Larger watersheds and streams score more positively.



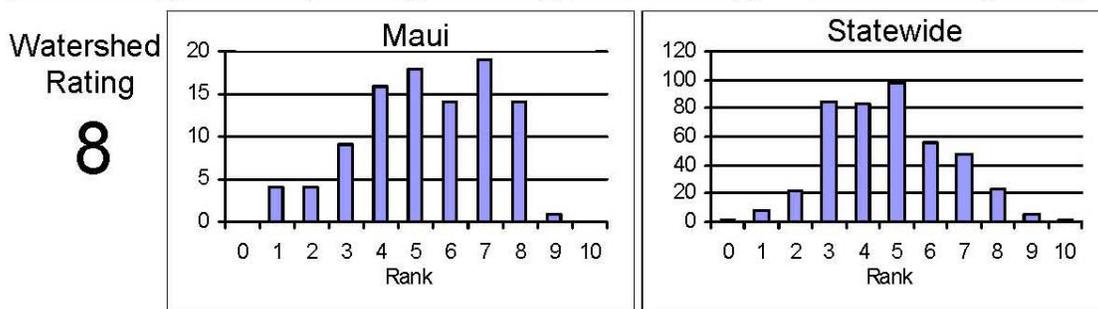
Wetness Rating: Rating is based on the average annual rainfall within the watershed. Higher rainfall totals score more positively.



Reach Diversity Rating: Rating is based on the types and amounts of different stream reaches available in the watershed. More area in different reach types score more positively.



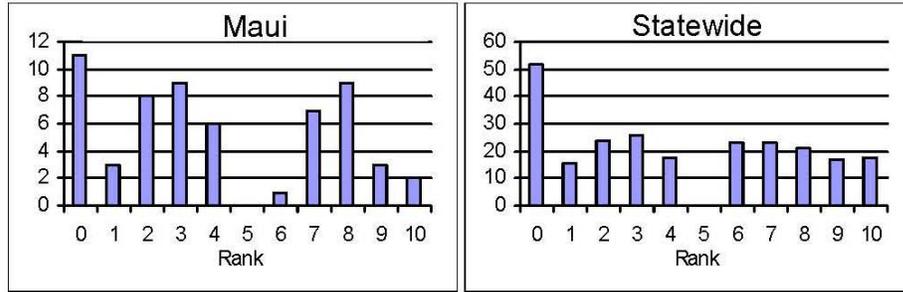
Total Watershed Rating: Rating is based on combination of Land Cover Rating, Shallow Waters Rating, Stewardship Rating, Size Rating, Wetness Rating, and Reach Diversity Rating.



BIOLOGICAL RATING: Hanawī, Maui

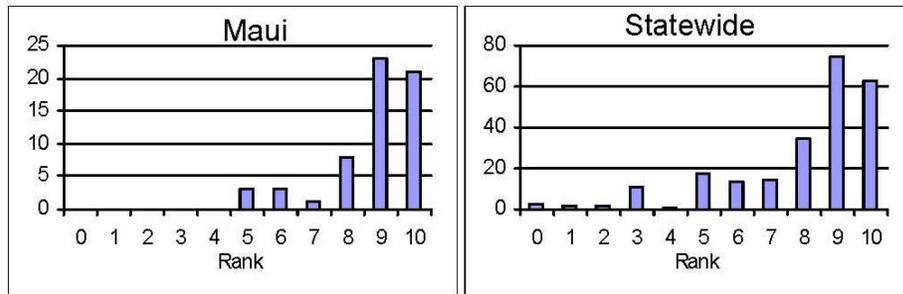
Native Species Rating: Rating is based on the number of native species observed in the watershed.

Stream Rating
9



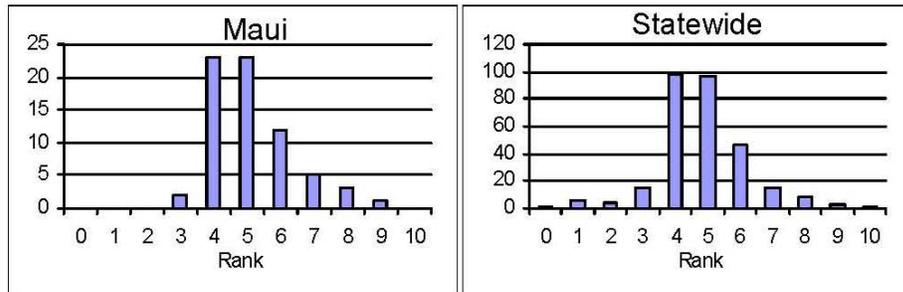
Introduced Genera Rating: Rating is based on the number of introduced genera observed in the watershed.

Stream Rating
9



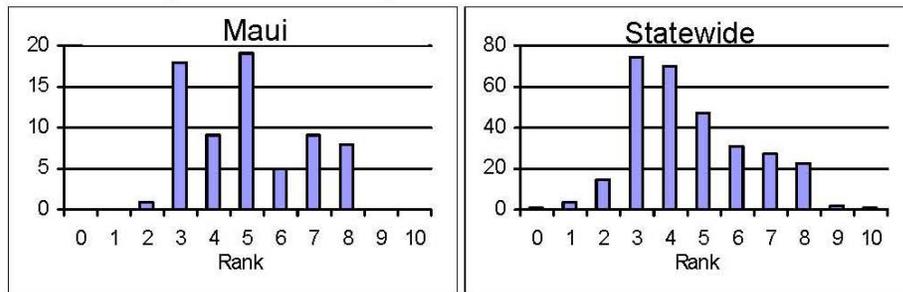
All Species' Score Rating: Rating is based on the Hawaii Stream Assessment scoring system where native species score positively and introduced species score negatively.

Stream Rating
8



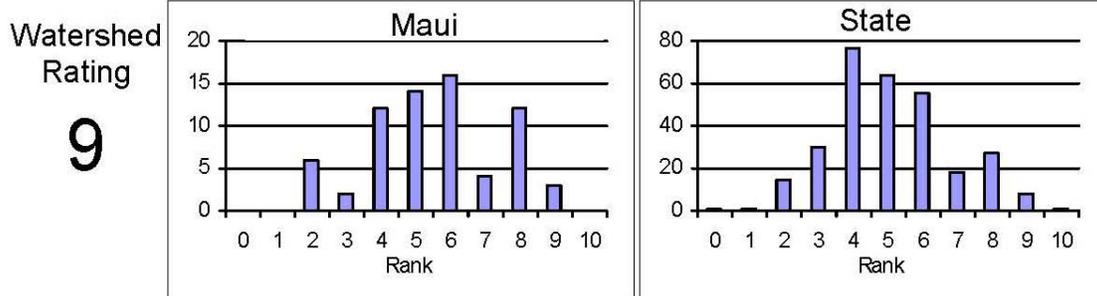
Total Biological Rating: Rating is the combination of the Native Species Rating, Introduced Genera Rating, and the All Species' Score Rating.

Stream Rating
8



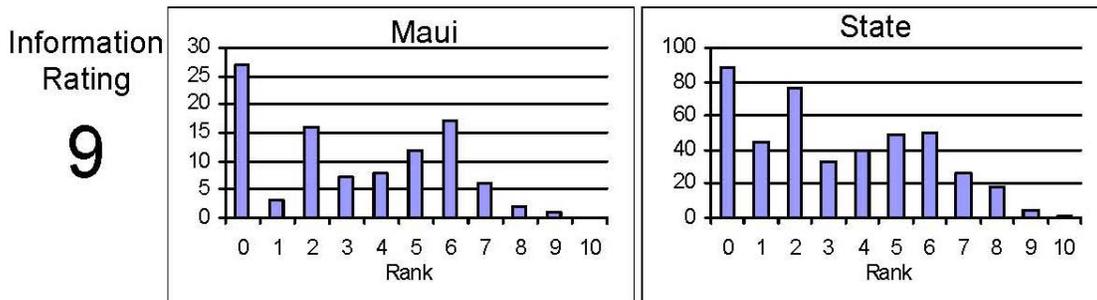
OVERALL RATING: Hanawī, Maui

Overall Rating: Rating is a combination of the Total Watershed Rating and the Total Biological Rating.



RATING STRENGTH: Hanawī, Maui

Rating Strength: Represents an estimate of the overall study effort in the stream and is a combination of the number of studies, number of different reaches surveyed, and the number of different survey types.



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Section 3: DAR Point Quadrat Report for Hanawī, Maui

For Surveys from 2/10/2004 to 6/30/2009

Introduction

This is a report of the Hawai‘i Division of Aquatic Resources stream surveys using the Point Quadrat Methodology. Trained biologists and technicians survey a series of randomly located points in a stream to generate an assessment of the species and habitat in the stream. The Point Quadrat Methodology is one of several techniques that could be chosen for the surveys and is used to develop a statistically comparable stream survey. This methodology is a standardized visual survey technique involving snorkeling, and it is well suited for the physical and ecological characteristics of Hawai‘i streams. The small, steep, dynamic nature of Hawaiian streams with their unique aquatic species is easily observed with this methodology. The in-stream distribution by elevation, behavior, and amphidromous life cycles are easily observed using this technique.

Methods

The point quadrat methodology requires underwater observation. Sampling was conducted using a dive mask, snorkel and two-piece wet suit with hood and glove. Spiked felt-soled wading boots or Japanese spiked **tabis** are also necessary for easy climbing on the wet, algae-covered rocks. After the initial survey site is chosen all the survey sites upstream are selected randomly to prevent any bias in habitat type selection (e.g., pools and runs) and to obtain a representative sample of all habitat types in the stream. At each site, fish and invertebrate observations are recorded and data is collected on the species present, number, size, and sex. Habitat and substrate type, depth and site dimension data are also collected. Other site observations recorded at each station include GPS coordinates and the following water quality parameters using a Hydrolab Quanta: temperature (° C), salinity (PSS), dissolved oxygen (mg/L), pH, conductivity (mS/cm) and turbidity (NTU). Stream flow measurements are collected using a Marsh McBirney Flo-Mate 2000 at the beginning and ending of each survey as well as at tributaries and diversions.

The watersheds (and watershed ID), region, and island surveyed in this report are:

Hanawī (ID: 64022), Ke‘anae, Maui

Surveys were conducted by these personnel:

Hau, Skippy
Higashi, Glenn
Kuamo‘o, Darrell
Leonard, Jason
Nishimoto, Robert
Sakihara, Troy
Shindo, Tim
Young, Rodney

Results

Table 3-1. The distribution of sites by reach during this survey effort.

Reach	Total number of surveys
Estuary	0
Lower	4
Middle	28
Upper	2
Headwaters	0
Unknown	0

Lower Reach

Table 3-2. Number of Habitat Types surveyed in the lower stream reach.

Reach	Total Habitats Surveyed	Plunge Pool	Cascade	Riffle	Run	Pool	Side Pool	No Water	Dirty Water	Unknown
Lower	4	0	0	0	2	2	0	0	0	0

Table 3-3. Observed Substrates (%) in point quadrat samples in the lower stream reach.

Reach	Detritus	Sediment	Sand	Gravel	Cobble	Boulder	Bedrock
Lower	0	0	0	8	32	48	12

Table 3-4. Observed Water Quality in point quadrat samples in the lower stream reach.

Reach	Temp (° C)	sCond (mS/cm)	DO (mg/L)	pH
Lower	18.825	n/a	n/a	n/a

Table 3-5. Summary of species observed in the lower reach of the watershed.

<u>Category</u>	<u>Status</u>	<u>Scientific Name</u>
Fish	Endemic	<i>Sicyopterus stimpsoni</i>
Fish	Endemic	<i>Kuhlia xenura</i>
Fish	Indigenous	<i>Kuhlia</i> sp.
Fish	Endemic	<i>Eleotris sandwicensis</i>
Fish	Indigenous	<i>Awaous guamensis</i>
Snail	Endemic	<i>Neritina granosa</i>

Table 3-6. Average Density and Total number of animals observed in the lower stream reach. Density values are calculated only for random sites, not non-random or outside sites, greater than 6 by 6 inches. Density values are in number of animals per square yard.

<u>Category</u>	<u>Status</u>	<u>Scientific Name</u>	<u>Reach</u>	<u>Avg. Density</u>	<u>Total # Observed</u>
Fish	Endemic	<i>Sicyopterus stimpsoni</i>	Lower	1.73	6
Fish	Endemic	<i>Kuhlia xenura</i>	Lower	1.73	6
Fish	Indigenous	<i>Kuhlia</i> sp.	Lower	1.44	5
Fish	Endemic	<i>Eleotris sandwicensis</i>	Lower	1.16	4
Fish	Indigenous	<i>Awaous guamensis</i>	Lower	1.44	5
Snails	Endemic	<i>Neritina granosa</i>	Lower	1.73	6

Middle Reach

Table 3-7. Number of Habitat Types surveyed in the middle stream reach.

Reach	Total Habitats Surveyed	Plunge Pool	Cascade	Riffle	Run	Pool	Side Pool	No Water	Dirty Water	Unknown
Middle	28	1	2	8	9	3	5	0	0	0

Table 3-8. Observed Substrates (%) in point quadrat samples in the middle stream reach

Reach	Detritus	Sediment	Sand	Gravel	Cobble	Boulder	Bedrock
Middle	1	0	3	12	29	46	11

Table 3-9. Observed Water Quality in point quadrat samples in the middle stream reach.

Reach	Temp (° C)	sCond (mS/cm)	DO (mg/L)	pH	Turbidity (NTU)
Middle	18.72	0.17	9.536	7.662	30.256

Table 3-10. Summary of species observed in the middle reach of the watershed.

Category	Status	Scientific Name
Crustacean	Endemic	<i>Atyoida bisulcata</i>
Fish	Endemic	<i>Sicyopterus stimpsoni</i>
Fish	Endemic	<i>Lentipes concolor</i>
Fish	Endemic	<i>Kuhlia xenura</i>
Fish	Indigenous	<i>Kuhlia</i> sp.
Fish	Endemic	<i>Eleotris sandwicensis</i>
Fish	Indigenous	<i>Awaous guamensis</i>
Snail	Endemic	<i>Neritina granosa</i>

Table 3-11. Average Density and Total number of animals observed in the middle stream reach. Density values are calculated only for random sites, not non-random or outside sites, greater than 6 by 6 inches. Density values are in number of animals per square yard.

Category	Status	Scientific Name	Reach	Avg. Density	Total # observed
Crustaceans	Endemic	<i>Atyoida bisulcata</i>	Middle	1.8	28
Fish	Endemic	<i>Sicyopterus stimpsoni</i>	Middle	1.86	29
Fish	Endemic	<i>Lentipes concolor</i>	Middle	2.57	40
Fish	Endemic	<i>Kuhlia xenura</i>	Middle	1.03	16
Fish	Indigenous	<i>Kuhlia</i> sp.	Middle	0.19	3

Fish	Endemic	<i>Eleotris sandwicensis</i>	Middle	0.19	3
Fish	Indigenous	<i>Awaous guamensis</i>	Middle	0.96	15
Snails	Endemic	<i>Neritina granosa</i>	Middle	14.71	229

Upper Reach

Table 3-12. Number of Habitat Types surveyed in the upper each stream reach.

Reach	Total Habitats Surveyed	Plunge Pool	Cascade	Riffle	Run	Pool	Side Pool	No Water	Dirty Water	Unknown
Upper	2	0	0	0	0	0	1	1	0	0

Table 3-13. Observed Substrates (%) in point quadrat samples in the upper stream reach

Reach	Detritus	Sediment	Sand	Gravel	Cobble	Boulder	Bedrock
Upper	0	20	20	5	10	5	40

Table 3-14. Observed Water Quality in point quadrat samples in the upper stream reach.

Reach	Temp (° C)	sCond (mS/cm)	DO (mg/L)	pH	Turbidity (NTU)
Upper	16.14	0.221	8.91	7.02	7

Table 3-15. Number of Sites for megalagrion species in the upper stream.

Insect	Endemic	<i>Megalagrion blackburni</i>

Table 3-16. Flow data taken during point quadrat in the middle stream reach.

Latitude	Longitude	Total CFS	MGD
20.81592	-156.10379	18.32	11.84
20.81427	-156.10576	9.7	6.27

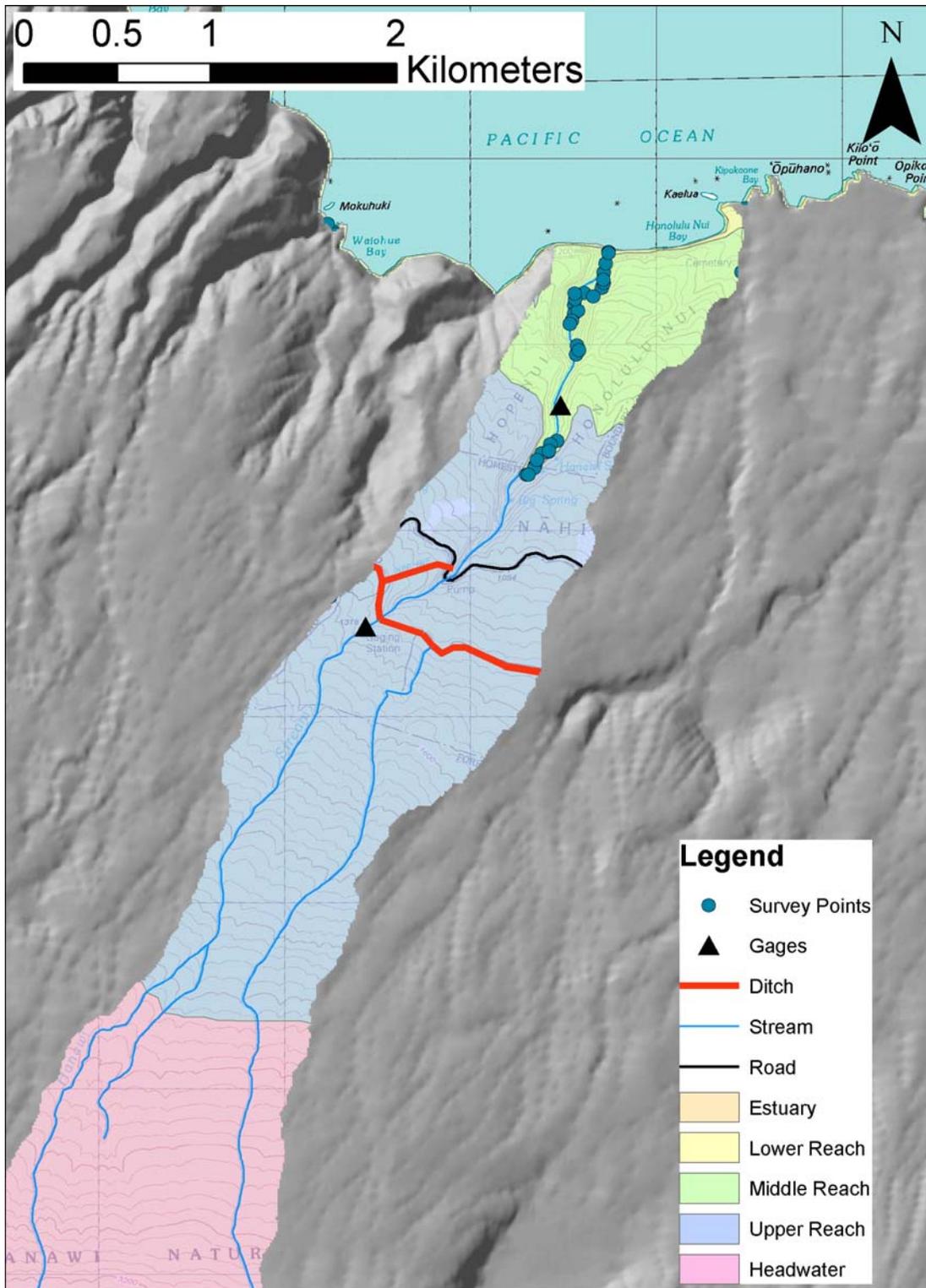


Figure 3-1. Locations of point quadrat surveys conducted in Hanawā Stream.

Lower Reach

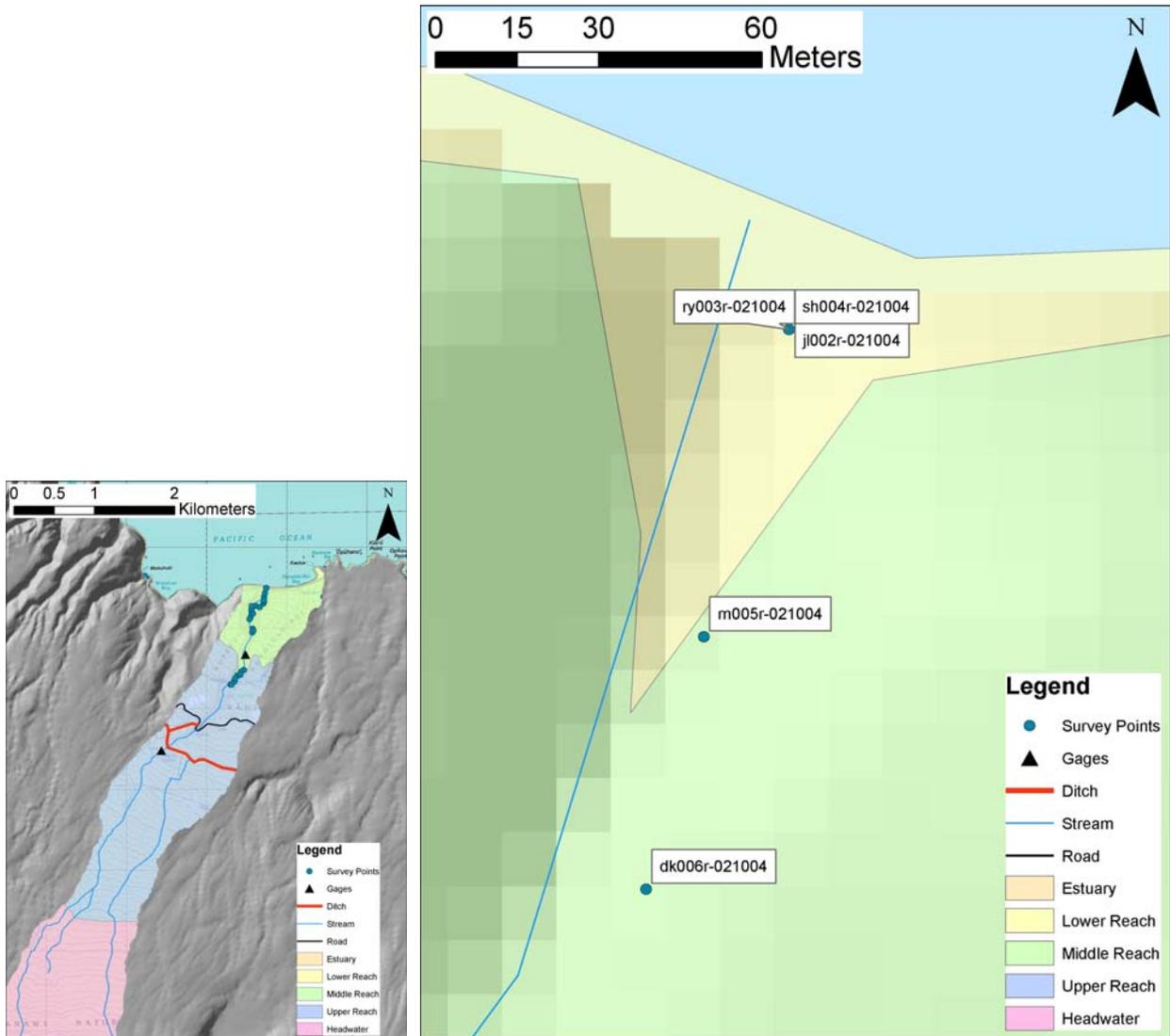


Figure 3-3. Point-quadrat survey locations in the lower reach of Hanawī Stream.

Middle and Upper Reach

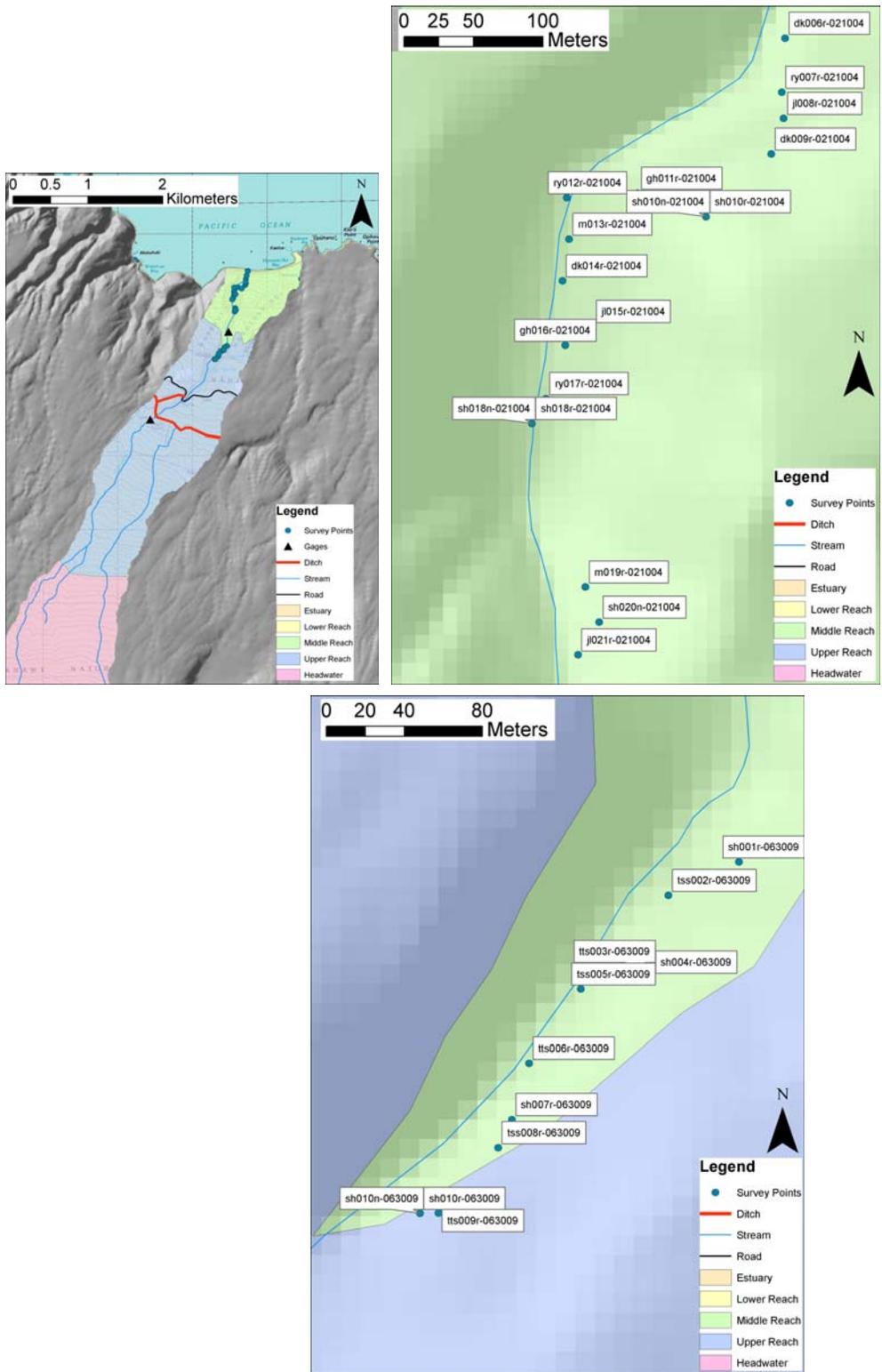


Figure 3-4. Point-quadrat survey locations in the middle and upper reaches of Hanawī Stream.

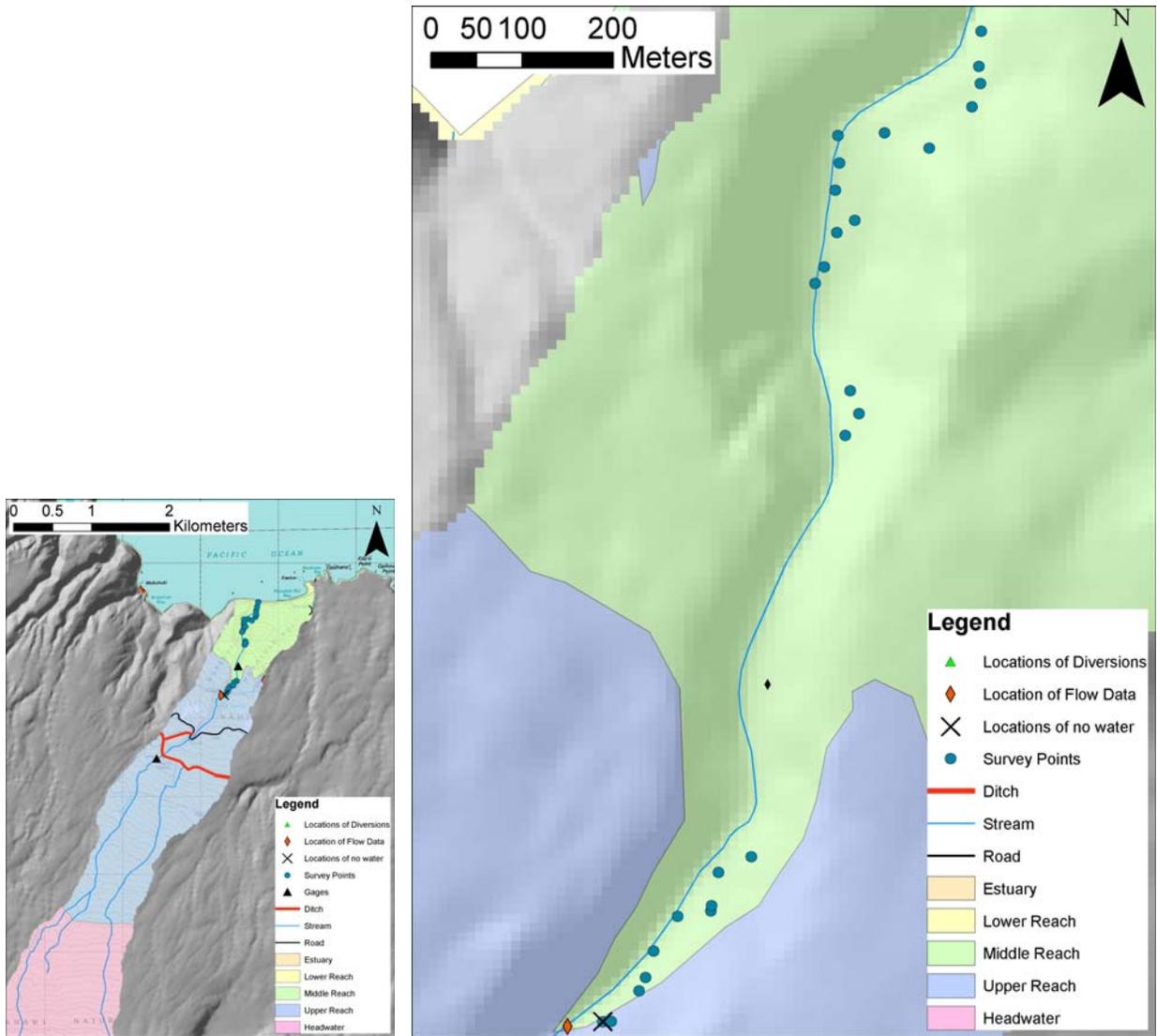


Figure 3-5. Locations of flow measurements taken in Hanawī Stream.

Section 4: Photographs taken during stream surveys

Lower Reach



Figure 4-1. Image shows the coastline characteristics near Hanawī and Makapipi Streams. Violet arrow indicates the mouth of Hanawī. (6/30/2009; Tributary name: Hanawī (64022001); PBN: sh64022001p-002-063009; Photo by: Hau, S.).



Figure 4-2. Photo of natural berm at the mouth of Hanawī Stream, Maui. (6/30/2009; Tributary name: Hanawī (64022001); PBN: sh64022001p-003-063009; Photo by: Hau, S.).



Figure 4-3. Photo of the estuary at the mouth of Hanawī Stream, Maui. (6/30/2009; Tributary name: Hanawī (64022001); PBN: sh64022001p-004-063009; Photo by: Hau, S.).



Figure 4-4. Lower reach of Hanawī Stream, Maui. (6/30/2009; Tributary name: Hanawī (64022001); PBN: sh64022001p-008-063009; Photo by: Hau, S.).

Middle and Upper Reach

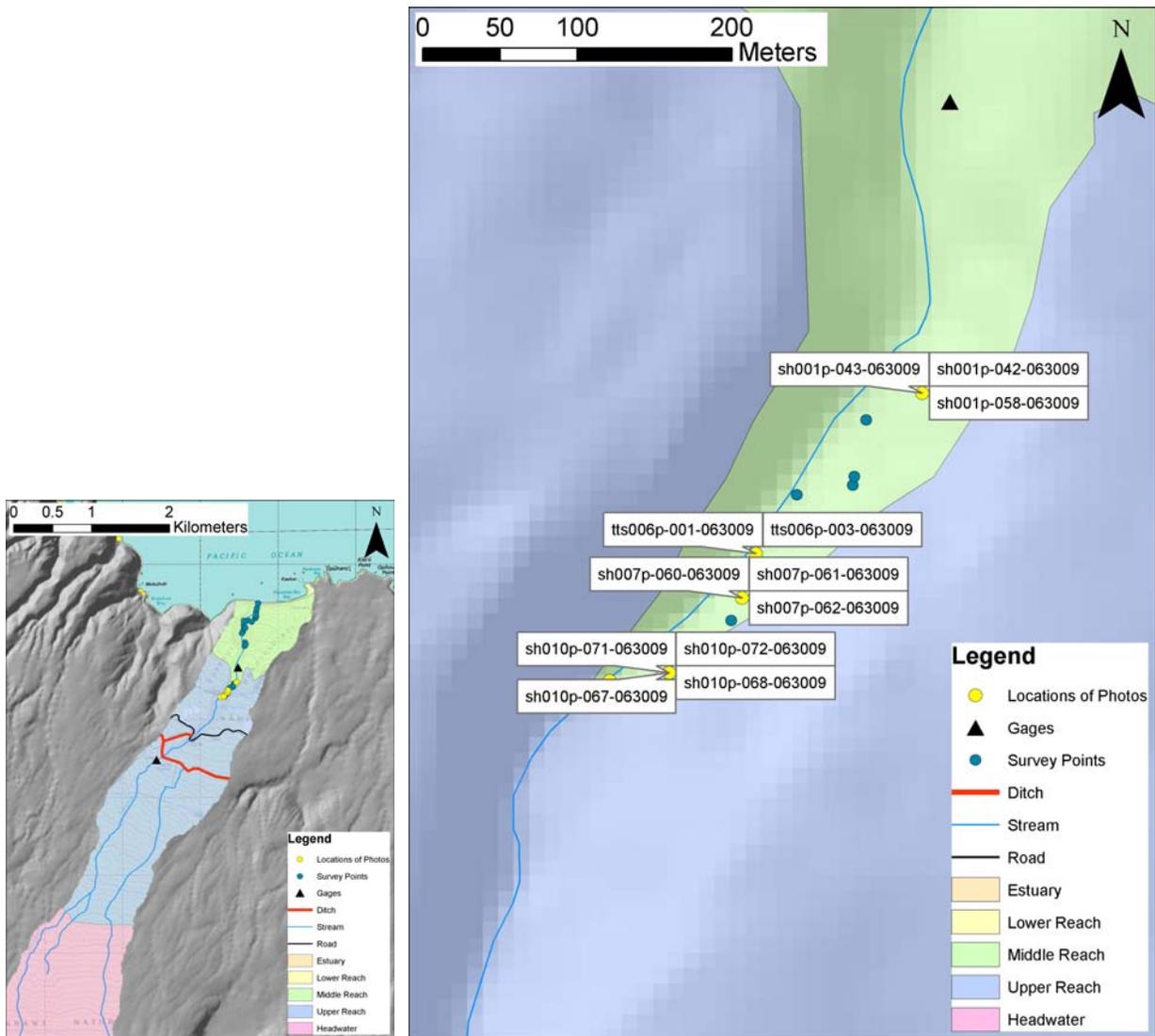


Figure 4-5. Photo locations in the middle and lower reaches of Hanawī Stream.



Figure 4-6. Photo of survey site 1. (6/30/2009; Tributary name: Hanawī (64022001); PBN: sh001p-042-063009; Surveyor: Hau, S.; Habitat type: Riffle; SBN: sh001r-063009; Lat. (DD): 20.81592, Long. (DD): -156.10379).



Figure 4-7. Photo upstream of site 1. Notice the people gathering 'ōpae in the background. (6/30/2009; Tributary name: Hanawī (64022001); PBN: sh001p-043-063009; Surveyor: Hau, S.; Habitat type: Riffle; SBN: sh001r-063009; Lat. (DD): 20.81592, Long. (DD): -156.10379).



Figure 4-8. Photo of the flow measurement near survey site 1. (6/30/2009; Tributary name: Hanawī (64022001); PBN: sh001p-058-063009; Surveyor: Hau, S.; SBN: 124; Lat. (DD): 20.81592, Long. (DD): -156.10379).



Figure 4-9. Photo of the pool where survey site 6 was conducted looking upstream past the site. (6/30/2009; Tributary name: Hanawī (64022001); PBN: tts006p-003-063009; Surveyor: Shindo, T.; Habitat type: Pool; SBN: tts006r-063009; Lat. (DD): 20.81500, Long. (DD): -156.10484).



Figure 4-10. Photo of the stream surrounding site 6. (6/30/2009; Tributary name: Hanawī (64022001); PBN: tts006p-001-063009; Surveyor: Shindo, T.; Habitat type: Pool; SBN: tts006r-063009; Lat. (DD): 20.81500, Long. (DD): -156.10484).



Figure 4-11. Photo of upstream view from survey site 7. (6/30/2009; Tributary name: Hanawī (64022001); PBN: sh007p-060-063009; Surveyor: Hau, S.; Habitat type: Riffle; SBN: sh007r-063009; Lat. (DD): 20.81474, Long. (DD): -156.10493).



Figure 4-12. Photo shows downstream view from survey site 7. (6/30/2009; Tributary name: Hanawī (64022001); PBN: sh007p-061-063009; Surveyor: Hau, S.; Habitat type: Riffle; SBN: sh007r-063009; Lat. (DD): 20.81474, Long. (DD): -156.10493).



Figure 4-13. Photo near survey site 7 showings a flowing spring on left side of Hanawī Stream. This is an unusually high quantity of water flowing from the spring. (6/30/2009; Tributary name: Hanawī (64022001); PBN: sh007p-062-063009; Surveyor: Hau, S.; Habitat type: Riffle; SBN: sh007r-063009; Lat. (DD): 20.81474, Long. (DD): -156.10493).

Upper Reach



Figure 4-14. Photo of random survey site 10 with no water, however the stream is flowing in the surrounding area. (6/30/2009; Tributary name: Hanawī (64022001); PBN: sh010p-070-063009; Surveyor: Hau, S.; Habitat type: No Water; SBN: sh010r-063009; Lat. (DD): 20.81431, Long. (DD): -156.10539).



Figure 4-15. Upstream view from random site 10. (6/30/2009; Tributary name: Hanawī (64022001); PBN: sh010p-071-063009; Surveyor: Hau, S.; Habitat type: No Water; SBN: sh010r-063009; Lat. (DD): 20.81431, Long. (DD): -156.10539).



Figure 4-16. Downstream view from random site 10. (6/30/2009; Tributary name: Hanawī (64022001); PBN: sh010p-072-063009; Surveyor: Hau, S.; Habitat type: No Water; SBN: sh010r-063009; Lat. (DD): 20.81431, Long. (DD): -156.10539).



Figure 4-17. Downstream view from site 10. (6/30/2009; Tributary name: Hanawī (64022001); PBN: sh010p-067-063009; Surveyor: Hau, S.; Habitat type: Side Pool; SBN: sh010n-063009; Lat. (DD): 20.81431, Long. (DD): -156.10539).



Figure 4-18. Photo of more spring water flowing on left side stream near site 10. Downstream of survey site 4 and has very cold water. (6/30/2009; Tributary name: Hanawī (64022001); PBN: sh010p-068-063009; Surveyor: Hau, S.; Habitat type: Side Pool; SBN: sh010n-063009; Lat. (DD): 20.81431, Long. (DD): -156.10539).



Figure 4-19. Upper reach Hanawī Stream. Exact location unknown. (6/30/2009; Tributary name: Hanawī (64022001); PBN: sh64022001p-015-063009; Photo by: Hau, S.).



Figure 4-20. Photo of waterfalls below Hāna Highway. (6/30/2009; Tributary name: Hanawī (64022001); PBN: sh64022001p-018-063009; Photo by: Hau, S.).



Figure 4-21. Hanawī Stream by Hāna Highway. (6/30/2009; Tributary name: Hanawī (64022001); PBN: sh64022001p-022-063009; Photo by: Hau, S.).



Figure 4-22. Photo taken above Hāna Highway showing a diversion in the lower half of the picture and a gage (red arrow) in the upper half of the picture. The diversion was not surveyed by DAR staff. (6/30/2009; Tributary name: Hanawī (64022001); PBN: sh64022001p-026-063009; Photo by: Hau, S.).

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Appendix: Survey Sites Latitude and Longitude

<u>Tributary</u>	<u>Stream</u>	<u>Survey Book #</u>	<u>Site</u>	<u>Surveyor</u>	<u>Date</u>	<u>Latitude</u>	<u>Longitude</u>
64022001	Hanawī	gh001r-021004	1	Higashi, Glenn	2/10/2004	20.82504	-156.10095
64022001	Hanawī	jl002r-021004	2	Leonard, Jason	2/10/2004	20.82499	-156.10094
64022001	Hanawī	ry003r-021004	3	Young, Rodney	2/10/2004	20.82499	-156.10094
64022001	Hanawī	sh004r-021004	4	Hau, Skippy	2/10/2004	20.82499	-156.10094
64022001	Hanawī	rn005r-021004	5	Nishimoto, Robert	2/10/2004	20.82448	-156.10110
64022001	Hanawī	dk006r-021004	6	Kuamo'o, Darrell	2/10/2004	20.82406	-156.10121
64022001	Hanawī	ry007r-021004	7	Young, Rodney	2/10/2004	20.82371	-156.10124
64022001	Hanawī	jl008r-021004	8	Leonard, Jason	2/10/2004	20.82354	-156.10123
64022001	Hanawī	dk009r-021004	9	Kuamo'o, Darrell	2/10/2004	20.82331	-156.10132
64022001	Hanawī	sh010r-021004	10	Hau, Skippy	2/10/2004	20.82291	-156.10178
64022001	Hanawī	sh010n-021004	10	Hau, Skippy	2/10/2004	20.82291	-156.10178
64022001	Hanawī	gh011r-021004	11	Higashi, Glenn	2/10/2004	20.82307	-156.10225
64022001	Hanawī	ry012r-021004	12	Young, Rodney	2/10/2004	20.82305	-156.10274
64022001	Hanawī	rn013r-021004	13	Nishimoto, Robert	2/10/2004	20.82278	-156.10273
64022001	Hanawī	dk014r-021004	14	Kuamo'o, Darrell	2/10/2004	20.82251	-156.10278
64022001	Hanawī	jl015r-021004	15	Leonard, Jason	2/10/2004	20.82221	-156.10258
64022001	Hanawī	gh016r-021004	16	Higashi, Glenn	2/10/2004	20.82209	-156.10277
64022001	Hanawī	ry017r-021004	17	Young, Rodney	2/10/2004	20.82175	-156.10291
64022001	Hanawī	sh018n-021004	18	Hau, Skippy	2/10/2004	20.82159	-156.10301
64022001	Hanawī	sh018r-021004	18	Hau, Skippy	2/10/2004	20.82159	-156.10301
64022001	Hanawī	rn019r-021004	19	Nishimoto, Robert	2/10/2004	20.82052	-156.10266
64022001	Hanawī	sh020n-021004	20	Hau, Skippy	2/10/2004	20.82029	-156.10257
64022001	Hanawī	sh021n-021004	21	Hau, Skippy	2/10/2004		
64022001	Hanawī	jl021r-021004	21	Leonard, Jason	2/10/2004	20.82008	-156.10272
64022001	Hanawī	sh001r-063009	1	Hau, Skippy	6/30/2009	20.81592	-156.10379
64022001	Hanawī	tss002r-063009	2	Sakihara, Troy	6/30/2009	20.81577	-156.10414

Appendix: Survey Sites Latitude and Longitude

<u>Tributary</u>	<u>Stream</u>	<u>Survey Book #</u>	<u>Site</u>	<u>Surveyor</u>	<u>Date</u>	<u>Latitude</u>	<u>Longitude</u>
64022001	Hanawī	tts003r-063009	3	Shindo, Tim	6/30/2009	20.81544	-156.10422
64022001	Hanawī	sh004r-063009	4	Hau, Skippy	6/30/2009	20.81539	-156.10423
64022001	Hanawī	tss005r-063009	5	Sakihara, Troy	6/30/2009	20.81534	-156.10458
64022001	Hanawī	tts006r-063009	6	Shindo, Tim	6/30/2009	20.81500	-156.10484
64022001	Hanawī	sh007r-063009	7	Hau, Skippy	6/30/2009	20.81474	-156.10493
64022001	Hanawī	tss008r-063009	8	Sakihara, Troy	6/30/2009	20.81461	-156.10500
64022001	Hanawī	tts009r-063009	9	Shindo, Tim	6/30/2009	20.81431	-156.10530
64022001	Hanawī	sh010n-063009	10	Hau, Skippy	6/30/2009	20.81431	-156.10539
64022001	Hanawī	sh010r-063009	10	Hau, Skippy	6/30/2009	20.81431	-156.10539